The Impact of Golden Ratio-Based Capital Structure on Financial Performance and Market Acceptance: Evidence from Sri Lanka

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ABSTRACT

The literature on the impact of capital structure on a firm's financial performance is diverse and evolving. Several studies have been conducted to investigate the impact of capital structure and financial performance. In recent years, there has been growing interest in the potential application of the golden ratio to finance. The golden ratio, also known as the Fibonacci ratio, is a mathematical constant with an approximate value of 1.618. It has been found in nature and art for centuries and is believed to create a sense of balance and harmony. Moreover, it is interesting that the golden ratio, which commonly describes the optimum behaviour in the natural world. In the recent era of modern science, encompassing fields like economics, business, and finance, discovered the existence of the golden ratio. In finance, this ratio is predominantly used for technical analysis, with relatively less attention given to its application in solving corporate finance issues, particularly concerning capital structure decisions. The purpose of this research is to empirically investigate the impact of golden ratio-based capital structure choice on firms' financial performance and market acceptance of listed companies on the Colombo Stock Exchange. This research utilized empirical and quantitative methods to systematically collect and analyze data, ensuring objective and replicable results. It followed a positivist research philosophy, emphasizing observable facts and scientific rigor to develop generalizable truths. This research used secondary data collected from the annual reports of the companies listed at the Colombo Stock Exchange (CSE). The inclusion criteria are the 136 listed manufacturing and service sector firms spanning the period from 2011 to 2017, giving a total of 952 observations. The results obtained from the research were mixed and, in some cases, contradictory. Significant differences were observed between the two company types. However, in conclusion, these results demonstrate that investor and business decisions are subject to the natural order.

Keywords

Capital Structure, Financial Performance, Golden Ratio, Market Acceptance

1. INTRODUCTION

The main three components of corporate finance, can create value for the business namely Capital structure (Financing policy), Capital budgeting (Investment policy) and Pay-out policy. One of the most crucial and insightful concerns in corporate finance is to determine how organizations should finance their investments and operations. The financing decision concerned with determining the mix of debt and equity is known as the capital structure problem. Capital structure decision can be considered as an important managerial decision as it has a significant impact on firm' s financial performance and market acceptance. This debt-equity choice (capital structure decision) and its impact on value creation has been one of the mainstream finance topics since the seminal paper by Modigliani and Miller (1958). However, the firm needs to find a particular combination of debt and equity that maximizes its overall market value. Selecting an appropriate combination of debt and equity minimizes the cost of financing and it will lead the firms to gain a competitive advantage in the market (Abor, 2007). Furthermore, Abor, (2007) has suggested that combining different levels of debt and equity levels in the capital structure is one of specific strategies used by firms to improve their performance. Aktan and Bulut (2008) define financial performance as the capability of the organization to realize more resources in its chosen business from time to time. Financial performance can be measured or identified by increased revenue generation, the value of assets, competitiveness and increased market share among other characteristics.

The concept of the golden ratio, deeply rooted in the Fibonacci sequence, has captured the fascination of mathematicians and researchers throughout history. The golden ratio is an "irrational mathematical constant", approximately 1.6180339887. It is denoted by the Greek letter phi(φ). is represented by the Greek letter phi (φ). There are various terms describing the relation that is called 'the golden ratio'; golden ratio, golden section, golden mean, (Livio,2002; Piotr, 1996; Richard, 1997), divine section (Latin: section Divina), divine proportion, golden proportion, golden number, golden cut, (Summerson, 1963). The golden ratio emerges when the ratio of two numbers equals the ratio of their sum to the larger number, creating a distinctive and aesthetically pleasing proportion. It has been observed in many natural phenomena. The golden ratio and the Fibonacci sequence have a wide application in the modern world. This ratio has been discovered by modern sciences, like economics, business, and finance. Over time, the study of the golden ratio has been not confined only to mathematics and geometry, but it also exists as a research and study inspiration in diverse fields: accounting, arts, architecture, biology, psychology, medicine, music, history etc. where its application has revealed intriguing correlations and predictive power. When it comes to the finance field, the ratio is mostly applied for technical analysis, and much less attention is given to its use in solving corporate finance problems, such as capital structure decisions.

The study introduces a unique and potentially significant aspect of finance by integrating the golden ratio into capital structure decisions. It addresses a significant research gap in the Sri Lankan context, offering fresh insights into the subject. To the best of my knowledge, there is no research available in the literature in Sri Lanka that investigates the question of optimal capital structure with an empirical approach and applies the golden ratio. Accordingly, this is the first study that examines the relationship between golden ratio-based capital structure on a firm's financial performance in Sri Lanka. The main objective of this research is to investigate the impact of the golden ratio-based capital structure on the financial performance and the market acceptance of companies listed on the Colombo Stock Exchange. In other words, to determine whether there are any positive impacts of a golden ratio-based capital structure on financial performance and market acceptance.

Firms that are able to find and maintain the optimal capital structure can reduce financing costs and boost firm performance. Therefore, finding the optimal financial leverage while maintaining the balance between the benefits and the risks to raise the firm's value are constantly vital matters for financial managers, and the topic remains as an interesting subject of empirical research in corporate finance. Accordingly, this research was conducted based on the problem that "Does golden ratio-based capital structure has an effect on the financial performance and the market acceptance of listed companies in Sri Lanka?"

2. LITERATURE REVIEW

2.1. Theoretical Background

2.1.1. Capital Structure

The capital structure of a firm is the composition or structure or the mix of types of debt and equity that the company uses to finance its business, which consists with a wide range of sub-instrument. Equity signifies the share of ownership in the company. Debt represents money that the company borrowed from financial institutions or the public through the issuance of debenture. Accordingly, there are several combinations among these instruments to create the capital for a company. Capital structure is a key determinant of the overall costs of capital. Further it contributes to the company's total level of risks.

Capital structure represents an abecedarian issue in the finance literature. The relationship between capital structure decisions and enterprise performance was emphasized by several theories substantially, including the agency theory, information asymmetry theory, signaling theory and the tradeoff theory. Since the pioneering research of Modigliani and Miller (1958), researchers have been following and extending their work to develop theories that explain capital structure decisions.

2.1.2. Capital Structure Theories

Traditional Theory of Capital Structure

According to this theory when the cost of capital is minimized, the optimal level of leverage is attained. This theory is supported by Alexander (1963), who asserts that the weighted average cost of capital (WACC) decreases when debt is used. In the opinion of Pandey (1999), there is an optimal level of capital structure, and this view is supported by two factors: the ability to deduct taxes from interest payments and market imperfections.

Theory of Irrelevancy / MM Theorem / Modigliani and Miller (MM) Proposition

In 1958 Franco Modigliani and Merton Miller laid the foundation for capital structure theory. They argued that, under certain assumptions, the value of a firm is independent of its capital structure. In other words, capital structure decisions do not affect firm value. According to them, no capital structure mix is better than another. It provides a starting point for understanding the neutrality of capital structure in a perfect market.

The Trade-off Theory

The trade-off theory of capital structure is a financial theory that states that a company should balance the costs and benefits of debt and equity financing to achieve an optimal capital structure. This theory introduces the concept that firms balance the benefits of debt (tax shields) with the costs (financial distress and agency costs). According to the trade-off theory, a company should refrain from using debt financing if the tax advantages gained outweigh the costs of potential bankruptcy.

Signal Transmission Theory

The theory explores how a firm's choice of capital structure can serve as a signal to investors and external stakeholders regarding its financial health and future prospects. This theory suggests that a firm's capital structure decisions can convey valuable information about its financial performance and management's expectations, ultimately impacting its ability to attract investors and influence its cost of capital.

Pecking Order Theory

The pecking order theory, initially proposed by Myers and Majluf in 1984, posits that firms prioritize sources of financing based on the informational asymmetry between management and external investors. According to this theory, firms have a hierarchy of financing sources, with internal funds being preferred, followed by debt, and then equity issuance.

Agency Cost Theory

The Agency Cost Theory revolves around the concept of agency costs arising from the principal-agent relationships in firms, particularly between shareholders and managers or creditors and shareholders. In the realm of agency problems, company executives typically prioritize their interests before

focusing on enhancing shareholder wealth and increasing stock prices. In the mid-1970s, studies into agency costs focused on conflicts of interest between shareholders (owners) and managers (agents) and between lenders and firm owners. An ideal capital structure was thought to strike a balance between agency costs, tax advantages of interest payments, and financial distress costs.

The Signaling Hypothesis

The signaling hypothesis, a fundamental concept in corporate finance, explores how firms use various financial decisions and signals to convey internal information about their financial health and prospects to external stakeholders. The signaling hypothesis was developed by Ross (1977), who argued that firms with strong prospects tend to issue equity, while those with limited growth opportunities are more inclined to issue debt.

Theory of Control Right

Control rights theory provides a comprehensive framework for understanding the intricate relationship between ownership, control rights allocation, agency conflicts capital structure decisions, and firm financial performance. The allocation of control rights within a firm shapes managerial behavior, influences leverage choices (debt capacity), and ultimately affects financial outcomes.

The Asymmetric Information Theory

The asymmetric information theory states that the insiders such as managers and owners possess better information about the firm and its performance compared to the external stakeholders. Furthermore, this theory posits that disparities in information between insiders (firm managers) and outsiders (investors) can significantly influence financial decisions and outcomes. When it comes to the impact of capital structure on a firm's financial performance, asymmetric information significantly influences the choice of capital structure, which, in turn, has a discernible impact on the firm's financial performance. The implications of the asymmetric information theory on capital structure choices reverberate throughout a firm's financial performance.

Market Timing Theory

This theory posits that firms may time their debt issuances based on market conditions. It has been stated (Baker and Wurgler, 2002: 1–32) that this theory highlights the significance of considering changes in market value over time when making decisions about issuing debt or equity. It further states that the condition of the stock market influences managerial decisions regarding capital structure, and managers may incorporate information from the stock market when determining how to finance their businesses (Myers,1984:575–592).

Golden Ratio and its Application

The Fibonacci sequence, named after the renowned mathematician Leonardo of Pisa (Fibonacci), begins with the numbers 0 and 1, where subsequent numbers in the sequence are obtained by summing the two preceding ones. An intriguing property of this sequence is dividing any number in the sequence by the one before it yields a fraction that converges asymptotically to the golden ratio, approximately 1.618. This leads to the definition of point C on line AB, where AC/CB = AB/AC = 1.618. Another way to express this is that line AB is divided

at point C, with AC representing 61.8% of AB and CB representing 38.2% of AB (Rahmatillah and Prasetyo,2016: 424–435). According to the golden ratio principle, the larger line should constitute 0.618, while the smaller line should be 0.382 (Ezirim et al.,2017:68-89). This mathematical phenomenon underscores the inherent connection between the Fibonacci sequence and the golden ratio. The Golden ratio is a fundamental element of the Fibonacci sequence, which appears in various financial contexts. Traders and analysts have used Fibonacci retracement levels to identify potential support and resistance levels in stock prices. It has been stated (Frost and Prechter,2005) that some practitioners of technical analysis use the Golden ratio as a tool for identifying trends and predicting price movements in financial markets. In portfolio management, some investors apply the Golden ratio to determine the allocation of assets in a portfolio, believing that it may optimize risk-adjusted returns. The aesthetic appeal of the Golden ratio may influence investor sentiment and decision-making, potentially affecting market dynamics.

In conclusion, capital structure theories have evolved over time, with considerations of tax benefits, bankruptcy costs, and financing hierarchy. The Golden ratio, deeply rooted in mathematics and aesthetics, has found relevance in finance through its application in technical analysis, portfolio management, and its potential psychological impact on financial markets. While its direct impact on capital structure remains a topic of exploration, its influence on financial decision-making is an intriguing aspect of contemporary finance.

2.2. Empirical Literature

In the context of capital structure, researchers have explored whether adhering to this ratio, particularly in terms of debt and equity proportions, can have an impact on a firm's financial performance. Some key findings from the literature are as follows. Recent economists focus on the golden ratio for economic development in the field of economics. Methods of managing economic theories were explored by Endovitsky et al. (2017, 2019) based on the system life cycle concept with the aim of reviewing the problems related to the assessment of financial condition and analysis of sustainable development of organizations. Furthermore, in 2019 they developed methods to assess the balance of subsystems of enterprise structure to assess the balance of development of economic entities. Moreover, there are numerous business applications of the golden ratio in the literature such as management, operations management, marketing, accounting and finance.

In the marketing field, the research done regarding sales strategies by Fischer, (1993); Thomas and Chrystal (2013) provide evidence for the use of the golden ratio in business. The relationship between consumer preferences and the golden ratio was explored by Nikolic et al. (2011). He analyzed packaging designs in terms of consumer preference and revealed the priority of packaging designs based on the golden ratio than other packaging designs. When it comes to operations management domain, Disney et al., (2004) investigated the use of the golden ratio to determine the optimal gain in stocks and the work in progress feedback loop. Furthermore, Pan and Jarrett (2013), applied a so-called ‘golden ratio search’ in quality management to search for an optimum. The golden ratio

search can be defined as the use of the proportions derived from the golden ratio (0.618 and 0.382) to condense the width of the range in each step. This approach becomes effective in unimodal optimization as it results in the least number of searches or trials to locate the optimum. The golden ratio search involves utilizing the proportions derived from the golden ratio (0.618 and 0.382) to narrow down the range in each step. This method proves effective in optimizing unimodal functions, requiring the fewest searches to find the optimal solution.

In the realm of finance, investigations centered around Fibonacci numbers and the golden ratio primarily focus on financial markets which is used in financial technical analysis to identify potential support and resistance levels in stock prices. They argue that stock markets behave irrationally and unpredictably, reflecting the inherent human desires, mass psychology, and emotions at play. Stock markets are viewed as chaotic and nonlinear, quantifiable through fractal geometry like the Fibonacci series (Williams, 2012). Ralph Nelson Elliott introduced his Wave Principle in 1935, predicting stock price movements based on Fibonacci numbers. His discovery revolutionized the perception of stock market trading, shifting it from chaos to organized predictability. Elliott's theory identifies repetitive cycles in stock price movements, making them observable and predictable (Fischer 1993; Livio 2003; Brown 2010). However, many contemporary market analysts are less optimistic about using Fibonacci numbers to predict financial markets, citing limitations in applying the theory in practice (Lo et al., 2000; Narasimhan and Jagadeesh 2000; Bhattacharya and Kumar 2006). Nonetheless, practitioners haven't entirely abandoned the idea of using Fibonacci numbers in their analyses; they continue to reference them with some adjustments (Bhattacharya and Kumar 2006; Frost and Prechter 2005; Greenblat 2007; Lahutta 2016).

In fundamental analysis, various accounting ratios alongside earnings data are employed by financial analysts to glean insights into firm value, growth, stability, future prospects, or the risk of bankruptcy. Amershi and Feroz (2000) explored whether the Fibonacci sequence, the golden ratio, and the golden mean, along with their frequencies, could distinguish between legitimate companies and fraud. They noted a lack of systematic research on the probability distribution of commonly used financial ratios, either at a single point in time or over multiple periods. Their paper aimed to analyze the unconditional probability distribution of the Total Debt/Total Invested Capital ratio to assess whether the occurrence of the Fibonacci golden mean and the golden ratio as potential values for this ratio are random or indicative of firm survival. However, they found no statistical significance in either the sample of randomly selected ones or surviving companies, although they identified numerous distributions that could statistically differentiate surviving companies from others.

The golden ratio's alignment with natural patterns extends to its application in defining ideal feedback gain in production and inventory control systems. It has also been employed as the foundation for "buy one get one free" (BOGOF) sales, striking a balance between company and customer needs. Research on the optimal capital structure has been conducted by Fruhan et al. (1992), Damodaran (1994), and Fernandez (2001). Fruhan et al. (1992) used a simple

example to show how stock price, firm value, and cost of capital change at different debt levels. They concluded that the optimal capital structure is a debt-to-equity ratio of 30%. Damodaran (1994) used a similar approach with real data from Boeing and obtained the same result. Fernandez (2001) criticized the approaches of Fruhan et al. and Damodaran, identifying conceptual problems in their work, with detailed explanations. The common point in all three studies is that they interpreted the optimal capital structure from a financial theory perspective, and none of them considered the golden ratio as a possible factor.

The relationship between capital structure and financial performance has been widely studied in the international literature. Most studies have found that capital structure choices determine firm performance and value, but the results have been mixed. Some studies, such as Arbor (2005), Adair and Adaskou (2015), and Jouida (2018), found a positive relationship between leverage and performance. Other studies, such as Majumdar and Chhibber (1999), Gleason et al. (2000), Vo and Ellis (2017), Le and Phan (2017), and Qayyum and Noreen (2019) found a negative effect of leverage on performance. A comprehensive literature review was published by Kulis and Hodzic in 2020. In that book they address the interdisciplinary nature of research in the number 1.618. A summary was prepared by them on the main findings related to the golden ratio in fields such as medicine, biology, chemistry, physics, geology, psychology, sociology, fashion and design, engineering, modern technologies, business and economics.

In 1957 Chapin searched for a principle of determination (i.e., evidence) of optimal firm size in order to research firm growth. By using Fibonacci series ratio model to derive a theoretical measure, he found that organizations are bounded in growth according to the Fibonacci proportion. Biancone et al. (2017) employed financial ratio analysis to investigate the possible existence of the golden ratio in accounting and the preparation of financial statements. They proved that the averages of the calculated financial ratios for each company were equal to a predetermined value (which they called the golden number).

The principles of the constructal law, areas defined by the golden ratio, and the second law of thermodynamics were applied by Rehwinkel (2016) to examine the attraction of business entities toward maximum debt states. Despite these concepts' associations with natural sciences, the author argued the relevance of these concepts in analyzing liabilities to assets. When it comes to the fields of corporate financial reporting and financial risk analysis, symmetry plays a role in the fundamental accounting equation, influencing the creation and interpretation of corporate capital structures. The author employed an inverted phi to determine the potential ranges for capital structure ratios over time, concluding that a transdisciplinary guideline can be developed through the constructal law, the golden ratio, and the second law, enabling the disclosure and analysis of capital structure formations in business entities and sectors.

This literature review reveals that there are a number of different finance and accounting-related areas where the golden ratio is used, nevertheless, these are mainly focused on the stock market and technical analysis. Rehwinkel (2016) was the only researcher who tried to connect the golden ratio with capital structure before J. Ulbert et al. (2022) but in that study no attention was given

to the relationship between the capital structure and the firm's financial figures or value. The impact of capital structures based on the golden ratio on financial performance and market acceptance has been rigorously examined by J. Ulbert et al. (2022). This innovative approach aimed to unveil how the golden ratio enhances their financial performance. Such structures were found to be effective instruments for enhancing company performance and market acceptance. The hypothesis that the optimal capital structure follows the golden ratio was developed based on the literature. Strong correlations were established between deviations from golden ratio-based capital structures and historical peaks in firms' several financial performance indicators and market performance indicators. These findings suggest that embracing the golden ratio in capital structure decisions can lead to improved financial performance.

3. METHODOLOGY

This research study was conducted as quantitative research and based on the positivist research philosophy. A purely empirical approach was used for this research: that capital structure is optimal when the company's financial performance figures (revenue and net income) and market indicators expressing investor's opinion (stock price and enterprise value) are closest to the firm's potential, that is, the historical maximum within a given period. Thus, this investigation is based on the hypothesis that this optimal capital structure follows the golden ratio. In other words, the research is based on the hypothesis following traditional thinking, meaning that the decisions on capital structure determine the firm's performance and value, while avoiding the assumption of a reverse causality represented by Margaritis and Psillaki (2010). The population of this study was manufacturing, and service companies listed on the Colombo Stock Exchange. In addition to the total sample, this analysis is extended to the examination of potential differences between different company profiles/types (manufacturing and service). Financial data (assets, liabilities, shareholders' equity, revenue, income, stock price and the EV/ EBIT valuation multiple) of all available quoted companies were examined for the period 2011–2017. This period was selected to observe the above relationship under 'normal' market circumstances, thus, the period examined contains the years after the 2008–2009 global crisis and before the outbreak of the coronavirus epidemic in 2020. Historical financial information was collected by using secondary data sources. The data collection resulted in 952 observations for each variable, based on the length of the examined period (7 years) and the number of firms in the sample (136). The input data of six different variables (financial performance indicators and market data) for each company-year in the sample were collected and used for the analysis, as presented in the following table.

Table 1: Input Data Collected for the Empirical Analysis

Variable	Description
$SHE_{i,t}$	Shareholders' Equity of company i in year t
$TA_{i,t}$	Total Assets of company i in year t
$TR_{i,t}$	Total Revenue of company i in year t

$NI_{i,t}$	Net Income of company i in year t
$P_{i,t}$	Closing stock price of company i in year t
$EV\_EBIT_{i,t}$	The ratio between Enterprise Value and Earnings Before Interest and Tax of company i in year t
Source: Ulbert, J., Takacs, A. and Csapi, V. ,2022	

The independent variable is defined as the shareholders' equity to total assets ratio's absolute deviation from the golden ratio-based 0.382 (which is one minus the invert of phi):

$$SHE / TA\_d_{i,t} = \left| \frac{SHE_{i,t}}{TA_{i,t}} - 0.382 \right|$$

The absolute deviation ratio is a measure of the magnitude of the deviation i.e, difference from the 0.382 value, but it does not indicate the direction of the deviation. The dependent variables are defined as follows:

Dependent variable 1: Deviation of actual total revenues from the seven-year maximum:

$TR\_d_{i,t} = [TR_{i,t} - Max\ (TR_i)]$

Dependent variable 2: Deviation of actual net income from the seven -year maximum:

$NI\_d_{i,t} = [NI_{i,t} - Max\ (NI_i)]$

Dependent variable 3: Deviation of the actual stock price from the seven -year maximum:

$P\_d_{i,t} = [P_{i,t} - Max\ (P_i)]$

Dependent variable 4: Deviation of the actual EV/EBIT multiple from the seven -year maximum:

$EV/EBIT\_d_{i,t} = [EV/EBIT_{i,t} - Max\ (EV/EBIT_i)]$

The regression models were developed based on the concept that is, if the assumption about the positive effect of a golden ratio-based capital structure on financial performance and/or market acceptance is valid, then there should be a significant positive relationship between the dependent variable and one or more dependent variables. Developed four regression models are as follows.

Revenue model: $TR\_d_{i,t} = a_i + ß \times SHE / TA\_d_{i,t} + u_{i,t}$

Income model: $NI\_d_{i,t} = a_i + ß \times SHE / TA\_d_{i,t} + u_{i,t}$

Price model: $P\_d_{i,t} = a_i + ß \times SHE / TA\_ d_{i,t} + u_{i,t}$

Value model: $EV/EBIT\_d_{i,t} = a_i + ß \times SHE / TA\_ d_{i,t} + u_{i,t}$

The four regression models were tested to find statistical evidence, that the financial performance and market acceptance indicators are better in those company years when the equity to total assets ratio is closer to the phi-based level. The Stata software was used for the statistical analysis, by setting a significance level of 5% where a summary of descriptive statistics, correlation analysis and multiple regression analysis was performed and analyzed. Furthermore, two control tests were made to confirm the robustness of the results i.e. two alternative versions of the independent variable were applied $SHE/TA\_ d_{i,t}^{0.618}$ and $SHE/TA\_ d_{i,t}^{0.5}$ variables express the deviation of the ratio observed for the company i in year t from 0.618 (assuming a reverse golden ratio based capital structure, containing 61.8% equity and 38.2% debt) and 0.5 (assuming a balanced capital structure of 50- 50% of equity and debt).

4. RESULTS AND DISCUSSION

4.1. Results

Descriptive analysis, correlation analysis, and regression analysis were performed to analyze the data that were collected, utilizing a fixed effect model aligning with the hypothesis testing. It is important to emphasize that the investigation was based on the traditional hypothesis that capital structure decisions influence a firm's performance and value, avoiding assumptions of reverse causality (Margaritis and Psillaki 2010: 621–632).

4.1.1. Descriptive Analysis

According to the results on Table 2, in general, the firms in the study deviate positively from the Golden Ratio-based capital structure. The standard deviation is relatively high, implying that there is substantial variation in how firms deviate from the Golden Ratio. Some firms may deviate significantly, both positively and negatively. The range from -0.393 to 8.577 shows that there is a widespread in the extent of deviation from the Golden Ratio.

Table 2: Summary of Descriptive Statistics for the Total Sample					
Variable	**Obs.**	**Mean**	**Std. Dev.**	**Min**	**Max**
SHE/TA_d	952	0.2390385	0.4073969	-0.3928977	8.576818
TR_d	945	-1.35e+09	4.48e+09	-4.40e+10	1.97e+07
NI_d	945	-4.64e+08	1.33e+09	-2.05e+10	0
P_d	945	-901849.2	1.35e+07	-2.65e+08	0
EV/EBIT_d	945	-85.10919	244.4722	-2304.043	0

The findings suggest that, on average, firms tend to have deviations from their seven-year maximums in terms of total revenues, net income, stock price, and EV/EBIT multiples. The independent variable, SHE/TA_d, shows that the majority of firms deviate from the Golden Ratio-based capital structure, with a positive deviation.

Table 3: Summary of Descriptive Statistics for the Manufacturing Sector Sub Sample					
Variable	**Obs.**	**Mean**	**Std. Dev.**	**Min**	**Max**
SHE/TA_d	476	0.1751899	0.3120854	-0.3928977	2.026242
TR_d	469	-2.15e+09	5.64e+09	-4.40e+10	1.97e+07
NI_d	469	-6.95e+08	1.78e+09	-2.05e+10	0
P_d	469	-134.1319	754.8332	-10999	0
EV/EBIT_d	469	-86.40649	267.0169	-2256.493	0

Source: Author calculations based on survey data

Table 4: Summary of Descriptive Statistics for the Service Sector Sub Sample					
Variable	**Obs.**	**Mean**	**Std. Dev.**	**Min**	**Max**
SHE/TA_d	476	0.302887	0.4761577	-0.3817666	8.576818
TR_d	476	-5.55e+08	2.70e+09	-3.58e+10	0
NI_d	476	-2.37e+08	5.53e+08	-4.75e+09	0
P_d	476	-1790304	1.89e+07	-2.65e+08	0
EV/EBIT_d	476	-83.83096	220.2902	-2304.043	0

Source: Author calculations based on survey data

4.1.2. Correlation Analysis

Table 5: Correlation Matrix for the Total Sample					
	SHE/TA_d	**TR_d**	**NI_d**	**P_d**	**EV/EBIT_d**
SHE/TA_d	1.0000				
TR_d	0.1121*	1.0000			
NI_d	-0.0040	0.2458*	1.0000		
P_d	-0.0402	-0.0195	-0.0132	1.0000	
EV/EBIT_d	-0.0924*	-0.0708*	-0.0291	-0.0214	1.0000

(Notes: '*'significant at 0.05)

Source: Author calculations based on survey data

In general, the results of the correlation analysis for the data set show that there is no strong statistical relationship between the dependent variables and the independent variables of this study.

4.1.3. Regression Analysis

The four models were tested on the total sample, which encompasses all companies (manufacturing and service sectors). Table 6 summarizes the regression result obtained for the four models (Revenue, Income, Price, and Value) on the total sample containing all manufacturing and service companies. Beyond the dependent and independent variable, the coefficient of the independent variable, the standard error, the t and p values and the explanatory power (R squared) are presented. '*' denotes that the model is significant at 5% level ($p < 0.05$).

Table 6: Regression Results on the Total Sample

Sample: All companies (n = 136), 2011–2017

Model	Dependent variable	Independent variable	Coefficient (β)	Std. error	t-ratio	p-value	R^2
Revenue	$TR\_d_{i,t}$	$SHE /TA\_ d_{i,t}$	1.23e+09	3.56e+08	3.46	0.001*	0.0126
Income	$NI\_d_{i,t}$	$SHE / TA\_ d_{i,t}$	-1.30e+07	1.07e+08	-0.12	0.903	0.0000
Price	$P\_d_{i,t}$	$SHE /TA\_ d_{i,t}$	-1328928	1074414	-1.24	0.216	0.0016
Value	$EV/EBIT\_d_{i,t}$	$SHE /TA\_ d_{i,t}$	-55.401	19.464	-2.85	0.005*	0.0085

Source: Author calculations based on survey data

Table 7: Regression Results on the Total Sample (balanced capital structure of 50-50%)

Sample: All companies (n = 136), 2011–2017

Model	Dependent variable	Independent variable	Coefficient (β)	Std. error	t-ratio	p-value	R^2
Revenue	$TR\_d_{i,t}$	$SHE/TA\_ d_{i,t}^{0.5}$	1.52e+09	5.03e+08	3.02	0.003	0.0096
Income	$NI\_d_{i,t}$	$SHE/TA\_ d_{i,t}^{0.5}$	-2.08+08	1.50e+08	-1.38	0.166	0.0020
Price	$P\_d_{i,t}$	$SHE/TA\_ d_{i,t}^{0.5}$	-2122719	1517274	-1.40	0.162	0.0021
Value	$EV/EBIT\_d_{i,t}$	$SHE/TA\_ d_{i,t}^{0.5}$	-100.4617	27.40231	-3.67	0.0000	0.141

Source: Author calculations based on survey data

Table 8: Regression Results on the Total Sample (reverse golden ratio-based capital structure)

Sample: All companies (n = 136), 2011–2017

Model	Dependent variable	Independent variable	Coefficient (β)	Std. error	t-ratio	p-value	R^2
Revenue	$TR\_d_{i,t}$	$SHE/TA\_ d_{i,t}^{0.618}$	1.60e+09	4.77e+08	3.36	0.001	0.0118
Income	$NI\_d_{i,t}$	$SHE/TA\_ d_{i,t}^{0.618}$	-1.46e+08	1.43e+08	-1.02	0.307	0.0011
Price	$P\_d_{i,t}$	$SHE/TA\_ d_{i,t}^{0.618}$	-2065010	1438625	-1.44	0.152	0.0022
Value	$EV/EBIT\_d_{i,t}$	$SHE/TA\_ d_{i,t}^{0.618}$	-93.21187	25.992	-3.59	0.0000	0.0135

Source: Author calculations based on survey data

Table 9: Regression Results on Manufacturing Sector Subsamples

Subsample: Manufacturing sector companies (n = 68), 2011–2017

Model	Dependent variable	Independent variable	Coefficient (β)	Std. error	t-ratio	p-value	R^2
Revenue	$TR\_d_{i,t}$	$SHE / TA\_ d_{i,t}$	2.34e+09	8.30+08	2.82	0.005*	0.0167
Income	$NI\_d_{i,t}$	$SHE / TA\_ d_{i,t}$	-4.68e+08	2.63e+08	-1.78	0.076	0.0067
Price	$P\_d_{i,t}$	$SHE / TA\_ d_{i,t}$	223.8242	111.4676	2.01	0.045*	0.0086
Value	$EV/EBIT\_d_{i,t}$	$SHE / TA\_ d_{i,t}$	-133.805	39.221	-3.40	0.001*	0.0242

Source: Author calculations based on survey data

Table 10: Regression Results on Service Sector Subsamples							
Subsample: Service sector companies (n = 68), 2011–2017							
Model	**Dependent variable**	**Independent variable**	**Coefficient (β)**	**Std. error**	**t-ratio**	**p-value**	**R^2**
Revenue	$TR\_d_{i,t}$	$SHE / TA\_ d_{i,t}$	3.75e+08	2.60e+08	1.44	0.150	0.0044
Income	$NI\_d_{i,t}$	$SHE / TA\_ d_{i,t}$	5.51e+07	5.33e+07	1.03	0.302	0.0023
Price	$P\_d_{i,t}$	$SHE / TA\_ d_{i,t}$	-145843	1825021	-0.80	0.427	0.0013
Value	$EV/EBIT\_d_{i,t}$	$SHE / TA\_ d_{i,t}$	-25.102	21.218	-1.18	0.237	0.0029

Source: Author calculations based on survey data

Table 11: Summary of Regression Analysis			
Sample / Model	**Total sample**	**Manufacturing**	**Service**
Revenue	significant positive (R^2 0.0126)	significant positive (R^2 0.0167)	not significant
Income	not significant	not significant	not significant
Price	not significant	significant positive (R^2 0.0086)	not significant
Value	significant negative (R^2 0.0085)	significant negative (R^2 0.0242)	not significant

Source: Author calculations based on survey data

The study confirms that a higher debt ratio does not definitively translate to a positive or negative impact on financial performance, contradicting previous research. This suggests the need for further investigation into alternative factors influencing performance. Further, the study identifies a critical turning point at a debt-to-total assets ratio of 61.8%, corresponding to the golden ratio. Interestingly, increasing leverage benefits manufacturing companies up to this point, beyond which it negatively affects financial performance. This finding underscores the importance of maintaining a balanced capital structure for optimal performance. The findings of descriptive analysis suggest that, on average, firms tend to have deviations from their seven-year maximums in terms of total revenues, net income, stock price, and EV/EBIT multiples. The independent variable, SHE/TA_d, shows that most firms deviate from the Golden Ratio-based capital structure, with a positive deviation. While the study presents mixed results, it sheds light on the intricate relationship between the golden ratio, capital structure, and financial performance.

5. CONCLUSION

Significant variations between the two company types were found through the testing of four regression models (Revenue, Income, Price, and Value). The positive impact of a golden ratio-based capital structure was only partially demonstrated (mostly for manufacturing organizations). The general conclusion is that financial managers in the manufacturing sector, should use the golden ratio in capital structure decisions, as it may improve the firm's financial performance and market acceptance. In conclusion, these findings demonstrate that the order of nature exists in both company and investor decisions. The study contributes to the literature by exploring an under-researched area. The

integration of mathematical concepts like the golden ratio into financial performance analysis is innovative. The findings suggest that golden ratio-based capital structures may be associated with improved financial performance. The research offers potential insights for financial managers by introducing important new aspects when implementing firms' financing strategies and policies. It is also expected that the results will aid financial managers in their decisions on capital structure i.e., how they should apply the golden ratio in their capital structure decisions, as this may give a boost to the firm's financial performance and market acceptance. Furthermore, this investigation may be useful for the government in its regulatory role and will help to determine the effectiveness of its regulatory guidelines. The research will help potential investors who wish to invest their money in the manufacturing and service sectors. The idea that a simple mathematical ratio could have a positive impact on financial performance is appealing.

However, more research is needed to confirm this relationship and to understand the underlying mechanisms. The empirical results should be considered in the light of some limitations, primarily due to the novelty of the research area. The study is limited to firms listed on CSE therefore the findings may not be generalizable to other markets. The intriguing premise of using the golden ratio in finance opens avenues for interdisciplinary research. Further exploration into the applicability of mathematical constants in other aspects of finance could yield valuable insights. Future research directions could include a broader dataset, and longer periods. Moreover, comparisons across different economic contexts and under varying market conditions would enhance the generalizability of the findings.

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