



Impacts of Change in Capital Structure on the Profitability of Pharmaceutical Firms: A Study of Pharmaceutical Industry in Singapore

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ABSTRACT

An optimal capital structure can reduce the cost of capital and then contribute to corporate profitability. Debt financing usually plays a critical role since the proper use of debt is expected to increase revenues and profits. Some academicians find some positive effects of operating or financial leverage on profitability, while other studies on corporate leverage conclude that debt will impede profit growth in the pharmaceutical industry. This study aims to investigate the correlation between leverage and profitability in the Singaporean pharmaceutical industry. This study constructs a regression model with one dependent variable, Return on Equity (ROE), and four independent variables, including Debt-to-Equity, Long-term Debt, Operating Leverage, and Interest Coverage ratios. The model is based on the secondary data collected from 30 SGX-listed pharmaceutical companies in the period from 2017 to 2021. Both correlation analysis and ordinary least squares (OLS) are adopted to explore the effects of leverage on profitability. The results show that Debt-to-Equity and long-term Debt ratios are negatively correlated with ROE, and Operating Leverage and Interest Coverage ratios have a positive correlation with ROE. Based on these findings, this study suggests managers avoid taking unnecessary debt, and short-term debt is required to maintain high operating leverage that positively affects profitability. Also, managers should not rely on long-term debt but rather finance the business growth with equity.

Keywords: *Capital Structure, Leverage Ratios, Profitability, Pharmaceutical Industry*

1. INTRODUCTION

Leverage in terms of financial and operating leverage is always a fundamental factor affecting the profitability of companies. Financial leverage is frequently used to measure capital structure, and many studies are exploring the correlation between capital structure and profitability. However, there is no certain conclusion about this correlation since the impacts of leverage are well-diversified across different industries. Also, some environmental or macroeconomic factors also have effects on companies. Thus, this research will concentrate on the pharmaceutical industry in Singapore, and it will investigate how leverage and related financing strategies will impact the profitability of selected pharmaceutical companies. This research will construct a regression model to depict the correlation between leverage and profitability. For the research methodology, a quantitative analysis based on panel data is adopted to explore the correlations between proxies tracking

leverage and profitability. This research will enable managers to make more reasonable financing-related decisions and maintain a more proper capital structure for pharmaceutical companies.

2. LITERATURE REVIEW

Many academicians have conducted research exploring the relationship between capital structure and profitability. Varghese and Sahai conducted a study of BSE-listed pharmaceutical companies to explore the effects of capital structure on the financial performance of firms. The result showed a positive relationship between the total debt level and Return on Equity (ROE) and Return on Asset (ROA) [1]. Pandey conducted an empirical analysis on the corporate leverage and profitability of the pharma industry in India. This study demonstrated that the operating leverage has significantly positive effects on returns of investment and earnings per share. Notwithstanding, the results showed

that financial leverage is not a significant determinant of profitability [2]. Innocent conducted a study of quoted pharmaceutical companies in Nigeria to investigate the effects of financial leverage on corporate financial performance. This study adopted the Debt-to-Asset ratio, Debt-to-Equity ratio, and the Interest Coverage ratio to track the financial leverage. The findings of this study showed that the first two ratios are negatively correlated with ROA, and the Interest Coverage ratio has an insignificantly positive correlation with ROA [3]. DINH and PHAM studied the influence of the capital structure on the financial performance of listed pharmaceutical companies in Vietnam. This study found that financial leverage measured by the Asset-to-Equity ratio has some positive effects on ROE, and self-financing exerts adverse effects on profitability [4]. Deesomsak and Pescetto conducted research on the determinants of capital structure of firms in the Asia Pacific region. This study found that the determinants of capital structure varied across different countries and concluded that decisions about capital structure are affected by the environmental factors of countries where the firms operate [5]. Farhan, Tabash, and Yameen studied the relationship between credit policy and corporate profitability in the Indian pharmaceutical industry. This research focused on account receivable and payable turnover, leverage, and the age of firms, and the findings showed that collection period of cash and leverage level are both negatively correlated with ROA. One recommendation about credit policies was that companies should use short-term borrowing to pay their suppliers early at a discount [6]. Dave examined the relationship between credit policy and the profitability of the firm. This study concluded that long-term Debt-to-Equity has an insignificant negative correlation with profitability [7].

Based on these previous studies, there are various conflicting findings and results about the effects of leverage on profitability. Especially, the impacts of total debt level or financial leverage on profitability are found to be positive by Varghese [1] and DINH [4] but negative by Innocent [3] and Farhan [5]. More importantly, Pandey found that financial leverage should not be a significant determinant of profitability [2], which even violates most of the studies mentioned above. These contradictions result in many uncertainties in this area. Also, most studies solely focus on the Indian pharmaceutical industry, and there are no sufficient studies on other countries, e.g., Singapore. To fill this research gap, the author will focus on financial and operating leverage and examine their correlations with profitability in Singapore.

3. METHODOLOGY

3.1. Variable clarification

Based on the literature review of previous studies, this research selects four independent variables, including Debt-to-Equity, Long-term Debt, Operating Leverage, and Interest Coverage ratios, and one dependent variable, Return on Equity ratio.

Debt-to-Equity ratio (DE) is calculated by total liabilities over shareholders' equity, which is the most common indicator of capital structure used by managers. This indicator measures the proportion of debt, including short- and long-term debt, to equity in the financing of a company [8].

$$DE = \frac{\text{Total Liabilities}}{\text{Total Shareholders' Equity}} \quad (1)$$

Long-term Debt ratio (LTD) is calculated by dividing long-term debt by total assets, which measures the financial leverage of a firm in the long term [1]. DE ratio takes short-term liabilities, which mature within one year, into consideration, and the LTD ratio only considers the long-term debt with a maturity of over one year and tracks how they are used to finance assets.

$$LTD = \frac{\text{Long-term Debt}}{\text{Total Assets}} \quad (2)$$

Operating Leverage ratio (OL) is calculated by the percentage change of EBIT over the percentage change of sales, which measures the degree of operating leverage of a company and reflects at what proportion the operating income will increase with sales [9]. The degree of operating leverage is a critical factor affecting business risk level, operating and financial performance, and even valuation of companies [10].

$$OL = \frac{\% \text{ Change in EBIT}}{\% \text{ Change in Sales}} \quad (3)$$

Interest Coverage ratio (IC) is calculated by EBIT over interest, which measures the capability of a company to cover its interest payments. The ability to meet fixed financial obligations is important to the survival of companies in the long term [3]. This ratio pertains to the solvency of the company.

$$IC = \frac{\text{EBIT}}{\text{Interest Expense}} \quad (4)$$

Return on Equity ratio (ROE) is calculated by net income over shareholders' equity and is a common measure of financial performance. Usually, the goal of managers is to maximize the interests of shareholders, and ROE is the most straightforward measure of returns on investment for shareholders assuming all the free cash is paid as dividends [11]. Thus, ROE is used as the indicator tracking the profitability of the company.

$$ROE = \frac{\text{Net Income}}{\text{Total Shareholders' Equity}} \quad (5)$$

3.2. Data Collection

The data is collected from a sample of 30 publicly traded pharmaceutical companies listed on the Singapore Exchange (SGX). The time horizon is five years, from 2017 to 2021. This research only collects and bases its

findings on secondary data from the annual reports of selected companies and the website of sgx.com, which conveys all the information about selected companies. Table 1 contains all the selected pharmaceutical companies listed on SGX.

Table 1. List of selected companies

No.	Name	No.	Name
1	Medtecs Intl	16	Alliance Healthcare
2	Asian Healthcare Specialists	17	OUE Lippo Healthcare
3	UG Healthcare	18	HC Surgical Specialists
4	Raffles Medical	19	ISEC Healthcare
5	IX Biopharma Ltd	20	Lonza Gr AG
6	Clearbridge	21	Q & M Dental Gr
7	Singapore O&G Ltd.	22	Riverstone
8	Thomson Medical	23	TalkMed Group
9	Healthway Med	24	Suntar Eco City Ltd
10	Haw Par	25	AsiaMedic Ltd.
11	Aoxin Q & M Dental Gr	26	Singapore Medical Group
12	Econ Healthcare (Asia)	27	QT Vascular
13	Cordlife Gr	28	Tianjin Zhongxin Pharma Gr
14	Hyphens	29	IHH Healthcare
15	Top Glove	30	Vicplas Intl

3.3. Model Specification

Ordinary least squares (OLS) method is adopted for this research to estimate the correlation between dependent and independent variables in a linear regression model. The beta coefficients and corresponding t-statistics of each independent variable will be the measurements of correlation. In the research, the detailed model specifications are displayed as follows:

$$ROE = \beta_0 + \beta_1 * DE + \beta_2 * LTD + \beta_3 * EBITs + \beta_4 * IC + \varepsilon \quad (6)$$

β_0 is the intercept; $\beta_1 - \beta_4$ are the coefficients of all the independent variables;

ε is the residual between expected and actual values

3.4. Research Hypothesis

To examine the correlation between leverage and profitability, this research has constructed hypotheses as follows:

H1: Debt-to-Equity ratio (DE) has an impact on Return on Equity ratio (ROE).

H2: Long-term Debt ratio (LTD) has an impact on Return on Equity ratio (ROE).

H3: Operating Leverage ratio (OL) has an impact on Return on Equity ratio (ROE).

H4: Interest Coverage ratio (IC) has an impact on Return on Equity ratio (ROE).

4. RESULTS AND DISCUSSIONS

4.1. Summary Statistics of Data

The outcome given by SPSS software conveys the main summary statistics of data of 30 selected companies over the past five years, with 150 observations in total, shown in Table 2.

Table 2. Summary Statistics

Variable	Mean	Median	S.D.	Min	Max
DE	0.3020	0.1910	0.2490	0.0311	0.8260
LTD	0.0716	0.0643	0.0468	0.0138	0.1890
OL	-0.7740	0.1110	4.9000	-30.6000	0.4700
IC	67.1000	13.3000	162.0000	-35.1000	952.0000
ROE	0.1090	0.0554	0.1790	-0.0004	0.8060

4.2. Correlation Analysis

Table 3. Correlation Matrix of Variables

		<i>DE</i>	<i>LTD</i>	<i>OL</i>	<i>IC</i>	<i>ROE</i>
Pearson Coefficient	DE	1.0000	0.1366	0.1308	-0.3694*	-0.2272*
	LTD	0.1366	1.0000	0.1459	-0.3035	-0.2696*
	OL	0.1308	0.1459	1.0000	0.1252	0.1297
	IC	-0.3694*	-0.3035	0.1252	1.0000	0.0805
	ROE	-0.2272*	-0.2696*	0.1297	0.0805	1.0000
Sig. (2-tailed)	DE	.	0.0002	0.0024	0.1315	0.1605
	LTD	0.0002	.	0.0000	0.1240	0.0070
	OL	0.0024	0.0000	.	0.0000	0.0005
	IC	0.1315	0.1240	0.0000	.	0.1114
	ROE	0.1605	0.0070	0.0005	0.1114	.

*Correlation is significant at the 5% significance level (two-tailed)

Table 3 displays the correlation between the independent and dependent variables, and all the independent variables are correlated with ROE. Most importantly, DE and LTD both have a significant negative correlation with ROE at the 5% significance level, and the corresponding coefficients are respectively -0.2272 and -0.2696. Thus, higher total leverage and long-term debt used to finance assets may indicate a lower level of return on equity. OL and IC are positively correlated with ROE, which means that ROE will increase with a higher proportion of Operating Leverage and interest coverage.

Additionally, there is a significant negative correlation between DE and IC at the 5% significance level. It implies that the increase in total leverage will lower the interest coverage ratio, likely raising some solvency concerns. DE and LTD have positive impacts on OL, which means that the higher total Debt-to-Equity ratio and long-term debt ratio will drive up the Operating Leverage ratio and lower the short-term operating

leverage. IC is also positively correlated with OL, which means that the higher interest coverage indicates a higher proportion of Operating Leverage as well as lower operating leverage.

4.3. Regression Analysis

The correlation analysis above only measures the correlations between two variables, which cannot be applied in practice since multiple variables will simultaneously affect companies' profitability. Hence, it is of significance to adopt a multi-variable regression model to measure the correlation between the leverage and profitability of a company. The author conducted an OLS regression analysis on the processed data via SPSS. Accordingly, some summary statistics of the result are displayed in Table 4, including t-statistics, f-statistics, adjusted R-squared, Durbin-Watson, and significance of coefficients. All these statistics are used to determine whether the selected model is appropriate for the collected and processed data.

Table 4. Summary of Data

<i>Model</i>	<i>R</i>	<i>R-squared</i>	<i>Adjusted R-squared</i>	<i>SE of estimate</i>	<i>F(4, 144)</i>	<i>P-value(F)</i>	<i>Durbin-Watson</i>
1	0.5198	0.2702	0.2018	0.0662	17.5630	9.26E-12	1.7834

In Table 4, R-squared and the adjusted R-squared are 0.2270 and 0.1897. In a conservative perspective, the adjusted R-squared indicates that 20.18% of the variations of ROE can be interpreted by the change in independent variables in this model, and the rest of 79.82% may be linked to other unselected variables. The standard deviation of estimate is 0.0662, which roughly

estimates the volatility and distribution of processed data. Also, the result of the F-test (4,144) is 17.5630, which is significant at the 1% significance level. Hence, the coefficients of independent variables are not jointly zero. Additionally, the Durbin-Watson test result is 1.7834 lower than 2. Thus, there is no autocorrelation among variables in this model.

Table 5. OLS Regression Result

<i>Model</i>		<i>Unstandardized coefficient</i>		<i>Standardized coefficient</i>		
		<i>Beta</i>	<i>Std. Error</i>	<i>Beta</i>	<i>t-ratio</i>	<i>Sig.</i>
1	const	0.2680	0.0438		2.1270	0.0200
	DE	-0.1914	0.0437	-0.1209	-4.3780	0.0056
	LTD	-1.1807	0.3077	-1.1659	-3.838	0.0420
	OL	0.0083	0.0013	0.0043	2.7854	0.0135
	IC	0.0012	0.0001	-0.0001	1.5341	0.0412

Table 5 displays the coefficients and related statistics of a multi-variable regression model. Based on the regression result shown in this table, the Debt-to-Equity ratio (DE) has a negative impact on ROE. There is a significant negative relationship between these two variables when considering the t-statistic of -4.3780. In detail, ROE will decrease by 0.1914 with a 1 unit increase in DE, assuming other regressors are unchanged. Thus, a higher proportion of total debt-to-total equity will lower the profitability of a company. The Long-term Debt ratio (LTD) has a negative impact on ROE so that ROE will decrease by 1.1807 with a 1 unit increase in DE. This implies that financing assets with long-term debt will negatively affect the profitability of a company. The Operating Leverage ratio (OL) has a positive impact on ROE, which indicates that 1 unit increase in OL will increase ROE by 0.0083. Similarly, the Interest Coverage ratio (IC) has a slight positive impact on ROE so that ROE will increase by 0.0012 with 1 unit increase in IC. The t-ratio and significance level of the coefficient of IC are 1.5341 and 0.0412 respectively, which implies that there is a statistically insignificant correlation between IC and ROE. In conclusion, all the previous hypotheses except H4 are not rejected. Eventually, the regression equation describing the impact of leverage on profitability is displayed in the following:

$$ROE = 0.2680 - 0.1914 * DE - 1.1807 * LTD + 0.0083 * EBITTS + 0.0012 * IC \quad (7)$$

4.4. Implications for Financial Management

Based on the correlation and regression analysis above, some related discussions and implications for financial management are developed in this part. It is significant to assess the impacts of these factors on profitability since managers are expected to make appropriate decisions to optimize the returns to shareholders. Managers should always match the maturity of liabilities and business cycles of projects at first; otherwise, the potential liquidity and solvency issues will firstly end the life of the company. Additionally, investors usually track these factors to see whether the changes in the capital structure of their targeted companies align with their expectations.

Firstly, managers should not incur unnecessary debt. DE has some negative effects on ROE, which suggests that managers should not overtake leverage in pharmaceutical companies. However, Varghese's research shows that DE has some positive effects on the ROE of BSE-listed pharmaceutical companies in India [1]. This difference can be explained by some environmental factors, such as the fact that the cost of borrowing differs across different countries. Firms can benefit from adding leverage when the cost of borrowing is relatively low. In Singapore, there are stronger legal protections of creditors' rights and more efficient rules of law [5]. Due to the high cost of borrowing, adding financial leverage will negatively affect profitability, and managers are discouraged from taking unnecessary debt.

Moreover, managers should not rely on long-term debt financing. The Long-term debt exerts strong negative effects on the profitability of pharmaceutical companies in considering the highest coefficient of LTD in the regression. Hence, long-term debt should be the preferred method of financing. As DE is negatively related to ROE, managers of pharmaceutical companies in Singapore are recommended to issue equity to finance their research and development.

Additionally, managers still need short-term borrowing to hedge the risks of high operating leverage. The profitability is positively correlated with the degree of operating leverage that measures the company's sensitivity to the market. Basically, a higher proportion of sales converted to EBIT represents that a higher volatility of operating incomes to sale changes [9]. Thus, operating leverage is beneficial to pharmaceutical companies. However, a higher degree of operating leverage also implies a higher risk of sales fluctuations [10]. Thus, managers still need to take short-term borrowing to cover possible losses when future sales are wrongly estimated.

Finally, the interest coverage has a weak positive on the profitability, which means that the stronger ability to meet obligations will improve the profitability. However, this correlation is statistically insignificant; thus, the positive effects of interest coverage are uncertain. It will not be essential for managers to consider this factor in taking financing in Singapore.

5. CONCLUSION

Throughout the research, a regression model describing the change in capital structure on the profitability of pharmaceutical companies in Singapore has been developed. In detail, adding unnecessary or long-term debt has negative effects on the profitability of companies. In contrast, operating leverage and interest coverage exert positive effects on profitability. Furthermore, there are several managerial implications developed from the results of the analysis. Managers of pharmaceutical firms in Singapore should avoid taking unnecessary leverage since over-leverage imposes adverse effects on profitability. Also, long-term debt is less preferred, and short-term debt is still necessary to maintain a healthy level of operating leverage. The operating leverage is the percentage change of EBIT divided by the percentage change of sales, which measures the company's sensitivity to the market conditions. Even if a high degree of operating leverage is beneficial to the pharmaceutical industry, high sensitivity to the market conditions also brings considerable risks. Thus, some short-term debt is important in hedging risks.

However, there are still some limitations to this research. Firstly, this research mainly concerns the variables related to financial and operating leverage, and some variables related to business operations are likely to impact profitability. Furthermore, the regression model solely relies on the financial performance, or ROE, to measure the profitability. Thus, it is also important to add some measures of operations into the model. For the future studies, some control variables, e.g., Asset Turnover, or business size, will be added to the model to better capture the change in profitability solely driven by leverage-related variables. Also, there are other measures of profitability from the perspective of profit margin. Future studies will adopt the Gross Profit or Operating Income margin to examine the correlation between leverage and these profit margins.

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