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Coughlan J.W., PhD, CPA, CMA
President, CPA School of Washington, Inc.

A FUTURE FOR ACCOUNTING

The article proposes that cost and fair value be replaced by explicit estimates of future cash flows. The ways to achieve the financial reporting transparency by the governmental regulation have been presented

Management and investment decisions relate to the present (cash) and the future (prospective cash flows). Accounting purports to deal with the past ("cost") and the present ("fair value"). If accounting is to be useful, it must address the same future that the manager and investor addresses.

This paper proposes an accounting that incorporates explicit estimates of future cash flows into the financial statements. It employs mathematical programming to provide a managerial decision framework. Linear programming, particularly the relations between primal and dual, provides a convenient tool to maintain the equality of assets with liabilities and equity. Consider the linear programming problem

Maximize cx

Subject to $Ax \leq b$ where c, x, and b are row and column vectors of appropriate size and A is a matrix. The objective function of the primal, cx, will be used to define assets and the dual will be used to explore problems of capital and income.

INDUSTRIAL ACCOUNTING

A Simple Example

Consider a newly formed corporation with cash and contributed capital of $300,000. Let it contemplate paying $298,000 to enter into a venture that promises to yield a $200,000 cash inflow at the end of the first year and a further $300,000 cash inflow at the end of the second and final year. Let an "appropriate" interest rate be ten percent and let management's goal be to maximize the present value of future cash flows.

The linear programming formulation in Exhibit 1 can be solved by inspection. The investment should be made (X = 1) and, from the first primal constraint, it will be seen that $2,000 is left over ($C_0$ = 2,000) and, assuming no other use for that money, it may be distributed as a dividend to stockholders. From the second constraint it can be

seen that, if the investment is made, we might expect to receive $200,000 at the end of the first year. The final constraint tells us that there is only one such capital budgeting opportunity available.

EXHIBIT 1
Simple Decision Problem

Primal

Maximize $C_0 + (1/1.1)C_1 + (250,000/1.21)X$

Subject to

$$\begin{aligned} C_0 + 298,000X &\leq 300,000 \\ C_1 - 200,000X &\leq 0 \\ X &\leq 1 \end{aligned}$$

Solution: $C_0 = 2,000$ $C_1 = 200,000$ $X = 1$

Objective Function Value = 390,430

Dual

Minimize $300,000\lambda_1 + \lambda_3$

Subject to

$$\begin{aligned} \lambda_1 &\geq 1 \\ \lambda_2 &\geq 1/1.1 \\ 298,000\lambda_1 - 200,000\lambda_2 + \lambda_3 &\geq 250,000/1.21 \end{aligned}$$

Solution: $\lambda_1 = 1$ $\lambda_2 = 1/1.1$ $\lambda_3 = 90,430$

Objective Function Value = 390,430

At time 0 after making the initial expenditure of $298,000 to enter into the venture, the basic financial statements would appear as in Exhibit 2. In place of the conventional income statement, a statement stressing sales and production for a year, Exhibit 2 presents a receipts and expenditures statement stressing receipts and expenditures over the period for which the capital budgeting decision has been made.

EXHIBIT 2
Receipts and Expenditures Statement
January 1, Year 1

Year 2 Expected future net receipts	250,000
Year 1 Expected future net receipts	200,000
January 1 Year 1 Actual expenditure	(298,000)
ANTICIPATED PROJECT INCOME	152,000
Unearned interest income	61,570
Net present value	90,430
TOTAL ANTICIPATED PROJECT INCOME	152,000

Balance Sheet

January 1, Year 1	
Expected future net receipts	450,000
Less: Unearned interest income	61,570
Present value of future cash flows	388,430
Cash	2,000
ASSETS	390,430
Contributed capital	300,000
Retained earnings	90,430
EQUITY	390,430

In place of the contemporary balance sheet which shows past expenditures on inventory and plant and equipment, the balance sheet in Exhibit 2 displays the cash expected to be realized in the future from the use of the inventory and plant and equipment. Inventory, plant and equipment, etc. are not worth what they took from the business (their cost) but rather what they will bring to the business (the future cash flows from their use). Notice that the objective function of the primal defines the assets of the firm: the objective function tells us that future receipts of $450,000 (the year 1 and year 2 net cash inflows from the operating statement) are presented on the balance sheet at their present values of $388,430; and the cash remaining in the firm (the $2,000) after investing in the new project is of course a present value on the balance sheet at that date. The total assets on this balance sheet ($390,430) coincide with the value of the objective function.

The objective function of the dual gives the components of the equity section of the balance sheet, namely the contributed capital (perhaps par and additional paid-in capital) of $300,000 and retained earnings of $90,430.[1] To understand the $90,430, consider the third dual constraint:

$298{,}000\lambda_1 - 200{,}000\lambda_2 + \lambda_3 \geq 250{,}000/1.21$

Into this inequality, which becomes an equality at the optimum solution, insert the values for the dual variables from Exhibit 1:

$298{,}000(1) - 200{,}000(1/1.1) + 90{,}430 = 250{,}000/1.21$

Now, except for the $90,430, move all terms to the right to obtain:

$90{,}430 = -298{,}000 + 200{,}000/1.1 + 250{,}000/1.21$

[1] The problem could have been formulated so the dual also identified other elements of income such as the interest income. Instead I have formulated the problem so that the prospective interest income is offset against the prospective future cash flows which are carried in the primal object function as present values, i.e. net of future interest earnings.

You will recognize this as the standard net present value (NPV) calculation of capital budgeting.

This $90,430 is defined in Exhibit 1 by the dual variable relating to the third primal constraint. Nothing in Exhibit 1 ties the third primal constraint ($X \leq 1$) to a particular year or date and you may object – and rightly so – that it is not very conservative to treat this net present value as being "realized" or "earned" upon making the initial investment in the project. This third constraint, which might be called a "no-year" constraint relates to the receipts and disbursements over the entire life of the project. The related dual variable – the $90,430 of NPV – might be reflected in a variety of patterns over the two years of the project. If, for example, none of the $90,430 were recognized at the time of committing to the project (i.e., investing the $298,000), then the $90,430 would be subtracted from the present value of the cash inflows to take us back to the cost of the project. In that approach, the first few lines of the balance sheet would appear as follows:

Expected future net receipts	$450,000
Less: Unearned interest income	61,570
Present value of cash inflows	$388,430
Less: Net Present Value	90,430
Unrecovered Cost of Project	$298,000

Now consider a different approach to conservatism.

Borders

In contemporary financial statements, we suggest that our numbers are "conservative" because they stress past facts and make no prognostications of the future. In fact, we do make prognostications of the future because, unless we make some assumptions about that future, we cannot justify carrying plant and equipment at cost. Implicit in the cost basis of accounting is the assumption that future receipts will be at least as great as the figures at which the assets are carried. With no prognostications of the future, the Sears Tower and the great pipelines of Russia and the Ukraine would be carried on the balance sheet at zero.

Furthermore, the concepts of "conservative" or "pessimistic" and the rival concepts of "liberal" or "optimistic" cannot be related to a unique figure such as displayed on the contemporary financial statements but instead relate to a range of numbers. Let the balance sheet of a company says its assets are worth $5,212,366, but

you and I know that its assets are worth possibly much less and possibly much more. We cannot depend on a "point" estimate but need instead a "range" estimate.

Inserting explicit estimates of future cash flows into the financial statements makes it easy to use a "range" to supplement a "point." Consider the $200,000 estimated future receipts for Year 1 in Exhibit 2. The actual number will not be $200,000 exactly. It may be $170,000 or it might be $208,000 and the statements in Exhibit 2 must be revised to make clear that the exact number will not be $200,000 but, assuming good estimates are made, will be somewhere near $200,000.

How near? Setting upper and lower limits on these future cash flows, we can designate a range within which the cash flow is expected to fall. If a future cash inflow falls below the lower limit or above the upper limit, it will suggest that perhaps the accounting was deficient but if the cash flow falls within the range it will suggest that the accounting was "in control." Think of the $200,000 estimate of Year 1 estimated future net receipts as being an expected value in a probability distribution with a standard deviation of $15,000. If the underlying distribution from which the actual number will be drawn were a normal distribution, we would know that by going up and down 1.96 standard deviations (or up $29,400 and down $29,400) we would have a 95 percent confidence interval.

There is no reason to think next year's estimated net receipts follow a normal distribution and, in the absence of better knowledge and more experience with this kind of accounting, the upper and lower limits on the estimates ought to be set well apart from the expected value. Lacking knowledge of the underlying distribution, we might employ Chebyshev's inequality which tell us that if we go up and down k standard deviation from the expected value then we will capture at least m (where $0<m<1$) of the distribution where k and m satisfy the following relation:

$1 - 1/k^2 \geq m$

If, for example, we want the interval to be wide enough to capture at least 0.9 of the distribution, we should solve

$1 - 1/k^2 = 0.9$ which gives $k = 3.16$.

Given the standard deviation of $15,000, we know from Chebyshev that if management's projection of year 1 cash flows is consistent with the true state for year 1, we will capture 90 percent or more of the probability distribution by going up and

down $47,400 (=3.16 * 15,000) from the expected value of $200,000 for year 1 estimated cash inflows.

A "bordered" version of the receipts and expenditures statement at time 0 appears in Exhibit 3 and the related balance sheet appears in Exhibit 4. Note the lower bound of $152,600 (=200,000-47,400) and the upper bound of $247,400 (=200,000+47,400) on the expected value of $200,000 for the year 1 estimated net receipts. Similarly, for year 2, using a standard deviation of $25,000 and the Chebyshev relationship, there is a lower limit of $171,000 and an upper limit of $329,000 on the estimated cash receipts for year 2.

EXHIBIT 3
Bordered Receipts and Expenditures Statement
January 1, Year 1

	Lower Limit	Expected Value	Upper Limit
Year 2 future net receipts	171,000	250,000	329,000
Year 1 future net receipts	152,600	200,000	247,400
1/1/Year 1 Actual expenditure	(298,000)	(298,000)	(298,000)
ANTICIPATED INCOME	25,600	152,000	278,400
Unearned interest income	43,550	61,570	79,590
Net present value	(17,950)	90,430	198,810
ANTICIPATED INCOME	25,600	152,000	278,400

From Chebyshev we would know there is at least a 90 percent likelihood that, if management and the accountants have a projection of the future which is close to the true but unknown situation for that future, the receipts for Year 1 would fall somewhere between $152,600 and $247,400. Indeed the Chebyshev inequality makes extreme assumptions about the distribution of sample values so that the probability may be well in excess of 0.9. Further, since we are dealing with a "two-tailed" distribution, the probability that the actual year 1 receipts fall below $152,600 is considerably below 0.1 and the joint probability that the actual net receipts for, say, both years 1 and 2 would be below the lower limits would be almost infinitesimal. These probabilities open the door to a meaningful and operational concept of conservatism and the validity of the financial statements as will be seen below.

EXHIBIT 4
Bordered Balance Sheet
January 1, Year 1

	Lower Limit	Expected Value	Upper Limit
Prospective future net receipts	323,600	450,000	576,400
Unearned interest income	43,550	61,570	79,590
PV of future cash flows	280,050	388,430	496,810
Cash	2,000	2,000	2,000
ASSETS	282,050	390,430	496,810
Contributed capital	300,000	300,000	300,000
Retained earnings	(17,950)	90,430	198,810
EQUITY	282,050	390,430	498,810

The Probability Concept

Does probability theory apply to this situation? Do the concepts of a standard deviation, a probability distribution and the Chebyshev inequality apply?

Objectivist probabilities. One of the two main schools that relate to probability theory is the objectivist school. This school was born centuries ago in connection with games of chance such as cards, dice and coin tosses. According to this school of thought, probability may be defined as relative long-term frequency in an experiment that can be repeated many times. This school would look askance at the application of probability theory in the present situation. It would argue that next year's cash inflows will happen only once, that next year is not an experiment that can be repeated countless times, that there is no probability distribution, and that a standard deviation and confidence interval cannot be defined.

Subjectivist probabilities. In contrast, those who favor the subjectivist or "personalistic" concept of utility, define probability as "strength of belief" or "degree of confidence" in a particular outcome and suggest that meaningful decisions in the presence of risk and uncertainty relating to a future event – even a unique event such as next year's net receipts that will happen just once – can only be made if probabilities are assigned and defined. Clearly the concept of probability employed in generating Exhibits 3 and 4 reflects the subjectivist school of probability.

The economists who theorize about "portfolio theory" and the corporate managers and financial practitioners who employ it embrace subjectivist probabilities.

While the "beta" of the capital asset pricing model may be estimated in some cases by using past data, it is nevertheless an estimate of the future covariance between the volatility of a particular asset and the volatility of the market. Likewise the "volatility" used in Black/Scholes option pricing, while sometimes estimated from historical data, is nevertheless an estimate of the standard deviation that applies to a future period. Faced with uncertainty and risk, game theory to the contrary notwithstanding, it is almost impossible to make meaningful decisions without making some use of personalistic probabilities.

None of this implies the business manager needs to take a course in probability any more than it implies she has to read texts on accounting to run an enterprise and generate financial statements. It is reasonable, however, when she tries to persuade the board of directors to make a particular decision, say to spend the $298,000 to initiate the capital budgeting proposal, to ask her to make some predictions about what the future cash flows will be. And if she predicts that the net cash inflow at the end of year 1 will be $200,000, while it is unreasonable and unfair for the board to expect the number to be exactly $200,000 (that probability is approximately zero), it is reasonable for the board to insist that she indicate the range of values (the $152,600 to $247,400 in Exhibit 3) within which the future net receipts will fall. If she is willing to assign a "confidence coefficient" – say 90 percent – to that interval and if the actual number falls outside the range, then the board may be justified in assuming that her prediction did not conform to the true but unknown situation for year 1. While it may be unreasonable to require her to specify a confidence coefficient, it is still relevant to ask her to choose an adjective such as "certain," "highly likely," or "probable" to apply to the likelihood that the actual number will fall within the range.

If the company has an independent auditing firm that expresses an opinion on its financial statements, we may indeed have something close to the objectivist approach to probability. If the financial statements give a range and the manager commits to a probability statement such as "highly likely" and the accounting firm suggests that the statements "present fairly" position and results, then we would wonder about the accounting firm if the number fell outside the limits. "Highly likely," of course, is not the same as "certain" so that occasionally the actual numbers will fall outside the limits. But an auditing firm that expresses hundreds of opinions on financial statements may be similar in some respects to a throw of dice that can be repeated hundreds of times. Yes, if we throw two dice, we may on some throws find that each

die gives a six. Similarly, if the auditor's opinion suggests that the range is correctly chosen, then on rare occasion the actual number will fall outside the range. If, on repeated throws of the two dice we often get both dice showing six, we have strong evidence that the dice are "loaded" or "biased" in some manner. Similarly, if the actual number frequently falls outside the range, we have good evidence that the auditing firm is defective.

A parallel may be drawn with the statistical quality control methods employed in manufacturing organizations. In the manufacture of cam shafts, suppose a process would be considered "in control" if not more than one cam shaft in one thousand falls outside the specified dimension. Periodically, we take a sample of one hundred and compare their sizes with the acceptable size. If none are defective, we may proceed on the assumption that the process may be in control; as a minimum we can conclude that there is no evidence that the process is 'out of control.' If one is defective, we may wonder and we may take another sample, but we do not necessarily assume that the process is out of control. But if, for example, three of the hundred in our sample are defective, we would probably reject the presumption that the process is in control.

Let it be accepted that the upper and lower limits relate to a confidence coefficient of 90 percent. Let an auditing firm express an opinion that the statements "present fairly" position and results and let the firm do that for a hundred different clients in a particular year. We would expect the actual numbers that eventuate in the following year to fall outside the limits a few times. If, for example, ten of the hundred fell outside the limits, we would consider that a remarkable affirmation of the 90 percent confidence coefficient and we would not be disturbed if in 8, 9, 11, 12 cases the actual number fell outside the limits. If, however, in no cases did the actual number fall outside the upper and lower limits, we would wonder if the true confidence coefficient were considerably higher than 90 percent. If, in twenty cases of a hundred, the actual number fell outside the upper and lower limits, we would ask whether the auditing firm was "in control."

In our example, suppose the bordered receipts and expenditures statement drafted at the end of year 1 (see Exhibit 5) shows the actual net receipts at the end of year 1 were $206,000. This $206,000, falling as it does well within the bounds of $152,600 and $247,400 shown in the comparable statement (Exhibit 3) generated at the beginning of the year, suggests that the accounting process is "in control" or, at the very least, it presents no evidence that the accounting process is out of control.

EXHIBIT 5
Bordered Receipts and Expenditures Statement
December 31, Year 1

	Lower Limit	Expected Value	Upper Limit
Year 2 future net receipts	206,600	254,000	301,400
Year 1 actual net receipts	206,000	206,000	206,000
1/1/Year 1 Actual expenditure	(298,000)	(298,000)	(298,000)
ANTICIPATED INCOME	114,600	162,000	209,400
Unearned interest income	18,782	23,091	27,400
Earned income	95,818	138,909	182,000
ANTICIPATED INCOME	114,600	162,000	209,400

In preparing Exhibit 5, the accountant has defined new and "tighter" bounds on the projected numbers for year 2. The fact that these tighter bounds are within the limits set in prior Exhibit 3 also suggests either that the accounting is "in control" or, at the very least, presents no evidence that there is anything wrong with the accounting.

To understand the $138,909, the earned income by the end of the year, consider the calculation of NPV at the beginning of the year but now use the revised actual and estimated numbers:

NPV(time 0) = 99,190 = - 298,000 + 206,000/1.1 + 254,000/1.21 (1)

Now consider a hypothetical savings account in which the following transactions occur:

	Deposit	Interest	Withdrawal	Balance
Time 0 deposit	298,000			298,000
Time 0 bonus	99,190			397,190
Time 1 transactions		39,719	206,000	230,909
Time 2 transactions		23,091	254,000	0

The earned income of $138,909 at the bottom of Exhibit 5 consists of the NPV of $99,190 recognized initially and the interest income of $39,719 recognized at the end of the year.[2]

[2] Assuming the amount of income recognized at the inception of the project was, as reflected in Exhibits 2 and 4, $90,430 there would be an adjustment to transfer out of unearned income $48,479 (=138,909-90,430) to earned income to bring the total of earned income up to the $138,909 shown at the bottom of Exhibit 5.

The numbers in the Expected Value column of Exhibit 6 – the balance sheet at the end of Year 1 - can easily be related to this hypothetical savings account. The year 2 withdrawal of $254,000 in the savings account corresponds to the expected future net receipts of $254,000 on the first line of the balance sheet and is, of course, the year 2 prospective future net receipts of $254,000 on the operating statement (Exhibit 5). The unearned interest income on the second line of the balance sheet is the $23,091 of interest that will be added to the savings account in the final year, and the balance in the savings account at the end of year 1, namely $230,909, corresponds to the present value of the expected future cash flows on the balance sheet. Implicit in Exhibit 6 is the assumption that the $2,000 available after investing in the project was not needed to carry on the project and was accordingly paid as a dividend to stockholders. The cash on the 12/31/Year 1 balance sheet of $206,000 is accordingly the amount that comes in at the end of year 1.

EXHIBIT 6
Bordered Balance Sheet
December 31, Year 1

	Lower Limit	Expected Value	Upper Limit
Prospective future net receipts	206,600	254,000	301,400
Unearned interest income	18,782	23,091	27,400
PV of future cash flows	187,818	230,909	274,000
Cash	206,000	206,000	206,000
ASSETS	393,818	436,909	480,000
Contributed capital	300,000	300,000	300,000
Retained earnings	93,818	136,909	180,000
EQUITY	393,818	436,909	480,000

RISK AVERSION

Business is a dynamic process with new decisions being made as events unfold. The illustration developed so far appears static. No new decisions were made after the initial capital budgeting decision. Now assume that the balance sheet in Exhibit 6 is actually drafted on the 30th not the 31st of December, Year 1. With $206,000 of cash available, the question is whether the company should distribute it as a dividend to stockholders or should invest in the opportunities presented in Exhibit 7.

The board believes stockholders will have no problem earning ten percent without the help of the corporation and that the $206,000 should be distributed in the form of a dividend unless management can use the money to earn a higher return. Since both projects promise a return well in excess of ten percent as indicated by the NPV figures the board finds both tempting.

The board, however, is concerned by the risk assessments ("high" and "extreme") and wants management to quantify the risks. Prior exhibits have used upper and lower limits to tell something about the integrity of the accounting but have assumed either that stockholders were "risk neutral" or, if risk constraints were present, they were non-binding and made no difference to the solution in Exhibit 1. Portfolio theory has assumed for half a century now that "risk aversion" is a factor in investment decisions and it is important to be able to incorporate "risk aversion" in the accounting model.

EXHIBIT 7
Cash Flows From Capital Budgeting Opportunities
12/31/Year 1 Opportunities

	Project X_2	Project X_3
Estimate Future Cash Inflows		
Year 4		150,000
Year 3	300,000	150,000
Year 2	100,000	150,000
Required 12/31/Year 1 Disbursement	(100,000)	(100,000)
Net Present Value at 10 Percent	238,843	273,027
Risk	High	Extreme

Management, of course, objects to the board that it is almost impossible to quantify risk in connection with the two projects other than to state that risk is "high" or "extreme" where these two terms refer to how much the future cash flows might fall above or below the expected values in Exhibit 7. Management asserts that this is the field of subjective probability and that some purists would not even permit the use here of the concepts of standard deviation, confidence level, etc.

The board and stockholders are implacable. While they may be relaxed about the projected cash flows for years 3 and 4, for year 2 they insist that management assure them that whatever projects are adopted, the cash inflows will not below the expected values by more than $300,000.

With some reluctance, management begins to estimate the standard deviations related to its various opportunities. Using Chebyshev, it concludes that if it goes up and down three standard deviations from the expected value, it will almost certainly capture almost all of the distribution of year 2 cash flows. Chebyshev gives us 8/9ths or 0.89 of the distribution for three standard deviations. Since Chebyshev makes extreme assumptions about the spread of actual values around the expected value, management concludes that they may have a 90 percent "degree of belief" that the resulting interval will capture whatever cash inflow eventuates in year 2. With regard to the values that fall outside the distribution of three standard deviations, it concludes that, since we are dealing with a two-tailed distribution, it is reasonable to think that of those values that might fall more than three standard deviations from the expected value perhaps half might exceed the expected value by the three standard deviations. Presumably stockholders will not be upset by those values that fall in the right-hand tail. Accordingly management decides that going up and down three standard deviations gives, at most, a 0.05 probability that the actual value that eventuates in year 2 will be more than $300,000 below the projected expected value. Three standard deviations and a limit of $300,000 below the expected value imply a standard deviation of $100,000.

The percent of values falling more than $300,000 below the expected value will, in fact, probably be considerably less than five percent. Most probability distributions involving monetary values are "skewed" to the right. The distribution of home values in a particular community, for example, has considerable "skewness" and going down three standard deviations from the average home value will leave considerably less than five percent below that lower limit. Zero is the lower limit on home values. Similarly, because of bankruptcy laws, for all practical purposes, zero is the lower limit on personal net worths and, accordingly, going down three standard deviation from average net worth (and certainly from median net worth) will leave considerably less than five percent of net worths below the lower limit.

Let's suppose management assesses the standard deviations and related variances as follows:

	Standard Deviation	Variance
Project X (adopted 1/1/Year 1)	15,000	225,000,000
Project X_2	63,245	4,000,000,000
Project X_3	110,000	12,100,000,000

While standard deviations cannot be added, it is possible to infer the combined spread or scatter by adding variances. In doing so, however, it is necessary to consider correlations or dependencies between projects, that is, it is necessary to take into account the covariances between projects. Let's suppose the only covariance is that between X_2 and X_3 and that this covariance is 2,740,000,000.

If management accepts the two new projects then its variance for year 2 is 19,065,000,000 determined as follows:

225,000,000+4,000,000,000+2,740,000,000+12,100,000,000 = 19,065,000,000.

Since this implies a standard deviation (the square root of variance) of $138,076, clearly management cannot adopt both of the new projects in full. To get a standard deviation of $100,000 the combined variance cannot exceed 10,000,000,000.

To simplify the problem a little, let us assume that project X, already adopted, can be ignored in determining the standard deviation in year 2. After a year of experience with X, management is comfortable with it. Notice that its standard deviation is small compared to that of the two new projects and the squared dimension, the variance, is almost trivial compared to that of the other two. Notice further that there are no covariances involving X and the other two.[3]

With this simplification in mind, a risk aversion constraint may be written as follows:

$$4{,}000{,}000{,}000X_2^2 + 2{,}740{,}000{,}000X_2X_3 + 12{,}100{,}000{,}000X_3^2 \leq 10{,}000{,}000{,}000.$$

Without changing the nature of this inequality, it has been divided by 100,000,000 and appears as the fourth constraint in the capital budgeting formulation in Exhibit 8.

Can a solution of 0.6 for project X_3 make sense? Since many projects must be either accepted or rejected, perhaps integer programming should be employed. If an integer restriction were imposed on the X values in the present case, it would be found that the objective function value would be only $444,843. If a fractional result with project three being only 0.6 accepted is possible, then the objective function value can be increased $163,817 to the $608,660 in Exhibit 8. If project three must be undertaken in full or not at all ("all or nothing"), then this $163,817 difference gives a

[3] After solving the "simplified" problem to derive a standard deviation of $100,000, I will show on subsequent pages how the volatility of the initial project might be brought into the analysis. It will be seen that it has a minor effect on the combined standard deviation.

powerful incentive to management to seek a "partner" that will accept responsibility for and take the rewards and risks related to 0.4 of project 3.

EXHIBIT 8

A Risk-Averse Decision Problem

Maximize $C_2 + (1/1.1)C_3 + (1/1.21)C_4 + (1/1.331)150{,}000X_3$

Subject To

C_2		$+ 100{,}000X_2$		$+ 100{,}000X_3$	$\leq$	206,000
	C_3	$- 100{,}000X_2$		$- 150{,}000X_3$	$\leq$	0
	C_4	$- 300{,}000X_2$		$- 150{,}000X_3$	$\leq$	0
		$40X_2^2$	$+ 27.4X_2X_3$	$+ 121X_3^2$	$\leq$	100
		X_2			$\leq$	1
				X_3	$\leq$	1

Solution: $C_2 = 46{,}000$ $C_3 = 190{,}000$ $C_4 = 390{,}000$ $X_2 = 1$ $X_3 = 0.6$
Objective function value: $608,660

John M. Cozzolino ("Porfolios of Risky Projects" available at http://www.casualtyactuaries.com/pubs/forum/94sforum/94sf057.pdf), commenting on a paper by Paul Samuelson, states:

"Sharing of risky projects with other firms … is widely observed in the business world. Oil exploration is often undertaken by combines of individual firms; banks share certain loans; insurance companies reinsure policies to control their risk; investment bankers form syndicates to underwrite jointly security issues."

Exhibit 8 assumes either that the projects can be accepted in part or that, if a project is "all or nothing," there are potential "partners" willing to accept portions of the project.

If, consistent with Exhibit 8, the company adopts the second project in full (X2=1) and acquires a 0.6 or 60 percent participation in the third project (X3=0.6), then the receipts and expenditures statement immediately after might appear as in Exhibit 9. Let us go through the expected value column. In Exhibit 7, it was predicted that the cash inflows in year 4 from the third project would be $150,000 if adopted in full. With a 60 percent participation, we can expect only a $90,000 cash inflow. For year 3, the expected cash inflow is the $300,000 from the second project and a 60 percent share of the $150,000 from the third, for a total of $390,000. There are three components to the expected $444,000 for year 2: $254,000 from the project adopted at the beginning of year 1 (Exhibit 5); $100,000 from adopting all of the second project; and a further $90,000 (or .6 * 150,000) from the third project. The $458,000

investment in the projects is the $298,000 invested in the first project at the beginning of the first year; the further $100,000 invested in the second at the end of the first year; and the $60,000 invested to acquire a 60 percent participation in the third at the end of the first year.

Now let's determine the lower bound of $141,000 for year 2 in Exhibit 9. The first project, adopted at the beginning of year 1, has two implications for the decisions at the end of year 1. First, from this first project we have $206,000 at the end of year 1 which plays a role in the first cash flow constraint in Exhibit 8. Second, the first project has some volatility consequences which we cavalierly dismissed in setting up Exhibit 8. Let us bring back into the analysis, the variability relating to the first project. As previously stated, the standard deviation for X is thought to be $15,000, indicating a variance of 225,000,000. Following the analysis in connection with Exhibit 8, the standard deviation relating to the second and third projects considered together is $100,000 indicating a variance of 10,000,000,000.

Assuming no covariance between X and the combined second and third projects, the total variance of the three can be determined by adding together the variances:

Variance of X + Variance of 2nd and 3rd projects = Combined variance

225,000,000 + 10,000,000,000 = 10,225,000,000.

EXHIBIT 9
Bordered Receipts and Expenditures Statement
December 31, Year 1
(After Capital Budgeting Decisions in Exhibit 8)

	Lower Limit	Expected Value	Upper Limit
Project cash inflows:			
Year 4	50,000	90,000	300,000
Year 3	200,000	390,000	800,000
Year 2	141,000	444,000	747,000
Past cash flows:			
Year 1 cash inflow	206,000	206,000	206,000
Investments	(458,000)	(458,000)	(458,000)
ANTICIPATED INCOME	139,000	672,000	1,595,000
Unearned income:			
Interest	59,963	130,431	281,358
Risk factor	316,371	316,371	316,371
Earned income	(237,334)	225,198	997,271
ANTICIPATED INCOME	139,000	672,000	1,595,000

The square root of this combined variance, namely $101,000 (with a little rounding), is the standard deviation of the three considered together. Subtracting $303,000 (or 3 * 101,000) from the expected value of $444,000 for year 2 gives the lower bound of $141,000 and adding $303,000 gives the year 2 upper bound of $747,000 in Exhibit 9.

This example may suggest the projected distribution is symmetric. As noted previously, distributions of monetary value are usually right skewed. To reflect this possible right skewness, the upper bounds for years 3 and 4 are much further above the expected values than the lower bounds are below the expected values.

When dealing with a distribution that is skewed to the right, it is often desirable to use the median rather than the arithmetic mean as the measure of central tendency. These and other improvements can be introduced as we get more experience with the kind of accounting introduced here.

Using the operating statement in Exhibit 9, we can derive most of the numbers on the balance sheet in Exhibit 10. Follow the numbers in the expected value column. The $924,000 is the total cash inflow expected over the next three years, namely $90,000 plus $390,000 plus $444,000 seen at the top of Exhibit 9. These numbers discounted at ten percent have a total present value of $793,569 which appears on the third line of the balance sheet. The second line, the unearned interest income of $130,431, reduces the amounts to be received to their present values.

It may be instructive to tie in the assets side of this balance sheet with the mathematical programming framework. Before the capital budgeting decisions at the end of year 1, the balance sheet (Exhibit 6) revealed that the company had $436,909 of assets. From Exhibit 8, the capital budgeting formulation, we saw that, using the $206,000 of cash available, the company could expect to accumulate $608,660, an increase of $402,660. Adding this $402,660 increase to the assets of $436,909 available immediately before the capital budgeting decision, we would expect to find a total of $839,569 on the balance sheet. We do, and it consists of the following two lines on the balance sheet:

Present value of expected future cash flows	$793,569
Cash	46,000
Total	$839,569.

From these assets of $839,569 in this new balance sheet, however, a “risk factor” of $316,371 has been deducted to arrive at assets of $523,198.

EXHIBIT 10
Bordered Balance Sheet
December 31, Year 1

	Lower Limit	Expected Value	Upper Limit
Prospective future net receipts	391,000	924,000	1,847,000
Unearned interest income	59,963	130,431	231,358
PV of future cash flows	331,037	793,569	1,565,642
Less: Risk factor	316,371	316,371	316,371
Prospects	14,666	477,198	1,249,271
Cash	46,000	46,000	46,000
ASSETS	60,666	523,198	1,295,271
Contributed capital	300,000	300,000	300,000
Retained earnings (deficit)	(239,334)	223,198	995,271
EQUITY	60,666	523,198	1,295,271

Dear reader, you have been patient in following many detailed calculations, and I am going to impose on you further to explain this "risk factor" of $316,371 and the retained earnings of $223,198. It is the last imposition and, after we are through this explanation, everything will be simple and "clear sailing."

To understand the risk factor, we must probe the constraints of the dual problem. In nonlinear programming, and, because of the risk aversion constraint in Exhibit 8 this is nonlinear programming, the dual constraints are arrived at through the Kuhn-Tucker conditions. Kuhn and Tucker (1951) show that these dual constraints may be arrived at in two steps:

- First, by forming an expression, sometimes called a "Lagrangian expression" by adding multiples of the primal constraints to the primal objective function.
- Second, by taking partial derivatives of the Lagrangian expression and requiring that they be non-negative.

To form the Lagrangian expression, multiply each of the primal constraints by a dual variable (designated by π) and add it to the primal objective function:

$$\Phi = C_2 + (1/1.1)C_3 + (1/1.21)C_4 + (1/1.331)150000X_3$$
$$+ \pi_1(206000-C_2-100000X_2-100000X_3)$$
$$+ \pi_2(-C_3+100000X_2+150000X_3)$$
$$+ \pi_3(-C_4+300000X_2+150000X_3)$$
$$+ \pi_4(100-40X_2^2-27.4X_2X_3-121X_3^2)$$

$+ \pi_5(1-X_2)$

$+ \pi_6(1-X_3)$ (1)

We shall look only at the partial derivatives pertaining to the second and third projects. Following Kuhn-Tucker, these partials will be non-negative and, as applied to the second and third projects, the partials will be equal to zero. For the second project, the partial derivative of (1) follows:

$$\partial\Phi/\partial X_2 = -100000\pi_1+100000\pi_2+300000\pi_3-80X_2\pi_4-27.4X_3\pi_4-\pi_5 = 0 \quad (2)$$

The values for the dual variables (the πs) are, respectively, 1, 1/1.1, 1/1.21, 1581.85, 86289 and 0. Inserting these numbers (and the 1 and 0.6 for the X values from the primal) into expression (2), and multiplying by –1, it becomes:

$$100000–100000/1.1–300000/1.21+80(1581.85)+27.4(.6)(1581.85)+86289=0 \quad (3)$$

The fifth dual variable, π_5, with a value of $86,289, pertains to the fifth primal constraint which states that there is only one of this project available. This $86,289 should be interpreted as the net present value and, carrying out some of the arithmetic, and shuffling the terms in (3) gives the following presentation:

$$NPV = 86289 = -100000+100000/1.1+300000/1.21-126548-26006 \quad (4)$$

The $86,289 should be added to the $138,909 of earned income in the expected value (EV) column of Exhibit 5 just before making the new capital budgeting decisions to arrive at the earned income of $225,198 appearing at the bottom of the operating statement in Exhibit 9. This $225,198 less the $2,000 paid as a dividend on January 2, year 1 gives the retained earnings of $223,198 on the bottom of the balance sheet (Exhibit 10).

While the first part of (4) is the standard calculation of NPV, observe that there are two additional terms at the end. If it were not for these two terms, the NPV calculation would suggest that NPV is $238,843 determined as follows:

$$238,843 = -100,000+100,000/1.1+300,000/1.21$$

The two additional terms in (4) tell us that some of the $238,843 relates to the risk aversion of the stockholders. These terms should be interpreted as the sacrifice of expected value that stockholders are willing to accept rather than experience the greater risk that full acceptance of both projects would entail. These two terms ($126,548 and $26,006) added together ($152,554) are part of the “risk factor” in the balance sheet in Exhibit 10.

The remainder of the "risk factor," namely $163,817, relates to the third project and can be identified by taking the partial derivative of (1) with respect to the third project:

$$\partial\Phi/\partial X_3 = 150000/1.331-100000\pi_1+150000\pi_2+150000\pi_3-27.4X_2\pi_4-242X_3\pi_4-\pi_6 = 0 \quad (5)$$

Inserting these numbers (and the 1 and 0.6 for the X values from the primal) into expressions (5), multiplying through by –1, moving one term to the right and carrying out some of the arithmetic, it becomes:

100000-150000/1.1-150000/1.21+27.4(1581.85)+145.2(1581.85)+0 = 150000/1.331 6)

The sixth dual variable with the value zero should be interpreted as the NPV and (6) may be shuffled into the following expression:

NPV = 0 = – 100000+150000/1.1+150000/1.21+150000/1.331-43343-229685 (7)

Since project three is only accepted to the extent of 60 percent or 0.6, all terms in (7) should be multiplied by 0.6 to arrive at the following expression:

NPV = 0 = -60000+90000/1.1+90000/1.21+90000/1.331-26006-137811 (8)

The last two terms in (8), namely $26,006 and $137,811, for a total of $163,817 account for the remainder of the risk factor, the $316,371 reducing the PV of the expected future receipts on the balance sheet.

To arrive at the negative retained earnings in the lower limit column, the deficit, of $239,334, it is only necessary to reduce the retained earnings in the expected value column by the present value of the difference between the expected future cash inflows and the lower limit cash inflows. The calculation follows:

-239,334 = 223,198 – 303,000/1.1 – 190,000/1.21 – 40,000/1.331

In a similar manner, the reader can arrive at all other numbers in Exhibits 9 and 10.[4]

The accounting presented here might be called "industrial accounting" and may be contrasted to contemporary accounting which I will call "mercantile accounting." I will outline the major differences between these two types of accounting and then diagnose some of the "symptoms of sickness" of contemporary or mercantile accounting. Next I will suggest that industrial accounting solves many of the problems of mercantile accounting. Finally I will try to persuade you that mercantile accounting, relying on "authoritative pronouncements," represents a pre-scientific era for

[4] A word of caution. There is nothing about the mathematical programming formulation that suggests the breakdown between the "risk factor" and "retained earnings" in the lower limit and upper limit columns. There are other solutions, in addition to those presented here, that are compatible with the mathematical programming formulation.

accounting and that industrial accounting, relying on experimentation and observation, opens the door to a scientific era.

Mercantile v. industrial accounting

When the Mediterranean was a Venetian lake, when Italian merchants dominated the commerce of the Western World, a type of accounting suited to serve the needs of short-term mercantile operations developed. That mercantile age has been replaced by a World with vast flows of capital relating to multi-year projects but accounting still reflects the hand of a long-dead merchant prince. With man exploring Venus, can we remain in Venice?

Decision periods. In mercantile operations, the basic decision period is short-term and often relates to the year or the quarter. The Venetian merchant princes were concerned with the time it took for a voyage to bring spices from the Orient or to take linens to a market. Even today, selling seasons often coincide with the quarter or the year and it is no surprise that the contemporary income statement uses the quarter and the year as its basic time period.

But major industrial operations more typically involve decisions relating to several years and the important period for the decision maker is usually the period spanned by his/her decisions rather than the rotation of the earth around the sun. An operating statement dictated by the calendar poorly serves to map and monitor those decisions.

Perhaps a regular monitoring period is important to management and investors, and perhaps that period can be the quarter or the year and perhaps it is necessary to have a figure for income for each of those periods. Industrial accounting provides such an annual figure for income; it is the change in the earned income component of the receipts and expenditures operating statement presented here. But the basic income figure cannot be the time it takes for Earth to monitor Sun but must instead be the income relating to the period for which decisions are made, the anticipated income in the operating statements presented here.

Realization criterion. To the merchant, the critical event is the sale and it is no surprise that contemporary accounting, mercantile accounting, uses sale as the principal realization criterion. But for the decision maker of today, however, for whom critical considerations are time preference and risk avoidance, industrial accounting provides a framework within which the timing of receipts and expenditures and the volatility of cash flows can easily be incorporated and become the realization criteria.

Past v. future. Mercantile accounting purports to deal with past fact, with, say, the income of the past year. But, since business decisions all relate to the future, its inability to address and incorporate that future prevents it from being a guide to managerial decisions. While the emphasis on the past might suggest that mercantile accounting could be good in monitoring performance, an effective monitoring requires that the reported results be compared in some manner with the promised results; such a comparison is impossible, however, in contemporary accounting because the promised results are not an integral part of the accounting model.

By contrast, industrial accounting incorporates past, present and future. The receipts and expenditures statement includes both past and future receipts and expenditures. The balance sheet correctly emphasizes the cash forecasted for the future and the cash on hand. To monitor management performance, it is possible to compare the actual receipts and expenditures of the past few years with the predictions of those numbers that appeared in the receipts and expenditures statement a few years back. We can see whether management predictions are borne out by future events.

Uncertainty and risk. By purporting to deal with past and present, the contemporary income statement give the appearance of being removed from risk and uncertainty. But risk and uncertainty, being central to business operations are integral to the reported results and standing of the enterprise no matter how effectively our accounting model may hide them. Let billions of rubles be spent on a natural gas or petroleum pipeline, a fifty year decision, and, in the year following its inauguration, can it make sense to say in the income statement that we know how well the pipeline did in that one year without considering prospective future receipts and expenditures? And can it make sense to say we know the number at which the pipeline will be carried on the balance sheet without making some predictions about future cash flows?5

Industrial accounting, with its explicit introduction of estimated future cash flows, makes clear the dependence of current results and carrying value on future events. And its introduction of lower and upper bounds makes it possible to reflect risk and uncertainty and to judge whether management and the accounting process are "in control."

[5] You can read more about "mercantile accounting" in Coughlan, Guide to Contemporary Theory of Accounts, Prentice-Hall, 1965, Chapter 11.

Symptoms of sickness

Complexity

If Van Gogh had to explain that the eye-searing yellow was a wheat field and the dark splotches were blackbirds, he would discard the canvas and return to the easel.

Annual reports of publicly held corporations typically run over a hundred pages. These contain perhaps six or seven pages of basic financial statements which should summarize useful information about the history, present status and prospects of the organization. Because they fail this task, they are followed by 30 to 50 pages of notes attempting to explain what the numbers mean and, in the US, they are preceded by 30 to 50 pages of SEC-mandated "management's discussion and analysis" (MD&A) intended for a similar purpose. Adding an aura of authenticity to this meaningless miasma, several assurances are appended from management and the independent auditor: management recognizes its responsibility for the financial statements and believes they present fairly results and position; management recognizes its responsibility for establishing and maintaining internal controls over financial reporting and believes its internal controls were effective; the independent auditors believe that the financial statements present fairly position and results; the independent auditors believe that management's assessment that it maintained effective internal control over financial reporting is fairly stated; and the independent auditors believe that management did maintain effective internal control over financial reporting.

This morass of facts and figures that surrounds, inundates and drowns the basic financial statements raises interesting questions about the adequacy of the financial statements. There is considerable empirical evidence (often referred to as the "efficient market hypothesis") that many of the facts in the notes, MD&A, and even in the financial statements are incorporated in and reflected in the prices of securities. But this question remains: If the six pages of financial statements perform their functions, why do we need the other hundred pages? Has the time come to discard the canvas and return to the easel?

Sacred Texts and Scandals

An excessive reliance on authority is a symptom of a pre-scientific discipline. Physicists, chemists, doctors and certainly accountants like you and I should be able to

rely on observation and experimentation. None should be compelled to rely upon authoritative texts and sacred documents.

The Bible, the Koran and the Veda have a place in religion. Biblical research, for example, may certainly be relevant to issues of faith and morals.

But care should be exercised in the application of religious texts to scientific areas where observation and experimentation should reign supreme. Let a committee of cardinals, relying on scripture, condemn the Copernican theories of Galileo, for example, but astronomy, being a scientific discipline will, despite the potent power of the prelates, confirm the theories of Copernicus and Galileo.

In accounting, our sacred texts are referred to as "authoritative pronouncements." These pronouncements attempt to define what are known as "generally accepted accounting principles" or GAAP.

The United States has had many eras involving "accounting scandals" and GAAP and the official pronouncements have played a role in all. Thus, in the early 1930's many companies put out handsome financial statements accompanied by letters from their CPA firms stating that the statements "present fairly financial position and results" only to be followed a few months later by bankruptcy filings. The Committee on Accounting Procedure was formed to define GAAP and it proceeded to issue 51 Accounting Research Bulletins and various other documents that were the "official pronouncements" of the 1940's and 1950's. Late in the 1950's a number of companies put out handsome financial statements accompanied by approving letters from their CPA firms only to be followed shortly thereafter by bankruptcy filings. In response, the accounting profession in 1959 replaced the Committee on Accounting Procedure by the Accounting Principles Board (APB) which proceeded to put out 31 opinions and various other documents that attempted to define GAAP. In 1970 to 1973, many prominent companies put out handsome financial statements accompanied by approving letters from CPA firms only to be followed shortly thereafter by bankruptcy filings. The response of the profession was to replace the APB by the FASB which attempted to define GAAP. Starting in early 2001, a number of companies put out – you fill in the words. The FASB that existed from 1973 to 2002, a FASB that represented a self-regulatory effort of the accounting profession and the business community, has, pursuant to the Sarbanes-Oxley Act and to certain

actions of the Securities Exchange Commission, been replaced by a new FASB, a FASB that is now, in my opinion at least, an agency of the federal government. Its mission is to define GAAP and I believe it will be every bit as successful as its predecessors.

Europe will not be left behind. We have the International Accounting Standards Board and its International Financial Reporting Standards and comparable bodies and statements exist in Canada, Australia, and various other countries. These bodies and their pronouncements are every bit as authoritative and "generally accepted" as their US cousins. And they result in financial statements that cannot stand alone and that require 50 to 100 pages of supplementary information.

The problem with all these efforts to define GAAP is that they do not provide for experimentation and observation. Whether financial statements are correct is not a matter of how authoritative pronouncements say we should measure cost or current value but rather a matter of what management says future cash flows and other events will be and whether those predictions are borne out by the future.

There have been thousands of cases in the U.S., and I have testified in a few, in which the issue has been whether the financial statements were correct and the cases invariably degenerate into the issue of whether the statements conformed to GAAP. In the Enron cases, for example, a key issue is whether there were official documents that required that the Special Purpose Entities (SPEs) should have been included in the consolidated statements. It doesn't really matter whether there was a Statement of Financial Accounting Standards (SFAS) on the subject (there was not) and whether certain memos involving the SEC could be considered a guide to GAAP. What really matters is what the cash flows and other transactions of Enron were going to be in the following few years and that information cannot be inferred from their financial statements. The top executives of Enron and their leading accounting and financial executives, obsessed by problems pertaining to raptors, derivatives, SPEs, and other arcane accounting matters, may not have attempted to define those future cash flows and other events and certainly no such information is evident from their financial statements.

Had Enron's financial statements contained explicit estimates of future cash flows in the manner suggested here, an easy test would have been available. If the cash inflows exceeded the lower limits, there would have been a presumption

(rebuttable, of course, but nevertheless a presumption) that the accounting was adequate and was consistent with managerial performance. Had the cash inflows fallen below the lower limits, a test would have been failed. This failure might suggest one of three things:

- That the accounting was defective and not consistent with management's plans and capabilities, or
- That the accounting may have been consistent with management plans and capabilities when generated at an earlier date but that management abilities had changed for the worse or that execution of plans may have been defective, or
- Something radical has happened to the company or its environment so that the world in which it operates is very different from the world in which it planned and prepared financial statements.

The presumption ought to lie with the first two bullets and the "something radical" excuse should require very good evidence. When a company makes its plans for the forthcoming few years there are thousands of little things that may differ from expectations, some good and some bad, and this multiplicity of little items (many of which will offset each other) is the reason why next year's cash inflow may be thought of as a probability distribution. A one percent decline in gross domestic product or a warm winter should not take away the presumption that there is something wrong with either the accounting or management. However, an outbreak of avian flu might well explain bad numbers for a chicken processing company and terrorist destruction of a theater might explain why receipts of the company owning that theater are below the "control limits."

Unfortunately, we will never be able to apply this cash flow test to the Enron cases. The final annual report for Enron (year ending 12/31/2000) does not set lower limits for the cash flows expected in 2001, it does not predict any cash flows for 2001 or subsequent years, and accordingly when Enron filed for bankruptcy (December 2001) we cannot determine whether the receipts and disbursements of 2001 were consistent with the plans and projections of management as reflected in their financial statements prepared in January and February of that year. We cannot even know what those plans and projections were or even whether there were such plans and projections. We are left with the almost meaningless question of whether there was an

authoritative pronouncement, a "sacred text," that permitted the exclusion of the raptors from the consolidated statements.

Just as it is possible to allege that financial statements are too optimistic (as is alleged but cannot be proven for Enron) it is possible to argue that financial statements are too "pessimistic." Thus in the case of the Federal Home Loan Mortgage Corporation ("Freddie Mac") which, it is alleged, understated its earnings for the purpose of facilitating "earnings management," the regulators and accounting firms are looking into the issue of authoritative pronouncements, when the issue should be whether actual cash flows exceeded some upper bound on what management could reasonably have expected those cash flows to be. Unfortunately whether some reasonable upper bound was exceeded will never be known because information about prospective cash flows is not an issue in the annual reports of Freddie Mac. Or for any other business enterprise.

It should not be necessary to rely on authority where observation is possible. Let a prestigious panel of sartorial experts praise the royal raiments but, if we see flesh where there should be cloth, the Emperor is naked. Whether financial statements are correct should not depend on whether they conform to the pronouncements of a panel, no matter how prestigious, but should instead depend on whether they present prognostications that can be confirmed or refuted by future events. Accounting research should not resemble biblical research with its search for and interpretation of sacred texts but should instead rely on experimentation and observation. Biblical research is like the unrolling of a scroll but accounting research should be like the growing of a tree.

Cost, fair value and future cash flows

Throughout the Twentieth Century we embraced the "cost" basis of accounting. In one well-known justification of cost, Homer Kripke (p. 1187) stated:

"The accountant is not necessarily wrong, however, in adhering to the cost principle, and he need not seek justification on the unconvincing grounds that cost is the best and only non-speculative evidence of value available, or that cost is 'going-concern value.' A better justification is that value is not an accounting concept and the accountant's job is not one of valuation."

Cost purports to relate to the past. It is not the future, at least not directly.

Starting in the mid 1970's, "fair value" began to play a prominent role. For example, SFAS 12 (1975) required that certain marketable securities be written down to the lower of cost or market and later SFAS 115 (1993) required that most investments in debt and equity instruments be carried at "fair value" rather than cost. By now many assets and liabilities must be carried in the balance sheet at fair value or at the lower of cost or fair market value. For many that are still carried at cost, fair value must be revealed in the notes. "Fair value" purports to relate to the present. It is not the future, at least not directly.

But of course both cost and fair value do relate to the future. To carry an asset at cost, for example, clearly implies that future receipts from the use of that asset will be at least as great as the cost at which the asset is carried. If no assumptions, however implicit, are made about future receipts, then plant and equipment, land and various other assets carried at cost would have to be carried at zero. Cost reflects the future seen through a glass darkly.

Fair value likewise relates to the future. Fair value is often defined as the price that would be arrived at between a willing buyer and a willing seller. The willing buyer clearly thinks the future receipts or the present value of those future receipts is at least as great as the price and the willing seller must likewise think that the future receipts or their present value cannot be much more than the price. Fair value is the future seen through a prism.

What I propose is an accounting based on management's plans and projections for the future and formulated in a manner to reflect management's decision process. It embraces the future rather than purporting to be concerned only with the past and the present. Let, for example, management use mathematical programming to make decisions about the future and the accounting should reflect the programming framework. Let time preference and risk aversion be tenets of managerial decision theory and present values and probabilities should be central to the accounting.

The historian emphasizes the past and, to the extent we emphasize cost, we think of ourselves as historians. The journalist emphasizes the present and, to the extent we emphasize fair value, we think of ourselves as journalists. The chemist asks what will happen if we mix one chemical with another and proceeds to find out by mixing the chemicals. The physiologist asks what will happen if we treat a malady with a pill and

proceeds to find out by giving one group the pill and another (the "control") a placebo. They look to the experiment and to the future to confirm or deny. We accountants, too, should work with management to present a picture of what we believe will happen if management plans are carried out and we can depend upon the future to confirm or deny the forecast we present. Experimentation and the future are the realm of the scientist and we accountants should move into that realm.

The future of accounting is not in the past.

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Information About Author

Eemya: John W. Coughlan

Otchestvo: Menya zavoot Dzhon (znacheet Ivan); moy Otets tozhe Ivan. Menya zavoot Ivan Ivanovitch

Scientific degrees: PhD, CPA, CMA

Position: President, CPA School of Washington, Inc.

Country: USA

John Coughlan has been a partner in a national firm of CPAs, has taught at several US universities, and is the author of several books and articles. You can get further information about him by going to http://geocities.com/WallStreet/Floor/9125.