

CHAPTER 2

ACCOUNTING UNDER IDEAL CONDITIONS

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LEARNING OBJECTIVES AND SUGGESTED TEACHING APPROACHES

1. To Appreciate the Concept of Ideal Conditions

This concept is drawn on throughout the book. Roughly speaking, by ideal conditions I mean conditions where future firm cash flows and interest rates are known with certainty or, if not known with certainty, where there is a complete and publicly known

set of states of nature and associated objective probabilities which enables a completely relevant and reliable expected present value of the firm to be calculated.

I assume risk-neutral investors in this Chapter, so that valuation of the firm is on the basis of expected present value, that is, no adjustment for risk is needed. The concept of a risk-averse investor is introduced in Section 3.4, and a capital asset pricing model of the firm's shares is described in Section 4.5.

2. To Use the Present Value Model Under Ideal Conditions to Prepare an Articulated Set of Financial Statements for a Simple Firm

The text limits itself to financial statements for the first year of operations. The problem material extends the accounting to a subsequent year (see problems 1, 2, 3, 5, 15, and 19). In subsequent years, the firm earns interest on opening cash balance. This is picked up by the accretion of discount calculation, since cash is included in opening net assets. Interest earned on cash balances leads naturally to the role of dividends in present-value accounting and the concept of dividend irrelevance.

3. To Critically Evaluate Reserve Recognition Accounting (RRA) as an Application of the Present Value Model

I usually allow some class time to criticize the assumptions of ideal conditions. Some students want to "blow off steam" because they perceive these assumptions as quite strong. I find that RRA is an excellent vehicle both to motivate and critique present value-based accounting. The fact that it is on line encourages students to take the present value model seriously, which I emphasize by basing class discussion on an example of RRA disclosure for a Canadian oil and gas firm that also reports to the SEC. Such disclosures are usually in SEC Form 40-F, not in the annual report (which says something about management's view of RRA).

I also emphasize the point that present value-based accounting products run into severe implementation problems when the ideal conditions they need do not hold.

I sometimes receive comments that the text over-emphasizes RRA. I find RRA so helpful to illustrate numerous course concepts that I have resisted such comments. However, instructors may wish to emphasize that RRA, based on a United States accounting standard, is relevant to Canadian oil and gas firms whose shares are traded in the United States. In this regard, it is worth noting that Husky Energy Inc., used as the text RRA illustration in Section 2.4.2, is a Canadian-based corporation.

4. Historical Cost Accounting in the Mixed Measurement Model

Instructors may wish to discuss historical cost accounting in relation to current value accounting, since historical cost is still an important component of the mixed measurement model. Section 2.5 compares these measurement bases in terms of relevance and reliability, timing of revenue recognition, recognition lag, and matching. This is a good place to emphasize the trade-off between relevance and reliability, and how different measurement bases imply different trade-offs.

This is also a good place to discuss the relative importance of the balance sheet and income statements under the two measurement bases. That is, historical cost accounting takes the view that the income statement is of greater importance because it gives the current installment of the firm's earning power, and provides a place to start to predict future firm performance. Under current value accounting, the balance sheet is of greater performance, the argument being that current values of assets and liabilities provides a better prediction of future firm performance.

6. To Question the Existence of Net Income as a Well-Defined Economic Construct

I use the reliability problems of RRA to question the existence of "true" economic income except under ideal conditions. With the text example, or some other example, of RRA disclosure in front of us, I ask the students if they would be willing to pay the RRA value for the proved reserves of an oil and gas company. Discussion usually brings out a negative response, for reasons such as difficulties in assessing expected quantities

and prices, disagreement with a 10% discount rate, possible inside information about costs, additional reserves, etc.

I then point out that there are numerous other assets and liabilities for which a quoted market price does not exist, and argue that information asymmetry is a major reason why market prices may not exist. The market for used cars and problems surrounding insurance markets in the presence of adverse selection and moral hazard provide other examples of "missing" markets.

Having established that there are not quoted market prices available for "everything," I point out that it is then impossible to fully value a firm on this basis and, as a result, it is also impossible to measure true economic income. I take a sort of perverse pleasure in asking those students who are heading for a professional accounting career if they really want to devote their lives to measuring something which does not exist. I am careful to end on an upbeat note, however, by pointing out that lack of a true measure of income means that a large amount of judgement is required to come up with a useful measure, and that judgement is the basis of a profession.

I usually do not go further than the above intuitive argument that incomplete markets are at the heart of problems of income measurement. However, instructors who wish to dig into incompleteness more deeply and precisely can assign Beaver & Demski's "The Nature of Income Measurement" (*The Accounting Review*, January, 1979).

Suggested Solutions to Questions and Problems

1.

P.V. Ltd.**Income Statement for Year 2**

Accretion of discount (10% × 286.36)	<u>\$28.64</u>
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P.V. Ltd.**Balance Sheet****As at Time 2**

Financial Asset		Shareholders' Equity	
Cash	\$315.00	Opening balance	\$286.36
		Net income	<u>28.64</u>
Capital Asset			
Present value	<u>0.00</u>		
	<u>\$315.00</u>		<u>\$315.00</u>

Note that cash includes interest at 10% on opening cash balance of \$150.

2. Suppose that P.V. Ltd. paid a dividend of \$10 at the end of year 1 (any portion of year 1 net income would do). Then, its year 2 opening net assets are \$276.36, and net income would be:

P.V. Ltd.**Income Statement****For Year 2**

Accretion of discount (10% × 276.36)	<u>\$27.64</u>
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P.V.'s balance sheet at time 2 would be:

P.V. Ltd.			
Balance Sheet			
As at Time 2			
Financial Asset		Shareholders' Equity	
Cash: (140 + 14 + 150)	\$304.00	Opening balance:	\$276.36
		(286.36 - 10.00 dividend)	
Capital Asset, at		Net income	<u>27.64</u>
Present value	<u>0.00</u>		
	<u>\$304.00</u>		<u>\$304.00</u>

Thus, at time 2 the shareholders have:

Cash from dividend	\$10.00	
Interest at 10% on cash dividend, for year 2	1.00	
Value of firm per balance sheet	<u>304.00</u>	<u>\$315.00</u>

This is the same value as that of the firm at time 2, assuming P.V. Ltd. paid no dividends (see Question 1). Consequently, the firm's dividend policy does not matter to the shareholders under ideal conditions. Note that a crucial requirement here, following from ideal conditions, is that the investors and the firm both earn interest on financial assets, including reinvested dividends, at the same rate of return.

Note also that if the investor spends the dividend rather than investing it, this must be because he/she values current consumption as preferable to investing. Thus, the investor is no worse off if the dividend is spent. Also, if the firm pays no dividend, and the investor wants to consume \$10, he/she can borrow at 10%. This liability is offset by the additional \$10 increase in firm value on the \$10 additional retained earnings. Again, the investor is no worse off.

3. Expected net income is also called accretion of discount because the firm's expected future cash flows are one year closer at year end than at the beginning. Consequently, the opening firm value is rolled forward or "accreted" at the discount rate used in the present value calculations.
4. The procedure here is similar to that used in Question 2. Assume that the good economy state is realized for year 1. Assume also that P.V. Ltd. pays a dividend of, say, \$40 at time 1. If the good economy state is also realized in year 2, P.V.'s year 2 net income will then be:

P.V. Ltd.	
Income Statement	
For Year 2	
(good economy in year 2)	
Accretion of discount $[(336.36 - 40) \times .10]$	29.64
Abnormal earnings, as a result of good state realization in year 2 (200 – 150)	<u>50.00</u>
Net income year 2	<u><u>\$79.64</u></u>

PV's balance sheet at the end of year 2 will then be:

P.V. Ltd.

Balance Sheet

As at Time 2

Financial Asset		Shareholders' Equity	
Cash (200 - 40 + 200 + 16)	\$376.00	Opening balance	\$336.36
		Less: Dividend end	
Capital Asset	<u>0.00</u>	of year 1	<u>40.00</u>
			\$296.36
		Add: Net income	<u>79.64</u>
	<u>\$376.00</u>		<u>\$376.00</u>

Thus, at time 2 shareholders have:

Cash from time 1 dividend	\$40.00
Interest period 2 on time 1 dividend: $\$40 \times 0.10$	4.00
Value of firm per balance sheet, time 2	<u>376.00</u>
	<u>\$420.00</u>

Note: cash balance of \$376 assumes no dividend paid for year 2.

If P.V. Ltd. paid no dividend at time 1, the value of the firm at time 2 would be:

Cash: $200 + 200 + 20$	\$420.00
Capital asset	<u>0.00</u> <u>\$420.00</u>

Thus, the shareholders' wealth is the same at time 2 whether the firm pays a year 1 dividend or not.

An identical analysis applies if the low state is realized in year 2. Shareholders' wealth is \$320 at time 2 regardless of whether P.V. Ltd. pays a dividend at time 1.

A similar analysis applies if the low state is realized in period 1.

Therefore, regardless of the state that is realized, shareholders are indifferent to dividend policy. As long as ideal conditions hold, the introduction of uncertainty does not invalidate dividend irrelevancy.

5.

<u>State realization</u>	<u>Probability</u>	<u>Cash end of year 1</u>	<u>Interest on opening cash balance</u>	<u>Sales year 2</u>	<u>Total</u>
bad, bad	0.25	100	10	100	210
bad, good	0.25	100	10	200	310
good, bad	0.25	200	20	100	320
good, good	0.25	200	20	200	<u>420</u>
					<u>\$1,260</u>

Thus, the liquidating dividend will be \$210, \$310, \$320, or \$420; each with probability 0.25. Thus, present value, at time 0, of expected liquidating dividend is:

$$\begin{aligned}
 PA_0 &= \frac{1}{1.10^2} [0.25(210 + 310 + 320 + 420)] \\
 &= \frac{0.25}{1.10^2} \times 1,260 = \$260.33
 \end{aligned}$$

Expected cash flow in each year is $0.5 \times 100 + 0.5 \times 200 = 50 + 100 = \150

Assuming no dividends, present value of future cash flows is thus:

$$PA_0 = \frac{1}{1.10^2} (150 + 15 + 150) = \frac{1}{1.10^2} (315) = \$260.33,$$

where \$15 is the expected return on investing period 1 cash.

Note: it is assumed that state realizations in each period are independent.

6. a. The expected value of a single roll of a fair die is:

$$\bar{x} = \frac{1}{6} \times (1 + 2 + 3 + 4 + 5 + 6) = 3.5$$

- b. First, you would have to write down a set of possible states of nature for the die. One simple possibility would be to define:

State 1: die is fair

State 2: die is not fair.

Then, subjective probabilities of each state need to be assessed, based on any prior information you have. For example, if the person supplying you with the die looks suspicious, you might assess the probability of state 2 as 0.50, say.

A problem with this approach, however, is that to go on to calculate the expected value of a single roll when the die is not fair, you do not have probabilities for each possible outcome of the roll. That is, you do not know just how unfair the die is.

A more elaborate alternative would be to formally recognize that the probability of rolling a 1 can be anything from zero to one inclusive, and similarly for rolling a 2, 3, . . . , 6, subject to the requirement that the six probabilities sum to one.

Formally, we can regard a state as a 1×6 vector

$$P = [p_1, p_2, \dots, p_6],$$

$$\text{subject to } p_i \geq 0$$

$$i = 1, 2, \dots, 6$$

$$\sum p_i = 1$$

Thus, the set of states consists of all vectors satisfying these requirements. All vectors except the one with all $p_i = 1/6$ represent a different possible bias.

Next, it is necessary to assess state probabilities. It is by no means obvious how to do this. You would have to bring to bear any information or subjective feelings that you may have. Lacking any objective information, one possibility is to assume that each possible state is equally likely. Then, the expected value of a single roll is 3.5.

This does not mean that you believe the die is fair, even though this is the same answer as in part a. Rather, it means that the various possible biases cancel each other out, since you feel that they are equally likely. Your uncertainty about the true state of the die suggests that you would be interested in any information that would help you refine your subjective probability assessment, which leads to part c.

c. It will never be known *with certainty* whether the die is fair or not because luck might influence the outcome of the rolls. However, after a few rolls you should be able to better predict future rolls. Yes, the four rolls should affect your belief that the die is fair because you can calculate the average roll, which is $1/4(6 + 4 + 1 + 3) = 3.5$ here. Since this is exactly the average roll that would be expected if the die was fair, you would probably increase your belief that it is fair.

Note: The main purpose of this question is to anticipate what happens when objective state probabilities are not available, in preparation for the introduction of decision making under uncertainty in Section 3.3. The analogy of this question is

to the problem of subjectively assessing probabilities over the true state of the firm and of the role of financial statement information in refining these probabilities. Questions 7, 8, and 9 of this chapter can usefully be assigned in conjunction with this question. Alternatively, this question could be assigned as part of Chapter 3.

7. Under ideal conditions of certainty, future cash flows are known by assumption. Thus estimates are not applicable.

Under ideal conditions of uncertainty, by assumption, there is a complete and publicly known set of states of nature, known cash flows conditional on each state, and *objective* probabilities of those states. Also, the interest rate to be used for discounting is given. Then, expected present value is a simple calculation that does not require estimates to prepare.

8. Under non-ideal conditions, it may be difficult to write down a complete set of states of nature and associated cash flows. Even if these can be written down, difficulties remain because objective state probabilities are not available. This is perhaps the most fundamental difficulty, since these probabilities must be subjectively estimated. Also an interest rate is not necessarily given. All of these difficulties lead to reliability problems of lack of representational faithfulness and possible bias. The expected present value calculation can still be made, but it is an estimate because the probabilities and other values that go into it are estimates.
9. Market value will be affected if the RRA information affects investors' subjective probabilities of states of nature concerning future firm performance. This could happen, for example, if the RRA statements show an increase or decrease in the present values of proved reserves. This evidence, while highly relevant, suffers from low reliability. Also, it is included in the financial statement notes, not in the financial statements proper. Nevertheless, if the relevance of RRA outweighs its low reliability, investors will increase or decrease their subjective probabilities over states of nature. This would affect their evaluations of future earnings and/or cash flows, their buy/sell decisions, hence the market value of the firm.

It can be argued that firm value will not be affected by pointing out that the RRA information may be perceived by investors as so unreliable that they ignore it.

10. Relevant information is information that enables investors to estimate the present value of future receipts from an asset (or payments under a liability). In an accounting context, relevant information helps investors to predict future firm performance, such as cash flows.

Reliable information is information that faithfully represents what it is supposed to represent.

Note: In this book, we use the term relevance to refer to what the Conceptual Framework now calls representational faithfulness. We do this because the term is shorter and familiar from past usage. Instructors who wish to expose students with the Framework terminology may wish to do so in this question. See Chapter 1, Note 14.

When conditions are not ideal, the estimation of the present value of future firm cash flows (i.e., relevant information) requires specification of a set of possible future cash flow amounts (i.e., states of nature). The probabilities of these states are subjective, which means that they must be estimated by the preparer. Also, an interest rate must be specified for the discounting calculations. All of these procedures are subject to errors and possible bias, reducing reliability. Thus, like almost all predictions of the future, relevant information tends to be unreliable.

Conversely, reliable information, such as the historical cost of a capital asset or the face value of debt, tends to be low in relevance because this basis of valuation involves no direct estimates of future receipts or payments. Rather, cost is based on market transactions at the acquisition date. While, at time of acquisition, historical costs generally reflect estimates of future receipts or payments, they quickly lose relevance since market values, expected future receipts, and interest rates change over time. Then, historical cost-based valuations lose relevance.

Therefore, the accountant who tries to secure greater relevance by predicting future events must cope with less reliability. Consequently, these two desirable

characteristics of accounting information must be traded off, since an increase in one leads to a decrease in the other.

11. Several reasons can be suggested why oil company managers have reservations about RRA:

- The discount rate of 10% might not reflect the firm's cost of capital.
- Low reliability. RRA involves making a large number of assumptions and estimates. While RRA deals with low reliability in part by requiring average prices of oil and gas for the period to be used (rather than prices anticipated when the reserves are expected to be sold), management may feel that average past prices bear little relationship to the net revenue the company will receive in the future. Furthermore, management may be concerned about low reliability of other estimates, such as reserve quantities.
- Frequent changes in estimates. Conditions in the oil and gas market can change rapidly, making it necessary for the firm to make frequent changes in estimates.
- Investors may ignore. Investors may not understand the RRA information. Even if they do, management may believe the RRA information is so unreliable that investors will ignore it. If so, why prepare it?
- Legal liability. Management may be concerned that if the RRA estimates are not realized, the firm will be subject to lawsuits from investors. Management's reservations may be an attempt to limit or avoid liability.

12. a. Most industrial and retail firms regard revenue as earned at the point of sale. Since sale implies a contract with the buyer and change of ownership, this

is usually the earliest point at which significant risks and rewards of ownership pass to the buyer, the seller loses control of the items sold (e.g., title passes to buyer) and at which the amount of revenue to be received can be determined with reasonable reliability.

b. Under RRA, revenue is recognized when oil and gas reserves are proven. This point in the operating cycle does not meet the IAS 18 criteria for revenue recognition. Since the oil and gas are still in the ground and the reserves are not sold, the significant risks and rewards of ownership have not been passed on and control remains with the producer. Also, the large number of revisions to estimates under RRA casts doubt on the reliability of the amount of revenue recognized. Presumably, this is why RRA is presented as supplementary information only. Presumably, however, collection is reasonably assured since oil and gas have ready markets.

Note: This question illustrates that the trade-off between relevance and reliability can be equivalently framed in terms of revenue recognition as well as balance sheet valuation. In effect, balance sheet valuation is in terms of the debit side of asset valuation whereas criteria for revenue recognition are in terms of the credit side. The basic trade-off is the same, however. In particular, it should be noted that early revenue recognition increases relevance, even though it may lose reliability.

13. a. From a balance sheet perspective under ideal conditions, inventory is valued at current value. This could be the present value of expected future cash receipts from sale, that is, value-in-use. Alternatively, inventory could be valued at market value, that is, at fair value since under ideal conditions these 2 values would be the same).

Note: In the present value examples of this chapter, all production is assumed sold for cash. If all production is not sold, inventory would be valued at current value, and cash would be less by this amount.

Since the firm's balance sheet includes inventory at current value, it is included at current value in the accretion of discount calculation. Thus, in effect, revenue on unsold production is recognized as the inventory is manufactured.

b. Cost basis accounting for inventory is due to lack of ideal conditions. Then, current value requires estimation, opening up inventory valuation to error and possible manager bias. Accountants must feel that this reduction in reliability outweighs the greater relevance of current inventory value.

Historical cost accounting for inventories is not completely reliable, since firm managers still have some room to manage (i.e., bias) their reported profitability through their choice of cost methods (FIFO, LIFO, etc.). Furthermore, even the cost of inventories is not always reliable. For example, overhead costs are usually allocated to the cost of manufactured inventory. These costs are affected by manager decisions about allocation rates and production volumes.

Note: it could also be mentioned that historical cost accounting for inventories is accompanied by the lower-of-cost-or-market rule. Then, reliability issues of estimating current valuation re-arise. Also, it is possible that the firm may attempt to hide obsolescence by not writing down obsolete inventory at all.

14. This practice implies that revenue is recognized as cash is collected. This basis of valuation might be used if the firm sells with little or no money down and a long collection period. Valuation of accounts receivable at the amount of the sale would require estimating credit losses. This estimate may be too unreliable under these conditions, outweighing the greater relevance of recognizing revenue as a sale is made.
15. a. Present value of capital asset 2015, 2016, and 2017

$$PA_0 = \frac{600}{1.06} + \frac{600}{1.06^2} + \frac{600}{1.06^3} = 566.04 + 534.00 + 503.77 = \$1,603.81$$

$$PA_1 = 566.04 + 534.00 = \$1,100.04$$

$$PA_2 = \$566.04$$

Sure Corp.

Balance Sheet

As at December 31, 2015

Cash (600 – 50)	\$550.00	Shareholders' equity	
Capital asset, at present value	<u>\$1,100.04</u>	Capital stock	\$1,603.81
		Retained Earnings	
		Net income	96.23
		Dividend	<u>(50.00)</u> <u>46.23</u>
	<u>\$1,650.04</u>		<u>\$1,650.04</u>

Sure Corp.

Income Statement

For the year ended December 31, 2015

Accretion of discount (1,603.81 × .06)	<u>\$96.23</u>
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b.

Sure Corp.

Balance Sheet

As at December 31, 2016

Cash (550 + 600 + 33 – 50)	\$1,133.00	Shareholders' equity	
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Capital asset, at		Capital stock	\$1,603.81
present value	<u>566.04</u>	Retained earnings	<u>95.23</u>
	<u>\$1,699.04</u>		<u>\$1,699.04</u>

Note: Cash includes $\$550 \times .06 = \33 interest on opening cash balance.

Retained earnings calculated as $\$46.23 + 99.00 - 50 = \95.23

Sure Corp.

Income Statement

For the year ended December 31, 2016

Accretion of discount ($1,650.04 \times .06$)	<u>\$99.00</u>
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c. Under ideal conditions, present value and market value are equal. This is because of arbitrage.

Under real conditions, market values provide only a partial implementation of fair value accounting. If reliable market values are available, fair values based on market prices provide a useful trade-off between relevance and reliability.

However, because of incomplete markets, market values are not available for all assets and liabilities. Then, estimates of fair value, such as the market value of related assets and liabilities, reversion to value-in-use, or models, are needed.

These problems complicate the implementation of fair value accounting due to possible low reliability.

d. The main reason for low reliability is the difficulty of estimating expected future cash flows, which would require a set of possible future cash flows (states of nature) and subjective probabilities of these states. Since, under realistic conditions these estimates are subject to error and possible manager bias, reliability is reduced.

Another reason arises from possible error and bias in the choice of interest rate for discounting. However, the prime bank rate and central bank rate are available as proxies.

Low reliability does not necessarily mean that present value-based accounting is not decision useful, since present values are high in relevance. These two desirable characteristics of accounting information must be traded off. If the benefit of higher reliability exceeds the danger of lower reliability, present value accounting is decision useful.

16. a.

P Ltd.

Balance Sheet

As at End of First Year

Financial Asset		Liabilities	
Cash (note 1)	\$1,137.40	Bonds outstanding (note 3)	\$616.00
 Capital Asset, at		 Shareholders' Equity	
present value (note 2)	<u>2,200.00</u>	Capital stock issued (note 4)	
			2,474.00
		Net income (note 5)	
			<u>247.40</u>
			<u>2,721.40</u>
	<u>\$3,337.40</u>		<u>\$3,337.40</u>

Notes:

1. Cash = \$1,210.00 cash flow - 72.60 (605 × 0.12) interest paid on bonds = \$1,137.40
2. Book value of asset = PV end of year 1 = (2,000 + 420)/1.10 = \$2,200
3. Bonds outstanding = PV at end of year 1 = (72.60 int. yr. 2 + principal due of 605)/1.10 = \$616
4. Capital stock is issued in the amount of cost of asset less proceeds of bonds:

$$\begin{aligned}
 & 3,100 - \left[\frac{72.60}{1.10} + \frac{72.60 + 605}{1.10^2} \right] \\
 & = 3,100 - (66 + 560) \\
 & = 3,100 - 626 \\
 & = \$2,474
 \end{aligned}$$

5. Net income for year 1 calculated as \$2,474 × .10 = \$247.40

Note: Purchase price of capital asset can be verified as:

$$1,210/1.10 + 2,000/(1.10)^2 + 420/(1.10)^2 = \$3,100$$

Note: An alternative net income solution, equally acceptable, is:

Accretion of discount	\$3100 × 0.10 = \$310.00
Less interest accrued on opening	
present value of bonds	\$626 × 0.10 = <u>62.60</u>
Net Income	<u>\$247.40</u>

In this case, discount is accrued on the opening value of the capital asset, with a deduction for interest accrued on the debt.

- b. Ideal conditions are unlikely to hold because:

- It is unlikely that future cash flows from the fixed asset can be accurately forecast.
- It is unlikely that there is a single interest rate in the economy, and interest rates may change over time.

c. If ideal conditions do not hold, expected income is likely to be different than the amount calculated in part a of \$247.40. When ideal conditions do not hold it is likely that the amounts and/or timing of expected future cash flows will change over the year. This gives rise to changes in estimates (i.e., abnormal earnings), which will be reflected in net income for the year.

Another reason why net income may change from expected is that interest rates may change, which would also change the present value of future cash flows. The resulting change in present value will be reflected in net income for the year.

17. a. Expected present value of North Ltd's asset on August 1, 2015 and July 31, 2016:

$$\begin{aligned}
 PA_0 &= 0.7 \left[\frac{900}{1.03} + \frac{900}{1.03^2} \right] + 0.3 \left[\frac{300}{1.03} + \frac{300}{1.03^2} \right] \\
 &= 0.7(873.79 + 848.34) + 0.3(291.26 + 282.78) \\
 &= 0.7 \times 1722.13 + 0.3 \times 574.04 \\
 &= 1,205.49 + 172.21 \\
 &= 1,377.70
 \end{aligned}$$

$$\begin{aligned}
 PA_1 &= 0.7 \times \frac{900}{1.03} + 0.3 \times \frac{300}{1.03} \\
 &= 0.7 \times 873.79 + 0.3 \times 291.26 \\
 &= 611.65 + 87.38 \\
 &= 699.03
 \end{aligned}$$

North Ltd.

Balance sheet**As at July 31, 2016**

Cash (900 – 15 - 50)	\$835.00	Bank loan	\$500.00
		Shareholders' equity	
Capital asset, at present value	<u>699.03</u>	Capital stock (PA ₁)	877.70
		Retained earnings	
		(206.33 – 50)	<u>156.33</u>
	<u>\$1,534.03</u>		<u>1,034.03</u>
			<u>\$1,534.03</u>

North Ltd.**Income Statement****For the year ended July 31, 2016**

Expected net income (accretion of discount) (877.70 × .03)	\$26.33
Abnormal earnings:	
Expected cash flow (0.7 × 900) + (0.3 × 300) = (630 + 90) = \$720.00	
Actual cash flow	<u>900.00</u> <u>180.00</u>
Net income for the year	<u>\$206.33</u>

Note: An alternate solution, equally acceptable, is:

Accretion of discount $\$1,377.70 \times 0.03 =$	\$41.33
Less interest accrued on bank loan $\$500 \times 0.03 =$	<u>15.00</u>
	26.33
Abnormal earnings, as above	<u>180.00</u>
Net income	<u>\$206.33</u>

- b. The implied revenue recognition timing is on a present value basis. That is, discounted expected future revenue is capitalized into capital asset on the balance sheet. Income for the period is thus interest on the opening capitalized balance plus or minus the difference between expected and actual cash flow for the period

Note: An alternative answer, equally acceptable, is that revenue is recognized as changes in current value occur. Here, the current value of operating cash increased by $(\$900 - 15 =)$ \$885 during the year, and the current value of equipment decreased by $(1,377.70 - 699.03 =)$ \$678.67, giving net income of \$206.33.

- c. Net income for the year ended July 31, 2016 on a historical cost basis:

Sales (900) minus amortization expense $(1,377.70/2 = 688.85)$ gives net income of \$211.15 for the year ended July 31, 2016.

The present value-based income statement is more relevant, since it is based on the present value of future cash flows. However, the historical cost-based income statement is more reliable, since, in the absence of ideal conditions, the present value-based statement requires *estimates* of future cash flows, probabilities, and the interest rate. When ideal conditions do not hold, these estimates are subject to error and possible manager bias.

18. a. Under ideal conditions, the amount paid for an asset equals its expected present value.

Expected present value of Electro's assets on January 1, 2015:

$$\begin{aligned}
 PA_0 &= 0.6 \left[\frac{900}{1.03} + \frac{1200}{1.03^2} \right] + 0.4 \left[\frac{600}{1.03} + \frac{600}{1.03^2} \right] \\
 &= 0.6(873.79 + 1131.12) + 0.4(582.52 + 565.56) \\
 &= 0.6 \times 2004.91 + 0.4 \times 1148.08 \\
 &= 1202.94 + 459.23 \\
 &= 1662.17
 \end{aligned}$$

Present value of assets on Jan. 1, 2016 also required to answer part b:

$$\begin{aligned}
 PA_1 &= 0.6 \times \frac{1200}{1.03} + 0.4 \times \frac{600}{1.03} \\
 &= 0.6 \times 1165.05 + 0.4 \times 582.52 \\
 &= 699.03 + 233.01 \\
 &= 932.04
 \end{aligned}$$

b.

Electro Ltd.

Balance Sheet

As at December 31, 2015

Cash (900 – 60)	\$840.00	Shareholders' equity	
Capital asset, at present value	<u>932.04</u>	Capital stock (PA ₀)	\$1,662.17
		Retained earnings (169.87 – 60)	<u>109.87</u>
	<u>\$1,772.04</u>		<u>\$1,772.04</u>

Electro Ltd.

Income Statement

For the year ended December 31, 2015

Expected net income (accretion of discount) $(1,662.17 \times .03)$	\$49.87
Abnormal earnings	
Expected cash flow $(0.6 \times 900) + (0.4 \times 600) = (540 + 240)$	\$780.00
Actual cash flow	<u>900.00</u> <u>120.00</u>
Net income for the year	<u>\$169.87</u>

c. The main reason is that ideal conditions do not prevail in practice. The high relevance of present value-based accounting remains. However, lack of ideal conditions creates concern about reliability of present value-based amortization, since estimates of future cash flows are subject to error and possible managerial bias. Furthermore, attempts to use market values (i.e., fair values) in place of present values run into market incompleteness. It seems that, for much property, plant and equipment, increased relevance of current values is outweighed by decreased reliability.

In addition, present values and/or fair values of property, plant, and equipment are volatile, since future cash flows and market values are usually highly dependent on the state of the economy. This creates volatility of net income. Managers dislike high net income volatility, particularly if they believe that the volatility does not reflect their performance in managing the company.

19. a. Under ideal conditions, the amount paid for an asset equals its present value:

$$\begin{aligned}
 PA_0 &= 0.6\left(\frac{100}{1.06} + \frac{200}{1.06^2}\right) + 0.4\left(\frac{100}{1.06} + \frac{50}{1.06^2}\right) \\
 &= 0.6(94.34 + 178.00) + 0.4(94.34 + 44.50) \\
 &= 0.6 \times 272.34 + 0.4 \times 138.88 \\
 &= 163.40 + 55.55 \\
 &= 218.95
 \end{aligned}$$

b.

QC Ltd.
Statement of Net Income
For the Year ended December 31, 2016

Accretion of discount (232.08 × .06)		\$13.92
Abnormal earnings		
Expected cash flow (0.6 × 200 + 0.4 × 50)	140.00	
Actual cash flow (high state)	<u>200.00</u>	<u>60.00</u>
Net income for the year		<u>\$73.92</u>

Note: Calculation of accretion of discount requires QC Ltd. net worth as at end of 2010:

Capital stock (= cost of capital asset)		\$218.95
Net income 2010 (218.95 × .06)		<u>13.13</u>
Net worth, December 31, 2010		<u>\$232.08</u>

Alternative calculation:

Cash		\$100.00
Present value of capital asset	0.6(200/1.06) + 0.4(50/1.06)	
	= 113.21 + 18.87 =	<u>132.08</u>
		<u>\$232.08</u>

c.

QC Ltd.
Balance Sheet
As at December 31, 2016

Current asset		Capital stock	\$218.95
Cash (100 + 200 + 6)	\$306.00	Retained earnings	
Capital asset, at present value	<u>0.00</u>	Net income, 2015	13.13
		Net income, 2016	<u>73.92</u> <u>87.05</u>
	<u>\$306.00</u>		<u>\$306.00</u>

20. Note: In this problem, state probabilities are not independent over time. Part b of this question requires calculations not illustrated in the text.

a. The cost of the machine equals its present value as at time zero:

$$\begin{aligned}
 PV_0 &= \frac{1}{1.08} (0.75 \times 1,000 + 0.25 \times 3,000) \\
 &\quad + \frac{1}{1.08^2} [0.25(0.60 \times 1,000 + 0.40 \times 3,000) + 0.75(0.10 \times 1,000 + 0.90 \times 3,000)] \\
 &= \frac{1}{1.08} (750 + 750) + \frac{1}{1.08^2} [0.25(600 + 1,200) + 0.75(100 + 2,700)] \\
 &= \frac{1}{1.08} \times 1,500 + \frac{1}{1.08^2} (0.25 \times 1,800 + 0.75 \times 2,800) \\
 &= 1,388.89 + \frac{1}{1.08^2} (450 + 2,100) \\
 &= 1,388.89 + 2,186.21 \\
 &= \$3,575.10
 \end{aligned}$$

$$\begin{aligned}
 PV_1 &= \frac{1}{1.08} (0.6 \times 1,000 + 0.4 \times 3,000) \\
 &= \frac{1}{1.08} (600 + 1,200) \\
 &= \frac{1,800}{1.08} = \$1,666.67
 \end{aligned}$$

b.

Conditional Ltd.

Income Statement for Year 1

(No major failure)

Accretion of discount (expected net income)	\$286.01
(3,575.10 × .08 = \$286.01)	

Abnormal earnings

Year 1:

Expected cash flows (0.75 × 1,000 + 0.25 × 3,000) 1,500.00

Actual cash flows	<u>3,000.00</u>	1,500.00
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Year 2:

Original expected cash flows:

(0.75 × 2,800 + 0.25 × 1,800)	2,550.00
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Revised expected cash flows resulting from

year 1 state realization:

(0.60 × 1,000 + 0.40 × 3,000)	<u>1,800.00</u>
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Reduction in year 2 expected cash flows	<u>750.00</u>
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Present value of reduction: (750/1.08)	<u>(694.44)</u>
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Net Income	<u>\$1,091.57</u>
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c.

Conditional Ltd.

Balance Sheet as at End of Year 1

(No major failure)

Financial Asset

Cash	\$3,000.00
------	------------

Capital Asset,

Shareholders' Equity

Capital Stock	\$3,575.10
---------------	------------

Retained Earnings

at present value	<u>1,666.67</u>	Net income	
		for the year	<u>1,091.57</u>
	<u>\$4,666.67</u>		<u>\$4,666.67</u>

20. a. Present value at January 1, 2015:

$$\frac{7,000}{1.10} + \frac{6,000}{1.10^2} + \frac{5,000}{1.10^3}$$

$$= \$15,078.89$$

Present value at December 31, 2015, based on revised estimates:

$$\frac{6,500}{1.10} + \frac{6,000}{1.10^2}$$

$$= \$10,867.77$$

ABC Ltd.

Income Statement from

Proved Oil and Gas Reserves

For the Year Ended December 31, 2015

Accretion of discount (15,078.89 × 0.10)	\$1,507.89
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Changes in estimates:

Shortfall in 2011 revenue

(7,000 - 6,500)	(\$500.00)
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Increase in present value

of future revenue	<u>1,280.99</u>	<u>780.99</u>
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\$2,288.88

Increase in present value of future revenue is calculated as follows:

Revised present value at December 31, 2015	\$10,867.77
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Original present value at December 31, 2015	
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$\frac{6,000}{1.10} + \frac{5,000}{1.10^2} =$	<u>9,586.78</u>
---	-----------------

Increase in present value of future revenues \$1,280.99

Note: While not required as part of the question, ABC's balance sheet as at December 31, 2015, is:

Cash	\$6,500.00	Capital stock	\$15,078.89
Oil well, at P.V.	<u>10,867.77</u>	Retained earnings	<u>2,288.88</u>
	<u>\$17,367.77</u>		<u>\$17,367.77</u>

b. Possible concerns arise from the low reliability of reserves estimates, and include:

- Reserve quantity estimates are subject to error.
- The timing of extraction may differ from estimate.
- Changes in price and cost estimates. Due to the number of assumptions about oil prices and costs in the present value calculations, the estimated future cash flow amounts might not reflect the amount of net revenue the firm will actually receive in future periods.
- Lawsuits. The expected future cash flows may not represent fair market value of reserves. Management may fear this will mislead investors, possibly leading to lawsuits.

22. a. **HL Oil & Gas Ltd.**

**Income Statement from Proved Oil and Gas Reserves
For the Year 2015**

Accretion of discount		\$700
Abnormal Earnings:		
Present value of additional reserves added during the year		1,500
Unexpected items:		
Changes in prices	1,200	

Changes in quantities	<u>(200)</u>	<u>1,000</u>
Net income for the year		<u>\$3,200</u>

b. The reason derives from concerns about reliability of the reserves estimates. The standard setters must have believed that while unproved reserves information is highly relevant, they could not be valued with sufficient reliability that the resulting estimates were decision useful.

c. Again, the reason derives from reliability concerns. Allowing each firm to choose its own discount rate opens up the possibility of manager bias, whereby the rate is chosen to achieve a desired present value.

A disadvantage is that when conditions are not ideal, different firms may have different costs of capital. This can arise, for example, from operating in different countries and in different geographical conditions. Then, mandated discount rates may not reflect the reserves' riskiness. This would reduce decision usefulness.

23. a. **FX Energy, Inc.**

Income Statement for 2015

Expected net income—accretion of discount	\$546
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Abnormal earnings:

Present value of additional reserves proved

during the year	2,511
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Unexpected items-changes in estimates

Net changes in prices and production costs	(159)
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Changes in estimated future development	
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costs	(53)
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Revisions in previous quantity estimates	(31)
--	------

Changes in rates of production and other	<u>116</u>	<u>(127)</u>	<u>2,384</u>
Net income from proved oil and gas reserves			<u>\$2,930</u>

b. RRA net income of \$2,930 differs from the historical cost-based loss of \$5,245 because of differences in the timing of revenue recognition. Under historical cost accounting, revenue is recognized when the reserves are lifted and sold. Under RRA, revenue is recognized as reserves are proved. Then, RRA net income consists of accretion of discount on the opening present value of proved reserves, adjusted for abnormal earnings (i.e., corrections of opening present value). For FX Energy, Inc., the main reason for the large abnormal earnings is the proving of \$2,511 of additional reserves during the year. Under historical cost accounting, this amount is not yet recognized as revenue.

c. The reason derives from concerns about reliability of the reserves estimates. Information about all reserves, and their expected future cash flows, would be highly relevant. However, the designers of the RRA standard must have felt that the low reliability of unproved reserves valuations would outweigh the increased relevance. That is, unproved reserve quantities are subject to even greater reliability concerns than proved reserves. and thus are unlikely to be decision useful.

d. Again, the reason derives from reliability concerns. Allowing each firm to choose its own discount rate opens up the possibility of manager bias, whereby the rate is chosen to achieve a desired present value.

A disadvantage is that when conditions are not ideal, different firms may have different costs of capital. This can arise, for example, from operating in different countries and in different geographical conditions. Then, relevance is decreased since the reserves' present value at 10% will not reflect the riskiness, hence the required rate of return, of those reserves.

24. a.

Moonglo Energy Inc.
Income Statement for Proved Oil and Gas Operations
For year 2015
RRA Basis

Accretion of discount	\$125
Present value of additional reserves added during year	162
Unexpected items: Changes in previous year's estimates	<u>134</u>
Net income from proved reserves for the year	<u><u>\$421</u></u>

Note: Items on the statement of changes in proved reserves not included in the income statement above ((456), (4), 629) represent cash receipts and disbursements during the year, whereas the items on the income statement above represent non-cash changes. An income statement based on cash receipts and disbursements less amortization expense yields the same result:

Sales (456 + 4)	\$460
Development costs incurred in year	(629)
Amortization "income" – increase in balance of proved reserves in year (1,660 – 1070)	<u>590</u>
Net income	<u><u>\$421</u></u>

See Notes 8 and 11 of this chapter.

b. Profit on a historical cost basis differs from RRA net income because of different bases of revenue recognition. Under RRA, income is recognized as reserves are proved. Under historical cost, income is recognized as sales are made. Since proving of reserves precedes sales, the two income measures will differ. Here, since the standardized measure increased for the year (i.e., an increase in proved reserves), RRA net income exceeds historical cost net income. Under historical cost, increases in the value of reserves are not recognized until the reserves are sold.

c. RRA is more relevant, since it records revenue earlier than historical cost. In effect, revenue is recognized as reserves are proved, rather than when sold as under historical cost. This gives the financial statement user an earlier reading of future firm performance.

If a balance sheet was prepared on an RRA basis, inventory of proved oil and gas reserves would be valued at average selling prices for the year, rather than at historical cost. Again, this is more relevant since selling price of inventory gives a better measure of future firm performance than historical cost, assuming reasonable reliability.

Note: Relevance would be even greater if proved reserves were valued at expected selling prices, as would be the case under ideal conditions.

RRA is less reliable than historical cost both because of possible errors in estimating amounts of reserves and their production and development costs, and possible manager bias. Under RRA, changes are often quite material. Here, changes to previous estimates (\$134), which could possibly be due to errors or bias in earlier estimates, exceed expected net income for the year (\$125).

Note: Changes in estimates which do not result from error or bias introduce volatility into present values, but are not themselves a source of unreliability.

From the information available, we do not know the reasons for the estimate changes.

25. a. The most relevant point of revenue recognition is at the beginning of the operating cycle. For a manufacturing firm, this would be as raw materials and other components of manufacturing cost are acquired and production begins. For an oil and gas firm, this would be as reserves are discovered. For a retail firm, this would be as merchandise is acquired. For a firm with long-term contracts, this would be when the contract is signed.

Indeed, one could envisage revenue recognition even earlier than this. For example, for a manufacturing firm, revenue could be recognized when acquisition of manufacturing capacity begins, consistent with accounting under ideal conditions. For an oil and gas firm, revenue could be recognized as reserves are estimated based on geological data.

The most reliable point of revenue recognition is as cash is collected from sales and services.

b. Points to consider:

- Lucent has an incentive to recognize 2000 revenue early to try to prevent its reported net income from falling below 1998 and 1999 levels.
- The earlier revenue is recognized, the greater the relevance.
- Early revenue recognition sacrifices reliability, since amounts and timing of cash collections become more difficult to predict.
- It is questionable whether the significant risks of ownership have not been transferred to the buyer with respect to merchandise shipped to distribution partners. Similar questions arise concerning whether Lucent has lost control of the items, revenues can be measured reliably, and whether collection is reasonably assured.

- Revenue recognition on partial shipments may violate the conventional point of sale criterion. However, if these shipments are part of a long-term contract, revenue recognized as goods are shipped may be consistent with the criterion of revenue recognition as the work progresses.
- Lucent's treatment of vendor financing appears to contradict the criteria. While, technically, products may have been sold, credits granted to assist the customer to finance purchases increase credit risk, reducing assurance about the amounts that will ultimately be collected.

A reasonable conclusion is that Lucent has been overly aggressive in recognition of revenue. The necessity to restate 2000 revenue suggests that the significant risks and rewards of ownership had not been transferred to the buyer and that control of items shipped had not been relinquished.

c. Ownership interest in the customer increases problems of reliable estimation of the amounts that will ultimately be collected. The vendor's revenue will be biased upwards and the likelihood of collection reduced if it uses its influence to force goods and services on the customer beyond the point where the customer can sell and pay for the goods and services in the normal course of business. This appears to have happened in the case of Lucent in 2000.

26. a. Relevant information is information that enables the prediction of future firm performance, such as future cash flows. Early revenue recognition anticipates these future cash flows, hence it is relevant. Thus, Qwest's revenue recognition policy provided relevant information.
- b. Reliable information is information that faithfully represents the firm's financial position and results of operations. When significant risks and rewards of ownership are transferred to the buyer and the seller loses control over the items transferred, the amount of future cash flows is determined with reasonable representational faithfulness and verifiability, since the purchaser has an obligation to pay. Also, if the amount of cash to be received is determined in an

arms-length transaction, the amount of sale is reliable due to lack of possible manager bias.

It seems that Qwest's revenue recognition policy met none of these reliability criteria. The future cash flows were not representationally faithful since there appeared to be no provision for returns, obsolescence, or unforeseen service costs. Furthermore, as evidenced by the later SEC settlements, substantial manager bias is apparent. Obviously, amounts ultimately collectible were not reasonably assured, since the SEC concluded that Qwest had inflated its revenues.

c. Under ideal conditions, revenue is recognized as production capacity is acquired, since future revenues, or expected revenues, are inputs into the present value calculations. The balance sheet valuations of capital assets incorporate these revenue projections. For an oil and gas company, revenue recognition is analogous—revenue is recognized as reserves are discovered or purchased.

The reason for recognizing revenue early is that under ideal conditions, future cash flows, or expected future cash flows, are perfectly reliable, being based on publicly known sets of states of nature and objective state probabilities. There is thus no sacrifice of usefulness in recognizing revenue as early as possible.

Note: A superior answer will point out that under ideal conditions net income consists of interest on opening present value (i.e., accretion of discount), plus or minus abnormal earnings under ideal conditions of uncertainty). These are not operating revenues, however, but simply an effect of the passing of time.

27. a.

Manulife Financial Corporation

Income Statement, Embedded Value Basis

Year Ended December 31, 2011

Accretion of discount	\$2,808
Abnormal earnings	
New business during the year	1,086
Unexpected items-changes in estimates	
Experience variances, etc.	(5,041)
Discount rate changes	(2,416)
Changes in exchange rates	<u>1,171</u> <u>(6,286)</u>
Net loss for the year	<u>(\$2,392)</u>

b. The most likely reason is low reliability of the embedded value. Without an audit to check the calculations, embedded value is subject to calculation error and possible bias due to manager manipulation. Consequently, investors perceive less information asymmetry only when the value is audited.

A related reason is that firms belonging to CFO Forum, which supports transparent reporting, are perceived by investors as committed to voluntarily reporting embedded value and, presumably, committed to its reliable reporting regardless of whether the news is good or bad. Without such commitment, investors may fear that management would discontinue reporting embedded value should it contain bad news. Thus membership in CFO Forum reinforces the effect of the audit.

c. One reason for the difference follows from the arguments in b. Since it appears that Manulife neither has its embedded value audited nor belongs to CFO Forum, investors may ignore the embedded value per share.

Another reason is that investors may be concerned about the substantial 2011 reduction in new business from \$1,841 in 2010 to \$1,086. Since embedded value

does not include expected new business in future years, investors may be concerned that the 2011 new business reduction will continue.

Also, the loss of \$2,416 from changes in discount rates indicates that Manulife raised the rate it uses to discount future receipts from its business in place. This may be interpreted by investors that Manulife has become more risky. To the extent that investors are collectively risk-averse, this will lower the value they place on Manulife shares.

Note: Other possible reasons, which anticipate text topics not yet covered, include:

- Investors may be concerned about the reduction in embedded value for the year of $(39,303 - 36,065)$ \$3,238, without realizing that this reduction includes dividends of \$846. Net loss in part a of \$2,392 is somewhat less pessimistic.
- Investors may not realize that some of the embedded value items may not persist, such as the unfavourable experience variances of \$5,041.
- General economic conditions may be poor, leading to investor pessimism and low stock prices for all firms.

28. a. The National Instrument 51-101 disclosures are more relevant than those of RRA. Reasons include:

- Information about probable reserves is given in addition to information about proved reserves.
- Future revenues are evaluated using forecasted prices as well as year-end prices. RRA uses only average oil and gas prices for the period.
- Unlike RRA, future net revenues are discounted at several different interest rates. This allows the investor to choose that rate closest to his/her

estimate of the firm's cost of capital. This rate could vary, for example, due to location of reserves or current interest rates in the economy.

b. Points to consider:

- A reasonably precise definition of proved reserves and unproved reserves. This adds to representational faithfulness.
- Reserves information must be verified by a qualified independent professional and reviewed by the Board of Directors. This adds to representational faithfulness.
- Use of forecasted prices reduces reliability to the extent that forecasted prices are more subject to errors of estimation and possible bias than year end or average period prices. Note, however, that volatility of prices per se is not a source of unreliability. Thus, assuming no valuation errors or biases, changes in reserves values as forecasted prices change capture the real volatility faced by the firm. Real volatility should not be hidden since this is information that investors may find useful.
- To the extent that estimation of unproved reserves is more subject to error and possible bias than for proved reserves, reliability of total proved plus probable reserves is lowered. Disclosure of only proved reserves avoids this source of unreliability.

c. Reasons for the disclaimer:

- Companies may be concerned about the reliability of their estimates, and wish to alert investors to this possibility.
- Companies may be concerned that if future revenues differ from those forecasted, they may be subject to lawsuits. Disclaimers should help defend against such suits.

- Managers may be concerned that their reputations will be adversely affected if future revenues differ from forecast. Disclaimers should help protect their reputations.
29. a. A theoretically correct measure of income is the net income of a firm for a period calculated on a present value basis; that is, accretion of discount on opening firm present value, plus or minus any differences between expected and actual cash flows for the period.

Alternatively, net income is theoretically correct if it is calculated so as to include the changes during the period in the market values of all assets and liabilities, adjusted for capital transactions (providing that the markets for all assets and liabilities exist and work reasonably well).

- b. A theoretically correct measure of income does not exist because ideal conditions do not exist. As a result, future cash inflows and outflows from assets and liabilities cannot be reliably estimated. This means that present value-based net income is not theoretically correct since theoretical correctness requires complete reliability.

Furthermore, market incompleteness can exist in the absence of ideal conditions. Then, properly working market values for all assets and liabilities of a firm need not exist. As a result, net income based on net changes in market values is not theoretically correct either.

- c. Historical cost accounting is reasonably reliable because the cost of an asset is usually an objective and verifiable number. However, while cost is also relevant at time of acquisition, it may lose relevance over time due to changes in market prices, interest rates and economic conditions, which will change the asset's current value. To the extent reasonably-working market prices exist, current value accounting is more relevant than historical cost while retaining reliability. However, if such market values do not exist, current valuation requires estimates of fair value, cash flow estimates, or the use of models. Estimates of

cash flows face serious problems of reliability, as do the inputs into valuation models.

Similar considerations apply to liabilities. If a reasonably-working market value exists for a liability (e.g., long term debt, certain derivative financial instruments), fair value provides both a relevant and reliable current valuation. If historical cost accounting ignores such value, it sacrifices relevance with little or no increase in reliability. However, if current value of a liability must be estimated on the basis of future cash outflows or by use of models, similar trade-offs as for assets exist. For example, the carrying value of long term debt is not necessarily adjusted for changes in interest rates or for changes in the credit standing of the issuer. Such changes are highly relevant to investors, but are subject to reliability concerns to the extent that a well-working market value does not exist (e.g., the debt may not be traded). Also, substantial reliability issues exist for current values of other liabilities, such as leases and post-retirement benefits, which do not typically have market values.

Overall, we may conclude that historical cost accounting sacrifices considerable relevance in order to attain reasonable reliability.

Additional Problems

2A-1. Note: In this problem, state probabilities are not independent over time.

XYZ Ltd. purchased an asset on January 1, 2005 with a useful life of two years, at the end of which time it has no residual value. The cash flows from the asset are uncertain. If the economy turns out to be "normal," the asset will generate \$4,000 in cash flow each year; if the economy is "bad," it will generate \$3,000 in cash flow per year; and if the economy is "good," the cash flow generated will be \$5,000 per year. Cash flows are received at year-end. In each year, the chances of a "normal" economy being realized are 30%, the chances of a "bad" economy are 50%, and the chances of a "good" economy are 20%. State realization for both years becomes publicly known at the end of 2005, that is, if the normal state happens for year 1, it will also happen for year 2, etc.

Assumptions

- Ideal conditions hold under uncertainty.
- The economy-wide interest rate is 10%.
- XYZ Ltd. finances the asset purchase partly by a bond issue and partly by a common share issue. The bond has a \$3,000 face value and a 10% coupon rate and matures on December 31, 2001.
- XYZ Ltd. has adopted the policy of paying out 50% of its net income as dividends to its shareholders.
- The economy turns out to be "good."

Required

- a. Calculate the present values of the asset at January 1, 2005, and December 31, 2005.

- b. Prepare the present value-based income statement of XYZ Ltd. for the year ended December 31, 2005.
- c. Prepare the present value-based balance sheet of XYZ Ltd. as at December 31, 2005.
- d. Explain why, even under uncertainty, present value-based financial statements are both relevant and reliable provided ideal conditions hold.
- e. Explain why shareholders of XYZ Ltd. are indifferent to whether they receive any dividend from the company.

2A-2. Relevant Ltd. operates under ideal conditions of uncertainty. Its operations are highly dependent on the weather. For any given year, the probabilities are 0.3 that the weather will be bad and 0.7 that it will be good. These state probabilities are independent over time. That is, the state probabilities for a given year are not affected by the actual weather in previous years.

Relevant Ltd. produces a single product for which the demand will fall to zero at the end of 2 years. It produces this product using specialized machinery, which will have no value at the end of 2 years. The machinery was purchased on 1 January, 2005. It was financed in part by means of a bank loan of \$2,000 repayable at the end of 2006, with the balance financed by capital stock. No dividends will be paid until the end 2006. Interest on the bank loan is payable at the end of each year. The interest rate in the economy is 6%.

Cash flows are not received until the end of each year. Amounts of cash flows for each year are given in the following payoff table:

State	Probability	Cash Flow	
		Year 1	Year 2
Bad weather	0.3	\$600	\$400
Good weather	0.7	\$6000	\$3000

State realization for 2005 is good weather.

Required

- a. Prepare, in good form, a balance sheet for Relevant Ltd. as at the end of 2005 and an income statement for 2005.
- b. As at January 1, 2006, how much is expected net income for 2006?
- c. Explain why the financial statements you have prepared in part a are both completely relevant and completely reliable.

2A-3. An area where discounting could possibly be applied is for future income tax liability resulting from timing differences. Consider a firm that purchases an asset costing \$100,000 on January 1 of year 1. It is amortized on a straight-line basis at 20% per year on the firm's books. Tax amortization is 40% on a declining - balance basis. The income tax rate is 45%.

The following schedule shows a simplified calculation of the income tax liability balance for this asset over its life, assuming zero salvage value. This is the firm's only capital asset.

Year	Opening	Additions	Tax	Straight-	Difference
	Tax B.V.		Amortization	Line	
			Amortization	Amortization	
1	—	\$100,000	\$40,000	\$20,000	\$20,000
2	60,000		24,000	20,000	4,000
3	36,000		14,400	20,000	(5,600)
4	21,600		8,640	20,000	(11,360)
5	12,960		12,960*	20,000	(7,040)

Tax on Income Tax

Year	Difference	Liability
1	9,000	9,000
2	1,800	10,800
3	(2,520)	8,280
4	(5,112)	3,168
5	(3,168)	0

*It is assumed that all of the remaining tax book value is claimed in year 5.

Required

- Calculate the discounted present value of the future income tax liability at the end of each of years 1 to 5. Use a discount rate of 12%.
 - Why are the balances calculated in part a different from the undiscounted income tax liabilities?
 - What problems would there be if the discounting approach was applied to the tax liability of a large, growing firm with many capital assets?
- 2A-4. On January 1, 2005, GAZ Ltd. purchased a producing oil well, with an estimated life of 15 years, and started operating it immediately. The management of GAZ Ltd. calculated the present value of future net cash flows from the well as \$1,500,000. The discount rate used was 10%, which is the company's expected return on investment. During 2005, GAZ Ltd. recorded cash sales (net of production costs) of \$600,000. GAZ Ltd. also paid \$50,000 cash dividends during 2000.

Required

- Prepare the income statement of GAZ Ltd. for the year ended December 31, 2005, using RRA.

- b. Prepare the balance sheet of GAZ Ltd. as at December 31, 2005, using RRA.
- c. Summarize the perceived weaknesses of RRA accounting.
- d. Why does SFAS 69 require that a 10% discount rate should be used by all oil and gas firms rather than allowing each firm to select its own discount rate?

2A-5 Rainy Ltd. operates under ideal conditions of uncertainty. Its cash flows depend crucially on the weather. On January 1, 2010, Rainy acquired equipment to be used in its operations. The equipment will last two years, at which time its salvage value will be zero. Rainy financed the equipment purchase by issuing common shares.

In 2010, net cash flows will be \$700 if the weather is rainy and \$200 if it is dry. In 2011, cash flows will be \$900 if the weather is rainy and \$300 if it is dry. Cash flows are received at year-end. In each year, the probability that the weather is rainy is 0.3 and 0.7 that it is dry. The interest rate in the economy is 6% in both years.

Rainy pays a dividend of \$50 at the end of 2010.

Required

- a. In 2010, the weather is rainy. Prepare a balance sheet as at the end of 2010 and an income statement for 2010.
- b. If we attempt to apply the present value model under uncertainty to the more realistic conditions under which accountants operate, the expected present value calculations often become unreliable. Explain why.
- c. Explain why well-defined (i.e., "true") net income does not exist under the realistic conditions under which accountants operate. In place of true net

income, what criterion have accountants adopted to guide their financial accounting and reporting decisions?

Suggested Solutions to Additional Problems

2A-1. a. Expected present value of asset on January 1, 2005:

$$0.50\left(\frac{3,000}{1.10} + \frac{3,000}{1.10^2}\right) + 0.30\left(\frac{4,000}{1.10} + \frac{4,000}{1.10^2}\right) + 0.20\left(\frac{5,000}{1.10} + \frac{5,000}{1.10^2}\right)$$

$$= \$2,603.31 + 2,082.65 + 1,735.54$$

$$= \$6,421.50$$

Expected present value of asset on December 31, 2005, given "good" economy:

$$5,000/1.10 = \$4,545.45$$

Note: PV of bonds payable = \$3,000 (equal to face value because market interest rate equals coupon rate)

b.

XYZ Ltd.

Income Statement

For the Year Ended December 31, 2005

Accretion of discount [(6,421.50 – 3,000) × .10]	\$342.15
\$5,000.00	

Abnormal earnings		
Actual cash flow, 2005	\$5,000.00	
Expected cash flow, 2005		
(4,000 × 0.30 + 3,000 × 0.50 + 5,000 × 0.20)	<u>3,700.00</u>	1,300.00
Expected cash flow 2006, at Dec. 31, 2005	5,000.00	
Expected cash flow 2006, at Jan. 1, 2005	<u>3,700.00</u>	
	<u>1,300.00</u>	
Present value at Dec. 31, 2005	1,300/1.10	<u>1,181.80</u>
Net income		<u>\$2,823.95</u>

c.

XYZ Ltd.

Balance Sheet

As at December 31, 2005

Financial Asset		Liabilities	
Cash (note 1)	\$3,288.02	Bonds payable	<u>\$3,000.00</u>
Capital Asset,		Shareholders' Equity	
At present value	<u>4,545.45</u>	Opening balance	3,421.50
		Retained earnings (note 2)	<u>1,411.97</u>
			<u>4,833.47</u>
	<u>\$7,833.47</u>		<u>\$7,833.47</u>

Notes:

1. Cash = revenues (5,000.00) - interest expense (300.00) - dividends (1,411.98 (1/2 of net income of 2,823.95))
 2. Retained earnings = net income (2,823.95) - dividends (1,411.98)
- d. Present value-based financial statements under ideal conditions of uncertainty are relevant because balance sheet values are based on expected future cash flows and dividend irrelevancy holds.

They are reliable because present value calculations are representationally faithful. That is, since all states of nature are identified and have known, objective probabilities, the state realization is observable, and the economy-wide interest rate is known, present value calculations precisely represent asset and liability values, and cannot be biased by managers.

e. Investors are indifferent across dividend policies under ideal conditions because cash retained and dividends distributed to investors earn the same known rate of return. Thus, regardless of the firms' dividend policy, investors' total wealth (the sum of dividends and value of share holdings in the firm) is independent of that dividend policy. Amounts not paid out as dividends remain within the firm and earn the same rate of return for the shareholders.

- 2A-2. a. First, calculate the cost of the specialized machinery at 1 Jan., 2005:

$$\begin{aligned}
 PA_0 &= 1/1.06[0.3 \times 600 + 0.7 \times 6000] + 1/(1.06)^2[0.3 \times 400 + 0.7 \times 3000] \\
 &= .9434[180 + 4200] + .8900[120 + 2100] \\
 &= 4132.09 + 1975.80 \\
 &= \$6,107.89
 \end{aligned}$$

Next, calculate the value of the machinery as at 1 Jan., 2006:

$$PA_1 = 1/1.06[0.3 \times 400 + 0.7 \times 3000]$$

$$= .9434[120 + 2100]$$

$$= \$2,094.35$$

Relevant Ltd.
Balance Sheet
As at 31 December, 2005

Assets		Liabilities and Shareholders' Equity	
Cash (6,000-120)	\$5,880.00	Bank Loan	\$2,000.00
Capital Asset, at present value	<u>2,094.35</u>	Shareholders' Equity	
		Capital Stock	\$4,107.89
		Retained Earnings	<u>1,866.46</u>
	<u>\$7,974.35</u>		<u>5,974.35</u>
			<u>\$7,974.35</u>

Relevant Ltd.
Income Statement
For the Year Ended 31 December, 2005

Expected Net Income [6,107.89 – 2,000 × .06]	\$246.46
Abnormal earnings	
Actual Cash Flow	6,000.00
Expected Cash Flow	
(600 × 0.3 + 6,000 × 0.7)	<u>4,380.00</u>
	<u>1,620.00</u>
Net Income	<u>\$1,866.46</u>

b. Expected net income for 2006, evaluated as at 1 Jan., 2006 is:

$$\$5,974.35 \times .06 = \$358.46$$

c. The financial statements are completely relevant because they are based on the expected present value of future cash flows. Thus they give complete information to investors about the firm's future economic prospects. They are completely reliable because the assumption of ideal conditions (essentially, that the set of possible states of nature, cash flows resulting from each state, and objective probabilities of the states, are publicly known) means that financial statement items are representationally faithful, free of bias, and verifiable.

2A-3. a. The discounted PV of the future income tax liability:

At the end of year 1

$$\begin{aligned} PA_1 &= \frac{1,800}{1.12} - \frac{2,520}{1.12^2} - \frac{5,112}{1.12^3} - \frac{3,168}{1.12^4} \\ &= (\$6,053.73) \end{aligned}$$

At the end of year 2

$$\begin{aligned} PA_2 &= -\frac{2,520}{1.12} - \frac{5,112}{1.12^2} - \frac{3,168}{1.12^3} \\ &= (\$8,580.17) \end{aligned}$$

At the end of year 3

$$\begin{aligned} PA_3 &= -\frac{5,112}{1.12} - \frac{3,168}{1.12^2} \\ &= (\$7,089.80) \end{aligned}$$

At the end of year 4

$$\begin{aligned} PA_4 &= -\frac{3,168}{1.12} \\ &= (\$2,828.57) \end{aligned}$$

At the end of year 5

$$PA_5 = 0$$

b. It is because the balances calculated in part a are discounted to reflect the PV of the future repayments of tax. This reduces their amounts.

c. i) Repayment of the future income tax liability is triggered when capital cost allowance falls below book amortization. Depending on the rate and time pattern of the growth of capital assets, the future income tax liability may never have to be actually repaid or, at least, the repayment could be postponed indefinitely. This would happen if the pool of capital assets grows sufficiently each year that capital cost allowance is always greater than straight-line amortization.

ii) It is not clear what interest rate should be used for the discounting. A risk-free rate, the firm's borrowing rate, or cost of capital are possible alternatives.

iii) Under the liability view of income tax timing differences, the future income tax liability has to be adjusted for changes in the tax rate. Thus, for a completely relevant present value calculation, changes in tax rates, and the timing of such changes, would need to be anticipated. Lacking such anticipation, the future income tax liability would have to be adjusted as tax rates change. This would require considerable cost and effort, and would introduce volatility into reported net income.

2A-4. a.	PV of future net cash flows, January 1, 2005	\$1,500,000
	Less net sales during 2005	<u>600,000</u>
		900,000
	Accretion of discount (10% of 1,500,000)	<u>150,000</u>
	PV December 31, 2005	<u>\$1,050,000</u>

GAZ Ltd.

Income Statement
For the Year Ended December 31, 2005

Accretion of discount (1,500,000 × .10)	<u>\$150,000</u>
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b.

GAZ Ltd.
Balance Sheet
As at December 31, 2005

Financial Asset	Shareholders' Equity
Cash (600,000 - 50,000) \$550,000	Opening balance \$1,500,000
 Capital Asset	
Reserves, at	Retained earnings
estimated P.V. <u>1,050,000</u>	(150,000 - 50,000) <u>100,000</u>
<u>\$1,600,000</u>	<u>\$1,600,000</u>

c. Weaknesses of RRA:

- The mandated discount rate of 10% might not reflect the actual risk and return for GAZ Ltd. This reduces relevance.
- RRA involves making a large number of assumptions and estimates, with respect to quantities and timing of their extraction. As a result, estimated future RRA cash flows may bear little relationship to the net revenue the company will receive in the future. This reduces relevance.

- Frequent, material changes in estimates reduce the reliability of the RRA values.
- RRA requires year-end oil and gas prices, rather than prices expected when it is anticipated the reserves will be lifted and sold.

This reduces relevance (although, it increases reliability).

d. Use of a single 10% rate was mandated in SFAS 69 to improve comparability across firms and over time for the same firm. The effect is to decrease relevance, since firms cannot choose a discount rate most suitable to their own riskiness and cost of capital. However, reliability is increased since management cannot bias the present value calculations by its choice of discount rate.

2A.5 a. Expected present value of asset on January 1, 2010 and 2011:

$$\begin{aligned}
 PA_0 &= 0.3 \left[\frac{700}{1.06} + \frac{900}{1.06^2} \right] + 0.7 \left[\frac{200}{1.06} + \frac{300}{1.06^2} \right] \\
 &= 0.3(660.38 + 801.00) + 0.7(188.68 + 267.00) \\
 &= 0.3 \times 1,461.38 + 0.7 \times 455.68 \\
 &= 438.41 + 318.98 \\
 &= 757.39
 \end{aligned}$$

$$\begin{aligned}
 PA_1 &= 0.3 \times \frac{900}{1.06} + 0.7 \times \frac{300}{1.06} \\
 &= 0.3 \times 849.06 + 0.7 \times 283.02 \\
 &= 254.72 + 198.11 \\
 &= 452.83
 \end{aligned}$$

Rainy Ltd.

Balance sheet

As at December 31, 2010

Cash (700 – 50)	\$650.00	Shareholders' equity	
Capital asset, at		Capital stock (PA ₁)	\$757.39
present value	<u>452.83</u>	Retained earnings (395.44 – 50)	<u>345.44</u>
	<u>\$1,102.83</u>		<u>\$1,102.83</u>

Rainy Ltd.

Income Statement

For the year ended December 31, 2010

Expected net income (accretion of discount) (757.39 × .06)		\$45.44
Abnormal earnings		
Expected cash flow (0.3 × 700) + (0.7 × 200) = (210 + 140)	\$350.00	
Actual cash flow	<u>700.00</u>	<u>350.00</u>
Net income for the year		<u>\$395.44</u>

b. The main reason why the present value calculations may become unreliable is that objective state probabilities are not available. Consequently, subjective probabilities must be assessed. However, these are subject to error and bias. Consequently, they are low in reliability.

Other reasons include the lack of a single interest rate in the economy, identifying the set of states of nature, and possible non-observability of the state realization. All of these introduce additional sources of error and bias into the present value calculations, reducing reliability.

c. A main reason is incomplete markets. Then, income cannot be measured by the change in the market values of the firm's assets and liabilities.

Lacking complete markets, fair value estimates or discounted present values must be used to value assets and liabilities. However, such estimates and calculations are low in reliability, resulting in major adjustments to previous years' estimates. If true net income existed, there would be no adjustments.

In view of these problems, accountants have retained historical cost for major asset and liability classes and adopted criteria of decision usefulness and full disclosure.