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ENHANCING FINANCIAL PERFORMANCE AND MARKET ACCEPTANCE THROUGH GOLDEN RATIO-BASED CAPITAL STRUCTURE DECISIONS: AN EMPIRICAL INVESTIGATION IN THE MANUFACTURING AND SERVICES SECTORS

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ABSTRACT

The discovery of the golden ratio and the development and the theory for the golden ratio in modern science have witnessed the use of the ratio across many fields, including business, economics and finance. However, the ratio has rarely been used in solving corporate problems, such as fundamental analysis and capital structure decisions. To bridge the gap in the literature, in this paper, we examine the role of the golden ratio in deciding the capital structure and its effect on the firm's financial performance and market acceptance for the manufacturing and services sector listed on the Pakistan Stock Exchange for the period from 2010 to 2019. In our analysis, we find a significant association between the deviation from the capital structure and the variation of the firm's financial performance and market acceptance by using the golden ratio. The empirical findings of this study suggest that the golden ratio is an efficient tool for measuring capital

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structure and is useful for firms to boost financial performance and market acceptance. In general, the findings in our paper suggest financial managers of both the manufacturing and services sectors use a 38.2% ratio of equity and 61.8% of debt at the capital structure level. To the best of our knowledge, no prior studies in the literature have examined the role of the golden ratio in deciding an optimal level of capital structure in Pakistan. Therefore, our paper has a significant contribution to the existing literature, and the empirical findings of the study are found strong and more evident for manufacturing than the services sector. Moreover, the findings in our paper also suggest managers in Pakistan apply the aforementioned percentage of debt and equity in capital structure level subject to performance measurement.

Keywords Golden ratio, Firm performance, Capital structure, Pakistan Stock Exchange, Market acceptance

INTRODUCTION

Financial decisions are considered the backbone of every business. Therefore, attracted the attention of many researchers around the world. Corporate finance classifies the decision in determining the capital structure mix that best suits an organisation (Uremadu & Efobi, 2012). Similarly, Chandra (2013) reports that capital structure classifies the mixture of debt and equity financing, which the corporation uses to acquire and maintain its assets efficiently. Similarly, sometimes the corporation offsets debt and equity financing to mitigate agency conflicts between shareholders and creditors. Sometimes organisations prioritise debt financing over equity financing because of fixed payment of debt obligations (interest and principal) and tax shield benefits (Chakrabarti & Chakrabarti, 2019). Serval studies (for example, see De Wet, 2006; Baker & Martin, 2011; Goyal, 2013), conclude that when firms use an optimal capital structure, it maximises shareholder wealth. Similarly, an optimal level of capital structure is optimised when a firm uses 50% of its debt and 50% of its equity (Welch, 2007; Swanson et al., 2003). In contrast, some studies report that using 50% of the equity in capital structure, the firm would not enjoy the privileges of debt financing (Song 2005; Chen & Chen, 2011). On the other hand, Vuong et al. (2017) find that short-term debt insignificantly affects firm performance by using return on assets (ROA), return on equity (ROE) and earnings per share (EPS) (Chan & Chu, 2022; Lok et al., 2022). Vu Thi and Phung (2021) find a negative and significant association between debt ratio and firm performance by using both ROA and ROE. Therefore, properly selecting the percentage of debt and equity in the firm capital structure leads to better financial performance (Amin & Cek, 2023; Suu et al., 2021).

In the 12th century, Leonardo da Pisa, a mathematician, introduced the decimal number system. Through his nickname, he articulates the "Fibonacci Summation" series, in which the next number is generated in this series by adding the previous two numbers, beginning with 0 and 1. The uniqueness of this series is that any number divided by the previous number asymptotically yields 1.618. Haylock (2006) documents that the proportion in series usually represents the balance and symmetry between components and the ensemble. Various proportionalities exist in mathematics, geometry, and harmonic proportion, but each type of proportionality is found in 1.618 (Kotliar, 2016). In 1815, German mathematician Martin Ohm used the golden ratio of 1.618 to represent Phi (φ) for the divine proportion for the first time. Over the last 2400 years, the golden ratio has fascinated people in different fields. The findings from diverse applications range from architecture to nature. In recent years, the golden ratio has been used in forecasting asset prices through technical analysis. The non-recurring decimal and the irrational number of the golden ratio, whose decimal part is identical to its square as denoted $\varphi^2 = 2.61803398874$, and the inverse of it is $1/\varphi = 0.61803398874$. Many academics and researchers in science and arts use the golden ratio and the Fibonacci number in the second half of the 20th century (Urmantsev, 2009).

Overview of the Textile and Service Sector of Pakistan

The textile industry operated in Pakistan is considered one of the country's largest and most important industries. Moreover, it is also considered the largest contributor to the country's economy, employment, and exports (Ali, 2023). Similarly, Aslam (2019) finds that the textile sector faces many declines for multiple reasons. Such reason includes high commodity prices and banks' borrowing rates, which adversely limit the financing ratio of the industry. Consequently, Imran (2019) documents that the textile industry accounts for 57% of all exports. Similarly, the sector also creates three million work opportunities. Moreover, the textile sector needs 15 million packs of cotton, but only 10 million packs are produced. In recent years, the textile industry was seen as the state's main source of employment and economic growth. The industry is ranked second in Pakistan regarding job creation and seventh in Asia for exporting textile products. In 2018, it accounted for 8.5% of the nation's overall GDP, and textile goods had an increase of 12.8% annually for the fiscal year ended in 2018. The sector's value increased by 7.18% on a semiannual basis at the start of 2018 to reach USD7.72 billion at the end of the year (Nini, 2018). Arain (2019) documented that in 2008–2009 the textile sector faced an adverse effect of financial turmoil due to political uncertainty and adverse law and order situations and reported negative growth of –0.70%. Later, the sector recorded a track recovery of 13.2% in 2012 to 2013. Similarly, Memon et al. (2020) document that the textile industry of Pakistan faced several challenges like, poor infrastructure, obsolete technology, lack of investment, political instability, and adverse law and order. Despite this, the textile sector has an opportunity to expand its services to South Asian regional competitors with full potential.

The global economy's growth and development largely depend on the service sector. Achieving the Millennium Development Goals (MDGs), which include poverty reduction, access to basic amenities, education, water, and health care, is becoming increasingly vital for a country's growth. The expansion of the global economy is now largely attributed to the service sector. It represents two-thirds of the world's gross domestic product (GDP) (Zeb et al., 2017).

The service sector is the fastest-growing industry, which has the highest employment rates and productivity levels overall. The service industry contributes 47% of the GDP to low-income countries annually, 53% to middle-income countries, and 73% to high-income countries. More foreign direct investment is being attracted due to the service sector's larger GDP contribution (Ahmed & Ahsan, 2011). The proportion of the service sector in Pakistan has increased during the period in all industries. With a 59.6% GDP contribution, the service sector is growing faster than the agricultural and industrial sectors. The sector's important contributions to the agricultural and industrial sectors account for its close economic ties (Government of Pakistan, 2017). One of the essential components in creating and maintaining Pakistan's development and progress is the service industry. The service industry has experienced rapid growth since 2008. Similar to other economies throughout the world, Pakistan's structure saw a significant transformation as a result of this industry. In 2014–2015, the service sector's overall growth contribution to GDP increased to 58.8% from 58.1% in 2013–2014. In high-income countries, the service sector accounts for about 75% of the total GDP (Government of Pakistan, 2017). Similarly, Khan (2017) reports that lack of availability, like the non-fulfillment of financing and credit needs of the sector by the national authorities. In 2017, the credit shot fell to a record USD2.9 billion. Only 5% needs of financing are served by the banking sector. The services sector in Pakistan is considered the corner store of Pakistan's economy, contributing 30% to GDP, 70% to job creation, 25% to total exports, and 1.7% to the production industry. As the service sector makes up two-thirds of the global economy in the era of globalisation and technology, it serves as the growth engine. The service sector, which accounts for 59.6% of Pakistan's GDP, is essential for economic growth (Rathore et al., 2018).

In business and economics, the tendency of the golden ratio has been widely used in economic development, management, sales, stock market analysis, growth forecast, quality control, and fraud detection. Several studies investigate the association between capital structure and firm profitability in manufacturing and services (e.g., Mahmood et al., 2017; Akhtar et al., 2019; Khan et al., 2021; Imran & Sulehri, 2023). However, affirming previous literature, little attention has been given to exploring the capital structure level using the golden ratio. Ulbert et al. (2022) have recently argued that using the golden ratio in finance is mainly applied to technical analysis. However, little attention has been given to investigating the corporate problem, such as capital-structure decisions.Therefore, the prime motivation of this study is to examine a deeper understanding of the golden ratio and capital structure decision. Moreover, this study is conducted to answer the question of how to choose an optimal level of capital structure to boost the financial performance of a business and market acceptance using the golden ratio. This study accounts for novelty for two reasons. First, no studies investigate the role of the golden ratio in deciding an optimal level of capital structure, particularly in Pakistan. Second, previous literature only examines the association between capital structure and the performance of a firm's financial decisions. The findings of this study indicate that the golden ratio is an efficient tool for deciding an optimal level of capital structure, and such decisions are also helpful for firms to boost market acceptance. Further, this study significantly contributes to the existing literature by examining the role of the golden ratio in deciding an optimal level of capital structure. Moreover, the findings of this study are helpful for financial managers in the context of Pakistan for choosing an optimal level of capital structure and policy implications.

LITERATURE REVIEW

Theories of Capital Structure

Recently, studying the association between capital structure and firm performance has attracted the interest of many researchers worldwide (Memon et al., 2012; Mahmood et al., 2022). Capital structure is the most contentious area, with debate posters on whether there is an optimal capital structure to balance a firm's financial performance or whether to rely on debt financing unrelated to the firm's market value (Modigliani & Miller, 1958; Aye, 2021; Chang et al., 2019). Existing literature on capital structure and firm financial performance document mixed results (e.g., Modigliani & Miller, 1958; Myers & Stewart, 1984; Titman & Wessels, 1988; Harris & Raviv, 1990; Rajan & Zingales, 1995; Ghosh et al., 2000; Frank & Goyal, 2003).

Trade-off theory

Considering the market imperfection, firms offset the disadvantages of debt financing and set an optimal level to maximise the debt-equity ratio. Further, such firms primarily struggle to achieve an optimal level (Myers & Stewart, 1984).

According to Modigliani and Miller's (1958) assumption, no taxes exist in a perfect market. The Modigliani and Miller's (MM) theorem is subject to a trade-off theory that considers the expense of bankruptcy and the impact of taxes. Trade-off theory is also regarded as the origin of other capital structure theories that examine how businesses determine their capital structure (Erulgen et al., 2022; Garivaltis, 2021). According to the MM theory, businesses use corporate taxes to determine their optimal debt amount and affect their profitability. Warner (1997) finds that the magnitude of bankruptcy cost considerably affects a firm's debt level bearing in its capital structure. Similar to this, Stiglitz (1969) documents that, as long as there are no transaction costs connected to bankruptcy, the invariance result is true even when there is a positive probability of bankruptcy. When capital structure (debt-to-equity ratio) rises, primarily, debt holders demand higher interest rates; ultimately, shareholders also demand higher returns on their investments. On the other hand, a greater debt level raises the cost of bankruptcy (Brealey & Myers, 2003, p. 508–509). Similarly, debt offers tax shield benefits to the firm, and such an advantage is because of interest paid off for debt (Modigliani & Miller, 1963; Myers, 2001). For instance, Jensen and Meckling (1976) note that when potential buyers believe default is inevitable, a company's sales and profits may decline, and its market value may decrease. This may be the case when potential product buyers have incomplete knowledge and judge the product's operating features based on their opinion of the firm's financial situation. If so, the bankruptcy's significance comes from the information it provides about the firm's longevity and its capacity to offer replacement parts. Similarly, Nadaraja et al. (2011) document that the trade-off theory provides guidelines for financial managers to decide the optimal percentage of debt used in the capital structure. Similarly, the trade-off theory also postulates that a company should not opt for debt financing when a tax shield benefit exceeds the company's expense, which results in bankruptcy. Shubita and Alsawalhah (2012) document that high leverage levels increase the credit default risk of a company and weaken its capacity to pay interest along with the principal amount. Similarly, when a corporation cannot meet its debts and financial obligation and fails to meet the required payment, the corporation will likely default.

Pecking order theory

Donaldson (1961) study the infancy of the pecking order hypothesis. The author studied the practices of financing for a large corporation. Further, it finds that the management of the company intensely prefers internal sources of funds rather than outsourcing for external funds financing except when the firms need funds. Moreover, rising capital through external funds managers usually avoided issuing new stocks. Firms usually rely on internally generated funds (e.g., undistributed earnings). Further, firms avail an opportunity of debt financing to generate additional funds, and later the firms issue equity to cover the remaining capital requirement (Myers & Stewart, 1984; Myers & Majluf, 1984). In contrast to earlier studies, Mayers (1984) documents that different capital structure theories do not explain the actual financing behaviour. Keeping these presumptions, it would be ideal for businesses to follow the ideal level of capital structure (Le & Wong, 2019). The modified pecking order (MPO) theory of capital structure was put forth by Myers (1984) as a substitute for the static trade-off theory of capital structure. The MPO theory of capital structure combines some parts of the trade-off theory and, in contrast to the conventional pure pecking order (PPO) theory, has a specified goal debt ratio. Using the MPO theory as a foundation, Myers (1984) added that an unusually profitable company in a slow-growing industry would initially have a lower debt ratio than the industry average and then maintain that level over time. In other words, one would continuously see less leverage utilisation in the capital structures of extraordinarily profitable enterprises compared to the rest of the market in a slow-growing industry. Similarly, the pecking order theory postulates that most corporations prefer internally generated funding to external funding (debt and equity). Primarily, no specific percentage or optimal level of capital structure was identified. Similarly, the golden ratio was formulated on the assumption of the pecking order theory for deciding the percentage of debt and equity that a corporation can use at the capital structure level. Considering the rules of the golden ratio, the larger line, which is 0.618, represents the portion of the debt, and the smaller line, which is 0.382, represents the equity. Therefore, most firms use debt financing instead of equity financing (Ezirim et al., 2017).

Agency theory

Jensen and Meckling (1976) define an agency relationship as a legal arrangement in which one party, known as the principal, engages another party, known as the agent, to carry out specific tasks on their behalf. An agent receives certain discretionary power from the principal. The principal's decision-making delegations and the ensuing labour decisions boost effectiveness and productivity.

Similarly, Jensen (1986) finds that in terms of small companies, the agency problem is more likely to persuade large companies. The agent is hired or retained by the principal due to the agent's unique skills, expertise, and capacity to raise the value of assets. The agent receives all or a portion of the principal decision rights over the assets (Moldoveanu & Martin, 2001). With this kind of delegation, the principal must trust the agent. In the case of dubious agent motivations and broken trust, agency theory examines potential conflicts of interest between the principal and the agent. By inspecting or reviewing and establishing mechanisms to ensure the agent behaves in the principal's interests, the principal aims to learn more (Berle & Mean, 1932).

Literature on Golden Ratio and its Application

In finance, most studies concentrate on the financial market using the Fibonacci number and golden ratio. Like the randomness in the Fibonacci number stock market, emotions and mass psychology also irrationally regarding human needs, wants, and demands. Fractal geometry, such as the Fibonacci series, can be used to measure the movement of the stock market (Williams, 2012). Similarly, Ralph Nelson (1935) developed the wave principle base on the Fibonacci number. The principle is further used to predict stock movements traded at the stock exchange. In the initial stage, this phenomenon was considered chaotic and disorganised. Later, this development (wave principle) changed the stock trading perception. This theory state that stock trading follows the mechanism of the repetitive cycle, which is predictable and the movements can be found in stock prices (Brown, 2010; Livio, 2003; Fischer, 1993). However, many market practitioners are pessimistic about predicting the performance of financial markets through the Fibonacci number. Moreover, according to some studies, the use of this theory in practice is minimal (see, e.g., Narasimhan, 2000; Lo et al., 2000; Bhattacharya & Kumar, 2006).

Chapin (1957) uses the Fibonacci sequence for firm size by collecting data from 80 churches, subgroup membership, and school enrolment. Moreover, this study finds that according to the Fibonacci sequence, the organisation is bound to the growth development phase in search of an optimal firm size. Amershi and Feroz (2000) studied the likelihood of the debt-to-total invested capital ratio using unconditional distribution and the Fibonacci golden mean and ratio for firm survival. This study finds no statistical significance for the firms which are randomly selected. Further, it finds an infinity distribution for the survival of sub-sample through which the firms can statistically discriminate among others. Using a statistical Z-test, Biancone et al. (2017) explore the philosophy of the Fibonacci number and golden mean in corporate balance sheets. Their study reports inconclusive results for financial ratios in terms of the predicted golden mean. Similarly, Rehwinkel (2016) applied the golden ratio to contractual law and business entities, attracting the states of maximum debt. This study finds that the golden ratio and the liabilities to assets ratio are relevant when used in contractual law.

In business and management, several studies investigate the applications of the golden ratio. Most literature on accounting, finance, operation management, and marketing is available. Some studies applied the golden ratio proportion to organizational structure, development, and management function (Dimovski & Uhan, 2012; Henderson & Boje, 2015; Opalenko & Rudenko, 2019). Some studies in the management domain highlight the work by using Fibonacci numbers for employee satisfaction, business practices, and optimal organisational function, resulting in better performance. The golden ratio has been used in sales strategies in the marketing field (see, e.g., Fischer, 1993; Nikolić et al., 2011; Thomas & Chrystal, 2013). Pan (2013) used the golden ratio to find an optimum quality level in the quality management domain. This study concludes that the golden ratio optimizes unimodal optimisation based on the least number to find the optimal level. Similarly, Disney et al. (2004) investigate the role of the golden ratio in operation management. The golden ratio is used in this study to predict work progress feedback and an optimal gain in inventory. In a similar vein, Endovitsky et al. (2017; 2019) studied the mechanism to manage economic theory on the concept of system-life-cycle. Papaioannou et al. (2019) used the golden ratio in medicine to analyse the blood pressure (BP) of people with significant illnesses. The authors document that the measured blood pressure was found out of the golden ratio.

Further, it documents that a large number of bodies suggest that the BP ratio varies, while the smaller value represents that it is found closer to the golden ratio number of 1.618. Kulis and Hodzic (2020) document comprehensive literature on the golden ratio and the philosophy behind the 1.618 number. This study summarises the key finding on the golden ratio in various fields, including biology, business, chemistry, engineering, economics, design, geology, medicine, modern technologies, psychology and sociology.

Related Work on Capital Structure and Firm Performance

Corporate managers must make important decisions regarding the relative debt and equity portions to use in capital structure decisions. Modigliani and Miller (1958) suggested that in a perfect capital market with no transaction costs, no taxes, and information symmetry, firm managers should not worry about equity ratio and debt ratio. Because, ideally, the ratio of debt to equity is preferable. For example, Modigliani and Miller (1963) suggest that firms maximise the use of debt in their capital structure because interest payments are tax-deductible.

This was accomplished by relaxing the assumption of taxes. Therefore, the ultimate use of debt positively affects a firm's financial performance. Moreover, Friedel et al. (2013) claim that most businesses have various options when deciding whether to use debt or equity. The benefit of a tax shield from interest payments is one of the variables that may lead to higher firm performance (Ramadan & Safavi, 2022; Pham et al., 2022). The possibility of financial difficulty is another element that affects how favourably debt financing is weighed against its expenses. Agency cost is one issue that emerges from the conflicts between shareholders and managers based on the capital structure. Asymmetric information, which acts as a signal for capital structure, is one of the elements that corporations consider when deciding whether to choose debt or equity. In recent years, the golden ratio has been used by many researchers in various fields. Numerous articles have recently been studied exploring the association between financial performance, capital structure, and market acceptance. Although, only limited studies investigate the hypothesis and casual reversal effect. The literature document that debt holders like to invest in more profitable firms (Margaritis & Psillaki, 2010). Some studies observed a positive association between capital structure and firm performance (e.g., Abor, 2005; Adair & Adaskou, 2015; Jouida, 2018). Similarly, other studies report a negative relationship (see, e.g., Majumdar & Chhibber, 1999; Gleason et al., 2000; Muhammad et al., 2014; Le & Phan, 2017; Vo & Ellis, 2017; Qayyum & Noreen, 2019; Khan et al., 2021). However, few studies found positive and negative relationships between financial performance and capital structure, but these studies did not highlight an optimal level of capital structure (Bandyopadhyay & Barua, 2016; Jaisinghani & Kanjilal, 2017).

Some studies concentrate on answering it to find an optimal level of capital structure. Similarly, Fruhan et al. (1992) collect data on fictive companies to examine the firm value, stock price, and the CoC (cost of capital) change over the different debt levels. This study documents that an optimal capital structure is 30%. Similarly, Damodaran (1994) finds that 30% is an optimal level of capital structure (Debt-equity ratio). Moreover, the detailed findings of Fernandez (2001) were found against the approach of (Fruhan et al., 1992; Damodaran, 1994). Extending to this, Amara and Aziz (2014), Khan (2012), Sheikh and Wang (2012), Saeed et al. (2013), and Javed et al. (2014) find that capital structure positively affects a firm's performance. Similarly, Awais et al. (2015), Alam et al. (2019), Ullah et al. (2020), Khan et al. (2021), Nazir et al. (2021), and Islam and Iqbal (2022) find significant positive and negative effects of debt maturity on firm performance.

Similarly, Endri, Ridho, et al. (2021) examines the relationship between capital structure and firm's financial performance. It finds that debt to asset ratio (DAR), debt to equity ratio (DER), long-term debt to asset, and total capital ratio (LDTC, LDTE) shows positive and negative effect on firm financial performance (ROA, ROE, and EPS, respectively). In a similar vein, Endri, Supeni, et al. (2021) investigate the impact of oil prices, interest rates, profitability, liquidity, and company size on leverage in mining companies. The authors find that liquidity, profitability, and oil prices negatively affect leverage, while companies' size does not impact leverage. Kurniasih et al. (2022) analyse the effect of the cost of capital and capital structure on firm value. It documents that the cost of debt (COD) and cost of equity (COE) negatively and positively affect firm value. Further, it finds that capital structure plays a quasi-moderating role in increasing the firm value. Ulbert (2022) recently studied the golden ratio and capital structure. This study finds that the golden ratio is an efficient tool for deciding an optimal capital structure ratio. Further, this study documents that firms can use the golden ratio to enhance their market acceptance and performance. Similarly, Amin and Cek (2023) examine the role of the golden ratio in deciding an optimal level of capital structure. It finds that firms using 61.2% of debt and 38.2% of equity in capital structure positively and significantly affect firm financial performance.

Several studies have been conducted in Pakistan which examine the effect of capital structure on firm financial performance. In light of such studies, no prior studies investigate the effect of the capital structure by using the golden ratio on the decision-making in Pakistan. Therefore, the present study will enrich the existing literature by highlighting the role of the golden ratio in deciding an optimal level of capital structure.

Hypothesis of the Study

H1: Equity-to-total asset ratio deviation from the golden ratio positively affects firm financial performance and market acceptance.

H2: Equity-to-total asset ratio deviation from the golden ratio negatively affects firm financial performance and market acceptance.

RESEARCH METHODOLOGY

Data and Variables

This study collects secondary data from 40 textiles (manufacturing companies) and 20 services companies from the Balance Sheet Analysis Report (BSA) published by the State Bank of Pakistan (SBP) for the period from 2010–2019. There are two main reasons for selecting this period. First, in the earlier period, the economies and financial markets were greatly influenced by the financial crisis of 2007–2008. Second, the world economies and financial markets have recently been greatly affected by the COVID-19 pandemic outbreak (Ulbert et al., 2022).

Golden Ratio Definition

Affirming the previous literature, the relevant portion of the golden ratio for capital structure is not indicated or directed. The golden ratio is further directed as 1/1.618 = 0.618 and 1 – 0.618 = 0.382. According to the division of the golden ratio-based structure. It can be inferred that the golden ratio follows the capital structure ratio of 61.8% (Debt) and 38.2% (Equity). However, the question remains unexplored about the inferred division of the golden-based ratio for an optimal capital structure ratio (Ulbert et al., 2022).

Calculation of Average Equity-to-total Asset Ratio and Historical Maximum

To make the appropriate decision, we calculate the average equity-to-total asset ratio. Later, the average equity-total asset ratio is reported to be around 1.46, which equals 40.6%, calculated as 1/ (1 + 1.46) = 0.406. This percentage infers that debt represents a higher portion of total capital. Later, for variable (dependent and independent) computation, we follow the approach of Ulbert et al. (2022), where we take four dependent variables, net income and total revenue proxy for firm financial performance and stock price and enterprise value proxy for firm's market acceptance. Similarly, we take the deviation of the equity-to-total asset ratio from the golden ratio as an independent variable. Furthermore, we estimated mean revenue and net income for financial performance, and stock price, enterprise value for market acceptance based on their historical maximum value. Later we sorted company-year data on the equity to total assets ratio. Further, we exclude extreme values of equity-total asset ratio above 70% and below 30%, with 373 ended year's observations.

Operationalisation of Dependent Variables and Independent Variable

The operationalised definition of dependent and independent variables are as follows. Similarly, Equations (1) to (4) shows the econometric model of four dependent variables, where TR represents total revenue, TI represents total income (proxy of financial performance), P represents the stock price, and Ev/EBIT represents the enterprise value (proxy of market acceptance). Further, Equation (6) shows the econometric model of the independent variable, where SHE/TA represents the equity-to-total asset ratio and its deviation from the optimal equity level of the golden ratio-based structure (0.382). SHE/TA represents the equity-to-total asset ratio and its deviation from the optimal equity level of the golden ratio-based structure (0.382).

Dependent variable

The dependent variable of the study is calculated as follows:

$$TR_{it} = \left| TR_{it} - Max\left(TR_{it} \right) \right| \tag{1}$$

Equation (1) shows the absolute deviation of the actual total revenue of the firm from 10 years to the maximum of the following equation:

$$NI_{it} = \left| NI_{it} - Max\left(NI_{it} \right) \right| \tag{2}$$

Equation (2) shows the absolute deviation of the actual total income of the firm from 10 years to the maximum by using the following equation:

$$P_{it} = \left| P_{it} - Max\left(P_{it} \right) \right| \tag{3}$$

Equation (3) shows the absolute deviation of the stock price of the firm from 10 years to the maximum by using the following equation:

$$\left(\frac{EV}{EBIT} \right)_{it} = \left| \left(\frac{EV}{EBIT} \right)_{it} - Max\left(\frac{EV}{EBIT} \right)_{it} \right| \tag{4}$$

Equation (4) shows the absolute deviation of the firm's enterprise value from 10 years to the maximum. Further, we follow the approach of Arzac (2005) for calculating enterprise value (Ev):

$$Ev = Market\ Capitalisation + Debt - Cash \tag{5}$$

Independent variable

The independent variable of this study is defined and calculated as follows:

$$\left(\frac{\text{SHE}}{\text{TA}}\right)_{it} = \left|\left(\frac{\text{SHE}}{\text{TA}}\right)_{it} - 0.382\right| \tag{6}$$

Equation (6) shows the absolute deviation of the equity-to-total asset ratio from the golden based-ratio (0.382).

Model Development

In this study, three models were used for panel data analysis, namely common-effects-model (CEM), fixed-effects-model (FEM), and random-effects-model (REM). First, we performed Lagrangian multiplier (LM) tests to choose the best model between the CEM and REM. Diagnostic tests gave results ($P < 0.05$), indicating that a random-effects model was appropriate. Later, employed the Hausman test to select the best model between the FEM and REM. The reported results of the Hausman test were found ($P > 0.05$). Therefore, we accepted the null hypothesis and employed REM for empirical analysis.

Firm financial performance

$$\text{TR}_{\text{it}} = \beta_0 + \beta_1 \left(\frac{\text{SHE}}{\text{TA}}\right)_{it} + \varepsilon_{\text{it}} \tag{7}$$

$$\text{TR}_{\text{it}} = \beta_0 + \beta_1 \left(\frac{\text{SHE}}{\text{TA}}\right)_{it} + \varepsilon_{\text{it}} \tag{8}$$

Market acceptance

$$\text{P}_{\text{it}} = \beta_0 + \beta_1 \left(\frac{\text{SHE}}{TA}\right) + \varepsilon_{\text{it}} \tag{9}$$

$$\left(\frac{\text{EV}}{\text{EBIT}}\right)_{it} = \beta_0 + \beta_1 \left(\frac{\text{SHE}}{\text{TA}_{\text{it}}}\right) + \varepsilon_{\text{it}} \tag{10}$$

In Equations (7), (8), (9) and (10), the term β_0 represents the constant term. The term β_1 represents the coefficient and the term represents the error term with the firm *i* and time effect *t*.

EMPIRICAL RESULTS

Figure 1 shows the average ratio of a company's current value to its historical maximum at different capital structure levels. Additionally, it shows the relationship between net income, total revenue, stock price, and enterprise value and their prior highest point between 2010 and 2019. The equity level is between 30% and 70% and the percentage is stated with a point interval.

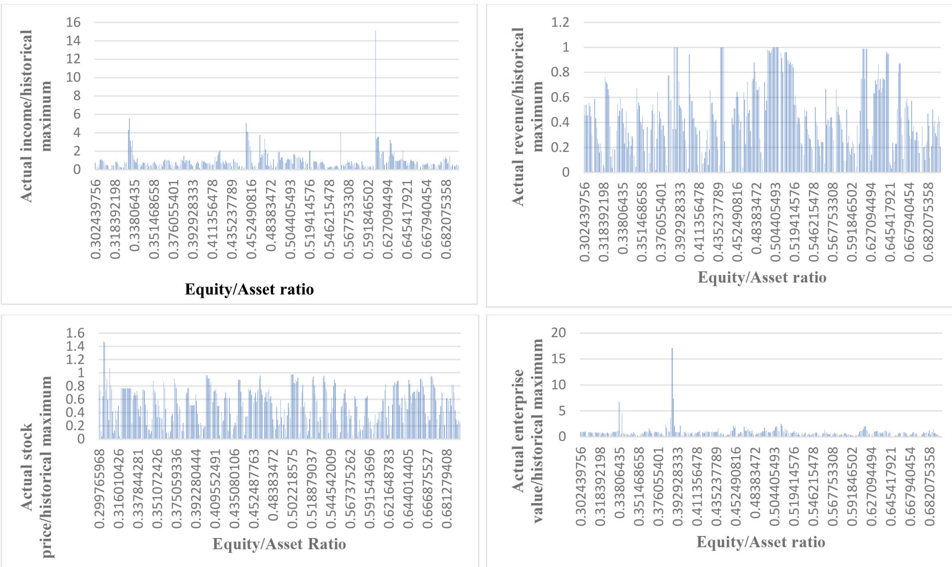

Figure 1. Average firm performance and market acceptance expressed as a ratio of their historical maximum across different capital structure levels.

Table 1 shows the results of four-panel regression models of both sectors. Empirical findings indicate that in the case of the income model, the coefficient is negative and statistically insignificant, with predictive power of 17.98%. In the case ofthe revenue model, the coefficient is negative and statistically insignificant, with a predictive power of 7.9%. The price model's coefficient is negative and statisticallyinsignificant, with an explanatory power of 7.5%. In the case of the enterprise model, the coefficient is positive and statistically significant at a 1% level with an explanatory power of 22.9%. Table 2 shows the results of four models on the individual sample of the manufacturing sector. Empirical findings in Table 2 indicate that in the case of the income model, the coefficient was negative and statistically significant, with an explanatory power of 29%. In the case of the revenuemodel, the coefficient is found to be negative and statistically significant, with an explanatory power of 37%. The coefficient of the price model is also found to be negative and statistically significant, with an explanatory power of

24%. In the case of the enterprise model, the coefficient is positive and statistically significant at a 1% level with an explanatory power of 34%.

Table 1
Full sample result of manufacturing and services sector

	Model 1 Income	Model 2 Revenue	Model 3 Price	Model 4 Value
Constant	1.527** (−0.558)	0.425*** (12.62)	0.479*** (24.41)	0.958*** (21.67)
SHE/TA	0.152 (0.576)	−0.019 (−1.321)	−0.009 (−0.722)	−0.438*** (−10.85)
Adj. R^2	17.98%	7.90%	7.50%	22.90%
Hausman test (Sig)	0.901	0.894	0.362	0.0861
Model	REM	REM	REM	REM

Note: Value in parenthesis indicates *t*-value, and 10%, 5% and 1% significance level is represented by *, ** and ***, respectively.

Table 2
Empirical results of the manufacturing sector

	Model 1 Income	Model 2 Revenue	Model 3 Price	Model 4 Value
Constant	0.869*** (9.079)	0.417*** (14.57)	0.495*** (19.95)	1.001*** (17.21)
SHE/TA	−0.033 (−0.618)	−0.026* (−1.790)	−0.028* (−18.85)	−0.603*** (−12.08)
Adj. R^2	30%	37%	25%	34%
Hausman test (Sig.)	0.213	0.23	0.667	0.403
Model	REM	REM	REM	REM

Note: Value in parenthesis indicates *t*-value, and 10%, 5% and 1% significance level is represented by *, ** and ***, respectively.

Table 3 shows the results of four models on the individual sample of the service sector. Empirical findings indicate that in the case of the income model, the coefficient was negative and statistically insignificant, with predictive power of 3%. In the case of the revenue model, the coefficient is negative and statistically insignificant, with an explanatory power of 11.3%. The price model's coefficient is also positive and statistically significant, with an explanatory power of 20%. In the case of the enterprise model, the coefficient is positive and statistically significant at a 1% level with an explanatory power of 25%.

Table 3
Empirical results of the services sectors

	Model 1 Income	Model 2 Revenue	Model 3 Price	Model 4 Value
Constant	2.828 (1.616)	0.439*** (5.489)	0.449*** (20.240)	0.718*** (10.880)
SHE/TA	−0.505 (−0.605)	−0.013 (−0.397)	0.018 (0.665)	0.160*** (2.716)
Adj. R^2	3.5%	11.4%	20.1%	24.6%
Hausman test (Sig)	0.808	0.268	0.008	0.394
Selected model	REM	REM	FEM	REM

Note: Value in parenthesis indicates *t*-value, and 10%, 5% and 1% significance level is represented by *, ** and ***, respectively.

Further, based on the Hausman test value, the random-effect model was found appropriate for empirical analysis except for the price model in the services sector, where the Hausman test *p*-value was found in favour of the fixed effect model. According to the aforementioned findings, the shareholders' equity-to-total asset ratio has a positive and substantial relationship with the price and value model, deviating absolutely from the golden base ratio proportion of 38.2%. The findings also indicate deviation from the historical maximum in terms of firm performance and acceptance. The outcome also shows that the company's shareholder equity-to-total asset ratio is more closely aligned with the golden base ratio proportion of 38.2%. Its revenue, stock price, and enterprise value aligned more closely with the potential maximum (see Figure 1).

Additionally, it is suggested that using a base capital structure with a golden ratio may improve/boost the company's (manufacturing and services) performance for producing more revenue and the capacity of market acceptance. The connection in the income model is thought to be too complex and falls short of the benchmark (see Figure 1). This suggests that companies in the manufacturing and service industries could generate the most income by using a higher shareholder equity-to-total asset ratio. The statistical result obtained from Table 4 indicates a notable difference in the relationship between the shareholder's equity-total asset ratio and the four models. The explanatory power for the income model varies from 3.45% to 29.63%. This shows that the t manufacturing industry is very close to the golden base ratio of 38.2% (therefore, the debt proportion is very close to 61.8%), which paints a clear picture of firms maximising their financial performance to increase their revenue and profits as well as their market acceptance to realise enterprise value. Additionally, the enterprise value model's explanatory power, which is found to be both favourable and important, is in the range of 22.98% to 34.42%. As a result, the debt ratio is close to 61.8%, and the revenue model is near the golden base-ratio proportion of 38.2%.

Table 4
Comparison of the manufacturing and services sector

Model	Full sample	Manufacturing	Services
Income	Negative insignificant (Adj. R^2 = 17.98%)	Negative insignificant (Adj. R^2 = 29.63%)	Negative insignificant (Adj. R^2 = 3.45%)
Revenue	Negative insignificant (Adj. R^2 = 7.90%)	Negative insignificant (Adj. R^2 = 37.15%)	Negative insignificant (Adj. R^2 = 11.37%)
Price	Negative insignificant (Adj. R^2 = 7.50%)	Negative insignificant (Adj. R^2 = 24.82%)	Negative insignificant (Adj. R^2 = 20.11%)
Value	Negative insignificant (Adj. R^2 = 22.90%)	Negative insignificant (Adj. R^2 = 34.42%)	Negative insignificant (Adj. R^2 = 24.58%)

Table 5 shows the coefficients (*β*) and *p*-value of the alternative versions of the explanatory variables. Compared with the original models, Table 5 shows how the independent variable's coefficient (*β*) and significance value change with alternative versions ($SHE/TA_{it}^{0.5}$ and $SHE/TA_{it}^{0.618}$). Later, robustness control tests were employed on two alternative versions of independent variables applied to four models (income, revenue, stock and enterprise value). First, the original model was employed with the label SHE/TA_d_{it}, which shows the shareholder's equity-total asset ratio deviation from the golden base ratio proportion of 38.2%. Later, the first alternative model was employed with the label $SHE/TA_{it}^{0.5}$ (assuming 50% equity and 50% debt). Then, a second alternative model was used with the label $SHE/TA_{it}^{0.618}$ (taking the golden base ratio proportion, containing 61.8% debt and 38.2% equity level). The same test was applied to two alternative models presented in Table 5 for empirical estimation. It indicates that for the revenue, price and incomemodel, the *p*-value was observed to increase in the alternative model, and its explanatory power decreased, which indicates that companies with shareholder equity-to-total asset ratios close to or at 38.2% could expect to see the greatest levels of revenue, stock price, and income. Compared to the original model, the modified alternative model $SHE/TA_{it}^{0.5}$ and $SHE/TA_{it}^{0.618}$ had a reduced *p*-value and higher explanatory power. In light of this, it suggests that the value model is getting closer to reaching its historical peak for businesses with convergent capital structure power or those that use 50% debt and 50% equity.

Except talking about *p*-values and explanatory power. The coefficients of the independent variables can provide a more comprehensive interpretation of the findings. According to the definition of variables, the optimal capital structure refers to the capital structure in which the independent variable coefficient reaches the highest positive value, and the deviation from the optimal capital structure causes its historical maximum value to drop the most. At the same time, the negative coefficient of the independent variable indicates that the firm may benefit from deviation from the ideal capital structure. It can be seen from Table 5 that the capital structure independent variable coefficient based on the golden ratio is the highest (61.8: 38.2), and for the valuation model, SHE/TA report with the highest coefficient in the case of balanced capital structure.

Table 5
Robustness test (alternative version) four models

	Income		Revenue		Price		EV-EBIT	
	Coefficient	Sig.	Coefficient	Sig.	Coefficient	Sig.	Coefficient	Sig.
SHE/TA	0.053	0.468	0.024	0.230	0.014	0.891	0.090	0.371
$SHE/TA^{0.50}$	0.023	0.464	0.043	0.272	0.044	0.882	0.378	0.088*
$SHE/TA^{0.618}$	–0.034	0.531	0.043	0.281	–0.010	0.978	–0.396	0.075*

Notes: * represents the significance level at 10%.

DISCUSSION

The empirical results of this study support the findings of Ulbert et al. (2022) who address the possibility that rising leverage could have a negative impact on firm performance although, like previous findings of many studies (e.g., Abor, 2005; Adair & Adaskou, 2005; Jouida, 2018), this study did not find an apparent positive effect of leverage on firm performance. However, in the case of negative effect, the findings of this study are consistent with the results of some previous studies, including Majumdar and Chhibber (1999), Gleason et al. (2000), Le and Phan (2017), Vo and Ellis (2017), and Qayyum and Noreen (2019). Moreover, in the case of both the positive and negative effects of both leverage and capital structure on financial performance, the findings in our paper support the findings in Bandyopadhyay and Barua (2016), Jaisinghani and Kanjilal (2017), Endri, Ridho, et al. (2021), Endri, Supeni, et al. (2021), and Kurniasih et al. (2022).

Similarly, considering the underpinning (pecking order) theory of capital structure, our findings support the findings of Ezirim et al. (2017) that no percentage was specified in the capital structure concerning debt and equity financing. In this paper, the golden ratio for deciding an optimal level was formulated based on the assumption of the pecking order theory, which states that the ratio segregated between 0.618 and 0.382 represent the larger line (debt) and smaller line (equity) for the corporation. The findings of our study significantly support the golden ratio and aforementioned percentage of 0.618 for debt and 0382 for equity financing.

In a similar vein, Nadaraja et al. (2011) find that the trade-off theory provides guidelines for financial managers to decide the optimal percentage of debt used in the capital structure. In contrast to earlier studies, Myers (1984) documents that different theories of capital structure do not explain the actual financing behaviour. Keeping these presumptions, it would be ideal for businesses to follow the ideal level of capital structure. It is essential to comprehend how agency theory is applied in financial management since it provides greater clarity for investors, stockholders and individuals interested in this problem, which results in so-called “agency costs.” The expense incurred in monitoring, supervising, and attempting to stop managers from abusing their power is known as the agency cost. Using debt in the financing strategy is one method to solve the agency problem. The principal typically seeks to maximise his wealth, whereas the agent seeks to maximise his profit by boosting his personal wealth and employment stability (Kalash, 2019; Abdullah & Tursoy, 2022). Similarly, Eckbo (2008) documents that when the market goes up, managers often issue new shares of stock or sell overvalued shares, whereas when the market goes down, managers frequently turn to debt financing. This idea states that opportunities in the capital market arise when people do not have the same level of information and influence over selecting a financing plan. The golden ratio can help firms decide how much debt and equity financing to utilize in their capital structure when the market price share declines, and thus, they by explore using debt financing. Similarly, Amin and Cek (2023) document that a firm uses equity at a percentage of 38.2%, and its capital structure reports a positive and significant impact on the firm financial performance. Further, it also reports that deviation from the debt-to-equity ratio is negative and significantly affects the firm financial performance (ROA, EPS, etc.).

Furthermore, this study concluded that, according to the golden ratio, the ratio of debt to total assets is around 61.8%. Leveraging a company up to this point is advantageous, but using debt ratios higher than this could generate a negative impact on the company’s performance and market acceptance. Although according to the golden ratio, the optimal level of debt-to-asset ratio is generally 61.8%, and the debt-to-equity ratio of 38.2% is the optimal level of capital structure, which varies by region and company diversity (Ulbert et al. 2022). Determining optimal capital structure levels in the Pakistani context. Our findings, therefore, are consistent with the findings from Fruhan et al. (1992), Damodaran (1994), Ulbert et al. (2022), and others. In terms of Pakistan, the results of this study are in line with those of Sheikh and Wang (2012), Muhammad et al. (2014), Khan (2012), Khan et al. (2021), Nazir et al. (2021), Islam and Iqbal (2022), and others. In short, these studies show that leverage and capital structure positively and negatively affect a firm’s financial performance.

CONCLUSION

In recent years, the golden ratio has been widely used in all science fields. Nevertheless, most, if not all, studies, see, for example, Ulbert et al. (2022), have never used the golden ratio in the company's fundamental analysis. Thus, to bridge the gap in the literature, this study extends the work of Ulbert et al. (2022) and others by investigating the role of the golden ratio in deciding an optimal level of capital structure. We further examine whether using the ratio could have significant impacts on a company's financial performance in the case of generating the ability to realise revenue and earn profit or market acceptance, which mainly relieson the manifestation of stock price, market value, and investor preferences for the firm in a specific context. This study takes the secondary data from the manufacturing (40 companies) and services sectors (20 companies) for 10 years from 2010–2019, listed on the Pakistan Stock Exchange. After empirical analysis, we found remarkable differences between the two sectors (manufacturing and services).

Later, we find a negative relationship in some cases (revenue and price models of the manufacturing sector), suggesting that the models reached the highest maximum value at various levels of capital structure. However, the subsample results are robust and provide strong statistical support for the view that market acceptance and firm performance indicators are better when their equity-to-total assets ratio is close to the phi value of 38.2%. These data suggest that business and investment decisions are reflected in corporate affairs and other areas of life. The findings of this study indicate that even though the phenomenon is more pronounced in the manufacturing industry than the service industry. Both sectors' financial performance and market acceptance can be enhanced by deciding on capital structure level (61.8% for debt and 38.2% for equity) based on the golden ratio. Moreover, financial managers could use the findings of our paper in both sectors as an important and new aspect for determining the optimal level of capital structure when working out the firms' financing strategies and policies.

In this article, we examine the role of the golden ratio in deciding an optimal level of capital structure by taking the data from both the manufacturing and services sectors. We observed the following limitations of this study. First, this study collects data only from 2010 to 2019. Second, we collect data only from the manufacturing and services companies. Third, we measure the firm financial performance through both income and revenue and measure market acceptance through both price and enterprise value. Thus, extensions of our paper could include taking data from other sectors like oil, refinery, cement and mining for a longer period of time. Further, other corporate variables like ROA, ROE, EPS and Tobins' Q could also be included as dependent variables in measuring financial performance. Future studies could include some control variables like firm size, firm age, and others, in measuring the impact of the capital structure by using the golden ratio in the presence of control variables to increase the generalisation of the model. Studies could also be carried out by taking cross-countries data of emerging and developed economies.

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