

# FINANCE AT A GLANCE

## The mathematical relationship between the balance sheet and the income statement

## Lesson 34

This lesson shows how the balance sheet (which is made up of assets, liabilities and equity) and the income statement (which is made up of revenues and expenses) are related to each other, and that this relationship has a mathematical basis. Understanding the following discussion needs a recall of principles learned in some of the past lessons, as well as of very basic high school algebra.

We learned in Lesson 1 that at any given point in time, **Assets = Liabilities + Equity**.

For illustrative purposes, we shall use the end of the year 2009 and the end of the year 2008 as the points in time as of which we use figures from the balance sheet. We shall use the symbol  $\text{Assets}_{2009}$  and  $\text{Assets}_{2008}$  to represent the amount of assets at these two points in time. We use similar symbols for the liabilities and equity.

$$\begin{aligned}(1) \quad & \text{Assets}_{2009} = \text{Liabilities}_{2009} + \text{Equity}_{2009} \\(2) \quad & \text{Assets}_{2008} = \text{Liabilities}_{2008} + \text{Equity}_{2008}\end{aligned}$$

In Lesson 11, we learned that Equity is made up of capital stock and retained earnings. Replacing Equity in equations (1) and (2) with Capital Stock + Retained Earnings, we get equations (3) and (4) as follows:

$$\begin{aligned}(3) \quad & \text{Assets}_{2009} = \text{Liabilities}_{2009} + \text{Capital Stock}_{2009} + \text{Retained Earnings}_{2009} \\(4) \quad & \text{Assets}_{2008} = \text{Liabilities}_{2008} + \text{Capital Stock}_{2008} + \text{Retained Earnings}_{2008}\end{aligned}$$

There are other components of Equity. However, for the sake of simplicity, we assume that there are only these two components. (The same logic holds even if all other components of Equity are included.)

We know from our knowledge of basic algebra that

$$\text{if } a = b + c + d \quad \text{and if } w = x + y + z$$

we can subtract the corresponding elements of these equations to get a third equation as follows:

$$a - w = b - x + c - y + d - z$$

Applying the same logic to equations (3) and (4) above, we get equation (5) as follows:

$$\begin{aligned}(5) \quad & \text{Assets}_{2009} - \text{Assets}_{2008} = \text{Liabilities}_{2009} - \text{Liabilities}_{2008} + \text{Capital Stock}_{2009} - \text{Capital Stock}_{2008} \\ & + \text{Retained Earnings}_{2009} - \text{Retained Earnings}_{2008}\end{aligned}$$

The amount represented by  $\text{Assets}_{2009} - \text{Assets}_{2008}$  is actually the change in assets from the end of 2008 until the end of 2009. We can represent this as  $\text{Change in Assets}_{2008-2009}$  in equation (5), and do the same for the rest of the items in that equation, to get the following:

$$(6) \quad \text{Change in Assets}_{2008-2009} = \text{Change in Liabilities}_{2008-2009} + \text{Change in Capital Stock}_{2008-2009} \\ + \text{Change in Retained Earnings}_{2008-2009}$$

We recall from Lesson 31 that within a given period, what is left of the net profits (after tax) after paying off dividend is the amount added to the beginning balance of the retained earnings to get the ending balance of the retained earnings, and is actually the **Change in Retained Earnings** over that period of time, as shown in equation (7):

$$(7) \quad \text{Change in Retained Earnings}_{2008-2009} = \text{Net Profit After Tax}_{\text{in } 2009} - \text{Dividends}_{\text{in } 2009}$$

We use  $\text{Net Profit After Tax}_{\text{in } 2009} - \text{Dividends}_{\text{in } 2009}$  to replace  $\text{Change in Retained Earnings}_{2008-2009}$  in equation (6), to get equation (8).

$$(8) \quad \text{Change in Assets}_{2008-2009} = \text{Change in Liabilities}_{2008-2009} + \text{Change in Capital Stock}_{2008-2009} \\ + \text{Net Profit After Tax}_{\text{in } 2009} - \text{Dividends}_{\text{in } 2009}$$

Then from Lesson 30, we know that

$$(9) \quad \text{Net Profits After Tax}_{\text{in } 2009} = \text{Revenues}_{\text{in } 2009} - \text{Expenses}_{\text{in } 2009}$$

where  $\text{Expenses}_{\text{in } 2009}$  include income taxes.

We now replace  $\text{Net Profits After Tax}_{\text{in } 2009}$  in equation (8) in terms of revenues and expenses as expressed by equation (9), to get

$$(10) \quad \text{Change in Assets}_{2008-2009} = \text{Change in Liabilities}_{2008-2009} + \text{Change in Capital Stock}_{2008-2009} \\ + \text{Revenues}_{\text{in } 2009} - \text{Expenses}_{\text{in } 2009} - \text{Dividends}_{\text{in } 2009}$$

From algebra, we know that an equation such as

$$e = f + g + h - i - j \quad \text{can be also rewritten as} \\ e + i + j = f + g + h$$

Rewriting equation (10), we finally get

$$(11) \quad \text{Change in Assets}_{2008-2009} + \text{Expenses}_{\text{in } 2009} + \text{Dividends}_{\text{in } 2009} = \\ \text{Change in Liabilities}_{2008-2009} + \text{Change in Capital Stock}_{2008-2009} + \text{Revenues}_{\text{in } 2009}$$

What we have just arrived at in equation (11) is the mathematical basis of the relationship between the balance sheet and the income statement. We call it the **balance sheet-income statement relationship equation** whenever we make references to it in the future.

We read equation (11) as:

**Within a given period, the change in assets plus the expenses and the dividends is equal to the change in liabilities plus the change in capital stock (and all other equity items excluding retained earnings) plus the revenues.**

Until the next lesson,

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