



RISK-ADJUSTED PERFORMANCE EVALUATION OF INVESTMENT PORTFOLIOS USING THE INFORMATION RATIO AND TESTING THEIR EFFICIENCY: AN APPLIED ANALYTICAL STUDY OF A SAMPLE OF INVESTMENT FUNDS LISTED IN SOME GULF COOPERATION COUNCIL COUNTRIES

Saadallah Mohammed Obaid Al-Nuaimi

Presidency of the University of Kirkuk
Director of the Department of Financial Affairs
methaqnoaman@uokirkuk.edu.iq

Methaq Noaman Hamood

University of Kirkuk
Faculty of Administration and Economics
Saedalnuaimy@uokirkuk.edu.iq

Abstract. Investment portfolio managers face a continuous trade-off between attempting to generate a large alpha (α) and minimizing tracking error as much as possible, because the golden rule of investment is to generate a return that exceeds the benchmark, which makes the investment portfolio different from its benchmark index and consequently results in tracking error. Despite the importance of the Information Ratio in evaluating risk-adjusted performance, it has not received widespread attention in the Arab markets under investigation, as these markets are characterized as emerging markets that rely on traditional performance measures that do not meet stakeholders' expectations. In addition, there is ongoing debate regarding the extent to which the Information Ratio is efficient in providing an accurate assessment of investment portfolio performance, given that it relies on historical data that may not reflect future risk-adjusted performance. Accordingly, this study was conducted to evaluate the performance of investment funds listed in the markets of the Gulf Cooperation Council countries, which, to the best of the researchers' knowledge, lack such studies. The study used a sample of (30) investment funds over the period from 1/1/2020 to 31/12/2025, based on weekly observations. The Information Ratio was calculated using the one-factor model. To identify the efficiency of the current Information Ratio and its ability to predict future risk-adjusted performance, measured by the subsequent Information Ratio, a simple linear regression model was employed. The research findings revealed weak performance among managers of exchange-traded investment funds in the markets of the Gulf Cooperation Council countries, in addition to the inability to distinguish between managers' performance resulting from their skills in selecting assets for investment and performance resulting from

random behavior or luck. The study also found that the Information Ratio is efficient in predicting future risk-adjusted performance. The researchers sought to provide new empirical evidence from emerging markets in an effort to offer recommendations that may assist investors in determining the usefulness of using the Information Ratio to compare investment funds in which they intend to invest, as well as the authorities responsible for appointing investment fund managers in assessing the possibility of using the Information Ratio as a tool for monitoring and evaluating managers' performance, considering it one of the fundamental criteria for their appointment and linking it to the compensation they receive.

Keywords: Information Ratio, Risk-Adjusted Performance, Investment Portfolio Performance, Investment Fund Managers' Performance, Information Ratio Efficiency.

Introduction

The evaluation of investment portfolio performance is of great importance to investment portfolios, as it serves as a reflective mirror that enables portfolio managers to reconsider their investment strategies by continuing to hold current assets, replacing them, or adding other assets. It also enables investors to identify the extent of management efficiency in achieving superior and sustainable performance. The scientific principles of investment require investment decisions and policies, as well as the achievements resulting from them, to be subjected to continuous evaluation in order to identify strengths and reinforce them, as well as diagnose weaknesses in order to address and rectify them.

Methods for evaluating investment portfolio performance can be divided into two types. The first consists of traditional methods, which compare the return of a managed portfolio with the return of its benchmark index [1]. Among these methods is the return on investment, which attempts to answer the following questions: Did the investment portfolio achieve positive returns? And were those returns the maximum possible? This simple perspective was unable to provide a satisfactory explanation for the simple fact that diversification is a sound investment strategy, nor was it able to compare the returns and risks of different investment portfolios. Consequently, new approaches emerged that compare the performance of a single investment portfolio with appropriate benchmarks. Many of these new investment approaches constitute part of what is known as the active investment portfolio management strategy [2]. These approaches are represented by risk-adjusted methods, which calibrate returns to take into account differences in the level of risk between the managed portfolio and the benchmark portfolio. Some of these measures have been influenced by the Capital Asset Pricing Model, including the Information Ratio, which measures the excess return of an investment portfolio relative to the tracking error of its benchmark index and seeks to answer the following question: How much return did the investment portfolio manager achieve compared with the risk assumed as a result of deviating from the benchmark index? [3].

The Information Ratio is one of the common methods used by investors to evaluate the performance of their investment portfolios because it is more sophisticated. It measures fund performance relative to a benchmark index (market index) and adjusts it according to the degree of volatility between them. It is defined as the active return divided by the tracking error. Active return represents the difference between the portfolio return and its benchmark return,

while tracking error can be represented by the standard deviation of active returns [4]. It can also be defined as a measure of investment portfolio management performance through which returns and risks are compared relative to the benchmark index, which represents a reference portfolio for managers who follow an active management strategy in their pursuit of outperforming the benchmark index (market portfolio). If they do not take risks in their portfolio, its performance will be similar to that of its benchmark index. By assuming risks, the active portfolio manager has the ability to outperform the benchmark index. However, risks may produce adverse outcomes, which may lead to managers losing their clients [5]. The active management strategy balances active returns with the active risks required to achieve these returns, and active return plays a fundamental role in evaluating this strategy [6].

There are three fundamental concepts and approaches through which the Information Ratio can be expressed. The first is that the Information Ratio relies on historical data to measure the performance of active portfolio managers, which is defined as follows:

$$IR = \frac{RP - RB}{Stdev(RP - RB)}$$

Where:

Information Ratio: IR

Active Return: $(RP - RB)$

Portfolio (Fund) Return: RP

Benchmark Index Return: RB

Standard Deviation of Active Return: $Stdev(RP - RB)$

According to the second perspective, the Information Ratio is defined as the ratio of the excess return ([image]) for each unit of residual risk ([image]), and it is measured as follows:

$$IR = \frac{\alpha}{\varepsilon}$$

The third perspective of the Information Ratio is the one that most closely approximates the theoretical approach (Research 3, p. 9). According to this perspective, the Information Ratio is divided into two components: the Information Coefficient (IC), which is defined as a measure of the manager's skill, i.e., the manager's ability to accurately forecast asset returns, representing the correlation between actual returns and the returns expected by the manager; and the second component is the Information Breadth ([image]), which represents the number of times the manager applies his or her skills, i.e., the number of independent bets made by the portfolio manager [7]. It is defined as the number of independent forecasts of exceptional returns. Grinold argues that this perspective represents the fundamental law of active management strategy. According to this perspective, the Information Ratio is defined as follows:

$$IR = IC + \sqrt{Br}$$

There is considerable debate in the financial literature regarding the efficiency of the Information Ratio in evaluating investment portfolio performance. Cornerstone Investment Partners argues that the Information Ratio is a backward-looking analytical tool (based on historical data), and that past results may not necessarily be indicative of future performance. Furthermore, like most other performance measures, it is subject to end-point bias, and the selection of different time periods may lead to different results. Blatt argues that it is surprising how two

simple words can generate all this debate in the business world [8]. To this day, many investment portfolio managers continue to debate what the Information Ratio is and how it should be calculated. Investors attach considerable importance to what this ratio tells them and may use it to determine whether or not to hire investment portfolio managers, while others argue that it is easy to manipulate and therefore its results cannot be relied upon.

Kidd adds that the Information Ratio can indicate the extent to which an investment portfolio manager has outperformed the benchmark in terms of return and risk; however, it cannot determine how this outperformance was achieved, whether it resulted from the manager's skill or from unexpected surprises, or whether the outperformance was based on small and consistent gains relative to the benchmark or on an extreme positive event. Muralidha argues that the simplest reason for not selecting the strategy that achieves the highest Information Ratio is its inability to generate sufficient returns when the level of risk is low [9].

On the other hand, since the Information Ratio assists investors and investment portfolio managers in selecting appropriate investments and understanding performance, Bertrand and Protopopescu argue that the Information Ratio represents the optimal measure of risk-adjusted active portfolio performance. In a study conducted by Gupta et al. they found that domestic investment fund managers face greater difficulty in outperforming their benchmarks compared with international investment fund managers. It was concluded that the Information Ratio, rather than alpha or tracking error, is the strongest indicator of the persistence of managers' performance [10].

Bertrand also demonstrated, by defining the Information Ratio as a forward-looking measure, that the Information Ratio remains constant across all efficient portfolios in terms of tracking-error volatility, and concluded that the Information Ratio represents the best measure of risk-adjusted active portfolio performance [11].

The researchers believe that the differences in perspectives result from the multiple approaches used to measure the Information Ratio, as well as differences in the measurement periods and observations (daily, weekly, monthly, and so forth), in addition to the failure to account for market conditions during the evaluation period (whether the market is bearish or bullish). Moreover, the selection of the benchmark index has a significant impact on the evaluation results.

The process of evaluating investment fund performance plays a significant role in guiding the decisions of investors and portfolio managers, as accurate measures constitute a fundamental basis for selecting the optimal investment strategy or support them in making more efficient investment decisions.

In light of the foregoing, this study was undertaken to evaluate the performance of investment funds in the Arab environment (emerging markets), which, to the best of the researchers' knowledge, lacks such studies. The study stems from the problem that the complexity of financial markets and the increasing level of risk have led to the emergence of modern performance measures [12]. However, the evaluation of investment portfolio performance continues to rely on traditional methods that do not reflect the actual efficiency of investment fund managers in achieving investors' objectives. Furthermore, it is difficult to distinguish between performance resulting from the capabilities and skills of investment fund managers and performance resulting from market fluctuations or luck.

There is also ongoing debate regarding the ability of the Information Ratio to provide an accurate and reliable assessment of investment fund performance. Many studies may assume the efficiency of the Information Ratio under all circumstances, whereas its practical application may be affected by several factors, such as the nature of financial markets (emerging or developed) and the degree of efficiency characterizing the market [13]. The findings of the study may also contribute to improving risk-adjusted performance mechanisms and measures and provide scientific evidence regarding the efficiency of the Information Ratio in emerging markets, which differ from developed markets in terms of efficiency, liquidity, and depth.

The remaining sections of the study are divided into several parts. The first section presents the research methodology, the second section is devoted to presenting and discussing the research findings, while the third and final section presents the conclusions of the study [14].

Methodology and Data

A quantitative descriptive-analytical approach was adopted to describe the Information Ratio and the mechanism for evaluating investment fund performance using it as a general framework. Since the study relies on quantitative data and actual indicators, the quantitative analytical approach was employed as a tool for evaluating and analyzing the performance of these funds and comparing them. The methodology was divided as follows:

Research Sample and Study Period

A purposive sample was selected consisting of investment funds listed on the stock markets of some Arab Gulf Cooperation Council countries, namely Saudi Arabia, the United Arab Emirates, Qatar, Oman, and Bahrain, as these are considered emerging markets. Funds for which data were unavailable and newly listed funds were excluded. Accordingly, the research sample consisted of (30) Arab investment funds. Appendix (1) presents these funds and their benchmark indices.

The study period covered six years, from 1/1/2020 to 31/12/2025. This period was divided into two parts. The first period, from 1/1/2020 to 31/12/2022, was based on weekly observations to evaluate the performance of the investment funds and investigate whether the performance achieved by the managers of these funds resulted from their skills in achieving superior performance or from market fluctuations or luck.

The remaining period, from 1/1/2023 to 31/12/2025, was also based on weekly observations to identify the extent to which the Information Ratio is efficient in predicting the future performance of the funds in the research sample. The Information Ratio was calculated for the aforementioned period, as presented in Appendix (2).

Research Variable Description

The study included several variables, which can be presented as follows:

Returns of Investment Funds and Their Benchmark Indices

The actual return of both the investment funds and their benchmark indices is calculated using the following formula:

$$R_{it} = (D_{it} + P_t - P_{t-1}) / P_{t-1}$$

Where:

Actual return of the fund or benchmark index: R_{it}

Dividend distribution during period t : D_{it}

Closing price of the fund or benchmark index during period t : P_t

Closing price of the fund or benchmark index during period $t-1$: P_{t-1}

Information Ratio

The Information Ratio was calculated based on the second concept mentioned previously, which uses historical data as a basis for predicting future performance, according to the following formula:

$$IR = \frac{\alpha}{TE}$$

Where:

Information Ratio: IR

Active return estimated through the regression of portfolio return on the benchmark return: α

Tracking error, also referred to as active risk: TE

Given that risk-adjusted performance measures are influenced by the Capital Asset Pricing Model, both α , TE

are determined using the one-factor model, and the following formula illustrates this:

$$R_i = \alpha + \beta R_b + \varepsilon$$

Where:

Rate of return of the investment portfolio: R_i

Rate of return of the benchmark index: R_b

Regression parameters estimated using the least squares method: (α , β , ε)

Analysis of Tracking Error into Its Components

The only way for investment funds to achieve performance that exceeds that of the benchmark index is to generate a positive alpha (α), such that the fund's performance differs from that of the benchmark. Consequently, the fund incurs tracking errors. All measures of tracking error are based on the difference between the fund returns and the returns of its benchmark index. Using the one-factor model, the tracking error can be represented according to the aforementioned equation. By subtracting the benchmark return from both sides, the active return of the fund is obtained according to the following equation:

$$R_i - R_b = \alpha + (\beta - 1) R_b + \varepsilon$$

The previous equation can be used to analyze the reason for the deviation of the fund return from the benchmark return into two components:

1. The first component, $(\beta - 1) R_b$, indicates that the fund's performance is determined by the relationship between the fund return and the return of its benchmark index, as measured by the coefficient β and the index returns R_b . If β is greater than (1), the fund is expected to outperform its benchmark when market returns are positive. However, if market returns are negative, the fund's performance will be lower than that of the benchmark. If β is less than (1), the fund is expected to outperform the benchmark when market returns are positive, whereas the benchmark will outperform the fund when its returns are negative. When β is equal to (1), the fund achieves performance equal to that of its benchmark index.

2. The second component arises from the characteristics and attributes of the fund manager, in addition to external influences affecting fund management that cause managers to deviate from the benchmark. This is reflected by the component $(i + \varepsilon_i)$ in the previous equation. Since the expected value of (i) is equal to zero, the average (α_i) , representing the average active return, reflects the ability and skill of the fund manager in selecting its assets.

Measuring the Skill of Investment Fund Managers

By decomposing tracking error into several components, it is possible to determine whether outperformance can be attributed to managers' skill in selecting the fund's assets or to random behavior. For investors, the optimal condition is for both $\beta = 1$ and $R^2 = 1$. This means that the analysis of *TEV* will contain only an alpha component. Therefore, whether the value of alpha is positive or negative, it is relatively easy to determine whether the fund manager has demonstrated stock-selection ability.

However, if $\beta = 1$, but an active fund manager uses their stock-selection ability and concentrates the fund in a small number of assets that are expected to outperform the benchmark index, the fund will be undiversified (i.e., $R^2 < 1$). This means that the fund will exhibit a high alpha component and a high residual variance component in the analysis. This facilitates understanding whether the fund manager has demonstrated stock-selection ability or whether the fund's performance is attributable to random behavior resulting from insufficient diversification.

Active fund managers are likely to have $\beta \neq 1$, which makes the interpretation of the analysis more complex. For example, some fund managers may tend to make the fund's beta coefficient (β) greater than 1 in order to increase the alpha component resulting from the use of leverage. However, beta coefficients exceeding one will lead to a lower alpha value and a higher residual risk value compared with what would be expected under $\beta = 1$. This means that the fund will exhibit a relatively lower alpha component and a higher residual variance component compared with a fund having $\beta = 1$, even if the fund manager possesses investment-selection ability.

Conversely, some funds may have a beta coefficient (β) less than 1 due to their cash holdings. However, beta coefficients substantially below one will result in a higher alpha value and lower residual risk compared with a fund having $\beta = 1$. This means that the fund may exhibit a relatively higher alpha component and lower residual variance, even if the fund manager has limited or no investment-selection ability.

In other words, if $\beta \neq 1$, the fund manager's selection ability can be extremely difficult to decipher from the analysis of *TE*.

Measuring the Sustainability of Active Management Performance

The ability of investment fund managers to achieve sustainable performance can be measured by determining the extent to which the current Information Ratio can predict the future Information Ratio. In other words, can the current Information Ratio, which is derived using historical data, serve as a good indicator of managers' future performance, according to the following model:

$$IR_{t+1} = \alpha + \beta IR_t + \varepsilon$$

Where:

Information Ratio in period t : IR_t

Information Ratio in period $t+1$: IR_{t+1}

Regression parameters estimated using the least squares method: (α , β , ϵ)

Results and Discussion

The evaluation of investment portfolio performance involves determining the actual performance of the investment portfolio in terms of return and risk and comparing this performance with an appropriate benchmark portfolio. The evaluation of such performance is considered one of the important foundations for portfolio asset allocation. In order for performance measurement to be valid and accurate, an appropriate performance measure must be selected [15]. Accordingly, a number of researchers have developed performance measures that combine these two dimensions, referred to as dual (composite) measures [16]. The Information Ratio is considered one of the most sophisticated measures for evaluating the relative performance of investment funds, as it provides a composite indicator that combines the realized active return with the efficiency of tracking error management, thereby reflecting managers' ability to generate sustainable added value relative to the benchmark index. Given the expanding role of active management in Arab financial markets, the Information Ratio has become an effective analytical tool for assessing the success of such investment policies and their ability to achieve a competitive advantage relative to benchmark indices.

The one-factor model was adopted through simple linear regression analysis to derive the Information Ratio variables for the investment funds in the research sample by considering the fund return as the dependent variable and the market index return as the independent (explanatory) variable. The results are presented in Table (1).

Table 1. Information Ratio Analysis

Fund Code	α	$\sigma\epsilon$	IR
LP65135728	0.0000524	0.00611516	0.008569
LP68257960	0.000788	0.00532251	0.148050
P0000GGOP	-0.00324	0.0293006	-0.110578
P0000PX52	-0.00219	0.0363537	-0.060241
P0000Puey	-0.0018	0.0348338	-0.051674
P0000UPM	-0.00275	0.0358108	-0.076792
P0000PX54	-0.00061	0.0241282	-0.025282
P0000HOSH	-0.00272	0.0523748	-0.051933
P000073Q	-0.00371	0.0260582	-0.142374
P0000T314	-0.0114	0.0387414	-0.294259
P00008MKM	-0.00021	0.00027793	-0.755575
P000142Q	-0.000371	0.0005615	-0.660728
P0000HGAW	-0.00193	0.0281564	-0.068546
P0000142Z	-0.00369	0.0394939	-0.093432
P0000HGB2	-0.000321	0.00016837	-1.906481

Fund Code	α	$\sigma\epsilon$	IR
P0000KSXM	-0.00536	0.0298612	-0.179497
P0000HGAV	-0.00116	0.0286767	-0.040451
P00008W6D	-0.00347	0.00156122	-2.222621
P00008MKN	-0.00392	0.0338758	-0.115717
P00001436	-0.00364	0.0420896	-0.086482
P00008MKF	-0.000344	0.0330358	-0.104129
P0000142R	-0.000321	0.0004255	-0.754408
P0000KSXQ	-0.000444	0.00062803	-0.706975
P0000HGAT	-0.000384	0.00015425	-2.489449
p00001004	-0.000165	0.032398	-0.005093
P00001461	-0.000136	0.0149261	-0.009112
P00001462	-0.00088	0.0152383	-0.057749
P0000USU9	-0.00255	0.0299872	-0.085036
P0000T13J	-0.00336	0.0426427	-0.078794
P0000KSXP	-0.00564	0.02933709	-0.192248

Source: Prepared by the researchers based on outputs from Minitab 16 software.

It is evident from Table (1) that the Information Ratio for the majority of the investment funds in the research sample was negative. The values ranged from the lowest negative value of (−2.489449), achieved by fund (P0000HGAT), to the highest negative value of (−0.005093), achieved by fund (P00001004). This indicates weak risk-adjusted performance of the aforementioned funds compared with their benchmark index (market index) against which these funds are traded. In other words, the performance of the managers of these funds falls within the lower half of the performance of other active portfolio managers, given that the Information Ratio follows a normal distribution pattern similar to a bell-shaped curve with a mean of (zero). An Information Ratio greater than (zero) indicates that managers' performance falls within the top (50%) of the performance of other managers, as stated by in their study on tracking risk assessment.

The best performance among the managers of the investment funds in the research sample was achieved by the manager of fund (LP68257960), whose Information Ratio reached approximately (15%). This indicates that the manager of the aforementioned fund outperformed the managers of the other funds in terms of performance, in addition to outperforming its benchmark index (market index) against which the fund is traded [17]. This resulted from the skill and efficiency of the fund manager in selecting assets that generate high risk-adjusted returns. Evidence of this is provided by the fund's active return (alpha), which amounted to (0.000788), representing the highest active return achieved by the fund compared with the other investment funds in the research sample. It was followed by fund (LP65135728), whose Information Ratio amounted to (0.000524).

The lowest alpha value was achieved by fund (P0000T314), amounting to (−0.0114), indicating the weakness and limited skill of the aforementioned fund manager and their inefficiency in selecting assets. The highest tracking error was recorded by fund (P0000HOSH), amounting to (0.0523748), indicating that the aforementioned fund deviates considerably from tracking its benchmark index

(market index) due to differences between the fund's components and those of the aforementioned index. The remaining funds achieved varying levels of active returns and tracking errors [18].

It is also evident that most of the market indices on which the funds in the research sample are traded recorded negative returns, with the exception of the Doha Securities Market Index, whose return reached (21.8%) during the analysis period extending from 1/1/2020 to 31/12/2022. This was the period during which the world was exposed to the COVID-19 pandemic, as shown in Table (2).

Table 2. Analysis of Single-Factor Model Variables

Fund Code	α	β	$\sigma\epsilon$	R2	Rb
LP65135728	0.00005	0.0565	0.00612	0.056	-0.64536
LP68257960	0.00079	0.0783	0.00532	0.144	-0.64536
P0000GGOP	-0.00324	-0.1	0.02930	0.02	-0.14803
P0000PX52	-0.00219	0.294	0.03635	0.03	-0.14803
P0000Puey	-0.00180	0.033	0.03483	0	-0.14803
P0000UPM	-0.00275	0.275	0.03581	0.011	-0.14803
P0000PX54	-0.00061	-0.089	0.02413	0.03	-0.14803
P0000HOSH	-0.00272	-0.063	0.05237	0	-0.23364
P000073Q	-0.00371	-0.18	0.02606	0.035	-0.23364
P0000T314	-0.01140	0.634	0.03874	0.22	0.218964
P00008MKM	-0.00021	0.00313	0.00028	0.062	-0.1531
P000142Q	-0.00037	-0.00214	0.00056	0.008	-0.1531
P0000HGAW	-0.00193	0.412	0.02816	0.111	-0.1531
P0000142Z	-0.00369	-0.256	0.03949	0.03	-0.1531
P0000HGB2	-0.00032	-0.00145	0.00017	0.041	-0.1531
P0000KSXM	-0.00536	0.182	0.02986	0.019	-0.1531
P0000HGAV	-0.00116	0.203	0.02868	0.029	-0.1531
P00008W6D	-0.00347	0.00153	0.00156	0.001	-0.1531
P00008MKN	-0.00392	-0.154	0.03388	0.011	-0.1531
P00001436	-0.00364	-0.195	0.04209	0.011	-0.1531
P00008MKF	-0.00344	-0.157	0.03304	0.012	-0.1531
P0000142R	-0.00032	-0.00597	0.00043	0.095	-0.1531
P0000KSXQ	-0.00044	-0.00161	0.00063	0.003	-0.1531
P0000HGAT	-0.00038	-0.0014	0.00015	0.045	-0.1531
p00001004	-0.00017	0.321	0.03240	0.05	-0.1531
P00001461	-0.00014	0.466	0.01493	0.342	-0.1531
P00001462	-0.00088	0.59	0.01524	0.445	-0.1531
P0000USU9	-0.00255	0.016	0.02999	0	-0.1531
P0000T13J	-0.00336	-0.509	0.04264	0.071	-0.1531
P0000KSXP	-0.00564	0.129	0.02934	0.01	-0.1531

Source: Prepared by the researchers based on Minitab 16 software output.

It is evident from Table (2) that the market most affected by the COVID-19 pandemic was the Dubai Financial Market, as the average return achieved by the aforementioned market was the lowest compared with the indices of the other markets in which the investment funds in the research sample are traded. The average return of the aforementioned market amounted to (−64.5%), as the UAE economy is one of the most diversified economies compared with the other countries in which the investment funds in the research sample are traded. It relies on tourism, trade, and aviation, in addition to relying primarily on energy resources [19]. It was followed by Oman, whose Muscat Securities Market Index achieved an average return of approximately (−23%), followed by Saudi Arabia, whose Tadawul Market Index achieved an average return of approximately (−15%). One of the main factors distinguishing Saudi Arabia from other countries may be the restrictions imposed on pilgrims and Umrah performers visiting the Holy Mosque to perform Hajj and Umrah rituals, which directly affected its economy. Bahrain ranked last in terms of the impact of the COVID-19 pandemic on its economy, as the Manama market achieved an average return of (−14.8%). The aforementioned countries share the characteristic that their economies rely heavily on oil revenues. Consequently, the decline in global oil prices, affected by the COVID-19 pandemic, adversely affected the performance of their markets.

The Arab markets experienced a significant decline during that period as a result of several economic and financial factors, in addition to those mentioned above. Lockdown and quarantine measures, as well as the suspension of economic activities, contributed to weakening the performance of listed companies, particularly those operating in the tourism, energy, and aviation sectors. Furthermore, uncertainty and investors' attempts to avoid risk resulted in substantial selling activity, an increase in the supply of shares, and an outflow of foreign investment [20]. All these factors contributed significantly to negatively affecting the performance of these markets.

It is also evident that the value of (R^2) was low for all the funds in the research sample, indicating the limited ability of financial market index returns to explain the changes occurring in the returns of investment funds listed in these markets. This may be attributed to the fact that the investment funds in the research sample were not adequately diversified. Fund (P00001462) recorded the highest value of (R^2), amounting to (44.5%), indicating that the market index explains (44.5%) of the changes occurring in the fund's returns, while the remaining percentage is attributable to other factors not included in the model. This was accompanied by a clear decline in the value of (β) for the funds in the research sample, in addition to fluctuations in its sign between negative and positive, which may indicate differences in the sensitivity of the funds to changes occurring in the benchmark index (market index), with some funds exhibiting a negative effect and others a positive effect. This may be attributed to the state of uncertainty resulting from the disruptions experienced by these markets, which led to a weakening of the relationship between the returns of the funds in the research sample and the market indices, consequently reducing the sensitivity of the funds to market movements.

Furthermore, the restructuring operations undertaken by most of the fund managers, represented by shifting toward safer assets with lower market correlations, as well as the increased cash holdings of most funds, weakened the ability of the (β) coefficient to explain the changes occurring in the returns of the funds in the research sample. As a result of the substantial decline in the values of

both (R^2) and (β), the value of tracking error ($\sigma\epsilon$) increased, although its theoretical value is assumed to be (zero). In addition, the value of (α) declined, with a negative value recorded for the majority of the funds in the research sample, making it difficult to determine whether the performance reflected by the Information Ratio resulted from the manager's skill and judgment in selecting assets or from random behavior or luck, as stated in (Tracking Error Source).

In an attempt to resolve the intellectual debate concerning the differing views among researchers regarding the extent to which the Information Ratio is efficient in evaluating investment portfolio performance, given that the Information Ratio is a backward-looking analytical tool (based on historical data) and that past results may not necessarily be indicative of future performance, in addition to its end-point bias, like most other performance measures, the researchers tested the ability of the current Information Ratio to predict the future Information Ratio. In other words, they attempted to determine the extent to which risk-adjusted performance, as measured by the Information Ratio, is sustainable. Table (3) presents the results of this test.

Table 3. Regression Results for Testing the Sustainability of Risk-Adjusted Performance of Arab Investment Funds Measured by the Information Ratio

Variables	Coefficient(β)	Std.Error	t-statistic	P.Valuo
Constant	0.0307	0.1201	0.26	0.80
IR _t	1.1872	0.1589	7.47	0.000
<u>Model Summary</u>				
R-squared	66.60%			
Adjusted R-squared	65.40%			
F-statistic	55.82			
Prob(F-statistic)	0.000			
Durbin-Watson statistic	1.97924			

Source: Prepared by the researchers based on the Minitab 16 program.

It is evident from Table (3) that the current Information Ratio is capable of exerting a positive and multiplicative effect on the future Information Ratio, as indicated by the value of the coefficient (β), which amounted to (1.1872). This indicates a high predictive power and the likelihood of persistence in risk-adjusted performance across time periods, as indicated by the (P-Value) of (0.000), which means that risk-adjusted performance is sustainable. Investment funds that achieve high (low) levels of the Information Ratio in the current period tend to maintain or enhance their superior (inferior) performance in subsequent periods. This indicates the continuity of the efficiency of investment decisions and management's ability to generate active returns in a sustainable manner.

The value of (Adjusted R-squared) also indicates that the current Information Ratio explains (65.40%) of the changes occurring in the future Information Ratio, while the remaining percentage is attributable to other variables not included in the model. Furthermore, the value of (Prob.F), which amounted to (0.000), indicates the overall significance of the model. The value of the (Durbin-Watson) test was (1.97924), which is close to (2), indicating the absence of an autocorrelation problem among the residuals in the estimated regression model. In other words, the model errors are largely independent over time, which enhances the reliability of the model results.

Conclusions

The research findings revealed a decline in the risk-adjusted performance of managers of investment funds listed in the Gulf Cooperation Council countries, as the majority of these funds achieved negative Information Ratios. In addition, the study found an inability to distinguish between managers' performance attributable to skill in asset selection and performance resulting from luck or random behavior. The research also concluded that the Information Ratio is characterized by efficiency and the ability to achieve sustainable performance, as the Information Ratio based on historical data with substantial informational content is capable of predicting future risk-adjusted performance. This indicates the efficiency and sustainability of the Information Ratio, thereby achieving the objectives of the research, which sought to provide a solution to the ongoing debate concerning the efficiency of the Information Ratio and its ability to achieve sustainable performance. This may assist the management of these funds and investors in relying on the aforementioned ratio as one of the best measures of sustainable risk-adjusted performance, such that it can be used to determine managers' suitability for appointment and the amount of their compensation. Investors may also use it periodically to determine whether to continue investing in the fund's assets or not, in addition to using the ratio to compare and select among the investment funds in which they intend to invest. One limitation of the current study is that it did not take into account trading costs and the costs associated with managing these funds. Furthermore, the world was exposed to the COVID-19 pandemic during the initial study period extending from 1/1/2020 to 31/12/2022, which negatively affected the performance of the Arab markets in which the funds in the research sample are traded. The indices of these markets recorded negative performance, with the exception of the Doha Securities Market Index. Accordingly, the researchers recommend conducting further studies over time periods characterized by stability, while taking into account both trading costs and the costs of managing these funds. They also recommend conducting further studies that consider a comparison between the Information Ratio and the Sortino Ratio in measuring risk-adjusted performance.

References

- [1] E. K. Al-Hamdouni, "Evaluating the performance of investment portfolios: An application in the Amman Financial Market," *Journal of Anbar University for Economic and Administrative Sciences*, vol. 4, no. 7, 2011.
- [2] M. A. I. Al-Ameri, *Investment Portfolio Management*. Amman, Jordan: Ithraa for Publishing and Distribution, 2013.
- [3] S. M. Al-Nuaimi, "Analyzing the passive investment portfolio management strategy using tracking error: A comparative study," *Tikrit Journal of Administrative and Economic Sciences*, vol. 17, no. 54, 2021.
- [4] S. H. A. Al-Mousawi, "Evaluating stock portfolio performance according to the M² measure and its role in selecting an efficient investment portfolio: An applied analytical study of a sample of companies listed on the Iraq Stock Exchange," *Iraqi Journal of Administrative Sciences*, no. 24, University of Karbala, 2009.
- [5] W.-F. Pan and T. Li, "The measurement of tracking errors of commodity ETFs in China," *Investment Management and Financial Innovations*, vol. 13, no. 2, pp. 29–35, 2016, doi: 10.21511/imfi.13(2).2016.03.

- [6] S. Lee, *Tracking Error and Real Estate Fund Performance*, Working Paper Series No. 17. London, U.K.: Faculty of Finance, Cass Business School, City University London, 2015. [Online]. Available: <https://openaccess.city.ac.uk/id/eprint/13813/>
- [7] P. F. Pope and P. K. Yadav, "Discovering errors in tracking error," *The Journal of Portfolio Management*, vol. 20, no. 2, pp. 27–32, 2004, doi: 10.3905/jpm.1994.409477.
- [8] J. B.-I. Aboy and J. Magadia, "Nonparametric performance hypothesis testing with the information ratio," *Cogent Economics & Finance*, vol. 9, no. 1, Art. no. 1902031, 2021, doi: 10.1080/23322039.2021.1902031.
- [9] R. C. Grinold and R. N. Kahn, *Active Portfolio Management: A Quantitative Approach for Producing Superior Returns and Controlling Risk*, 2nd ed. New York, NY, USA: McGraw-Hill, 2000.
- [10] S. L. Blatt, "An in-depth look at the information ratio," Master's thesis, Worcester Polytechnic Institute, Worcester, MA, USA, 2004. [Online]. Available: <https://digital.wpi.edu/show/6969z107m>
- [11] L. Wang and O. Shayevitz, "Graph information ratio," arXiv:1612.09343v2, 2017, doi: 10.48550/arXiv.1612.09343.
- [12] Cornerstone Investment Partners, LLC, *Comparing Apples to Apples: Using Information Ratio in Small Cap to Identify Manager Skill*, Executive Summary, Aug. 2023. [Online]. Available: <https://www.cornerstone-ip.com>
- [13] E. Qian and R. Hua, "Active risk and information ratio," *Journal of Investment Management*, vol. 2, no. 3, pp. 1–15, 2004.
- [14] A. Alenius, "Downside risk measures in evaluation of portfolio performance," Bachelor's thesis, Lappeenranta University of Technology, Lappeenranta, Finland, 2014. [Online]. Available: <http://urn.fi/URN:NBN:fi-fe2014112146476>
- [15] J. Menchero, "Rethinking the fundamental law of active management," *Journal of Investment Management*, vol. 15, no. 2, pp. 92–107, 2017.
- [16] A. S. Muralidhar, "Why maximising information ratios is incorrect," *Journal of Asset Management*, vol. 6, no. 4, pp. 266–277, 2005, doi: 10.1057/palgrave.jam.2240182.
- [17] D. Kidd, "The Sharpe ratio and the information ratio," *Investment Performance Measurement*, vol. 2011, no. 1, pp. 1–4, CFA Institute, 2011.
- [18] C. Boido and G. Fulci, "Active management fees and information ratio churn," Working Paper, 2022. [Online]. Available: <https://ssrn.com/abstract=4164801>
- [19] P. Bertrand and C. Protopopescu, "The statistics of the information ratio," *International Journal of Business*, vol. 15, no. 1, pp. 71–86, 2010. [Online]. Available: <http://www.ijb-journal.com/index.php/ijb/article/view/390>
- [20] E. M. Ankrim, *Measuring Investment Skill Using the Effective Information Coefficient*, Working Paper, 2007. [Online]. Available: <https://www.northinfo.com/documents/292.pdf>