Al-Furat Journal of Innovations in Management Sciences

ATU- AFJIMS, Volume: 1, Issue: 3, 15 July 2025

Impact of Capital Structure Based on the Golden Ratio on Financial Sustainability

Arafat Faris Saeed Al-Khafaji[1], Zaid M Alabassi[2]

[1,2] Al-Furat Al-Awsat Technical University (Technical Administrative College/Kufa, Department of Business Administration Technologies, 54003, Iraq)
[1](arafat.saeed@student.atu.edu.iq)
[2](zaid-alabassi@atu.edu.iq)

Abstract. *This analytical study aims to analyze and measure* ***the impact of a capital structure based on the golden ratio on financial sustainability.*** *A sample of ten industrial companies listed on the Iraq Stock Exchange was selected, covering a time period from 2010 to 2023. To test the study hypotheses, a range of statistical methods were employed, including multiple regression analysis and the T-test, utilizing approved statistical data analysis software, particularly E-Views. The study concluded that, the most notable being that designing a capital structure according to the golden ratio provides companies with greater financial flexibility. This approach helps avoid excessive reliance on internal funding sources alone and reduces rigidity in debt ratios. Such a strategy contributes to enhancing the companies' capacity to optimally exploit available investment opportunities, positively reflecting on maximizing long-term returns while ensuring adequate liquidity levels, thereby supporting financial sustainability. Based on the above, the study recommends that the targeted industrial companies in the sample adopt an approach that considers the golden ratio when designing their capital structure, particularly when determining debt and retention ratios. These ratios should align with the ideal range of the golden ratio.*

Keywords: Capital Structure, Golden Ratio, Financial Sustainability

1. INTRODUCTION

The industrial sector in Iraq is considered one of the fundamental pillars of the economy, as the country possesses a variety of activities ranging from heavy industries, such as machinery and automobile manufacturing, to light industries like clothing and food production. The industrial sector relies on modern technologies and innovation to enhance efficiency and improve product quality, contributing to meeting the needs of both local and international markets. This sector serves as a crucial foundation for achieving and supporting the economies of many countries worldwide. However, industries face multiple challenges, including rapid technological changes, sustainability requirements, and fluctuations in global markets. In light of these challenges, countries strive to develop policies that support innovation and enhance the industrial sector's competitiveness. he the review of the financial data of the industrial companies in the study sample reveals a significant decline in the long-term returns of some of these companies, resulting in a deterioration of their financial sustainability. This has exacerbated the challenges of maintaining operations in a complex and highly competitive economic environment, making them more susceptible to market risks and financial crises.

In this context, the decline in financial sustainability poses a fundamental threat to industrial companies, as it adversely affects their performance and reputation while diminishing their ability to survive and expand in the market. Therefore, there is an urgent need to reconsider their financing practices by adopting a capital structure based on the golden ratio. This approach ensures an effective

balance between debt financing and equity, thereby supporting their capacity to achieve long-term financial sustainability. Based on the above, the research problem can be formulated through the following questions:

- ✓ What are the key indicators of a capital structure based on the golden ratio?.
- ✓ How does this structure impact the attainment of financial sustainability in industrial companies?

The study of a capital structure based on the golden ratio and its impact on financial sustainability is increasingly recognized as a significant topic within the field of financial management. This importance stems from its role in enhancing the theoretical framework through a review of relevant literature, alongside providing empirical evidence that clarifies the relationship between deviations in capital structure and the level of financial sustainability. Moreover, the study contributes practical guidelines that support financial decision-making, yielding a dual impact—both theoretical and practical—on the development of sustainable financing policies and practices within companies.

The objectives of the study are as follows, To analyze and measure the impact of adopting a capital structure based on the golden ratio on achieving financial sustainability in industrial companies. To assess the level of financial sustainability in the industrial companies within the study sample, as well as their ability to maintain long-term financial stability.

The study is based on two hypotheses:

H1: There is no significant effect of the capital structure indicator based on the golden ratio on the return on assets.

H2: The indicators of the capital structure based on the golden ratio do not have a significant effect on the return on equity.

2. LITERATURE REVIEW:

2.1. CONCEPT OF CAPITAL STRUCTURE BASED ON THE GOLDEN RATIO

The golden ratio is one of the most widely discussed concepts in mathematics, as well as in various other sciences. It is denoted by the symbol phi (ϕ) (PHI), derived from the name of the Greek sculptor and architect Phidias. It can also be represented using the Greek letter (φ). The golden ratio is achieved when the ratio of the sum of two numbers to the larger of the two is equal to the ratio of the larger number to the smaller one [1]. The precise value of the golden ratio is an irrational number, expressed as ($\Phi = a/b = (a+b)/a = 1.61803399$) [2] . According to Livio [3], a straight line is divided in a maximum and average ratio. If we examine the figure, line AB is longer than segment AC, while segment AC is longer than CB. If the ratio of the length of AC to CB is the same as the ratio of AB to AC, this indicates that the line has been divided in a maximum and average ratio, or in the golden ratio.

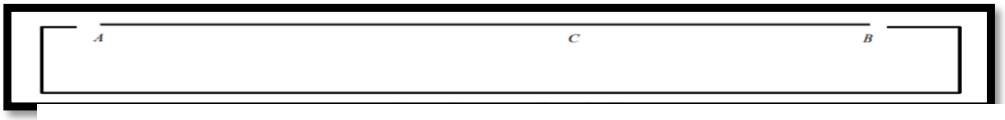

Fig. 1. EXPLANATION OF THE GOLDEN RATIO

SOURCE: LIVIO, M. (2008). THE GOLDEN RATIO: THE STORY OF PHI, THE WORLD'S MOST ASTONISHING NUMBER. CROWN.

The Fibonacci sequence, constructed according to the recursive rule ($F_{n+1} = F_n + F_{n-1}$) for every integer ($n \geq 1$), with initial conditions ($F_0 = 0, F_1 = 1$), is a foundational concept in mathematics and is intrinsically linked to the Golden Ratio. This relationship arises because the ratio of consecutive Fibonacci numbers converges to the Golden Ratio [4].

The Golden Ratio (φ) is not only a mathematical constant but also manifests in biological systems, architecture, and financial markets. As noted by Henein et al. [5], it appears in human anatomical proportions, engineering, and business applications, making it a universal principle in both natural and artificial systems. The Golden Ratio is defined algebraically as the unique positive solution to the equation ($\varphi = \frac{1}{\varphi} +$), Historically, ancient Egyptians applied this ratio in the construction of the pyramids [6]. Mathematically, the Golden Ratio is expressed by the Greek letter Phi (Φ), an irrational number representing the solution to the quadratic equation ($X^2 - X - 1 = 0$), yielding the exact value: $\varphi = \frac{1+\sqrt{5}}{2} = 1.618$), The symbol (Φ) was adopted for the Golden Ratio by the mathematician (Mark Barr), who chose it as the initial letter of the Greek alphabet. Interestingly, this notation also pays homage to the Greek sculptor (Phidias), who extensively employed the Golden Ratio in his works and is similarly associated with the symbol (Φ).

The capital structure based on the golden ratio is one of the most contentious topics in corporate finance. Since Modigliani and Miller (1958) introduced their theory regarding the formulation of a capital structure based on the golden ratio (the irrelevance theory of capital structure), it has continued to stimulate discussion in the literature on this subject [7]; [8]. The capital structure based on the golden ratio represents a fundamental axis in the field of corporate finance. One of the motivations for managing this capital structure is to reduce its cost and maximize shareholder wealth [9]. To achieve this goal (maximizing shareholder wealth), a company must determine an optimal mix of equity and debt [10].

Hirdinis [11] indicates that the capital structure based on the golden ratio is key to maximizing investment efficiency and subsequently improving financial performance. The capital structure represents the relationship between equity and debt that require repayment over a specific period. In other words, it comprises a mix of debt, securities issued by the company, and retained earnings [12] . This capital structure is a type of long-term capital that contributes to achieving optimal investment in fixed assets while ensuring profitability through a combination of loans and equity [13].

The capital structure based on the golden ratio is a significant issue in financial management because the decisions regarding its formulation involve risks that must be borne by business owners. Furthermore, these decisions may lead to generating a certain rate of return. Such decisions will determine the amount of financing required and the sources from which these funds will be obtained [14].

2.2. CONCEPT OF FINANCIAL SUSTAINABILITY

Financial sustainability is a critically important concept in modern business administration, as companies increasingly recognize the need to implement measures and tools that achieve financial sustainability. This concept encompasses a company's ability to maintain financial stability and maximize long-term returns while achieving its operational and strategic objectives. It significantly impacts future expectations, with financial sustainability identified as a key factor in the success of large, medium, and small enterprises [15].

There has been a growing demand for transparency from consumers and investors. As a result, many companies have begun publishing reports on financial sustainability, improving efficiency, and selecting appropriate financing sources such as loans, self-financing, and investments [16].

The financial management of industrial companies, which represent the sample of the study, plays a pivotal role in shaping financial sustainability. Effective management of financial resources, along with risk assessment, investment decision-making, and debt management, are essential tools for a company's long-term survival and growth [17]. This approach contributes to the development and longevity of companies by generating value for investors, providing the appropriate framework for efficient capital allocation and financial planning [18].

Septiani & Murwaningsari [19] conclude that financial sustainability is a strategy that involves effective management of financial indicators. Financial sustainability within a company can be evident through its ability to generate value for shareholders and ensure long-term operations by effectively managing financial resources. Additionally, financial sustainability contributes to the management and integration of cash flows and the globalization of companies' financial systems.

2.3. IMPORTANCE OF FINANCIAL SUSTAINABILITY

Financial sustainability is crucial as it aligns financial objectives with sustainability principles. Sustainable finance is characterized by a comprehensive approach to managing financial resources that incorporates economic, social, and environmental factors. This approach ensures the protection of long-term investments, risk management, and innovation stimulation, ultimately creating lasting value for stakeholders and contributing to sustainable development [20]. It ensures the stability of financial operations, enhances revenue generation, reduces distressed assets, and improves risk management. It enables companies to effectively address financial threats and opportunities [21].

The importance of financial sustainability and performance is evident in many industrial companies. Numerous studies indicate that reporting on financial sustainability positively impacts financial performance by enhancing the company’s reputation, reducing operational risks, and improving resource efficiency. Companies with better financial sustainability practices tend to outperform their peers financially, while sustainability reporting can enhance long-term financial performance [22]; [23]. Financial sustainability is included as one of nine dual criteria for measuring corporate sustainability, evaluated by comparing actual growth rates with sustainable growth rates, such as return on equity. The authors found that financially sustainable companies exhibit higher exposure to financial risks and lower asset growth rates. Companies must manage financially to ensure current financial success without jeopardizing future financial viability, including the success of future generations.

Kumar & Prakash [24] noted that financial sustainability is a fundamental pillar for corporate success, contributing to financial stability and long-term growth. Here are some key points illustrating its importance:

- Survival and Growth: Financial sustainability helps companies endure and grow during economic downturns while reducing costs and risks. It enables firms to invest in innovation and maintain competitiveness.
- Attracting Investors: Financial sustainability helps attract investors and lenders who focus on environmental, social, and governance (ESG) factors by showcasing sound financial management and maintaining stakeholder trust.

- Enhancing Creditworthiness: It improves access to capital and facilitates loans and equity investments for expansion and market leadership or modernization.
- Operational Stability: It allows companies to maintain operations during crises, preserving market share and positioning for growth post-recovery.

3.1. MATERIALS

3.1.1. Measures of the Study

We will rely on certain indicators for the study variables. We will measure the capital structure based on the golden ratio using two indicators, and we will also measure financial sustainability using two indicators, which can be clarified as follows:

Indicators of Capital Structure Based on the Golden Ratio

1. Deviation of Equity Ratio: This ratio refers to the proportion of equity to total assets, reflecting the extent to which a company relies on owners' equity to finance its investments [25]. A positive deviation of equity from the optimal level (0.382) indicates that the company heavily depends on equity for financing, and vice versa [26]. The deviation of the equity ratio is calculated using the following formula [1]:

$$ERD = \frac{TE}{TA} - 0.382 \quad \dots\dots\dots\dots\dots 1$$

Where:

- ERD: Deviation of equity ratio.
- TE: Total equity.
- TA: Total assets.

2. Deviation of Debt to Equity Ratio: This ratio indicates the proportion of borrowed funds to equity. An increase in this ratio signifies that the company is relying more on debt to finance its investments [27]. A positive deviation of debt from the optimal level (0.618) indicates that the company significantly relies on debt for financing, and vice versa [26]. The deviation of the debt to equity ratio is calculated using the following formula [1].

$$DED = \frac{TD}{TE} - 0.618 \quad \dots\dots\dots\dots\dots 2$$

Where:
DED: Deviation of the debt to equity ratio.
TD: Total debt.
TE: Total equity.

Financial sustainability indicators can be measured through the following metrics: [28]**.**

1. Return on Assets (ROA): This metric is used to assess how effectively a company generates profits from its assets. A higher ROA indicates enhanced financial sustainability. It is calculated by dividing net income by total assets, according to the following equation:

$$ROA_t = \frac{NI_t}{TA_t} \quad \dots\dots\dots (3)$$

Where:
ROA_t= Return on assets
NI_t= Net income for the period
TA_t= Total assets for the period

2. Return on Equity (ROE): This metric evaluates the effectiveness of a company in enhancing shareholder wealth, serving as a measure of shareholder investment return. An increase in this ratio reflects improved financial sustainability. It is calculated by dividing net income by equity, as per the following equation:

$$ROE_t = \frac{NI_t}{E_t} \quad \ldots\ldots\ldots\ldots (4)$$

Where:
ROA_t= Return on equity
NI_t= Net income for the period
E_t= Equity for the period

3.1.2. STUDY POPULATION AND SAMPLE

The study population consists of companies in the industrial sector listed on the Iraq Stock Exchange. The sample of the study comprises ten industrial companies listed on the Iraq Stock Exchange, which can be detailed in the following table (1):

Table 1. Study Sample Overview

Company Name	Company Symbol	Company Establishment Date	Company Listing Date on the Stock Exchange	Company Capital at Listing	Company Location
Baghdad Soft Drinks Company	IBSD	18/07/1989	15/06/2004	204,335,333,333 Iraqi Dinars	Baghdad
Iraqi Engineering Works	IIEW	01/10/1985	08/07/2004	1,500,000,000 Iraqi Dinars	Baghdad
Iraqi Carpets and Furnishings	IITC	10/05/1989	25/07/2004	500,000,000 Iraqi Dinars	Baghdad
Ready-Made Garments Production	IRMC	31/05/1976	25/07/2004	3,186,600,000 Iraqi Dinars	Baghdad
Iraqi Date Manufacturing and Marketing	IIDP	29/01/1989	04/09/2004	17,250,000,000 Iraqi Dinars	Baghdad
Canadian Vaccine and Pharmaceutical Production	IKLV	10/01/1990	25/07/2004	5,940,000,000 Iraqi Dinars	Baghdad
Al-Mansour Pharmaceutical Industries and Medical Supplies	IMAP	19/04/1989	27/11/2004	16,000,000,000 Iraqi Dinars	Baghdad
Modern Tailoring	IMOS	14/02/1989	08/07/2004	2,000,000,000 Iraqi Dinars	Baghdad
Iraqi Carton Manufacturing	IICM	01/03/1978	08/07/2004	7,590,000,000 Iraqi Dinars	Baghdad
Baghdad Packaging Materials Manufacturing	IBPM	27/05/1962	25/07/2004	1,080,000,000 Iraqi Dinars	Baghdad

3.2. METHODS

3.2.1. Analysis of the Equity Ratio Deviation

This section presents and analyzes the results of the equity ratio deviation for the industrial companies listed on the Iraq Stock Exchange for the period 2010-2023.

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Table 2. Results of Equity Ratio Deviation for the Sample Industrial Companies

No	Company Name / Time Period	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Average
1	Baghdad Soft Drinks Company	-0.223	0.161	0.125	0.550	0.578	0.573	0.519	0.570	0.569	0.525	0.510	0.513	0.618	0.488	0.434
2	Iraqi Engineering Works	0.411	0.436	0.590	0.589	0.593	0.590	0.585	0.331	0.528	0.536	0.529	0.592	0.591	0.589	0.535
3	Iraqi Carpets and Furnishings	0.273	0.216	0.252	0.195	0.268	0.331	0.303	0.286	0.302	0.300	0.285	0.338	0.398	0.367	0.294
4	Ready-Made Garments Production	-0.173	0.241	0.222	0.122	0.300	0.314	0.470	0.446	0.188	-0.136	-0.118	0.207	0.445	0.490	0.216
5	Iraqi Date Manufacturing and Marketing	0.540	0.506	0.499	0.548	0.555	0.510	0.571	0.624	0.723	0.701	0.724	0.813	0.833	0.823	0.641
6	Canadian Vaccine and Pharmaceutical Production	0.539	0.528	0.539	0.561	0.576	0.596	0.597	0.593	0.522	0.570	0.570	0.582	0.580	0.572	0.566
7	Al-Mansour Pharmaceutical Industries	0.536	0.719	0.381	0.561	0.509	0.561	0.542	0.559	0.425	0.411	0.528	0.538	0.544	0.459	0.519
8	Modern Tailoring	0.307	0.480	0.484	0.491	0.508	0.421	0.344	0.445	0.354	0.434	0.439	0.478	0.482	0.412	0.434
9	Iraqi Carton Manufacturing	-0.300	0.406	0.068	-0.131	0.588	0.471	0.801	0.740	0.280	0.275	0.437	0.338	0.518	0.412	0.350
10	Baghdad Packaging Materials Manufacturing	0.505	0.575	0.608	0.613	0.601	-0.283	0.583	0.574	0.607	0.601	0.602	0.601	0.606	0.607	0.529
Average for the Period		0.241	0.427	0.377	0.410	0.508	0.408	0.531	0.517	0.450	0.422	0.450	0.500	0.561	0.522	0.452

From Table (2), it is evident that the industrial companies in the study sample exhibited variability in the equity ratio deviation, with an overall average of (0.452). The company "Iraqi Date Manufacturing and Marketing" achieved the highest rate among the sampled companies, with a positive deviation of (0.641), indicating a significant reliance on equity for financing its investments. Conversely, the company "Ready-Made Garments Production" recorded the lowest rate at (0.216), suggesting a lower reliance on equity for financing. The remaining companies' values ranged between the highest and lowest averages.

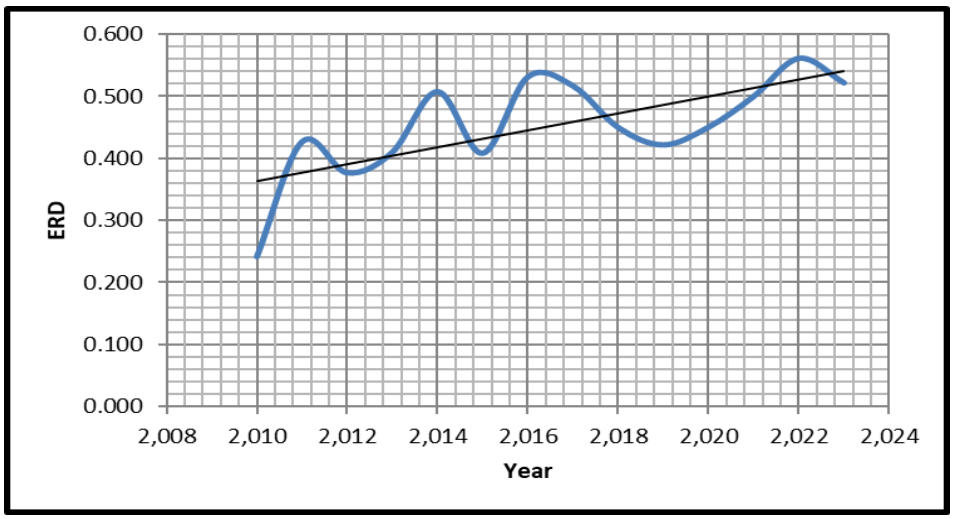

Fig. 2. Curve of Average fr the Period - Equity Ratio Deviation for the Sample Industrial Companies

Figure (1) illustrates the average for the period, with the horizontal axis representing the years and the vertical axis showing the values of equity ratio deviation. It is evident that the average increased over the time series, with the highest average recorded in 2022, while the lowest average occurred in 2010.

3.2.2. Analysis of Debt-to-Equity Ratio Deviation

This section presents and analyzes the results of the debt-to-equity ratio deviation for the industrial companies listed on the Iraq Stock Exchange for the period 2010-2023.

Table 3. Results of Debt to Equity Ratio Deviation for the Sample Industrial Companies

No	Company Name / Time Period	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Average
1	Baghdad Soft Drinks Company	-0.473	-0.578	-0.544	-0.545	-0.576	-0.571	-0.508	-0.567	-0.566	-0.516	-0.497	-0.501	-0.491	-0.468	-0.529
2	Iraqi Engineering Works	-0.356	-0.396	-0.589	-0.588	-0.592	-0.589	-0.584	-0.582	-0.519	-0.528	-0.520	-0.591	-0.591	-0.588	-0.544
3	Iraqi Carpets and Furnishings	-0.090	0.055	-0.040	0.115	-0.079	-0.216	-0.158	-0.122	-0.155	-0.152	-0.228	-0.281	-0.375	-0.306	-0.145
4	Ready-Made Garments Production	3.441	0.162	0.117	0.415	-0.078	-0.075	-0.376	-0.338	0.169	2.461	2.172	0.081	-0.409	-0.471	0.519
5	Iraqi Date Manufacturing and Marketing	0.680	-0.459	-0.461	-0.502	-0.513	-0.450	-0.422	-0.387	-0.436	-0.420	-0.439	-0.436	-0.454	-0.445	-0.368
6	Canadian Vaccine and Pharmaceutical Production	-0.533	-0.519	-0.533	-0.558	-0.574	-0.596	-0.596	-0.612	-0.499	-0.484	-0.482	-0.521	-0.518	-0.524	-0.539
7	Al-Mansour Pharmaceutical Industries	-0.528	-0.525	-0.307	-0.558	-0.496	-0.557	-0.536	-0.556	-0.378	-0.357	-0.519	-0.531	-0.538	-0.428	-0.487
8	Modern Tailoring	-0.167	-0.459	-0.464	-0.473	-0.494	-0.372	-0.240	-0.408	-0.260	-0.393	-0.399	-0.456	-0.460	-0.359	-0.386
9	Iraqi Carton Manufacturing	1.538	-0.349	0.602	4.369	2.327	3.542	1.777	1.812	3.673	3.544	2.943	3.055	3.701	3.356	2.564
10	Baghdad Packaging Materials Manufacturing	0.509	0.427	0.392	0.387	0.399	0.390	0.419	0.428	0.394	0.399	1.398	1.400	1.394	1.393	0.695
Average for the Period		0.402	-0.264	-0.183	0.206	-0.068	0.050	-0.122	-0.133	0.142	0.355	0.343	0.122	0.126	0.116	0.078

From Table (3), it is clear that the industrial companies in the study sample exhibited variability in the debt-to-equity ratio deviation, with an overall average of (0.078). The company "Iraqi Carton Manufacturing" achieved the highest rate among the sampled companies, with a positive deviation of (2.564), indicating a significant reliance on external financing (debt) for funding, which suggests a substantial deviation from the established ratios. Conversely, the company "Iraqi Engineering Works" recorded the lowest rate at (-0.544), indicating a lower reliance on debt for financing. The remaining companies' values ranged between the highest and lowest averages.

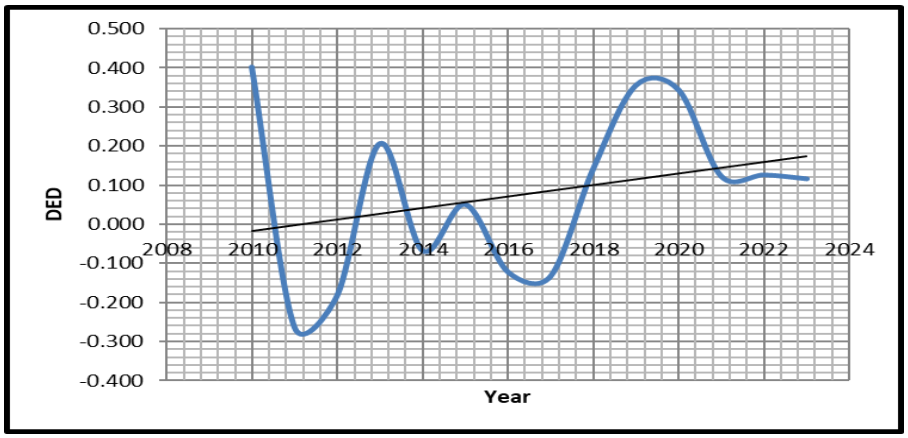

Fig. 3. Curve of Average for the Period - Debt to Equity Ratio Deviation for the Sample Industrial Companies

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Figure (2) illustrates the average for the period, with the horizontal axis representing the years and the vertical axis showing the values of debt-to-equity ratio deviation. It is evident that the average increased over the time series, with the highest average recorded in 2010, while the lowest average occurred in 2011.

3.2.3. Analysis of Return on Assets (ROA)

This section presents and analyzes the results of the return on assets (ROA) for the industrial companies listed on the Iraq Stock Exchange for the period 2010-2023, as shown below.

Table 4. Results of Return on Assets (ROA) for the Sample Industrial Companies

No	Company Name / Time Period	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Average
1	Baghdad Soft Drinks Company	0.050	0.024	0.112	0.128	0.112	0.133	0.127	0.116	0.124	0.126	0.128	0.095	0.123	0.180	0.113
2	Iraqi Engineering Works	0.037	0.144	0.004	0.002	0.096	0.135	0.129	0.084	0.039	0.016	0.122	0.034	0.012	0.100	0.068
3	Iraqi Carpets and Furnishings	0.056	0.058	0.064	0.057	0.060	0.070	0.067	0.086	0.112	0.203	0.152	0.197	0.025	0.153	0.097
4	Ready-Made Garments Production	0.083	0.346	0.385	0.113	0.051	0.047	0.004	0.072	0.047	0.023	0.014	0.054	0.025	0.038	0.093
5	Iraqi Date Manufacturing and Marketing	0.334	0.047	0.047	0.017	0.004	0.042	0.095	0.091	0.123	0.003	0.000	0.085	0.009	0.047	0.067
6	Canadian Vaccine and Pharmaceutical Production	0.196	0.195	0.178	0.104	0.040	0.008	0.050	0.010	0.120	0.003	0.002	0.001	0.002	0.002	0.065
7	Al-Mansour Pharmaceutical Industries	0.028	0.031	0.073	0.040	0.053	0.070	0.003	0.021	0.008	0.282	0.052	0.035	0.047	0.002	0.053
8	Modern Tailoring	-0.276	0.011	0.003	0.111	0.119	0.198	0.091	0.229	0.212	0.143	0.124	0.062	0.246	0.223	0.107
9	Iraqi Carton Manufacturing	-0.125	-0.409	-0.056	-0.070	-1.174	-0.841	-0.227	-0.036	-0.163	-0.060	-0.157	-0.032	-0.046	-0.455	-0.275
10	Baghdad Packaging Materials Manufacturing	0.007	0.001	0.010	0.035	0.033	0.084	0.004	0.002	0.017	0.018	0.006	0.008	0.009	0.001	0.017
Average for the Period		0.039	0.045	0.082	0.054	-0.061	-0.005	0.034	0.068	0.064	0.076	0.044	0.054	0.045	0.029	0.041

From Table (4), it is evident that the industrial companies in the study sample exhibited variability in ROA, with an overall average of (0.041). The company "Baghdad Soft Drinks" achieved the highest rate among the companies sampled, with a rate of (0.113), indicating that the company is moving towards financial sustainability (increased returns). Conversely, the company "Iraqi Carton Manufacturing" recorded the lowest rate at (-0.275), indicating weak financial sustainability. The remaining companies' values ranged between the highest and lowest averages.

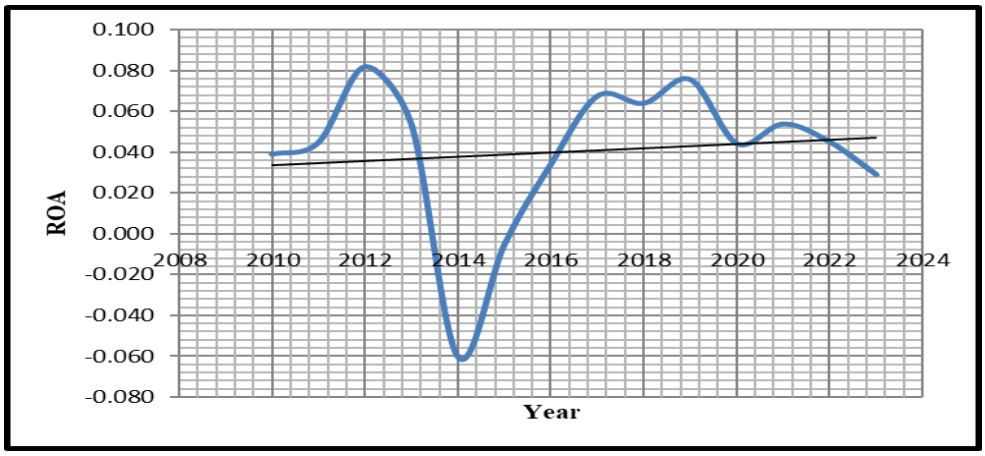

Fig. 4. Average for the Period - Return on Assets (ROA)

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Figure (3) illustrates the average for the period, with the horizontal axis representing the years and the vertical axis showing the values of ROA. It is evident that the average increased over the time series, with the highest average recorded in 2012, while the lowest average occurred in 2014.

3.2.4. Analysis of Return on Equity (ROE)

This section presents and analyzes the results of the return on equity (ROE) for the industrial companies listed on the Iraq Stock Exchange for the period 2010-2023, as shown below.

Table 5. Results of Return on Equity (ROE) for the Sample Industrial Companies

No	Company Name / Time Period	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Average
1	Baghdad Soft Drinks Company	0.313	0.044	0.222	0.137	0.116	0.139	0.141	0.122	0.131	0.139	0.143	0.107	0.123	0.206	0.149
2	Iraqi Engineering Works	0.047	0.176	0.004	0.002	0.099	0.139	0.134	0.118	0.043	0.018	0.134	0.035	0.012	0.103	0.076
3	Iraqi Carpets and Furnishings	0.086	0.097	0.101	0.099	0.093	0.098	0.097	0.129	0.164	0.298	0.228	0.274	0.305	0.205	0.162
4	Ready-Made Garments Production	0.399	0.556	0.637	0.223	0.074	0.068	0.004	0.087	0.082	0.095	0.051	0.091	0.030	0.044	0.174
5	Iraqi Date Manufacturing and Marketing	0.363	0.053	0.054	0.019	0.004	0.047	0.100	0.091	0.111	0.003	0.000	0.071	0.007	0.039	0.069
6	Canadian Vaccine and Pharmaceutical Production	0.212	0.214	0.193	0.110	0.042	0.008	0.051	0.010	0.133	0.003	0.002	0.001	0.002	0.002	0.070
7	Al-Mansour Pharmaceutical Industries	0.030	0.028	0.096	0.042	0.059	0.075	0.003	0.023	0.010	0.356	0.057	0.038	0.050	0.003	0.062
8	Modern Tailoring	-0.400	0.013	0.004	0.127	0.134	0.246	0.125	0.277	0.288	0.175	0.151	0.073	0.285	0.281	0.127
9	Iraqi Carton Manufacturing	-1.526	-0.519	-0.125	-0.279	-1.210	-0.987	-0.192	-0.032	-0.246	-0.092	-0.192	-0.045	-0.051	-0.573	-0.433
10	Baghdad Packaging Materials Manufacturing	0.008	0.000	0.010	0.036	0.034	0.084	0.004	0.003	0.017	0.018	0.007	0.008	0.009	0.000	0.017
Average for the Period		-0.047	0.066	0.120	0.052	-0.056	-0.008	0.047	0.083	0.073	0.101	0.058	0.065	0.077	0.031	0.047

From Table (5), it is clear that the industrial companies in the study sample exhibited variability in ROE, with an overall average of (0.047). The company "Ready-Made Garments Production" achieved the highest rate among the sampled companies, with a rate of (0.174), indicating that the company is moving towards financial sustainability (increased returns). Conversely, the company "Iraqi Carton Manufacturing" recorded the lowest rate at (-0.433), indicating weak financial sustainability. The remaining companies' values ranged between the highest and lowest averages.

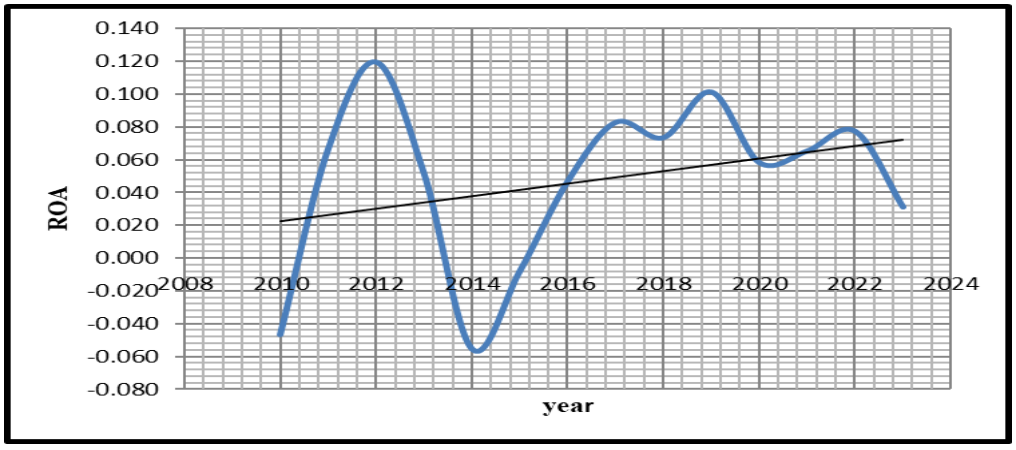

Fig. 5. Curve of Average for the Period - Return on Equity (ROE)

Figure (4) illustrates the average for the period, with the horizontal axis representing the years and the vertical axis showing the values of ROE. It is evident that the average increased over the time series, with the highest average recorded in 2012, while the lowest average occurred in 2014.

3.2.5. Normal Distribution Test and Descriptive Statistics

The normal distribution test is used to verify whether the data conform to a normal distribution, which is essential for the validity of statistical tests that assume normality. The (Jarque-Bera) test will be employed to assess the normal distribution of the sample in statistical and economic analysis. Additionally, the standard deviation will be used to measure dispersion. The industrial companies in the study sample will be represented by numbers (1) to (10) respectively, corresponding to the following companies: Baghdad Soft Drinks, Iraqi Engineering Works, Iraqi Carpets and Furnishings, Ready-Made Garments Production, Iraqi Date Manufacturing and Marketing, Canadian Vaccine and Pharmaceutical Production, Al-Mansour Pharmaceutical Industries, Modern Tailoring, Iraqi Carton Manufacturing, and Baghdad Packaging Materials Manufacturing.

Table 6. Normal Distribution Test Based on Study Indicators for the Sample Industrial Companies

ERD	ERD_01	ERD_02	ERD_03	ERD_04	ERD_05	ERD_06	ERD_07	ERD_08	ERD_09	ERD_10
Jarque-Bera	1.001822	4.581015	0.061163	1.116183	1.482068	1.152340	0.772533	1.636910	1.037791	0.479646
Probability	0.605978	0.101215	0.969882	0.572300	0.476621	0.562047	0.679589	0.441113	0.595177	0.786767
Std. Dev.	0.536799	0.083631	0.054547	0.224984	0.125104	0.024797	0.083305	0.061433	0.305434	0.521191
DED	DED_01	DED_02	DED_03	DED_04	DED_05	DED_06	DED_07	DED_08	DED_09	DED_10
Jarque-Bera	1.315235	3.931934	0.252857	4.771779	0.249377	0.945410	2.827763	2.312092	1.413458	2.754608
Probability	0.518084	0.140020	0.881237	0.092007	0.882772	0.623314	0.243197	0.314728	0.493255	0.252258
Std. Dev.	0.039668	0.456523	0.134853	1.232294	0.555966	0.041848	0.083342	0.099159	1.339793	0.461394
ROA	ROA_1	ROA_2	ROA_3	ROA_4	ROA_5	ROA_6	ROA_7	ROA_8	ROA_9	ROA_10
Jarque-Bera	3.043174	1.472734	1.779776	3.201780	3.807802	2.008319	4.028186	3.099035	1.876828	4.469702
Probability	0.218365	0.478850	0.410702	0.201717	0.148986	0.366353	0.133441	0.212350	0.391248	0.107008
Std. Dev.	0.037320	0.052954	0.056821	0.413013	0.423284	0.077606	0.417783	0.481705	0.504406	0.420366
ROE	**ROE**	ROE_1	ROE_2	ROE_3	ROE_4	ROE_5	ROE_6	ROE_7	ROE_8	ROE_9
Jarque-Bera	4.959589	1.228681	1.885069	4.577415	3.710035	2.044493	3.774462	2.174362	3.422141	4.469037
Probability	0.083760	0.540998	0.389639	0.101397	0.156450	0.359786	0.151491	0.337166	0.180672	0.107044
Std. Dev.	0.063058	0.059246	0.082898	0.204846	0.419724	0.084789	0.417787	0.503477	0.478479	0.420283

3.2.6. Heteroskedasticity Test

Heteroskedasticity occurs in both cross-sectional data and time series models. It refers to the unequal spread of observations, which affects the variance of estimated parameters and subsequently the standard error. Sometimes, a lower variance than estimated is obtained, meaning that heteroskedasticity impacts hypothesis testing. The (ARCH) test will be used to test for heteroskedasticity.

Table 7. Heteroskedasticity Test

Heteroskedasticity Test: ARCH			
F-statistic	1.104339	Prob. F(1,11)	0.3159
Obs*R-squared	1.186055	Prob. Chi-Square(1)	0.2761
Test Equation:			
Dependent Variable: RESID^2			
Method: Least Squares			
Date: 05/02/25 Time: 09:07			
Sample (adjusted): 2010 2023			

The results in Table (7) above, based on the ARCH test, indicate that the p-value is (0.26), which is greater than (0.05). Based on these results and the type of test used, it can be concluded that there is no issue of heteroskedasticity.

3.2.7. Unit Root Test

The Unit Root Test is used for Panel Data to determine whether the variables in the dataset contain unit roots (non-stationary) or are stationary. This test is important because analyzing non-stationary data without treatment may lead to misleading conclusions, such as the problem of spurious regression. Since the current study's data combines both time series and cross-sectional dimensions, traditional tests like ADF may be ineffective due to the increased complexity of the data structure. Therefore, more specialized and advanced tests are employed.

Table 8. Unit Root Test

Indictor	Method	Statistic	Prob.
ERD	Levin, Lin & Chu	-3.04461	0.0000
DED	Levin, Lin & Chu	-2.50325	0.0062
ROA	Levin, Lin & Chu	-4.14318	0.0000
ROE	Levin, Lin & Chu	-7.69154	0.0000

It is evident from Table (8) that the series data (which combines time and cross-sectional dimensions) for all indicators were stationary (homogeneous at level), as the p-values for all indicators were less than (0.05), indicating that the null hypothesis, which states that the time series contains a unit root, can be rejected.

4. RESULTS AND DISCUSSION

4.1. RESULTS

Hypothesis Test for the First Hypothesis: There is no significant effect of capital structure indicators based on the golden ratio on return on assets (ROA). Table (9) shows the results of the test. Additionally, the relationship between the study variables can be expressed in the following equation:

$$\boldsymbol{ROA = B_0 + B_1 ERD + B_2 DED}$$

Where:
ROA: Dependent variable (Return on Assets).
β0: Constant term.
Bi: Coefficient of effect.
ERD, DED: Indicators of capital structure based on the golden ratio.

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Table 9. Results of the Test for the Effect of Capital Structure Indicators Based on the Golden Ratio on ROA

Dependent Variable: ROA_?				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.221975	0.066773	-3.324305	0.0012
ERD_?	0.015063	0.094807	0.158879	0.8740
DED_?	0.183407	0.048108	3.812421	0.0002
Fixed Effects (Cross)			Fixed Effects (Period)	
01--C	-0.116867		2010--C	-0.066750
02--C	-0.131527		2011--C	-0.093594
03--C	0.038846		2012--C	-0.043056
04--C	0.239322		2013--C	-0.116719
05--C	-0.042322		2014--C	-0.183010
06--C	-0.168085		2015--C	-0.129310
07--C	0.065266		2016--C	-0.075867
08--C	0.173440		2017--C	-0.053265
09--C	-0.167596		2018--C	-0.041587
10--C	0.109523		2019--C	-0.039850
			2020--C	-0.071956
			2021--C	0.319065
			2022--C	0.303628
			2023--C	0.292270
Effects Specification				
Cross-section fixed (dummy variables)				
Period fixed (dummy variables)				
R-squared	0.693944			
Adjusted R-squared	0.623524			
S.E. of regression	0.248467			
Sum squared resid	6.976162			
Log likelihood	11.28865			
F-statistic	9.854379			
Prob(F-statistic)	0.000000			

Test for the Second Hypothesis: There is no significant effect of capital structure indicators based on the golden ratio on return on equity (ROE). Table 10) shows the results of the test. Additionally, the relationship between the study variables can be expressed in the following equation:

$$\boldsymbol{ROE = B_0 + B_1 ERD + B_2 DED}$$

Where: ROE: Dependent variable (Return on Equity).

β0: Constant term. Bi: Coefficient of effect.

ERD, DED: Indicators of capital structure based on the golden ratio.

Table 10. Results of the Test for the Effect of Capital Structure Indicators Based on the Golden Ratio on ROE

Dependent Variable: ROE_?				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.045180	0.073822	-0.612014	0.5418
ERD_?	0.041929	0.104815	0.400034	0.6899
DED_?	0.185101	0.053186	3.480266	0.0007
Fixed Effects (Cross)			Fixed Effects (Period)	
01—C	0.025670		2010—C	-0.196431
02—C	-0.006458		2011—C	-0.034863
03—C	0.087859		2012—C	0.017909
04—C	0.028894		2013—C	-0.113102
05—C	0.120724		2014—C	-0.179791
06—C	-0.050788		2015—C	-0.143999
07—C	0.165261		2016—C	-0.067390
08—C	0.246972		2017—C	-0.034317
09—C	-0.669037		2018—C	-0.062990
10—C	0.050903		2019—C	-0.060372
			2020—C	-0.103545
			2021—C	0.337848
			2022—C	0.340171
			2023—C	0.300871
Effects Specification				
Cross-section fixed (dummy variables)				
Period fixed (dummy variables)				
R-squared	0.572164			
Adjusted R-squared	0.473724			
S.E. of regression	0.274695			
Sum squared resid	8.526679			
Log likelihood	-2.760426			
F-statistic	5.812302			
Prob(F-statistic)	0.000000			

4.2. DISCUSSION

Table (9) above shows the results of the effect of independent indicators on the dependent variable (ROA), as well as the results of the differentiation of the effect among companies. It is evident that the coefficient of determination is (0.69), indicating that the independent indicators explain (0.69) of the variation in (ROA). Furthermore, the significance of the model reached (0.000), which is less than the assumed significance level (0.05), indicating that the model is significant.

- The beta coefficient for (ERD) is (0.02), while the significance value is (0.87), which is not significant compared to the significance level assumed by the researcher (0.05). Based on these results, the null hypothesis is accepted.
- The beta coefficient for (DED) is (0.18), while the significance value is (0.000), which is significant compared to the significance level assumed by the researcher (0.05). Based on these results, the alternative hypothesis is accepted.

The section of Table (9) related to the differentiation among industrial companies indicates that the company "Ready-Made Garments Production" exhibited a distinctive effect of the independent indicators on (ROA). Regarding the differentiation among years, it is clear that the year (2021) showed a distinctive effect of the independent indicators on (ROA).

Table (10) above presents the results of the effect of independent indicators on the dependent variable (ROE), as well as the results of the differentiation of the effect among companies. It is evident that the coefficient of determination is (0.57), indicating that the independent indicators explain (0.57) of the variation in (ROE). Furthermore, the significance of the model reached (0.000), which is less than the assumed significance level (0.05), indicating that the model is significant.

- The beta coefficient for (ERD) is (0.04), while the significance value is (0.69), which is not significant compared to the significance level assumed by the researcher (0.05). Based on these results, the null hypothesis is accepted.
- The beta coefficient for (DED) is (0.19), while the significance value is (0.000), which is significant compared to the significance level assumed by the researcher (0.05). Based on these results, the alternative hypothesis is accepted.

The section of Table (10) related to the differentiation among industrial companies indicates that the company "Modern Tailoring" exhibited a distinctive effect of the independent indicators on (ROE). Regarding the differentiation among years, it is clear that the year (2022) showed a distinctive effect of the independent indicators on (ROE).

5. CONCLUSIONS

In light of the results obtained from the practical aspect of the study, and relying on a set of statistical and financial methods, it has been concluded that formulating a capital structure based on the golden ratio leads to increased financial flexibility. This approach encourages a departure from rigid debt-to-equity ratios and reduces reliance solely on internal financing sources. Consequently, this enhances the company’s ability to optimally exploit investment opportunities, which, in turn, reflects positively on maximizing long-term returns while ensuring the necessary liquidity at specified levels.

The findings indicate that approaching the golden ratio creates a surplus in funds, thereby improving investment efficiency and enabling the optimal utilization of investment opportunities. Conversely, deviating from the golden ratio (i.e., increasing reliance on borrowed financing) elevates

financial risks, potentially pushing the company toward failure and eventual bankruptcy, which negatively impacts the return on investment.

Based on the conclusions drawn from the study, a set of recommendations can be proposed to assist the sample companies, particularly in the industrial sector, in keeping pace with development, addressing challenges, and enhancing financial sustainability. To achieve the desired benefits for these companies, we recommend that the companies in the study sample formulate their capital structure by considering the golden ratio and establishing debt ratios that align closely with this range, along with retention ratios that are consistent with the golden ratio.

These measures will help break the rigidity in the funding sources for some companies in the study sample, thereby creating a balance that leads to the integration of financing and investment. This integration, in turn, reflects positively on maximizing the company's efficiency in creating and utilizing investment opportunities. Ultimately, these mechanisms will contribute to maximizing the companies' long-term returns while enhancing their efficiency in managing their assets and increasing their capacity to meet financial obligations.

Furthermore, we recommend that the companies in the study sample adopt a diversification principle in financing by relying on internal funding sources while also resorting to external financing sources (borrowing). We advise the companies against excessive reliance on external financing, as this may lead to increased bankruptcy costs relative to the benefits derived from such debt.

REFERENCES

[1] H. I. M. Amin and K. Cek, "The effect of golden ratio-based capital structure on firm's financial performance," *Sustainability*, vol. 15, no. 9, p. 7424, 2023.
[2] E. P. Prokopakis *et al.*, "The golden ratio in facial symmetry," *Rhinology*, vol. 51, no. 1, pp. 18–21, 2013.
[3] M. Livio, *The golden ratio: The story of phi, the world's most astonishing number*. Crown, 2008.
[4] C.-E. Hretcanu and M. CRAŞMAREANU, "Applications of the golden ratio on Riemannian manifolds," *Turkish Journal of Mathematics*, vol. 33, no. 2, pp. 179–191, 2009.
[5] M. Y. Henein *et al.*, "The human heart: application of the golden ratio and angle," *International journal of cardiology*, vol. 150, no. 3, pp. 239–242, 2011.
[6] T. Omotehinwa and S. Ramon, "Fibonacci numbers and golden ratio in mathematics and science," *International Journal of Computer and Information Technology*, vol. 2, no. 4, pp. 630–638, 2013.
[7] N. Rani, S. S. Yadav, and N. Tripathy, "Capital structure dynamics of Indian corporates," *Journal of Advances in Management Research*, vol. 17, no. 2, pp. 212–225, 2020.
[8] A. Y. Saif-Alyousfi, R. Md-Rus, K. N. Taufil-Mohd, H. Mohd Taib, and H. K. Shahar, "Determinants of capital structure: evidence from Malaysian firms," *Asia-Pacific Journal of Business Administration*, vol. 12, no. 3/4, pp. 283–326, 2020.
[9] Y. Feng, A. Hassan, and A. A. Elamer, "Corporate governance, ownership structure and capital structure: evidence from Chinese real estate listed companies," *International Journal of Accounting & Information Management*, vol. 28, no. 4, pp. 759–783, 2020.
[10] K. H. Kyissima, G. Z. Xue, T. P. Yapatake Kossele, and A. R. Abeid, "Analysis of capital structure stability of listed firms in China," *China Finance Review International*, vol. 10, no. 2, pp. 213–228, 2020.
[11] M. Hirdinis, "Capital structure and firm size on firm value moderated by profitability," 2019.
[12] S. Kruk, "Impact of capital structure on corporate value—review of literature," *Journal of Risk and Financial Management*, vol. 14, no. 4, p. 155, 2021.
[13] M. B. Shaik *et al.*, "Which determinants matter for capital structure? an empirical study on NBFC'S in India," *International Journal of Entrepreneurship*, vol. 26, pp. 1–9, 2022.
[14] S. Mujiatun, R. Rahmayati, and D. Ferina, "Effect Of Profitability And Asset Structure On Capital Structure (In Sharia Based Manufacturing Companies In Indonesia Stock Exchange In 2016-2019 Period)," presented at the Proceeding International Seminar Of Islamic Studies, 2021, pp. 458–468.

[15] O. Irianto and T. Adiatma, "Financial Sustainability Publication Trend: A Bibliometric Study," *Academic Journal of Interdisciplinary Studies*, vol. 12, 2023.
[16] P. N. Sharma and M. Widiyanti, "Corporate Sustainability and Financial Performance: Evidence from State-owned Enterprises in Indonesia," *KnE Social Sciences*, pp. 474–488, 2024.
[17] S. Manaf, M. A. Mukhyi, D. Veronica, M. Ahyar, and S. I. Timisela, "Corporate Financial Management, Risk Assessment, and Investment Strategies: Analyzing Their Effects on Business Sustainability," *Global International Journal of Innovative Research*, vol. 2, no. 6, 2024.
[18] E. Nogueira, S. Gomes, and J. M. Lopes, "Financial Sustainability: Exploring the Influence of the Triple Bottom Line Economic Dimension on Firm Performance.," *Sustainability (2071-1050)*, vol. 16, no. 15, 2024.
[19] V. Septiani and E. Murwaningsari, "PENGARUH KECUKUPAN MODAL, EFISIENSI OPERASIONAL DAN DIVERSIFIKASI PENDAPATAN TERHADAP FINANCIAL SUSTAINABILITY," *JURNAL AKUNTANSI DAN AUDIT TRI BHAKTI*, vol. 3, no. 1, pp. 129–145, 2024.
[20] O. Timofei, "Finanțarea durabilă-punte conceptuală între teoriile financiare și principiile sustenabilității," *Vector European*, no. 02, pp. 128–138, 2024.
[21] U. Bharti, S. Singh, and R. Kumar, "Non-Performing Assets of Commercial Banks: A Trend Analysis," *Business Administration*, vol. 110, 2023.
[22] P. Singh, R. K. Singh, D. Pandey, A. Singh, and R. Pal, "Corporate Sustainability Reporting and Financial Performance: An Empirical Analysis of Indian Listed Companies," 2024.
[23] W. Gleißner, T. Günther, and C. Walkshäusl, "Financial sustainability: measurement and empirical evidence," *Journal of Business Economics*, vol. 92, no. 3, pp. 467–516, 2022.
[24] K. Kumar and A. Prakash, "Developing a framework for assessing sustainable banking performance of the Indian banking sector," *Social Responsibility Journal*, vol. 15, no. 5, pp. 689–709, 2019.
[25] M. Heikal, M. Khaddafi, and A. Ummah, "Influence analysis of return on assets (ROA), return on equity (ROE), net profit margin (NPM), debt to equity ratio (DER), and current ratio (CR), against corporate profit growth in automotive in Indonesia Stock Exchange," *International Journal of Academic Research in Business and Social Sciences*, vol. 4, no. 12, p. 101, 2014.
[26] J. Ulbert, A. Takács, and V. Csapi, "Golden ratio-based capital structure as a tool for boosting firm's financial performance and market acceptance," *Heliyon*, vol. 8, no. 6, 2022.
[27] Z. Alabassi, H. Naser, E. Hussien, A. Al-Yahya, and A.-F. Al, "The Effect of Firm Size on Earnings Per Share Through Financial Leverage An analytical study of a sample of industrial Firms listed on the Iraqi stock exchange," vol. 5, Nov. 2022.
[28] Z. M. Alabassi, E. H. A. AL-Yahya, and H. Naser, "The effect of dynamic financial structure on financial sustainability-An analytical study of a sample of industrial companies listed on the Iraqi stock exchange".