Present Value and Discounting

Cash flow analysis involves working with expenses (costs) and revenues that will occur in the future. When working with future cash flows we must take into account that the value ($) of a cash flows depreciates (decreases) over time. There are two main reasons for this depreciation. First, the value of a dollar decreases each year due to inflation caused by the government increasing the money supply (printing more money). Second, cash that we have right now, as opposed to in the future, can be invested in order to generate a return. In order to get an accurate estimate for the value of a future cash flow we must discount it in order to get the present value, i.e. the value in today's dollars.

The process for discounting a cash flow is as follows:

1. Determine if you are working with quarterly or annual cash flows.
2. Determine the number of periods in the future the cash flow that the cash flow will occur. A period will be either a year or a quarter depending on the type of analysis from Step 1.
3. Determine the discount rate. The discount rate must match the type of analysis from Step 1. If no discount rate is provided then a 10% annual discount rate is typically used.
4. Calculate the present value of the cash flow according to the discounting formula below.

\[ PV = FV \times \left( \frac{1}{1+\frac{d}{n}} \right)^n \]

The two most common errors when performing discounting are using the wrong number of periods (incorrect value of \( n \)) or a discount rate that does not match your cash flow analysis (incorrect value of \( d \)). In order to avoid these issues:

- Make sure that you start from Year 0 (the present) when determining the number of periods in the future that the cash flow will occur. When performing discounting \( n=0 \) is the present. Note that when \( n=0 \), the discounting formula will reduce to \( PV = FV \).
- If an annual discount rate is given and you are performing a quarterly cash flow analysis, then you will need to convert to a quarterly discount rate by dividing by 4. Likewise, if a quarterly discount rate is provided and you are performing an annual cash flow flow analysis you will need to multiply the quarterly discount rate by 4.

**Example:**

Your company has estimated that it will have a revenue of $50M in Year 5 of operations. Assuming an annual discount rate of 12%, how much is that revenue worth in today's dollars?

\[
\begin{align*}
FV &= \$50M \\
n &= 5 \\
d &= 0.12 \\
PV &= \frac{\$50M}{(1+0.12)^5} = \$28.37M
\end{align*}
\]

The concept of discounting can also be applied to determine the future value of a cash flow based on an estimate of the present value in today's dollars. This is called compound interest and is given by the formula below.

\[ FV = PV \times (1+d)^n \]

**Example:**

Your company has estimated that it will cost $10M to manufacture the first production run of the product based on discussions with the suppliers. Based on the product development plan, the product will be ready for manufacturing in Year 3. Assuming a 10% annual discount (inflation) rate, how much will that manufacturing cost three years from now?

\[
\begin{align*}
PV &= \$10M \\
n &= 3 \\
d &= 0.10 \\
FV &= \$10M \times (1+0.10)^3 = \$13.31M
\end{align*}
\]