

Could Profitability, Efficiency, and Financial Leverage Signal Return on Equity: An Application of DuPont Analysis in Thailand Setting?

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Abstract

This study aimed to examine a relationship between profitability, efficiency, along with financial leverage and Return on Equity (hereinafter referred to as ROE) of big market capitalization (hereinafter referred to as big market cap) companies listed on the Stock Exchange of Thailand (hereinafter referred to as the SET). This study used both simple regression and multiple regression to analyze and compare the results of the DuPont ratios of 93 big market cap companies listed on setting 100 index constituents (including 6 companies on the reserve list) during 2015–2019, a five-year study period. Moreover, cross-sectional data approach and time-series data approaches are employed in this study. The results from simple regression indicate that net profit margin is significant to explain ROE, but total asset turnover and equity multiplier are not significant to explain ROE. Notwithstanding this, the result from multiple regression indicates that a combination of net profit margin, total asset turnover, and equity multiplier is significant to explain ROE. This evidence suggests that management, analysts, and the like should carefully apply DuPont ratios to forecast the future earnings of a company. In other words, DuPont ratios should not be separately used, resulting in underestimating this comprehensive financial tool to predict the future earnings of a company.

Keywords: DuPont Ratios; ROE; Net profit margin; Total asset turnover; Equity multiplier; Simple regression; Multiple regression

Introduction

It is indisputable that capital market plays a major role in an economic resource allocation of each country across a continent. Particularly, in an emerging market, like Thailand, big market cap companies listed on the SET play a crucial part to draw funds from domestic investors and international investors. To do so, the big market cap companies are necessary to maintain profitable. Good financial health of the big market cap companies is not only beneficial to shareholders, but also beneficial for the country's economy. On the other hand, poor financial health of the companies can result to business failure and the country's economic stagnation.

Financial analysis is a measure of analyzing accounting information of a company at a designated period in order to help stakeholders to understand financial health of the company with support of a wide variety of financial techniques. One of commonly used financial techniques is ratio analysis (for instance, studies of Bansal and Kar, 2021; Karim, Shetu & Razia, 2021; Rodrigues & Rodrigues, 2018; Stefano, 2015; and Zainudin & Hashim, 2016).

According to Corporate Finance Institute (n.d.), financial ratios can be classified into five groups, that is, liquidity ratios, efficiency ratios, leverage ratios, profitability ratios, and market value ratios. Each group measures different performances of a company. For instance, liquidity ratios measure a company's capability to repay short-term liabilities, while efficiency ratios measure how a company effectively manages its assets to generate revenues. Profitability is a measure of a company's ability to generate revenues relative to operating costs/expenses, resulting to being one of the most comprehensive financial measures in evaluating a company's success. Return on Equity, or ROE, is a prominent ratio in Profitability that has been frequently used by previous studies such as Almazari (2012), Dinh & Pham (2020), and Kamar (2017).

Referring to previous studies aforementioned, ROE is a widely used ratio to assess a company's financial performance. Concerning to DuPont analysis framework, ROE composes of net profit margin, total asset turnover, and equity multiplier. Net profit margin represents profitability; total asset turnover represents efficiency; and equity multiplier represents financial leverage (Almazari, 2012; and Hao & Choi, 2019). In addition, Kamar (2017) finds that ROE has a significant effect on the stock price of cement companies listed on Indonesia Stock Exchange. This is consistent with Juwita & Diana (2020)

finding that ROE has a significant positive effect on the stock price of listed companies on Indonesia Stock Exchange, indicating that higher ROE leads to higher stock price and vice versa. It is indisputable that higher stock price can lead to shareholder's wealth return. Therefore, the result of this study will provide a comprehensive financial tool to management of start-ups and/or small-medium enterprises in Thailand in managing ROE, resulting to growing their company's market capitalization or stock price.

Furthermore, from conducting literature review in the past 10 years, Thai study relative to DuPont analysis of ROE is lacking and difficult to refer to. It seems the DuPont analysis framework has been ignored by academics and researchers in Thailand even though the DuPont analysis of ROE is a prominent ratio of profitability of a company that management has to pay more attention in maximizing shareholders' wealth. Unlike researchers in Thailand, researchers in other countries (such as Indonesia, India, Pakistan, the U.S., and so on) have frequently conducted their studies concerning an effectiveness of the DuPont analysis of ROE to financial performance or stock price of a company. To fulfil the study gap in Thailand and to revisit the DuPont analysis framework, this study attempts to examine the DuPont analysis of ROE of big market cap companies listed on the SET.

Research Objectives

To systematically examine the three components of ROE, the objectives of this study are as follows:

1. To examine a predictive ability of net profit margin, total asset turnover, and equity multiplier, individually, to ROE of big market cap companies listed on the SET.
2. To examine a predictive ability of a combination of net profit margin, total asset turnover, and equity multiplier to ROE of big market cap companies listed on the SET.
3. To search for the most influential predictor of future earnings of big market cap companies listed on the SET by comparing the predictive ability in (1) and (2)

Scope of Research

Applying a secondary data research approach, this study initially collects financial ratios of 106 biggest market cap companies listed on SET 100 index constituents (including 6 companies on the

reserve list). Due mainly to data availability, only 93 companies make it as a sample of this study, accounting for 88 percent (93/106) of the companies listed on SET 100 index plus 6 companies on the reserved list, and 16 percent (93/590) of the companies listed on the SET. Referred to the SET data on 23 November 2021, there are 590 listed companies. The study period is five years, during 2015–2019. To explain DuPont analysis of ROE, this study uses net profit margin representing profitability; total asset turnover representing efficiency; and equity multiplier representing financial leverage.

Literature review

In the 1920s, DuPont analysis was developed by a management at the DuPont Corporation to investigate the company's financial profitability (Turner et al., 2015; Warrad & Nassar, 2017). In an early development stage of Dupont analysis, only net profit margin and total asset turnover are in the DuPont analysis, which two financial ratios are components of return on assets (ROA). Later on, the DuPont analysis' conceptual shift from ROA to ROE by including equity multiplier (Almazari, 2012). The modified DuPont analysis of ROE has been widely used by accounting and financial researchers, who try not only to extend the use of DuPont analysis to different settings where such analysis is to be lacking, but also to provide an empirical evidence of the DuPont analysis' effectiveness as a useful signal for analysts' earnings forecast.

In the U.S., there were a couple studies relative to DuPont analysis as a financial tool in assessing a company's financial profitability. Chang, Chichernea & HassabElnaby (2014) study financial performance of U.S. health care companies using the DuPont analysis technique and find that net profit margin is a more contributor to the companies' future profitability than total asset turnover. Also, Turner et al. (2015) examine what drives financial profitability of U.S. private and public hospitals applying DuPont analysis. The results show that the U.S. private hospitals are more aggressive than the U.S. public hospitals in terms of DuPont analysis. In other words, the U.S. private hospitals has higher net profit, higher total asset turnover, and noticeably more financial leverage than these of the U.S. public hospitals.

In emerging markers (for instance, Southern Asia, Southeast Asia, and the like), DuPont analysis was commonly used by researchers so as to investigate financial profitability of a company in a wide

variety of industries. Sheela & Karthikeyan (2012) examine top three Indian pharmaceutical companies' financial performance using DuPont analysis. Their findings is consistent with the U.S. studies aforementioned that DuPont analysis is the most useful financial tool to assess profitability of a company. Padake & Soni (2015) employ DuPont analysis to measure Indian 12 banks' efficiency and find that an individual ratio alone cannot indicate an efficiency of the banks, but a combination of DuPont ratios provides a financial tool to capture the banks' efficiency. According to the three studies, it can be inferred that net profit margin and total asset turnover are the key components driving financial performance of a company.

Kim (2016) applies DuPont analysis to investigate financial performance of Korean seven food distribution companies and confirms that DuPont analysis provides a comprehensive measure of profitability of a company. Hao & Choi (2019) investigate operating performance of seven Chinese online shopping companies and document that financial performance of the companies depends on a combination of net profit margin and total asset turnover. Shahnian & Endri (2020) assess financial performance of seven Indonesian trading, service and investment companies and note that a combination of profit margin and total asset turnover is a comprehensive measure of financial performance of a company.

According to the literature review aforementioned, it can be inferred that 1) DuPont analysis of ROE has been extensively used to assist researchers in assessing financial performance of a company since the 1920s, 2) DuPont analysis can be used to examine operating profitability/ financial performance of companies in different countries, industries and/or sectors, and 3) there is no Thai study concentrating on the effectiveness of DuPont ratios in prior literature in the past 10 years. The study gap in Thailand setting will be reduced by this study.

As seen from previous studies above, the three components of ROE are net profit margin, total asset turnover, and equity multiplier. To find what are the key drivers of ROE of big market cap companies listed on the SET, the following hypothesis are developed:

H1: There is a significant relationship between net profit margin and ROE of big market cap companies listed on the SET.

H2: There is a significant relationship between total asset turnover and ROE of big market cap companies listed on the SET.

H3: There is a significant relationship between equity multiplier and ROE of big market cap companies listed on the SET.

H4: There is significant relationship between a combination of net profit margin, total asset turnover, and equity multiplier, and ROE of big market cap companies listed on the SET.

Research Methodology

Like previous studies (Kamar, 2017; and Shahnia & Endri, 2020) applying secondary data approach, this study used accounting information of big market cap companies listed on SET 100 index constituents, including 6 companies on the reserve list, derived from a data source of the SET. Due mainly to data availability, only 93 companies were used as a sample of this study. The study period was from 2015 to 2019, a five-year period before COVID –19 pandemic. In addition, this study employs panel data approach, consisting of cross-sectional data (seven industry groups), and time series data (a five-years period). Statistics used includes skewness, kurtosis, natural logarithm, simple regression, and multiple regression.

Table 1 Industry groups of the big market cap companies

Industry Group Name	Number of companies
Agro and Food Industry [AGRO]	7
Financials [FINCIAL]	14
Industrials [INDUS]	2
Property and Construction [PROPCON]	16
Resources [RESOURC]	20
Services [SERVICE]	25
Technology [TECH]	9
Total	93

Since this study focuses on DuPont ratios, accounting information used in this study includes net profit margin, total asset turnover, equity multiplier, and ROE. Representing profitability, net profit margin, that shows a relationship between net profit after tax and net sales, is calculated by dividing

net profit by net sales. Representing efficiency, total asset turnover, that demonstrates a relationship between net sales and total assets, is computed by dividing net sales by total assets. Representing leverage, equity multiplier, that indicates a relationship between total assets and total shareholders' equity, is calculated by dividing total assets by total shareholders' equity. Last but not least, ROE, representing financial performance/profitability of a company that reveals a relationship between net profit after tax and total shareholders' equity, is calculated by dividing net profit by total shareholders' equity. The DuPont analysis, or ROE decomposition, equation can be written as follows:

$$\text{ROE} = \text{Net Profit Margin} \times \text{Total Asset Turnover} \times \text{Equity Multiplier} \quad \dots (1)$$

Results

Since this study applies both simple regression and multiple regression, it is necessary to check a distribution normality of data to ensure that the data used comply with a preliminary requirement of regression. Skewness and kurtosis are two statistical measures used to check whether data are normally distributed or not, and these parameters' value should be zero in a normal distribution (Ghasemi & Zahediasl, 2012). Also, Pek, Wong & Wong (2017) note that data transformations were developed to address an assumption of data distribution normality in regression, and to enhance an interpretation of intended findings for non-statisticians. Aminu & Shariff (2014) state that skewness values between 3 and -3, and kurtosis value between 10 and -10 are an acceptable range. Therefore, this study applies Aminu & Shariff (2014)'s statistical criteria of skewness and kurtosis.

Table 2 Test of Data Distribution Normality before Data Transformation

DuPont Ratios	Skewness	Kurtosis
Net Profit Margin	3.08	18.09
Total Asset Turnover	7.64	66.52
Equity Multiplier	6.60	52.84
ROE	0.23	6.87

Table II shows that almost DuPont ratios, except ROE, have skewness values between 3.08 and 7.64 indicating that data are positively skew. Moreover, a majority of ratios, except ROE, have

kurtosis values more than 10, the critical point, indicating that data have heavy tails or outliers, particularly total asset turnover and equity multiplier. ROE's skewness value of 0.23 is nearly zero, but its kurtosis value of 6.87 indicates that there are a number of outliers. As a result, this study performs data transformation of all ratios aforementioned by applying natural logarithm, which is commonly used in previous studies such as the studies of Almazari (2014), Chen et al. (2019), Lulaj (2021), Maglio, Rapone & Rey (2018), and Nerviana (2015).

Table 3 Test of Data Distribution Normality after Data Transformation

DuPont Ratios	Skewness	Kurtosis
Net Profit Margin	(0.49)	0.41
Total Asset Turnover	0.01	0.32
Equity Multiplier	1.53	3.50
ROE	(1.16)	4.82

Table III illustrates that all skewness values and kurtosis values of DuPont ratios move closer to zero indicating data being relatively perfectly symmetrical and having fewer outliers. As can be seen, after data transformation, normality of distribution of data is consistent with a preliminary assumption of regression. To develop a prediction model of ROE decomposition of big market cap companies listed on the SET, an estimation of both simple regression and multiple regression is conducted.

Since this study applying natural logarithm to comply with an assumption of regression, an equation of ROE prediction model will be written as follows:

$$\ln(\text{ROE}) = \ln(\text{Net Profit Margin}) + \ln(\text{Total Asset Turnover}) + \ln(\text{Equity Multiplier}) \dots (2)$$

Note:

Unlike the ROE decomposition equation in (1), the ROE predictive equation in (2) is derived from regression analysis so the + (plus sign) is used, instead of the × (multiplication sign).

H1: There is a significant relationship between net profit margin and ROE of big market cap companies listed on the SET.

H2: There is a significant relationship between total asset turnover and ROE of big market cap companies listed on the SET.

H3: There is a significant relationship between equity multiplier and ROE of big market cap companies listed on the SET.

Table 4 An Estimation of Simple Regression Models

	Model I	Model II	Model III
Net Profit Margin (Unstandardized Coefficients B)	0.306*		
Total Asset Turnover (Unstandardized Coefficients B)		0.059	
Equity Multiplier (Unstandardized Coefficients B)			0.078
Constant (Unstandardized Coefficients B)	-1.327*	-1.958*	-2.088*
Durbin-Watson	2.202	1.990	2.102
R ²	0.235	0.009	0.005
F	26.662	0.815	0.446
P-value of F	0.000*	0.369	0.506

Note: * = 0.05

Model I = Net Profit Margin as Independent Variable

Model II = Total Asset Turnover as Independent Variable

Model III = Equity Multiplier as Independent Variable

Table IV shows that, when it comes to an individual component of DuPont ratios, net profit margin (Model I) is 0.05 statistically significant to explain ROE of big market cap companies listed on the SET. According to Model I, Durbin-Watson is 2.202 indicating that the data or observations of net profit margin have no autocorrelation problem. R² is 0.235 representing that approximately 23.50 per cent of a change of ROE can be explained by net profit margin. F value of 26.662 and p-value of F of 0.000 signify that the regression model is fit. In sum, there is a significant relationship between net profit margin and ROE of big market cap companies listed on the SET. Therefore, H1 is accepted. The estimation of ROE prediction model using net profit margin as a sole predictor can be written as follows:

$$\ln(\text{ROE}_{\text{predicted}}) = -1.327 + 0.306 \ln(\text{Net Profit Margin}) \quad \dots (3)$$

On the other hand, total asset turnover (Model II) and equity multiplier (Model III) are not statistically significant to explain ROE. It can be inferred that 1) there is no significant relationship between

total asset turnover and ROE of big market cap companies listed on the SET, and 2) there is no significant relationship between equity multiplier and ROE of big market cap companies listed on the SET. Therefore, H2 and H3 are rejected.

According to the results of simple regression above, it can be concluded that the three components of ROE cannot be separately considered because it is against the academics' perspective that net profit margin, total asset turnover, and equity multiplier are the collectively three components of ROE. In other words, a company can improve ROE by managing net profit margin, total asset turnover, and equity multiplier. This explains why this study use the three financial ratios in running both simple and multiple regressions.

To confirm that the long-developed DuPont analysis framework is still workable for Thai companies, this study further examines the three components of ROE by combining them together. To provide a more useful predicting tool of ROE in Thailand context and to answer the following hypothesis, multiple regression will be applied.

H4: There is significant relationship between a combination of net profit margin, total asset turnover, and equity multiplier, and ROE of big market cap companies listed on the SET.

Table 5 An Estimation of a Multiple Regression Model

Model	Unstandardized Coefficients		Standardized Coefficients Beta	T	p-value
	B	Std. Error			
Constant	0.011	0.067		0.164	0.870
Net Profit Margin	1.006	0.028	1.591	35.895	0.000*
Total Asset Turnover	0.970	0.031	1.575	31.263	0.000*
Equity Multiplier	0.932	0.040	0.856	23.335	0.000*

Durbin-Watson = 1.983, $R^2 = 0.939$, $F = 437.476$, p-value of $F = 0.000$, * = 0.05

Table V shows that Durbin-Watson is 1.983, nearly 2.00, suggesting no autocorrelation problem among observations of net profit margin, total asset turnover, and equity multiplier. R^2 is 0.939, a noticeably move closer to 1.00, indicating that a combination of net profit margin, total asset turnover, and equity multiplier can approximately 94 per cent explain a movement of ROE. F value is 437.476

and p-value of F is 0.000 provide sufficient evidence to conclude that the three components of DuPont analysis in multiple regression model improve the fit.

According to B values of the three components of DuPont analysis, it can be inferred that net profit margin is the most contributor to ROE, followed by total asset turnover, and equity multiplier, respectively. A constant's t value is 0.164 (p-value > 0.05), net profit margin's t value is 35.895 (p-value < 0.05), total asset turnover's t value is 31.263 (p-value < 0.05), and equity multiplier's t value is 23.335 (p-value < 0.05).

In conclusion, there is a significant relationship between a combination of net profit margin, total asset turnover, and equity multiplier, and ROE of big market cap companies listed on the SET. Therefore, H4 is accepted. The estimation of ROE prediction model using a combination of the three ratios and multiple regression model can be written as follows:

$$\ln(\text{ROE}_{\text{prediced}}) = 1.006 \ln(\text{NPM}) + 0.970 \ln(\text{TAT}) + 0.932 \ln(\text{EM}) \dots (4)$$

Where

NPM = Net Profit Margin

TAT = Total Asset Turnover

EQ = Equity Multiplier

As can be seen, the ROE prediction model in (3) having net profit margin as an only predictor can explain an approximately 24 percent ($R^2 = 0.235$) change of ROE. Conversely, the ROE prediction model in (4) having a combination of net profit margin, total asset turnover, and equity multiplier as predictors can explain an approximately 94 percent ($R^2 = 0.939$) change of ROE. This confirms that, when it comes to assessing ROE, the three ratios should be collectively considered in one analysis. This is consistent with the DuPont analysis framework that ROE can be improved by managing an optimal set of net profit margin, total asset turnover, and equity multiplier. Moreover, as per the log transformed B values, the most influential predictor of ROE of big market cap companies listed on the SET is net profit margin (B=1.006), followed by total asset turnover (B=0.970), and equity multiplier (B=0.932), respectively.

Since this study transforms original data to the log transformed data to answer all hypotheses, it is time to convert the log transformed data to original data. Hence, the ROE predictive model after taking natural logarithm out can be written as follows:

$$\text{ROE}_{\text{predicted}} = 0.272 (\text{NPM}) + 0.013 (\text{TAT}) + 0.004 (\text{EM}) \quad \dots (5)$$

Pertaining to the ROE predictive model based on original data, the sequence of an important predictor of ROE is still true. As seen in (5), the most influential predictor is net profit margin ($B=0.272$), followed by total asset turnover ($B=0.013$), and equity multiplier ($B=0.004$), respectively. Management and/or financial analysis can use the ROE prediction model in (5) to forecast future earnings of start-ups, small and medium enterprises and/or listed companies in the SET.

Conclusion and recommendations

This study attempts to thoroughly examine three areas of DuPont analysis. When it comes to an individual component by using simple regression, net profit margin is statistically significant to explain ROE of big market cap companies listed on the SET. This is consistent with the result of Warrad & Nassar (2017) study. On the other hand, total asset turnover and equity multiplier are not statistically significant to explain ROE. The result of total asset turnover is not consistent with that of Warrad & Nassar (2017) study. It is probably due to the fact that this study uses companies listed on SET 100 index constituents (including 6 companies on the reserve list) and the study period of 2015–2019, while Warrad & Nassar (2017) use all industrial sectors listed companies during the period of 2008–2015. However, the result of equity multiplier is consistent with that of Bhagyalakshmi & Saraswathi (2019) study, and Warrad & Nassar (2017) study.

When it comes to a combination of DuPont analysis by using multiple regression, there is a significant relationship between a combination of net profit margin, total asset turnover, and equity multiplier, and ROE of big market cap companies listed on the SET. This is consistent with the result of previous studies (for example, studies of Almazari (2012); Kim (2016); Sheela & Karthikeyan (2012); and Turner et al. (2015)).

Like the result of Almazari (2012) study and Turner et al. (2015) study, the big market cap companies in this study make the most use of their operating and investing activities, rather than depend on financing activity. Operating and investing activities represent profitability and efficiency, while financing activity represents leverage. According to multiple regression, net profit margin is the most influential driver of ROE; total asset turnover is the second most influential driver; and equity multiplier is the least influential driver. In other words, the big market cap companies focus more on internal activity-generated revenue than external activities-generated revenue. This findings help confirm the effectiveness of DuPont analysis documented in the prior literature.

Furthermore, this study provide empirical evident that DuPont analysis is a useful financial tool to forecast future earnings of a company when using a combination of net profit margin, total asset turnover, and equity multiplier, rather than using an individual component at a time. Generally, this study expands an understanding of DuPont analysis associated with a use of accounting information, particularly in Thailand setting.

Knowledge from Research

This study contributes to the literature at least four ways: 1) it extends the use of DuPont analysis in Thailand context, where such analysis is considered to be lacking in Thailand setting, 2) it provides evidence on how to effectively use the DuPont analysis to forecast future earnings of a company, and 3) it helps expand understanding of DuPont analysis associated with the use of accounting information of big market cap companies listed on the Stock Exchange of Thailand.

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