Accounting as a source of information (Y4)

The interpretation of accounting numbers as intending to *measure* value is natural and tempting. But a student of accounting knows that historical cost numbers are often used because market values are not available. Thus, the accounting number is often a measure of subjective value at the time of an executed transaction, which may have occurred in the distant past. If accounting numbers are not objective and timely measures of value, some would argue that they are not valuable.

It is important to understand that *measuring* value, or "valuation," is not the only purpose of accounting numbers. Even if accounting value does not equal economic value, and even if accounting income does not equal economic income, accounting numbers can be useful information. Accounting numbers can tell the user something about transactions and event related to the firm's activities, and indirectly, something about future cash flows. We say accounting numbers can have *information content*, even if they don't measure economic value or change in economic value.

The purpose of this note is to lay the foundation for what we mean by information and information content. Information content is always with respect to something that we are trying to predict or estimate. One way accounting numbers are used is to predict future cash flows or future accounting numbers. Indirectly, then, they can be used to infer value (although perhaps not *market* value). Accounting numbers are also used to evaluate whether managers have made appropriate use of the assets to which they have been entrusted. This role of accounting is sometimes called *stewardship* or *management control*. You will concentrate on management control in AMIS H212 and H525.

The best way to introduce the topic of information is with an example. We will concentrate on the simpler setting of trying to estimate the present value of future cash flows, rather than on stewardship. The example presumes only a basic understanding of probability.

An investor believes the firm's present value of future cash flows (PV) will be either 10,000 or 1,000. She also believes the firm's accounting income (AI) will be - 1,000, 0 or 1,000. There are 6 possible PV-AI combinations. The investor assigns the following probabilities to these combinations.

Joint probabilities: Pr(AI, PV)

		PV = 10,000	PV = 1,000
AI =	- 1,000	0.05	0.15
AI =	0	0.30	0.25
AI =	1,000	0.15	0.10

The probabilities in all six cells add to one, because this is the full set of events that can occur related to AI-PV realizations. Further, one can add the entries in a column to obtain the probability that the present value takes on a particular value. For example, one can add the left column to get the probability that the present value is 10,000: (.05+.30+.15) = .50. Similarly, one can add the entries in a row to obtain the probability that accounting income takes on a particular value. For example, one can add the first row to get the probability that accounting income is - 1,000: (.05+.15) = .20.

A risk neutral investor would be interested in the expected present value of future cash flows, given a particular realization of accounting income. Suppose the firm reveals that accounting income for the period is 1,000. The first step towards determining the expected present value conditional on income being equal to 1,000 is to calculate the *conditional* probability of 10,000 and 1,000.

Bayes' Theorem, which guides us in revising beliefs, is pretty intuitive here. If we happened to learn accounting income was 1,000, the only two possibilities are {PV = 10,000 and AI = 1,000} or {PV = 1,000 and AI = 1,000}. The probabilities of these two events must add to one, but the joint probabilities add to .15 + .10 = .25 < 1. To normalize the conditional probability distribution, so the probabilities of all events add to one, we divide the joint probabilities by the marginal (unconditional probability) that accounting income is 1,000, which is equal to .25. Thus, the probability that present value is 10,000 given the accounting income is 1,000 is .15/.25 = 3/5. The probability that the present value is 1,000 given the accounting income is 1,000 is .10/.25 = 2/5.

Because there are three possible realizations of accounting income, there are three relevant conditional probability distributions, denoted Pr(PV|AI).

Conditional probabilities: Pr(PV|AI)

		PV = 10,000	PV = 1,000
AI =	- 1,000	1/4	3/4
AI =	0	6/11	5/11
AI =	1,000	3/5	2/5

Now that we have the conditional probabilities, we can calculate the expected present value, conditional on each possible realization of accounting income. If accounting income happened to be - 1,000, the conditional expected present value would be (1/4) 10,000 + (3/4) 1,000 = 3,250. Recall that, before we learned accounting income, the unconditional expected present value was .5 (10,000) + .5 (1,000) = 5,500, so a risk neutral investor would value the firm at 5,500 without any accounting information. If subsequently she learned the accounting income was - 1,000, she would revise downward her expected present value to 3,250. Therefore, in this example the investor who learned that accounting income was - 1,000 would consider this to be bad news. Below are the conditional expected present value numbers for all possible realizations of accounting income.

		Conditional expected present values: E[PV|AI]	**Investor interpretation**
AI =	- 1,000:	(1/4) 10,000 + (3/4) 1,000 = 3,250	bad news
AI =	0:	(6/11) 10,000 + (5/11) 1,000 = 5,909	somewhat good news
AI =	1,000:	(3/5) 10,000 + (2/5) 1,000 = 6,400	very good news

The probabilities in the example were chosen so that a $1,000 loss would be considered bad news. Also, zero profit would be considered somewhat good news, because the expected present value would be revised upward by only 409 upon learning accounting income was zero. Using parallel logic, a 1,000 profit is considered to be very good news. While intuitive, this feature was arbitrarily chosen, and is driven by the assumed probability structure.

One final note: there is a consistency in our calculations. If we weight the expected present values conditional on accounting income by the probability of the corresponding realization of accounting income, we arrive back at the unconditional expected present value.

$$E[PV] = Pr(AI = -1{,}000)\,E[PV|AI = -1{,}000] + Pr(AI = 0)\,E[PV|AI = 0] + Pr(AI = 1{,}000)\,E[PV|AI = 1{,}000]$$

$$= .20\,(3{,}250) + .55\,(5{,}909) + .25\,(6{,}400) = 5{,}500$$

Generally, we might think of accounting income as being information that is relevant for determining the value of the firm. This is what motivated the example above. As illustrated, the idea is that the investor's beliefs about the firm's present value are potentially changed upon learning the value of accounting income. This in turn causes the investor to update her valuation assigned to the firm. Notice from the example that this is possible without the accounting income numbers ever measuring the change in economic value.