Risk-Adjusted Performance: A two-model Approach Application in Amman Stock Exchange

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Abstract

The purpose of the paper is to investigate the risk-adjusted performance of stock portfolios through the application of the Markowitz and single-index models. The monthly closing prices of 115 companies listed in Amman Stock Exchange (ASE) and ASE index over the period (2000-2006) were used. Two elementary developed models will be applied namely; Markowitz and single-index. Furthermore, the paper offers better options for decision making process in choosing optimal portfolios in ASE. Results show that there is no significant difference between the two tested models, and that the numbers of stocks in the portfolios do not affect the result when comparing the two portfolio models.

Key Words: Markowitz model; Single-Index model (SIM); Amman Stock Exchange (ASE); ASE Portfolios.

1. Introduction

Investors in an ideal investment environment are normally faced with a complicated task of selecting good investments, thus making them to consider trade-offs between risk and return and to combine various types of investments in an optimal portfolio. A rational investor always seeks to minimize risks and maximize returns on his investment. To reach the optimal portfolios, investors ought to maximize the level of return for a given level of risk. Alternatively they seek to reduce the risk for a given level of return. This is done through the construction of a portfolio of assets which is subject to the investor's portfolio. Although the majority of the studies were carried out in developed countries, only a limited number of studies were conducted in developing countries. The study seeks to test whether the Markowitz or SIM of a portfolio selection model provides better investment options to investors in ASE.

The study's problem is related to how to begin the portfolio selection models which are regarded as vital for investors in order to select their investment. Presently, the Markowitz model is the best normative model of stock selection using a full covariance matrix.

It was noticed by shape (1963) that considerable savings could be explained by a single index of the market since prices of all securities often tend to rise and fall at the same time. Indeed, most of the covariances between securities could be explained by a reference to a single market index. He estimated best fitting line for each stock with the market index using regression model analysis. So, the main problem of this study lies with the investor's indecision due to his/her inability to decide which model he/she selects owing to the difficulty of performance in the Markowitz model.

The study's significance arises from the fact that the applications of these fundamental models develop an offer to investors for making decision in the choice of optimal portfolios in the ASE. The comparison of these models is very important for investors to choose the appropriate one to construct their portfolios. It is correctly asserted that the appropriate variance for the portfolio selection model reflects portfolio risk, that measures the risks created not only by the inherent fluctuations of returns, but also by the decision makers who lack the complete information about the parameters of models. It conducting an empirical analysis that has entered into actual portfolio selection decisions is seen as an added value in this study.

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The study aims to realise the following objectives:

1. Evaluating the risk-adjusted performance of stocks portfolios formed from ASE using Markowitz and the SIM models.
2. Comparing a sample with the results of the full covariance (Markowitz model) and the results of SIM model.
3. Examining the performance of the Markowitz model in relation to the SIM model in portfolio selection process.
4. Providing the investors in ASE with complete information in order to assist them in portfolio selection process.

The outline of this paper is as follows: The next section offers a theoretical background of the Markowitz and SIM models; section 3 sheds light on the stock exchange market in Jordan; section 4 exhibits the literature review; section 5 illustrates methodology, data sources and sample; section 6 reports the empirical results. Conclusions, limitation and managerial implications are presented in the last section.

2. Theoretical Background

Markowitz's (1952 and 1959) was the pioneer work on portfolio analysis. The major assumption of the Markowitz’s approach to portfolio analysis is that investors are basically risk-averse. This means that investors must be given higher returns in order to accept higher risk. Markowitz then developed a model of portfolio analysis. The three highlights of this model are normally; the two relevant characteristics of a portfolio are its expected return and some measure of the dispersion of possible returns around the expected return; rational investors will be chosen to hold efficient portfolios, those that maximize expected returns for a given level of risk or, alternatively, minimize risk for a given level of return.; it is theoretically possible to identify efficient portfolios by analysing of information for each security on expected return, variance of return, and the interrelationship between the return for each security and for every other security as measured by the covariance (James and Farrell, 1997).

Sharpe (1963) attempted to simplify the process of data input, data tabulation, and reaching a solution. He also developed a simplified variant of the Markowitz model that reduces data and computational requirements. Although Markowitz model was theoretically elegant its serious limitation was the sophisticated and volume of work was well beyond the Markowitz model.

Index models can handle large population of stocks. They serve as simplified alternatives to the full-covariance approach to portfolio optimization. Although the SIM model offers a simple formula for portfolio risk, it also makes an assumption about the process generating security returns. The accuracy of the formula of the SIM model for portfolio variance is as good as the accuracy of its assumption (Haugen, 1993). According to Terol et al. (2006) Markowitz model is a conventional model proposed to solve the portfolio selection problems by assuming that the situation of stock markets in the future can be characterized by the past asset data. However, it is difficult to ensure the accuracy of this traditional assuming because of the large number of extensions to problems of the traditional portfolio selection. As for SIM model, it includes fuzzy betas obtained not only from statistical data but also from expert knowledge. The generalization of the Markowitz mean-variance model which includes cardinality and bounding constraints ensure the investment in a given number of different assets and limit the amount of capital to be invested in each asset (Fernandes & Gomez, 2007). Markowitz model contributes in geometric mean optimization advocated for long term investments. On the other hand, the SIM models are no longer good approximations to multi period (Briec & Kerstens, 2009).

3. An Overview of the Stock Exchange Market in ASE

276 companies traded on ASE until March 2011. The performance of ASE in the years 2009 and 2010 was exceptional. The trading value of ASE that ended the trading transactions for 2010 was JD6.7 billion compared to JD9.7 billion for 2009. The ASE price index weighted by free float shares closed at 2374 points in 2010 with a decrease of 6.3% when compared with the closing of shares that stood at 2534 points and 2758 points at the end of 2009 and 2008 respectively. However, non-Jordanian ownership as a percentage of market capitalization of the ASE rose to 49.6% at the end of the 2010, compared with 48.9% at the end of the 2009, and 49.2% at the end of 2008. Although, The net non-Jordanian investments in the ASE witnessed sharp decline by JD14.6 million for the year 2010, compared with a decline of only JD3.8 million for 2009. Five new companies were listed at the ASE during 2010 raising the number of listed companies to 277. In addition, the market capitalization of listed shares at the ASE stands at JD21.9 billion, constituting 122.7% of the GDP.

The number of traded shares witnessed an increase during 2010 reaching 7 billion shares, traded through 1.9 million transactions, compared with 6 billion shares traded during 2009 through 3 million transactions. The share turnover ratio also increased to reach 102.2% during the period 2010, compared with 91.3% during the period 2009.

Figure (1) shows the trading movements of the Amman Financial Market since its inception in 1978 until 2010. The figure records the value and amount traded in Jordanian Dinars (JD) during the stated period.

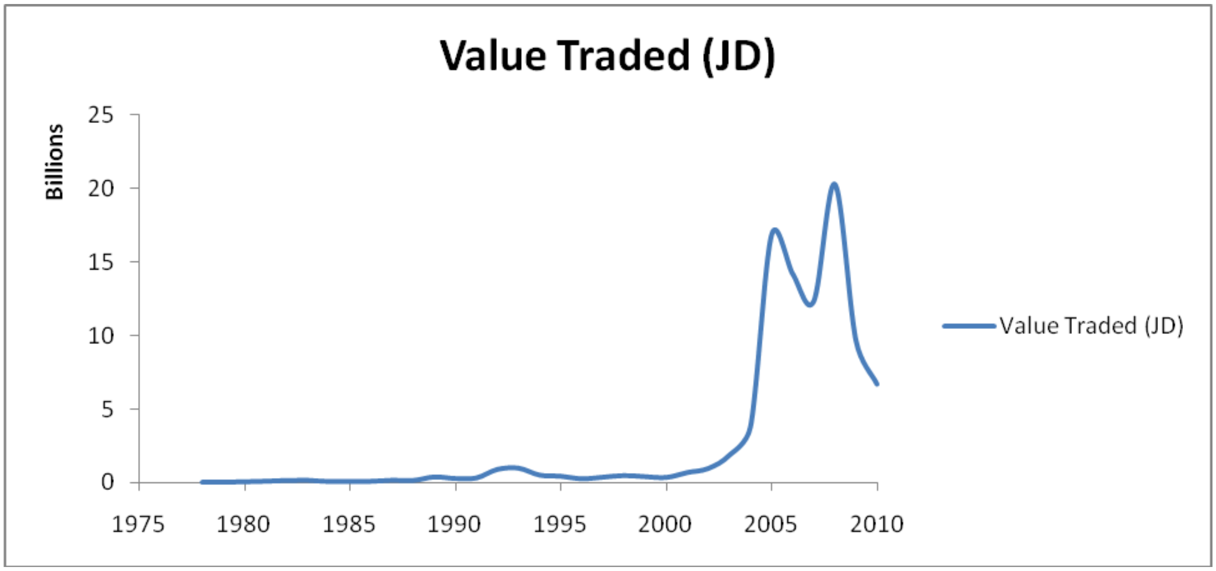

Figure (1): Value Traded.

Figure (1) of ASE value traded shows differences in the pattern of trading between 1978 and 2010. Trading started at JD5,615,891 in 1978, rising gradually to reach the first peak in 2005 with a value of JD16,871,051,948 then dropped dramatically in 2006 and 2007 to JD14,209,870,592, JD 12,348,101,910 respectively and then climbed back to reach the second peak with a value of JD 20,318,014,547 in 2008, only to drop again to JD 6,689,987,155 in 2010 (www.ase.com.jo/en/trading-value-ase).

Figure (2) shows the ASE General Free Float Price Index for the 1978-2010 period.

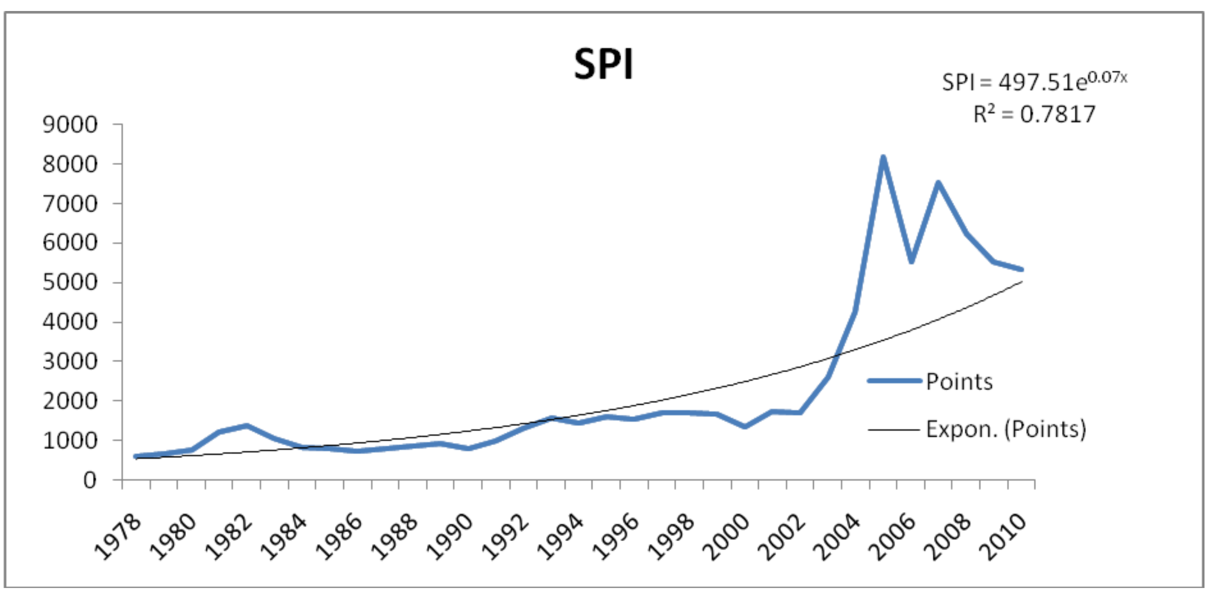

Figure (2): Price index.

The ASE price index weighted by free float show growth rate of 10.4 percent during the 1978-2010 period, it shows also a decrease from 2758 points to 2534 points at the end of 2008, with the number of traded shares increasing during the period in 2009. One of the features of Free Float Index is to give better reflection for the changes of stocks prices in the market by not being biased to the companies that have large market capitalization. This provides diversification in the index sample by giving better chances to small and medium companies to reflect the index.

4. Literature Review

The majority of previous studies in this field are based on Markowitz's or the SIM Model, as tools to investigate issues in portfolio. These studies are mostly carried out in developed countries.

As seen by Frankfurter et al. (1976) the SIM approach is based on Markowitz model. However, this approach adds the simplifying assumption that returns on various securities are related only through common relationship with some basic underlying factors. According to this study, under conditions of certainty, the Markowitz and SIM approaches will arrive at the same decision set in the experiment. These results demonstrate that under conditions of uncertainty, SIM approach is advantageous over the Markowitz approach. It was found that variation in performance is explained in terms of the two essential differences in the models. First, fewer and different estimators are used in the SIM model to summarize past history. Second, the linear assumption of the SIM model does not necessarily hold. They finally found that in experiments, the SIM process performs worse than Markowitz process, and gives superior results when only short data histories are available.

Yamazaki and Konno (1991) show that the mean absolute risk function can remove most of the problems and obstacles associated with the classical Markowitz model while maintaining its advantages over equilibrium models. The mean absolute deviation risk model can be used as an alternative to Markowitz's risk model as it generates a portfolio resembling that of the Markowitz model within a fraction of time required to solve the latter.

By applying portfolio selection models examining the relative performance of various estimators and the effectiveness of short sales Board and Sutcliffe (1994) forecasted the means variances and covariances. Results show that the short sales decision was considerably more important than the choice of estimation method in improving the performance of actual portfolios The relatively good performance of the non-Markowitz techniques and of the simplistic overall mean method is an interesting finding as it suggests that sophisticated portfolio selection techniques and forecasting methods may not offer significant benefits over much more straightforward methods.

A study by Ledoit and Wolf (2003) revealed that the covariance matrix of stock returns is estimated by an optimally weighted average of two existing estimators: covariance matrix and single-index covariance matrix. The authors developed a flexible method for some structures into a large dimensional estimation problem, namely the problem of estimating the covariance matrix of a large number of stock returns, and the estimated covariance matrix is the input of the well known portfolio selection method of Markowitz.

It was also found by Edward et al. (2005) that the generalized Markowitz's portfolio selection theory and generalized Sharpe's rule improved decision making from investment addressing a dynamic portfolio investment problem and discussed how we can dynamically choose candidate assets, achieving the possible maximum revenue and reducing the risk to the minimum. They generalized Markowitz's portfolio selection theory and Sharpe's rule for investment decision. An analytical solution is exhibited to show how an institutional or individual investor can combine Markowitz's portfolio selection theory, generalized Sharpe's rule and Value-at-Risk to find candidate assets and optimal level of position sizes for investment (dis-investment).

An empirical comparison among suggested portfolio choice models comparing the final wealth, expected total realized return of the optimal portfolio, and performance ratios for obtained sequences of excess returns was suggested by Biglova and Rachev (2007). They also showed the strongly reject sequences of the normality assumption in favour of the stable Paretian hypothesis. Celik (2007) proposed that the market risk indicator (Beta) of Turkish banks' common stocks is much higher than those of USA. By analyzed banking sector in USA and Turkey focusing on 18 biggest banks' common stocks and measured the risk of common stocks and show their relations with the market portfolio's return based on theoretical framework of modern portfolio theory and Capital Assets Pricing Model (CAPM). Also the volatility of American banks common stocks are lower than those of Turkish and the risk and return relationship is not totally supported by Capital Asset Pricing model.

Omet (1995) argued that the two models are similar. Also, investors might be able to use the more practical approach in generating their efficient frontiers. In other words the SIM model can be used, which is more practical than the Markowitz model in generating ASE efficient frontier. Omet's study (1995) was much related to this research. However, there are some differences such as the period of study, the sample, and the portfolio structure, and concentrated on the efficient frontier.

Al-Qudah et al. (2004) investigated the effects of diversification on the portfolio riskiness in ASE, and the methodology based on the Markowitz Model (1952). The results proved the existence of a significant statistical relationship between portfolio size and the risk reduction. Yet, the t-test stated that significant reduction benefits of diversification were virtually exhausted when a portfolio contains 10-15 stocks. Furthermore, investors should implement marginal analysis in order to determine the number of stocks required in a well-diversified portfolio.

Segot and Lucey (2005) examined the capital market integration in the MENA countries and its implications for an international portfolio investment allocation. Results showed that Israel and Turkey were the most promising markets in the region. They are followed by Jordan, Egypt and Morocco, while Tunisia and Lebanon lagged behind.

Paudel and Koirala (2006) tested whether Markowitz and SIM models of portfolio selection offer better investment alternatives to Nepalese investors by applying these models to a sample of 30 stocks traded in Nepalese stock market from 1997-2006. Results show that the application of the elementary model developed about a half century ago offered better options for making decision in the choice of optimal portfolios in Nepalese stock market.

Abdelazim and Wahba (2006) argue that even in a bearish market, the optimally selected portfolio, which was weekly managed using Neural Networks, was able to generate positive returns utilizing the Markowitz Efficient Frontier. Their results also demonstrated the usefulness of applying the proposed approach represented by Genetic Algorithms and Neural Networks in active portfolio selection and management. The US stock market represented by a pool of 40 US companies from 2000- 2002, and the Egyptian stock market, represented by a pool of 37 companies from 1998-2000 addressed the portfolio selection and management problem, modern portfolio theory and Markowitz efficient frontier using Artificial Intelligence techniques and Genetic Algorithms Techniques (GAs) to construct an optimal portfolio. GAs is tested on 2 stock markets, the US stock market, and the Egyptian stock market.

Bergh & Rensburg (2008) drew a comparison between the results of the Markowitz mean variance optimization technique with the higher moment methodology proposed by Davies et al. (2005) using world hedge fund index and asset class data from 1994 – 2004. Result affirm the findings of Davies et al. (2005) and Feldman et al. (2002) suggesting that the application of Markowitz mean variance portfolio selection to an array of published hedge fund indices produces fund-of-fund portfolios with higher ex post returns but naı¨ve exposure to undesirable higher moment risks. While the higher moments of hedge fund index return distribution are accounted for in the portfolio optimization algorithm, the resultant portfolios have improved diversification and higher moment statistics. An optimal combination of the naive1/N rule with one of the four sophisticated strategies namely the Markowitz rule, the MacKinlay and Pa´stor (2000) rule, the Jorion (1986) rule, and the Kan and Zhou (2007) rule as a way to improve performance proposed by Tu & Zhou (2011). It was found that the combined rules not only outperform the 1/N rule in most scenarios, but also have a significant impact in improving the sophisticated strategies. The study is interpreted as reaffirming the usefulness of the Markowitz theory in practice.

Based on the study's objectives, orientations and the literature review the following hypotheses can be formulated:

H1: There exists a significant difference between portfolio selection in terms of risk, based on the Markowitz and SIM model, in ASE.

H2: There exists a significant difference between Markowitz variance and single index variance.

H3: There exists a significant difference between Markowitz and SIM variance in case of the change in the number of Stocks in ASE constructed portfolios.

5. Methodology and Data

5.1 Data Source and Sample

The stock market price index is viewed as the study's population. It includes stocks of all companies distributed in three sectors (Financial, Services and Industrial), listed in ASE during the study period (2000-2006).

Since stock price index reflects both the risks and returns of the commonly traded stocks of ASE, this index is constructed by including prices of all the securities traded in ASE. The conduct of this index will be investigated by resorting to statistical testing (SPSS.18 and Microsoft excel) to determine the variability of the stock returns in ASE during the study period.

The data will cover the 1/1/2000-31/12/2006 period for duration of the seven years. The period at the beginning of the third millennium, a time period that preceded the global financial crisis; pre-2007, gives an opportunity for supportive studies to show if there are any differences, during and after the financial crisis, and to evaluate the relative effectiveness of the Markowitz and SIM models.

The selected sample fulfils the following conditions:

1. Companies listed on the ASE market during the period of this study.
2. All companies share the same fiscal year, ending on 31 December of each year.
3. Companies having no change in position (e.g. mergers, stock split, and suspension of trade).

Given these conditions, a sample of 115 companies listed on the ASE satisfied our requirements. The data were obtained from the Department of Research and International Relationship of the ASE market. It consisted of daily reports issued by the ASE market on closing prices, volume of trade, and the number of shares traded.

5.2 Methodology

The research methodology is centred on the application of two models, namely; Markowitz and SIM models. The actual (realized) return on each stock is calculated as follows (Al-Qudah et al., 2004):

$$R_{i,t+1} = \frac{P_{i,t+1} - P_{i,t}}{P_{i,t}} \quad (1)$$

$$\overline{R}_i = \frac{\sum_{t=1}^{n} R_{i,t+1}}{n} \quad (2)$$

$$\sigma_{Ri}^2 = \frac{\sum_{t=1}^{n} (R_{i,t+1} - \overline{R}_i)^2}{n-1} \quad (3)$$

Where $R_{i,t+1}$ is the return on stock i in the month $t+1$; $P_{i,1}$ is the closing price of stock i of the month ; $P_{i,t+1}$ is the closing price of stock i in the month $t+1$; $\overline{R}_i$ is the average rate of return for stock i ; n is the number of holding months of stock i; σ_{Ri}^2 is the variance of stock i.

The expected return on a portfolio $E(R_{p,t+1})$ is calculated using equation (4). The risk of a portfolio is given by formula (5), and the expression covariance (R_i, R_j) is given by equation (6):

$$E(R_{p,t+1}) = \sum_{i=1}^{n} W_i E(R_i) \quad (4)$$

$$Var(R_p) = \sum_{i=1}^{n} W_i^2 Var(R_i) + \sum_{i=1}^{n} \sum_{\substack{j=1 \\ i \neq j}}^{n} W_i W_j Covariance(R_i, R_j) \quad (5)$$

$$Covariance\,(R_i, R_j) = \rho_{i,j} SD(R_i) SD(R_j) \quad (6)$$

Where n is the number of securities in the portfolio; W_i is the proportion (weight) of invested funds in security i (i=1,....,n); $E(R_i)$ is the expected return on security i (i=1,....,n); $Var(R_p)$ is the variance of the return in the portfolio; $Var(R_i)$ is the variance of the return on security i; W_j is the proportion (weight) of invested funds in each of the securities in the portfolio; Covariance (R_i, R_j) is the covariance between the returns of securities i and j; $\rho i, j$ is the correlation coefficient which measures the extent to which the returns on securities i and j are linearly related; and *SD* is the standard deviation of securities i and j. If we substitute equation (6) into equation (5) we have Jones, (1991):

$$Var(R_p) = \sum_{i=1}^{n} W_i^2 Var(R_i) + \sum_{i=1}^{n}\sum_{\substack{j=1 \\ i \neq j}}^{n} (W_i)(W_j)\rho_{i,j} SD(R_i) SD(R_j) \quad (7)$$

From equation (5) or (6), one realizes that the risk of a portfolio is a weighted average of the individual securities in the portfolio plus the covariance between each security and every other security in the chosen portfolio. Sharpe (1964) suggested the single index model to make the calculation of risk more practical. The essence of this model is that all shares are affected by the movement of the market in general. The SIM can be expressed by:

$$R_{i,t} = \alpha_i + \beta_i R_{M,t} + e_{i,t} \quad (8)$$

Where $R_{i,t}$ is the return on security i for the time period t; $R_{M,t}$ is the return on the market index for the time period t; α_i is the constant term, β_i is the sensitivity of stock i to the return of the market; $e_{i,t}$ is the residual error term for period t.

Using the SIM model, one needs to apply the following equations (Haugen, 2001):

$$\sigma^2(R) = \beta^2\sigma^2(R_m) + \sigma^2(\varepsilon) \quad (9)$$

$$\sigma^2(\varepsilon) = \sigma^2 r - \beta^2\sigma^2(R_m) \quad (10)$$

$$Cov(R_i, R_j) = \beta_i\beta_j\sigma^2(R_m) \quad (11)$$

Where $\sigma^2(R)$ is the variance of the return; β represents the systematic risk; $\sigma^2(\varepsilon)$ is the residual variance (unsystematic risk) and $\sigma^2(R_m)$ is the variance of market return.

The return on each share as well on the market index is calculated as follows:

$$R_{t=}(P_t - P_{t-1}) / P_{t-1} \quad (12)$$

Where P_t is the price level of a share or index for the time period t.

6. Results Analysis

The examination of the relationship between the Markowitz and the SIM models required the selection of 35 equally weighted portfolios with two sizes of portfolio. The first size (10 stock portfolio) generated 12 portfolios based on queuing randomize portfolio that were randomly selected to simulate equally weighted portfolios of second sizes, 5 stock portfolios (23 portfolios from the second size were generated based on queuing randomize portfolio selection). As shown in table (1) ten and five stocks were selected. The next step involves computing the variance for each portfolio generated in order to determine the relationship between the two selection models according to the output of methodology equations (1-12) as illustrated in Appendix 1 and 2.

The results obtained show the portfolio size split was used to examine the portfolio size does affect the relationship between the two selection models. In order to test the hypotheses formulated above, the researchers conducted a primary analysis, monthly mean rates of return, stock variances, betas, Standard Deviation, Correlations, and Covariance between stocks and Market (see Equations as clarified in section 6 and the Appendix 1 & 2).

Table1: five and ten stocks portfolio variance.

Number of stocks in portfolio	Markowitz Variance	SIM. Variance	Number of stocks in portfolio	Markowitz Variance	SIM. Variance
10	0.0039	0.0037	5	0.0023	0.0021
10	0.0017	0.0014	5	0.0038	0.0028
10	0.0028	0.0021	5	0.0051	0.0042
10	0.0021	0.0020	5	0.0030	0.0025
10	0.0035	0.0031	5	0.0024	0.0026
10	0.0019	0.0019	5	0.0038	0.0033
10	0.0086	0.0088	5	0.0071	0.0067
10	0.0037	0.0028	5	0.0053	0.0037
10	0.0024	0.0025	5	0.0043	0.0038
10	0.0023	0.0022	5	0.0020	0.0021
10	0.0020	0.0019	5	0.0061	0.0063
10	0.0026	0.0023	5	0.0202	0.0212
			5	0.0071	0.0054
			5	0.0048	0.0036
			5	0.0061	0.0059
			5	0.0022	0.0022
			5	0.0041	0.0038
			5	0.0034	0.0037
			5	0.0038	0.0041
			5	0.0026	0.0025
			5	0.0039	0.0040
			5	0.0034	0.0035
			5	0.0039	0.0037

Source: Appendices 1 and 2.

Table (1) illustrates the relationship between Markowitz and SIM models. Furthermore, the results in Table 1 show that the two selection models have nearly similar variance.

As shown in the Table (2) , while the mean for Markowitz and SIM models in the case of 10 stocks portfolios are 0.0047 and 0.0044 respectively and the mean for Markowitz and SIM models in the case of 5 stocks portfolios are 0.0031 and 0.0028 respectively. However, the differences between the two means are very small; 0.0003.

Table 2: Descriptive Summary of Table 1.

10 stocks portfolios			5 stocks portfolios		
Measure	Markowitz Model	SIM Model	Measure	Markowitz Model	SIM Model
Mean	0.0047	0.0044	Mean	0.0031	0.0028
Min	0.0020	0.0021	Min	0.0017	0.0014
Max	0.0202	0.0212	Max	0.0086	0.0088
Standard Deviation	0.0035	0.0037	Standard Deviation	0.0019	0.0020

Source: Table 1.

The ANOVA analysis of 10 stocks portfolios which are reported in Table (3) indicate that the effective score for Markowitz and SIM models are relatively the same. However, the difference between the two means and standard deviations are very small; 0.00023 and 0.0177 respectively.

Table 3: ANOVA Table for Markowitz Variance versus SIM Variance I.

ANOVA Analysis	Sum of Squares	df	condition	Mean	Std. Deviation	Std. Error Mean	F	Sig.
Between Groups	.000	1	1.000	.003125	.0018704	.0005399	.08	.768
Within Groups	.000	22	2.000	.002892	.0019589	.0005655	9	
Total	.000	23						

Source: Output of SPSS Package, version 18.

Furthermore, the result (Table 3) reveals that the F-test is (Sig. = 0.768 > 0.05) meaning that is statistically insignificant; therefore, H1 and H2 are rejected.

Table (4) shows ANOVA analysis of 5 stocks portfolios. These results indicate that the F-test value is (Sig. = 0.758 > 0.05) which means that is statistically insignificant; therefore, H1 and H2 are also rejected.

Table 4: ANOVA Table for Markowitz Variance versus SIM Variance II.

ANOVA Analysis	Sum of Squares	df	condition	Mean	Std. Deviation	Std. Error Mean	F	Sig.
Between Groups	.000	1	1.000	.004852	.0036535	.0007618	.096	.758
Within Groups	.001	44	2.000	.004509	.0038595	.0008048		
Total	.001	45						

Source: Output of SPSS Package, version 18.

It can be seen from Table (4) that the effective score for Markowitz and SIM models are almost the same. Furthermore, the difference between the two means and standard deviations are very small 0.0003 and 0.0002 respectively. Based on the ANOVA analyses for 5 and 10 stocks portfolios as shown in the Tables (3 and 4), also H3 is rejected. This is because there is no significant difference between Markowitz and SIM variance, regardless of the stock number in ASE constructed portfolios.

7. Conclusion, Limitation and Managerial Implications

The Markowitz and SIM models in ASE were applied by using the monthly closing prices of 115 companies listed in ASE and ASE index for the 2000 -2006 period. From the analysis, the following important results can be presented. First, the results show how the SIM model is similar to Markowitz model for portfolios formed. Second, the number of stocks in the portfolios constructed does not seem to affect the result of comparing the two portfolio selection models. Third, it is whether investors use Markowitz or SIM model on their portfolio selection decisions. Therefore, these results were used to reject the hypotheses of the study, H1, H2, and H3. Fourth, the F-test indicates that there is an insignificant difference between the Markowitz and SIM models.

As the portfolio selection models are very important for risk test, investors should take special care when selecting their portfolios. These results are useful to individual and institutional investors, managers, and policy makers in making decision and adopting new investment policies. Future research of ASE in Jordanian universities and research centres should concentrate on portfolio selection models. It is necessary to build a network of research and training institutions to provide a suitable policy for the development of new portfolio selection models and policies.

The study has a number of limitations, namely:

- Lack of previous studies investigating similar purposes, as this study, refer to that most of the studies were carried out in developed countries, only limited numbers of studies have been conducted.
- The exclusion of companies that are not listed on the ASE; companies that are listed and traded but stopped operations.
- This study used monthly data rather than daily data.

The current paper is important for all stakeholders. It is viral for policy makers, all kinds of investors, corporations and other financial market participants. The study shows that the two models are similar. There seems to be no significant difference between the two models, whereby, the results are almost similar to the earlier results (e.g. Omet, 1994; Paudel and Koirala, 2006; and Edward et al., 2005). On the other hand, Frankfurter et al. (1976) revealed that under conditions of uncertainty, SIM approach had potential advantages over the Markowitz approach. They found that variation in performance was explained in terms of the two essential differences in the models; namely:

1. Fewer, and different, estimators are used in the SIM model to summarize past history.
2. The linear assumption of the SIM model does not necessarily hold.

In this study, we add to the canon of knowledge related to the Markowitz and SIM models. By examining the H3 hypothesis, it was found that changing the number of stocks did not affect the results which are used to reject the H3 hypothesis.

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Appendix 1: The Standard Deviation, Correlations, and Covariance between stocks and Market.

Code	Standard deviation	Correlation coefficient	Covariance (R_i, R_m)	Code	Standard deviation	Correlation coefficient	Covariance (R_i, R_m)
1	0.1456	0.470	0.0032	58	0.0816	0.563	0.0030
2	0.1514	0.468	0.0030	59	0.1696	0.261	0.0015
3	0.1113	0.449	0.0031	60	0.3679	0.178	0.0020
4	0.1439	0.411	0.0037	61	0.0764	0.345	0.0016
5	0.0588	0.590	0.0030	62	0.1013	0.275	0.0017
6	0.1644	0.600	0.0039	63	0.0587	0.102	0.0008
7	0.1371	0.564	0.0037	64	0.0000	-0.058	0.0000
8	0.1225	0.355	0.0025	65	0.0000	0.049	0.0002
9	0.1170	0.237	0.0023	66	0.1035	0.508	0.0031
10	0.1748	0.581	0.0042	67	0.0918	0.158	0.0008
11	0.1457	0.484	0.0038	68	0.0480	0.280	0.0015
12	0.0364	0.055	0.0003	69	0.1856	0.254	0.0017
13	0.0368	0.418	0.0019	70	0.0059	0.216	0.0009
14	0.0603	0.229	0.0012	71	0.1288	0.314	0.0025
15	0.0718	0.361	0.0017	72	0.1032	0.200	0.0013
16	0.1731	0.278	0.0019	73	0.1183	0.041	0.0003
17	0.1255	0.495	0.0036	74	0.0000	0.068	0.0016
18	0.1742	0.350	0.0038	75	0.1265	0.381	0.0025
19	0.1163	0.166	0.0014	76	0.0818	0.218	0.0011
20	0.1431	0.175	0.0010	77	0.0630	0.247	0.0015
21	0.1415	-0.093	-0.0007	78	0.0327	0.201	0.0006
22	0.1154	0.013	0.0001	79	0.0000	0.000	0.0000
23	0.1198	0.285	0.0020	80	0.0734	0.280	0.0016
24	0.1203	0.140	0.0007	81	0.0488	0.374	0.0024
25	0.0584	0.257	0.0020	82	0.0790	0.196	0.0013
26	0.0000	0.079	0.0003	83	0.1387	0.344	0.0025
27	0.1356	0.426	0.0030	84	0.0824	0.161	0.0013
28	0.1274	0.366	0.0026	85	0.0682	0.260	0.0014
29	0.0346	0.086	0.0007	86	0.2236	0.422	0.0134
30	0.0681	0.019	0.0001	87	0.1124	0.088	0.0009
31	0.0781	0.224	0.0017	88	0.1615	0.353	0.0035
32	0.1273	0.455	0.0029	89	0.1006	0.042	0.0005
33	0.0999	0.223	0.0017	90	0.0000	0.098	0.0002
34	0.1079	0.313	0.0016	91	0.1838	0.481	0.0046
35	0.0840	0.181	0.0010	92	0.1260	0.296	0.0025
36	0.0000	0.400	0.0040	93	0.0000	0.051	0.0004
37	0.0670	0.375	0.0027	94	0.0616	0.429	0.0019
38	0.0753	0.270	0.0033	95	0.1592	0.298	0.0024
39	0.1899	0.259	0.0020	96	0.0459	0.276	0.0016
40	0.0970	0.249	0.0015	97	0.0000	0.097	0.0000
41	0.1551	0.273	0.0029	98	0.1516	0.293	0.0024
42	0.1204	0.624	0.0043	99	0.0827	0.152	0.0009
43	0.1087	0.136	0.0004	100	0.0000	0.105	0.0008
44	0.0276	-0.036	-0.0001	101	0.1331	0.262	0.0021
45	0.1726	0.174	0.0013	102	0.0667	-0.033	-0.0004
46	0.1016	0.182	0.0014	103	0.0000	0.030	0.0003
47	0.1007	0.492	0.0025	104	0.1475	0.221	0.0020
48	0.1059	0.140	0.0010	105	0.1355	-0.107	-0.0008
49	0.1077	0.553	0.0025	106	0.1040	0.189	0.0019
50	0.2682	0.357	0.0039	107	0.0807	0.206	0.0009
51	0.0548	0.381	0.0026	108	0.1698	0.030	0.0002
52	0.2115	0.580	0.0075	109	0.0935	0.404	0.0031
53	0.1714	0.353	0.0030	110	0.0261	0.170	0.0010
54	0.2288	0.491	0.0055	111	0.0566	0.325	0.0023
55	0.2375	0.309	0.0030	112	0.0000	0.010	0.0000
56	0.2127	0.393	0.0047	113	0.1492	0.366	0.0018
57	0.1832	0.595	0.0046	114	0.1082	0.116	0.0007
				115	0.0493	0.112	0.0011

Appendix 2: Return, variance, and Beta of the Stocks of the [1/1/2000-31/12/2006] Period.

Stock Code	Mean Return	Variance	Beta	Stock Code	Mean Return	Variance	Beta
1	0.0140	0.0131	0.8816	59	0.0110	0.0094	0.4156
2	0.0102	0.0115	0.8245	60	0.0177	0.0348	0.5444
3	0.0211	0.0132	0.8457	61	0.0072	0.0059	0.4332
4	0.0138	0.0227	1.0146	62	0.0126	0.0104	0.4585
5	0.0139	0.0073	0.8264	63	0.0258	0.0170	0.2183
6	0.0210	0.0118	1.0675	64	0.0006	0.0000	-0.0048
7	0.0198	0.0117	0.9983	65	0.0002	0.0050	0.0567
8	0.0249	0.0137	0.6813	66	0.0191	0.0102	0.8418
9	0.0227	0.0265	0.6326	67	-0.0066	0.0068	0.2136
10	0.0212	0.0144	1.1432	68	0.0132	0.0078	0.4050
11	0.0271	0.0173	1.0430	69	0.0024	0.0125	0.4651
12	0.0177	0.0060	0.0699	70	0.0111	0.0043	0.2340
13	0.0072	0.0055	0.5055	71	0.0193	0.0170	0.6717
14	0.0088	0.0078	0.3317	72	0.0130	0.0115	0.3515
15	0.0100	0.0059	0.4556	73	0.0091	0.0133	0.0783
16	0.0143	0.0130	0.5202	74	0.0324	0.1582	0.4407
17	0.0091	0.0147	0.9834	75	0.0115	0.0120	0.6853
18	0.0222	0.0321	1.0272	76	-0.0023	0.0076	0.3124
19	0.0208	0.0205	0.3896	77	-0.0003	0.0100	0.4054
20	0.0055	0.0096	0.2808	78	-0.0037	0.0028	0.1758
21	0.0159	0.0162	0.1936	79	0.0000	0.0000	0.0000
22	0.0087	0.0082	0.0190	80	0.0309	0.0093	0.4440
23	0.0104	0.0132	0.5376	81	0.0134	0.0116	0.6612
24	0.0173	0.0065	0.1856	82	0.0019	0.0118	0.3498
25	0.0052	0.0174	0.5560	83	0.0111	0.0140	0.6683
26	-0.0159	0.0037	0.0789	84	0.0277	0.0181	0.3553
27	0.0058	0.0133	0.8069	85	0.0194	0.0081	0.3851
28	0.0025	0.0140	0.7112	86	0.0635	0.2766	3.6427
29	0.0157	0.0175	0.1869	87	0.0025	0.0264	0.2350
30	-0.0007	0.0039	0.0189	88	0.0177	0.0271	0.9535
31	0.0092	0.0167	0.4753	89	0.0297	0.0438	0.1457
32	0.0164	0.0110	0.7825	90	-0.0065	0.0013	0.0579
33	0.0096	0.0164	0.4677	91	0.0252	0.0250	1.2475
34	0.0054	0.0073	0.4379	92	0.0289	0.0198	0.6824
35	0.0142	0.0092	0.2843	93	0.0071	0.0165	0.1069
36	0.0509	0.0274	1.0875	94	0.0142	0.0056	0.5273
37	0.0036	0.0139	0.7248	95	0.0266	0.0178	0.6509
38	0.0217	0.0410	0.8960	96	0.0104	0.0089	0.4262
39	0.0235	0.0161	0.5384	97	-0.0009	0.0001	0.0133
40	0.0129	0.0096	0.4009	98	0.0190	0.0184	0.6516
41	0.0207	0.0303	0.7789	99	0.0140	0.0093	0.2398
42	0.0156	0.0133	1.1810	100	0.0048	0.0163	0.2188
43	-0.0074	0.0020	0.0987	101	0.0165	0.0181	0.5768
44	0.0031	0.0041	0.0376	102	0.0322	0.0358	-0.1008
45	0.0282	0.0161	0.3624	103	-0.0044	0.0196	0.0685
46	0.0008	0.0153	0.3701	104	0.0316	0.0234	0.5548
47	0.0067	0.0070	0.6728	105	0.0160	0.0168	-0.2276
48	0.0218	0.0137	0.2685	106	0.0130	0.0287	0.5245
49	0.0091	0.0058	0.6884	107	0.0180	0.0053	0.2456
50	0.0255	0.0320	1.0476	108	0.0182	0.0111	0.0512
51	0.0147	0.0131	0.7137	109	0.0111	0.0167	0.8556
52	0.0314	0.0465	2.04992	110	0.0250	0.0095	0.2712
53	0.0159	0.0197	0.81273	111	0.0121	0.0140	0.6314
54	0.0308	0.0346	1.49888	112	0.0006	0.0002	0.0021
55	0.0292	0.0265	0.82374	113	0.0056	0.0070	0.5031
56	0.0312	0.0399	1.28672	114	0.0121	0.0092	0.1828
57	0.0210	0.0161	1.23943	115	0.0144	0.0289	0.3121
58	0.0098	0.0076	0.80502				