USING PROJECTED EARNINGS WHEN COMPUTING STOCK PRICE IN A BUSINESS SIMULATION GAME

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ABSTRACT

Stock price can be an important measure of student performance in a business simulation game. A simple stock price algorithm may be used and has certain advantages, but financial theory suggests that a more complicated model, based on the present value of future cash flows should be used. Furthermore, using a forward looking stock price algorithm encourages students to plan for maximizing future profits.

INTRODUCTION

The need for realistic stock pricing algorithms in business simulation games was called for by Goosen [1]. As presented in corporate finance textbooks [2], stock pricing theory is based on the present value of all future cash flows (i.e. dividends). Therefore, it seems that stock price algorithms in business simulation games should consider the future cash flows.

Wolfe and Gold [4] studied the stock price algorithms from a sample of six commercially available business simulation games and listed the variables used in each of the algorithms. All the algorithms used current period profit, outstanding shares, and owner's equity. Five of the algorithms also used short-term per/share dividend. A few of the algorithms included the past trend in profit, but the study reported "overall a rather short-term view was taken in determining stock prices". There was no mention of any of the algorithms projecting future cash flows.

Forecasting future stock value for business simulation games was considered by Pillutla and Thavikulwat [3]. In their study a linear regression model was used to forecast the book value of a company based on monetary market share, unit market share, the company's production experience, and the company's product inventory. The results of the study "unequivocally support the proposition that monetary market share and production experience are extraordinarily powerful strategic variables" and "they add predictive power to book value per share and before-tax net income per share".

This paper will first describe the context of the business simulation game under consideration. Then a simple stock price model which uses only current cash flow will be presented and the shortcomings of this simple model will be discussed. Next, a revised stock price model incorporating forecasted cash flows used in computing the current stock price will be presented. The addition of forecasted cash flows is supported by the findings of Pillutla and Thavikulwat [3] in that the forecasted cash flows will be based on the monetary market share (i.e. marketing strategy) and production experience (i.e. operations strategy) of the company. This paper will suggest that forecasted profit should also be based on the financial strategy of the company as well. Finally, the advantages of the revised stock price model will be discussed.

THE SIMULATION GAME AND THE COURSE

This paper is based on a business simulation game which was built in-house and in which the stock price is used as the primary measure of student performance in the game. The simulation is a total enterprise, two-product game with marketing, production, and financial variables. This game has been used in a semester capstone course in which student teams (3 to 5 students) compete during in a 4-year (16-quarter) game. The game emphasizes planning and the students are provided with a comprehensive Excel workbook and students are encouraged to plan at least four periods ahead of the current period. The course emphasizes teamwork, planning, and oral and written communication. Course grading is based in team performance in the game (50%), written annual plans (25%), a marketing plan presentation (12.5%), and individual presentations (12.5%).

THE SIMPLE STOCK PRICE MODEL

The simple stock price model uses the current period earnings per share and dividends per share in a formula with pre-determined price-earnings ratios as multipliers to calculate the current stock price. The algorithm is written to reward payment of a dividend which is consistent with net income, to recognize that retained earnings should lead to higher cash flows in the future, and to react correctly to issuing or buying back shares of stock. This model also requires the use of "traps" to prevent companies from trying to drive up their stock price by paying unrealistic dividends or by buying back an unrealistic number of shares of stock.

While this formula for stock value favors simplicity over reality, it does have some favorable aspects. If stock price is the primary measure of student success in the game, then the students have two perfectly clear goals – maximize earnings per share and payout a consistent dividend. All strategies and decisions by the students can be focused on these two goals. Likewise, the design criteria for the game can be generalized into simply rewarding good decisions in a way that will increase revenue and/or decrease expenses and therefore lead to higher profits and a higher stock price. For example, good marketing decisions will lead to higher sales, good labor practices will be rewarded with higher productivity, and good debt management will result in lower borrowing costs. Taking an example from today's terminology, "it's the money that's green", i.e. sustainability initiatives must be profitable. These criteria are all quite logical and lead to a business simulation game which is quite competitive and quite realistic.

The major drawback from using the simple model is that students have less incentive to plan for future earnings and concentrate only on maximizing current earnings. In fact, there is a disincentive for any expansion that requires borrowing or issuing common because of an immediate increase in interest expense or a dilution of earnings without a corresponding increase in current income. This is because the financial downside is incurred immediately while the revenue upside occurs in later periods as the expansion produces greater income in the future. Furthermore, although it may still be beneficial there is also less incentive for students to plan ahead, focusing only on current earnings.

THE REVISED STOCK VALUE MODEL

The approach to a forward looking stock price model is relatively straightforward. The game should forecast environmental variables (e.g. demand, parts and labor costs, interest rates, etc.) based on

information available to the students, and also project student decisions (based on past decisions). Then the algorithms of the simulation can be used to calculate future earnings and the future earnings are then used in the calculation of the current stock price. Note that a team's marketing, operations, and financial strategies are reflected in their previous decisions which are used to project future decisions.

At first this revised stock model may be confusing to students in that teams with the current earnings may not have the highest stock price. But when students realize that the stock price is forward looking and teams in a position to make higher earnings in the future will have the highest current stock price. Not only is this closer to the theoretical stock price model, but it also encourages the students to also be forward looking and to focus their planning on future periods. Expansion in itself will not guarantee a winning stock price, rather, a successful plan requires that the expansion must be planned in accordance with carefully forecasted environmental variables and the execution of optimal marketing, operations, and financial strategies.

REFERENCES

[1] Goosen, Kenneth R. (1994), "Increasing the effectiveness of performance evaluation through the design and development of realistic finance algorithms", *Developments in Business Simulation & Experiential Exercises* (21), 63-69

[2] Ross, S. A., Westerfield, R.W. & B. D. Jordan. (2006). Common Stock Valuation. Fundamentals of Corporate Finance, 7th ed., Irwin/McGraw Hill, pp. 233-254.

[3] Pillutla and Thavikulwat (2005), "Forecasting Stock Value", *Developments in Business Simulation & Experiential Exercises* (32), 255-261

[4] Wolfe and Gold (2004), "A Study of Business Game Stock Price Algorithms", *Developments in Business Simulation & Experiential Exercises* (31), 190-196