

Building an efficient portfolio by using the weighted moving average in the light of the global pandemic (COVID19) (An applied study in the Iraq stock market)

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ABSTRACT

The research aims to study how to build an efficient portfolio by using the weighted moving average in the light of the global pandemic and compare it with the efficient portfolio for the previous period before the global pandemic. The rapid spread of Corona virus (COVID-19) is having major impacts on the financial markets around the world. However, the global pandemic caused a great risk, which led the investors to suffer huge losses in a very short period of time, in addition, to the global Covid-19 pandemic, the economic recession and the drop in oil prices led to a drop in the share prices of companies, as well as most of the companies listed in the Iraq Stock Market (Iraq Stock Exchange), trading in their shares decreased after the appearance of the first case in Iraq in 25/2/2019. The weighted moving average is one of the technical analysis tools, and this technical and mathematical tool has been used to build a portfolio consists of (24 companies). The first ten companies that have the highest weighted moving average have been selected and the research period is divided into the period before the global pandemic which started from 25/2/2019 to 24/2/2020 and the concurrent period of the global pandemic from 25/2/2020 to 2/24/2021 and the researcher used the statistical program [Microsoft Excel 10]. It has been concluded from the research that the Sharpe ratio for the technical portfolio for the concurrent period of the global pandemic was higher than the Sharpe ratio for the previous technical portfolio before the global pandemic, although the Sharpe ratio for both portfolios is negative, meaning that the returns of the portfolio are less than the risk-free return, but the Sharpe ratio for the technical portfolio for the concurrent period is better than the technical portfolio for the previous period, which confirms that the decrease in the number of trading sessions and the volume of trading have affected the performance of the investment portfolio, the smaller the number of trading volume, the better the performance of the portfolio. The researcher recommends with using other technical and mathematical tools to build an efficient investment portfolio in the light of the global pandemic.

Keywords: Stock Market, COVID19, Iraq, Portfolio

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1. Introduction

On 25, February, 2020, the Iraq authorities in the city of Al-Najaf announced the first infection with the Corona virus, and this virus is considered as a global epidemic. The number of confirmed infections has increased and the number of infections has continued to rise for more than 170 affected countries. The rapid spread of this disease has great economic effects. Therefore, since many countries adopt strict quarantine policies, their economic activities are greatly limited, and the damages caused by the global pandemic are mass unemployment and failure of business and industrial works. The global pandemic has affected the countries of the world in general and Iraq in particular [1]. The selection of an efficient investment portfolio is

an important academic topic for several years, as well as the large number of studies on this subject. The problem of this research lies in the fact that the returns on shares of companies which are listed in the Iraq Stock Exchange have negative values, i.e., low returns with high risks, so the importance of the research lies in studying how to build an efficient investment portfolio by using the weighted moving average. As usual when a devastating shock (e.g., COVID-19) hits the financial and economic systems the way they are now. This calls into a question about the appropriateness of the current theories and hypotheses [2-4]. In this spirit, we re-search for a hypothesis that an efficient investment portfolio can be built by using mathematical technical analysis tools in light of the global pandemic.

2. Research methodology

2.1. Problem

The companies listed on the Iraq Stock Exchange have achieved low returns due to their high risk. The companies listed in the Iraq Stock Exchange have been affected by the global pandemic, and Iraq has faced financial pressures as a result of the worsening political situations, besides the black cloud of Corona, whose effects have reverberated on all economies of the world, in addition to the factor of the decline in oil prices, which is considered as the main source of the country. Therefore, the research seeks to answer the following questions:

A- Is it possible to build an efficient investment portfolio by using the weighted moving average indicator for the previous period before the global pandemic?

B- Is it possible to build an efficient investment portfolio by using the weighted moving average indicator for the concurrent period of the global pandemic?

2.2. Hypotheses

Through the problem of the research, the hypotheses of the research can be written in the following form:

A- It is not possible to build an efficient investment portfolio by using the weighted moving average indicator for the previous period before the global pandemic.

B- It is not possible to build an efficient investment portfolio by using the weighted moving average index for the concurrent period of the global pandemic.

2.3. Important of the research

A- The importance of the research stems from the use of one of the mathematical technical analysis tools in building their efficient investment portfolios in light of the global pandemic.

B- Comparing the evaluation of the performance of the investment portfolio which is built in the period preceding the global pandemic and the concurrent period of the global pandemic.

C- The possibility of knowing the impact of the decrease in the number of trading sessions in choosing shares to build the investment portfolio. The shares of the companies that have their high views were selected from among the companies listed in the Iraq Stock Exchange, with the exclusion of the companies that do not have views during the research period.

2.4. Objectives of the research

A- Studying how to build an efficient portfolio by using the weighted moving average in light of the global pandemic.

B- Contribute to providing an intellectual and theoretical framework for technical analysis and the investment portfolio.

C- The current research aims to arrange stocks and choose the shares of the highest companies through one of the mathematical technical analysis tools, specifically the weighted moving indicator.

D- Making a comparison between the portfolios that were built during the concurrent period of the global pandemic and the period before it.

2.5. The community and the sample of the research

The community of the research includes all the companies which were listed in the Iraq Stock Exchange for the seven sectors, namely, (banks, insurance, investment, services, industry, hotels, tourism, agriculture), which amounted to 117 companies. The sample of the research was selected from companies that have more

than 100 views. Therefore, the sample of the research consists of 24 companies, so the research period was represented by the previous and concurrent periods of the global pandemic.

A- The previous period for the global pandemic was from 25/2/2019 to 24/2/2020.

B- The concurrent period of the global pandemic was from 25/2/2020 to 24/2/2021.

It was used in the research:

A- The daily closing prices of all shares of the companies listed on the Iraq Stock Exchange.

B- The annual risk-free rate of return.

2.6. The indicators

A- Arranging the stocks of the companies through one of the technical analysis tools specifically (the weighted moving indicator) and ranking the companies in descending order and choosing the top ten companies through the following equation [5].

The Weighted Moving Average = [(1 × Day 1 closing price) + (2 × Day 2 closing price) + (3 × Day 3 closing price) + (4 × Day 4 closing price) + (5 × Day 5 closing price)] ÷ total weighted Moving Average of Closing price

B- Calculating returns of the stocks by using the following equation [6].

$$R_{it} = \text{LN}(P_t) - \text{LN}(P_{t-1})$$

R_{it} = return of the stock

P_t = the current closing price

(P_{t-1}) = Previous closing price

LN = the natural logarithm

C- Calculating the risks of each stock through the following equation [7].

$$\sigma^2_i = (\text{Sstock return} - \text{Average Return})^2 / n$$

σ^2_i = standard deviation

Return of the Stock

Average Return of the Stock

N = Number of the Views

D- Calculating the return of the portfolio, noting that the return of the portfolio was calculated under the equal weights by using the following equation [8].

$$r_p = \sum_{j=1}^n w_j \cdot r_j$$

r_p = Return of the portfolio

W = Weight of the Stock

R_i = Average of the Return of the Stock of the Companies

E- Calculating the risk of the portfolio, noting that the risk of the portfolio was calculated under the equal

$$\sigma_p^2 = \sum_{j=1}^N (X_j^2 \sigma_j^2) + \sum_{j=1}^N \sum_{\substack{k=1 \\ k \neq j}}^N (X_j X_k \sigma_{jk})$$

weights by using the following equation [9].

X = Weight of the Stock

σ_j = The Standard Deviation of the returns of the j Stock

σ_d = The Standard Deviation of the returns of the k Stock

σ_{jk} = The Covariance between the Stocks k, j

σ_p = risk of the portfolio

F- Calculating the ratio of Sharpe to evaluate the performance of the investment portfolio by using the following equation [10].

$$S_p = \frac{\text{Risk Premium}}{\text{Total Risk}} = \frac{r_p - r_f}{\sigma_p}$$

S_p = Ratio of the Sharpe
 r_p = Return of the portfolio
 r_f = Average of the risk-free return
 σ_p = Risk of the portfolio

3. Review of literatures

3.1. Technical analysis

Technical analysis is a search in the recurring patterns of stock prices to predict future prices, where most technical analysts rely on price charts and trading volume [11, 12]. So, technicians are only concerned with the movement of prices in the financial markets, and technical analysis only studies supply and demand in the market, but it must continue in the future, i.e. technical analysis tries to understand and determine market behavior by studying the market itself, so understanding the benefits of technical analysis will give a set New tools that can be the best trader or investor [13, 14] Technical analysts are called graphic lists because they study the records or charts of past stock prices to obtain recurring patterns that they can exploit to make profits [15]. Technical analysis relies heavily on the study of the past patterns, supply and demand of the stocks, psychology (behavioral finance), and the use of certain mechanical rules. These rules include [16].

- Using a moving average of the price of the stock over time (often 20, 40, or 200 days), trying to determine when a stock is oversold due to an upward correction (or vice versa).
- Studying the number of the daily rises and falls in the prices and the number of the stocks traded on that day, and such a rise in the price and volume indicates an increase in the investors' benefits.
- Determining areas of support, the prices at which investors will buy more stocks (and the areas of resistance, the prices at which investors will sell). Technical analysis widely uses different mathematical indicators or tools to show different aspects of the price, such as indicators that measure momentum, or the rate of change in the price, and these tools are called technical indicators [17]. Among these indicators is the moving average, which is the most used technical tool and is applied by technical analysts. The moving average is one of the easiest and widely used indicators, as it is designed to know the current trend and know what it will take from the trend in the future, and one of its types is the weighted moving average [18-20]. The weighted moving average has been applied to time series data to smooth out irregular changes or fluctuations in the data, and thus for the technical analyst to identify the price patterns more easily. It is used as a means of calculating short-term forecasts for time series [21, 22], and the weighted moving average indicator is calculated by giving different weights to the prices of daily correlations collected for a certain period and the weight is given to the highest prices of the last closing and thus can reflect the movement of time series efficiently in the prediction models [23]. Thus, the reason behind giving the highest weight to the last closing prices is that the movement of the last closing prices is the best indicator of the future movement [24]. The weighted moving average indicator was used through its ability to arrange the companies in descending order and to choose the top ten first companies in building the investment portfolio.

3.2. The investment portfolio

In the past and before the appearance of modern MPT theory, investment was related to returns only and not to risk [25]. John Burr Williams mentioned in his book *'The Theory of Investment Value'* in 1938 that the value of an investment is the present value of the dividend of the profits of the stock which are of great importance to the investor because it is the value that cannot be bought or owned without the investor taking the risk [25]. However, perhaps the intent of the famous saying which states (Do not put all the eggs in one basket) is to distribute the investor's risks on his investments, so this approach is called the naive approach, or the random approach based on the number. Thus, the choice of securities in the portfolio was based on the intuition, and instinct, and not the choice of securities intentionally [26], but in 1952 Markowitz's entry came, which is the pioneering basis for what is known as the modern portfolio theory, where he developed portfolio theory through his article, which was published for the first time in the Financial Journal, which was entitled (Portfolio Selection: Portfolio Selection: Efficient Diversification [27]. Although Markowitz laid the foundation for the modern conservative theory, this approach is rarely used in practical application because it requires a large number of inputs and its use leads to the consumption of effort, time and cost [28], and on this basis, Tobin in 1958 simplified the number of Markowitz entries by adding a risk-free asset, that is, investors in the market will keep the risk-free assets in the market. Their investment terms, that is, their portfolio will consist of two parts, one part carries risk, such as stocks, and the other part is risk-free, such as treasury bonds

[27] and the later development in 1964, when sharp contributed to the development of modern portfolio theory by replacing the standard deviation with the beta coefficient. This means from unsystematic risk through portfolio diversification and valuation of securities as a function of systemic risk [29]. Sharp was awarded the Nobel Prize in Economics for his contribution to the development of investment portfolio theory through the capital asset pricing model [30] (CAPM) The Sharp Capital Asset Pricing Model (CAPM) is based on linking the risks that are measured by the beta coefficient to the expected rate of return or (the required rate of return on the security [31], then the (CAPM) is a fixed model Linear, one-factor, assumes that the opportunity cost of equity is determined by the level of the company of exposure to financial market risks (measured by a beta coefficient) and that the basic assumption of the pricing model is For capital assets, the cost of equity is affected by risk factors that vary with sources of systemic risk, and therefore not by the individual risks of each company [32]. Later on, started Sharp another development known with the name as the single indicator model (the market model) [33]. Sharp's single- indicator model is based on portfolio construction on the assumption that stock prices move due to a common response to market changes, and that according to the single-index model, the market return is taken as an indicator of the macroeconomic factor [28]. Sharp has simplified the joint covariance matrix for Markowitz through the single indicator model, assuming that the joint movement between stock returns is due to the movement of the market index [33]. In 1976, Rose developed the (CAPM) Capital Asset Pricing Model. The model was called the Arbitrage Pricing Theory (APT)[34], Rose relied on many factors such as (risk premium, company size, market value, inflation), in addition to the market return, which affects the return and risk of the security [35, 36]. The investment portfolio is intended as a composite tool with at least two different assets and that the investor who owns investments can use them optimally, (i.e.,) the investor tries to achieve the highest return at a certain level of risk, or achieve the lowest risk at a certain level of return and this can be achieved by intentionally choosing assets when building an investment portfolio [37]. The investment portfolio includes a set of investment tools that achieve the best exchange between the expected return and risk, and the greater the volatility of the investment tools, the greater the potential risk, and therefore the expected rate of return will increase, so it is necessary to limit the volatility of investment tools [38]. Through what have been mentioned earlier, it can be said that the investment portfolio includes a group of financial instruments such as stocks, bonds, treasury bonds, cash, certificates of deposit, commodities, real estate and other investment tools, meaning that the investment portfolio consists of two parts, the first part includes risky assets, while the other part includes risk-free assets and that the objective The investor from the investment portfolio is to diversify his investments in order to achieve the trade-off between return and risk[40 ,39] .

4. Building an efficient portfolio

4.1. Arranging (ranking) the companies according to the weighted moving average indicator for the period prior to the global pandemic

When building an efficient investment portfolio by using one of the technical analysis tools, which is the weighted moving average indicator, where the weighted moving average is calculated based on the weighted moving average for the inputs for a specific period of time with the giving bigger weight to the last closing prices. This is done by multiplying the weight factor by the total closing price for a certain group and then summarizing the resulting values, so this indicator was applied to all companies listed in the Iraq Stock Exchange. The companies that have more than (100 views) were selected, amounting to 24 companies, with the exclusion of the companies that do not have daily data during the research period. The weighted moving indicator has reached as in Table (1) for the companies that are listed in the Iraq Stock Exchange and included in the construction of the portfolio, and that the companies are arranged in descending order, and only the top ten companies were chosen to build the efficient investment portfolio that has the highest weighted moving average [41].

Table 1. Descending ranking of the companies according to the weighted moving average for the previous period before the global pandemic

No.	Name of the Company	The Company Symbol	The Weighted Moving Average
1	Babylon Hotel	HBAY	63.76660033
2	Baghdad Iraq for Public Transport	SBPT	18.61462366

No.	Name of the Company	The Company Symbol	The Weighted Moving Average
3	The Iraqi Company for Carpet and Furniture	IITC	8.359366667
4	Baghdad Hotel	HBAG	8.295603306
5	Asia Cell Company	TASC	8.009
6	The Iraqi Company for Meat Production and Marketing	AIPM	4.499558589
7	The Modern Sewing Company	IMOS	3.108208651
8	Al- Karkh Games City Company	SKTA	2.940986667
9	Al- Mamoura Company for Iraqi Investment	SMRI	1.640142582
10	The National Chemical Industries Company	INCP	1.109410256
11	Al- Iraqia Company for Land Transport	SILT	1.106852564
12	Al- Mansour Company for Pharmaceutical Industries	IMAP	0.880297064
13	Al-Mansour Bank for Investment	BMNS	0.660295567
14	The Commercial Sumer Bank	BSUC	0.574454829
15	Al- Ahli Bank of Iraq	BNOI	0.467974555
16	Iraqi Commercial Bank	BCOI	0.445142379
17	Iraqi Islamic Bank	BIIB	0.392915825
18	Iraqi Credit Bank	BROI	0.391592593
19	Baghdad Bank	BBOB	0.296223256
20	Investment Bank of Iraq	BIBI	0.24539961
21	Mosul Bank	BMFI	0.153047619
22	Gulf Commercial Bank	BGUC	0.151988636
23	Middle East Bank	BIME	0.105898374
24	United Bank	BUND	0.06247081

The ranking of the companies is due to the different closing prices, meaning that the Babylon Hotel took the highest weighted moving average during the period and it reached (63.76660033) because the prices of the shares which belong to the Babylon Hotel are high and they are ahead of all the similar companies and other companies in the Iraq Stock Exchange and that the hotel is making very good profits, while the lowest weighted moving average for the National Chemical Industries Company reached (1.109410256), the first ten companies are involved in building the investment portfolio, because their closing prices are high, so the weighted moving average took an advanced arrangement and excluded companies that have low closing prices.

4.2. Calculating the return and risks for the period preceding the global pandemic

It is clear in Table (2) that there is a discrepancy in the return of the ten companies, and the highest return for the National Chemical Industries Company reached (0.00503954), causing its risk to rise, while the lowest return for Babylon Hotel was (- 0.000556327). The reason belongs to the change in the prices of the stock during the research period, while the highest risk was for the Iraqi Company for Meat Production and Marketing, it amounted to (0.109514084), while the lowest risk was in the Baghdad Hotel, which amounted to (0.01515396), meaning that the low return led to a decrease in the risk.

Table 2. Return and Risks for the Top Ten Companies for the Period Preceding the Global Pandemic

No.	Name of the Company	The Company Symbol	Expected Return	Standard Deviation	Variance
1	Babylon Hotel	HBAY	-0.000556327	0.027895976	0.000778185
2	Baghdad Iraq for Public Transport	SBPT	0.00047	0.020001357	0.000400054

No.	Name of the Company	The Company Symbol	Expected Return	Standard Deviation	Variance
3	The Iraqi Company for Carpet and Furniture	IITC	0.001564575	0.016075417	0.000258419
4	Baghdad Hotel	HBAG	-0.000382556	0.01515396	0.000229643
5	Asia Cell Company	TASC	0.000166361	0.017880646	0.000319718
6	The Iraqi Company for Meat Production and Marketing	AIPM	0.000572051	0.109514084	0.011993335
7	The Modern Sewing Company	IMOS	0.00356	0.03404	0.00116
8	Al- Karkh Games City Company	SKTA	0.000762992	0.017852522	0.000318713
9	Al- Mamoura Company for Iraqi Investment	SMRI	-0.00020682	0.018144476	0.000329222
10	The National Chemical Industries Company	INCP	0.00503954	0.031014716	0.000961913

4.3. Ranking of the companies according to the weighted moving average indicator for the concurrent period of the global pandemic

When building an efficient investment portfolio by using the weighted moving average indicator during the period from 25/2/2020 to 24/2/2021. The companies with more than (100 views) were selected and the number of 24 companies, with the exclusion of companies that do not have daily data during the period of the global pandemic. The weighted moving indicator, as shown in Table (3), reached the companies that are listed in the Iraq Stock Exchange and included in the construction of the portfolio. The companies are arranged in descending order, as well as, only ten companies were selected to build an efficient investment portfolio, which has the highest weighted moving average.

Table 3. Descending order of the companies according to the weighted moving average indicator for the concurrent period of the global pandemic

No.	Name of the Company	The Company Symbol	The Weighted Moving Average
1	Babylon Hotel	HBAY	72.29
2	Baghdad Iraq for Public Transport	SBPT	19.10024055
3	The Iraqi Company for Carpet and Furniture	IITC	9.786727829
4	Baghdad Hotel	HBAG	7.811437309
5	Asia Cell Company	TASC	7.120234568
6	The Modern Sewing Company	AIPM	5.809487179
7	The Iraqi Company for Meat Production and Marketing	IMOS	4.537380117
8	Al- Karkh Games City Company	SKTA	3.021953846
9	The National Chemical Industries Company	INCP	2.198236686
10	Al- Mamoura Company for Iraqi Investment	SMRI	1.938948718
11	Al- Iraqia Company for Land Transport	SILT	1.429941176
12	Al- Mansour Company for Pharmaceutical Industries	IMAP	1.288305221
13	Al- Ahli Bank of Iraq	BMNS	0.733513889
14	Al-Mansour Bank for Investment	BSUC	0.589967593
15	Iraqi Commercial Bank	BNOI	0.445776119
16	The Commercial Sumer Bank	BCOI	0.42006734
17	Iraqi Islamic Bank	BIIB	0.413969419
18	Baghdad Bank	BROI	0.396085271
19	Iraqi Credit Bank	BBOB	0.391749175
20	Investment Bank of Iraq	BIBI	0.244071038

21	Gulf Commercial Bank	BMFI	0.135092896
22	Mosul Bank	BGUC	0.132947368
23	Middle East Bank	BIME	0.112398082
24	United Bank	BUND	0.070702703

The ranking of the companies is due to the different closing prices, meaning that the Babylon Hotel took the highest weighted moving average during the period and it reached (72.29) because the closing prices of the Babylon Hotel are high and it is ahead of all similar companies and other companies in the Iraqi market for securities and that the hotel is making very good profits. While the lowest weighted moving average for Al-Mamoura Company for Iraqi Investment Company was reached (1.938948718) and the first ten companies are involved in building the investment portfolio, because its closing prices are high, so it took an advanced arrangement with the exclusion of companies that do not take the beneficiary arrangement of the weighted moving average index.

4.4. Calculating the return and risks for the concurrent period of the global pandemic

It is obvious in Table 2 that there is a discrepancy in the return for the ten companies, and the highest return for the modern sewing company was (0.006687), while the lowest return for the Babylon hotel was (0.000446) due to the high risk, while It was a risk for the Modern Sewing Company, which amounted to (0.049368), while the lowest risks were in the Iraqi Carpet and Furniture Company, which amounted to (0.021804).

Table 4. Return and risks of the top ten companies for the concurrent period of the global pandemic

No.	Name of the Company	The Company Symbol	The Return	Standard Deviation	Variance
1	Babylon Hotel	HBAY	-0.000446	0.03163	0.001000549
2	Baghdad Iraq for Public Transport	SBPT	0.003143965	0.025649109	0.000657877
3	The Iraqi Company for Carpet and Furniture	IITC	0.000749	0.021804	0.000475415
4	Baghdad Hotel	HBAG	0.000213960	0.022166035	0.0004913
5	Asia Cell Company	TASC	0.001611834	0.022449255	0.000503969
6	The Modern Sewing Company	AIPM	0.006687	0.049368	0.002437
7	The Iraqi Company for Meat Production and Marketing	IMOS	0.000087	0.027814936	0.000773671
8	Al- Karkh Games City Company	SKTA	-0.000182	0.027419	0.000752
9	The National Chemical Industries Company	INCP	0.0016680	0.0307635	0.000946
10	Al- Mamoura Company for Iraqi Investment	SMRI	0.003064918	0.032615146	0.001063748

4.5. Building an efficient investment portfolio based on the weighted moving indicator for the previous and concurrent period of the global pandemic

Table 5 shows that the matrix of joint variance varies from one company to another and that some of them have a positive variance, such as the Iraqi Company for Carpets and Furniture, and this indicates the high risk of the portfolio because Markowitz emphasized the intentional selection of the stocks when building the investment portfolio, by selecting the stocks that have a negative common variance, and the common variance has reached (0.000000220).

Table 5. Global pre-pandemic covariance matrix

	HBAY	SBPT	IITC	HBAG	TASC	AIPM	IMOS	SKTA	SMRI	INCP
HBAY	0.0007782									
SBPT	-0.0000118	0.0004001								

	HBAY	SBPT	IITC	HBAG	TASC	AIPM	IMOS	SKTA	SMRI	INCP
IITC	-0.0000177	0.0000345	0.0002584							
HBAG	0.0000413	-0.0000025	0.0000086	0.0002296						
TASC	-0.0000922	0.0000365	0.0000025	0.0000171	0.0003197					
AIPM	-0.0000980	-0.0002028	-0.0000163	0.0002982	-	0.0119933				
IMOS	-0.0000575	0.0000322	-0.0000189	-0.0000314	0.0002435	-0.0000191	0.0011589			
SKTA	-0.0000286	0.0000600	0.0000302	0.0000201	0.0000289	0.0000208	0.0000384	0.0003187		
SMRI	0.0000459	-0.0000229	0.0000736	0.0000141	0.0000039	0.0000814	-0.0000073	-0.0000025	0.0003292	
INCP	-0.0001689	-0.0000009	0.0000238	0.0000338	0.0000779	0.0000777	-0.0000446	-0.0000167	0.0000535	0.0009619

Table 6 illustrates that the covariance matrix varies from one company to the other and that some of them have a positive variance, which indicates a high portfolio risk. The covariance has reached (0.0001850).

Table 6. Covariance matrix for the concurrent duration of the global pandemic

	HBAY	SBPT	IITC	HBAG	TASC	AIPM	IMOS	SKTA	SMRI	INCP
HBA Y	0.0010005									
SBPT	-0.0000394	0.0006579								
IITC	-0.0000409	0.0000217	0.0004754							
HBA G	-0.0000338	-	0.0001969	0.0004913						
TAS C	0.0000019	0.0000061	0.0000100	0.0000472	0.0005040					
AIP M	0.0002868	-	-	-	-	0.0007737				
IMO S	0.0000627	0.0000308	-	-	-	0.0001841	0.0024372			
SKT A	-0.0000458	-	0.0002026	0.0000808	0.0000085	-	-	0.0007518		
SMRI	0.0000961	0.0000863	0.0000474	0.0000482	0.0001542	0.0001537	0.0002424	0.0000322	0.0000360	0.0010637
		0.0000377	0.0000057	0.0000795	0.0000965	-	-	-	-	-
						0.0000262				
INCP	-0.0001010	0.0000389	0.0000548	-	0.0001255	0.0000302	0.0000730	-0.0000573	0.0000079	0.0009464
				0.0000155						

After building the two portfolios of the top ten companies for the previous and concurrent period of the global pandemic, we note from Table (7) that the highest return of the technology portfolio for the concurrent period of the global pandemic (0.001660), which is greater than the return of the technical portfolio for the period preceding the global pandemic (0.00110), while the risk of the technical portfolio for the concurrent period was the risk of the technical portfolio for the period preceding the global pandemic is (0.055694005), and the most important thing is that the Sharpe ratios of the technical portfolio for the concurrent period of the global pandemic (-0.5010), which is higher than the Sharpe ratio of the technical portfolio for the simultaneous period of the global pandemic (-2.13756), which indicates the inefficiency of the technical portfolio of the previous and concurrent global pandemic because the return of the portfolio is less than the risk-free rate of return. As a result, the hypothesis that (it is not possible to build an efficient investment portfolio by using the weighted moving average indicator for the period prior to the global pandemic) should be rejected, as well as reject the second hypothesis which states (it is not possible to build an efficient investment portfolio by using the weighted moving average indicator for the concurrent period of the global pandemic).

Table 7. Technical portfolio for the previous and concurrent period of the global pandemic

Indicator	Technical Portfolio for the Period Prior to the Global Pandemic	Technical Portfolio for the Period Concurrent to the Global Pandemic
The Return	0.001098465	0.0016597699
Standard Deviation of the Portfolio	0.0133190405651491	0.055694005

Variance of the Portfolio	0.000177397	0.003101822
The Average Return Free of Risk	0.029566	0.029566
Sharpe Ratio	-2.13756	-0.5010

5. Conclusions and recommendations

5.1. Conclusions

The current research reached a set of conclusions, the most important of which are:

- The study concludes that the decrease in the number of trading sessions after the global pandemic, the decrease in the returns of the stocks and the high risk of previous and concurrent periods of the global pandemic have significantly affected the construction of the investment portfolio and its performance.
- The economic and political conditions greatly affected the prices of the stocks of the companies, which led to a significant decrease in their returns with a high risk.
- By using the daily data of the shares of the company, it is possible to build an efficient investment portfolio during the period of crises.
- The study concludes that the return of the technical portfolio for the concurrent period of the global pandemic is higher than the returns of the technical portfolio for the period prior to the global pandemic, due to the high risk.
- The study concludes although the return of the portfolio for the concurrent period of the global pandemic is higher than the return of the technical portfolio for the period prior to the global pandemic, and that its performance was weak when compared with the technical portfolio for the period prior to the global pandemic. This confirms that the decrease in the number of trading sessions and trading volume affected the performance of the investment portfolio.

5.2. Recommendations

The current research reached a set of recommendations, the most important of which are:

- The researchers recommend measuring the market portfolio and comparing it with the technical portfolio in the light of the global pandemic to show the extent to which the efficient technical portfolio differs in the light of the global pandemic with the reference portfolio.
- The investor must balance his investment tools in terms of the return and risk according to sound foundations and rules.
- The necessity of benefiting from the current study and previous studies similar to it, in order to increase investors' awareness of these important tools in building a portfolio.
- The researchers recommend using other technical mathematical tools to build an efficient investment portfolio in the light of the global pandemic.

References

- [1] M. Mofijur, I. R. Fattah, M. A. Alam, A. S. Islam, H. C. Ong, S. A. Rahman, G. Najafi, S. Ahmed, M. A. Uddin, and T. Mahlia, "Impact of COVID-19 on the social, economic, environmental and energy domains: Lessons learnt from a global pandemic," *Sustainable production consumption*, 2020.
- [2] A. Al-zubidi, Rajaa K. Hasoun, S. Hashim, and H. Alrikabi, "Mobile Application to Detect Covid-19 pandemic by using Classification Techniques: Proposed System," *International Journal of Interactive Mobile Technologies*, vol. 15, no. 16, pp. 34-51, 2021.
- [3] C. Hevia and P. A. Neumeyer, "A perfect storm: COVID-19 in emerging economies," *Covid-19 in developing economies*, vol. 1, no. 1, pp. 25-37, 2020.
- [4] A. G. M. Al-dawoodi, and M. T. Mahmuddin, "An empirical study of double-bridge search move on subset feature selection search of bees algorithm," *Journal of Telecommunication, Electronic and Computer Engineering*, vol. 9, no. 2-2, pp. 11-15, 2017.
- [5] R. Rhoads, *Candlestick Charting for Dummies*. John Wiley & Sons, 2011.

- [6] E. Azizah, E. Rusyaman, and S. Supian, "Optimization of investment portfolio weight of stocks affected by market index," in *IOP Conference Series: Materials Science and Engineering*, 2017, vol. 166, no. 1, p. 012008: IOP Publishing.
- [7] A. Macenning, D. B. Hakim, and T. Andati, "Analysis and Optimization of Investment Portfolio Performance (Case Study of PLN Pension Fund)," 2019.
- [8] V. Davnis, V. Tinyakova, V. Fetisov, M. Chervontseva, and S. Oparina, "Double-level indication of globalization effects in portfolio investment models," 2019.
- [9] S. A. Ross, R. W. Westerfield, B. D. Jordan, G. S. Roberts, J. A. Pandes, and T. A. Holloway, *Fundamentals of Corporate Finance 10th Canadian ed.* McGraw Hill, 2019.
- [10] A. Ljungberg and A. Högstedt, "Modern Portfolio Theory Combined With Magic Formula: A study on how Modern Portfolio Theory can improve an established investment strategy," ed, 2021.
- [11] P. Tufano, Z. Bodie, S. Horan, J. Gannon, and C. Farrell, "Consumer Finance 101 for Financial Educators, Financial Advisers, and Regulators," 2015.
- [12] A. Ghazi, S. Aljunid, S. Z. S. Idrus, A. Fareed, A. Al-dawoodi, Z. Hasan, R. Endut, N. Ali, A. H. Mohsin, and S. S. Abdullah, "Hybrid Dy-NFIS & RLS equalization for ZCC code in optical-CDMA over multi-mode optical fiber," *Periodicals of Engineering Natural Sciences*, vol. 9, no. 1, pp. 253-276, 2021.
- [13] R. Vishwanath and C. Krishnamurti, *Investment management: A modern guide to security analysis and stock selection.* Springer, 2009.
- [14] N. Hussien, I. Ajlan, M. M. Firdhous, and H. Alrikabi, "Smart Shopping System with RFID Technology Based on Internet of Things," *international Journal of Interactive Mobile Technologies*, vol. 14, no. 4, pp. 17-29, 2020.
- [15] Z. Bodie, "Inflation and Retirement Annuities," Available at SSRN 3395060, 2019.
- [16] C. Brentani, *Portfolio Management in Practice (Essential Capital Markets).* Elsevier Butterworth-Heinemann, 2004.
- [17] L. Stevens, *Essential technical analysis: tools and techniques to spot market trends.* John Wiley & Sons, 2002.
- [18] M. R. Karim, *Scala Machine Learning Projects: Build real-world machine learning and deep learning projects with Scala.* Packt Publishing Ltd, 2018.
- [19] H. Salim, N. A. Jassim, "Design and Implementation of Smart City Applications Based on the Internet of Things," *International Journal of Interactive Mobile Technologies (IJIM)*, vol. 15, no. 13, pp. 4-15, 2021.
- [20] L. F. Jawad, B. Majeed, H. Alrikabi, "Tactical Thinking and its Relationship with Solving Mathematical Problems Among Mathematics Department Students," *International Journal of Emerging Technologies in Learning (iJET)*, vol. 16, no. 9, pp. 247-262, 2021.
- [21] M. B. Perry, "The weighted moving average technique," *Wiley Encyclopedia of Operations Research and Management Science*, 2010.
- [22] A. Ghazi, S. Aljunid, S. Z. S. Idrus, C. Rashidi, A. Al-dawoodi, B. A. Mahmood, A. Fareed, M. U. Zaenal, N. H. Qasim, and R. M. Rafeeq, "A Systematic review of Multi-Mode Fiber based on Dimensional Code in Optical-CDMA," in *Journal of Physics: Conference Series*, 2021, vol. 1860, no. 1, p. 012016: IOP Publishing.
- [23] J. Yu, Kim, S. B., Bai, J., & Han, S. W. , "Comparative study on exponentially weighted moving average approaches for the self-starting forecasting. ," *Applied Sciences*, , vol. 10, no. 20, p. 7351., 2020.
- [24] A. W. Adewuyi, "Modelling Stock Prices with Exponential Weighted Moving Average (EWMA)," *Journal of Mathematical Finance*, vol. 6, no. 01, p. 99, 2016.
- [25] J. B. Guerard Jr, *Handbook of portfolio construction: contemporary applications of Markowitz techniques.* Springer Science & Business Media, 2009.
- [26] J. C. Van Horne and J. M. Wachowicz, *Fundamentals of financial management.* Pearson Education, 2005.
- [27] M. E. Mangram, "A simplified perspective of the Markowitz portfolio theory," *Global journal of business research*, vol. 7, no. 1, pp. 59-70, 2013.
- [28] I. Mahmud, "Optimal portfolio construction using sharpe's single-index model: evidence from chittagong stock exchange," 2020.

-
- [29] G. Omojefe and B. Gregory, "Measuring Co-Movement in International Portfolio Diversification," *KIU Journal of Social Sciences*, vol. 5, no. 4, pp. 25-34, 2020.
- [30] E. F. Fama and K. R. French, "The capital asset pricing model: Theory and evidence," *Journal of economic perspectives*, vol. 18, no. 3, pp. 25-46, 2004.
- [31] L. C. Gapenski and G. H. Pink, *Understanding healthcare financial management*. Health Administration Press Chicago, 2007.
- [32] E. Laghi and M. Di Marcantonio, "Beyond CAPM: estimating the cost of equity considering idiosyncratic risks," *Quantitative Finance*, vol. 16, no. 8, pp. 1273-1296, 2016.
- [33] I. Mahmud, "Optimal Portfolio Construction: Application of Sharpe's Single-Index Model on Dhaka Stock Exchange," *JEMA: Jurnal Ilmiah Bidang Akuntansi dan Manajemen*, vol. 16, no. 1, pp. 60-92, 2019.
- [34] P. Richard and N. Bill, *Corporate Finance and Investment-Decisions & Strategies*. Pearson Education Limited, 2006.
- [35] M. Rásonyi, "Arbitrage pricing theory and risk-neutral measures," *Decisions in Economics and Finance*, vol. 27, no. 2, pp. 109-123, 2004.
- [36] F. K. Reilly and K. C. Brown, *Investment Analysis and Portfolio Management (Text Only)*. Cengage Learning, 2011.
- [37] M. Oudat, H. Hasan, and A. Alsmadi, "Macroeconomic variables and portfolio investment in Bahrain using an ARDL bound testing approach," *Accounting*, vol. 6, no. 4, pp. 465-472, 2020.
- [38] M. Dzicher, "Sampling methods for investment portfolio formulation procedure at increased market volatility," *Journal of Economics & Management*, vol. 43, pp. 74-93, 2021.
- [39] A. A. Sultan and S. M. Noor, "Absorptive capacity, civil conflict and e-commerce adoption among Iraqi firms," *Advanced Science Letters*, vol. 23, no. 8, pp. 7992-7995, 2017.
- [40] A. A. Sultan, S. A. Alfaiza, and H. A. Riyadh, "Impact of mass collaboration on knowledge sharing process using mediating role of innovation capability," *International Journal of Organizational Analysis*, 2021.
- [41] S. A. Abdulsatar Abduljabbar Sultan, Mohammad, Ummi and M. M. A. NaiemahSaraih, "Factors Influencing the Adoption of Mobile Banking Service among Cihan Bank Customers in the Kurdistan Region of Iraq," *International Journal of Advanced Science Technology*, vol. 27, no. 1, pp. 289-301, 2019.