3.2: Future Value

When you put your money in a savings account (or invest it in some fashion), you earn a certain return (sometimes called interest) in order to compensate you. Because of this, a dollar today is not worth the same amount as a dollar sometime in the future. Since you earn money on the dollar invested (or saved) today, you will have more than a dollar at some later future point (making a dollar today worth more than the same dollar received later). The specific amount that you will have at the future date is referred to as a Future Value.

Consider if you had $100 today and were able to earn 12% per year by putting that money in a savings account at XYZ bank. How much would you have in one year? Two years? Three years? At first, you might think that you would have $112 in one year, $124 in two years and $136 in three years as you would earn $12 per year in interest. However, this is WRONG! It ignores the concept of compounding. After one year, you would indeed have $112. However, during the second year you earn 12% interest on the full $112 instead of only the $100 you started with. Therefore, you will earn $13.44 (=112×0.12) in interest in the second year and have $125.44 in two years. During the third year, you will earn $15.05 (=125.44×0.12) in interest and have $140.49 in three years. Therefore, the Future Value of $100 for three years at 12% is $140.49. In other words, $100 today is equivalent to $140.49 received three years from now assuming that you can earn 12% interest annually.

Solving for Future Value

We have three ways to solve for the FV: formula, financial table, and financial calculator.

Method 1: Using a Formula to Find the FV

The first is directly with a formula. Under this method, we use the following formula:

$$FV = PV(1+k)^n$$

where

FV is the future value (in year n) for which we are trying to solve
PV is the present value (how much we have today)
k is the rate of return we are earning (also referred to as the interest rate, required return, growth rate, or discount rate)
n is the number of years which we will be saving (or investing) the money.

Method 2: Using a Table to Find the FV

The second method is to use Financial Tables, in Appendix A. Financial tables are cumbersome and don't allow us as much flexibility as other methods, so they will not be covered in this text.

Method 3: Using a Financial Calculator to Find the FV

The third method (and the method focused on here) is to use the financial calculator or spreadsheet. Each financial calculator follows the same basic ideas, but the specifics are different for each brand of calculator. The steps below are for the HP10BII, TI-BAII+ and TI-83/84. If this is the first time using your financial calculator, see the detailed instructions Setting up Your Financial Calculator, in Appendix B. Please pause here to read that and set up your financial calculator before proceeding.

Calculator Steps to Compute FV:

HP10BII	TI-BAII+	TI-83/84

HP10BII	TI-BAII+	TI-83/84
Step 1: Enter N Step 2: Enter I/YR Step 3: Enter 0 for PMT Step 4: Enter PV Step 5: Press the FV key	Step 1: Enter N Step 2: Enter I/YR Step 3: Enter 0 for PMT Step 4: Enter PV Step 5: Press the CPT key Step 6: Press the FV key	Go to APPS⇒Finance⇒ TVM_Solver Step 1: Enter N Step 2: Enter I/YR Step 3: Enter 0 for PMT Step 4: Enter PV Step 5: Move to FV line and press the ALPHA SOLVE key

Note: The order of steps 1-4 is not important. The FV answer will appear as a negative number, ignore the negative sign for now. For the TI-83/84 calculators your P/Y and C/Y on the onscreen display should both be 1 for now.

✔ Example **3.2.1**: Finding FV using

Find the Future Value of $350 invested for 25 years at 9.5% per year.

Solution

Step 1: 25 N
Step 2: 9.5 I/YR
Step 3: 350 PV
Step 4: 0 PMT
Step 5: FV⇒

You should get a solution of $3383.93.

In other words, if we invest $350 today and let it compound at 9.5% per year for 25 years, we will have $3383.93 at the end of the 25th year.

Technically, you will get a value of -3383.93. The negative sign is an important aspect of financial calculators. The calculator is looking for the solution that balances both parties of a transaction. Here, since the $350 starting value was positive, the calculator assumes that this amount is being received today. If an individual receives $350, that individual needs to pay back $3383.93. Positive values represent cash inflows and negative values represent cash outflows. In a problem like this, it is not essential. However, later in the chapter, we will introduce problems where the cash flow direction is essential. Specifically, whenever there are nonzero values for two or three of the cash flows (PV, PMT, and/or FV), cash flow direction matters. In those cases, figure out if the cash flow is coming to you (available at that moment to spend) or the cash flow is going away from you (set aside into a savings plan). If the cash flow is coming to you, it is positive. If it is going away from you, it is negative. If we applied that logic in this example, the $350 PV would actually be -350. However, this would not change the value of the FV other than to make it positive.