Using Artificial intelligence in securities trading and its effect on investment return

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Abstract

The use of artificial intelligence applications has witnessed a noticeable increase in securities trading operations by investment funds and individuals alike, and a large percentage of trading operations are now carried out through these applications without any human intervention. In this research, we are trying to shed light on these operations and will test the financial performance of the funds. Those that use artificial intelligence in their trading and those that rely on humans for that, and the research reached many conclusions and recommendations, the most important of which was that the funds that use artificial intelligence were able to outperform the funds that use traditional trading, albeit to a limited extent. The research recommended the necessity of increasing the level of awareness and training. On the use of artificial intelligence applications by Iraqi companies.

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The introduction

Trading in securities is one of the most important financial activities that achieve high levels of returns for investors, which calls for close attention to trading mechanisms and making investment decisions to buy or sell securities that are in the interest of investors and achieve for them the highest returns with the lowest levels of risk.

If the approaches to investment and financial market analysis were concentrated in two basic approaches: technical analysis and fundamental analysis, then all the decisions that were taken according to the results of the analysis and prediction of the resulting price trends were taken by financial experts working in financial brokerage companies, investment funds and banks alike.

However, the development of information technologies, which led to the emergence of a completely new field of knowledge represented by artificial intelligence, has changed the nature and trends of financial activity in financial markets in general and securities trading operations in particular. Many investment funds have turned to using artificial intelligence applications in their operations to benefit from its advantages. This research aims to analyze the investment returns in six investment funds that were divided into three pairs of funds, one of which uses artificial intelligence in trading, while the other relies on humans to make decisions.

The researcher made sure that each pair of funds was similar in terms of the target market and securities and within the same geographical scope, and he adopted one basic hypothesis, which is that funds that use artificial intelligence applications in trading operations will achieve higher returns than funds that use traditional trading methods.

In order to reach the expected results, the variables related to the research were addressed within the theoretical framework and the research methodology was formulated that addressed the problem, importance, objectives, and sample. Then the third section was allocated to the applied aspect, and finally, conclusions and recommendations were presented in the fourth paragraph of the research.

1-theoritical aspects

1-1.Artificial intelligence: concept and types

AI represents the ability of machines to learn and think similarly to humans by building complex algorithms and patterns to learn and solve problems without human intervention. Some may think that the term artificial intelligence is new, but in fact, the idea of artificial intelligence goes back to researcher John McCarthy (1956) which at that time focused on how to give machines the ability to think like humans (Hadilan,2020,300)

The first attempt to build intelligent machines that can (simulate) the human mind was recorded by the scientist Frank Rosenblatt in 1957, when he developed a simplified model of a neural network that closely resembles neurons in the human brain. (Kiim S, Chon m,2015,320)

In the middle of the twentieth century, artificial intelligence research witnessed rapid progress represented in the development of control sciences of machines, digital computers, and intelligent algorithms, leading to machine learning and deep learning. Then this field of knowledge developed into an independent science called artificial intelligence, which is the field that includes everything related to the use of machines, Computers and software for learning, solving problems, proposing solutions, analysing data, and making decisions independently of human intervention (Huenf Cf, Tsdn Cn ,2017,287)

Artificial intelligence is based on a set of skills that are programmed automatically to operate independently and repeatedly. The most prominent of these skills are the following: (Chuli rj,et,al. 2022,1100),(Dary E, dontu K ,2019, 201)

1-Education: This aspect of AI programming referred to the acquisition of data and requirements for how to convert it into actionable information. Speed, algorithmic reasons, hardware with step-by-step instructions on how to use the computer for a particular task.

2-Reasoning To reason is to draw inferences appropriate to the situation. Inferences are classified as deductive and inductive; the difference between these types of reasoning is that in the deductive case the truth of the premises guarantees of the conclusion, whereas in the inductive case the truth of the premise lends support to the conclusion without giving absolute assurance.

3-Self-improvement: in artificial intelligence, may be characterized as a systematic search through a range of actions in order to reach some goals or solutions. Problem-solving methods divide into special purpose and general purpose. A special-purpose method is tailor-made for a particular problem and often exploits very specific features of the situation in which the problem is embedded. In contrast, a general-purpose method is applicable to a wide variety of problems.

4-Creativity: This aspect of artificial intelligence, modern networks and systems based on basic rules and techniques, and other technologies use artificial intelligence to create new images, new texts, new music, and new ideas.

The key Components of AI are (Allen D, meller, 2020,322) , (Bogierki g,et.al,2016,2970)

1. Machine learning: Machine learning is an AI application that automatically learns and improves from previous sets of experiences without the requirement for explicit programming.

2. Deep learning: Deep learning is a subset of ML that learns by processing data with the help of artificial neural networks.

3. Neural network: Neural networks are computer systems that are loosely modelled on neural connections in the human brain and enable deep learning.

4. Cognitive computing: Cognitive computing aims to recreate the human thought process in a computer model. It seeks to imitate and improve the interaction between humans and machines by understanding human language and the meaning of images.
5. Natural language processing (NLP): NLP is a tool that allows computers to comprehend, recognize, interpret, and produce human language and speech.
6. Computer vision: Computer vision employs deep learning and pattern identification to interpret image content (graphs, tables, PDF pictures, and videos).

1-2.Trading in financial markets

Since the opening of the first financial markets in the sixteenth century in Amsterdam, trading in securities, buying and selling, was traditionally carried out through the presence of the two parties, the seller and the buyer, or their agents, at the same time and place. This situation continued until the development of modern communication tools at the beginning of the twentieth century, when trading systems were developed through the phone or other communication devices, which contributed to accelerating trading operations, reaching electronic stock exchanges, all of these operations are carried out via remote communication.(Gini,2020,577)

However, the buying and selling operations themselves were based on two basic approaches: the technical analysis approach, which includes an analysis of historical price patterns and trading values to get specific patterns within the rule (history repeats itself) and thus it is possible to predict the direction of future price movement and make buying and selling decisions on their basis. It has been developed many technical analysis tools such as Japanese candlesticks, trends, support and resistance levels, momentum, etc.(Hullamnd,2022,798)

While the second approach is the fundamental analysis, which is based on the basics of analysing fair market prices according to the returns and risks of companies and the surrounding

circumstances, and thus making decisions to buy and sell according to these facts.(Nwery,2019,466)

Both of the above approaches depend on the human element, skills and experience possessed by specialists to make appropriate decisions according to investors' preferences and orientations. Although these experts are increasingly using software and expert systems, buying and selling decisions are still made by them and at the time they determine according to their convictions.(Heilor,2018,509)

Therefore, these decisions must be affected by the bias of investors or their influence by the behaviour of others within what has become known as herd behaviour, in addition to the influence of private feelings, convictions and personal expectations in making buying and selling decisions and other trading in the financial markets, in addition to the difficulty of following the rapid market movement of tens of thousands of securities and analyse the information flowing to the financial markets within a short and appropriate time to make the financial decision that is in the interest of those dealing in the financial markets. (Rosifisky,2020,152)

As a result, and in view of the tremendous developments in the field of cognitive technologies and the development of artificial intelligence models, companies have begun to shift towards using these technologies in trading operations within what has become known as the Robo Trading or Quant Trading approach, which will be discussed in the following paragraphs.

1-3. AI in financial trading:

A quant fund (short for quantitative fund) is an investment fund that uses mathematical and statistical techniques together with automated algorithms and advanced quantitative models to make investment decisions and execute trades. There is no human intellect and judgment involved in investment selection and related decisions.(Chung b ,2020,290)

Quant funds operate using computer-based models, which mitigate risks and losses related to human fund management. Just

like any other investment fund, quant funds aim to outperform the market by placing funds with liquid and publicly traded assets in a superior way. In financial terms, the goal is to generate alpha (excess return). (Dary E, dontu K ,2019,201)

The quant fund depending on (Robo- trading) (fully automated machine that make investment decisions without any human interactions), most of Robo trading operations are carried out through financial technology, which has become more interested and accepted due to the investment funds that use it enjoying credibility and outstanding performance. Investors have also become more knowledgeable about using these technologies and understanding their smart applications. It is believed that the use of these technologies in trading has caused a crisis (Flash Crash) in the Dow Jones Index in 2010, as the index lost 1,000 points, equivalent to 9% of its value, in a few minutes, then regained it again after only a few minutes, and its use has increased at the present time to represent the value of 80% of trading in the American financial markets, which exceeds 2 trillion Dollars of securities, commodities and various financial contracts. (yaushi,2021,409)

Quant Trading, Quant Strategy, and Robo Trading are usually referred to as (black boxes) because they represent an important part of the secrets of investment funds and companies dealing in financial markets.

The quantitative (Robo) investment process is containing three stages: (Hadilan E,2022, 402)

Stage 1: Input System

This step involves providing appropriate inputs which include financial market data and company data, Like income, growth, cost of capital, interest, price profits, sales, marketing costs, taxes, etc.

In the data entry stage, securities with unsuitable factors such as high risk, large debt, and other relevant factors are excluded from the quantitative model and securities that are likely to generate

high income and low risk are retained. Typical investment rules are also defined at this stage.

Step 2: Forecasting Engine

The forecasting stage: This stage includes evaluating the expected forecasts of a number of variables related to the investment process and based on the data entered in the first stage as the expected returns risks and prices are estimated within a time horizon specified by the smart system.

Step 3: Portfolio Construction

This stage includes forming the investment portfolio by selecting securities that apply pre-defined rules and using a series of smart learning algorithms and machine learning software. This process is repeated every second, and in some systems the inputs and results are evaluated every millisecond (one part out of 100 of Second) Here, all smart learning and selection processes take place without any human intervention, as the trading system is directly linked to the financial markets to send buy and sell orders and conduct trades according to the results reached by the smart system.

2-Research Methodology

2-1. Research problem: Artificial intelligence represents one of the most important modern fields that has begun to have a wide impact in the financial fields, especially in the field of trading in securities and commodities in the financial markets, as the use of various artificial intelligence applications such as machine learning, deep learning, Robo trading, and quant trading. the operations has expanded rapidly for Financial trading and building investment portfolios by investment funds. However, this use is still viewed with suspicion, and its negative effects may outweigh its positive effects on investors. Hence comes the problem of researching the efficiency of artificial intelligence applications in securities trading and the impact of this on the returns of companies that these applications are used compared to companies that rely on traditional trading based on human skills.

2-2.Research importance

The importance of research is it deals with a modern topic that the Iraqi and Arab libraries lack to a large extent and the use of

artificial intelligence applications requires extensive scientific knowledge and studies to determine the nature of use and the extent of its effectiveness, especially in the Iraqi environment.

2-3. Research objectives

The research objectives are as follows:1- Identify the most prominent applications of artificial intelligence used by investment funds in their trading operations in financial markets

2- Analysis of the returns of companies that use artificial intelligence applications in trading operations

3- Comparing the financial performance of companies that use artificial intelligence applications with those companies that do not use these applications in trading operations in the financial markets.

2-4. Research hypothesis

The research adopts one basic hypothesis:

The financial performance of investment funds that use artificial intelligence applications in trading in financial markets exceeds the financial performance of funds that do not use these applications in their financial transactions.

2-5. Research sample

In order to test the hypothesis of the study and reach results, six investment funds were selected and divided into three pairs for comparison purposes. Three of them use artificial intelligence techniques in their financial transactions, while the other three do not use these applications. The similarity of the scope of work in the same financial markets geographically was taken into account, Targeting investment in the same segments of securities for each pair of companies, the table (2-1) shows these companies

Table (2-1) research sample

N	fund	**Assets billion $ 2023**	Trading
1	Abante quant value small caps	0.7	Quant (Robo)
2	Goldman Sachs small caps	1.4	Human
3	Robeco QI Chinese A-share Active Equities	0.5	Quant (Robo)

4	Robeco A-share equity Chinese	0.6	Human
5	Blackrock advantage small	0.4	Quant (Robo)
6	Victory small cap stock fund	0.5	Human

2-6. Research period: Quarterly data on the financial performance of investment funds, represented by return on investment, was used for six years from the first quarter of 2018 until the fourth quarter of 2023.

3. Practical aspect

In this aspect, we will compare the financial performance of funds that use (Quant strategy) strategies based on artificial intelligence, algorithms, and quantitative methods with those funds that use trading strategies based on humans, in which decisions are made by the specialized expert teams in the fund and for three pairs of funds, for every two funds that work in the same targeted investment sector and class of securities and operate in the same financial markets

First pairs of funds:

1-Abante quant value small caps(quant)

2-Goldman Sachs small caps.(human)

Abante Quant Value Small Caps FI is an open-end fund. The Fund's objective is to outperform MSCI World Small Cap Index. The Fund invests at least 75% of its assets in equity securities of primarily small capitalization, mainly in small-cap international securities, with reasonable liquidity, and also in medium/large-cap securities. It will invest mainly in Europe, Asia and the US, and the rest in Australia, Canada, Latin America and/or other countries, including emerging ones (without exceeding 25%). Exposure to currency risk will not exceed 80%. The rest of the assets are invested in government and corporate fixed-income securities. The selection of securities is based on financial algorithms and a quantitative method that, within the "value" universe defined by those companies that are undervalued and of

great financial solidity, chooses those with the best price dynamics (“momentum”).

The GS Fund invests, under normal circumstances, at least 80% of its net assets (plus any borrowings for investment purposes) (“Net Assets”) in a diversified portfolio of equity investments in small-cap issuers with public stock market capitalizations within the range of the market capitalization of companies constituting the Russell 2000® Value Index at the time of investment. Under normal circumstances, the Fund’s investment horizon for ownership of stocks will be two to three years. The Fund seeks its investment objective of long-term capital appreciation by investing in value opportunities that the Investment Adviser defines as companies with identifiable competitive advantages whose intrinsic value is not reflected in the stock price. Although the Fund will invest primarily in publicly traded U.S. securities, it may invest up to 25% of its Net Assets in foreign securities, including securities of issuers in emerging countries and securities quoted in foreign currencies. The Fund may also invest in the aggregate up to 20% of its Net Assets in companies with public stock market capitalizations outside the range of companies constituting the Russell 2000® Value Index at the time of investment and in fixed income securities, such as government, corporate and bank debt obligations.

Abante Company achieved the highest rate of return in the first quarter of 2021, amounting to 17.15%, while it recorded the highest rate of loss - 25.51% in the first quarter of 2020. It seems that this was achieved due to the Corona pandemic; the table shows that the highest rate of return achieved by GS Company was 31.58% in the fourth quarter of 2020, while the highest value of the loss rate was -36.11 in the first quarter of the same year. It seems that these fluctuations were affected by circumstances facing financial markets during the Corona pandemic, and the average rate of return during the research period was 2.23%

By comparing the average rate of return during the research period it is clear that the two companies achieved a close average return of 2.73% in Abante Company and 2.23% in GS Company. It is clear that GS Company achieving the highest rates of return in most of the research periods, and the same applies to loss rates as well, as negative returns were achieved during two years of the research period (2018 and 2022) in GS Company, while these returns were achieved during one year Only in Abante Company, in 2022. It also appears that GS Company outperformed Abante Company in four years, while Abante Company's performance was better in only two years. Tables (3-1),(3-2) , figure (3-1) show these results.

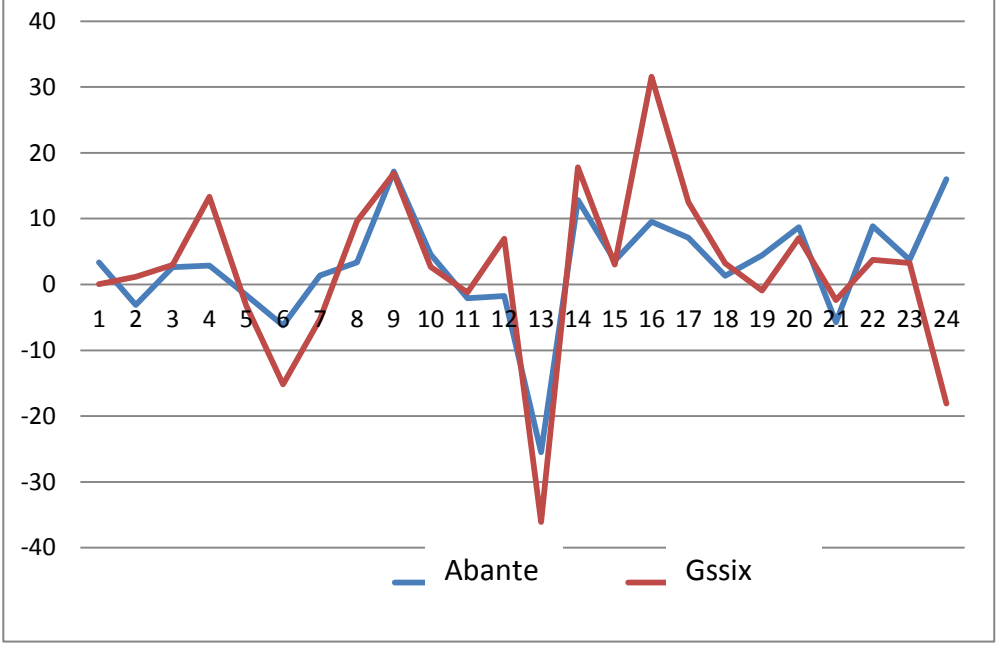
Table (3-1)
Abante rate of return Q1 2018 – Q4 2023

year	Q1	Q2	Q3	Q4	Ave.
2023	3.38	-3.10	2.62	2.85	1.44
2022	-1.63	-6.21	1.34	3.36	-0.79
2021	17.15	4.58	-2.10	-1.73	4.48
2020	-25.51	12.85	3.62	9.54	0.13
2019	7.12	1.31	4.43	8.70	5.39
2018	-5.73	8.86	3.77	16.02	5.73
Ave.	-----	------	------	------	2.73

Table (3-2)
GS rate of return Q1 2018 – Q4 2023

year	Q1	Q2	Q3	Q4	Ave.
2023	0.05	1.17	2.96	13.35	4.38
2022	-3.19	-15.20	-5.28	9.63	-3.51
2021	16.86	2.66	-1.24	6.95	6.30
2020	-36.11	17.82	3.03	31.58	4.08
2019	12.49	3.21	-0.93	7.05	5.46
2018	-2.40	3.77	3.26	-18.08	-3.36
Ave.	------	-----	-----	------	2.23

figur 3-1
Trading return of Abante and Gssix
Q1 2018 - Q4 2023 %



Second pair:

1- Robeco QI Chinese A-share Active Equities (quant)

2- Robeco A-share equity Chinese (human)

Robeco QI Chinese A-share Active Equities is an actively managed fund that invests in stocks of companies with an A-share listing in mainland China. The selection of these stocks is based on a quantitative model depending on AI and optimization algorithms . The fund's objective is to achieve a better return than the index. The fund uses a quantitative stock selection strategy which ranks stocks on their expected future relative performance using three factors: valuation, quality and momentum. The portfolio overweighs stocks with an attractive valuation, a profitable operating business, strong price momentum, and positive recent revisions from analysts.

Robeco Chinese A-share Equities is an actively managed fund that invests in Chinese A-shares. The selection of these stocks is based on fundamental analysis. The fund's objective is to achieve a better return than the index. The fund identifies attractive macro-economic themes and selects fundamentally sound companies which can be large caps, midcaps and/or small caps. The fund selects primarily domestic Chinese stocks (A-shares).
https://www.robeco.com

Robeco QI Company achieved the highest rate of return on trading operations in the financial markets in the first quarter of 2019, at a rate of 33.99%, while the highest negative rate was achieved in the third quarter of 2022, while the highest rate of return in Robeco eq. Company reached 20.17% and was achieved in the first quarter in 2019, it is clear that Robeco QI had better performance during the research period, as it achieved a positive return rate of 0.33%, while Robeco eq. company suffered from a negative return on average of -0.19%, as it recorded a loss for four years during the six-year research period for the years 2018 - 2021-2022-2023, while Robeco QI achieved negative returns in only three years, 2018 - 2022 - 2022.

However, the general trend of profit and loss appears close and identical in some periods of the research, as Robeco QI fund achieves the highest returns compared to Robeco eq. fund during the periods of achieving profits, while Robeco eq. fund recorded the highest losses during the period of achieving losses. Tables (3-3),(23-4) figure (3-2) show these results

Table (3-3)
Robeco QI rate of return Q1 2018 – Q4 2023

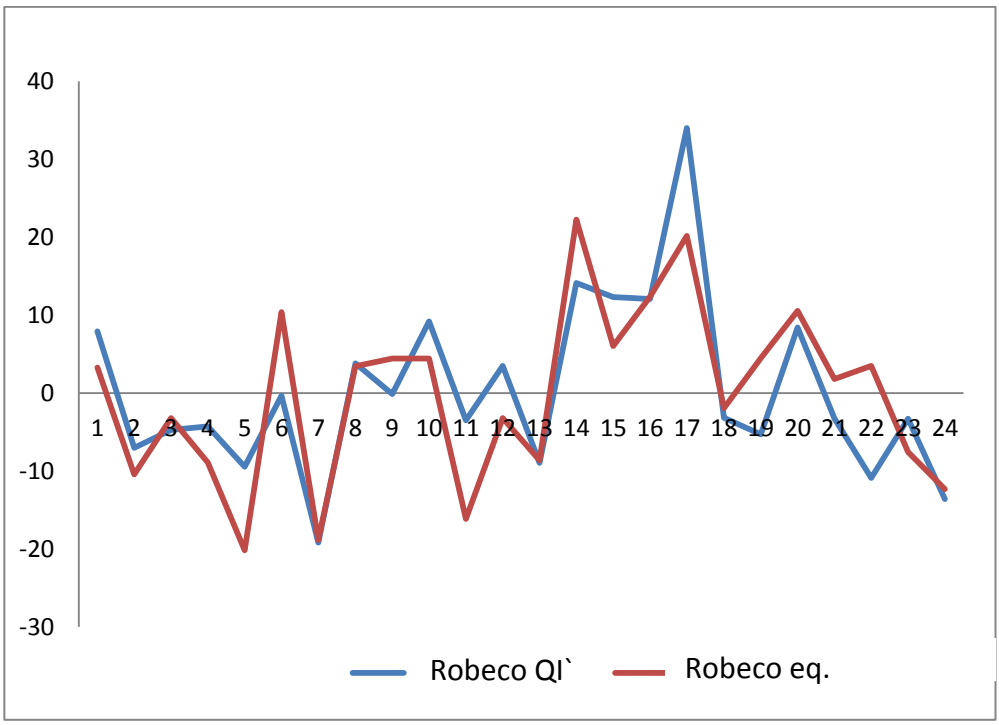
year	Q1	Q2	Q3	Q4	Ave.
2023	7.90	-7.05	-4.75	-4.28	-2.05
2022	-9.46	-0.35	-19.19	3.80	-6.3
2021	-0.15	9.19	-3.52	3.46	2.25
2020	-8.97	14.10	12.30	12.07	7.38
2019	33.99	-3.19	-5.33	8.42	8.47

2018	-3.28	-10.90	-3.31	-13.61	-7.77
Ave.					0.33

Table (3-4)
Robeco eq. rate of return Q1 2018 – Q4 2023

year	Q1	Q2	Q3	Q4	Ave.
2023	3.26	-10.45	-3.20	-8.94	-4.83
2022	-20.17	10.38	-18.88	3.45	-6.31
2021	4.40	4.41	-16.15	-3.20	-2.64
2020	-8.63	22.24	6.01	12.33	7.99
2019	20.17	-1.94	4.45	10.52	8.3
2018	1.81	3.48	-7.56	-12.33	-3.65
Ave.					-0.19

Figure (3-2)
Trading return of Robeco QI and Robeco eq.
Equity 2018- Q4 2023 %



Third pairs :
1-Blackrock advantage small (quant)
2- Victory small cap stock fund (human)
The Blackrock fund invest at least 80% of its net assets (plus any borrowings for investment purposes) in equity securities of small cap companies and at least 80% of its net assets (plus any borrowings for investment purposes) in securities or instruments of issuers located in the United States. The advisor defines these companies as those with market capitalizations, at the time of the fund's investment, comparable in size to the companies in the Russell 2000® Growth Index. From time to time it may invest in shares of companies through "new issues" or initial public offerings ("IPOs") , the fund use quantitative method and AI in choosing securities (buy and sale) without any human intervention.
Vector fund normally invests at least 80% of its assets in equity securities of companies with small market capitalizations. Although the fund invests primarily in U.S. securities, it may invest up to 20% of its total assets in foreign securities including securities issued in emerging markets.
The Fund seeks long-term capital growth by investing in innovative small-cap companies that can take market share in their respective industries, allowing for higher and more sustainable earnings growth than the broader market. About the Fund, Targeted towards investors looking for a best ideas portfolio of high-growth stocks in an inefficient segment of the U.S. equity markets. Invests at least 80% of the Fund’s assets in small U.S. companies with a market cap of less than $3 billion or 120% of the market cap of the largest company in the Russell 2000® Index utilizing a disciplined, research-intensive selection process.
https://www.vcm.com.
The year 2020 recorded the highest positive and negative rates of return for Black Company, affected by the Corona pandemic, as the highest rate of return was 30.82% recorded in the second

quarter of the year, while the highest loss rate was achieved at a rate of -26.19% in the first quarter of the same year, while the highest rate of return was achieved at Victory Company by 33.17% in the third quarter of 2020, and the highest loss rate -30.17% in the first quarter of the same year. It appears that the overall performance, on average, during the research period was very close in both funds, as Victory fund recorded a rate of 2.85%, while the general average return of Black fund was 2.75% only. The general trend of performance in the two funds was very similar, and they achieved losses in the same two years, 2018-2022, at different rates, and no significant performance superiority appeared in any of the study periods except few periods. Tables (3-5),(3-6) figure (3-3) show these results.

Table (3-5)

Blackrock rate of return Q1 2018 – Q4 2023

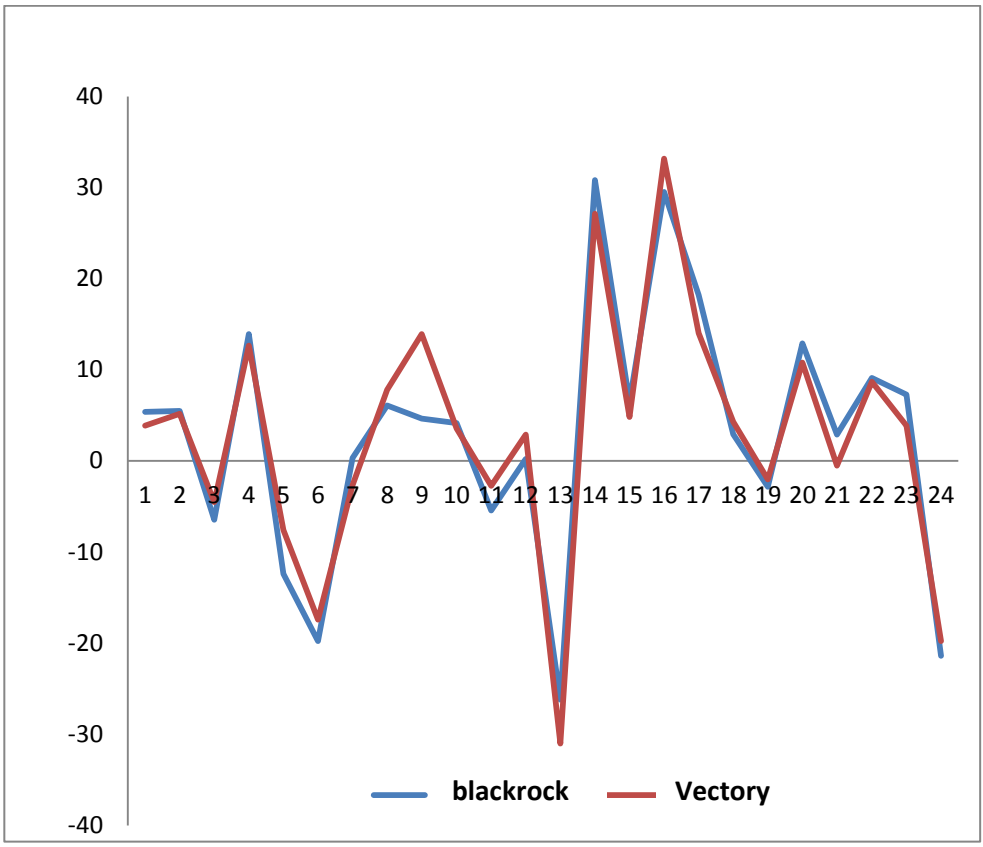
year	Q1	Q2	Q3	Q4	Ave.
2023	5.38	5.49	-6.46	13.93	4.59
2022	-12.40	-19.75	0.32	6.09	-6.44
2021	4.66	4.16	-5.42	0.21	0.9
2020	-26.19	30.82	6.46	29.52	10.15
2019	18.21	2.93	-2.84	12.89	7.8
2018	2.90	9.11	7.29	-21.37	-0.52
Ave.					2.75

Table (3-6)

Victory rate of return Q1 2018 – Q4 2023

year	Q1	Q2	Q3	Q4	Ave.
2023	3.89	5.16	-4.51	12.66	4.3
2022	-7.59	-17.42	-2.66	7.81	-5
2021	13.93	3.57	-2.72	2.90	4.42
2020	-31.02	27.12	4.82	33.17	8.5
2019	14.03	4.29	-2.03	10.81	6.78
2018	-0.51	8.69	3.87	-19.78	-1.93
Ave.					2.85

Figure (3-3)
Trading return of Blackrock and Victory



As a final result, it appears that trading companies using artificial intelligence algorithms have been able to outperform, even (relatively), traditional trading companies in terms of average overall performance during the study period, but unable to exceed the performance of companies using traditional trading in annual performance, as they were completely equal in this performance by nine years for every one of them, the three companies that used artificial intelligence recorded better performance than the companies that used traditional trading in nine years , and this also applies inversely. Therefore we can't accept the study hypothesis. Table (2-7) show these results.

Table (3-7) rate of return comparing

Year	Abante/ Gssix	Robeco QI /Robeco eq.	Blackrock/ Vectory
1	GS.	RO QI	BL
2	AB.	RO QI	VE
3	GS.	RO QI	VE
4	GS.	RO EQ.	BL
5	GS.	RO QI	VE
6	AB.	RO EQ	BL
Ave.	AB.	RO QI	VE

4- Conclusions and recommendations

4-1- Conclusions

1- Artificial intelligence is one of the most important tools used in trading in financial markets, and this use is increasing rapidly.

2- Companies that use artificial intelligence applications achieve financial returns that often exceed the returns of companies that use traditional trading based on the humans.

3-Applications of artificial intelligence enable funds to overcome the negative aspects of personal bias and not affected by some behavioural phenomena in the financial markets

4-Companies that use artificial intelligence in trading may be exposed to losses due to unexpected and adverse market movements or in times of crises such as the Corona pandemic crisis.

5-Artificial intelligence applications are based on highly complex software and are in constant development. There are new inventions every day in this field, which represents great opportunities for investment funds and dealers in financial markets to benefit from its unlimited potential in analysis and evaluation.

2- **Recommendations**

1- The necessity of increasing awareness levels for all traders in financial markets about the nature and mechanisms of using artificial intelligence applications in financial transactions.

2-Funds must be very careful when using artificial intelligence applications in their financial transactions and update and review them on an ongoing basis

3- Conduct more extensive research and studies that include a larger number of companies and for longer periods of time to reach more accurate results in this broad field.

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