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When a company faces the prospect of a major capital investment, its decision can hinge on whether accrual or cash flow techniques are used to evaluate return on that investment. The author suggests a combination of the two to gain—

A BETTER PERSPECTIVE ON CAPITAL EXPENDITURE DECISIONS

by William L. Ferrara

The Pennsylvania State University

WITHOUT doubt the most crucial decisions facing managements are capital expenditure decisions. In the usual case these decisions involve rather large commitments of funds with the hope of attaining an objective such as increased profitability, a greater share of the market, and even improved relations with employees, stockholders, or the public at large.

Some typical decisions relate to expansion via the addition of new products, plants, sales territories, and even the acquisition of entire companies. The significance of these decisions is immediately obvious, since once the decisions are made the company will be committed to a pattern of activity as

well as a pattern of expenditure for an extended period of time.

Unfortunately, there are too many practitioners as well as academicians who do not really understand the alternative methods available to evaluate the financial aspects of these expenditures. Furthermore, there is insufficient understanding of the fact that some of the usually discarded methods might be especially appropriate from a behavioral point of view. Finally, there is too little understanding of the thought that some of these methods are more appropriately considered complementary rather than mutually exclusive alternatives.

Thus the purpose of this article

is twofold: 1) to review the alternative methods with the thought of placing them in proper perspective from a theoretical and behavioral point of view and 2) to put forth the idea that some of the alternative methods complement each other and, accordingly, should not be thought of as alternatives but as useful parts of the total package of information presented to a decision maker.

All of the usual techniques for evaluating capital expenditure decisions can be evaluated via the following illustrative problem:

Amex Company is considering the introduction of a new product. The new product will

TABLE I

Accrual Accounting

Return on Investment

Calculate the percentage return on average investment¹ during the life of the project. Make the go-no go decision on the basis of whether or not the calculated percentage exceeds the desired minimum.

Residual Income

Include in the incremental income calculation a charge for the use of capital, i.e., for the average investment¹ required based upon the minimum desired return. Make the go-no go decision on the basis of whether or not the incremental income does or does not exceed the capital charge.

Cash Flow Accounting

Return on Investment²

Calculate the percentage return on investment. Make the go-no go decision on the basis of whether or not the calculated percentage exceeds the desired minimum.

Net Present Value

Reduce incremental cash flows to their present value by discounting at the desired minimum rate. Make the go-no go decision on the basis of whether or not the net present value is positive or negative.

¹ Some might prefer to use original investment.

² Also known as the "internal rate of return."

Accrual accounting is based upon the philosophy that income is recognized when it is earned (a right to receive cash exists) and expenses are recognized when they are incurred (an asset is used up or a debt is owed). Under the cash flow technique income is recognized when cash is collected and expenses are recognized when cash is paid. The usual main difference between accrual and cash flow accounting is depreciation.

be manufactured in an existing plant; however, new equipment costing \$150,000 with a useful life of five years (no salvage value) will be necessary. The space in the existing plant to be used for the new product is currently used for warehousing. When the new product takes over the warehousing space, Amex Company will rent warehouse space at an annual cost of \$25,000. The new product will be sold via an already established marketing organization. An accounting study produces the following estimates of incremental revenue and expense on an average annual basis:

Sales	\$500,000
Cost of merchandise sold (excluding depreciation)	
Variable	230,000
Fixed	150,000
Depreciation of new equipment (straight-line)	30,000
Warehouse rental	25,000

Marketing expense—
3% of sales 15,000

The company requires an after tax return on new investment proposals of 10 per cent. The Federal income tax rate is 50 per cent.

Even though all would agree that only incremental items (i.e. those items which will change because of a specific decision) are to be considered in decision making, there is often disagreement on whether the incrementalism should be in accrual terms or cash flow terms. Under each approach there are two basic methods, which can be described as shown in Table 1, above.

Accrual accounting is based upon the philosophy that income is recognized when it is earned (a right to receive cash exists) and expenses are recognized when they are incurred (an asset is used up or a debt is owed). Under the cash flow technique income is recognized when cash is collected and expenses are recognized when cash is paid.

EXHIBIT I

Accrual Accounting Calculations

<p>a) Incremental Annual Income</p> <table border="0" style="width: 100%;"> <tr> <td>Sales</td> <td style="text-align: right;">\$500,000</td> <td></td> </tr> <tr> <td>Cost of merchandise sold</td> <td style="text-align: right;">\$380,000</td> <td></td> </tr> <tr> <td>Depreciation</td> <td style="text-align: right;">30,000</td> <td></td> </tr> <tr> <td>Warehouse rental</td> <td style="text-align: right;">25,000</td> <td></td> </tr> <tr> <td>Marketing expense</td> <td style="text-align: right;">15,000</td> <td style="text-align: right;">450,000</td> </tr> <tr> <td>Net income before tax</td> <td style="text-align: right;">\$ 50,000</td> <td></td> </tr> <tr> <td>Tax @ 50%</td> <td style="text-align: right;">25,000</td> <td></td> </tr> <tr> <td>Net income after tax</td> <td style="text-align: right;"><u>\$ 25,000</u></td> <td></td> </tr> </table>	Sales	\$500,000		Cost of merchandise sold	\$380,000		Depreciation	30,000		Warehouse rental	25,000		Marketing expense	15,000	450,000	Net income before tax	\$ 50,000		Tax @ 50%	25,000		Net income after tax	<u>\$ 25,000</u>		<p>c) Return on Investment</p> <table border="0" style="width: 100%;"> <tr> <td colspan="2">Incremental annual income divided by incremental average investment or</td> </tr> <tr> <td style="text-align: right;">25,000</td> <td style="text-align: right;">= 33 1/3%</td> </tr> <tr> <td style="text-align: right;">75,000</td> <td></td> </tr> </table>	Incremental annual income divided by incremental average investment or		25,000	= 33 1/3%	75,000	
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25,000	= 33 1/3%																														
75,000																															
<p>b) Incremental Average Investment</p> <p>Original investment plus investment (book value) at end of useful life divided by 2 or $(150,000 + 0) \div 2 =$ \$75,000</p>	<p>d) Residual Income</p> <table border="0" style="width: 100%;"> <tr> <td colspan="2">Incremental annual income less a charge for the use of capital or</td> </tr> <tr> <td style="text-align: right;">Net income after tax</td> <td style="text-align: right;">\$25,000</td> </tr> <tr> <td style="text-align: right;">Less: Capital charge</td> <td></td> </tr> <tr> <td style="text-align: right;">10% of 75,000</td> <td style="text-align: right;"><u>7,500</u></td> </tr> <tr> <td>Residual Income</td> <td style="text-align: right;"><u>\$17,500</u></td> </tr> </table>	Incremental annual income less a charge for the use of capital or		Net income after tax	\$25,000	Less: Capital charge		10% of 75,000	<u>7,500</u>	Residual Income	<u>\$17,500</u>																				
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EXHIBIT II

Cash Flow Accounting Calculations

<p>a) Incremental Annual Cash Flow</p> <table border="0" style="width: 100%;"> <tr> <td>Net income after tax</td> <td style="text-align: right;">\$25,000</td> </tr> <tr> <td>Add: Non-cash deduction</td> <td></td> </tr> <tr> <td style="padding-left: 20px;">Depreciation</td> <td style="text-align: right;">30,000</td> </tr> <tr> <td>Annual cash flow</td> <td style="text-align: right;"><u>\$55,000</u></td> </tr> </table>	Net income after tax	\$25,000	Add: Non-cash deduction		Depreciation	30,000	Annual cash flow	<u>\$55,000</u>	<p>c) Return on Investment</p> <p>Rate of discount which reduces the present value of five annual inflows of \$55,000 to \$150,000 or 24% +</p>
Net income after tax	\$25,000								
Add: Non-cash deduction									
Depreciation	30,000								
Annual cash flow	<u>\$55,000</u>								
<p>b) Incremental Cash Investment</p> <p>\$150,000 investment (outlay) for new equipment</p>	<p>d) Net Present Value</p> <p>Five annual inflows of \$55,000 discounted at 10% and compared to a \$150,000 investment outlay of \$58,450</p>								

The usual main difference between accrual and cash flow accounting is depreciation. Depreciation is an expense under accrual accounting via the philosophy that the cost of an asset should be allocated to its useful life, as the asset is used, even though all of the cash paid for the asset may be paid out at the beginning of the asset's useful life. Depreciation is not considered an expense under cash flow accounting, since depreciation as such involves no cash outlay. However, the impact of depreciation deductions on outlays for taxes is recognized in the cash flow method.

In succeeding pages the two accrual techniques and the two cash flow techniques will be illustrated.

In order to fully assess the profitability of the new product, the \$25,000 incremental income should be related to the incremental average investment of \$75,000 as shown

in Exhibit I, above. Under the return on investment concept these two items are related as a percentage; i.e., the \$25,000 incremental annual income is 33 1/3 per cent of the incremental average investment of \$75,000. Under residual income the same two items are related by charging the required return (10 per cent) on the average investment (\$75,000) to the income statement in the form of interest³ (\$7,500).

Accrual return on investment and residual income represent two distinct ways to present the same data in order to evaluate an investment decision. In both instances the required return is 10 per cent after taxes. Under return on investment the estimated return is determined

³ In the early part of this century such an interest charge represented quite a controversial item under the title of "imputed interest."

(33 1/3 per cent) and compared to the required return in order to make a decision, while under the residual income concept the residual income is determined by charging the required return to the income statement in the form of interest in order to make a decision.

A return on investment (33 1/3 per cent) in excess of the required return (10 per cent) and a positive residual income, in essence, represent the same thing even though they are expressed in different ways, that is, one is expressed in percentage terms while the other is expressed in terms of dollars. Alternatively one might say that the favorable nature of the proposed investment can be expressed in terms of the 23 1/3 per cent return in excess of the required 10 per cent return or the \$17,500 residual income. A quick calculation will indicate that 23 1/3 per cent of the average investment (\$75,000) equals the \$17,500 residual income.

Exhibit II, at left, indicates the methodology of determining cash flow evaluations for capital expenditure decisions.

What was said above concerning the two accrual methods can also be said for the two cash flow methods; i.e., cash flow return on investment and net present value represent two distinct ways to present the same data. Return on investment concentrates on the return in excess of the required return as a percentage while net present value deals with the same differential expressed in dollars.

An interesting comparison at this point would be the relationship between the two accrual methods and the two cash flow methods of evaluating investment proposals. The net present value method and the residual income method are in essence the same method except for the difference between cash flow and accrual methodology. Both dollarize the amount of return in excess of the required 10 per cent return.

The return on investment method as applied to either cash flows or accruals is also essentially the

same. Greater appreciation of this similarity can be attained by remembering that the cash flow return on investment is determined by finding the rate of discount which makes the net present value of a proposal equal to zero. The accrual rate of return can also be thought of in the same terms, since the accrual rate of return is that rate of interest applied to investment which will make residual income equal to zero.

As will be made clear, the payback technique has a number of variants. In its simplest sense it is a measure of how quickly (in terms of years) an investment outlay will be recouped via the net cash inflows⁴ from the investment. The necessary calculations are as follows:

$$\begin{aligned} \text{Simple Payback Period} &= \\ &= \frac{\text{Incremental Cash Investment}}{\text{Annual Net Cash Inflow}} \\ &= \frac{150,000}{55,000} \\ &= 2.73 \text{ years} \end{aligned}$$

A payback of 2.73 years indicates that the company will recover its \$150,000 initial outlay in a little more than two and one-half years.

The main difficulty with the above payback calculation is that it makes no allowance for earnings requirements, i.e., the required 10 per cent return on investment. This difficulty is what prompts most people to reject the "simple payback calculation" as a criterion for judging the worth of an investment proposal.

In recent years a very interesting variation of payback has been proposed.⁵ The variation introduces the required rate of return into the payback calculation in order to derive the payback period in dis-

⁴ One could compute payback in accrual terms. This, however, doesn't appear too fruitful since the notion of payback is implicitly, if not explicitly, cash flow oriented.

⁵ Rapaport, Alfred, "The Discounted Payback Period," *Management Services*, July-August, 1965, pp. 30-36.

EXHIBIT III

Years	Present Value Factors @ 10%	Cash Flows	Discounted Flows	Cumulative Net Present Value
0	1.000	(\$150,000)	(\$150,000)	(\$150,000)
1	.909	55,000	49,995	(100,005)
2	.826	55,000	45,430	(54,575)
3	.751	55,000	41,305	(13,270)
4	.683	55,000	37,565	24,295
5	.621	55,000	34,155	58,450

EXHIBIT IV

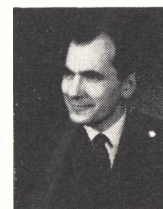
Years	Cumulative Net Present Value	Per Cent Recovered
0	(\$150,000)	—0—
1	(100,005)	33.3
2	(54,575)	63.6
3	(13,270)	91.2
4	24,295	116.2
5	58,450	139.0

counted terms. The concept is very simple and the calculations involved represent a slightly different arrangement of the same calculations made when determining net present value. Calculations are as shown in Exhibit III, above. The ultimate net present value at the end of Year 5, \$58,450, is the same as calculated earlier, but the cumulative year by year net present value indicates at what point in time the \$150,000 Year 0 outlay is recovered in terms of inflows discounted at the required earnings rate of 10 per cent. Examination of the "Cumulative Net Present Value" column indicates that the discounted payback period is between three and four years. At the end of the third year the cumulative net present value is negative, but the discounted inflows for the fourth year convert the negative net present value to a positive amount by the end of the fourth year. Thus, for the present project one can state that the discounted payback period is three plus years or approximately 3½ years if one assumes that the discounted inflows of Year 4 are received evenly throughout Year 4.

A comparison of the simple payback with the discounted payback has to be in favor of the discounted payback since the discounted payback recognizes the required

earnings rate in determining how long it takes to recoup an investment outlay. The discounted payback is actually the "breakeven" useful life of the project, which can be a very useful bit of information to those charged with approving investment proposals. The simple payback presumes to be a breakeven useful life, but it is not since it ignores the required earnings rate. From a realistic point of view one must reject the simple payback (2.73 years) since at a useful life of 2.73 years the project under consideration is a loss project. Only when the project reaches its discounted payback life can it be considered a candidate for profitable investment of funds.

A useful addition to the concept of discounted payback is the dis-



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the Graduate School of Sales Management and Marketing sponsored annually by Sales and Marketing Executives-International at Syracuse University. His research has been published in many professional journals and he is co-author of *Management Accounting for Profit Control*, published by McGraw-Hill.

counted payback profile. This profile results from a calculation of the percentage of an investment outlay recovered cumulatively during its useful life. The percentages are shown in Exhibit IV, page 51, for the project under consideration.

These percentages can be used as they are or they can even be plotted in graph form. The total percentage recovered is usually referred to as the "profitability index," which has been considered by some to be a useful criterion for ranking alternative investment proposals.⁶

The utility of the discounted payback profile is quite obvious, whether it be prepared in tabular or graph form. An evaluation of alternative investment proposals with approximately the same net present value or cash flow return on investment could be greatly facilitated by knowledge of both the discounted payback (break-even) period and the discounted payback profile.

Human nature is such that it always seeks to simplify or make routine the decision making process. In the context of capital expenditure decisions there seems to be an urge to come up with the "one best" method of financial evaluation which embodies a single criterion. The philosophy to be expressed here is that there is no single criterion, such as net present value or accrual return on investment, even though there might be a best basic method, i.e., cash flow or accrual.

The choice between cash flow and accrual methods is not as clear as it first appears, since the choice depends upon whether we consider financial evaluations as "applied economics" or "applied social psychology."⁷ As used here "applied

economics" refers to evaluations which ignore the fact that men will make decisions in accordance with their own selfish interests. Alternatively, "applied social psychology" refers in the present context to the plight of the executive who is convinced that cash flow methods are most appropriate for his evaluation of capital expenditure decisions while he is simultaneously aware of the fact that his performance will be evaluated via earnings per share or operating income calculated in non-cash-flow terms, i.e., via accrual accounting. The consideration of financial evaluations from the viewpoint of "applied social psychology" is more commonly referred to as the "behavioral point of view."

Economics vs. psychology

In succeeding pages the "cash flow vs. accrual" issue will be considered from both the applied economics and behavioral points of view. Then by way of conclusion some more useful perspectives can be developed.

The choice between accrual and cash flow methods is not a difficult choice in a conceptual sense from the applied economics point of view. Accrual methodology is not preferred because it does not consider the time value of money.

Accrual methodology does not consider the time value of money, essentially because it ignores the fact that depreciation does not involve an outlay of cash. The outlay of cash for depreciable assets usually occurs at the point of purchase. Another facet of how the accrual method does not consider the time value of money relates to the fact that the accrual method does not recognize that monies received in different years cannot be considered equivalents.

The reason for concentrating on the time value of money relates to the concept of opportunity costs. Money does have value in that it can be invested, even for very short periods of time. The return that monies invested can earn

is the opportunity cost of money. In the present context we assumed that the opportunity cost of money was 10 per cent after taxes, i.e., the firm could invest all available resources and earn at least 10 per cent.⁸ Therefore, any project that does not yield 10 per cent is considered financially undesirable.

An advocate of the accrual method could respond to the above allegations by stating that the accrual method does consider the opportunity cost of money via return on investment and residual income. The whole idea of the accrual return on investment calculation is to compare earnings on a project with earnings which can be obtained elsewhere (10 per cent). The whole idea of residual income is to include as an opportunity cost in the income statement the return on investment which can be earned elsewhere. Thus the advocate of accrual methods could argue that accrual methods do provide for the opportunity cost of money.

The response to the above imaginary advocate of accrual methods is not difficult. It is as follows:

Even though the accrual method provides for consideration of the opportunity cost of money, it does so in too limited a sense. *Proper consideration of the opportunity cost of money requires that the incremental costs, revenues, and investment be stated in terms of cash, the resource to be invested.* Expression of incremental costs, revenues, and investment in terms of cash is the essence of the cash flow method.

After one decides that the cash flow method is the best basic method (from the applied economics point of view) for financial evaluation of capital expenditure pro-

⁶ Anthony, Robert N., *Management Accounting: Text and Cases*, 3rd Ed., R. D. Irwin, Inc., Homewood, Illinois, 1964, pp. 636-638.

⁷ The author first encountered these useful terms in the interesting article by Robert N. Anthony, "Framework for Management Planning and Control," *Management Services*, February-March, 1964, pp. 18-24.

⁸ The basic considerations involved in determining the opportunity cost of money, i.e., the minimum desired return (often referred to as the "cost of capital"), can be found in most texts on management accounting or financial management.

posals, one must consider how to work with the variety of techniques available under the cash flow method. Unfortunately most discussants of cash flow technology attempt to justify one cash flow technique as better than others. The position to be taken here is that each of the three cash flow techniques illustrated earlier should be a part of every capital expenditure evaluation; i.e., net present value, cash flow return on investment, and discounted payback (including discounted payback profile) should be considered for every project.

Each of the three cash flow techniques emphasizes a different dimension of the financial evaluation. Net present value emphasizes the scale of the project in Year 0 dollars; cash flow return on investment emphasizes the percentage return; while discounted payback emphasizes the project's breakeven point in years.

Arguing that one of the techniques is superior to the others is in essence saying that it is best to concentrate on scale or percentage return or breakeven (recouping investment). Such an argument is spurious since it ignores the fact that each dimension provides a useful view of the project that the other dimensions do not. The extra cost involved in deriving three cash flow measures, rather than one, will not be significant, since in essence the three measures represent three different arrangements of the same data.

From a behavioral point of view the choice between accrual and cash flow methods leans rather heavily in favor of accrual methodology as long as the profitability of the total firm or its parts (profit centers) is measured in accrual terms. The basis for this conclusion is that organization decision makers will inevitably tend to make decisions in accordance with the methodology used to evaluate their performance. If decision makers are evaluated in accrual terms (they are in the overwhelming majority of cases in business

today) one can only expect them to keep a close watch on forecasted accrual performance for decision making while they go through the mechanics of a mandated cash flow evaluation.

The incongruous nature of a situation wherein decision making and performance evaluation are on different wavelengths can be illustrated by the following non-hypothetical situations:

In a replacement decision will gains or losses on disposition of equipment be ignored, except for tax consequences, since they have no impact on cash flows or will they inevitably be considered since they will have an impact on the income statement? Remember that an income statement is a significant part of the evaluation of management.

There is at least one major company which has a policy of evaluating major capital expenditure proposals via cash flow techniques, but the final decision is made only after the impact of the expenditure program on projected earnings per share is also evaluated.

The behavioral considerations discussed here have led some to recommend that performance evaluations be made in cash flow terms in order to bring decision making and performance evaluation methods into conformity. For example, both Anthony and Solomons move in this direction with regard to accounting for property, plant, and equipment.⁹

Dearden, on the other hand, recommends some adjustments to or specific variations of accrual methods to make them conform better

Unfortunately, most discussants of cash flow technology attempt to justify one cash flow technique as better than others. The position to be taken here is that each of the three cash flow techniques should be a part of every capital expenditure evaluation; i.e., net present value, cash flow return on investment, and discounted payback should be considered.

⁹ Anthony, Robert N., "Accounting for Capital Costs," included in *Management Control Systems* by Robert N. Anthony, John Dearden, and Richard F. Vancil, R. D. Irwin, Inc., Homewood, Illinois, 1965, pp. 343-348; David Solomons, *Divisional Performance: Measurement and Control*, Financial Executives Research Foundation, New York, 1965, pp. 134-143.

. . . it is easy to conclude that cash flow methods are superior to accrual methods in the case of capital expenditure decisions . . . but, when the relationship between decision making and performance evaluation is considered, one can legitimately move in the direction of considering a conclusion that accrual methods are superior to cash flow methods. . . .

to cash flow concepts in the case of divisional profit reporting.¹⁰ For example, he recommends adoption of the composite depreciation method in order to eliminate the possibility of gains or losses on the disposition of assets.

Lerner and Rappaport suggest that the answer might lie in constraining cash flow decision methodology through the imposition of an accrual earnings requirement.¹¹ Thus, one might accept a less than optimal group of investment proposals measured in cash flow terms in order to enhance the opportunity to attain a designated accrual earnings growth rate. On his own, Rappaport suggests that the basic problem may reside "in the accrual accounting measurement model which must somehow be reconciled with the economic present-value model."¹²

Another possible approach is to determine if there really would be a difference in the go-no go nature of capital expenditure decisions and/or the ranking of alternative capital expenditure proposals depending upon whether cash flow or accrual techniques are used. If in most instances there would be no difference in the decision or the ranking, one could then argue that capital expenditure decisions be based upon accrual methods in order to have conformity between decision making and performance measurement techniques. The alternative of using cash flow methods for performance evaluation while retaining the theoretically sound cash flow approach to decision making does not appear to be a real alternative, at least for many years, due to our fondness for accrual concepts in performance reporting.

¹⁰ Dearden, John, "Problem in Decentralized Profit Responsibility," *Harvard Business Review*, May-June, 1960, pp. 79-87.

¹¹ Lerner, Eugene M., and Alfred Rappaport, "Limit DCF in Capital Budgeting," *Harvard Business Review*, September-October, 1968, pp. 133-139.

¹² Rappaport, Alfred, (ed.), *Information for Decision Making*, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1970, p. 311.

The preliminary results of a simulation study tend to support the idea that there wouldn't be much difference in the decision or the rankings via accrual or cash flow techniques.¹³ Thus the apparently odd conclusion of basing capital expenditure decisions upon accrual methods may actually be the most rational conclusion from a behavioral point of view. This is especially true if accounting information is to be truly utilitarian.

Disregarding the inevitable relationship between decision making and performance evaluation, it is easy to conclude that cash flow methods are superior to accrual methods in the case of capital expenditure decisions. Furthermore it is not too difficult to conclude that such specific cash flow techniques as return on investment, net present value, and discounted payback should be considered complementary since they each emphasize different and important dimensions of proposed capital expenditures.

When the relationship between decision making and performance evaluation is considered, one can legitimately move in the direction of considering a conclusion that accrual methods are superior to cash flow methods. The basis for this statement is that performance evaluation is usually based upon accrual techniques and that there may be no difference in the go-no go nature and/or the rankings of competing proposals whether they are evaluated via accrual or cash flow methods. If further research indicates a lack of significant difference between cash flow and accrual evaluations, then such specific accrual techniques as return on investment, residual income, and perhaps an accrual version of payback should be considered useful parts of the total package of information to be presented to a decision maker.

¹³ MBA Research Project in process by Scott Edwards, The Pennsylvania State University, College of Business Administration. The preliminary results of this study must be considered no more than tentative and suggestive.