



The time value of money -- the idea that money received in the present is more valuable than the same sum in the future because of its potential to be invested and earn interest -- is one of the founding principles of finance.

Let's say you lent your friend \$2000. Would you rather he repaid you today, or tomorrow? The logical choice would be today, because you'll be able to use your money, and potential gains that come with it, sooner.

What Is the Time Value of Money?

Money is worth more in the present than in the future because there's an opportunity cost to waiting for it. In addition to your loss of use if you don't get your hands on it right away, there's also inflation gradually eroding its value and purchasing power.

If you're going to part with your money for any period of time, you probably expect a larger sum returned to you than you started with. Whether you're lending or investing, the goal is to make a gain to compensate you for going without your money for a while.

Suppose your friend offers to repay you \$2000 today or \$2050 next year. You must consider whether you'd earn more than \$50 over the next year by investing your money elsewhere before choosing to delay receiving payment. Other factors include your time preference (whether you need the money right now or can wait awhile to get it back) and whether you trust your friend to actually repay you -- another reason why money is worth more in the present: it may never materialize in the future. As the saying goes, "a bird in the hand is worth two in the bush."

Why Does the Time Value of Money Matter?

The time value of money matters because, as the basis of Western finance, you will use it in your daily consumer, business and banking decision-making. All of these systems are driven by the idea that lenders and investors earn interest paid by borrowers in an effort to maximize the time value of their money. Your job within this system is to limit the cost of money to you and to increase returns on your investments.

The concept isn't new - it dates back to ancient times - and although, as with Islamic finance, there may be cultures that forbid charging interest, their decisions are driven by similar monetary concepts.

Formula for Calculating the Time Value of Money

So how do you measure the time value of money? The formula takes the present value, then multiplies it by compound interest for each of the payment periods and factors in the time period over which the payments are made.

Formula: $FV = PV \times [1 + (i / n)] ^{(n \times t)}$

- **(PV) Present Value** = What your money is worth right now.
- **(FV) Future Value** = What your money will be worth at some future time after it (hopefully) earns interest.
- **(I) Interest** = Paying someone for the time their money is held.
- **(N) Number of Periods** = Investment (or loan) period.

- **(T) Number of Years** = Amount of time money is held

For instance, if you start with a present value of \$2,000 and invest it at 10% for one year, then the future value is:

$$FV = \$2,000 \times (1 + (10\% / 1) ^ (1 \times 1) = \$2,200$$

Of course, this calculation requires some knowledge of basic math, and in most cases, a business or scientific calculator. Fortunately, such calculators are available free online. In addition, there are sites that provide you with specialized financial calculators that can do these calculations easily – all you need to do is enter the values!

How Interest Rates Affect the Time Value of Money

Interest compensates a party for time she spends apart from her money. Expressed as a percentage over a specific period of time, it's a charge or an income that is a measure of money's value over time.

Usually, the longer someone lends their money to another party, the higher the interest rate they charge for it. Debt of shorter duration, like a 15-year fixed mortgage, usually commands a lower rate than, say a 30-year fixed rate mortgage.

Likewise, an interest-bearing investment like a bank certificate of deposit usually pays a lower interest rate the shorter the term. If you commit to leaving your money in the account longer, you're often rewarded with a higher interest rate.

There are several different types of interest rate:

- Simple Interest
- Compound Interest
- Fixed Interest Rate
- Variable Interest Rate

Simple vs. Compound Interest

Simple interest is illustrated in the example above -- simply adding a 10% gain to \$2,000 for a year yields \$2,200.

Compound interest, however, is calculated by adding the interest accrued up until certain intervals during the life of the loan or investment in a way that can significantly increase the future value. Time value of money is usually calculated with compound interest.

Using the same formula as above to compute the same \$2,000 at 10% for one year -- but this time compounding interest quarterly, or four times a year -- yields:

$$FV = PV \times [1 + (i / n)]^{(n \times t)}$$

This is calculated as follows: $\$2000 \times [1 + (10\% / 4)]^{(4 \times 1)} = \$2,207.63$

So that's another \$7.63 in the course of a year. Note that, with compound interest, the future value is higher than it is when calculated with simple interest.

Fixed Interest Rates vs. Variable Interest Rates

In investing and borrowing, consumers often walk a delicate line of trying to maximize the time value of their money while avoiding too much risk.

As prices rise, many take on debt to be able to afford homes, cars, vacations and other high-cost items. That's why it's important to look closely at the type of interest you're paying and how it may change over the long term while also seeking to make strong returns to bolster the time value of your money.

If you have money invested in a certificate of deposit (CD), chances are it pays you a **fixed interest rate**. Fixed rate refers to an interest rate that

will not change over time. The opposite of that is a **variable rate**, which is an interest rate that changes depending on how much benchmark rates rise or fall in the open market.

Calculated simply, if you invest \$1,000 in a one-year CD at a fixed 2% interest rate, the future value of your \$1000 will be \$1,020. The time value of your \$1,000 is 2%, or \$20, in exchange for letting the bank keep your money for a year.

Opportunity Cost and Time Value of Money

Time value of money varies and involves an opportunity cost. That means that if you're putting the \$1000 in the CD, you may be foregoing an opportunity to use the money as a good faith deposit on a home. Calculating the time value of your money should tell you that instead of investing at all, you should have instead paid down expensive variable rate credit card debt that's costing you hundreds a month.

An instrument or loan with a variable rate recalculates the interest paid or charged periodically.

For instance, a borrower may take out an adjustable rate mortgage (ARM) that has a low introductory rate of 2%, which will begin to adjust five years into the loan to a spread over a benchmark like the one-year Treasury bill. That means it adds the 2% to whatever the T-bill rate is and that's the interest rate you pay on your loan for one year. The following year, it adjusts again depending on what T-bill rates are then, and so on until the loan matures.

Borrowers calculating the time value of money for these loans like that the interest cost is postponed for several years. The loan is designed to attract borrowers who may not otherwise be able to afford a fixed-rate mortgage and who then pin their hopes on interest rates remaining low once the interest rate begins to adjust to market value.

When that happens, the mortgage rate can jump higher suddenly depending on how much interest rates have increased since he first took out the loan. There's no way to predict how much interest rates will rise five years from now, making it impossible to calculate the time value of money on the loan, so these can be risky.

Savvy investors who plan to sell their homes within the next several years make a TVM calculation to reduce their borrowing costs with an adjustable rate mortgages versus higher-interest fixed-rate loans. Taking advantage of the lower introductory rate, they aren't worried that the rate will reset much higher because they won't have the mortgage long enough to pay the higher rates.

Annual Percentage Rates and Time Value of Money

One way investors can guard against paying exorbitant interest rates is to either defer or save up for purchases they won't be able to pay in full on credit cards with high APRs (annual percentage rates).

An APR is helpful in TVM calculations because it is a rate that reflects what it will actually cost you to borrow money from a credit card, mortgage or other loan on a yearly basis. In addition to the interest rate, it factors in fees, points and other costs associated with your debt. The APR makes it clear what the real cost is to you, so comparing APRs for different debt products can help you identify those with a lower total cost for your TVM calculation.

Consumers with a high time preference -- meaning they have a hard time waiting to make desired purchases -- fall prey to notoriously high credit card APRs up to 25% and may end up in the position of only being able to afford the minimum payments. With credit card debt, the time value of money is extremely high -- often higher than individual investors' returns on investments.

The future value for a \$5000 vacation you paid on a credit card with an APR of 25%, if it takes you a year to pay it off, is about \$5,700. The

credit card company is making \$700 in just one year to lend you money to go on vacation. Before taking on credit card debt, consider that you're forgoing the \$700 you'll spend on interest and you're missing out on the potential future value of that money.