

# Developments In Business Simulation & Experiential Exercises, Volume 22, 1995

## THE IMPACT OF SALES AND INCOME GROWTH ON PROFITABILITY AND MARKET VALUE MEASURES IN ACTUAL AND SIMULATED INDUSTRIES

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### ABSTRACT

Research and development expenditures, advertising outlays, and asset growth, as a proxy for plant and equipment expenditures, can logically be expected to influence sales and income growth in similar ways in different environments. If sales and income growth affect profitability and market value measures in simulated and actual environments, the leverage variables may have an indirect as well as a direct impact on profitability and market value. Income growth has the most significant impact on profitability and market value in the business game while asset growth is the most significant variable affecting financial performance in the executive game. Sales growth is the most significant growth variable affecting financial performance in the actual industries examined. The indirect effects vary widely from industry to industry, but research intensity appears to negatively impact sales growth in the durable products industry and has a positive impact on sales growth in the nondurable products industry.

### INTRODUCTION

Sales and income growth can be expected to influence rate of return and market value measures in both simulated and actual industries. It is unclear if growth in one year will affect profitability and market value measures in a succeeding year in simulated and actual environments. Asset growth, which can be used as a proxy for plant and equipment expenditures, and research intensity, may also affect sales and income growth in a base year or succeeding year, indirectly affecting profitability and market value. These direct and indirect effects may be different in simulated and actual industries, but if students are to learn from simulations there should be a reasonable correspondence between variable effects in simulated environments and real world industries.

Recently, value based planning and performance measurement has been receiving more attention in business literature and in actual practice, since it provides a framework for using firm value as a strategic performance measures and focuses on profitability and growth as

determinants of firm value (Varaiya, Kerwin, and Weeks, 1987). Many analysts and company executives believe that shareholder value (e.g., stock appreciation + dividends) is a better measure of long term corporate performance than accounting based figures such as ROI, ROE, and EPS which are subject to variation in accounting treatments and which do not take into account the company cost of capital, including debt interest cost and equity cost. Although income measures are widely used as performance measures in simulated environments, many simulations do not provide for computation of stock prices and in those that do, market values are often not emphasized. Since return on equity has been shown to be highly correlated with market value/equity and other market value measures, it can be used as a proxy for market value indicators.

### INCOME MEASURES REFLECT SHORT TERM ORIENTATION

Income or financial profitability measures have been frequently used as indicators of company performance in many studies of strategic evaluation. Rowe and Mason (1987) point out that the use of numerical descriptors in the form of financial ratios is very useful in showing the extent to which company revenue and profit objectives are achieved. A Conference Board Survey of financial indicators in 57 companies (Walsh, 1987) indicated that return on assets, return on sales, and return on equity were the most important performance measures employed. These measures were among those used by Peters and Waterman (1982) to discriminate among excellent and non-excellent companies. Krueger (1992) has emphasized the use of return on assets as an important performance measure in management analysis.

Return on equity, which is equal to (profit margin) x (asset turnover) x (financial leverage), is among the most widely used income measures because it shows the return to the firm's stockholders for an examination period. Profit margin is a useful measure of the firm's competitive position while asset turnover is a measure of operating efficiency and capital intensity.

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Asset leverage is a measure of financial strategy that shows the portion of total assets financed by stockholders' equity. Increasing financial leverage may improve the return to stockholders, but also will likely increase fixed costs and volatility of earnings.

### MARKET VALUE-BASED MEASURES PROVIDE STRATEGIC ORIENTATION

Shareholder value is created when financial benefits of strategic activities exceed the cost of such activities. Shareholder value, theoretically, is the economic value of investments discounted by an interest rate equal to the cost of capital and is often measured by increases in share prices plus dividends for an appropriate measurement period. Shareholder value has been widely used to evaluate capital investments and acquisitions, but its use in assessing strategies and operational activities is not as common.

Market Value/Stockholder's Equity (i.e., Market/Book) is a market oriented ratio that may serve as a better measure of strategic performance than return on assets or return on equity. Market value is determined by the market's assessment of future earnings streams that company assets can generate while book value equals the amount paid for assets when acquired. Although book values can be distorted due to arbitrary allocations and inadequate adjustments for the value of the dollar, company comparisons of market ratios are often valid since all companies in an industry can be assumed to be affected in the same way.

Hax and Majluf (1984) state that market/book value is the best available measure of stockholder value creation. Rappaport (1981) points out that market/book is not tied to past events but can be perceived as reflecting investor perceptions of expected returns in excess of investment. Bogue and Buffa (1984) assert that market to book values are indicators of success in improving firm value. In essence, this ratio is equal to expected future payments/past resources committed and can serve as a good proxy for the net present values of future cash flows generated by inflation and risk as seen from the investor viewpoint.

### KEY VARIABLES INFLUENCE MARKET VALUE

If value creation is to be the focus of strategic activities, company goals and subgoals must emphasize drivers such as maximizing cash flows and increasing operating profit margins. Although increasing sales and income growth may be worthwhile objectives, such actions may not always

increase shareholder value. For example, expanding operations in a given market may increase sales growth, but a key question is whether the expansion will result in a profit margin that exceeds capital cost.

Rappaport (1981) says in creating shareholder value, cash flow drivers are the sales growth rate, operating profit margin, fixed working capital investment, and cost of capital. Bogue and Buffa (1984) state that there are four factors that contribute to increasing economic value: scale (size), returns in excess of cost of capital, growth inherent in selected opportunities, and duration over which growth can be maintained. Varaiya, Kerwin, and Weeks (1987), found in an analysis of 400 companies from the Standard and Poor's 500 companies that the spread, between return on equity and cost of capital, and earnings growth were associated with higher firm value and that the spread was more important than the earnings rate. The effect of sales and asset growth on firm value has been analyzed by Fruhan (1984) and Higgins and Kerwin (1983).

In a PIMS based study, major factors found to influence company stock price were profitability (return on equity), growth prospects, and risk (Branch, Gale, 1983). Investment growth and R&D intensity reflect growth expectations and ultimately market value. Companies with above average profit levels and high growth rates produced market/book ratios about three times higher than that of low profit, slow growth companies. The positive effect of sales and income growth and R&D intensity is highest when return on equity is high.

An examination of stock market data for 600 companies indicated that return on equity, investment (asset) growth, R&D intensity (R&D outlays/sales revenues), and interest coverage (as evidenced by high levels of profitability) were significantly related to market value/equity (Branch and Gale, 1984). In a related study, Buzzell and Gale (1987) pointed out that research intensity coupled with high return on equity had a significant impact on stock values for companies in the PIMS database.

In a study of 52 Canadian companies, researchers found that the stock market places a positive value on R&D outlays as indicators of expected profitability and growth (Johnson, Pazderka, 1993). Using 95 announcements of increased R&D outlays, researchers found that the stock market responded positively

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even if earnings declined (Chan, Martin, and Kensinger, 1990). High technology firms that announced increases in R&D had positive abnormal shareholder returns, while low technology firms had negative returns. The relationship of firm R&D intensity to industry average R&D intensity was more important than the size of the increase, industry concentration, or firm's dominance in its industry.

As Chauvin and Hirschey (1993) point out, size advantages appear to make advertising and R&D more profitable for large firms, and such firms seem to make greater gains in market value but it is rare to find firms that have both substantial R&D and advertising programs. It seems likely that advertising and R&D are seen as alternative forms of product differentiation in real world industries, although this perception is not common in simulated environments. R&D activities not only create entry barriers but also permit introduction of new product lines, providing indications of expected growth prospects and improved cash flows (Jose, Nichols, and Stevens, 1986). Advertising and promotion expenditures make product differentiation possible, allow economies of scale in production as promotion expenditures increase sales, and cause firms to gravitate to similar intensity levels, thereby reducing industry profit. Firm promotional and R&D intensity levels, which were significantly above or below industry benchmark figures, reduced firm stock values based on a study of 155 firms covering the period 1963 to 1977.

### METHODOLOGY

To examine the effects of growth and R&D variables on profitability and market value, data was collected for two years for 29 companies playing the executive game and 28 companies playing a modified version of the Edge, Keys, and Remus business game. The Edge, Keys, and Remus game is a moderately complex game involving two products which allows students to make decisions involving advertising and research and development levels, pricing, number of salespersons, sales commission rates, production quantities and plant expansion. The Executive Game is a one-product game in which sales and income results are affected by the marketing/price/R&D mix as well as by maintenance, production levels, raw materials purchases and plant expansion decision.

In order to compare the game outcomes with real-world industries, data was collected for years 1992 and 1993 on growth, R&D, income, and market value variables for 48

durable products companies (i.e., computer/electronics companies) and 48 nondurable products companies (i.e., drugs/chemical companies). Sales, income, and asset growth for years one and two, R&D/sales revenues, and return on sales were correlated with return on equity and with market value of equity (in industries where available) for years one and two using a SAS program to provide industry comparisons.

### RESULTS

Table One gives correlations for variables in the Business Game and Table Two gives correlations for variables in the Executive games. As Table One shows, in the Business Game environment, sales growth has the strongest effect on return on equity of any of the growth measures in years one and two. Asset growth and R&D/sales revenue had a strong positive impact on sales growth while advertising/sales has a negative impact on sales growth in years one and two. Sales growth is related to income growth in both years but income growth is related to return on equity only in year one.

In Table Two for the Executive Game companies, sales growth is positively correlated with income growth only in year one and with asset growth only in year two. Asset growth is related to income growth only in year one. Both sales and asset growth are positively related to return on equity in years one and two, with sales growth having the strongest impact in year one and asset growth having the most significant impact on return on equity in year two.

R&D/Sales revenues are positively related to sales and income growth as well as asset growth in years one and two for the Business Game companies. In the Executive Game, R&D/sale's revenue is negatively correlated with sales growth in year one. In the Business Game environment, advertising/sales revenue is negatively correlated with sales and income growth as well as with asset growth in year one. It is also negatively correlated with sales growth in year two. For the Executive Game companies, advertising/sales revenue is not related to any growth measure in years one or two.

Increasing R&D/sales revenue, generally has a positive impact on the growth variables in the Business Game while increasing advertising/sales has a negative impact. In the Executive Game, increasing advertising levels does not significantly affect sales or asset growth in either year.

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In the Business Game, sales and income growth are positively related to market value/equity in years one and two. Asset growth is not related to market value, R&D intensity has a positive relationship to sales growth in both years, and this appears to exert an indirect influence on market value/equity. The Executive Game does not have a stock price, but the strong influence of asset growth on return on equity suggests it could significantly influence market value.

Tables Three and Four give correlations for variables from actual companies. As Tables Three and Four indicate, in both the nondurable and durable products industries, asset growth is positively related to sales growth in years one and two. However, sales growth is not related to income growth in years one or two for the nondurable products group and only to income growth in year two for the durable products group. Sales, income, and asset growth are positively related to return on equity in year one for the nondurable products group but asset growth is more strongly related to sales growth in year one than year two. The growth variables are not related to return on equity in year one in the case of the durable products group. In year two, sales and asset growth are positively related to return on equity only in the durable products industry.

R&D/sales revenue is positively related to sales growth in year one for the nondurable products industry and negatively related to sales growth in year two for the durable products industries. However, research intensity is not related to income growth in either year for either industry. Percentage increase in R&D is positively related to sales and asset growth in years one and two for the nondurable products group. For the durable products companies, the percentage increase in R&D is positively related to sales and asset growth in year one and sales growth in year two.

In the nondurable products industries, sales growth has the most significant impact on return on equity and this impact seems to be reinforced with the positive impact of research intensity and asset growth on sales growth. In the durable products industries, asset growth has a positive impact on sales growth in both years with the effect most pronounced in year two. However, the effect of asset growth on sales growth is partially offset by the negative impact of R&D outlays. This can be explained in part by company efforts to maintain existing levels of R&D activity during periods of reduced profitability.

In the nondurable industries, sales and asset growth in year one and asset growth in year two are positively related to market value/equity. R&D/sales revenue has a positive influence on sales growth, and percentage increase in R&D has a strong impact on asset growth in year two, suggesting an indirect impact on market value. None of the growth measures are related to return on equity or market value/equity in the durable products industry for year one, although income growth has the strongest relationship with these performance measures. In year two, sales growth is positively related to market value/equity and the strong correlation of asset growth with sales growth implies an indirect effect on market value/equity.

### CONCLUSIONS

Sales and income growth in the Business Game appear to have a significant impact on market value with plant and equipment expansion (i.e., asset growth) and research intensity exerting a positive indirect effect. Sales and asset growth in the Executive Game, along with income growth in year one, would seem to be driving forces in efforts to increase market value. Advertising intensity, with a positive effect on income growth in year one, appears to have more impact on return on equity as a proxy for market value than does research intensity.

In the nondurable products industry, sales and asset growth positively affect market value in year one with asset growth more significant in year two. R&D/sales have an indirect impact on market value in year one due to its relationship with sales growth. Percentage increase in R&D is also indirectly related to market value, since it is highly correlated with sales and asset growth in years one and two.

In the nondurable products industry, none of the growth measures are related to either return on equity or market value/equity in year one. However, sales growth is positively related to market value/equity in year two and asset growth is indirectly related to market value due to its strong relationship with sales growth. Research intensity has a negative impact on sales growth, which could offset to some extent the impact of asset growth.

In the Business Game environments examined, income growth is more highly correlated with market value than the other growth measures while asset growth has the most significant effect on the return on equity used as a market value proxy in the Executive Game

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environment. In the actual durable and nondurable industry environments, sales growth seems to be the growth variable exerting the most influence on market value, enhanced by the indirect effect of asset growth. Research intensity has a positive effect on growth in year one for the nondurable products companies and a negative effect on growth in year two for the durable products companies.

Future research will be needed to clarify certain unexplained aspects of the study. Examination of the variable relationships over a three to five year period would shed light on lead-lag effects. Incorporating cost of capital into market value calculations would make these measures more pertinent. The effects of company size and deviations from industry averages for research and advertising intensity upon profitability and market value should also be considered. An examination of the impact of the size and timing of plant and equipment expenditures on market values in actual and simulated environments should also prove interesting.

### APPENDIX I

**TABLE ONE  
THE CORRELATION OF LEVERAGE, R&D AND  
GROWTH VARIABLES FOR  
THE BUSINESS GAME COMPANIES**

	YEAR 1		
	Sales Growth	Income Growth	Asset Growth
Sales Growth	-	0.490*	0.790*
Inc. Growth	0.490*	-	0.510*
R&D\$/Sale	0.390*	0.420*	0.400*
ADV\$/Sales	-.630*	-.240	-.450*
Net Inc/Equity	0.770*	0.620*	0.500*
Mkt Val/Eqy	0.840*	0.800*	0.340
	YEAR 2		
Sales Growth	-	0.420*	0.620*
Inc. Growth	0.420*	-	0.180
R&D\$/Sales	0.720*	0.370*	0.430*
Adv\$/Sales	-.490*	-.240	-.220
Net Inc/Equity	0.520*	0.140	0.300
Mkt. Val/Eqy	0.650*	0.870*	0.260

\*Significant @ P = 0.05

APPENDIX II

TABLE TWO  
THE CORRELATION OF LEVERAGE, R&D AND  
GROWTH VARIABLES FOR  
THE EXECUTIVE GAME COMPANIES

	YEAR 1		
	Sales Growth	Income Growth	Asset Growth
Sales Growth	-	0.560*	0.350
Inc. Growth	0.560*	-	0.460*
R&D\$/Sale	-.410*	-.340	-.014
ADV\$/Sales	-.280	0.400*	-.016
Net Inc/Equity	0.640*	0.660*	0.710*
	YEAR 2		
Sales Growth	-	-0.020	0.470*
Inc. Growth	-0.020	-	0.120
R&D\$/Sales	-.070	-.100	-.210
Adv\$/Sales	0.330	-.140	-.320
Net Inc/Equity	0.440*	0.120	0.840*

\*Significant @ P=0.05

APPENDIX III

TABLE THREE  
THE CORRELATION OF LEVERAGE, R&D AND  
GROWTH VARIABLES FOR  
THE ACTUAL COMPANIES IN  
THE NONDURABLE PRODUCTS INDUSTRIES

	YEAR 1		
	Sales Growth	Income Growth	Asset Growth
Sales Growth	-	0.182	0.725*
Inc. Growth	0.182	-	0.070
R&D\$/Sale	0.340*	0.106	0.211
% Inc in R&D\$	0.807*	-.050	0.587*
Net Inc/Equity	0.461*	0.173	0.352*
Mkt Val/Eqy	0.572*	0.020	0.363*
	YEAR 2		
Sales Growth	-	-.028	0.393*
Inc. Growth	-.028	-	-.132
R&D\$/Sales	0.152	-.113	0.123
% Inc in R&D\$	0.379*	0.149	0.530*
Net Inc/Equity	0.139	0.052*	0.060
Mkt. Val/Eqy	0.251	0.179	0.296*

\*Significant @ P=0.05

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### APPENDIX IV

**TABLE FOUR**  
**THE CORRELATION OF LEVERAGE, R&D AND**  
**GROWTH VARIABLES FOR**  
**THE ACTUAL COMPANIES IN**  
**THE DURABLE PRODUCTS INDUSTRIES**

	YEAR 1		
	Sales Growth	Income Growth	Asset Growth
Sales Growth	-	-.011	0.441*
Inc. Growth	-.011	-	0.006
R&D\$/Sale	-.197	0.207	-.259
% Inc in R&D\$	0.381*	-.119	0.369*
Net Inc/Equity	0.018	-.152	0.214
Mkt Val/Eqy	0.196	0.275	0.184
	YEAR 2		
Sales Growth	-	0.516*	0.702*
Inc. Growth	0.516*	-	0.533*
R&D\$/Sales	-.301*	0.046	0.026
% Inc in R&D\$	0.326*	0.178	0.240
Net Inc/Equity	0.404*	-.172	0.350*
Mkt. Val/Eqy	0.288*	0.137	0.181

\*Significant @ P=0.05

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