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## THE LAGGED EFFECTS OF DECISION VARIABLES ON FINANCIAL PERFORMANCE MEASURES USED IN TWO BUSINESS SIMULATION

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### ABSTRACT

An interesting research question is whether advertising levels, research and development outlays, and plant or asset expansions made in one period in simulated environments will affect outcomes in the next period. Rates of return on sales, assets, and equity are commonly used in both actual and simulated environments to measure financial performance. The lagged effects of decision variables may vary between actual and simulated environments, depending on the specific measures chosen.

### INTRODUCTION

Higher advertising levels have been shown to have a positive impact on perceived product quality, market share, and profitability. R&D outlays often have a negative impact on profitability in the short run but may have a positive long-term impact. High levels of capital intensity (e.g., sales/assets) have also been associated with lower levels of profitability in real world environments.

Two simulated environments composed of 28 companies playing the Edge, Keys and Remus Multinational Game and 29 companies playing the executive game are compared in order to determine the effects of growth and leverage ratios on income ratios for a two year period (i.e., current year and lagged year). The growth ratios included sales, income, and asset growth while the leverage ratio included sales/assets, assets/equity, advertising expenses/sales revenues, and R&D outlays/sales revenues. The income ratios used were net income/sales revenues, net income/assets, and net income/equity.

### RESULTS

For the executive game companies, sales, income, and asset growth have a positive impact on return on assets and return on equity for year one but only asset growth is related to return on assets for the business game companies in year one. On a lagged basis, asset growth is the only variable related to return on assets for the executive game companies. All three-growth variables are significantly related to the return on equity on a current and lagged year basis for the business game companies.

Among the leverage variables, sales/assets is related to return on assets and return on equity in year one for both simulated environments. Assets/equity is negative related to return on assets in year one and lagged year two but is positively related to return on equity on a lagged basis for

the business game companies. These findings correspond to real world studies indicating that more capital intensive and highly leveraged companies will often have lower profits than those with less capital intensity and financial leverage.

Advertising expenses/sales revenues is negatively related to return on assets and return on equity for the executive game companies in year one but not lagged year two. For the business game companies, advertising expenses/sales revenues is not significantly related to return on assets in year one or lagged year two. Advertising expenses/sales revenues is negatively related to return on equity in year one but not in lagged year two for the business game companies.

R&D expenses/sales revenues is negatively related to return on assets in year one for the executive game companies but not for the business game companies. There is no lagged effect on return on assets in either environment. R&D expenses/sales revenue is positively related to lagged year return on equity for the business game companies but not for the executive game companies.

### CONCLUSION

The lagged relationships generally become more significant when the return on equity is used instead of return on assets in the case of the business game companies but not for the executive game companies. One exception is asset growth, which is positively related to return on equity in year two for both simulated environments. Thus, plant expansion and asset growth in year one can lay the foundation for higher levels of profitability in year two. The negative impact of advertising in both simulations in year one is not consistent with real world experience but may be due in part to the start up nature of first year operations in simulated environments. The negative impact of R&D outlays in year one for the executive game companies and positive impact in lagged year two for the business game companies is consistent with outcomes in many real world environments.

The limitations of the study include the fact that only two years of data are examined, not all decision variables are considered, and interrelationships among independent variables are not fully explored. The aggregation of the data into annual segments eliminated consideration of

quarterly economic fluctuations and decisions. However, possible lagged effects of decision variables on financial performance measures are highlighted and directions for future research are clearly indicated.