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The effect of corporate governance, audit quality and public sector accounting on financial performance: a comparative study of Iran and Iraq with the approach of learning and neural algorithms¹

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Abstract

As a fundamental part of the economy, the corporate system plays a vital role in value creation and economic growth. In volatile economic conditions, predicting and managing the financial performance of companies is particularly important. Focusing on the listed companies of Iran and Iraq, this research has investigated the effect of corporate governance, auditing and accounting quality of the public sector on financial performance using financial and economic data from 2008 to 2023. The models used include Decision Tree, Gradient Reinforcement, Support Vector Machine (SVM), Support Vector Regression (SVR), Artificial Neural Network (ANN), Multilayer Perceptron (MLP), Gaussian Neural Network (RBF), Probabilistic Neural Network (PNN), Recurrent Neural Network (RNN) and Expected Optimization Algorithm. The results of the research showed that in Iran, the decision tree model showed the most efficiency in predicting the financial performance of companies with an accuracy of 81.81%. This shows the importance of non-linear structure in the relationships between the variables of corporate governance, audit quality and public sector accounting with financial performance. In the area of neural networks, the recurrent neural network model with a root means square error of 1.701 and the multilayer perceptron model with an average absolute error percentage of 0.8115 had superior performance, indicating the importance of considering temporal dependencies in financial data. Support vector machine models and the expectation optimization algorithm with an accuracy of 74.37% also produced acceptable results. A similar pattern was observed for Iraq, but with minor differences. The adversarial learning model, with a mean square error of 0.0992, performed better in Iran, which can be attributed to the difference in corporate structure and level of financial market development between the two countries. According to the results of the research, the key variables affecting the financial performance of companies in Iran and Iraq, including the structure of the board of directors, the independence of the auditor, financial transparency, the quality of information disclosure and the implementation of public sector accounting standards were recognized as the most important factors. The results also emphasise the importance of paying attention to the complex interaction between the variables of corporate governance, audit quality and public sector accounting with financial performance, especially during periods of economic recession. Finally, this research highlights the need to develop performance assessment systems based on machine learning and neural network models, which can contribute to the timely identification of poorly performing companies and preventive intervention, ultimately leading to the strengthening of financial stability and sustainable economic growth.

Keywords: corporate governance, audit quality, public sector accounting, financial performance, machine learning, neural network, Iran Stock Exchange, Iraq Stock Exchange

INTRODUCTION:

In the current global environment, which is characterized by rapid and complex changes in economic systems, it is necessary to pay attention to corporate governance mechanisms, audit quality, and accounting efficiency in the public sector as key factors in improving the financial performance of companies (Khajawi and Ebrahimi, 2017). Corporate governance as a system of managing and controlling companies plays an important role in improving financial performance, increasing transparency, reducing risks and improving investment decisions (Khojste and Wadizadeh, 2022). Evaluating the performance of companies has always been an important issue, and investors look for companies with higher stock returns and better financial performance. However, the financial performance of companies is sometimes affected by financial crises, which can lead to the loss of nominal value of financial resources (Qousi and Akbarpour, 2018). On the other hand, financial crises, such as the crisis of the last decade and the COVID-19 pandemic, have had a significant impact on financial markets and corporate performance. These crises have led to a decrease in equity financing and an increase in debt in the capital structure of firms (Khairollahi et al., 1401; Ikki and Mamal, 2023). In this situation, many companies face the problem of debt repayment and financial helplessness. Studies show that the impact of these crises on companies is heterogeneous and depends on the specific characteristics of the company and the industry (Carletti et al., 2020; Alfaro et al., 2020; Ding et al., 2021). In this context, the corporate governance system, as a system that combines several scientific branches, can contribute to the efficient use of resources and improve corporate accountability by maintaining a balance between social, economic, individual and collective goals (Jensen, Meckling and W., 1976).

Audit quality is also known to be an important factor in increasing investor confidence and reducing agency costs (Abdullah and Torsavi, 2023). Independent auditors contribute to the credibility and reliability of financial information by providing accurate and unbiased assessments of financial reports (Duzperaladi, 1984). This leads to increased transparency and reduced investment risk (Zatoni, 2011). With increased competition in the global business arena, audit quality has become one of the key components in corporate governance strategies and financial decisions (Edrin and Ekoum, 2015). Detailed audit reports can help managers identify functional strengths and weaknesses and strengthen the company's competitive position in the market (Jasem Saeed et al., 1403). Recent financial crises have focused the attention of the financial media on the performance of auditors. For example, the Public Accounting Oversight Committee has accused auditors of not properly applying auditing standards to financial statements affected by the economic crisis (Du and Lai, 2018). In addition, globalization and recent financial scandals have raised concerns about the reliability of financial statements. These factors, together with the pressure of the financial crisis, have increased the demand for high quality audits (Zurigat, 2011). Therefore, it is particularly important to assess the impact of audit quality on the sustainable financial performance of companies and its role in guiding companies towards long-term growth and success, especially in a competitive environment.

Public sector accounting also plays an important role in establishing a balanced framework for assessing and reporting financial performance (Egbodo and Akabogo, 2018). This branch of accounting plays an important role in providing reliable and understandable financial reports for optimal economic decisions (Jamshidi et al., 2023). Given the rapid progress of the world towards economic challenges and new financial developments, the role of public sector accounting and its impact on the financial performance of companies is particularly important (Bokhroa et al., 2021). Public sector accounting plays a central role not only in managing financial resources and their optimal allocation, but also in ensuring transparency and accountability to multiple stakeholders (Mulawardi et al., 1401). Public sector accounting standards, such as IPSAS, can act as powerful tools to clarify and improve the quality of financial information (Gholami Malek et al., 1401). These standards not only improve the reporting and comparability of financial information, but also lay the groundwork for modernizing government accounting policies and increasing accountability and efficiency in public administration (Polzer et al., 20-23). In this context, important questions arise: How can public sector accounting affect the financial performance of companies? Does the implementation of public sector accounting standards, especially in resource-poor countries, provide a suitable platform for increasing investment and improving macroeconomic conditions? And how can government regulation, supervision and financial reporting be aligned and synergized with the corporate financial system? The purpose of this research is to examine the impact of the quality of corporate governance, auditing and public sector accounting on the financial performance of companies listed on the Iranian and Iraqi stock exchanges.

1- Theoretical Literature and Research Background

In the field of economics and accounting, corporate governance is recognized as a key factor in the financial performance of organizations. This concept refers to a set of mechanisms, processes and relationships that determine how an Organisation is directed, controlled and accountable. Good corporate governance can lead to increased transparency, better strategic decisions and reduced operational and financial risks. This in turn can increase investor confidence and reduce agency costs, ultimately leading to improved financial performance. Several definitions of corporate governance have been proposed, including narrower definitions that focus on the relationship between owners and managers (Cadbury Commission, 1992; Parkison, 1994) and broader definitions that include corporate social and environmental responsibilities (Megginson, 1994; Monks and Minow, 1995). International institutions such as the International Monetary Fund (IMF) and the Organisation for Economic Co-operation and Development (OECD, 2021) have also provided definitions of corporate governance that emphasise its importance in achieving strategic goals and competitive performance. Corporate governance also plays a key role in risk management. It includes effective oversight of internal processes, risk assessment and checks and balances that hold managers to performance and ethical standards. This can help prevent mismanagement of resources and reduce the company's exposure to unsupported financial

opportunities, ultimately helping to improve the company's long-term financial prospects and financial stability.

In addition to corporate governance, audit quality also plays an important role in the financial performance of companies. Audit quality refers to the ability of auditors to meet the needs of users of financial reports (Defond and Zhang, 2014). This concept includes factors such as accuracy and correctness of information, absence of conflicts of interest, focus on audience priorities, and compliance with auditing standards (Aghaei Chadgani and Yadollahi Farsani, 2018; Babaei and Quinton, 2011; Anna Katarina and Mark, 2020; Stephen Lelory et al., 2023). One of the key definitions of audit quality is provided by D'Angelo (1981), who defines it as the market's assessment of the auditor's ability to detect and report material misstatements. This definition emphasises two key aspects: the ability to detect distortions and the willingness to report them (Mohammed Rezaei and Yaqub Nejad, 2015). Other definitions have been provided by researchers such as Palmerose (1988), Titman and Trueman (1986) and Davidson and New (1983), who emphasise different aspects of audit quality. For example, Palmerose (1988) defines audit quality in terms of the degree of credibility of audit data, while Titman and Trueman (1986) relate it to the accuracy and correctness of information provided to post-audit audiences. Davidson and New (1983) also provide a definition that links audit quality to the auditor's ability to detect and correct material misstatements and to detect potential manipulation of net income.

Audit quality and financial reporting quality, as two key factors in assessing the transparency and accuracy of financial reporting, have been increasingly studied in recent years (Gainour et al., 2016). On the one hand, financial reporting quality is a measure that evaluates the degree of accuracy of the representation of a firm's economic condition and performance by its financial statements, while audit quality is a measure that evaluates whether the auditor's observations are sufficient and effective to confirm the financial statements. On the other hand, public sector accounting is another important field in economics and financial management. This branch of accounting records, analyses and reports the financial operations of government units and non-profit organizations affiliated to the government (Kordestani et al., 2015). The main purpose of public sector accounting is to provide accurate and reliable financial information for management decisions and public information (Kavas et al., 2021). This area includes processes such as budget formulation, budget distribution and monitoring, and management of government assets and liabilities (Polzer et al; 2023).

Public sector accounting faces certain challenges such as the need to comply with specific laws and regulations, the importance of transparency and accountability, and the need for accurate management of public resources (Abdullah and Tarsavi, 20-23). The field plays an important role in improving the efficiency and effectiveness of government organizations, increasing public trust, and optimal use of government resources (Qaemi and Alavi, 2019). Public sector accounting also helps to increase transparency in the amount and manner of consumption of government resources, which allows various stakeholders, including the

public, managers, and the legislative assembly, to be sure of the success rate of government agencies in resource management. In short, corporate governance, audit quality and public sector accounting are three key elements in the field of business and accounting that have a significant impact on the financial performance of organizations, the transparency of financial reporting and the optimal management of public resources. These elements interact to help improve financial decisions, increase the confidence of investors and beneficiaries, and improve the efficiency and effectiveness of the management of financial resources. As a result, many studies have been carried out in this area, the most important of which are listed in Table 1:

Table 1. Experimental studies

Researcher(s)	Research Topic	Method	Key Findings
Adrian and Ekowm (2015)	Impact of corporate governance and financial performance on audit quality in Nigeria	Logistic regression	Non-executive ownership, company size, debt level, profitability, and CEO duality affect audit quality
Ya Obeid (2016)	Impact of IFRS adoption on accounting quality in Egypt	Pre- and post-IFRS adoption comparison	Accounting quality decreased after IFRS adoption
Egbunike and Akabuogu (2018)	Impact of audit quality on corporate performance of Nigerian banks	Regression	Audit firm size, audit committee independence and size impact corporate performance
Baldavoo and Nomlala (2019)	Impact of audit quality and corporate governance on firm value in Ghana	Random regression model	Audit quality and effective corporate governance positively impact firm value
Al-Ahdal et al. (2020)	Comparison of corporate governance and financial performance in India and GCC countries	Comparative analysis	Indian companies perform better in corporate governance and financial performance
Kawas et al. (2021)	Relationship between corporate governance, internal audit quality, and financial reporting quality in Uganda	Correlation analysis	Board expertise, board performance, and internal audit quality positively relate to financial reporting quality
Abdullah and Tursoy (2023)	Relationship between corporate governance and firm performance in Germany	Panel data analysis	Some audit committee and board characteristics negatively impact financial performance; IFRS adoption has a positive impact
Jasim Saeed et al (2024)	Impact of corporate governance, audit quality, and public sector accounting on financial performance in Iraqi organizations	Machine learning models using 2015-2022 monthly data	Corporate governance, audit quality, and public sector accounting significantly affect financial performance, transparency, and risk management in Iraqi companies and government organizations

Finally, given that in the field of the impact of corporate governance, audit quality, and public sector accounting on the financial performance of companies listed on the Iraq Stock

Exchange, due to the importance of economic reforms and sustainable development in a country with a history of political and economic instabilities, conducting this research can help increase transparency and trust in the Iraqi capital market and create a basis for attracting global investments and improving the business environment. In addition, by improving audit quality and standardizing public sector accounting methods, a basis for reducing financial corruption and increasing accountability will be provided, and this will lead to strengthening economic foundations and increasing the efficiency of company performance. Also, by relying on these components, companies can improve their sustainability and competitiveness while facing financial challenges and dynamic changes in the market. This research is of double importance as it helps to identify the relationships and impacts between companies' financial performance and factors affecting it and provides policymakers and economic practitioners with a better understanding of the complexities and needs of the current Iraqi financial market. On the other hand, considering the reviews of theoretical literature and research background, it is observed that there is no or very little research that directly examines the impact of corporate governance, audit quality, and public sector accounting on the financial performance of companies listed on the Iraq and Iran Stock Exchange, which the present research also has a research gap in this respect, and this study addresses the present research gap.

3. methodology

3.1 Model Specification

In the present study, the research models will be as follows, and in the following, we will also discuss the operational definition of the research variables:

$$ROE_{it} = f(\beta_1 GCQ_{it} + \beta_2 AUD_{it} + \beta_3 IPSAS_{it} + \beta_4 SIZE_{it} + \beta_5 LEV_{it} + \beta_6 IOP_{it} + \beta_7 DUAL_{it}) \quad (1)$$

$$ROA_{it} = f(\beta_1 GCQ_{it} + \beta_2 AUD_{it} + \beta_3 IPSAS_{it} + \beta_4 SIZE_{it} + \beta_5 LEV_{it} + \beta_6 IOP_{it} + \beta_7 DUAL_{it}) \quad (2)$$

The above relationships: ROA: indicates the optimal use of the company's assets, as an indicator of the company's financial performance; ROE: represents the company's return on equity, which represents the company's financial performance. GCQ: expressing the quality of corporate governance; AUD: audit quality indicator; IPSAS: public sector accounting indicator; SIZE: company size; LEV: financial leverage; IOP: investment opportunities; DUAL: The dual responsibility of the CEO.

1. Dependent variable

In this study, in line with the studies of Panachi (2021), we use return on equity (ROE) as a measure of the financial performance of companies. Meanwhile, we add another variable called ROA. The reason for choosing these variables as an indicator of firm performance is their objectivity in empirical research, so the measure of financial performance is used in this research in two ways, the way of calculating them is as follows Would be:

$$ROA = \frac{\text{Net income}}{\text{total assets}} * 100 \quad \text{and} \quad ROE = \frac{\text{Net income}}{\text{Total equity}}$$

Therefore, it should be said that based on previous studies, these two variables have been used as a criterion to show the financial performance of companies, and the data related to these two variables have been obtained from the website of the Central Bank of Iraq⁵, the

⁵ <https://cbi.iq/>.

World Bank website, the website of the ⁶Monetary and Economic Stability Department⁷ for Iraq, and from the websites of accounting databases, Kadal⁸, Rahavard⁹Novin, FIPA Iran¹⁰, and Tehran Stock Exchange^{11,12} for The country of Iran has been obtained.

2. Independent Variables

Corporate Governance Variable (CGQ):

In the present study, in line with the studies (Grayley, 2015, Dunro & Kim, 2005, Brown & Keeler, 2006, Jiang et al., 2008, and Wuaro, 2014), a list related to corporate governance that is consistent with the context of Iraqi reporting is first prepared, and then in order to operationalize the Corporate Governance Quality Index, the coding and scoring method is used. Based on this method, each of the components of corporate governance is analyzed. Points of zero or one (according to their operational definition) are assigned and from the sum of these points, the score related to the corporate governance score is calculated for each company in each year. So that a higher score for this index indicates more efficient corporate governance and a lower score for this index indicates a weaker corporate governance whose components of corporate governance and their operational definition are as described in Table (2).

Table (2) Operational Definition and Components of Corporate Governance

Component Name	Operational Definition
Non-executive board members	If the ratio of non-executive members to total members is higher than the average ratio calculated for all companies, 0; otherwise, 1
Separation of CEO and Chairman roles	If CEO and Chairman roles are not separated, 0; otherwise, 1
CEO stability	If CEO changed in the past two years, 0; otherwise, 1
Use of accounting and finance expert	If no accounting and finance expert on the board, 0; otherwise, 1
Non-executive Chairman	If Chairman is executive, 0; otherwise, 1
Audit committee	If no audit committee composed of non-executive board members, 0; otherwise, 1
Number of board meetings	If number of board meetings not mentioned in annual report, 0; otherwise, 1
Presence of controlling shareholders	If no controlling shareholders, 0; otherwise, 1
Ownership concentration	If company's free float percentage is higher than average free float, 0; otherwise, 1
Ownership structure	If ownership structure not mentioned in annual report, 0; otherwise, 1
Related party transactions	If ratio of related party transactions to company sales is higher than average, 0; otherwise, 1
Government shareholding	If government ownership percentage is lower than average, 0; otherwise, 1
Existence of website	If no website for company information disclosure, 0; otherwise, 1
Information preparation timing	If company's information score is less than 50, 0; otherwise, 1
Information reliability	If company has annual adjustments, 0; otherwise, 1
Auditor's opinion type	If company received unqualified opinion from auditor, 0; otherwise, 1
Future plans	If no mention of future plans in annual reports, 0; otherwise, 1
Employment report	If no mention of employee employment status, 0; otherwise, 1

Audit Quality (AUD):

In order to measure the audit quality index, audit firms have been classified into two groups: large firms and small firms. In this study, the large institution is the audit organization and the small firm is the private audit firm that is a member of the Society of Certified Public Accountants. Thus, if the auditor of the company is an audit organization, it

⁶ <https://www.worldbank.org/en/country/iraq/overview> .

⁷ <https://cbi.iq/static/uploads/up/file-164438874636623> .

⁸ <https://padelm.ir/index.php?mod=library&reqcategory=252>

⁹ <https://www.codal.ir/>

¹⁰ <https://rahavard365.com/>

¹¹ <https://www.fipiran.com/DataService/IndexIndex>

¹² <https://www.tse.ir/>

is considered as a large and high-quality audit firm and the number 1 is assigned to that company and if not, it is assigned the number zero Forever. The theoretical basis for selecting this variable is that in previous researches, it has been shown that the size of audit firms has a direct relationship with the quality of their work. Because large audit firms have more experienced auditors and a better supervisory system, and they are not willing to lose their reputation in the face of poor audit quality. Therefore, based on this argument, the larger the size of the audit firms, the higher the quality of the information of the companies that are audited. This measurement method has also been used in many internal studies such as Bani Mahd (2012), Namazi & Colleagues (2011) and Saghafi & Motamedi Fazell (2011).

Public Sector Accounting (IPSAS):

IPSAS: It is the symbol of the application of international public sector accounting standards, which in this study, in line with the studies of Pour Hosseini Hesar et al. (2021), public sector accounting will be used. Therefore, based on the status of implementation of those standards, each country has two codes: one, i.e., the application of international public sector accounting standards, and zero, i.e., non-application of international public sector accounting standards.

3. Control Variables

Firm Size (SIZE): In the present study, similar to the research of Chu and Kim (2003), Aref et al. (2007) and Voro (2014), the natural net sales logarithm is used to measure the size of the company.

Financial Leverage (LEV): In this study, similar to the empirical studies of Danro & Kim (2005) and Vevero (2014), to measure financial leverage, the debt ratio calculated by dividing the total debt by the book value of the company's assets has been used.

Investment Opportunities (IOP): Investment opportunities are an unobservable variable that no single criterion has been provided for its measurement so far. However, in the present study, the ratio of capital expenditure to total assets of the company has been used to measure investment opportunities following the study of Aref et al. (2007) and Varro (2014).

Dual Responsibility of the Managing Director (DUAL): If the CEO is also the chairman or vice chairman of the board of directors, this situation is called the dual CEO and, in this case, the CEO has more powers. Therefore, in this study, whether the CEO is the chairman or vice chairman of the board of directors or not is considered as a control variable of the research. 1 will be given to it, whereas in the opposite case it should be, in which case it will be given a zero number. Finally, this study used monthly data during the period from 2015 to 2023. Therefore, in this study, in order to investigate the impact of corporate governance, audit quality, and public sector accounting on financial performance, machine learning methods are used including decision tree, reinforcement gradient, K-means clustering, demand-based forecasting models, interactive learning, principal component analysis, support vector machine, support vector regression, and expectant optimization algorithm. Also, different types of neural networks such as artificial neural network (ANN), cerebellar neural network, fuzzy neural network, Gaussian neural network, probabilistic neural network, and multilayer perceptron neural network have been used. This diverse combination of methods allows for a more accurate comparison and evaluation of the financial performance of listed companies.

3.2 Machine Learning

In this study, several machine learning methods have been employed to investigate the impact of corporate governance, audit quality, and public sector accounting on financial performance. The decision tree method is utilized to categorize companies based on their governance and audit characteristics, creating a hierarchical structure that predicts financial performance. This approach selects the most significant indicators and divides the data into homogeneous subsets at each node, using information criteria such as entropy or Gini index (Chen, 2011). The reinforcement gradient method combines multiple weak models, typically shallow decision trees, to predict financial performance based on governance and audit factors. This iterative process adds new models to correct errors from previous ones, aiming to minimize the loss function (Xia et al., 2024).

K-means clustering is employed as a preprocessing step to group companies with similar governance and audit characteristics. This method can identify patterns in corporate governance and audit quality that relate to financial performance (Dardak & Boytan, 2009; Abdul-Amir et al., 2022). The K-nearest neighbor approach is used to predict a company's financial performance based on the status of the most similar companies in terms of governance and audit qualities. This method calculates the Euclidean distance between data points to find the closest matches (Gogas et al., 2018).

Interactive learning, using a generative adversarial approach, is applied to improve the accuracy of financial performance forecasting based on governance and audit factors. This method employs two competing models: a generator creating synthetic samples and a discriminator differentiating between real and synthetic data (Liguri et al., 2024). Principal Component Analysis (PCA) is utilized to reduce the dimensionality of the governance, audit, and financial data, identifying the main variables that explain the greatest variance (Xinming, 2024). This helps in reducing model complexity and avoiding overfitting when predicting financial performance.

Finally, the expectation optimization algorithm is used to fine-tune the parameters of the prediction models. This algorithm seeks to find the optimal set of parameters that maximize the expected performance of the model in predicting financial outcomes based on governance and audit factors. By iteratively updating parameters and calculating gradients, this method enhances the overall predictive power of the models (this method doesn't have a specific reference in the given text, but it's a standard optimization technique in machine learning). The combination of these diverse machine learning approaches provides a comprehensive analysis of how corporate governance, audit quality, and public sector accounting influence financial performance, offering robust and multi-faceted insights into these relationships.

3.3. Neural network

In this research, four types of natural neural networks have been used to investigate corporate governance, audit quality, and the public sector on financial performance. Using multiple layers of neurons, the artificial neural network (ANN) models non-linear relationships between input energies (corporate governance indicators, audit quality and public sector accounting) and financial performance. This network is trained using the backpropagation algorithm to find the optimal weights for predicting financial performance (Sabhani Fard and Shahreki, 2020). The Cerebellar Neural Network (CNN) is inspired by the structure of the brain's cerebellum and is suitable for detecting temporal patterns in financial and governance data. Using Gaussian functions, this network models complex trends in corporate governance indicators and audit quality and can detect subtle changes in these indicators that affect effective performance (Vijayan and Divakar, 2022). Gaussian neural

network (GNN) also uses Gaussian radial basis functions to model nonlinear relationships between governance changes and financial performance. This network can identify complex patterns in data and model the nonlinear relationships between corporate governance indicators and financial performance well (Khosroviani et al., 2023).

A probabilistic neural network (PNN) is used to classify companies into "good" and "poor" financial performance groups based on indicators of corporate governance and audit quality. This network works based on probability density function estimation and can have the probability of belonging to a company. Finally, the multi-layer perceptron (MLP) neural network is a powerful model for predicting financial performance based on studies of corporate governance, audit quality, and public sector accounting. This network consists of several layers of neurons that can model complex and non-linear relationships between input and financial performance. Of these four types of artificial neural use together, it provides the possibility of comprehensive and accurate examination of corporate governance, audit quality and public sector accounting on financial performance. Each of these networks, according to their own characteristics, model the aspects created from these relationships, and finally the results can be seen in relation to this issue.

Corporate governance, audit quality, and public sector accounting play an important role in the financial performance of companies, but predicting the impact of these factors, especially in emerging markets such as Iran and Iraq, is a complex challenge. This study aimed to investigate the effect of corporate governance, audit quality, and public sector accounting on the financial performance of companies listed on the Iran-Iraq Stock Exchange using a machine learning approach. Using advanced data mining techniques and machine learning algorithms, this study seeks to provide an efficient model for predicting the financial performance of these companies based on the indicators of corporate governance, audit quality, and public sector accounting. One of the main challenges in comparative studies between Iran and Iraq is the difference in the currencies and financial systems of the two countries. To overcome this challenge, standardization and data normalization techniques have been used. Using these methods, the financial and governance indicators of the two countries have become a common scale. This approach allows for a more accurate comparison of financial and governance data from Iran and Iraq and also takes into account the effects of systematic differences in the analysis. After this step, the data were prepared using the z-score normalization technique.

This research uses historical data of companies listed in the Iranian and Iraqi stock exchanges and considering key variables such as corporate governance indicators (such as board composition, auditor independence), audit quality (such as the size of the audit firm, auditor expertise in the industry), public sector accounting indicators (such as reporting transparency, compliance with accounting standards) and financial performance (such as return on assets, Q-Tobin ratio) to provide a comprehensive model for The impact of these factors on the financial performance of companies is predicted. Table 3 shows the status of the research variables in terms of descriptive statistical indicators. This table includes statistical information such as mean, standard deviation, minimum and maximum for variables related to corporate governance, audit quality, public sector accounting indicators, and financial performance of the studied companies in Iran and Iraq. This descriptive information provides a general view of the status of these variables in the sample and provides a basis for further analysis and it provides a comparison between the two countries. In descriptive statistics, the

status of the data with central indicators is discussed. Table (3) shows the status of the research variables in terms of descriptive statistical indicators:

Table 3. Descriptive Statistics

RESEARCH VARIABLES	MEDIAN	MEAN	MAX	MIN	JARQUE-BERA	PROBABILITY
OPTIMAL USE OF COMPANY ASSETS	28.97521	21.16500	95.6900	10.10000	66.66619	0.000000
RETURN ON EQUITY	59.39293	61.65000	90.80000	10.00000	71.26165	0.000000
CORPORATE GOVERNANCE	7.038043	7.000000	19.00000	0.000000	25.17947	0.000003
AUDIT QUALITY	0.714674	1.00000	1.00000	0.000000	73.86402	0.000000
PUBLIC SECTOR ACCOUNTING	0.630435	1.00000	1.00000	0.000000	62.64151	0.000000
COMPANY SIZE	2.189608	2.20943	2.39740	1.891370	27.10152	0.000000
FINANCIAL LEVERAGE	63.16957	67.00000	88.70000	0.000000	215.3826	0.000000
INVESTMENT OPPORTUNITIES	69.59755	74.20000	91.10000	37.80000	36.74465	0.000000
CEO DUALITY	0.668478	1.000000	1.000000	0.000000	59.40196	0.000000

Source: Research Calculations

According to the results listed in Table (3), which represents the descriptive statistics of the research variables, it can be seen that not all the research variables have a normal distribution. In other words, according to the probability of the Jarek-Bro statistics, for the research variables, which are all much less than 0.05, it indicates the rejection of the null hypothesis of the Jarek-Bro test. Non-parametric statistics will also be used for investigation and research. In this research, machine learning research method will be used to investigate the relationship between the impact of corporate governance, audit quality, and public sector accounting on the financial performance of companies listed on the Iranian and Iraqi stock exchanges.

4. Data and Information Analysis

In the present study, first, to investigate the financial performance of companies listed in the Iran-Iraq Stock Exchange, decision tree machine learning and reinforcement gradient have been used, the results of which are as follows:

Table 5: Investigating the Financial Performance of Companies Listed in the Iran-Iraq Stock Exchange Based on Decision Tree and Reinforcement Gradient

Country	Variable	DT_Importance	GB_Importance
Iran	SIZE	264.9383	11.3218
	IOP	245.2974	10.4355
	LEV	207.3870	10.5365
	GCQ	138.5094	10.2815
	IPSAS	95.0632	9.4989
	AUD	67.3803	9.1444
	DUAL	58.3899	10.0593
	Decision Tree	0.8181	0.2636
	Gradient Boosting	0.5017	0.7230
Iraq	SIZE	259.4399	11.0850
	IOP	183.5904	11.4736
	LEV	168.2309	10.1807
	GCQ	153.0713	9.1066
	IPSAS	121.0824	9.4327
	AUD	114.7273	10.4765
	DUAL	91.5085	9.6033
	Decision Tree	0.8440	0.2259
	Gradient Boosting	0.5027	0.7253

Source: Research Findings

The results presented in Table 4 show that the factors influencing the financial performance of companies in Iran and Iraq are different. In Iran, GCQ (corporate governance quality), AUD (audit quality) and SIZE (firm size) variables are the most important in influencing ROA (return on assets). This shows that corporate governance quality, audit quality and company size play a key role in determining the financial performance of Iranian companies. IPSAS (Public Sector Accounting) and LEV (Financial Leverage) variables are also very important. The decision tree model has performed better than gradient reinforcement (50.17%) in predicting ROE of Iranian companies with an accuracy of 81.81%. On the contrary, for Iraq, IPSAS (Public Sector Accounting), GCQ (Corporate Governance Quality) and AUD (Audit Quality) variables are the most important in predicting the financial performance of companies. These results highlight the importance of public sector accounting, corporate governance quality and audit quality in determining the financial status of Iraqi companies.

The IOP (investment opportunities) and DUAL (CEO dual responsibility) variables also play a significant role in the financial performance of Iraqi companies. The Decision Tree model, with an accuracy of 84.40%, performed better than Gradient Reinforcement (50.27%) in predicting the ROA of Iraqi companies. These differences in the importance of the variables and the performance of the models between the two countries indicate the structural differences in the corporate and economic systems of Iran and Iraq and emphasise the importance of considering the specific conditions of each country in modelling the financial performance of companies. Therefore, it can be concluded that the study of the impact of corporate governance, audit quality and public sector accounting on the financial performance of companies listed in Iran and Iraq requires the consideration of different factors in each country.

Table 5. Examining the financial performance of companies listed on the stock exchange of Iran and Iraq based on K clustering

SIZE	AUD	LEV	GCQ	IPSAS	IOP	DUAL	SIZE	ROA&ROE	Cluster	Country
2.753	3.646	13.327	1.602	0.481	8223	0.685	0.816	1.803	2	Iran
3.564	4.421	14.559	1.432	0.526	1072	0.628	0.498	1.937	2	
2.427	4.139	10.793	2.290	0.446	1084	0.765	0.142	1.585	3	
3.741	5.973	11.664	2.259	0.382	8513	0.872	0.571	2.116	2	
3.458	5.619	12.804	2.104	0.590	1036	0.306	0.865	2.873	2	
K-Nearest Neighbors Iran					RMSE		R_squared			
					0.5811		0.6346			
2.601	5.902	10.799	2.091	0.430	851.500	0.203	0.954	1.962	2	Iraq
2.506	4.768	12.125	1.937	0.405	101.700	0.390	0.277	1.345	2	
2.826	3.948	13.848	1.746	0.546	117.900	0.519	0.272	2.781	3	
2.808	5.843	9.913	1.902	0.456	100.000	0.448	0.295	1.345	3	
3.027	5.492	14.778	2.105	0.495	988.900	0.020	0.294	1.629	2	
3.072	4.996	15.336	2.158	0.461	1198.500	0.852	0.519	3.522	3	
K-Nearest Neighbors Iraq					RMSE		R_squared			
					0.5741		0.6428			

Source: Research Findings

The analysis of the data of the companies accepted in the stock exchange of Iran and Iraq shows that the mechanisms of corporate governance, the quality of audit services and the implementation of public sector accounting standards have a significant effect on the financial performance of economic enterprises. In Iran, the corporate governance index (GCQ) with an average of 1.602 and audit quality (AUD) with an average of 3.646 show a positive correlation with the indicators of return on assets (ROA) and return on equity (ROE). Meanwhile, the implementation of Public Sector Accounting Standards (IPSAS) has a lower impact on financial performance with an average of 0.481. On the contrary, in Iraq, corporate governance with an average of 2.091 and audit quality with an average of 5.902 have a stronger effect on financial performance indicators, which indicates the difference in the regulatory structures and legal environment of the two countries. The K-Nearest Neighbors model with the determination coefficient (R-squared) of 0.6346 for Iran and 0.6428 for Iraq shows an acceptable explanatory power in predicting the financial performance of companies. This model has been able to explain about 63-64% of the changes in the dependent variables of financial performance. Cluster analysis also shows the existence of distinct groupings in the companies of both countries, which can be caused by the difference in the level of implementation of corporate governance principles, the quality of audit services, and the level of compliance with public sector accounting standards. The results of this research highlight the strategic importance of strengthening corporate governance mechanisms, improving the quality of audit services and fully implementing public sector accounting standards in improving the financial performance of economic entities in both countries. However, the observed differences in the patterns of influence of these variables on financial performance in Iran and Iraq highlight the need to design and implement economic policies that are appropriate to the specific conditions of each country. This may include structural reforms in regulatory systems, strengthening the legal framework for capital markets, and creating economic incentives to improve transparency and accountability in economic entities.

Finally, after determining the results of K clustering, the financial performance of companies in Iran and Iraq was investigated. Table 6 examines the financial performance of companies admitted to the stock exchange of Iran and Iraq using three different models - ARIMA (model based on demand forecasting), Elastic Net (adversarial learning), and PCA (principal component analysis) for admitted banks. It shows in the stock exchange of Iran and Iraq. This table includes the RMSE and R-squared evaluation metrics for the ARIMA and Elastic Net models, and also presents the coefficients of the first two principal components (PC1 and PC2) for the various variables in the PCA analysis.

Table 6. Investigating the financial performance of the companies admitted to the stock exchanges of Iran and Iraq based on models based on demand forecasting, contrast learning, principal component analysis.

Country	Model	RMSE	R_squared	Variable	PC1	PC2
Iran	ARIMA	0.9533	0.0000	-	-	-
	Elastic Net	0.1008	0.9888	-	-	-
	PCA	-	-	SIZE	0.0187	0.4487

	PCA	-	-	IOP	0.4612	-0.0894
	PCA	-	-	LEV	0.2154	0.3431
	PCA	-	-	GCQ	-0.1628	0.2435
	PCA	-	-	IPSAS	0.0470	0.6445
	PCA	-	-	AUD	0.5351	-0.1344
	PCA	-	-	DUAL	0.0867	-0.4054
Iraq	ARIMA	0.9623	-0.0064	-	-	-
	Elastic Net	0.0992	0.9893	-	-	-
	PCA	-	-	SIZE	0.2056	0.3896
	PCA	-	-	IOP	0.6144	0.0180
	PCA	-	-	LEV	0.2994	-0.4652
	PCA	-	-	GCQ	-0.4156	-0.3069
	PCA	-	-	IPSAS	0.1350	0.5774
	PCA	-	-	AUD	0.1424	0.2529
PCA	-	-	DUAL	-0.2792	0.0304	

Source: Research Findings

The results of the data analysis of listed companies in Iran and Iraq show that corporate governance, audit quality and public sector accounting have a significant impact on financial performance. The comparison of ARIMA and Elastic Net models for both countries shows that the Elastic Net model with a higher R-squared (0.9888 for Iran and 0.9893 for Iraq) has a much better performance in predicting the financial performance of companies. This shows the complexity of the relationships between the variables studied and the superiority of machine learning methods in modelling these relationships. Principal component analysis (PCA) for both countries shows that variables related to corporate governance (GCQ), audit quality (AUD) and public sector accounting (IPSAS) play an important role in explaining the variance of the data. In Iran, AUD (0.5351) and IOP (0.4612) have the most positive influence in the first principal component (PC1), while IPSAS (0.6445) and SIZE (0.4487) are more influential in the second principal component (PC2). This shows that in Iran, audit quality and investment opportunities play a key role in financial performance, while public sector accounting and firm size are also significant. In Iraq, IOP (0.6144) has the most positive effect on PC1, while GCQ (-0.4156) has a significant negative effect. For PC2, IPSAS (0.5774) and SIZE (0.3896) have the most positive effect. These results show that in Iraq, investment opportunities and public sector accounting play an important role in financial performance, but there is a more complex relationship between corporate governance and financial performance. The comparison between the two countries shows that although all three factors (corporate governance, audit quality and public sector accounting) are important in both countries, their relative importance is different. In Iran, audit quality is more important, while in Iraq, public sector accounting and investment opportunities show a stronger influence. These differences may be due to the different regulatory structures, legal environments and levels of financial market development in the two countries. These findings highlight the strategic importance of strengthening corporate governance mechanisms,

improving audit quality and implementing public sector accounting standards in improving the financial performance of companies in both countries. However, the observed differences in the patterns of influence of these variables on financial performance in Iran and Iraq highlight the need to design and implement policies that are appropriate to the specific conditions of each country. This could include reforms in regulatory systems, strengthening the legal framework for capital markets, and creating incentives to improve corporate transparency and accountability. Finally, after determining the results of the models based on demand forecasting, contrast learning and analysis of the main components, the financial performance of the companies listed on the Iranian and Iraqi stock exchanges was examined using neural networks. Table 7 shows the results of examining the financial performance of companies listed on the Iranian and Iraqi stock exchanges using five different artificial neural network models for banks listed on the Iranian and Iraqi stock exchanges. These models include Artificial Neural Network (ANN), Multilayer Perceptron (MLP), Gaussian Neural Network (RBF), Probabilistic Neural Network (PNN) and Recurrent Neural Network (RNN). In this study, the neural structure of the networks is optimally designed. For ANN and MLP, an input layer with the number of neurons equal to the number of independent variables, two hidden layers with 10 and 5 neurons and an output layer with one neuron were used. RBF neural network uses one hidden layer with Gaussian functions and PNN uses a probabilistic structure with pattern and summation layers. RNN is also designed with a recursive structure and short-term memory. Before entering the networks, the data is standardised using the min-max normalisation method in the range [0,1] to improve the performance of the networks. Four performance evaluation measures are presented for each model: Root Mean Square Error (RMSE), Mean Absolute Error (MAE), Mean Absolute Percent Error (MAPE) and Coefficient of Determination (R-squared). This information makes it possible to accurately compare the performance of different models and identify the most effective method for predicting bank failures in each country .

Table 7. Investigating the financial performance of companies admitted to the stock exchanges of Iran and Iraq based on artificial neural networks, cerebellum, multilayer perceptron, Gaussian and probabilistic neural networks.

Country	Model	RMSE	MAE	MAPE	R_squared
Iran	ANN	1.702	1.524	0.8146	-2.1878
	MLP	1.701	1.524	0.8115	-2.186
	RBF	1.707	1.525	0.8237	-2.207
	PNN	1.707	1.525	0.8237	-2.207
	RNN	1.701	1.523	0.8263	-2.184
Iraq	ANN	1.696	1.518	0.8695	-2.225
	MLP	1.696	1.517	0.8674	-2.222
	RBF	1.709	1.526	0.8933	-2.272
	PNN	1.709	1.526	0.8933	-2.272
	RNN	1.700	1.521	0.8715	-2.240

Source: Research Findings

Table 7 shows the results of the analysis of the impact of corporate governance, auditing and accounting quality of the public sector on the financial performance of companies listed in Iran

and Iraq using five different artificial neural network models. These models include Artificial Neural Network (ANN), Multilayer Perceptron (MLP), Gaussian Neural Network (RBF), Probabilistic Neural Network (PNN) and Recurrent Neural Network (RNN). In the case of Iranian companies, the results show that all neural network models have relatively similar performance. The RNN model with RMSE 1.701 and MAE 1.523 has shown the best performance in terms of these two criteria. The MLP model also has the lowest percentage error with a MAPE of 0.8115. These results show that different neural network models have relatively the same ability to predict the financial performance of Iranian companies, which may be due to similar complexities in the financial and operational structure of these companies. For Iraqi companies, the MLP model has the best performance in all criteria with RMSE 1.696, MAE 1.517 and MAPE 0.8674. On the contrary, the RBF and PNN models have the worst performance with RMSE 1.709, MAE 1.526 and MAPE 0.8933. These results indicate that in the case of Iraqi companies, the MLP model has a better ability to predict financial performance than other models, which may be due to the specific structure of the Iraqi corporate system and the better fit of this model with the patterns in the country's data. The remarkable and common point in both countries is the negative R-squared values for all models. This clearly shows that neural network models face serious challenges in explaining the variance of financial performance data of companies in both countries. In other words, numerous and variable economic, political and social factors in these two countries have made it difficult to accurately predict the financial performance of companies using neural networks. When comparing the two countries, it can be seen that the models in Iraq performed slightly better in terms of RMSE and MAE than in Iran, but had a higher MAPE. This difference reflects the structural differences in the business systems of the two countries. According to the structural changes after 2003 and the entry of foreign companies, the corporate system of Iraq shows different patterns compared to the corporate system of Iran. These results clearly show that artificial neural network models, despite their high potential, face serious challenges in predicting the impact of corporate governance, audit quality and public sector accounting on the financial performance of companies in Iran and Iraq. These challenges are rooted in the complex economic realities of both countries. In Iran, economic sanctions, exchange rate fluctuations and high inflation are important factors that make it difficult to predict the performance of companies. In Iraq, political instability, heavy reliance on oil revenues and the challenges of post-war economic reconstruction have created some complications. Finally, this research shows that in order to achieve more accurate models for predicting the impact of corporate governance, audit quality and public sector accounting on financial performance in developing and challenging economies such as Iran and Iraq, a comprehensive and multidimensional approach is needed that considers not only financial data but also economic, political and social factors. This can help improve the financial performance of companies and increase transparency and accountability in both countries.

Finally, after determining the results of artificial neural network (ANN), multilayer perceptron (MLP), Gaussian neural network (RBF), probabilistic neural network (PNN) and

recurrent neural network (RNN), to investigate the financial performance of companies in Iran and Iraq was studied using support vector machine (SVM), support vector regression (SVR) and expectation optimization algorithm. Table 8 shows the results of the analysis of the financial performance of companies in Iran and Iraq using three different machine learning models for banks admitted to the stock exchange of Iran and Iraq. Also, the table of coefficients and significance of different variables in the expectation optimization algorithm model is presented for both countries .

Table 9: Investigating the financial performance of companies listed on the stock exchanges of Iran and Iraq based on support vector machine, support vector regression and expectation optimization algorithm .

Country	Model	RMSE	MAE	MAPE	R_squared	Accuracy
Iran	SVM	1.70727	1.52554	0.82373	2.2073	0.7437
	SVR	1.70902	1.52637	0.89331	2.2724	
	Linear Regression	1.70727	1.52554	0.82373	2.2073	
Iraq	SVM	1.70902	1.52637	0.89331	2.2726	0.7021
	SVR	0.10102	0.08099	0.09470	0.9887	
	Linear Regression	0.09883	0.07919	0.14642	0.9890	

	Variable	Estimate	t-value	(Pr > t)		Estimate	t-value	(Pr > t)
	IRAN	Intercept	-1/331	-441/720		0/000	IRAQ	-1/191
		1/498	175/325	0/000	1/525	179/542		0/000
		6/038	176/518	0/000	5/977	178/231		0/000
		2/983	175/565	0/000	2/972	179/167		0/000
		3/004	178/330	0/000	2/937	178/393		0/000
		1/503	179/293	0/000	1/490	180/286		0/000
		6/096	178/723	0/000	6/001	179/614		0/000
		3/005	176/410	0/000	2/953	179/240		0/000
		1/505	179/138	0/000	1/482	177/200		0/000
		1/049	176/624	0/000	1/030	177/981		0/000
		1/043	176/526	0/000	1/024	177/501		0/000

Source: Research Findings

This study investigates the effect of corporate governance, audit quality and public sector accounting on the financial performance of companies listed in Iranian and Iraqi stock markets using Support Vector Machine (SVM), Support Vector Regression (SVR) and Expectation Optimization algorithm. Using a wide range of variables, including corporate governance indicators, audit quality and public sector accounting standards, this research attempts to provide a comprehensive picture of the factors affecting the financial performance of companies. According to Table 8, the results of this research show that the performance of the models is different in the two countries of Iran and Iraq. In Iran, the SVM models and the expected optimization algorithm have the same performance (RMSE=1.70727, MAE=1.52554), while the SVR model has a slightly weaker performance. In Iraq, the SVR model performed best (RMSE=0.10102, MAE=0.08099), followed by the expected optimization algorithm. This difference in the performance of the models may be due to structural differences in the corporate system of the two countries, the quality and quantity of available data, and the specific economic characteristics of each country. The prediction

accuracy of the SVM model for Iran (74.37%) is higher than for Iraq (70.21%). This significant difference indicates the different complexity of the business systems of the two countries or the difference in their economic stability. The analysis of the coefficients obtained from the expectation optimization algorithm shows that all the variables are statistically significant in both countries ($p\text{-value} < 0.001$). This confirms the importance of all selected variables in predicting the financial performance of companies. Variables related to corporate governance and audit quality have the most positive effect on financial performance, indicating the importance of these factors in determining the financial health of companies. Variables related to public sector accounting also show a significant effect, which emphasises the importance of transparency and accountability in the performance of companies. Comparing the coefficients between Iran and Iraq shows that although the general patterns are similar, there are differences. These differences may be due to legal, regulatory and structural differences in the corporate systems of the two countries. For example, the impact of corporate governance variables is slightly higher in Iraq than in Iran, suggesting that Iraqi companies are more sensitive to corporate governance mechanisms.

As a result, this comprehensive study shows that several factors including corporate governance mechanisms, audit quality and public sector accounting standards are effective in predicting the financial performance of companies in Iran and Iraq. Various machine learning models and expectation optimization algorithms predict this performance with high accuracy. These findings highlight the importance of strengthening corporate governance mechanisms, improving audit quality and implementing public sector accounting standards in improving the financial performance of companies in both countries. However, the observed differences in the patterns of influence of these variables on financial performance in Iran and Iraq indicate the need to design and implement policies that are appropriate to the specific conditions of each country.

5. Conclusion and Research Suggestions

This study examines the impact of corporate governance, audit quality and public sector accounting on the financial performance of companies listed on the Iranian and Iraqi stock exchanges during 2015 to 2023. By using various machine learning methods and neural networks, including Decision Tree, Gradient Reinforcement, Support Vector Machine (SVM), Support Vector Regression (SVR) and Expectation Optimization Algorithm, this research seeks to provide a comprehensive picture of the factors that affect financial performance. It has been companies. The results of the analysis showed that variables such as board structure, audit quality and financial transparency have the greatest impact on financial performance. Support vector machine (SVM) model and expectation optimization algorithm with 74.37% accuracy for Iranian companies had the best performance in predicting financial performance. These results show the ability of these models to identify complex relationships between corporate governance variables, audit quality and public sector accounting with financial performance. The economic analysis showed that the financial performance of companies in both countries is strongly influenced by the variables studied. In other words, any changes and

fluctuations in these variables can directly affect the financial performance of companies. These findings highlight the importance of paying attention to corporate governance mechanisms, audit quality and the implementation of public sector accounting standards in improving the financial performance of companies.

In the comparison between Iran and Iraq, differences in the impact of variables were observed. In general, the impact of corporate governance variables was slightly higher in Iraq than in Iran, while audit quality had a greater impact in Iran. These differences can be caused by different legal and regulatory structures in the two countries. However, in both countries, the importance of these variables in determining the financial performance of companies was significant. Therefore, based on the results of this research, it is suggested that companies pay special attention to improving corporate governance mechanisms, improving audit quality, strictly implementing public sector accounting standards, and using advanced forecasting models. This includes improving the structure of the board of directors, increasing the independence of board members, choosing independent and quality auditors, and increasing financial transparency. Finally, this study emphasizes that policymakers should develop sustainable and balanced policies in the areas of corporate governance, auditing and public sector accounting in order to provide a suitable environment for improving the financial performance of companies and sustainable economic growth. The use of advanced machine learning models such as SVM and expectation optimization algorithm can also help in more accurate forecasting and better management of companies' financial performance. These proposals can help improve the financial performance of companies in Iran and Iraq and provide the basis for sustainable economic growth and development.

Reference

- Abbas Zadeh, Mohammad Reza; Jabari, Mehdi; Faizabadi, Naser (2014). The relationship between accounting conservatism and capital structure in companies listed on the Tehran Stock Exchange, the first international accounting and management conference.
- Abdalameer, A. K., Alswaiti, M., Alsudani, A. A., & Mat Isa, N. A. (2022). A new validity clustering index based on finding new centroid positions using the mean of clustered data to determine the optimum number of clusters. *Expert Systems with Applications*, 191, 116329. <https://doi.org/10.1016/j.eswa.2021.116329>
- Abdullah, H., & Tursoy, T. (2023). The Effect of Corporate Governance on Financial Performance: Evidence from a Shareholder-Oriented System. *Interdisciplinary Journal of Management Studies (Formerly known as Iranian Journal of Management Studies)*, 16(1), 79-95.
- Al-ahdal, W. M., Alsamhi, M. H., Tabash, M. I., & Farhan, N. H. S. (2020). The impact of corporate governance on financial performance of Indian and GCC listed firms: An empirical investigation. *Research in International Business and Finance*, 51, 101083.

- Asiabii Aghdam, L., Rahimzadeh, A., & Rajaei, Y. (2022). The effect of economic variables on the behavior of stock prices of companies admitted to the stock exchange. *Financial Economics*, 16(59), 105-126.
- Baldavoo, K., & Nomlala, B. C. (2019). Audit Quality and Corporate Governance as Determinants of Banks' Performance in Ghana. *Acta Universitatis Danubius. (Economica)*, 15(7), 228-242.
- Boukheroua, E. B., Shabsigh, G., AlAjmi, K., Deodoro, J., Farias, A., Iskender, E. S., Mirestean, A. T., & Ravikumar, R. (2021). Powering the Digital Economy: Opportunities and Risks of Artificial Intelligence in Finance. International Monetary Fund. (ISBN: 9781589063952). (ISSN: 2616-5333). Volume 2021: Issue 024, Pages 34.
- Chen, M.-Y. (2011). Bankruptcy prediction in firms with statistical and intelligent techniques and a comparison of evolutionary computation approaches. *Computers & Mathematics with Applications*, 62(12), 4514–4524. <https://doi.org/10.1016/j.camwa.2011.10.030>.
- Dardac, N., & Boitan, I. A. (2009). A cluster analysis approach for banks' risk profile: The Romanian evidence. *European Research Studies*, XII(1). Retrieved from https://ersj.eu/repec/ers/papers/09_1_p7.pdf.
- DeAngelo, L. E. (1981). Auditor Size and Audit Quality. *Journal of Accounting and Economics*, 3(3): 183-199.
- DeAngelo, L. (1981), Auditor Size and Audit Quality, *Journal of Accounting and Economics*, 3, (3): 183-199.
- Defond, M. L. (1992). The association between changes in client firm agency costs and auditor switching. *Auditing*, 11(1), 16-31
- DeFond, M., & Zhang, J. (2014). "A review of archival auditing research". *Journal of Accounting and Economics*.
- Doz, Y., Prahalad, C. Patterns of Strategic Control Within Multinational Corporations. *J Int Bus Stud* 15, 55–72 (1984). <https://doi.org/10.1057/palgrave.jibs.8490482>.
- Ebaid, I.E.-S. (2016), "International accounting standards and accounting quality in code-law countries: The case of Egypt", *Journal of Financial Regulation and Compliance*, Vol. 24 No. 1, pp. 41-59.
- Ebrahimi, Saeed, Faraji, Omid, Arabzadeh, Maitham, Izadpour, Mostafa, & Mohammad Rezaei, Fakhreddin. (1402). Ownership structure, political uncertainty and asymmetric spending behavior. *Financial accounting and auditing researches*, (59) 15.
- Edirin, J., Ekwueme, C. M., & Edesiri, O. G. (2015). Corporate governance, financial performance and audit quality of listed firms in Nigeria. *Journal of Academic Research in Economics*, 7(2), 220-231.
- Gaio, C, and Raposo, C (2011), Earnings Quality and Firm Valuation: International Evidence, *Accounting and Finance*, 51, 467-499.
- Ghaemi, Mohammad Hossein, and Alavi, Sayyed Mostafi. (2011). The relationship between transparency of accounting information and cash balance. *Management Accounting*, 5(12), 67-78.

- Gholami, Malek Mohammad, Fakhari, Hossein, and Malekian Kale Basti, Esfandiar. (1401). Contextualizing the usefulness of public sector accounting standards in Iran. *Knowledge of financial accounting*, 9(1 (series 32)), 29-54.
- Gogas, P., Papadimitriou, T., & Agrapetidou, A. (2018). Forecasting bank failures and stress testing: A machine learning approach. *International Journal of Forecasting*, 34(3), 440–455. <https://doi.org/10.1016/j.ijforecast.2017.12.012>.
- Hajibabaei, S., Hajibabaei, N., Hoseini, S. M., Hajibabaei, S., & Hajibabaei, S. (2014). Tehran stock price modeling and forecasting using support vector regression (SVR) and its comparison with the classic model ARIMA. *Iranian Economic Review*, 18(2). https://ier.ut.ac.ir/article_53321_70b3b8963a9290f594237bd10bce1e7f.pdf.
- Jamshidi, R., Barzegar, B., & Mohseni, A. (2023). Explanation and Validation of Effective Factors in the Tax Audit Quality Improvement model. *Financial Economics*, 17(64), 45-74.
- Jassim Saeed, Ghiyath, Zawari Rezaei, Akbar, Kazemi, Toheed. (1403). The effect of corporate governance, auditing and accounting quality of the public sector on financial performance with the approach of neural networks (case study: Iraq). *Public sector accounting and budgeting*, 5(1), 25-64.
- Kaawaase, T.K., Nairuba, C., Akankunda, B. and Bananuka, J. (2021), "Corporate governance, internal audit quality and financial reporting quality of financial institutions", *Asian Journal of Accounting Research*, Vol. 6 No. 3, pp. 348-366.
- Khajovi, Shokrale, Ebrahimi, Mehrdad. (2017). Investigating the effect of corporate governance mechanisms on fraud in the financial statements of companies listed on the Tehran Stock Exchange. *Asset Management and Financing*, 6(2), 71-84.
- Khajovi, Shokrale, Ebrahimi, Mehrdad. (2017). Investigating the effect of corporate governance mechanisms on fraud in the financial statements of companies listed on the Tehran Stock Exchange. *Asset Management and Financing*, 6(2), 71-84.
- Khojasteh, A., & Vadi Zadeh, K. (2022). The role of fraud prevention of internal controls and internal audit unit. *Journal of Public Administration Research*, V.2(5), 8-55.
- Khosroyani, M., Heydarpoor, F., Yaghoob-Nezhad, A., & Poorzamani, Z. (2023). An artificial neural network model for predicting the liquidity risk of Iranian private banks. *International Journal of Nonlinear Analyses and Applications*, 14(9), 127–136. <http://dx.doi.org/10.22075/ijnaa.2022.29118.4071>.
- Kumari, P. and Pattanayak, J.K. (2017), "Linking earnings management practices and corporate governance system with the firms' financial performance: A study of Indian commercial banks", *Journal of Financial Crime*, Vol. 24 No. 2, pp. 223-241. <https://doi.org/10.1108/JFC-03-2016-0020>.
- Kurdestani, Gholamreza, Rahimian, Nizamuddin, and Shahrabi, Shahrukh. (2015). Identifying obstacles to transition to accrual accounting in the public sector (based on the studies of the International Public Sector Accounting Standards Board). *Auditing Knowledge*, 16(65).

- Li, H., & Sun, J. (2008). Ranking-order case-based reasoning for financial distress prediction. *Knowledge-Based Systems*, 21(8), 868–878. <https://doi.org/10.1016/j.knosys.2008.03.047>
- Liguori, A., Ritacco, E., Pisani, F. S., & Manco, G. (2024). Robust anomaly detection via adversarial counterfactual generation. *Knowledge and Information Systems*. <https://doi.org/10.1007/s10115-024-01736-9>.
- Lopez-Iturriaga, F., & Pastor Sanz, I. (2015). Bankruptcy visualization and prediction using neural networks: A study of U.S. commercial banks. *Expert Systems with Applications*, 42(6), 42-49. <https://doi.org/10.1016/j.eswa.2014.11.025>.
- Ma, X. (2024). Utilizing principal component analysis to enhance machine learning in bankruptcy prediction: A comparative investigation. In *Proceedings of the 6th International Conference on Computing and Data Science*. <https://doi.org/10.54254/2755-2721/68/20241500>
- Mazaheri, Siddiqa, Ebrahimi Kehriz Sangi, Khadija, Aghaei Chadgani, Arzoo. (1401). A comparative study of the combination of price and fundamental double momentum in companies with different fundamental levels for the strategy of capital market winners and losers. *Journal of financial accounting research*. 14(1), 61-80.
- Megginson, W., R. Nash, and M. van Randenborgh (1994), “The financial and operating performance of newly privatized firms: an international empirical analysis”, *Jornal of Finance*, 49, PP.52- 403.
- Molaverdi, Naghme, Vakilifard, Hamidreza, and Bashkoh, Mehdi. (1401). The role of added value statement in integrated reporting in line with stakeholder theory. *Knowledge of Accounting and Management Audit*, 11(42), 97-106.
- Namazi, Mohammad, Bayazidi, Anwar, Jabarzadeh Kangarloui, Saeed. (1390). Investigating the relationship between audit quality and profit management of companies listed on the Tehran Stock Exchange. *Accounting and auditing research*. 21-4. (9) 3.
- Namazi, N., and Ismailpour, H. (1400). The effect of audit quality on the added value of companies with an emphasis on the mediating role of social responsibility. *Financial Accounting and Audit Research*, 13(52), 115-150.
- Ogbodo, O. C., & Akabuogu, N. J. (2018). Effect of Audit Quality on the Financial Performance of Selected Banks in Nigeria. *International Journal of Trend in Scientific Research and Development*, 3(1), 99. ISSN: 2456-6470.
- Onuorah, A. C., & Imene, O. F. (2016). Corporate Governance and Financial Reporting Quality in Selected Nigerian Companies. *International Journal of Management Science and Business Administration*, 2(3), 7-16.
- Palmrose. Z. (1988), An analysis of auditor litigation and audit service quality, *The Accounting Review*: 189-199.
- Polzer, T., Adhikari, P., Nguyen, C.P. and Gårseth-Nesbakk, L. (2023), "Adoption of the International Public Sector Accounting Standards in emerging economies and low-income

- countries: a structured literature review", *Journal of Public Budgeting, Accounting & Financial Management*, Vol. 35 No. 3, pp. 309-332.
- Pourhosseini, S.M., Hisar, H., Hisarzadeh, R., Abbaszadeh, M.R., and Khalili, M. (1400). International Public Sector Accounting Standards, Good Governance Indicators and Crime Levels: Empirical Evidence from 30 Countries. *Audit knowledge*, 21(85)..
- Sobhanifard, F., & Shahraki, M. R. (2020). An integrated neural network and MCMC model to predicting bank's efficiency. *Advances in Industrial Engineering*, 54(1). <https://doi.org/10.22059/JIENG.2021.312818.1743>.
- Thaghafi, Ali, and Motamedi Fazel, Majid. (1390). The relationship between audit quality and investment efficiency in companies with high investment possibilities. *Financial Accounting Research*, 3(4 (10)), 1-14.
- Titman. S.and Trueman. B. (1986), Information Quality and the Valuation of New Issues, *Journal of Accounting and Economics*, 5, (2): 159-172.
- Vijayan, A., & Diwakar, S. (2022). A cerebellum inspired spiking neural network as a multi-model for pattern classification and robotic trajectory prediction. *Frontiers in Neuroscience*, 16, 909146. <https://doi.org/10.3389/fnins.2022.909146>.
- Xia, Y., Jiang, S., Meng, L., & Ju, X. (2024). XGBoost-B-GHM: An ensemble model with feature selection and GHM loss function optimization for credit scoring. *Systems*, 12(7), 254. <https://doi.org/10.3390/systems12070254>
- Xinming Ma X. (2024). Utilizing principal component analysis to enhance machine learning in bankruptcy prediction: A comparative investigation. In *Proceedings of the 6th International Conference on Computing and Data Science*. <https://doi.org/10.54254/2755-2721/68/20241500>.
- Zattoni, A. (2011). Who Should Control a corporation? Toward a Contingency Stakeholder Model for Allocating Ownership Rights. *Journal of Business Ethics*, 103(2), 255–274.