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THE SENSITIVITY OF THE GROWTH OF EARNINGS PER SHARE IN THE TRAMP SHIPPING IDUSTRY OF TAIWAN

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Abstract: The growth of earnings per share is an important goal for running business. The shipping industry experienced dramatic changes in 2003, and the operating revenue increased quickly. But the relationship between the growth of EPS (G) and each of the financial variables remained unknown to managers, otherwise they could use financial variables to increase the growth of the firm. The main purpose of this study is to explore the relationship between G and the financial variables in the shipping industry in Taiwan. Spraakman's growth model is used to help managers to express G of shipping companies in terms of five financial variables. In the study, the model was built to show how financial variables affect the growth of earnings per share. The sensitivity or the change of G in each financial component was quantified. Researchers chose 6 open-market tramp shipping companies to verify the model. The empirical results showed that the sensitivity of earnings per share for shipping companies was a good tool for managers to increase the profit.

Key Words: earnings per share (EPS), sensitivity analysis, financial ratios

1. INTRODUCTION

The growth of earnings per share is an important goal for running business. Certainly financial writers, scholars, security analysts, and senior managers all agree to the comment. How can managers construct financial variables to increase the growth of earnings per share for one's firm? Financial variables that influence the growth of earnings per share include

return on investment, interest rate cost of debt, leverage, payout ratio, and income tax rate. But what kind of the relationship is between the growth of EPS (hereafter, we call at G for short) and each of the financial variables? Spraakman (1979) conducted research that focused on the relationships between G and financial variables, but the theory applied to a shipping company has not been done yet. With the drastically moving upward of Baltic index in 2003 and limited ships available on the market, the freight of tramp shipping companies has steadily risen. The shipping industry experienced dramatic changes in 2003, and the operating revenue increased quickly. But the relationship between the growth of EPS and each of the financial variables remained unknown to managers, otherwise they could use financial variables to increase the growth of the firm. The main purpose of this study is to explore the relationship between G and financial variables that employed Spraakman's theory. This paper focuses on the relationship between G and each financial variable of the shipping industry. Six open-market tramp shipping companies were chosen to verify Spraakman's model. The empirical results showed that the sensitivity of earning per share for shipping companies was a good tool to increase the profits.

2. LITERATURE REVIEW

Undoubtedly, return on investment affects earnings per share of corporate directly. In order to achieve the target investment performance, managers must choose the project of investment deliberately. Without sufficient capital, manager may have to finance from outside resource. There are many ways of financing, such as debts, bonds, equity, and so on. The resource of financing will have great impact on the capital cost. Since the leverage has great impact on earnings and the capital cost, the importance of the leverage must be addressed. Modigliani and Miller (1958) had a great deal of literature on the optimal leverage for a firm. A firm's leverage is related to the corporate taxes (Modigliani and Miller, 1963) and bankruptcy cost (Baxter, 1967; Hirshleifer, 1970). Yet, there has been no analysis concerning how one level of leverage rather than another affects G. Under certain financial structure and taxation system, the income tax rate and interest rate of debt of a company are considered as a constant. However, there are other financial variables affecting G, such as payout rates and return on investment. Furthermore, most researchers assume that payout rate is constant. From different perspective of views, the research of Lintner (1956) and Brittain (1966) suggested that firms gear dividend policies to target payout rates instead of constant payout rates. Spraakman (1979) found five factors that influenced earnings growth. They were return on investment, interest rate cost of debt, leverage, payout ratio, and income tax rate. He analyzed the sensitivity of the growth of earnings per share to some of these financial variables. Lin (2004) found that shipping firms increased payout rates after taxation integration. The main purpose of this study is to explore the relationship between G and financial variables that employed

Spraakman's theory, in order to help financial managers and investment analysts to express G of shipping companies in terms of five financial variables.

3. METHODOLOGY

Spraakman (1979) developed this growth model, which assumed that a firm had a generally financial statement. These statements were rearranged for simplicity of presentation (see Table 1).

Table 1. Financial Statements

Income Statement

One Format	Another Format
Sales	Investment*
- Costs	× Return on Investment**
- Depreciation	= Pre-interest, Pre-tax Profits
- Interest Costs	- Interest Costs
= Pre-tax Profits	= Pre-tax Profits
- Taxes	- Taxes
= After-tax Profits	= After-tax Profits
- Dividends	- Dividends
= Retained Earnings	**= Retained Earnings**

* To clarify the meaning of investment, we define investment as long-term capital in our study.

** Return on Investment is defined as the Pre-tax profits plus interest expenses of Long-term debts then divided by long-term capital (assumed in this study).

Balance Sheet

Physical Investment	Financial Investment
Current Assets	Debts (long-term)
- Current Liabilities	
= Working Capital	+ Equity
+ Net Fixed Assets*	
= Physical Investment	= Financial Investment

*Net Fixed Assets is identical to Non-Current Assets (assumed in this study).

The notations are defined as follows:

P = after-tax profits,

S =sales,

C =costs,
f = depreciation,
i = interest rate cost of debt,
D, $\overline{D}$ = debt and average annual debt, respectively,
T =income tax rate,
L =debt as a proportion of investment (debt plus equity),
I, $\overline{I}$ = investment and average annual investment, respectively,
R =pre-tax, pre-interest profits as a proportion of average annual investment,
E =equity,
V =dividend payout ratio,
Z =financial growth factor (see Equation (A-7) below),
G =the earnings per share growth rate,
Δ =indicates change; subscripts, when used, indicate time periods,

We can make a conclusion here.

$$\begin{aligned} P &= [(S - C - f) - (i \times \overline{D})](1 - T) \\ &= [(S - C - f) - (i \times L \times \overline{I})](1 - T) \\ &= [(R \times \overline{I}) - (i \times L \times \overline{I})](1 - T) \\ &= \overline{I}[R - (i \times L)](1 - T) \end{aligned} \quad \text{(A-1)}$$

Annual retained earnings of a corporation depend not only upon P but also on the dividend policy. As the payout ratio V declines, retained earnings, ΔE, as a percent of P will increase:

$$\Delta E = P(1\text{-}V). \quad \text{(A-2)}$$

Also, as earnings are retained in the firm for investment purposes, debt will be added in a relationship to equity deemed desirable by the firm.

$$\Delta I = \Delta E[1/(1\text{-}L)]$$

$$\text{where, } \frac{\Delta E}{\Delta E} + \frac{\Delta D}{\Delta E} = 1 + \frac{L}{1-L} = \frac{1}{1-L} \quad \text{(A-3)}$$

= the leverage multiplier

The first three equations have dealt with a single time period. Additional time periods are needed to describe the dynamic nature of G. Now researchers assume the firm enters the second year with its year earlier investment I_0 plus that period's change in investment, ΔI_1. Subsequently, the total investment matches a certain complement of R, I, L, V, and T.

If R, I, L, V, and T are assumed to remain constant,

$$\frac{P_2}{P_1} = \frac{\bar{I}_2[R-(i\times L)](1-T)}{\bar{I}_1[R-(i\times L)](1-T)}$$
$$= \frac{I_0 + \Delta I_1 + (\Delta I_2/2)}{I_0 + (\Delta I_1/2)} \quad \text{(A-4)}$$

From Equations (A-1), (A-2), and (A-3), ΔI_1 can be expressed as:

$$\Delta I_1 = P(1\text{-}V)\left(\frac{1}{1-L}\right)$$
$$= \bar{I}[R-(i\times L)](1-T)\,(1\text{-}V)\left(\frac{1}{1-L}\right)$$
$$= Z_1[I_0 + (\Delta I_1/2)] \quad \text{(A-5)}$$

where $Z=[1/(1\text{-}L)](1\text{-}V)(1\text{-}T)[R\text{-}(i\times L)]$.

Equation (A-5) simplifies to

$$\Delta I_1 = \frac{2\times Z\times I_0}{2-Z} \quad \text{(A-6)}$$

By using this approach, ΔI_2 can be defined as

$$\Delta I_2 = \frac{(2\times Z\times I_0)(2+Z)/(2-Z)}{(2-Z)} \quad \text{(A-7)}$$

Equation (A-4) can be expressed in terms of Z. By simplifying, it becomes Equation (A-8):

$$\frac{P_2}{P_1} = \frac{\Delta I_2}{\Delta I_1} = (2+Z)/(2-Z). \quad \text{(A-8)}$$

The techniques used in producing Equation (A-8) can be employed for more time periods, but the results will always be the same. To have the relationship above expressed as a percentage, the number 1 must be subtracted from the P_2/P_1. Namely:

$$G = \frac{2+Z}{2-Z} - 1 = \frac{2+Z}{2-Z} - \frac{2-Z}{2-Z} = \frac{2Z}{2-Z} \quad \text{(A-9)}$$

To quantify the sensitivity of G to R, I, L, V, and T, three steps are needed. For step one, the first derivatives must be calculated for Z on G and each of the five financial variables. Equations (A-10) to (A-15).

$$\frac{dG}{dZ} = \frac{4}{(2-Z)^2} \quad \text{(A-10)}$$

$$\frac{dZ}{dR} = \frac{(1-V)(1-T)}{(1-L)} \quad \text{(A-11)}$$

$$\frac{dZ}{di} = \frac{-L(1-V)(1-T)}{(1-L)} \quad \text{(A-12)}$$

$$\frac{dZ}{dL} = \frac{(R-i)(1-V)(1-T)}{(1-L)^2} \tag{A-13}$$

$$\frac{dZ}{dV} = \frac{[(i \times L) - R](1-T)}{(1-L)} \tag{A-14}$$

$$\frac{dZ}{dT} = \frac{[(i \times L) - R](1-V)}{(1-L)} \tag{A-15}$$

By using the chain rule, the first derivative of a financial factor on G can be calculated. This is shown in the next equation for R.

$$\begin{aligned} \frac{dG}{dR} &= \frac{dG}{dZ} \times \frac{dZ}{dR} \\ &= \frac{4}{(2-Z)^2} \times \frac{(1-V)(1-T)}{1-L} \end{aligned} \tag{A-16}$$

The first derivative of the other four financial variables on G is calculated in the same fashion.

To indicate the sensitivity of G to the financial factors, Equation (A-17) will determine the percentage change in G resulting from a specified change in R, given that the other variables remain constant:

$$\frac{dG(R)}{G} = \frac{(dG/dR)d'R}{G} \tag{A-17}$$

where $d'R$ is the specified percentage change.

For the other four financial variables, the final step in the sensitivity calculation is determined in the same way. With similar reasoning to (A-17), we obtain the results as follows:

$$\frac{dG(i)}{G} = \frac{(dG/di)d'i}{G} \tag{A-18}$$

$$\frac{dG(L)}{G} = \frac{(dG/dL)d'L}{G} \tag{A-19}$$

$$\frac{dG(V)}{G} = \frac{(dG/dV)d'V}{G} \tag{A-20}$$

$$\frac{dG(T)}{G} = \frac{(dG/dT)d'T}{G} \tag{A-21}$$

4. EMPIRICAL RESULTS

G can be explained in terms of the five financial factors. Equation (A-9) describes the complex relationships mathematically:

$$G = 2Z/(2-Z) \tag{A-22}$$

where $Z = [1/(1-L)][(1-V)(1-T)[R-(i \times L)]$.

This model is constructed to show how financial variables affect the growth of earnings per share. Because shipping industry has capital-intensive, high debt, high financial risk, unsteady income, and highly affected by oil price and exchange rate, six open-market tramp shipping companies in Taiwan are chosen to verify the model.

From Equation (A-22), we can see the increase in the return on investment, R, leads an increase in G while everything else is constant. If the interest rate cost of debt, i, decreases, G grows faster (given that the return on investment is greater than the interest rate cost of debt leverage). Based on the equation above, the direction of the causal relationship between five variables and G can be specified. Generally speaking, financial managers understand all these directions of influence. However, the degree of a variable's influence cannot be determined without knowing numerical values of the other four variables. This equation provides a tool to analyze the growth of earnings per share (G).

To know more than just the direction of a change in G, the sensitivity analysis or the change of G to a change in each financial variable must be quantified.

Based on (A-22), with the value of Z= 1.04% from the First Steamship, we obtain G=2*1.04%/(2-1.04%)=1.05%. We obtain the other five G of the tramp companies in the same way.

Table 2 lists the 2003 financial variables of six tramp shipping firms in Taiwan. It shows the arrangements in each firm that leads to its G level.

Table 2. Arrangements of Financial variables (%)

Financial variables / Corp.	ROI	interest cost	leverage	payout ratio	Income tax rate	Z	G
First Steamship	1.57	3.82	19.06	0	0	1.04	1.05
Sincere Navigation	18.39	1.30	12.10	69.44	4.06	6.08	6.27
U-Ming	23.66	1.06	22.38	94.5%	5.78	1.54	1.55
CMT	11.54	1.47	18	71.94	8.75	3.52	3.58
ETITC	15.11	2.35	60.79	77.18	9.74	7.19	7.45
Taiwan Line	17.05	4.26	40.00	88.00	14.98	2.61	2.64
Average	14.55	2.38	28.72	66.86	7.22	3.66	3.76

Table 2 shows Sincere Navigation and ETITC have the higher G, 6.27% and 7.45%, respectively. Compared to Sincere Navigation, the ETITC has a lower return on investment. However, its leverage, interest cost, payout ratio and income tax rate are higher than those of the Sincere Navigation. There is more than one way to make earnings grow for ETITC. If financial mangers can increase leverage and payout rate, they should attain more profits.

Furthermore, from Table 2 we can see that the Sincere Navigation and ETITC are able to achieve 6.27% G and 7.45% G, substantially above the group average. This may be mainly due to its relatively high return on investment. Meanwhile, the First Steamship has relatively low return on investment for its rather depressed G of 1.05%. It becomes clear that the sensitivity of G to each variable must be known. Which variables are most potent and least powerful? Sensitivity analysis can answer these questions.

Table 3 specifies the elasticity of G to an arbitrary 10% change in each financial variable. In the case of the First Steamship, a 10% alteration in the return on investment (from 1.57% to 1.73%) leads to a 12.48% growth in G; in the case of the ETITC, a 10% change in the interest rate cost of debt (from 2.35% to 2.59%) leads to a negative 3.44% change in its G. It can be observed that a 10% change in return on investment has a greater impact on the Gs of the First Steamship (12.48%) than on those of it of Sincere Navigation (3.55%), U-Ming (0.67%), CMT (3.24%), ETITC (5.65%) and Taiwan Line (1.75%). Similarly, a 10% change in the payout ratio has a greater impact on the ETITC's G (minus 18.22%) and Taiwan Line's G (minus 7.68%) than on the other four firms. The elasticity of G to any one financial variable depends on the particular arrangement of all financial variables.

Table 3. Elasticity of G to its Financial Variables (%)

Corp.	ROI	interest cost	leverage	payout ratio	Income tax rate
First Steamship	12.48	-2.38	-0.35	-2.10	-0.11
Sincere Navigation	3.55	-0.43	0.69	-3.39	-0.67
U-Ming	0.67	-0.15	0.19	-5.54	-0.17
CMT	3.24	-0.58	0.40	-3.24	-0.40
ETITC	5.65	-3.44	1.84	-18.22	-0.86
Taiwan Line	1.75	-0.70	0.37	-7.68	-0.32

According to above analysis, we know that Spraakman's model is suitable for Taiwan's shipping firms. Financial managers could utilize this model to not only make decisions but also increase growth of earning. Moreover, companies could attain a higher stock price based

on good financial results through the sensitivity analysis.

5. CONCLUSIONS

The Spraakman's model was analyzed to show how financial variables affect the growth of earnings per share in the study. Based on the model, financial managers can realize how earning per share is affected by changing any of the five financial variables. Six open-market tramp shipping companies were chosen to verify the model, and the sensitivity analysis of G was conducted. The empirical results showed that the sensitivity of earning per share for shipping companies was a good tool for managers to increase profits. With the higher operating revenue in 2003, the tramp shipping companies know how to create more growth of earning and higher stock price in order to finance more capital from vast investors.

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