Accounting in Perfect and Complete Markets

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November 2004

The authors thank the Ohio State undergraduate and graduate students, especially James Herbeck, for their comments.

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Abstract

This note explores the relationship between market values and accounting numbers. It emphasizes the importance of market structure in the interpretation and use of accounting data. In a perfect and complete markets setting, where everyone knows the characteristics of the firm's opportunity set and has equal access to markets, value is well-defined. We show that, in this euphoric setting, there exists a way to construct the balance sheet and income statement such that either can be used to value the firm. When at each point in time assets are recorded at market, and depreciation is calculated as the change in an assets book value, net assets and accounting income are each greater for firms that have greater future opportunities. We further show that, when accounting valuation and income calculations deviate from the market valuation approach, the financial statements can still provide a measure of firm value, but both the balance sheet and income are necessary. In general, the firm's market value is equal to accounting book value plus discounted residual income. This relationship holds no matter how the accounting is done, as long as it satisfies the clean surplus relation. Unfortunately, this result implies accounting choice is not important when markets are perfect and complete. Further, the result can easily be extended to accommodate uncertainty, as long as the players are risk neutral and there is no information asymmetry. Thus, while accounting data can be used in a straightforward fashion to evaluate the firm in a perfect and complete market setting, it is not a useful setting in which to study accounting choice. We maintain that, in order to undertake a meaningful study of accounting choice, one where accounting choice can impact social value, one must consider information asymmetries.

Introduction

Accounting activities are widespread in business and other organizations. Accounting is also an academic discipline with a rich tradition. While the practice and study of accounting are very old, there are many unanswered and important questions which remain. The aspect of accounting that we explore is the relationship between accounting numbers and the value of the firm.[1]

Before proceeding, we would like to mention a few 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 budgeting (Horngren et al. 1996). One begins with a sales budget, derives a cash collections/payments policy and an inventory policy, and forecasts of accounts receivables, inventory, and accounts payable follow. Add a cash "inventory" policy, and one is then able forecast financing needs. 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, 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). Third, the accounting system produces a number that people refer to as income, and a true measure of income has many important properties. For example, the income number may not only be important to those interested in a particular firm, but may also tell us something about the economy in the aggregate. For example, under certain limited conditions one can show that income is related to productive and social efficiency. So we should keep in mind the range of the phenomena affected by accounting. An extensive study of accounting involves understanding accounting in its broader context.

We now turn to the issue at hand: the study of accounting income and its relation to market valuation. Perhaps the most important aspect of this note is the careful links developed between accounting and the value of the firm. We construct a simple model characterized by a commonly known price of money (interest rate) and known opportunities for the firm.[2] In this setting individuals' consumption possibilities are greatest if they maximize the present value of

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[1] This note is closely related to Preinrich (1938), Edwards and Bell (1961) and Ohlson (1995).

[2] Alternatively, one can assume management alone knows the firm's opportunities and further is willing to disclose whatever they know.

future cash flow. Due to the competitive nature of markets, it follows that asset prices will be equal to discounted cash flows.

We show that in the simple but illuminating setting of perfect and complete markets it is possible to construct balance sheets and financial statements so that they measure firm value. Assets are valued at their market values which, as mentioned, are equal to the discounted cash flows associated with their ownership.[3] And income is equal to the change in the value of net assets, net of capital contributions and dividends. The result is that either the balance sheet or the income statement can be used to rank firms (both are not needed).

We know that firms do not generally use market value accounting. The reasons often cited are (1) markets are sometimes incomplete (there is no market), so no market value exists, and (2) markets are often imperfect, most often due to asymmetric information regarding properties of the asset, so that the price at which the asset is traded is not generally a good indicator of "value" (Christensen and Demski, 2002, Ch. 9). We therefore also explore non-market approaches to valuation and income measurement, while maintaining the assumption of perfect and complete markets. Alternatives to market value accounting "time" the recognition of income differently. As a result, the market accounting result that income or asset values communicate firm value no longer holds. However, we illustrate that firm value can in fact be communicated through *simultaneous* use of the balance sheet and income statement. We demonstrate that accounting book value plus discounted abnormal earnings is equal to market value, as long as accounting satisfies the clean surplus relation. We further show that uncertainty can be accommodated within this framework, and suggest an intuitive decomposition of accounting income into an expected (operating income) portion plus an unexpected (holding gain or loss) portion.

In conclusion, this note focuses on valuation aspects of accounting in perfect and complete markets. The conundrum is that, while the perfect and complete market setting appears to be a promising venue to study proper accounting, because value is well-defined, it is one where accounting choice is irrelevant and so has no impact on social value. However, some would argue that, while accounting uses the language of valuation, providing an approximation to market value is not its main purpose. A second purpose of accounting is to provide information about the

[3] 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 see the use of lower-of-cost-or-market for inventories, market value for marketable securities, and present value for bonds and notes.

firm's opportunities.[4] However, Christensen and Demski (2003) and Demski and Sappington (1990) show that the communication of information by management is not constrained by accounting rules. So again, accounting choice has no bite. Therefore, an interesting study of accounting must take place in an arena of information asymmetry, where managers have private information about the firm's opportunities.

Accounting, Income and Markets

We focus somewhat on the accounting income number and aggregate assets although, as mentioned, accounting's structure imposes relationships among income and other accounting data.[5] We begin by pointing out that income is just a number. It is not something we eat or otherwise consume. Income is important because it measures our ability to acquire "things" which we like to consume directly. It turns out that 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 will restrict our attention to an economic setting called *perfect and complete markets*. We begin with a brief description of these market assumptions. Exactly where these assumptions are important to the interpretation of accounting income will be made clear after we make some headway in the analysis.

"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. A frequently used example of a commodity that is not easily exchanged within a market setting is pollution. "Perfect" is a description of the structure of the market and is a little bit tricky. A perfect market is one in which there are no *transaction costs*, which are costs incurred to organize and complete a transaction. They include things like the cost of acquiring information about commodities or prices, or paying someone a fee to orchestrate the transaction. 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 the 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.

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[4] In fact, one could argue that if providing a measure of value was the main purpose of accounting, accounting is an abject failure. Think about how many items on a balance sheet are not valued at market.

[5] Arya, Fellingham, Schroeder and Young (1996) model the full set of relations among accounts and illustrate the self-correcting aspects of the double entry bookkeeping system.

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 price 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?). Recall that the objective of this note is to provide some structure so we can address what we mean 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. So we naturally start with the easy thing first — perfect and complete markets.

Accounting Valuation and Income Measurement

Now that we have our market structure in place, in this section we do some simple accounting.[6] Assume our firm owns one asset which will produce a cash flow of $26, $24, and $22 at the end of the next three years. Everybody's interest rate, the market price of borrowing and lending over one year, is 10%. To prepare balance sheets (and income statements) we will use the following accounting valuation rule.

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

Why will this valuation rule turn out to be a good one? Here perfect and complete markets enter. If markets are complete, every asset has a market value. If markets are perfect, everyone knows the cash flows that will result from holding a particular asset. And since everyone faces the same interest rate, everyone would come up with the same number for the value of the firm's assets — in a competitive equilibrium it would be the present value of its

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

future cash flows. Thus market values and discounted cash flows are equivalent under perfect and complete markets.[7]

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 larger or smaller value to the asset than the owner, so the market price would not be equal to the current owner's 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! So, in cases where markets do not work well, market value accounting will not (or cannot) represent the value of the assets to the firm.

Applying this valuation rule to our example, the asset will be valued as follows:

$$\text{Time 0: } \$60 = \frac{26}{(1.10)} + \frac{24}{(1.10)^2} + \frac{22}{(1.10)^3}.$$

$$\text{Time 1: } \$40 = \frac{24}{(1.10)} + \frac{22}{(1.10)^2} \qquad \text{Time 2: } \qquad \$20 = \frac{22}{(1.10)}.$$

The cash flow stream and present value calculations can be presented in the following format.

Time	0	1	2	3
	|----------|----------|----------|			
CF	0	$ 26	$ 24	$ 22
PV of future CF's	60	40	20	0
	$ 60	$ 66	$ 44	$ 22

Below are the financial statements.

Balance sheets	Time 0	Time 1	Time 2	Time 3
Cash	$ 0	$ 26	$ 52.60	$ 79.86
Long term asset	60	40	20	0
Total	$ 60	$ 66	$ 72.60	$ 79.86
Contributed capital	$ 60	$ 60	$ 60	$ 60
Retained earnings	0	6	12.60	19.86
Owners' equity	$ 60	$ 66	$ 72.60	$ 79.86

Income Statements	Year 1	Year 2	Year 3
Cash revenue	$26	$24	$22
Interest	0	2.60	5.26
Depreciation expense	(20)	(20)	(20)
Income	$6	$6.60	$7.26

[7] We are already in a little trouble here. Perfect and complete markets means there are no opportunities to earn rents. This means there is no reason to actually sell or buy assets.

Check that all the numbers are sensible. Because no dividends are paid, the cash received earns interest at 10%. So interest earned in year 2 is 10% of $26. In year 3, interest earned is 10% of (26 + 2.60 + 24) = $5.26.

Depreciation is reported in the usual way: it is equal to the difference between ending and beginning asset value adjusted for acquisitions and disposals (of which there are none). For example, year 1 depreciation is 60 - 40 = 20. Given our accounting valuation rule and perfect and complete markets, depreciation reflects the change in the market value of the asset. This depreciation method is commonly referred to as *economic depreciation*. 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 valuation of the asset.

To add intuition, depreciation expense results because some of the future cash flows have been realized, and so are no longer available from ownership of the asset. That is, some of the future cash flows have been converted to cash on hand. Of course, because we are one period closer to the remaining cash flows, depreciation expense nets the interest earned on the beginning of the period asset against the realized cash flow. That is, at the end of period one a cash flow of $26 is received, but we receive $6 of interest on the $60 asset; economic depreciation is 26 - .10(60) = 20. The remaining years' depreciation expense numbers can be calculated in this same alternative way.

There are four things about these financial statements we want to be sure we understand.

(1) The assets are reported using the discounted value of future cash flows.

(2) Because discounted cash flow calculations are forward-looking, there is a demand to do accruals. Cash accounting cannot accomplish proper valuation and income measurement.

(3) Each period's accounting income is equal to the interest rate times beginning owners' equity. Note, for example, that year 3 income is $7.26, which is 10% of year 2 beginning owners' equity of $72.60. It is easily verified that the other years work the same way. This relationship is a sensible one which follows from our perfect and complete market structure. All assets can be traded for dollars and all dollars earn the same rate of return.[8, 9]

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

$$OE_0 = \frac{26}{(1.10)} + \frac{24}{(1.10)^2} + \frac{22}{(1.10)^3}.$$

(4) We have a *clean surplus* accounting relationship which is maintained. In every period ending owners' equity is equal to beginning owners' equity plus accounting income for the period. For example, year 3 owners' equity ($79.86) is equal to year 2 beginning owners' equity ($72.60) plus year 3 income ($7.26). Of course, in general owners' equity would be adjusted for dividends and contributions of capital, but we don't have any of them here.

An important question that arises is whether greater accounting income can be interpreted as characteristic of a more valuable firm. First let us attach some meaning to the term "better." In perfect and complete markets the owners of the firm prefer higher net present value to lower. They can rearrange their holdings in the marketplace to suit their own consumption preferences, and higher net present value of their share of the firm increases the opportunities available to them. 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 ample market opportunities. In the market setting of our discussion, then, "better" means higher net present value for the owners. Item (3) implies the equivalence between a more valuable firm and greater 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. Year 2 income is similar, because income is the interest rate times year 0 present value times (1+i). It follows that if the cash flow stream is chosen to increase net present value, every period's income will also be 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 indicative of a more valuable firm. 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*.

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

$$OE_1 = 26 + \frac{24}{(1.10)} + \frac{22}{(1.10)^2}.$$

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] Certainty and risk neutrality are important here, as well.

[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

To review, we have (1) a market setting (perfect and complete markets) and (2) an accounting technique (present value accounting) for presenting the balance sheet and income statement under which the firm is more valuable if it greater accounting income in every period. So either the income statement or the balance sheet can be used to rank firms. A question that should arise immediately is, why do we not use present value accounting for all assets?

Non-Market Approaches to Accounting Income Measurement

In the previous section we valued the asset at each point in time at its market value, equal to the present value of its future cash flows. We concluded that either the balance sheet or the income statement could be used to value the firm, if assets were valued at market and income were calculated as the net change in market value. What happens to our conclusion if we don't construct our accounting numbers using the market value rule?

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 accounting numbers can still provide a measure of firm value, but now both the balance sheet and the income statement are necessary.

The problem can be couched in terms of well-known accounting problems such a whether to capitalize or expense or which depreciation method to use. For concreteness, suppose that our asset had been purchased for its discounted present value of 60 at time zero, but will be depreciated using the sum-of-the-years'-digits method. Below we produce the financial statements.

Balance sheets	Time 0	Time 1	Time 2	Time 3
Cash	$ 0	$ 26	$ 52.60	$ 79.86
Long term asset	60	30	10	0
Total assets and owners' equity	$ 60	$ 56	$ 62.60	$ 79.86
Contributed capital	$ 60	$ 60	$ 60	$ 60
Retained earnings	0	(4)	2.60	19.86
Total assets and owners' equity	$ 60	$ 56	$ 62.60	$ 79.86

Income Statements	Year 1	Year 2	Year 3
Cash revenue	$26	$24	$22
Interest	0	2.60	5.26
Depreciation expense	(30)	(20)	(10)
Income	($ 4)	$6.60	$17.26

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redistribution social welfare can be increased in the Pareto sense. Dorfman, Samuelson and Solow (1985) demonstrate this in a simple and elegant linear model of production. Further, Arya, Fellingham, Glover, Schroeder and Young (1996) exploit the linear technology to forge the link between income maximization and productive efficiency, demonstrating that economic income is maximized whenever productive efficiency is achieved.

Recall the income numbers under the market value approach were 6.00, 6.60 and 7.26 and summed to 19.86. We see the income numbers still add to 19.86. We note that cash flows are equal to 26 + 24 + 22 + 2.60 + 5.26 – 60 = 19.86 as well. So one may view choice among accounting methods as a choice regarding how to allocate total income to individual accounting periods.

It turns out that one can still use the accounting numbers to value the firm in the following way. At any point in time, it turns out that if trades are recorded at market value, the market value of all assets is equal to the beginning book value prepared plus the present value of future residual income (PRI) at every point in time. This holds for *any* accounting procedures that satisfy the clean surplus relation. Residual income for each year is equal to accounting income minus normalized earnings on the book value of the firm's assets, where normalized earnings is defined as beginning book value times interest rate. The calculations appear below.

Income Statements

	Year 1	Year 2	Year 3
Beg. book value	$ 60	$56	62.60
Income	(4)	$6.60	17.26
Less: Normal earnings (@ 10%)	6	(5.60)	(6.26)
Residual income	($ 10)	$1.00	$11.00

Time 0 Market value: $60 = \frac{26}{(1.10)} + \frac{24}{(1.10)^2} + \frac{22}{(1.10)^3} = 60 + \frac{(10)}{(1.10)} + \frac{1}{(1.10)^2} + \frac{11}{(1.10)^3}$

Time 1 Market value: $66 = 26 + \frac{24}{(1.10)} + \frac{22}{(1.10)^2} = 56 + \frac{1}{(1.10)} + \frac{11}{(1.10)^2}$

Time 2 Market value: $72.6 = 52.6 + \frac{22}{(1.10)} = 62.6 + \frac{11}{(1.10)}$

We now sketch out a simple proof that book value plus discounted future residual income is unaffected by the choice of accounting method. Suppose the firm consists of a two year asset initially valued at BV_0 and with accounting earnings (however calculated) of E_1 in period 1 and E_2 in period 2. Then book value plus discounted future residual income 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 increase depreciation by one dollar in year 1 (decreasing earnings) and decrease depreciation (increasing earnings) in year 2 by one dollar. Then the recalculated book value plus discounted abnormal earnings are as follows:

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

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

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

We see that the expression for initial book value plus discounted future residual income is unchanged by the choice of depreciation method. The key is that clean surplus is maintained; the decrease in present income by increasing depreciation in year one decreases book value at the start of year two, which increases year two residual income and also decreases year two depreciation. These effects exactly offset each other in the present value calculation. This analysis implies that concerns over income smoothing would be of no importance if markets were perfect and complete.

Notice what we have done. Because book values do not equal discounted cash flows at the beginning of year two and three, we must use both the balance sheet and the income statement to translate the accounting numbers into market value. But the calculation is straightforward. In summary then, we have the following rule which allows the reader of financial statements to convert accounting numbers to market values.[11]

Market value = Book value + Discounted future residual income

[11] 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.

Uncertainty

In this section we extend the previous approach to accounting in perfect and complete markets to the case of uncertainty. We see that no major difficulty arises in dealing with this case, and further, develop some insight into potential benefits from decomposing the income number into operating income and holding gains and losses.

We illustrate these issues with a modified version of the economic setting described above. Assume our firm owns one asset which will produce a cash flow of $26 and $24 in years one and two, respectively. However, at time zero everyone is uncertain about the year three cash flows; they believe that they will be either 8.69 or 35.31. Each is equally likely. During year one everyone learns whether the third year's cash flows will be low, or high. Everybody's interest rate is 10%.

Before proceeding, we first must specify how market participants price risk. For simplicity, we assume that individuals are risk neutral, and so they value the asset at its *expected* present value. If the asset's value turns out to be 8.69 in year three, its time zero present value is 50; if it turns out to be 35.31, its present value is 70. The time zero expected present value, and market value, is thus .5(50) + .5(70) = 60. At time one, depending on what is learned during year one, the present value is either $24/1.1 + 8.69/1.1^2 = 29$ or $24/1.1 + 35.31/1.1^2 = 51$. At time two, depending on what was learned at time one, it is either 8.69/1.1 = 7.9 or 35.31/1.1 = 32.1.

With these parameters in place events unfold in one of two ways - the resultant financial statements are provided below. The numbers chosen for depreciation and the holding gain or loss may need a little explanation. Depreciation expense for the period is set equal to the difference between the market value of the asset at the beginning of the period and the beginning of the year's expected market value for the end of that period. Year one depreciation is therefore equal to 60 - .5(29) + .5(51) = 20. Time two depreciation is either 29 - 7.9 = 21.1 or 51 - 32.1 = 18.9.

The holding gain calculation is designed to include only the change in the asset value that is unexpected. For example, in the 8.69 case the holding gain can be calculated as follows: 29 - (60-20) = – 11.

One noteworthy observation is that the *net income* number is no longer equal to the interest rate times beginning owners' equity. However, decomposing income into the depreciation and holding gain components as described above implies that *operating income* is equal to the interest rate times beginning owners' equity.

Case one - period three cash flow is 8.69:

Balance sheets	Time 0	Time 1	Time 2	Time 3
Cash	$ 0	$ 26	$ 52.60	$ 66.55
Long term asset	60	29	7.90	0
Total assets	$ 60	$ 55	$ 60.50	$ 66.55
Contributed capital	$ 60	$ 60	$ 60	$ 60
Retained earnings	0	(5)	0.50	6.55
Owners' equity	$ 60	$ 55	$ 60.50	$ 66.55

Income Statements	Year 1	Year 2	Year 3
Revenue:			
Cash revenue	$26	$24	$8.69
Interest	0	2.60	5.26
Depreciation expense	20	21.1	7.9
Operating income (loss)	$6	$5.50	$6.05
Holding gain (loss)	(11)	0	0
Net income (loss)	$(5)	$5.50	$6.05

Case two - period three cash flow is 35.31:

Balance sheets	Time 0	Time 1	Time 2	Time 3
Cash	$ 0	$ 26	$ 52.60	$ 93.17
Long term asset	60	51	32.10	0
Total assets	$ 60	$ 77	$ 84.7	$ 93.17
Contributed capital	$ 60	$ 60	$ 60	$ 60
Retained earnings	0	17	24.70	33.17
Owners' equity	$ 60	$ 77	$ 84.70	$ 93.17

Income Statements	Year 1	Year 2	Year 3
Revenue:			
Cash revenue	$26	$24	$35.31
Interest	0	2.6	5.26
Depreciation expense	20	18.9	32.1
Operating income (loss)	$6	$7.7	$8.47
Holding gain (loss)	11	0	0
Net income (loss)	$17	$7.70	$8.47

Conclusions

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 one identify conditions under which accounting data can be translated into the firm's market value?

This paper illustrates that 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 present value (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. Furthermore, this approach works no matter how one does the accounting, as long as it satisfies clean surplus. This implies that, if one thinks accounting choice matters, one must look beyond perfect and complete markets. We show that uncertainty in and of itself does not affect this relationship between market values and accounting numbers. This further implies that it is not uncertainty, but information asymmetry, that is important if one is to understand why accounting choice matters.

Ijiri (1975) suggests that the power of accounting information is its ability to deal with concerns of *accountability*. Management (and their accountants) may be tempted to bias their information about the firm. It is important that accounting systems be designed to discourage management from injecting bias. In game theoretic terms, accounting's cutting power is "off the equilibrium path." It has been suggested that the double entry accounting system and historical cost principle are especially useful in this regard. A worthwhile next step may be to study properties of accounting in a world of market frictions such as those introduced by management's private information. Retaining the structure of accounting in this enriched setting is a more formidable task, one that is undertaken in Christensen and Demski (2003).[12]

[12] Beaver and Demski (1995) and Arya, Fellingham, Glover, Schroeder and Young (1996) explore accounting valuation and income determination in incomplete markets. See also Farlee, Fellingham and Young (1996), who study value and income in imperfect markets arising due to information asymmetry.

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