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Optimizing Local Portfolio Return Under Risk in Terms of International Stock Markets Indices

Hegazy Zaher [*]
Professor of Mathematical Statistics, Institute of Statistical Studies and Research (ISSR), Cairo University, Egypt.

Naglaa Raga Said
Assistant Professor of Operations Research, (ISSR).Cairo University, Egypt.

Nisren Hassanen Mohamed
PHD student, Dept. Of Operations Research, (ISSR). Cairo University, Egypt.

Abstract: Forecasting stock market indicators usually based on historical data of the same stock market. This paper proposes an alternative approach to forecast a stock market global index using the minimum number of similar indices of other foreign countries stock markets. The objective is to find the best linear combination of foreign stock markets indices which satisfies two goals, to minimize risk and maximize return. The study covers (16) countries distributed all over the world.

Keywords: Stock markets indicators, forecasting, linear combination, International stock markets, minimum risk.

I. INTRODUCTION

A. Introduction

The risk can be defined as any state where some events are not known with certainty [5]. Prediction of financial markets has special importance to equity investors. Technical Analysis is a general method to study investor behaviour, and focuses on prices and volume data only. This approach uses in short-term Investment horizons and access to price and exchange data. With the high generation computers which used in this field [9]. The basic idea of this paper is to study the effect of changes in the global stock market indicator using stock market indicators of other countries. The main target is to increase the investor's future decisions in stock markets. This paper considers the effect of changes in the foreign stock markets indicators on the local stock markets indicator. The used data is the historical data of Gulf Area Stock Markets, (Bahrain Stock Exchange (BSE), Doha Securities Market (DSM), Abu Dhabi Securities Exchange (ADSM), Kuwait Stock Exchange (KSE), Muscat Securities Market (MSM), Dubai financial market (DFM)), local stock markets, (Cairo & Alexandria Stock Exchange (CASE 30)) moreover, International Stock Markets, (Brazil, Mexico, India, Malaysia, Canada, Switzerland (SWISS),United States of America (USA), United Kingdom (UK), South Korea, Indonesia, Norway, Singapore, Japan, Hong Kong, Germany, France, Australia). The used data in this study considers the time interval from December 21, 2005 to July 15, 2008. The inputs will be indicators of the other countries and the output will be the indicator of the country under consideration. Markowitz technique will be used to model the problem under consideration.

B. General Index of a Stock Market

The stock market index is used to measure the value of the stock market and is calculated from the prices of selected stocks and used by investors and financial managers to compare the return on specific investments [11].

II. RISK ANALYSIS

A. Stock Market Risk Management

Risk management defined as 'the process of minimizing risks the product's lifecycle to obtain its benefit-risk balance' [13]. So to define, assess, and prioritize of risks. And then coordinated, minimize, monitors, and controls the impact of different events to maximize the possible of opportunities [6].

The return from any investment is generally depends on the amount of the risk satisfactory to the investor [12]. It is difficult to master risk management of an investor.

Investor should choose risk trend (risk seeker, risk neutral or risk averse). It is clear that without taking some risk there is no return. Therefore, investors should have strategies to minimize their risk. The goal of any stock market risk management process is to avoid losing money. There are several strategies to help you to reach this important goal. The most successful investors use all the stock market risk management strategies as they understand how important it is to avoid making a mistake while investing in the stock market [10].

Portfolio risk management requires:

- Identification of possibility risks.
- Assessment of the amount and probability of those risks occurring.
- Choosing a path or technique to optimize the risks and returns of the portfolio.

B. Measurement of Return and Risk Using Markowitz Model

The model depends on:

- Mean (Expected Return)
- Variance (or its square root SD) [4].

Risk and Return have a high correlation in investments and finance. Decisions of investment generally consist of a trade-off between risk and return. There are many forms of the stock market risk and each can lead to a loss. The return rate is defined by [7]-[1].

Rate of Return (R):

$$R = \frac{\text{End of Period Receipt - Initial Investment}}{\text{Initial Investment}} \quad (1)$$

The portfolio expected return is the expected asset returns multiply by the weights given to each asset in the portfolio. Assuming the portfolio has N assets with returns R_i, i= 1.. N.

Let,

R_p = Return on the portfolio

R_i = Return on asset i

W_i = Weight of component asset i (that is, the share of asset i in the portfolio).

∂_{ij} = the correlation coefficient of the returns and the assets i and j.

σ_p^2 = the portfolio variance.

σ_i = the standard deviation of asset i.

σ_j = the standard deviation of asset j.

Portfolio return:

$$E(R_P) = \sum_{j=1}^{m} w_j E(R_j) \quad (2)\ [5]$$

Portfolio returns variance:

$$\sigma_p^2 = \sum_i \sum_j w_i w_j \sigma_i \sigma_j \partial_{ij} \quad (3)\ [5].$$

C. The concept of Markowitz efficient frontier

Any efficient portfolio can be created as any number of asset combinations. When the expected return of the resulting portfolio is more than the expected on the global minimum variance portfolio, then the portfolio is an efficient frontier Portfolio. Otherwise, the portfolio is an inefficient frontier portfolio. As a Result, to compute the portfolio frontier in (E (R_p), σ_p) space (Markowitz bullet) [8]. The efficient frontier gives the relationship of the return the risk (volatility) of the portfolio. It can be shown as a curve of risk and expected return of a portfolio. The best return can be found on the efficient frontier of that curve. An inefficient portfolio can be moved closely to the efficient frontier using diversification to increase returns without increasing risk.

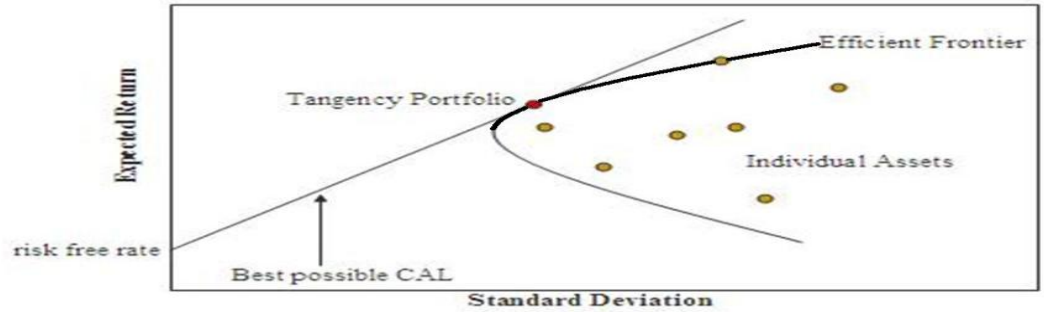

Figure 1 the efficient frontier of risky assets and individual assets

The efficient frontier is given by the line passing by the upper edge of this region. The points lying on the efficient frontier give the best possible return. If the investor has access to risk free investment, the risk of the portfolio can further be reduced, which is shown in Fig.1 by the CAL [1], [7] - [8].

III. PROBLEM MODELING

To attain a satisfactory solution, the following model will be used:

$$Min\ \sigma_p^2 = \sum_{i=1}^{n}\sum_{j=1}^{n} w_i w_j \rho_{ij} \sigma_i \sigma_j \quad (4)$$

subject to (5)

$$\sum_{i=1}^{n} w_i E(R_I) = E \quad (6)$$

$$\sum_{i=1}^{n} w_i = 1.0$$

Where e is the target expected return. The first constraint (5) refers to the expected return on the portfolio which should be equal to the target return decided by the portfolio manager. Constraint (6) gives the weights of the assets invested in the portfolio which should sum to one [2]-[3].

A. Model Experimentation

First Experimental data were gathered directly from daily stock market indices for a period of 663 days starting from December 21, 2005 till July 15, 2008. The following stock markets were included in this study with their global indicators: Cairo & Alexandria Stock Exchange (CASE 30), Bahrain Stock Exchange (BSE), Doha Securities Market (DSM), Dubai Financial Market (DFM), Kuwait Stock Exchange (KSE), Muscat Securities Market (MSM), USA, France (CAC40), United Kingdom (FTSE100), Norway, India, Hong Kong, Japan, Switzerland (SWISS), Singapore, and Canada. Second the following algorithm is used to generate solutions satisfying the model given in (3).

B. Solution Algorithm

Step 1
Find the mean, standard deviations and the variance of similar indices of other stock markets. Also find the Correlation co-efficient and the Covariance.
Step 2
Start with any portfolio weights.
Step3
Use equations (2) and (3) from the previous section to compute the portfolio means, variance, and standard deviation.
Step 4
Calculate the minimum variance portfolio.
Step5
Set the maximum satisfying minimum variance and specify the constraints as in equations (5) and (6). Select the range of the portfolio weights of the risky assets to reach the optimization solution. The solution is shown in tables 4, 5. Where the optimal portfolio risks (as measured by the standard deviation) and the corresponding portfolio expected monthly return. The weights in the optimal portfolio are also shown in tables I, II for each (16) countries.

Table I the Weights of Optimal Portfolio for Each Country

Indicators	Bahrain Stock Exchange	Doha Securities Market	Dubai financial market	Cairo & Alexandria Stock Exchange	Canada	France	Norway	United Kingdom
ADSM	0.076	0.199	0.017	0.022	-	-	0.089	0.020
BSE	-	-	0.502	0.509	-	-	-	0.550
DSM	0.058	-	0.016	-	0.048	-	0.089	-

DFM	-	-	-	-	-	-	-	-
CASE30	0.025	0.082	-	-	-	-	-	0.027
MSM	-	-	0.161	0.166	0.302	-	-	-
KSE	0.474	-	-	-	0.382	0.531	0.580	0.202
Brazil	-	-	-	-	0.002	-	-	-
Canada	-	0.386	0.154	0.124	-	-	-	-
CAC40	-	-	-	0.001	-	-	-	-
DAXgermany	-	-	-	-	-	0.102	-	-
Mexico	-	-	-	-	0.108	-	-	-
Norway	-	-	0.002	0.027	0.071	-	-	0.050
FTSE100	-	-	-	0.041	-	-	-	-
USA	-	-	-	0.058	-	-	-	-
Singapore	-	-	0.038	-	-	0.108	-	-
Malaysia	0.288	-	-	-	-	-	-	-
Japan	0.045	0.086	-	0.016	0.033	-	-	-
India	-	-	-	-	-	-	-	-
South Korea	-	-	-	-	0.055	0.046	0.184	0.040
Indonesia	-	-	-	0.002	-	-	-	-
SWISS	-	0.198	0.066	-	-	0.151	-	0.111
Australia	-	-	0.039	-	-	-	-	-
China	0.032	-	-	0.025	-	0.047	0.058	-
Tasi	-	0.049	0.004	0.009	-	0.014	-	-
SUM	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

Table II Continue

Indicators	United States of America	Singapore	Japan	India	Hong Kong	Switzerland	Muscat Securities Market	Kuwait Stock Exchange
ADSM	-	-	0.162	0.034	-	-	0.093	-
BSE	0.704	0.724	-	-	0.539	0.402	-	0.672
DSM	0.058	-	0.128	0.020	0.019	-	0.045	0.042
DFM	-	-	-	-	-	-	-	0.005
CASE30	-	-	0.056	-	-	-	-	0.043
MSM	-	-	-	0.228	-	0.133	-	-
KSE	-	-	-	0.299	0.207	0.151	0.357	-
Brazil	0.013	-	-	-	-	-	-	-
Canada	-	-	-	0.196	-	0.107	-	-
CAC40	-	0.115	-	0.046	-	-	0.120	-
DAXgermany	-	-	-	-	-	-	-	-
Mexico	-	0.047	-	-	-	-	0.097	-
Norway	-	-	0.006	-	-	-	0.017	-
FTSE100	-	-	0.126	-	-	0.025	-	-
USA	-	-	-	-	-	0.056	-	-
Singapore	-	-	0.094	0.025	0.044	0.015	-	-
Malaysia	-	-	-	0.130	0.136	0.098	0.228	-
Japan	-	0.014	-	-	-	-	-	-
India	-	0.009	-	-	0.001	-	-	-
South Korea	-	0.046	-	-	-	-	0.000	0.042
Indonesia	-	0.014	-	-	-	-	-	0.006

SWISS	0.187	-	0.212	-	-	-	-	0.161
Australia	-	-	0.136	-	0.039	-	-	-
China	0.038	0.031	0.048	0.021	0.015	0.014	0.026	0.028
Tasi	-	-	0.031	-	-	-	0.017	-
SUM	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

For example referring to Table I
Bahrain stock market global index = 0.076*(ADSM-GI) + 0.058(DSM-GI) +...+0.032(CHINA-GI)
Where GI indicate the global index of the countries

The following table gives the expected return, variance and standard deviation to each indicator of all countries under consideration in the other columns.

Table III the optimal portfolio risks and expected return for each country

Indicators	Bahrain Stock Exchange	Doha Securities Market	Dubai financial market	Cairo & Alexandria Stock Exchange	Canada	France	Norway	United Kingdom
Expected return	0.00037	0.00010	0.00047	0.00050	0.00071	0.00034	0.00038	0.00032
Portfolio variance	0.00003	0.00004	0.00002	0.00002	0.00003	0.00003	0.00004	0.00002
Portfolio std.deviation	0.006	0.007	0.004	0.004	0.005	0.006	0.006	0.004

Table IIII the optimal portfolio risks and expected return for each country

Indicators	United States of America	Singapore	Japan	India	Hong Kong	Switzerland	Muscat Securities Market	Kuwait Stock Exchange
Expected return	0.00031	0.00037	0.00010	0.00060	0.00037	0.00049	0.00064	0.00032
Portfolio variance	0.00002	0.00002	0.00005	0.00002	0.00002	0.00001	0.00003	0.00002
Portfolio std.deviation	0.005	0.005	0.007	0.005	0.004	0.004	0.006	0.005

IIII. CONCLUSION

The main results given in this paper are:

1) Any global stock market index in the world can be expressed in terms of other global stock markets indices of other countries so that to minimize the portfolio variance under constraints.
2) A stock market (of a given country) is highly affected with the performance of a subgroup of the indicators of other countries.
3) It is possible to use other stock markets indicators to forecast the performance of the local stock market of a given country.

REFERENCES

[1] A. ravipati, markowitz's portfolio selection model and related problems, 2012.
[2] B. Simon, Financial modeling, The MIT press, Cambridge, Massachusetts, London, England, 1999.
[3] B. Simon, Principles of Finance with excel, oxford university press, 2006.
[4] F. K. Reilly and Keith C., Brown, Investment Analysis and Portfolio Management, 7th edition, 2003.
[5] j. chavas, risk analysis in theory and practice, 2004.
[6] H., Douglas, The Failure of Risk Management: Why it is Broken and How to Fix It. John Wiley & Sons. P.46, 2009.
[7] M. H., Portfolio selection, The Journal of Finance, Vol. 7, No. 1, pp.77-91, 1952.
[8] M. H, Portfolio Selection: Efficient Diversification of Investments, 1959.
[9] M.H. Kosaka, M., Yajima, H. and Komoda N, Application of Neural Network to Technical Analysis of Stock Market Prediction, Studies in Informatic and Control, Vol.7, No.3, pp.111-120, 1959.
[10] V. K. Tharp, Trade Your Way to Financial Freedom, 2007.
Source:
http://www.tradingonlinemarkets.com/Articles/Trading_Discpline/stock_market_risk_management.htm.
[11] (2013) http://en.wikipedia.org/wiki/Stock_Market_Indices.
[12] (2013)http://www.stockinvestingideas.com/risk-management.
[13] FDA, Guidance for Industry, Development and Use of Risk Minimization Action Plans, March 2005. Source: www.fda.gov/downloads/Drugs/GuidanceComplianceRegulatoryInformation/Guidances/UCM071616.pdf.

