Appendix 7.1. Using Excel to Perform Present-Value Calculations

Present-value calculations for analyses that cover many years can be performed easily using Microsoft Excel. Let's assume that we want to calculate the present value of a $20,000 annual benefit that occurs over a 20-year period starting in Year 3 (relative to now, which is Year 0). The discount rate is 3%.

We would first set up a column in our spreadsheet for the years, shown as Column A in Figure 1. The benefit will occur for 20 years starting in Year 3, so the numbers go up to 22. Note that the benefits for Years 0–2 are zero. We entered the annual benefit of $20,000 in Cell E2 and the discount rate in Cell E5. Entering these off to the side will allow us to change these values easily if we want to consider a different scenario, such as a different discount rate.

For Year 3 the present value of the benefit is:

$$\begin{aligned} \text{PV} &= \$20{,}000/(1+0.03)^3 \\ &= \$18{,}303 \end{aligned}$$

To perform this calculation in Excel, we would enter the following exactly into Cell B5:

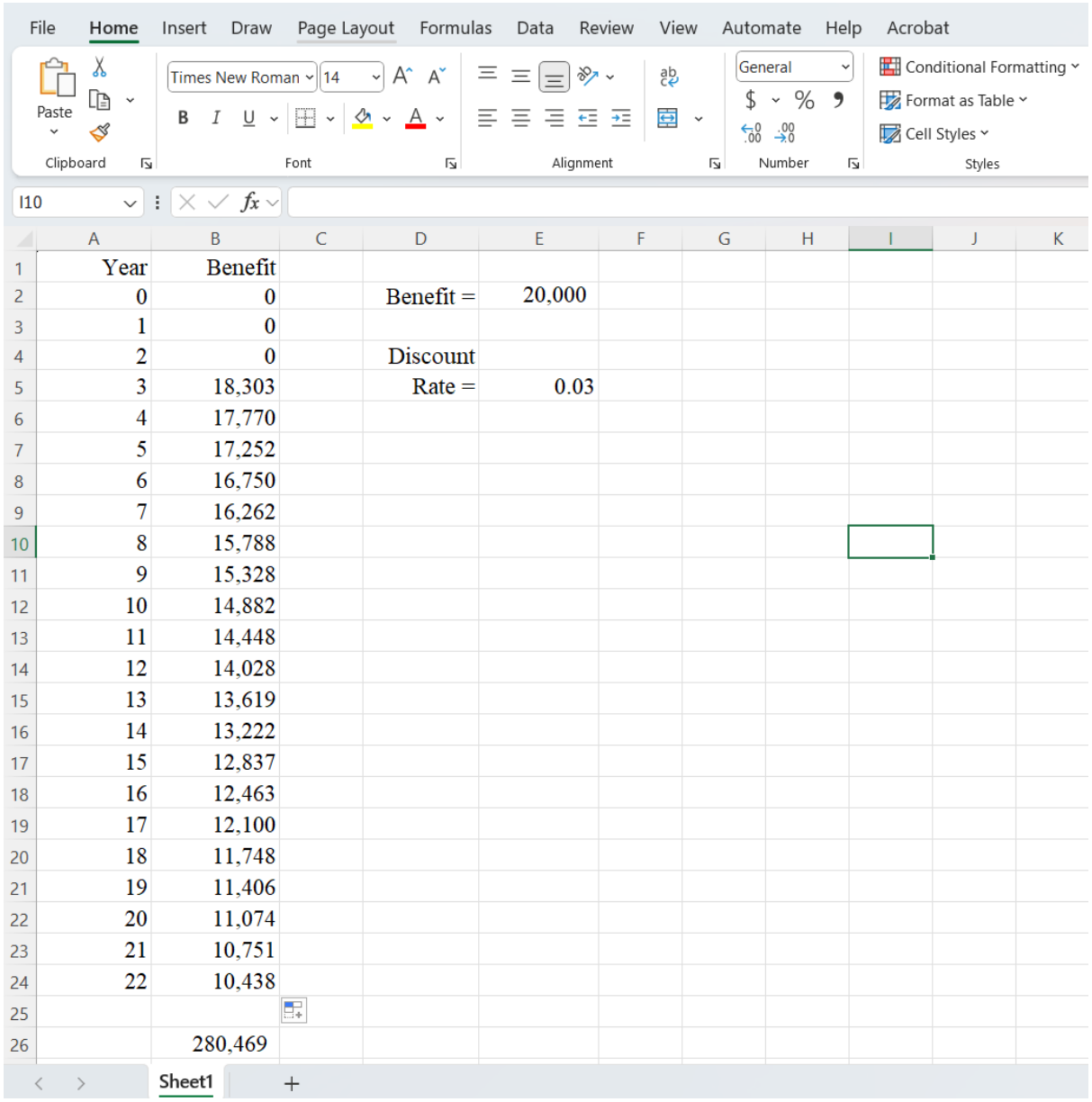
$$= \text{E2}/((1+\text{E5})\text{\^{}A5})$$

The "=" is necessary to indicate you are entering a formula. Entering E2 tells Excel to use the value in Cell E2 (20,000) as the numerator of the equation. The denominator refers to the cells with the discount rate and the year. When you enter this formula, you should get a value of 18,303. (We round off all numbers to the nearest whole number in this appendix.)

Next, copy the formula from Cell B5 to Cell B6, to obtain the present value for Year 4. You should get a value of 0—obviously not correct. If you look at the copied formula (click on Cell B6), you will see that every cell reference has been shifted down by one line. The copied formula should read:

$$= \text{E3}/((1+\text{E6})\text{\^{}A6})$$

Figure 1. Using Excel to Perform Present-Value Calculations



	A	B	C	D	E	F	G	H	I	J	K
1	Year	Benefit									
2	0	0		Benefit =	20,000						
3	1	0									
4	2	0		Discount							
5	3	18,303		Rate =	0.03						
6	4	17,770									
7	5	17,252									
8	6	16,750									
9	7	16,262									
10	8	15,788									
11	9	15,328									
12	10	14,882									
13	11	14,448									
14	12	14,028									
15	13	13,619									
16	14	13,222									
17	15	12,837									
18	16	12,463									
19	17	12,100									
20	18	11,748									
21	19	11,406									
22	20	11,074									
23	21	10,751									
24	22	10,438									
25											
26		280,469									

While we wanted to refer to Cell A6 instead of Cell A5 (Year 4 instead of Year 3), we wanted to maintain the references to Cells E2 and E5. To do this in Excel, when we enter a formula we place "$" before the column and the row to fix a reference to a specific cell. Then whenever the formula is copied, the reference won't change.

Go back to the formula in Cell B5 and revise it as follows:

= $E$2/((1+$E$5)^A5)

Now the references to Cells E2 and E5 are fixed, and only the reference to Cell A5 will adjust when the formula is copied. The value in Cell B5 should still be 18,303. If we copy this revised formula to Cell B6, the new value should be 17,770. The formula in Cell B6 should be:

= $E$2/((1+$E$5)^A6)

We are now discounting by four years instead of three. We can then copy this formula down to all the remaining years. With each additional line down, we are discounting by an additional year. The value for the last year should be 10,438. Summing over all the years (Excel has a simple summation command), we get a total present value of $280,469, as shown in Cell B27.

With the input variables for the annual benefit and the discount rate on the side, we can easily revise our analysis. Suppose that we want to redo our calculations with a 5% discount rate. All we would need to do is change the value in Cell E5 from 0.03 to 0.05. All calculations will automatically update. The new total present value should be $226,072 instead of $280,469.