Accounting in Perfect and Complete Markets

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Abstract

This teaching note explores the relationship between market values and accounting numbers, simplifying and integrating the ideas in Demski (1992), Edwards and Bell (1961), Ohlson (1991), Ohlson (1995), Peasnell (1982), and Preinrich (1938). This note also illustrates cases where the logic of these papers, which exploits simplistic perfect and complete markets, can or cannot be used to interpret or justify current accounting practices. The note uses numerical examples and does not require an understanding of how to solve recursive equations, which facilitates its main purpose, to make the valuation framework more accessible to undergraduate students. One way this note differs from Ohlson (1995) is in its emphasis on different accounting methods. In particular, several examples are used to illustrate that, if the user of financial statements is willing to use the balance sheet and income statement simultaneously, one need not be concerned about accounting method choice. We conjecture that this note may be useful to instructors of accounting, since the FASB's views regarding accounting pronouncements, as well as explanations in accounting texts, are often based on perfect and complete market thinking. Thus, this framework can be used to lend additional structure and logic to issues of accounting method choice and accounting regulation.

INTRODUCTION

Interpreting arguments for specific accounting methods is often a difficult task for the readers of accounting pronouncements and textbooks. It is important to be able to justify accounting choices based on consistent logic (Demski, 1996). This teaching note presents a simplified version of the Edwards-Bell-Ohlson (E-B-O) framework and illustrates how it may be used to clarify arguments that support or oppose specific accounting methods. The E-B-O framework is the name given to the ideas in Ohlson (1991), Ohlson (1995) and Edwards and Bell (1961). This work is also closely related to Feltham and Ohlson (1995, 1996), Peasnell (1982) and Preinrich (1938). Interpretations of E-B-O in the literature include Bernard (1995), Demski (1992), and Lundholm (1995).

In this note we simplify the E-B-O framework by using numerical examples that do not require an understanding of how to solve recursive equation. This approach makes the E-B-O valuation framework more accessible, so that one can proceed to discuss its relevance to accounting. One way this note differs from Ohlson (1995) is in its emphasis on different accounting methods.

The main aspects of the E-B-O framework we illustrate herein are as follows. In a simple economy, where the only consumption commodity is money to be delivered at some point in time and everyone faces the same common knowledge interest rate, the market value is equal to the present value of future cash flows associated with the asset. In this setting, there exists a

set of accounting procedures such that accounting income is equal to the change in economic welfare of the owners of the firm. The accounting procedures call for valuing assets at market value and calculating income as the change in book value of owners' equity. Within this setting, accounting accruals arise not for "matching purposes," but because market value (or equivalently, the present value criterion) is forward-looking. Since the balance sheet mimics market value, it is the only financial statement needed to value the firm.

We also explore non-market approaches to valuation and income measurement. Alternatives to market accounting methods of course "time" the recording of income differently. As a result, the two market value accounting properties (1) owners' equity is equal to owner welfare, and (2) income is equal to changes in owners' welfare no longer hold. However, we illustrate that firm value can still be inferred from *simultaneous* use of the balance sheet and income statement. We consider the case where the asset is initially recorded at some value other than cost, and demonstrate that market value is equal to accounting book value plus discounted abnormal accounting earnings, as long as a clean surplus (all-inclusive) approach is used; that is, as long as all changes in owners' equity other than dividends and capital contributions are run through the income statement.

This article offers up the case of perfect and complete markets as a benchmark, which may be useful for evaluation of accounting methods where markets work well. This benchmark is apparently useful, since the FASB's views regarding existing or potential accounting pronouncements, as well as

explanations in accounting texts, are often based on perfect and complete market thinking. For example, mark-to-market accounting and present valuation for long-term investments can be justified in a concise and logical manner by invoking the E-B-O framework. A second reason to be interested in this benchmark is that it points to accounting issues that only arise when market imperfections are pervasive. For example, the note can be used to justify traditional methods of depreciation in terms of simulating a market where no ready market is apparent.

We are able to use this simple setting to clearly illustrate the articulation of the balance sheet and income statement. In this setting there is no tension between the two financial statements. Since the financial statements can be used to reproduce market value, one needs not be concerned about accounting method choice when markets are frictionless.[1] This implies that a richer framework must be considered if we are to make logical arguments regarding accounting method choice. Thus, this note should be viewed as a first step in understanding the relationship between accounting numbers and market value.

The rest of the paper proceeds as follows. In section two, we describe the market and accounting assumptions. In section three we present economic income accounting, where only the balance sheet is needed to value the firm. In section four, we show that under any approach consistent with clean surplus accounting the financial statements can be used to recover market value. Section five discusses limitations and concludes the paper.

ACCOUNTING, INCOME AND MARKETS

We will focus somewhat on the income number although, as mentioned, accounting's structure imposes relationships among income and other accounting data.[2] We should begin by pointing out that income is just a number. It is not something we eat or otherwise consume. When we speak of economic income, we refer to a measure of our ability to acquire things which we like to consume directly. Our ability to engage in market transactions to acquire things - and how we interpret income - depends on the arrangement of economic markets.

In this note we conduct a formal analysis of an economic setting called *perfect and complete markets*. We do not restrict ourselves in the analysis in this way because we believe markets generally are perfect and complete, but because it allows us to focus on specific characteristics of accounting information. We view the analysis of this simple setting as a first step in developing a formal understanding of the role of accounting.

We begin with a brief description of these market assumptions. *Complete* is a description of what things can be bought and sold; markets are complete when everything anyone cares about can be exchanged in a market transaction. *Perfect* is a description of the structure of the market and is a little bit tricky. It has to do with costs that are incurred to organize and complete the transaction. These are called *transaction costs* and include things like the cost of acquiring information about commodities or prices, or paying someone a fee to

orchestrate the transaction. Perfect markets are markets without transaction costs. We refer to market incompleteness or imperfections as *market frictions*.

A market where different economic actors face different prices is not a perfect market. An individual who does not have access to the most favorable price incurs a transaction cost either by paying to acquire the wherewithal to obtain the favorable price or by simply transacting at the unfavorable price. In the latter case the transaction cost is included in the price of the commodity.

We would tend to think of the New York Stock Exchange as a market with few frictions - transactions costs of executing trades are not high, security prices are public information and portfolios can be easily formed. In contrast, we would tend to think of the market for managerial talent to contain more serious frictions, in part because CEO's bring private information regarding an industry or their own talent to their employer. (For examples of teaching notes that model market imperfections arising from private information, see Arya et al. (1996c) and Fellingham and Young (1997)).

One additional characteristic of the market structure which is important for our discussion of income is time. That is, it must be possible to buy or sell a commodity for delivery later. The reason this is important is that income measurement is about the passage of time, and how the wealth position is different at the end of a time period than it was at the beginning.

The way we capture temporal transactions in our market structure is with an interest rate - the premium at which money now can be exchanged for money later. In this context, complete markets imply that everyone can trade

across any time periods that they like - that is, everyone has an interest rate. Perfect markets imply that the interest rate is the same for everyone, and the interest rate is known to everyone.

The curious reader may ask why study perfect and complete markets. After all, there are lots of things we care about that are not traded in markets (pollution?) or goods for which different people pay different prices (insider trading?). We understand accountants are most needed when markets are not well-functioning. A second concern is that the model does not capture uncertainty. Uncertainty is extremely important to study the market for investments and also for understanding the *information role* of accounting in these markets. The certainty case is presented to make the analysis simple, not to dismiss it as unimportant. There are several aspects of the relationship between accounting and market value which do not change significantly if uncertainty is introduced.

Recall that the objective of this note is to provide some structure so we can address what is meant by income, as well as how it should be measured. It turns out that under perfect and complete markets this question is easy to address, and under market incompleteness or imperfections it is extremely difficult to address. But keeping track of where the perfect and complete market assumption enters the analysis may be useful in suggesting how to proceed when markets are not frictionless.

ACCOUNTING VALUATION AND INCOME MEASUREMENT USING MARKET VALUE ACCOUNTING

Now that we have our market structure in place, we proceed to do some simple accounting.[3] Assume our firm owns one asset which will produce a sequence of cash flows of $2,600, $2,400, and $2,200, each occurring at the end of the year. Immediately after the third year the firm pays its only (liquidating) dividend. Everybody's interest rate (discount rate) is 10%. A timeline appears in Figure 1 below.

(Insert Figure 1 here)

To prepare balance sheets and income statements we use the following accounting valuation rule.

Accounting valuation rule: At each point in time, assets are valued at the present value of future cash flows.

Why do we propose this valuation rule? Here perfect and complete markets enter. If markets are complete, every asset can be traded and has a price. If markets are perfect, everyone knows the cash flows that will result from holding a particular asset, and everyone can borrow and lend at the same interest rate. In a competitive equilibrium, there are no economic profits, so the price of the asset would be equal to the present value of its future cash flows. Thus, market values are equal to discounted cash flows under perfect and complete markets.[4] Using this accounting valuation rule is equivalent to

valuing assets at their market value. We shall see that one can make a logical argument for market value accounting when markets are perfect and complete.

Although this approach may look a little abstract, both market and present value approaches are sometimes recommended by (United States) Generally Accepted Accounting Principles. For example, we use lower-of-cost-or-market for inventories, fair value for trading securities, and effective interest amortization for bonds and notes.[5]

Before proceeding, we note that market value accounting may not in general work well. Imagine that markets were not perfect. In particular, what if the current owner of the asset knew the cash flows, but outsiders did not? They might attribute a greater or lesser value to the asset than the owner, so the market price would not be equal to the current owners' discounted cash flows from holding the asset. Thus, the market value would not necessarily be a good way to value the asset. What if the markets were not complete? That's even easier, there is no market price! Thus, in cases where markets do not work well, market value accounting may not (or cannot) represent the value of the assets to the firm.

We are not advocating the market valuation rule; it is presented here because it leads to desirable properties of the financial statements within the context of our simple model. As we know, there are situations where market valuation is not attempted, for example, in the case of long-lived assets. But one implication of our analysis is that not adopting market valuation for long-lived

assets may be justified on the grounds that there are significant frictions in this market.

Applying this valuation rule to our example, the asset will be valued now (Time 0) as follows.

$$6{,}000 = \frac{2{,}600}{(1.10)} + \frac{2{,}400}{(1.10)^2} + \frac{2{,}200}{(1.10)^3}$$

Similarly, the asset values at Time 1 and 2 are as follows.

$$4{,}000 = \frac{2{,}400}{(1.10)} + \frac{2{,}200}{(1.10)^2} \quad \text{and} \quad 2{,}000 = \frac{2{,}200}{(1.10)}$$

In order to prepare financial statements for the firm, it is necessary to determine when the firm pays dividends and returns capital to the owners. Since everyone faces the same interest rate, dividend policy (timing) is irrelevant to the value of the firm. This is one of the well-known Modigiliani-Miller results from finance, which relies on the perfect markets assumption. Since management knows no more about the firm than the owners, dividend policy has no effect on the firm's ability to raise capital, and so it does not affect the firm's future cash flows.

In Example 1, we assume without loss of generality that the firm retains cash until the end of its life, whereupon it pays a single liquidating dividend. It is more instructive if we construct the last balance sheet just prior to paying the dividend (Time 3).

Below are the financial statements. Note that the balance sheet and income statement fully articulate. Any change in net assets that is not a capital contribution or a dividend affects net income (clean surplus).

Example 1: No interim dividends

Balance sheets	Time 0	Time 1	Time 2	Time 3
Cash	$ 0	$ 2,600	$ 5,260	$ 7,986
Long term asset	6,000	4,000	2,000	0
Total assets	$ 6,000	$ 6,600	$ 7,260	$ 7,986
Capital	$ 6,000	$ 6,000	$ 6,000	$ 6,000
Retained earnings	0	600	1,260	1,986
Total owners' equity	$ 6,000	$ 6,600	$ 7,260	$ 7,986

Income Statements	Year 1	Year 2	Year 3
Revenue:			
Cash revenue	$2,600	$2,400	$2,200
Interest revenue	0	260	526
Depreciation expense	(2,000)	(2,000)	(2,000)
Income	$600	$660	$726

The financial statements are constructed using simple "savings account accounting." The cash balance is increased by net cash flows from the asset plus the interest earned during that period. Cash retained by the firm earns interest at the market rate of 10% (as does the long-term asset). Interest earned in Year 2 is 10%·2,600 = 260. In Year 3, interest earned is 10%·(2,600 + 260 + 2,400) = 526. Net cash inflows from the long term asset and interest earned are recorded as separate revenue items on the income statement.

The long term asset is valued using a discounted cash flow approach. Depreciation expense on the income statement is equal to the difference between the ending and beginning long term asset value adjusted for acquisitions and disposals (of which there are none). Since the values are

established in perfect markets, depreciation when calculated under this method reflects the change in the market value of the asset. Thus, this method is commonly referred to as *economic depreciation*.

The technique of economic depreciation is worth contemplating. In Example 1, Year 1 depreciation is 6,000 - 4,000 = 2,000. Depreciation expense results because some of the future cash flows have been realized, and so are no longer available from ownership of the asset. This suggests another way of arriving at the depreciation number. As time passes: (1) some of the *future* cash flows are converted to cash *on hand*, and (2) interest has been earned on the beginning balance of the long term asset. Thus, depreciation expense can be calculated by netting the interest earned on the beginning of the period asset against the realized cash flow. For example, at the end of Year 1 a cash flow of $2,600 is received, but we receive interest on the $6,000 asset. Economic depreciation for Year 1 is thus: 2,600 - 10%·6,000 = 2,000.[6]

In this example, the sequence of depreciation expense numbers turns out to be equal to those obtained under the familiar straight line depreciation approach, but this is purely a coincidence: the depreciation numbers follow from the movement of the asset's market value through time.

Accountants generally would regard depreciation not as a measure of (change in) value, but as a means of cost allocation:

> "Assets are depreciated not on the basis of a decline in their market value, but on the basis of a charge of systematic charges to expense. Depreciation is defined as the accounting process of allocating the cost of intangible assets to expense in a systematic

> and rational manner to those periods expected to benefit from the use of the asset ... This approach is employed because the value of the asset may fluctuate between the time the asset is purchased and the time it is sold or junked. Attempts to measure these interim value changes have not been well received by accountants because values are difficult to measure objectively." (Kieso and Weygandt, 1998).

Nevertheless, it may be reasonable to interpret some arguments for choice of method in terms of simulating a market value. For example, an activity method of depreciation would generally not be considered appropriate for a building, because "[A] building is subject to a great deal of steady deterioration from the elements (time) regardless of its use. In addition, where an asset is subject to economic or functional factors, independent of its use, the activity methods loses much of its significance." (Kieso and Weygandt, 1998). While the argument is usually stated in terms of "better matching," it is also possible to interpret the argument as follows. The value of the building declines over time by an (approximate) constant amount, independent of the activity, and so straight line depreciation is appropriate for a building. Arguments in favor of accelerated depreciation methods can be similarly interpreted as simulating a market for the long lived asset in which the value of the asset declines rapidly in the early parts of its life.

As mentioned above, one can show that dividend policy (timing) does not affect value in this setting. However, it does affect the sequence of accounting numbers. In Example 2, we consider a different dividend policy:

dividends are 500 in Year 1 and 2, paid at the end of each year. At the end of Year 3 the remaining cash balance is returned to the owners. Below are the financial statements.

Example 2: Interim dividends

Balance sheets	Time 0	Time 1	Time 2	Time 3
Cash	$ 0	$ 2,100	$ 4,210	$ 6,831
Long term asset	6,000	4,000	2,000	0
Total assets	$ 6,000	$ 6,100	$ 6,210	$ 6,831
Capital	$ 6,000	$ 6,000	$ 6,000	$ 6,000
Retained earnings	0	100	210	831
Total owners' equity	$ 6,000	$ 6,100	$ 6,210	$ 6,831

Income Statements	Year 1	Year 2	Year 3
Revenue:			
Cash revenue	$2,600	$2,400	$2,200
Interest revenue	0	210	421
Depreciation expense	(2,000)	(2,000)	(2,000)
Income	$600	$610	$621

Notice that income in Year 2 is 50 dollars lower than in Example 1, because of the 500 dollar dividend payment made at the end of Year 1. This does not alter Time 0 firm value, however. Rather than accruing to the firm, the 50 dollars of interest income would be obtained privately by the recipient of the dividend.[7]

Summarizing, there are four important features of this setting:

1. The assets are reported at market values, which in this setting are equal to the discounted value of future cash flows.

2. Income is equal to the change in market value of the firm. It is calculated as net cash inflows (including interest) minus economic depreciation (decrease in market value of the long-term asset). Equivalently, each period's accounting income is equal to the interest rate times beginning owners' equity. Note, for Example 2, Year 2 income is 610, which is 10% of Year 2 beginning owners' equity of 6,100. This relationship is a sensible one which follows from: (1) the use of market value accounting, and (2) the perfect and complete market structure -- all assets can be traded for dollars and all dollars earn the same rate of return.[8,9]
3. A *clean surplus* accounting relationship is maintained. Dividends and capital contributions affect retained earnings and capital; they do not affect income directly. However, dividends do affect the firm's future income, because they reduce the firm's assets (cash). In Example 2, Time 2 owners' equity (6,100) is equal to Time 0 owners' equity (6,000) plus Year 1 income (600) minus Year 1 dividends (500).
4. Since value (in essence, the discounted cash flow calculation) is forward-looking, there is a demand to do accruals. Cash accounting cannot accomplish proper valuation and income measurement.

One would probably assume that higher net income is necessarily good news about the firm. In practice this might be difficult to demonstrate. One advantage of our simple market setting is we can demonstrate that, when calculated as above, more accounting income is better.

First, we should attach some meaning to the term "better." In perfect and complete markets the owners of the firm prefer higher net present value to lower. Higher net present value of their share of the firm increases the opportunities available to them; they can always rearrange their holdings in the marketplace to suit their own consumption preferences. This is the rationale for using maximum net present value as the criterion in capital budgeting and other problems in finance -- higher net present value is always preferred to lower in the presence of sufficient market opportunities.

In the market setting of our discussion, then, "better" means higher net present value for the owners. Item 2 establishes the equivalence of "better" and higher income. Since Year 1 income is the interest rate times Time 0 present value, Year 1 income is higher if and only if Year 0 present value is higher.

We have established that valuing assets at their discounted future cash flow and defining accounting income to be the change in owners' equity minus net contributions to capital implies that more income is better. Thus, a larger accounting income number is associated with greater economic welfare for the firm's owners.[10] As a consequence, we refer to the accounting income number computed under this approach as *economic income*.

To review, we have: (1) a market setting (perfect and complete markets), and (2) an accounting technique for presenting the balance sheet and income statement under which firms with higher present value of future cash flows always have higher accounting income. Further, which firm is more valuable can be determined directly from the balance sheet alone.

At this juncture, two questions arise. Can we count on the existence of perfect and complete markets, and must we use the present value accounting valuation technique? We can think of examples where markets function well; we also can think of examples where they do not. Whether markets are close enough to perfect and complete is a difficult question to answer, and one on which we defer. Rather, we focus on the second of these questions: When markets are perfect and complete, must we employ market values on the balance sheet for the financial statements to be useful for valuation purposes?

ACCOUNTING VALUATION AND INCOME MEASUREMENT USING NON-MARKET APPROACHES

In the previous section, we described a set of accounting procedures under which at each point in time the balance sheet measured the welfare of owners and the income statement measured the change in their welfare. In this section, we consider the case where the asset is at some point in time valued at a number other than its market value. We shall see that one can still use accounting numbers to value the firm, but now both the balance sheet and the income statement are necessary.

This problem can be couched in terms of well-known accounting problems such as whether to capitalize or expense (research and development costs?) or which depreciation method to use. For concreteness, suppose that the asset in Example 1 had been purchased for its discounted present value of 6,000 at Time 0. But instead of capitalizing the entire amount, suppose a portion of it was expensed immediately. In particular, suppose 900 was expensed (prior to

Year 1) and 5,100 was capitalized. Furthermore, depreciation is recorded on a straight line basis in Years 1 through 3. Below we reproduce the financial statements.

Example 3: Non-market valuation (no interim dividends)

Balance sheets	Time 0	Time 1	Time 2	Time 3
Cash	$ 0	$ 2,600	$ 5,260	$ 7,986
Long term asset	5,100	3,400	1,700	0
Total assets	$ 5,100	$ 6,000	$ 6,960	$ 7,986
Capital	$ 6,000	$ 6,000	$ 6,000	$ 6,000
Retained earnings	(900)	0	960	1,986
Total owners' equity	$ 5,100	$ 6,000	$ 6,960	$ 7,986

Income Statements	Year 1	Year 2	Year 3
Revenue:			
Cash revenue	$2,600	$2,400	$2,200
Interest revenue	0	260	526
Depreciation expense	(1,700)	(1,700)	(1,700)
Income	$ 900	$960	$1,026

Recall that in Example 1 the income numbers under economic depreciation were 600, 660 and 726 and summed to 1,986. We see the income numbers no longer add to 1,986. Thus, when assets are not initially valued on the balance sheet at market value, simply adding earnings over the future time period will not help us value the firm.[11]

However, one can still use the accounting numbers to value the firm in the following way. We shall show that, at any point in time, market value is equal to the beginning book value plus the discounted future *abnormal* earnings. Abnormal earnings for each year are the accounting earnings less the *normal*

earnings on the firm's assets. Normal earnings are defined as the beginning book value of owners' equity times the interest rate; they can be thought of as the imputed charge for the use of capital. For this reason, abnormal earnings are often referred to as residual income (Maher and Deakin, 1994, p. 817). The calculations appear below.

Abnormal earnings calculation - Example 3

	Year 1	Year 2	Year 3
Beg. book value	$ 5,100	$ 6,000	$ 6,960
Income	$ 900	$ 960	$ 1,026
Normal earnings (@ 10%)	(510)	(600)	(696)
Abnormal earnings	$ 390	$ 360	$ 330

Market value calculation using accounting numbers

Time		
0	$5{,}100 + \frac{390}{(1.10)} + \frac{360}{(1.10)^2} + \frac{330}{(1.10)^3}$	$= 5{,}100 + 900 = 6{,}000$
1	$6{,}000 + \frac{360}{(1.10)} + \frac{330}{(1.10)^2}$	$= 6{,}000 + 600 = 6{,}600$
2	$6{,}960 + \frac{330}{(1.10)}$	$= 6{,}960 + 300 = 7{,}260$

We now sketch out a simple proof that this result holds. For simplicity, we assume no dividends. At Time 0 we recorded a book value which is less than market value and expensed more prior to Time 0. This meant that, in the future, expense was less than it would have been if we had recorded the asset at its market value at Time 0.

Formally, suppose the firm consists of a two-year asset initially valued (arbitrarily) at BV_0 and with accounting earnings (however calculated) of E_1 in

Year 1 and E_2 in Year 2. Then book value plus discounted abnormal earnings (DAE) at Time 0 are as follows:

$$BV_0 + \frac{E_1 - i\,BV_0}{(1+i)} + \frac{E_2 - i\,(BV_1)}{(1+i)^2}$$

$$= BV_0 + \frac{E_1 - i\,BV_0}{(1+i)} + \frac{E_2 - i\,(BV_0 + E_1)}{(1+i)^2}$$

Now suppose we decrease book value by one dollar at Time 0 but decrease expense and hence increase accounting earnings in Year 1 by one dollar (we could also spread the one dollar out over the two years). Then book value plus discounted abnormal earnings at Time 0 are as follows:

$$BV_0 - 1 + \frac{E_1 + 1 - i\,(BV_0 - 1)}{(1+i)} + \frac{E_2 - i(BV_0 - 1 + E_1 + 1)}{(1+i)^2}$$

$$= BV_0 - 1 + \frac{E_1 - i\,(BV_0)}{(1+i)} + \frac{1}{1+i} + \frac{i}{1+i} + \frac{E_2 - i(BV_0 + E_1)}{(1+i)^2}$$

$$= BV_0 + \frac{E_1 - i\,BV_0}{(1+i)} + \frac{E_2 - i\,(BV_0 + E_1)}{(1+i)^2}$$

We see that the book value plus discounted abnormal earnings expression is unchanged by the amount of the asset purchase that is capitalized. To complete the proof, we can start with book value equal to market value and hence abnormal earnings are zero in each year. Now we have book value plus abnormal earnings equal to market value. We have already shown that shifting accounting earnings does not change the expression.

The key is that clean surplus is maintained; the uncapitalized amount affects future income through lower expenses. The same phenomena occurs with any timing differences such as using different depreciation or inventory

methods. Transferring a dollar of Year 1 accounting income to Year 2 leaves the market value expression unchanged! This analysis reminds us that concerns over "income smoothing" are unwarranted in a world without market frictions.[12]

Notice what we have done. When book values do not equal market values at Time 0, we must use both the balance sheet and the income statement. And we must now discount future *abnormal* earnings.[13] In summary, we have the following rule which allows the reader of financial statements to convert accounting numbers to market values.[14]

Market value = Book value of Owners' equity + Discounted abnormal earnings

The market assumption is important to our calculations. Everyone faces the same cost of borrowing and lending, and agrees on the firm's future cash flows (or, under uncertainty, the probability distribution of future cash flows). Then (risk-neutral) market value is equal to discounted expected present value. Imposing clean surplus, one may substitute for the discounted present value calculation, based on expected *cash flows*, the book value plus discounted expected abnormal *accounting* earnings calculation. And one is indifferent between utilizing predictions of future dividends, cash flows, or accounting earnings.

Given that in the setting of this paper one is indifferent among these valuation approaches, one might ask why we see so much attention given to how one prepares accrual accounting earnings. Addressing this issue may require stepping outside this simple model. Some have argued that

implementing a cash flow or dividend approach is more difficult in practice than the discounted abnormal earnings approach.[15] We have implicitly assumed away any forecasting difficulties. In addition, there may be a concern about strategic behavior by managers, also implicitly assumed away in our analysis. Financial statements prepared under traditional accrual accounting have the advantage of being based (in large part) on actual transactions which can be verified, whereas managers' expectations about the future (dividends, cash flows, or earnings) are difficult to verify (Ijiri, 1975).

CONCLUSIONS AND LIMITATIONS

Income can be calculated using a wide variety of techniques. Some acceptable alternative accounting techniques are given below, but, as we know, the list is virtually endless.

- Straight-line or accelerated depreciation
- Manufacturing costs can be allocated to different products based on material costs or machine hours
- LIFO or FIFO inventory valuation
- Revenue recognition may occur at various times --(e.g. Percentage of Completion or Completed Contract Method for long term construction contracts)

Given the variety of accounting choices available, can accounting data be used to value firms?

This note integrates the ideas in the valuation literature, using the E-B-O framework, to illustrate how accounting numbers can be used to value the firm in perfect and complete markets. These are strong assumptions, but they are useful for thinking about accounting and valuation. Nevertheless, one cannot help but notice the paradox. We demonstrate that market value accounting works well for valuing firms in frictionless markets. We then consider alternative approaches to doing the accounting and demonstrate how both the balance sheet and income statement can be used to value firms. But if market values are available, why bother to do the accounting under one of the non-market approaches? Thus, we present the E-B-O framework not because it answers all the questions we have about accounting, but because it is useful for answering a few simple questions, and opens the door to the study of more intricate models of accounting valuation.

This note focuses on a particular aspect of accounting: the role of the market structure in interpreting accounting numbers. Specifically, it illustrates that in the highly stylized setting of perfect and complete markets the financial statements can easily be used to infer the economic value of the firm. But there are many other aspects of accounting that are also important. First, accounting provides structure that disciplines our planning for future economic events and our interpretation of economic events underlying the numbers reported in financial statements. An important example is the construction of a budget (see Horngren et al. 1997). We begin with a sales budget, add a cash collections/payments policy and an inventory policy, and accounts receivables,

inventory values, and accounts payable follow. Add a cash inventory policy, and we quickly move from cash balances to financing decisions. And, of course, the balance sheet and income statement follow thereafter. It is easy to see how these steps in the budgeting process are influenced by the structure of accounting.

Second, accounting produces an income number which has many important properties. The income number may not only be important to individuals acting on their own behalf, but may also tell us something about the economy in the aggregate. For example, under certain conditions the income number is related to productive and social efficiency.

Third, and perhaps most important, the structure of accounting is such that errors (unintentional or intentional) are unlikely to persist. For example, overstating ending inventory in one period overstates income in that period, but causes the next period's income to be understated (unless further inventory overstatements take place). Further, the numbers are generally auditable. Together these feature makes accounting especially valuable in dealing with stewardship problems.

Ijiri (1975) suggests that the most important aspect of accounting information is its ability to deal with concerns of *accountability*. Management may be tempted to bias their disclosures about the firm. It is important that accounting systems be designed to resist manipulation. In addition, accounting's real cutting power may lie "off the equilibrium path." That is, accounting's most important role may not be in producing an income number

consistent with market value, but rather in disciplining non-accounting disclosures related to market value. It has been suggested that the double entry accounting system and historical cost approach are especially useful in this regard.[16]

Further study of firm value in settings where market imperfections are present requires considerable additional structure. A preliminary effort in this direction is Farlee et al. (1996). Another worthwhile next step may be to study the relationship between accounting numbers and market value in a world of market incompleteness. However, making headway will not be easy, as the notion of equilibrium, as well as accounting, is relatively unexplored in incomplete markets. Preliminary efforts include Arya et al. (1996a) and Beaver and Demski (1995).

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FIGURES

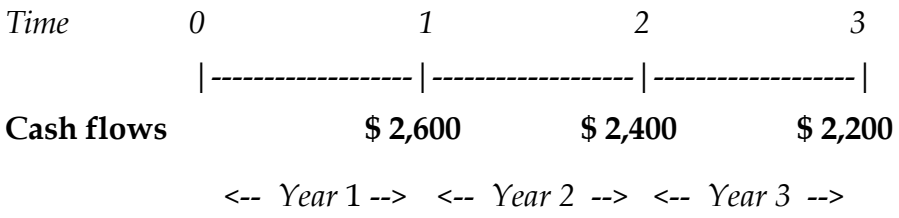

Figure 1: Timeline - Cash flows

ENDNOTES

[1] Further, there would be no need to charge certain changes in net assets (except dividends or capital contributions) directly to retained earnings in order to avoid misinterpretation of the earnings number.

[2] Arya et al. (1996b, 1997) model an accounting system as a mapping from transactions to account balances, and capture the full set of relations among accounts.

[3] See Demski (1992, Chapter 2 and 3) for a somewhat different approach.

[4] Actually, owners would be fundamentally interested in dividends, since they can be used for consumption purposes. But it has been demonstrated that there is an equivalence between the present value of future dividends and the present value of the firm's future cash flows in perfect and complete markets. See, for example, Ohlson (1995).

[5] "Many of the recent standards, such as FASB Statements No. 106, 107, 109, 113, 114, 116, 118, 121, and 122 address the issue of present value somewhere in the pronouncement or related basis for conclusions." (Kieso and Weygandt, 1998, p. 278). For a complete list of circumstances where present value is used in accounting valuation see Kieso and Weygandt (1998, p. 279).

[6] The remaining years' depreciation expense numbers can be calculated in this same (alternative) way. Calculating depreciation expense in this fashion emphasizes the savings account accounting analogy.

[7] Dividend irrelevance is illustrated by comparing Examples 1 and 2. Recall that the present value of the firm's future cash flows is 6,000. In Example 1, the liquidating dividend is received three periods from the initial investment, so the present value of dividends paid to owners is as follows.

$$6{,}000 = \frac{7{,}986}{(1.10)^3}$$

In Example 2, the present value of dividends is as follows

$$6{,}000 = \frac{500}{(1.10)} + \frac{500}{(1.10)^2} + \frac{6{,}831}{(1.10)^3}.$$

[8] To verify this, let us use the example above. Denote owners' equity at time t by OE_t. The firm's owners' equity at time zero is the value of the owners' claim on the productive asset:

$$OE_0 = \frac{2{,}600}{(1.10)} + \frac{2{,}400}{(1.10)^2} + \frac{2{,}200}{(1.10)^3}.$$

The firm's owners' equity at time one is the value of the owners' claim on the productive asset plus the cash (which we have assumed remains inside the firm):

$$OE_1 = 2{,}600 + \frac{2{,}400}{(1.10)} + \frac{2{,}200}{(1.10)^2}.$$

The first term is the cash flow; the last two terms together are the value of the productive asset at time one. It is easy to see that OE_1 is equal to OE_0 times one plus the interest rate. One may use the same approach to verify that $OE_2 = OE_1 (1+i)$.

[9] Under uncertainty and risk neutrality, value would be equal to the expected net cash flows resulting from the asset, and the result is modified to be *Expected* earnings = 10% (beginning owners' equity). Risk aversion can be incorporated heuristically by using the risk-adjusted discount rate.

[10] We are using "better" to indicate that the *owner* is better off with larger income. In this note we do not address whether *society* is better off when firms have higher income. However, it is well known that frictionless markets lead to productive efficiency and so with wealth redistribution social welfare can be increased in the Pareto sense. Dorfman et al. (1985) demonstrates this in a simple and elegant linear model of production. Further, Arya et al. (1996a) exploits the linear technology to forge the link between income maximization and productive efficiency, demonstrating that economic income is maximized whenever

productive efficiency is achieved.

[11] The observant reader will notice that if one were to include the $900 expensed before year one at the time the asset was purchased, income can be added to obtain: - 900 + 900 + 960 + 1,026 = 1,986. This approach requires going backwards as well as forwards through the financial statements.

[12] If managers have private information regarding present and future investment opportunities, they may be able to shift accounting income from one period to another to affect their own performance evaluation. The existence of such private information is assumed away in frictionless markets. We return to this issue in the Limitations and Conclusions section of the paper.

[13] Note one does not discount earnings.

[14] Much of this development is due to Preinrich (1938) and Edwards and Bell (1961). Ohlson (1995), and Feltham and Ohlson (1995, 1996) extend the analysis to formally capture market structure, uncertainty and cash flow dynamics.

[15] Empirical studies which explore the ability of these three approaches to predict firm values include Penman and Sougiannis (1997) and Francis et al. (1997).

[16] Historical data also may be useful even when it is subject to manipulation, since it can be used to condition future investment decisions (Fellingham and Young, 1996; Arya, et al., 1990).