

What Is Future Value?

How To Calculate the Future Value of an Investment

By Jeffrey M. Green February 9, 2022

The time value of money is fundamental to all financial planning, from the decision you make to buy or lease a car to a corporate decision to invest in new machinery. Future value determines the effect of time on money. Using future value and other measures can help you make sound financial decisions.

What Is Meant By Future Value?

The basic principle behind the time value of money is simple: One dollar today is worth more than one dollar you will receive in the future. This is because you can invest the dollar you have today, and it can grow over time at a rate of return, or interest. The dollar that you receive “tomorrow” can’t be invested today, and therefore doesn’t have the same potential to increase in value.

Future value is what a sum of money invested today will become over time, at a rate of interest.

For example, if you invest \$1,000 in a savings account today at a 2% annual interest rate, it will be worth \$1,020 at the end of one year. Therefore, its future value is \$1,020.

Let's look at what happens at the end of two years: \$1,000 becomes \$1,044. The first year you earned \$20, but the second year, you earn \$24. Why? The extra \$ 4.00 is the 2% return on the \$20 earned at the end of the first year.

The process of earning interest on interest is called compounding, and it has a *powerful* effect on the future value of an investment.

A Real-World Example of Future Value

One way to apply future value to financial decision-making is to consider your tax refund. If you will receive a refund, it means you had more tax withheld from your paycheck than what you owed. You're effectively overpaying the IRS, which then refunds that overpayment once you file.

If you change your withholding, you could invest those overpayments throughout the year and earn interest. By the time you'd receive a refund, you could instead have that same amount plus whatever interest it earned—this is the time value of money in action. (Of course, you need to be disciplined enough to invest the extra amount in your paycheck and not spend it.) By overpaying the IRS throughout the year, you give it a 0% loan until it gives you a refund.

How To Calculate the Future Value of an Investment

There are two types of future value calculations:

- The “future value of a lump sum” is the value of a single deposit, like a bank CD over time.
- The “future value of an annuity” is the value of a series of payments, like contributions to a 401(k), over time. The term "annuity" refers to a series of payments, not the financial product.

The easiest way to calculate future value is to use one of the many free calculators on the internet, or a financial calculator app such as the HP 12C Financial Calculator available on Google Play and in the Apple App Store. Most spreadsheet programs have future value functions as well.

If, however, you like math problems, here's how to manually calculate future value:

Future Value (FV) of a Lump Sum

$$FV = PV \times (1+r)^n$$

PV = deposit, or present value

r = rate of interest over a period of time (such as a year)

n= the number of time periods (such as the number of years)

Future Value (FV) of an Annuity

$$FV = PMT \times [(1+r)^n - 1]/r$$

PMT = payment, or contribution

r = rate of interest over a period of time (such as a year)

n= the number of time periods (such as the number of years)

Future Value of an Annuity Example

A common use of future value is planning for a [financial goal](#), such as funding a retirement savings plan. Future value is used to calculate what you need to save and invest each year at a given rate of interest to achieve that goal.

For example, if you contribute \$2,400/year to a retirement account (\$200/month) and want to calculate what that account will be worth in 30 years, you could use the future value of an annuity formula. For this example, you assume a 7% annual rate of return:

$$\begin{aligned} FV &= \$2,400 \times [(1+0.07)^{30} - 1]/0.07 = \\ & \$2,400 \times [7.612 - 1] / 0.07 = \\ & \$2,400 \times 94.461 = \\ & \$226,706 \end{aligned}$$

Over the span of 30 years, you would contribute a total of \$72,000, but because of the time value of money and the power of compounding interest, your account would be worth \$226,706 (with an annual 7% rate of return), or more than three times the amount you invested.

Future value is also useful to decide the mix of stocks, bonds, and other investments in your portfolio. The higher the rate of interest, or return, the less money you need to invest to reach a financial goal. Higher returns, however, usually mean a higher risk of losing money.

Present Value vs. Future Value

We can also measure present value. Using it, you can calculate the worth of something today when you know its value in the future. This process

is also referred to as "discounting" because, for any positive rate of return, the present value will be less than what it is worth in the future.

The interest rate used to calculate present value is called the "discount rate."

To illustrate present value, let's look at a prior example. We already determined that the future value of \$1,000 deposited for one year into an account earning an annual 2% interest rate is \$1,020:

$$FV = 1000 \times (1+0.02)^1 = \$1,020$$

We also know that the present value of that \$1,020 is \$1,000 because it's what we started out with. Present value is the mirror image of future value.

Some common uses for present value include:

- Calculating the value of taking pension annuity payments versus taking a lump sum
- Determining whether a business owner's investment will meet profit expectations
- Valuing a business

Present Value (PV) of a Lump Sum and Example

Now, let's use the present value formula to determine the present value of \$1,000 paid one year in the future (relative to that same amount paid today and deposited in a 2% interest-bearing account).

$$PV = FV \times 1/(1+r)^n$$

FV= Future Value

r = rate of interest over a period of time (such as a year), referred to as the discount rate

n= The number of time periods (such as the number of years)

$$PV = \$1,000 \times 1/(1.02)^1 = \$980.40$$

In other words, the value today of \$1,000 received a year from now is \$980.40. The comparison illustrates why lenders charge interest.

Present Value (PV) of an Annuity

You can also determine the present value of a stream of payments using the present value of an annuity formula:

$$\text{PV of an annuity} = \text{PMT} \times [1 - 1/(1+r)^n] / r$$

PMT = Payments

r = discount rate of interest

n = The number of time periods

Key Takeaways

- Future value measures the effect of time on money.
- Future value is what a sum of money invested today will become over time, at a rate of interest.
- Future value is used to plan for financial goals.
- Compounding of interest has a powerful effect on the future value of an investment.