

# The Impact of Electronic Diversification on Optimal Portfolio Construction: Evidence from Iraqi Banks

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**Abstract:** This study examines the impact of electronic diversification (e-diversification) on financial decision-making in the construction of investment portfolios. The research is conducted on a sample of five banks listed on the Iraq Stock Exchange over the period 2019–2023. A quantitative comparative approach is employed to evaluate the performance of a traditional portfolio and an electronically optimized portfolio based on risk–return indicators. The empirical analysis assesses the effectiveness of applying digital optimization techniques in improving portfolio allocation under uncertain market conditions. The results indicate that the electronically diversified portfolio outperforms the traditional portfolio. Specifically, the expected return increases from 0.66% to 6.13%, while portfolio risk decreases from 3.77% to 1.07%. These findings suggest that e-diversification enhances investment efficiency by improving asset allocation and reducing exposure to market volatility. The study concludes that electronically supported diversification provides a more structured and data-driven framework for investment decision-making compared to traditional portfolio construction methods, particularly in emerging financial markets.

## 1 INTRODUCTION

Financial Decision Making - a Multi-Dimensional Evolution In a world where the economy is dynamic and ever-changing, portfolio diversification has become one of the most popular areas for investors looking to improve their investments [1] by diversifying investments over multiple asset classes, markets, and sectors, individuals can reduce the risks based on the market changes or declines [2]. This strategy safeguards against risk and creates opportunities for superior returns as the relationship between various asset classes and shifts in economic activity diverge. Moreover, diversification enables investors to take advantage of the growth potential of different sectors, thereby providing a more agile investment portfolio. The subject of portfolio finance performance is so crucial for the establishments and the enterprises today as the world is settling down in the midst of quick shifts and epic rivalry. It is a way to measure how efficiently resources available are put to use and for managers to perform studies prior to any decision-making [3]. These studies are financial performance evaluations such as the analysis of return

and risk ratios, financial balances and financial ratios. Therefore, the institutions have been resorting to modern methods to diversify their decisions and investments, and electronic diversification is among the modern methods that can be followed for this purpose.

Diversification is the cornerstone of modern portfolio theory to help investors to balance risk and return effectively. This fundamental concept serves as a stepping stone to understanding strategies and their impact on investment returns [4]. Portfolios that implement diversification tend to do well through various means, i.e., risk protection and risk/return optimization. By spreading investments across various asset classes, types of sectors or even geographic areas, investors are more insulated from the individual losses related to a single investment. In the current time, the current diversity (Solver), an advanced diversity techniques have been reached the study thus seeks to identify the effect of electronic diversification in investment portfolio financial decisions.

## 2 LITERATURE REVIEW

### 2.1 Investment Portfolio

The investment portfolio is “a complex management of investment tools consisting of two or more assets and subject to the management of a person responsible for it and called the portfolio manager”. The portfolio manager may own it or be paid. Then, the powers in its management will vary according to the contract terms concluded between him and the portfolio owners. (Saaty) proposed the analytical hierarchy process (AHP) to deal with the problem of selecting an investment portfolio by evaluating the performance of each company according to various criteria. (Huang) [5] Identified the securities using Data Envelopment Analysis (DEA). Then, the author defined a new definition of risk using genetic algorithms to deal with the problem of the decision to select the investment portfolio. In general, decision-making in the portfolio selection problem is conflicting objectives at the same time, such as the rate of return, liquidity, and risk. Multi-objective programming techniques such as objective programming (GP) and mean programming (CP) are used to select the portfolio due to the uncertainty of the investment environment. Accordingly, it is clear that the investment portfolio is “a combination of financial instruments or investment tools that are carefully and accurately selected to obtain a satisfactory return at a certain level of risk.” Through these definitions, we conclude that investment portfolios are:

- 1) The investment portfolio comprises more than one financial or real instrument.
- 2) The investment portfolio consists of financial assets such as stocks, bonds, etc., and real assets such as gold, precious metals, etc.
- 3) Each investment portfolio has a manager who may be its owner or its lessor and is called the portfolio manager.
- 4) The investment portfolio aims for a satisfactory return and acceptable risk.

### 2.2 Building the Optimal Investment Portfolio

Successful portfolio investment starts with the clarity of the investment vision of the senior management in the investment institution because testing the method that is relied upon to measure the desired goals depends on significant factors that affect the investment decision: environmental factors and personal factors. Therefore, investment visions that

need cognitive enhancement and sound financial research depend on the point of view of the portfolio manager in one of the following cases: [6].

- Reliance on local securities that are mainly affected by local factors. Investment is how the assets to be invested will be distributed from multiple markets.
- The value of global companies affects international industrial factors as it depends on the industrial sector in which they are invested.
- The companies’ application field behaviors are adequately evaluated, which makes them able to rely on the investment pattern.

The process of building the portfolio includes a set of steps, which are (setting goals, setting policies, choosing the portfolio, feedback, evaluating the portfolio, and reviewing the portfolio) [7]. To successfully build a portfolio of investments, investors need to appoint an individual or team to manage this group of investments, and institutions and even their organizations are set up in different ways to meet this need [8].

### 2.3 Diversification of Investment Decisions

Diversification in the fields of finance and risk management is a technique related to hedging. It is the combination of a wide range of investment instruments within a single portfolio with a single capital because reality has proven that investing in a single instrument led to an increase in the impact of fluctuations and risks on the investor’s returns due to the investments being limited to a single instrument [9]. However, if the investment portfolio consists of a number of investment instruments, any change in the prices and returns of a specific instrument will not affect the returns of the portfolio as a whole, especially if the correlation coefficient between the instruments that make up the portfolio is negative. Diversification reduces investment risks [10].

### 2.4 Diversification Strategies

Three strategies can be used in the diversification process, which are:

- 1) Including multiple types of financial instruments in the components of the investment portfolio, such as stocks, mutual funds, and bonds. Given the different risks in securities, the portfolio can be distributed into various mutual funds that adopt different investment strategies,

such as funds that aim to achieve growth, balanced funds, small capital funds, large capital funds, and financial index funds. When the investment portfolio consists of diverse instruments, the levels of risk are reduced, as profits in other areas offset large losses in a particular area.

- 2) The securities of each sector or even geography differ. This leads to reducing the risks to a minimum from the impact of changes in the sector or location of specific investments
- 3) Diversifying investments by mixing local and international investments through investing and diversifying the investment portfolio in many countries so that any events within a particular country will have less impact on the total investment in the investor's investment [11].

Recently, the diversification strategy using (solver) has been added as a modern technology based on artificial intelligence, which is an effective approach to maximizing returns and minimizing risks. This tool, available in Excel, can solve optimization problems related to optimal asset allocation in the portfolio through a set of criteria specified by the investor [12].

### 3 METHODS

#### 3.1 Research Design and Instrument

This study adopts a quantitative research design to examine the impact of electronic diversification on investment portfolio performance. The analysis is conducted using financial data from companies listed on the Iraq Stock Exchange.

The research procedure involves two stages. First, a traditional investment portfolio is constructed based on historical return and risk indicators. Second, an electronically optimized portfolio is developed using diversification techniques that apply optimal asset weighting to achieve improved risk–return efficiency.

This comparative approach allows for evaluating the effectiveness of electronic diversification in enhancing portfolio performance relative to conventional investment allocation methods.

#### 3.2 Sample

The population of the study consists of companies listed on the Iraq Stock Exchange, which includes nine sectors with a total of 132 companies.

A purposive sample was selected from the banking sector in the regular market due to its availability of continuous financial data and its importance in investment activities. The final sample includes five banks:

- Gulf Bank;
- Iraqi National Bank;
- Commercial Bank of Iraq;
- Mansour Bank;
- Credit Bank.

The study period covers financial data from 2019 to 2023.

### 3.3 Hypothesis

Based on the study objectives, the following hypotheses were formulated:

- H1: An investment portfolio can be effectively constructed for the selected banks in the study sample.
- H2: Electronic diversification of financial decisions significantly improves the efficiency of the optimal investment portfolio for the selected banks in the study sample.

## 4 RESULTS

### 4.1 Return and Risk

Table 1 presents the descriptive statistics of return and risk for the selected banks over the period 2019–2023. The overall average return of the sample is 0.66%, while the average risk level is 3.77%. These results indicate that the traditional portfolio structure is characterized by relatively low profitability accompanied by moderate volatility.

At the aggregate level, the findings suggest that conventional portfolio construction exhibits limited efficiency in balancing risk and return, which supports the need for alternative approaches such as electronic diversification to enhance portfolio performance.

At the individual bank level, the results reveal significant heterogeneity in performance. The highest average return is observed in Al-Mansour Bank (1.6%), whereas the lowest return is recorded in the Iraqi National Bank (0.1%), indicating variation in profitability across institutions.

Table 1: Returns for the Period 2019-2023.

Year	Gulf Bank	Iraqi National Bank	Commercial Bank of Iraq	Mansour Bank	Credit Bank	RE	Ri
2019	-0.056	0.075	0.000	0.011	0.009	0.8%	4.2%
2020	0.003	-0.196	-0.005	-0.019	-0.003	-4.4%	7.6%
2021	0.015	0.044	0.046	-0.010	-0.111	-0.3%	5.8%
2022	0.016	0.004	-0.026	0.020	-0.005	0.2%	1.6%
2023	0.044	0.078	0.037	0.077	0.116	7.0%	2.8%
RE	0.4%	0.1%	1.0%	1.6%	0.1%	0.66%	3.77%
Ri	3.3%	10.2%	2.7%	3.4%	7.2%		

Regarding risk exposure, the Iraqi National Bank exhibits the highest risk level (10.2%), while the Commercial Bank of Iraq records the lowest risk level (2.7%). This variation reflects differences in risk management practices and asset structure across banks.

Intermediate performance is observed in the remaining banks. Gulf Bank records an average return of 0.4% with a risk level of 3.3%, while Credit Bank shows a return of 0.12% accompanied by a relatively higher risk level of 7.2%. Overall, the results confirm the existence of a clear risk–return trade-off across the sample, where higher returns are generally associated with higher risk exposure.

Figures 1 and 2 illustrate the evolution of returns and risk over the study period. The results show an increase in returns following the base year 2020 compared to 2019, followed by fluctuations during 2021–2023. Similarly, risk levels increased after 2020, declined in 2022, and then rose again by the end of the period to 2.8%.

Based on these results, the first hypothesis is supported, confirming that constructing an investment portfolio for the selected banks is feasible.

Tables 2 and 3 present the results of the optimal portfolio constructed through diversification and electronic optimization techniques. The optimization results show a substantial improvement in performance compared to the traditional portfolio.

Specifically, the traditional portfolio yields an average return of 0.66% with a risk level of 3.77%, whereas the optimized portfolio achieves a significantly higher return of 6.13% while reducing risk to 1.07%. This indicates that electronic diversification improves portfolio efficiency by enhancing returns and simultaneously reducing exposure to risk.

The optimal allocation suggests investing 23.14% in Gulf Bank, 33.51% in Iraqi National Bank, 22% in

Mansour Bank, and 21.34% in Credit Bank, while excluding Commercial Bank of Iraq from the optimized portfolio. This allocation reflects the rebalancing effect of diversification, where capital is shifted toward more efficient risk–return combinations.

Overall, the results demonstrate that electronic diversification leads to a more efficient investment structure compared to traditional portfolio construction by improving expected returns and reducing portfolio risk.

Accordingly, the second research hypothesis was achieved, which indicates that e-diversification of financial decisions contributes to improving the optimal investment portfolio of the banks in the study sample, as shown in the conclusion in Figure 3.

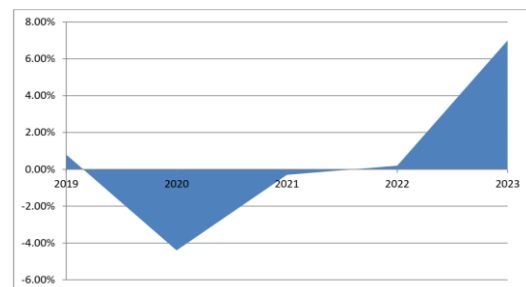


Figure 1: Banks' return rates for the period 2019-2023.

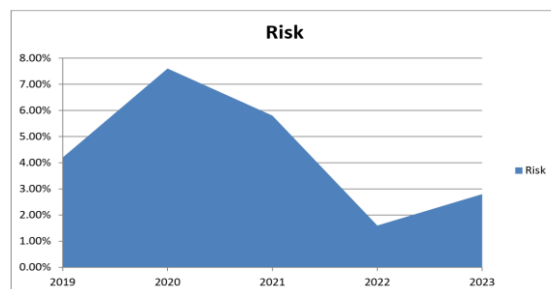


Figure 2: Risk rates for the period 2019-2023.

Table 2: Indicators of the optimal investment portfolio for the period 2019-2023.

Year	Gulf Bank	Iraqi National Bank	Commercial Bank of Iraq	Mansour Bank	Credit Bank	RE	Ri
Weight Before Diversification	13.45%	3.56%	31.04%	48.30%	3.65%		
Weight After Diversification	23.14%	33.51%	0.00%	22.00%	21.34%		
Re Before Diversification	0.66%			Ri Before Diversification		3.77%	
Re After Diversification	6.13%			Ri After Diversification		1.07%	

Table 3: Covariance matrix of bank returns.

Gulf Bank	Iraqi National Bank	Commercial Bank of Iraq	Mansour Bank	Credit Bank
A	B	C	D	E
0.00068	0.00022	0.00024	0.00034	0.00051
0.00022	0.00678	0.00080	0.00129	0.00130
0.00024	0.00080	0.00044	0.00017	0.00004
0.00034	0.00129	0.00017	0.00069	0.00125
0.00051	0.00130	0.00004	0.00125	0.00337

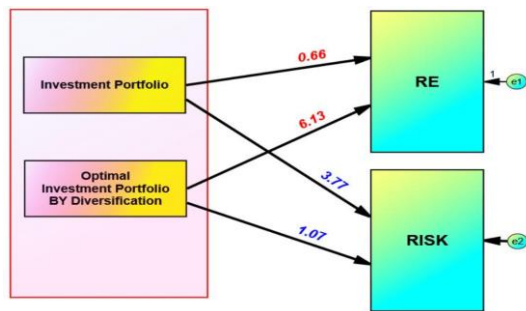


Figure 3: The impact of diversification of financial decisions on the investment portfolio.

## 5 DISCUSSION

The empirical results indicate that electronic diversification improves portfolio efficiency by introducing a systematic optimization mechanism that enhances asset allocation quality. Unlike traditional approaches, which rely on static weighting rules, the proposed method dynamically evaluates the interaction between assets through risk–return and covariance structures.

The improvement in portfolio performance can be attributed to the model’s ability to identify inefficient assets and redistribute capital toward instruments with stronger marginal contributions to portfolio efficiency. This leads to a more balanced risk exposure and improved diversification effectiveness.

From a theoretical perspective, the findings extend modern portfolio theory by demonstrating that diversification efficiency can be significantly enhanced through algorithmic optimization techniques. In this context, diversification is not only

a risk-mitigation mechanism but also an allocation optimization process driven by data analytics.

The results further suggest that electronic diversification is particularly effective in emerging markets, where market inefficiencies and information asymmetry increase the value of computational decision-support systems. This supports the role of digital tools in improving the rationality and structure of investment decision-making under uncertainty.

## 6 CONCLUSIONS

This study investigated the impact of electronic diversification on investment portfolio performance using banking sector data from the Iraq Stock Exchange over the period 2019–2023.

The empirical evidence demonstrates that the electronically optimized portfolio significantly outperforms the traditional portfolio in terms of both return and risk metrics. The results confirm that applying quantitative optimization techniques leads to more efficient portfolio construction under real market conditions.

Accordingly, both hypotheses are supported. The first hypothesis is confirmed, indicating that a structured investment portfolio can be effectively constructed using quantitative methods. The second hypothesis is also supported, confirming that electronic diversification has a positive impact on portfolio efficiency.

The study contributes to the literature on portfolio optimization by highlighting the role of digital tools in improving investment decision-making processes in emerging financial markets.

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