2.2 The Present Value Model Under Certainty

The present value model is widely used in economics and finance and has had considerable impact on accounting over the years. We first consider a simple version of the model under conditions of certainty. By "certainty" we mean that the future cash flows of the firm and the interest rate in the economy are publicly known with certainty. We denote these as **ideal conditions**.

EXAMPLE 2.1
THEORETICAL ILLUSTRATION OF THE PRESENT VALUE MODEL UNDER CERTAINTY

Consider P.V. Ltd., a one-asset firm with no liabilities. Assume that the asset will generate end-of-year cash flows of $100 each year for two years and then will have zero value. Assume also that the risk-free interest rate in the economy is 10%. Then, at time 0 (the beginning of the first year of the asset's life), the present value of the firm's future cash flows, denoted by PA_0, is:

$$\begin{aligned} PA_0 &= (\$100 \div 1.10) + (\$100 \div (1.10)^2) \\ &= \$90.91 + \$82.64 \\ &= \$173.55 \end{aligned}$$

We can then prepare a present value opening balance sheet as follows:

P.V. Ltd.
Balance Sheet
As at Time 0

Capital asset, at present value	$173.55	Shareholders' equity	$173.55

Now, move on to time 1, one year later. At that time, the present value of the remaining cash flows from the firm's asset is:

$$\begin{aligned} PA_1 &= \$100 \div 1.10 \\ &= \$90.91 \end{aligned}$$

The firm's income statement for year 1 is:

P.V. Ltd.
Income Statement
For Year 1

Cash flow	$100.00
Amortization expense	82.64
Net income	$ 17.36

Amortization expense is calculated as \$173.55 – \$90.91 = \$82.64—that is, the decline in the present value of the future receipts from the asset over the year. This way of calculating amortization differs from the way that accountants usually calculate it. Nevertheless, it is the appropriate approach under the ideal conditions of this example, namely, future cash flows known with certainty and a fixed risk-free interest rate.

Then, the end-of-year-1 balance sheet is:

P.V. Ltd.
Balance Sheet
As at End of Year 1

Financial Asset			**Shareholders' Equity**	
Cash		\$100.00	Opening value	\$173.55
Capital Asset			Net income	17.36
Opening value	\$173.55			
Accumulated amortization	82.64	90.91		
		\$190.91		\$190.91

This assumes that the firm pays no dividend. A dividend can be easily incorporated by reducing cash and shareholders' equity by the amount of the dividend.

Note the following points about Example 2.1:

1. The net book value of the capital asset at any year-end is equal to its fair value (see the definition of fair value in Section 1.2), where fair value is here determined as the present value of the future cash flows from that asset, discounted at 10%. Amortization expense is the change in present value over the year.
2. Net income for the year is equal to the year's cash flow of \$100 less the \$82.64 decline in the present value of the asset. Note that it is also equal to $PA_0 \times 10\% = \$173.55 \times 10\% = \$17.36$. This amount is called **accretion of discount**. It is the opening present value multiplied by the interest rate. The term arises because the stream of cash receipts is one year closer at the end of the year than it was at the beginning. The \$17.36 is also referred to as *ex ante* or **expected net income** since, at time 0, the firm expects to earn \$17.36. Of course, because all conditions are known with certainty, the expected net income will equal the *ex post* or **realized net income**.
3. **Relevant** financial statements are defined as those that give information to investors about the firm's future economic prospects. The information in Example 2.1 is entirely relevant. To see this, note first that, fundamentally, economic prospects are defined by the firm's stream of future dividends—it is dividends that provide a payoff to investors, the present value of which serves to establish firm value.

Then, it might seem that the firm's dividend policy will affect its value, since the timing of dividends will affect their present value. However, under ideal conditions, this would not be the case, and is called **dividend irrelevancy**.

To see why dividend policy does not matter under ideal conditions, note that as long as investors can invest any dividends they receive at the *same rate* of return as the firm earns on cash flows *not* paid in dividends, the present value of an investor's overall interest in the firm is independent of the timing of dividends. This holds in our example since there is only one interest rate in the economy. In effect, the firm's cash flows establish the size of the "pot" that is ultimately available to investors and it does not matter if this pot is distributed sooner or later. If it is distributed during the current year, investors can earn 10% on the distributions. If it is distributed in a subsequent year, the firm earns 10% on amounts not distributed, but this accrues to investors through an increase in the value of their investment. The present value to the investor is the same either way.

Under dividend irrelevancy, cash flows are just as relevant as dividends, because cash flows establish the firm's dividend-paying ability. As a result, the financial statements under Example 2.1 are entirely relevant.

4. As an accountant, you might be wondering why the firm's net income seems to play no role in firm valuation. This is quite true—it doesn't, under ideal conditions of certainty. The reason is that future cash flows are known and hence can be discounted to provide balance sheet valuations. Net income is then quite trivial, being simply accretion of discount as pointed out above. In effect, under ideal conditions, the balance sheet contains all the relevant information and the income statement contains none.[1] Even though net income is "true and correct," it conveys no information because investors can always figure it out by multiplying the opening balance sheet value by the interest rate. To put this another way, there is no information in the current net income that helps investors predict future economic prospects of the firm. These are already known to investors by assumption. This is an important point and we shall return to it later. For now, suffice it to say that when ideal conditions do not hold, the income statement assumes a much more significant role.

5. Define **reliable** financial statements as being precise and free from bias. The information in Example 2.1 is entirely reliable, since we have assumed that future cash flows and the interest rate are known with certainty. Note that there are *two components* of reliability. One is precision, the extent to which the financial statements are free of random error, or noise. Noise can arise from errors in the firm's accounting system, and from errors in estimates. Noise can also be present even in the absence of errors. This can occur if the quantity being estimated is subject to wide variation. For example, suppose that present value, or current market value, is used in the financial statements as a measure of the fair value of an asset. Even if they are not biased, these volatile measures of value may be proved wrong by subsequent events, such as changing market prices, if conditions are not ideal. Of course, under ideal conditions of certainty, this would not occur.

The second component of reliability is freedom from bias or manipulation. Lack of reliability harms investors in two related ways. First, information that is imprecise will need revision later. This can adversely affect investors' current decision calculations. Second, managers may bias or otherwise manipulate financial statement information, which can also adversely affect investor decisions. When information is perfectly reliable, neither of these problems can arise.

In sum, noise is absent under ideal conditions of certainty, since future cash flows and the interest rate are publicly known. As a result, present value and market value cannot be proven wrong by later events. Also, any errors, or attempts by management to bias the financial statements, would be immediately detected.

6. Under the ideal conditions of future cash flows known with certainty and the economy's risk-free interest rate given, the market value of the asset will be equal to its present value. To see this, consider the following argument: Given an interest rate of 10%, no one would be willing to pay more than $173.55 for the asset at time 0—if they did, they would be earning less than 10%. Also, the owners of the asset would not sell it for less than $173.55—if offered less than $173.55, they would be better off to retain it and earn 10%. If they needed the money they could borrow at 10% against the asset as security. Thus, the only possible equilibrium market price is $173.55. This argument is a simple example of the principle of **arbitrage**. If market prices for identical goods and services are such that it is possible to make a profit by simply buying in one market and selling in another, these are called arbitrage profits. However, it seems reasonable to expect that, if future cash flows and the risk-free rate are publicly known, the scramble of self-interested individuals to make these quick profits would eliminate any price discrepancies.[2]

7. Arbitrage means that there are two ways to determine asset fair value. We can calculate the discounted present value of future cash flows, as in Example 2.1. We will call this the **direct approach**. Alternatively, we can use market value. We will call this the **indirect approach**. Under ideal conditions, the two approaches yield identical results.

8. As P.V. Ltd. owns only one asset and has no liabilities, the firm's market value would also be $173.55 at time 0, being the sum of the financial assets[3] and the present value of future cash receipts from the capital asset. Thus, the total market value of P.V.'s shares outstanding would be $173.55. In more general terms, if a firm has more than one asset, the market value of the firm would be the sum of the value of its financial assets plus the value of the joint future receipts from its capital assets, including intangibles, less the present value of any liabilities. At points in time after time 0, the firm's market value continues to equal the sum of its financial assets plus capital assets, net of liabilities. Note, however, that dividend policy affects the amount of financial assets. To the extent that the firm does not pay out all of its profits in dividends, it will earn a return on reinvested assets. Question 2, at the end of this chapter, illustrates this point. See also the discussion of dividend irrelevancy above.