USING A MODIFIED DIVIDEND DISCOUNT MODEL FOR STOCK MARKET GAMES

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ABSTRACT

This paper presents a dividend discount model (DDM) modified for high-growth stocks as an investment decision tool for participants of stock market games. The participants input data from Value Line Investment Survey reports to the modified DDM for making their investment decisions. Comparing pre- and post-tests of economic and financial literacy on participants conducted during a stock market game period, the authors of this paper find anecdotal evidence that the performance improvement of the experimental group is statistically significant at 0.1 level, confirming the usefulness of the game for improving economic and financial literacy. **JEL classification:** G11

INTRODUCTION

The goal of this paper is to demonstrate that an effective application of fundamental analysis to stock market games can improve investment decisions of participants and enhance their economic and financial knowledge. The main objective is to present a pedagogical integration model for incorporating the fundamental analysis into an effective stock market investment simulation. To accomplish the objective, this study utilizes Value Line Investment Survey (VLIS) reports for the pedagogical DDM modified for high-growth stocks as an effective investment decision tool for the participants of stock market games. That is, the participants input the data from VLIS reports to an Excel spreadsheet template of the modified DDM for making their investment decisions. A Value Line Investment Survey report is a part of a stock analysis system published by Value Line, an investment research and financial publishing firm. Black and Kaplan supported the system's results in his famous article, "Yes, Virginia, There Is Hope: Tests of the Value Line Ranking System" (Black and Kaplan,1973)

To determine the effectiveness of stock market games, this study compares pre- and post-tests of economic and financial literacy on participants conducted during a stock market game period. Behrman et al. (2012) defines financial literacy as the ability to process economic information and make informed decisions about household finances. A stock market game is a simulation for stock market investing. This paper describes and analyzes stock market games conducted in undergraduate and graduate

investments courses during the fall semester of 2015. The key significance of the project is that the successful outcomes of the project provide anecdotal evidence that stock market games implemented in undergraduate and graduate curricula improve students' economic and financial literacy. The greater the amount of financial literacy that individuals obtain, the better equipped they are to make decisions that will have a positive impact on their financial well-being.

Fundamental Analysis Explained

The function of fundamental analysis is to analyze the fundamentals of a company to determine the company's overall health, or the company's net worth. The fundamentals are the company's basic quantifiable measures based on information derived from its financial statements such as earnings, dividends, cash flows, sales revenues, net incomes, retained earnings, etc. These metrics are normally summarized by a variety of financial ratios. Two frequent measures used for financial analysis applied to investment decisions for fair value calculations are dividends and price-earnings multiple ratios, which are the key variables discussed in this paper. The key objective of fundamental analysis for stock investment decisions is to find the company's fair value or its intrinsic value per share to which the market price of the company's share can be compared, so that an investor can determine if the market price is under- or over-priced compared to the fair value.

Modified Dividend Discount Model

One of the widely used models for fundamental analysis is the dividend discount model (DDM), which allows investors to calculate the fair value of a share of stock based on estimated dividends of the share, exclusive of other variables. The model is originated in the 1960s by Myron J. Gordon, so the constant growth version of DDM is called the Gordon Model as shown in the equation (1) below.

$$Vt = D,t+1/ (k - g) \quad (1)$$

where:
Vt = fair value of a share at time t
D,t+1 = expected dividend per share at the end of period t+1
g = expected dividend growth rate of the share (assumed to be constant)
k = investor's required rate of return of the share using Capital Asset Pricing Model defined in the equation (2) below.

$$k = rf + beta*[E(r,m) – rf] \quad (2)$$

where:
rf = risk-free rate which is the 10-year Treasury rate as of the evaluation date
beta = the systematic risk of the share
[E(r,m) – rf] = expected market rate of return minus risk-free rate
= the market risk premium (Mkt-Prem), which is generally 3~7% according to Dimson/Marsh/Staunton (2003).

Two key assumptions of the Gordon Model is that dividends are growing at a constant rate and k > g. However, realistically speaking, dividends are not always expected to grow at a constant rate. Therefore, the analyst has to treat dividends for the non-constant stage separately from the constant stage, applying each year's dividend growth rate. Another problem is that if the company's growth rate exceeds the required rate of return, one cannot use the Gordon Model simply because the stocks don't have a negative value.

Alternatively, to avoid the problem of the high-growth cases, the Vt can be calculated by the product of P/E and EPS as follows:

$$Vt = P/E * EPSt \quad (3)$$

where:
P/E = price per share divided by earnings per share for a 12-month period
EPSt = earnings per share at period t (12-month period)
This paper adopts the alternative use of the above equation (3) to modify the DDM.

The subsequent sections of this paper include a literature review, followed by a pedagogical design, i.e., a pedagogical logic model of a stock market game based on the use of fundamental analysis. Then, it presents evidence of the usefulness of stock market games, discussing anecdotal evidence of the usefulness of stock market games for enhancing the economic and financial knowledge of the participants. It concludes by summarizing the benefits and limitations of the modified DDM and potential usefulness of stock market games.

LITERATURE REVIEW

Pointing out the significant impact of stock ownership on wealth inequality, the Pew Research Center recently reported, "The median net worth of white households was $141,900 in 2013, down 26% since 2007, while the median net worth of African-American households fell by 43% to $11,000 for the same period." (Kochhar and Fry, 2014). The Pew explains that white households were much more likely than minority households to own stocks directly or indirectly through retirement accounts. Thus, they were in better position to benefit from the recovery in financial markets. For example, the Dow Jones Industrial Average (DJIA) recovered +153% from 6,547 on March 9, 2009, to 16,577 on December 31, 2013.

Wood, et al. (1992) discussed benefits of the Stock Market Game (SMG). They claimed that a major benefit of competitive activities in playing a stock market game would serve as the motivation for trying to win in different ways at different grade levels. More advanced students may be motivated to follow newspaper stories to identify stocks with high potential for gain, such as takeover candidates. They point out that using the game to teach more general economic concepts is the approach of the Joint Council on Economic Education and the Securities Industries Association. Therefore, their study sheds light on the possibility that economic and financial literacy could be improved for participants in stock market games implemented in college-level courses as well.

Hinojosa, et al. (2010) conducted a nationwide randomized controlled trial (RCT)

assessing the impact of playing Stock Market Game (SMG) on student mathematics achievement and investor knowledge (in Grades 4-10) for the 2008–09 school year. They found that a supplemental program designed to teach students about saving and investing can help students learn topics within financial literacy. Harter and Harter (2010) also conducted a study on the impact of SMG and they found that playing the SMG along with teaching seven general lessons from the "Learning from the Market" curriculum improves student financial literacy.

Behrman, et al. (2012) find that financial literacy enhances people's likelihood of contributing to their pension savings and suggests that this is a valuable pathway through which improved financial literacy can build household net worth. Also, Xiao et. al. (2014) report that college students have basic knowledge of money management and principles but they lack specific knowledge concerning risk diversification and other necessary knowledge for their financial dealings.

PEDAGOGICAL DESIGN

Participants take a pretest of economic and financial literacy before the game starts. Participants construct their entry portfolio using Google Portfolio Management System (Google Portfolio website). The Google Portfolio Management System has the distinctive feature of handling both long and short positions. The students can realistically learn the clear differences between long and short positions through observing the portfolio activities in the Google portfolio system. At the end of the game, each participant submits a portfolio performance report. Participants take a post-test of economic and financial literacy after the game concludes.

The inputs of the pedagogical design model include 1) a modified dividend discount model (DDM) template with the Value Line Investment Survey reports as the source of input data for the fundamental analysis; 2) the Google Portfolio management system as the stock market game platform for maintaining portfolios of long and short positions of the stock market game participants; 3) pre- and post- tests of economic and financial literacy on the game participants. The modified DDM template in an Excel spreadsheet is shown on Exhibit 1A to be used by the game participants.

The outputs of the model in terms of activities are: 1) explain details of the Value Line Investment Survey reports to be used for the modified DDM template in the context of the fundamental analysis; 2) conduct experiments with long and short positions in a stock market game; 3) collect, manage, and analyze the pre- and post- tests of economic and financial literacy. The instructor or coordinator of the stock market games plays instructional, facilitative and technical roles. The students participating in the stock market games are active learners of knowledge necessary to perform well in the stock market investment simulation.

The short-term impact of the model includes: recognition of the importance of fundamental analysis, improving relevant economic and financial knowledge, increased awareness of the relevance of economic and financial literacy through participation in activities of a stock market game, and superior stock investment performance. The intermediate impact is enhanced economic and financial literacy of the participants. The long-term impact is enhanced future wealth creation of the participants.

Modified DDM Template

Adapting the two-stage DDM (Dividend Discount Model) using data derived from the Value Line Investment Survey (Bodie, Marcus and Kane, 2012), this paper develops the following step-by-step instructions to be given to participants of a stock market game project in its earliest stage. Exhibit 1A, "Excel Spreadsheet Template for Modified DDM Applied to Johnson and Johnson (JNJ), August 9**,** 2016" is an Excel Template used for Johnson and Johnson (JNJ), taking Steps below to calculate its fair value as of August 9, 2016 and to make investment decisions on JNJ as of August 9, 2016. Exhibit 1B, "Value Line Investment Survey Report of Johnson and Johnson (JNJ), August 9, 2016" shows the actual Value Line Investment Survey report of JNJ used for the Exhibit 1A with key data inputs indicated with pointing arrows. The following steps are from collecting data to making decisions.

Step 1: Review the 2-Stage DDM using input data drawn from the Value Line Investment Survey report.

Step 2: Obtain the Value Line Investment Survey reports for three stocks (at least one long position and at least one short position) to be used in an investment project.

Step 3: Collect the necessary input data for each stock analysis from the Value Line Investment Survey report and other sources:
Beta
Recent Price (P0)
Dividends per share: D1, D2, D3, D4, where D1 = Dividend at the end of 1st year; D2 = Dividend at the end of 2nd year; D3 = Dividend at the end of 3rd year; D4 = Dividend at the end of 4th year.
Return On Equity (ROE)
Dividend Payout Ratio (DPR)
Risk-free Rate (rf)
Expected Equity Market Premium (Mkt-Prem)
k = the investor's required rate of return

Step 4:
Calculate output variables (the JNJ example shown in Exhibit 1A and 1B assumes the evaluation point is at year 2016 for a demonstration purpose. Therefore, D1 = D, 2017; D2 = D, 2018; D3 = D, 2019; D4 = D, 2020):
g = constant dividend growth rate
= ROE * b, where b is the earnings retention ratio;
P4 = P, 2020 = D5/(k-g) or P4 = P/E * EPS4 =P/E * EPS, 2020
V0 = V, 2016 = D1/(1+k) + D2/(1+k)^2 + D3/(1+k)^3 + (D4+P4)/(1+k)^4
where, for example, read D2/(1+k)^2 as D2 divided by (1+k) squared, etc.

The original version of the two-stage DDM using the data derived from the Value Line Investment Survey (Bodie, Marcus and Kane, 2012) fails to show how to handle most high-growth stocks if (k-g) is not positive, in which case the constant dividend growth model cannot be used.

As shown in Exhibit 1A, this paper resolved the dilemma by adopting the conditional solutions as follows (see the modification formula in Cell F59, the formula for V0, in the Exhibit 1A):

The positivity condition asks a question, "Is k > g?"
If the answer is yes, use P4 = D4*(1+g) / (k-g) = D5 / (k-g).
However, if the answer is no, which means k = g or k < g, then use P4 = P/E * EPS4.
This conditional modification is essential because many Value Line Investment Survey reports show that the positivity condition is not met in most cases of high-growth stocks, so one cannot use the constant dividend growth model at all.

Step 5: Determine investment decisions based on the following rules.
For a long position:
If the company's V0 > P0, P0 is underpriced, the recommendation is "Buy."
If the company's V0 = P0, P0 is in equilibrium, the recommendation is "Hold."
If the company's V0 < P0, P0 is overpriced, the recommendation is "Sell."
For a short position:
If the company's V0 > P0, P0 is underpriced, the recommendation is "Cover."
If the company's V0 = P0, P0 is in equilibrium, the recommendation is "Hold."
If the company's V0 < P0, P0 is overpriced, the recommendation is "Short."

The Excel template of Exhibit 1A automates the decisions using the twelve data inputs in the upper right portion of the spreadsheet. The decision for a long position is shown in Cell F62 and for a short position, in Cell F63.

EVIDENCE OF USEFULNESS OF A STOCK MARKET GAME

To see the effectiveness of stock market games, Yu, Assad, and Fuller (2016) compared pre- and post-tests of economic and financial literacy on the participants conducted during a stock market game period. That is, they conducted a College of Business-wide test of the effectiveness of stock market games for improving the economic and financial literacy of the participants of the games in undergraduate and graduate courses of investments during the fall semester of 2015. The experimental group participants are a judgmental sample of 26 students enrolled in either an undergraduate or a graduate Investments class in the College of Business during the fall semester of 2015. The control group participants are a judgmental sample of 30 students of undergraduate or graduate students in business classes at the same College of Business for the same period. The participants in the experimental groups took both the pre- and post-tests of economic and financial literacy and participated in the stock market games. The students in the control groups did not participate in the stock market games, but took the pre- and the post-economic and financial literacy tests. These tests were administered simultaneously to make cross-sectional and trend analyses possible.

The pre- and post-tests of economic and financial literacy consisted of questions dealing with basic knowledge of economics and finance related to the stock market. The results of the pre- and post-tests of economic and financial literacy between the experimental and the control groups were analyzed to see if there was a significant improvement in economic and financial knowledge as a result of participation in

the stock market games. Testing the statistical significance was conducted using the Wilcoxon Matched-Pairs Signed-Ranks Test. The results are presented in Table 1 for the experimental group and Table 2 for the control group. The results compared the performance of students on pre- and post-economic and financial literacy tests. The key results show that the performance improvement of the experimental groups during the experiment period was statistically significant at 0.1 for the 2-tailed test. On the other hand, performance improvement of the control groups was not statistically significant.

CONCLUSION

This paper demonstrates that Value Line Investment Survey (VLIS) reports can be utilized at the early stage of stock market games by the participants to select their portfolio components. In particular, the modified DDM suggested in this paper makes it possible for an investor to use the data extracted from Value Line Investment Survey reports for investment decisions even if a key pre-condition of the constant dividend growth model ($k>g$) is not met. Therefore, the modification suggests a practical resolution of the dilemma in cases where k (the required rate of return) is not greater than g (the dividend growth rate), which is the case for most high-growth stocks, in attempts to use the constant dividend growth model for investment decisions. The modification is based on utilization of the P/E multiple ratio of a stock instead of the constant dividend model. In rare cases where the P/E ratio can have a negative value, the modification cannot be used, which is beyond the scope of this paper. However, since most P/E ratios are positive, the modification is quite practical.

This paper also shows anecdotal evidence that playing stock market games with fundamental analysis as the key preparation in investment decision improves the economic and financial literacy of participating students. The significant improvement of students' economic and financial knowledge as a result of their active engagement in the stock market games with their understanding of the fundamental analysis process and risk diversification is conducive to improving their future financial wellbeing.

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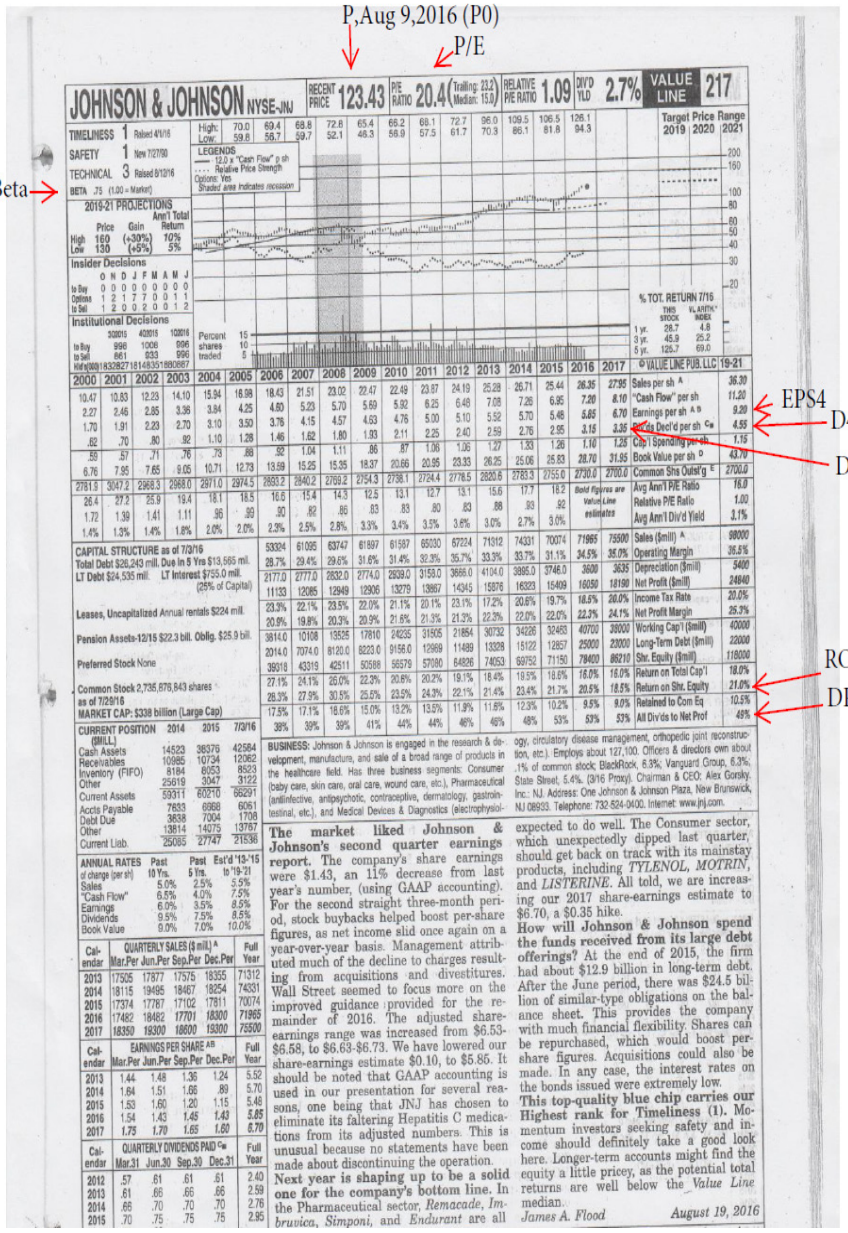
EXHIBIT 1A. EXCEL SPREADSHEET TEMPLATE FOR MODIFIED DDM APPLIED TO JOHNSON AND JOHNSON (JNJ), AUGUST 9, 2016

	C	D	E	F
40			Inputs:	
41			Beta	0.75
42			P0	123.43
43			D1	3.35
44			D2	3.75
45			D3	4.15
46	*Data from Value Line Investment Survey*		D4	4.55
47			ROE	0.21
48			DPR	0.49
49			PE	20.4
50			EPS4	9.2
51			rf	0.016
52			Mkt-Prem	0.07
53				
54			Outputs:	
55			g	0.1071
56			k	0.0685
57			P4	-130.5
58			P4	187.68
59			V0	157.298
60			Check Value	1
61			Decision	
62			"for a long"	Buy
63			"for a short"	Cover

Formulas in the Output Cells:

g	=F47*(1-F48)
k	=F51+F41*(F52)
P4	=F46*(1+F55)/(F56-F55)
P4	=F49*F50
V0	=IF(F56>F55,F43/(1+F56)+F44/(1+F56)^2+F45/(1+F56)^3+(F46+F57)/(1+F56)^4, F43/(1+F56)+F44/(1+F56)^2+F45/(1+F56)^3+(F46+F58)/(1+F56)^4)
C.V.	=IF(F59>F42,1,IF(F59=F42,0,-1))
“for a long”	=IF(F60=1, “Buy”, IF(F60=0, “Hold”, “Sell”))
“for a short”	=IF(F60=1, “Cover”, IF(F60=0, “Hold”, “Short”))

EXHIBIT 1B. VALUE LINE INVESTMENT SURVEY REPORT OF JOHNSON AND JOHNSON (JNJ), AUGUST 9, 2016



Source: Value Line Investment Survey, August 19, 2016. ©Value Line, Inc. All Rights Reserved Worldwide. "Value Line" is a registered trademark of Value Line Inc.

TABLE 1. WILCOXON SIGNED RANKS TEST, EXPERIMENTAL GROUP

Ranks		N	Mean Rank	Sum of Ranks
VAR6*-VAR5**	Negative Ranks	4[a]	10.63	42.5
	Positive Ranks	13[b]	8.5	110.5
	Ties	9[c]		
	Total	26		

a. VAR6 < VAR5
b. VAR6 > VAR5
c. VAR6 = VAR5

Test Statistics:

	VAR6 - VAR5
Z	-1.646
Asymp. Sig. (2-tailed)	0.1

Notes:
* Var6=Post-test score
** Var5=Pre-test score

TABLE 2. WILCOXON SIGNED RANKS TEST, CONTROL GROUP

Ranks		N	Mean Rank	Sum of Ranks
VAR2*-VAR1**	Negative Ranks	10[a]	8.70	87.00
	Positive Ranks	11[b]	13.09	144.00
	Ties	10[c]		
	Total	31		

a. VAR6 < VAR5
b. VAR6 > VAR5
c. VAR6 = VAR5

Test Statistics:

	VAR2 - VAR1
Z	-.999
Asymp. Sig. (2-tailed)	.318

Notes:
* Var2=Post-test score
** Var1=Pre-test score