Accounting In Perfect And Complete Markets Essay, Research Paper

Accounting in Perfect and Complete MarketsIntroductionThis note represents a preliminary step in the study of accounting. Accounting serves many purposes, and it is not easy to decide where to begin ; we begin by exploring the relationship between accounting numbers and the value of a firm and its assets. Market structure affects value, and furthermore, the relationship between value and accounting. We will consider the relationship between the balance sheet and income statement, and how they keep track of the unfolding of economic events. But before we plunge in, we should mention a few other aspects of accounting that are also important. First, accounting provides structure that disciplines our planning of future economic events and our interpretation of economic events underlying the numbers reported in financial statements. An important example is the budgeting exercise. 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. You 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, accounting produces an earnings number (income) 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. 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 return to the study of accounting income and its relation to market valuation. In this note, we construct a simple model characterized by a commonly known price of money (interest rate). In the specified setting individuals’ consumption possibilities are greatest if they maximize the present value of future cash flow. Due to the competitive nature of markets, it follows that asset prices will be equal to discounted cash flows. Most important, in this simple but illuminating setting of perfect and complete markets it is clear how to construct balance sheets and financial statements so that they communicate what one needs to know about the firm. Assets are valued at their market values which, as mentioned, are equal to their discounted cash flows. And income is equal to the change in net assets.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. Perhaps the most important aspect of this note is the careful links developed between accounting and the value of the firm. In this note we first assume assets are booked at cost, and that at each point in time the asset appears on the balance sheet at its market price (economic depreciation). Next we consider the case where the asset is booked at cost, but depreciation follows common practice (e.g., straight line). Finally, we consider the case where the asset is initially booked at some value other than cost, but a consistent depreciation method is used. Under the first case, income in every period will be higher for firms with more valuable assets. Under the second case, the former may not be true, but total income over the life of the firm will be higher for firms with more valuable assets. Under the third case, book value plus discounted abnormal earnings are higher for firms with more valuable assets. Accounting, Income and Markets We will focus somewhat on the income number although, as mentioned, the accounting’s structure imposes relationships among income and other accounting data. And we should 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. 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. “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. 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. 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 everyone knows its value. 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 alas, under market incompleteness or imperfections it is extremely difficult to address. So let us start with the easy thing first — perfect and complete markets. Accounting Valuation and Income MeasurementNow that we have our market structure in place, let’s do some accounting. 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 (discount rate) is 10%. A timeline appears below. time0123|——————-|——————-|——————-|cash flows$26$24$22Timeline – Cash flowsTo prepare balance sheets (and income statements) we will 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 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 future cash flows. Thus market values and discounted cash flows are equivalent under perfect and complete markets. 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 discounted 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 can not) represent the value of the assets to the firm. Applying this valuation rule to our example, the asset will be valued now (year 0) as follows:$60 = 26(1.10) + + . Similarly, the asset value at year 1 is:$40 = 24(1.10) + . All we need to construct financial statements is a valuation rule and we have one, so here are the financial statements. Balance sheetsYear 0Year 1Year 2Year 3Cash$ 0$26$52.60$79.86Long term asset6040200Owners’ Equity$60$66$72.50$79.86Income StatementsYear 1Year 2Year 3Revenue: Cash Revenue$26$24$22 Interest02.605.26Depreciation expense202020Income$6$6.60$7.26 Check that all the numbers are sensible. Since no dividends were 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). Since the values are established in perfect markets, depreciation when calculated this way reflects the change in value to the firm. Thus, this method of depreciating is commonly referred to as economic depreciation. Depreciation expense results because some of the future cash flows have been realized, and so are no longer available to the owner of the asset. Some of the future cash flows have been converted to cash on hand. For example, year 1 depreciation is 60 – 40 = 20. 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. There are four things about these financial statements we want to be sure we understand. Thing 1 — The assets are reported using the discounted value of future cash flows. That’s the rule which allowed the construction of the statements; and, further, that was the only rule we required to make a complete set of statements.

Thing 2 — Since discounted cash flow calculations are forward-looking, there is a demand to do accruals. Cash accounting cannot accomplish proper valuation and income determination. Thing 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 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 (in this case 10%). (Certainty and risk neutrality are important here, as well.)Thing 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 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. A tangential question that arises is why more accounting income may be better. First let’s 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. 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 sufficient market opportunities. In the market setting of our discussion, then, “better” means higher net present value for the owners. Thing 3 establishes the equivalence of “better” and higher income. Since period 1 income is the interest rate times year 0 present value, year 1 income is higher if and only if year 0 present value is higher. Year 2 income is similar since income is the interest rate times year 0 present value time (1 + interest rate). 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 better. Thus, a larger accounting income number is associated with greater economic welfare for the firm’s owners. As a consequence, we shall henceforth refer to this approach to calculating accounting income as the economic income approach. Back to the main point at hand. 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 more valuable firms always have higher accounting income in every period. Two problems are immediate, however. Can we count on the existence of perfect and complete markets, and can we use the present value accounting valuation technique? Let’s consider the second of these questions. Other Approaches to Accounting Income MeasurementIn the previous section we valued the asset at its cost, and subsequently carried it at the present value of its future cash flows. The latter is, of course, a forward-looking calculation. Yet accounting rules we see rely heavily on objective, verifiable numbers, minimizing to the extent possible reliance on expectations of future events. What happens to our conclusions if we don’t construct our accounting numbers using the discounted cash flow valuation rule? Rather, suppose we initially book the asset at cost, but use some (arbitrary) conventional depreciation method, such as the sum of the years’ digits method. The first thing we notice is that the equivalence between higher net present value (”better”) and higher income in every period no longer holds. Thing 3 is no longer necessarily true. But not everything is lost. Even if we use other accounting techniques, it is still the case that higher income is associated with better investments. But to get the relationship to hold we may have to add up income numbers from more than one period. To illustrate this idea reconsider the original example with some accounting changes. Balance sheetsYear 0Year 1Year 2Year 3Cash$ 0$26$52.60$79.86Long term asset6030100Owners’ Equity$60$56$62.60$79.86Income StatementsYear 1Year 2Year 3Revenue: Cash Revenue$26$24$22 Interest02.605.26Depreciation expense302010Income$(4)$6.60$17.26 In these financial statements a different valuation rule is used; the asset is not reported at the discounted cash flow amount in every period. Instead, the asset is recorded at its cost (which we assume is equal to its discounted cash flow) less accumulated accounting depreciation (using the sum of the years’ digits method). The main point raised here is that the sum of the income numbers, – 4 + 6.6 + 17.26 = 19.86, remains the same as it did under the discounted cash flow valuation rule. This is a general result and is illustrated further for a scheme which depreciates the entire asset in year 1. Balance sheetsYear 0Year 1Year 2Year 3Cash$ 0$26$52.60$79.86Long term asset60000Owners’ Equity$60$26$52.60$79.86Income StatementsYear 1Year 2Year 3Revenue: Cash Revenue$26$24$22 Interest02.605.26Depreciation expense6000Income$(34)$26.60$27.26 Even under this depreciation scheme the total income remains at 19.86. The examples above illustrate the following facts:1.With discounted cash flow valuation, we know that for better firms:a.income is higher in every period, andb.total income for all three periods is higher. 2.With any consistent valuation scheme (where the long term asset is valued at its cost), we know that total income for all three periods is higher. The second fact follows from the error correcting nature of the double entry accounting system. If income is made higher in one period it must be lower in some future period. For example, one period’s ending inventory becomes the next period’s beginning inventory. Thus, if the former period’s ending inventory is overvalued income in that period is overstated, but the next period’s beginning inventory is also overvalued, so that period’s income is understated. Thus, all is not lost when alternative (and more verifiable and objective) valuation rules are used. Income still retains the more-is-better property, but it is total income, not period-by-period income. So more than one period may have to pass before income appropriately ranks a firm’s decisions. Accounting may not be as timely as other information sources, but its reliability is not problematic. The previous examples illustrated that the use of any consistent accounting system implied more income (on a total basis) was better. Implicitly we assumed markets were in equilibrium, since the asset was purchased at a cost equal to the present value of future cash flows. Valuing assets at other than market valueIn this section we consider the case where the asset is at some point in time valued at some number other than its market value. We shall see that one can still use accounting numbers to rank firms, but something other than adding up income numbers is required. Consider the previous example, where sum of the years’ digits depreciation is used. After year one, the asset no longer appears at market value. Below we reproduce the financial statements. Balance sheetsYear 0Year 1Year 2Year 3Cash$ 0$26$52.60$79.86Long term asset6030100Owners’ Equity$60$56$62.60$79.86Income StatementsYear 1Year 2Year 3Revenue: Cash Revenue$26$24$22 Interest02.605.26Depreciation expense302010Income$(4)$6.60$17.26Recall the income numbers under economic depreciation were 6, 6.6 and 7.26. For years two and three, we see the income numbers no longer add to 13.86. So adding earnings over this time period will no longer help us value the firm.One can use the accounting numbers to value the firm in the following way. At any point in time, value is equal to the beginning book value plus the discounted future abnormal earnings. Abnormal earnings for each year are the earnings less the normal earnings on the firm’s assets. Normal earnings are defined as the beginning book value times the interest rate. The calculations appear below. Income StatementsYear 2Year 3Beg. book value$56.00$62.60Income$6.60$17.26Normal earnings (@ 10%)(5.60)(6.26)Abnormal earnings$1.00$11.00Market value = 56 + + = 56 + 10 = 66. Notice what we have done. Since book values do not equal discounted cash flows at the beginning of year two, we must use both the balance sheet and the income statement. And we must now discount abnormal earnings. In summary then, we have the following rule which allows the reader of financial statements to convert accounting numbers to market values. Market valueBook value=+of the firm Discounted abnormal earningsConclusionsIncome 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 rank investment alternatives?This paper demonstrates how accounting numbers can be used to value the firm in perfect and complete markets. These are strong assumptions. Nevertheless, they are useful for thinking about accounting and valuation. But still, our work has just begun. We have yet to study uncertainty; this turns out not to be a difficult extension. More importantly, we wish to further our study of accounting by considering the effect of market frictions on accounting valuation and income measurement. This extension is more formidable. ReferencesArya, Fellingham, Glover, Schroeder and Young, “Income and Efficiency in Incomplete Markets,” Working paper (1996). Arya, Fellingham, Schroeder and Young, “Double Entry Bookkeeping and Error Correction,” Working paper, 1996. Beaver, W., and J. Demski, “Income Measurement and Valuation,” Working paper, University of Florida (1995). Demski, J., Managerial Uses of Accounting Information. Boston: Kluwer Academic (1992). Dorfman, R., P. Samuelson, and R. Solow, Linear Programming and Economic Analysis. New York: Dover Publications (1987). Edwards, E., and P. Bell. 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