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Ethical Stochastic Objectives Programming Approach for Portfolio Selection

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Abstract

The paper develops an ethical stochastic multiple objectives programming approach to address the ethical portfolio selection problem in the stochastic environment under the *Shari'ah* compliant framework. Two random objectives considered in this paper which are maximizing portfolio return and maximizing social welfare of portfolio. The risk of portfolio is measured by covariance matrix of total return. The ethical stochastic multiple objectives programming approach is based on goal programming approach, a chance constrained approach and Shari'ah compliant framework. The model is applied on 60 stocks including conventional and ethical/Islamic securities in GCC. The results show that, portfolios with higher proportion of ethical/Islamic securities in the portfolio and with higher expected loss the higher is the portfolio performance in terms of Sharpe measure.

Keywords: *Shari'ah* compliant, Ethical investment, Goal programming, Multiple objectives, Stochastic multiple objectives programming, Chance constrained approach, Sharpe index as portfolio performance measure

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1. Introduction

Based on rational behavior the purpose of any business is to maximize profit. Business goals normally has nothing to do with ethics, morality and humanity. However, based on religion, business and morality cannot be separated and business must play fairly and equitably by the rules of morality. This view was emphasized more by the Church in the European countries. The Church prescribed that business must exist only to do good for the society. Repeated financial crisis and especially the recent 2007-2008 financial crisis have raised questions whether such crisis could have been avoided if there were strong ethics embedded in financial transactions, public policy, regulations, governance, and leadership. In addition, erosion of economic value, the social cost to the society and especially to the poor is becoming serious concern for the community. The increased complexity of financial transactions and financial markets, especially with the development of complex derivatives, has also raised ethical issue (Maghrebi et al., 2015).

Additionally, the consideration of ethics and morals of investment decision is becoming more and more important and attractive for some investors who are concerned and care about the right of society and humanity. As a result, ethical investment or social responsible investments (SRI) are growing and academic resources devoted to the study of ethics have also increased in the last two decades. (Maghrebi et al., 2015). Cowton (2004) described ethical investment as: "A set of approaches which include social or ethical goals or constraints in addition to more conventional financial criteria in decisions over whether to acquire, hold or dispose of a particular asset, particularly publicly traded shares, attractive or desirable social characteristics".

Because of the growing interest in ethical investment from society, Islamic finance appears to be a good choice for such investors as ethical investment operate based on *Shari'ah* compliant framework. The *Shari'ah* compliance is a religious framework that provides the social and ethical boundaries for business and banking activities (Gassner & Philipp, 2007). Islamic finance has to comply with *Shari'ah* compliance which dictates a set of prohibitions such as: "Transactions in unethical goods and services; Earning returns from a loan contract (Riba/Interest); Compensation-based restructuring of debts; Excessive uncertainty in contracts (Gharar); Gambling and chance-based games (Qimar); Trading in debt contracts at discount, and; Forward foreign exchange transactions" (Tariq, 2004).

The consideration of ethics can be seen in all these prohibitions that attract both Islamic and traditional investors globally to ethical investments. Islamic investment are prohibited in specific industries/companies that are believed to be unethical, such as those involved in dealing with alcohol, tobacco, arms defense, pornography, etc., from their investment universe (Ghoul & Karam, 2007). Table 1. Shows the distinction between Islamic and conventional investments.

Table 1: comparison between conventional and Islamic investment

Key area	Conventional Investment	Islamic Investment
Main purpose of investment	The investment seeks to maximize financial return only.	The investment seeks financial return while conforming to *Shari'ah* law.
Securities selection process	Securities selection is made solely based on the characteristics of the securities that suit the objectives of the investment but without reference to any specific socially-oriented considerations.	*Shari'ah* guidelines are used as the screening mechanism in securities selection process to ensure only *halal* approved securities are selected whilst non-*halal* securities are avoided.
Asset universe	Unlimited. All securities can be selected or admitted into the conventional portfolio.	Limited. Only the approved *Shari'ah* compliant securities are allowed for investment.
Investment support services	Only requires investment research support services to search for undervalued securities and monitor the investment performance.	Requires the following services: 1. *Shari'ah* advisory board to screen, monitor and make decision on securities admissibility or withdrawal. May also requires *Shari'ah* officer to supervise and monitor *Shari'ah* compliancy. 2. Research team to search for potential securities and monitor funds performance.
Type of investors	Economic rational individuals who typically prefer more profit and low risk.	Religious or ethically-concerned investors.

Source: (Rahimie, 2010)

2. Research Problem and Literature Review

Despite the growing interest in Islamic finance and ethical investment, few empirical studies consider the ethical objective in portfolio selection besides the traditional objectives of risk and return. In this paper we consider, maximizing social welfare as an ethical objective in addition to traditional return and risk objectives for portfolio selection.

In reality there are set of investors who just would like to optimize their investments based on two objectives of maximizing return and minimizing risk. They would derive highest utility if they obtain higher return with minimum level of risk for a particular set of securities in the portfolio. For such investors, the Markowitz (1952) mean-variance framework provides an opportunity to build their portfolio by allocating their wealth through a set of optimal weights in the securities. The mean-variance Markowitz (1952) is as follow:

$$Min \sum_{i=1}^{n}\sum_{j=1}^{n} \sigma_{ij} x_i x_j$$

$$s.t. \sum_{i=1}^{n} R_i\, x_i \geq R^*$$

$$\sum_{i=1}^{n} x_i = 1$$

$$0 \leq x_i \leq u_i, \;\; i = 1,2,\dots,n$$

where x_i is the amount to invest in the i^{th}security, R_i is the random return of the i^{th} security, σ_{ij} is the covariance coefficient between R_i and R_j and $R^*$is the desired return of the efficient portfolio that investors would like to achieve and u_i is the upper limit on investment in the i^{th} security. The Markowitz (1952) mean-variance model has the capability of considering only two objectives risk and return in the model.

On the other hand, in practice, there are a set of financial decision makers (FDM) who would like to optimize their investments with additional objectives beyond return and risk, and sometimes the objectives are conflicting each other. Zopounidis et al. (1999) provided a list of 15 objectives in portfolio selection that might be considered by FDM such as gross book value per share, capitalization ratio, stock market value of each firm, the marketability of each share, financial position progress, capital gain, transaction value per day, and equity ratio. Another set of objectives proposed by Steuer et al. (2005) include return, dividends, amount invested in R&D, social responsibility, liquidity, number of securities in portfolio.

However considering multiple criteria in the portfolio selection problem is now a reality for investors. In such a case, Markowitz (1952) bi-objective model does not capture the essence of multi-objectives of the FDM in the financial portfolio selection problem. (Aouni, 2009, 2010). Some multi-dimensional approaches have been proposed in literature that are able to handle multiple conflicting objectives. Among them, goal programming approach is a popular approach. In the Goal programming approach (GP) introduced by Charnes and Cooper (1959), investors can consider multiple conflicting objectives for their portfolio selection in order to attain the efficient portfolio.

However, some of the objectives proposed by Zopounidis et al. (1999) and Steuer et al. (2005) are random objectives such as return, dividend, liquidity and social responsibility. In such a case, the stochastic objectives or random parameters need to be subjected to one of stochastic optimization approaches for portfolio selection. Two approaches have been proposed for handling stochastic multiple objectives. They are chance constrained approach and recourse approach (Ben Abdelaziz et al., 2007).

Ben Abdelaziz et al. (2007) employed the chance constrained compromise programming model (CCCP), which combined the compromise programme (CP) model and the chance constrained programming approach (CCP). They considered three objectives return, exchange flow and risk. The authors assumed that the securities return are random and are normally distributed.

Masmoudi and Abdelaziz (2012) proposed the recourse goal programming approach, which is a mix of the goal programming approach and the recourse approach to solve the portfolio problem when stochastic multiple objectives are involved. They assumed that, investors have a minimum acceptable expected rate of return of their portfolio that if they do not achieve the minimum acceptable return then, they have to pay penalty.

Masri (2015) proposed a multiple stochastic goals approach to the agent portfolio selection. The model is a mixture of goal programming, a chance constrained, and recourse approach by considering two target returns on the return objectives. The author proposed a chance constrained approach which is based on Ben Abdelaziz et al. (2007) to the investor's ideal rate of return that agent would like to achieve to improve agent's reputation in the market. The author proposed recourse approach based on Masmoudi and Ben Abdelaziz (2012) to the investor's minimum rate of return objective that agent should reach to avoid any penalties.

Substantial research papers exists to handle ethical investments but there are very few that have addressed the stochastic multiple objectives in ethical investment and Islamic finance. Ballestero et al. (2012) added one more objective which is ethical objective to the traditional mean-variance framework. The authors considered the traditional financial objective in the theory of classical utility under uncertainty and an ethical objective in the same utility framework. Two types of assets considered in the model included green or ethical assets, and non-ethical assets.

Recently, Masri (2017) proposed a framework which is a combination of goal programming, a chance constrained approach and a recourse approach on *Shari'ah* compliant portfolio selection in an Islamic security market. The model is based on the principles of *Shari'ah* by avoiding excessive risks and by providing an ethical and socially responsible approach to portfolio selection. The author proposed the model on two return objectives. The first return objective is to maximize the return of portfolio for a given probability of loss and the second return objective is based on minimum acceptable return. As the Muslim investors need to pay 2.5% of their return as a Zakat then any return below this amount is consider as a loss and recourse cost.

Ben Abdelaziz and Abed (2018) reviewed different approaches to ethical investment and they mentioned that if the investor is willing to consider ethical securities in their portfolio, then they need to add one more constraint to the bi-objective portfolio selection model. They proposed the ethical constraint as follows:

$$\sum_{i=1}^{n} e_i x_i \geq \beta$$

where e_i is an ethical performance score of the i^{th} security; β is regarded as investor's choice for a minimum desired ethical level of the portfolio:

$$0 \leq \beta \leq max_{1 \leq i \leq n}\, e_i$$

3. Conceptual Framework to Address Research Problem

Our first objective in this paper is to maximizing the return of the portfolio that yields the maximum profitability or reward from investing in the stock based on traditional Markowitz framework. The second objective of this paper is to include the social welfare return of the portfolio based on ethical investment framework suggested by Ballestero et al. (2012) by maximizing the return of ethical/social responsible investment return (to measure the social welfare of portfolio). The first two objectives are stochastic in nature as return is a random variable. Then chance constrained approach is a suitable approach to model the stochastic objectives on the return objective function. Based on chance constrained the random return objective can be written as follow:

$$\Pr\left(\sum_{i=1}^{n} R_i x_i \geq R^{TT}\right) \geq (1 - \alpha)$$

α indicates a threshold defined as $\alpha \in [0, 1]$ which is the acceptable level of probability of not achieving investor's targeted value or the acceptable level of probability of loss. We then follow Ben Abdelaziz et al. (2007), and assume that the securities return are normally distributed with known mean and variance. In such a case, the above objective can be written as:

$$E\left(R^{TT} - \sum_{i=1}^{n} R_i x_i\right) + \emptyset^{-1}(1-\alpha)\,\sigma\left(R^{TT} - \sum_{i=1}^{n} R_i x_i\right) \leq 0$$

Mathematically this objective can be written as:

$$E\left(\sum_{i=1}^{n} R_i x_i\right) - \emptyset^{-1}(1-\alpha)\,\sigma\left(\sum_{i=1}^{n} R_i x_i\right) \geq R^{TT}$$

where $E(.)$ and $\sigma(.)$ are mean and standard deviation of securities return respectively and $\emptyset^{-1}$ is the inverse distribution function of a standard normal distribution and R^{TT} is the targeted return that investors would like to achieve as a portfolio return.

For our social welfare objective, based on the chance constrained approach the social welfare constraint can be written the same as the stochastic return constraint, and can be written as follows:

$$E\left(\sum_{i=1}^{k} R_i x_i\right) - \emptyset^{-1}(1-\alpha)\sigma\left(\sum_{i=1}^{k} R_i x_i\right) \geq R^{TS}$$

where $E(.)$ and $\sigma(.)$ are mean and standard deviation of return on ethical/Islamic securities respectively and R^{TS} is the targeted value that ethical or Muslim investors would like to achieve.

To deal with the risk objective of our ethical stochastic multiple objectives programming in our portfolio selection, we use the covariance matrix of total return introduced by Markowitz (1952) and is as follows:

$$x_i V_i x_i'$$

3.1 An Ethical Stochastic Multiple Objectives Programming Approach

The linear equivalent program to the ethical stochastic multiple objectives programming can be written as follows:

$Min\ \delta_1^- + \delta_2^- + \delta_3^+$

$s.t.$

$$E\left(\sum_{i=1}^{n} R_i x_i\right) - \emptyset^{-1}(1-\alpha)\sigma\left(\sum_{i=1}^{n} R_i x_i\right) + \delta_1^- = R^{TT} \quad i = 1, \dots k, k+1, \dots, n$$

$$E\left(\sum_{i=1}^{k} R_i x_i\right) - \emptyset^{-1}(1-\alpha)\sigma\left(\sum_{i=1}^{k} R_i x_i\right) + \delta_2^- = R^{Ts} \quad i = 1, \dots, k$$

$x_i V x_i' - \delta_3^+ = 0 \quad i = 1, \dots, n$

$0 \leq x_i \leq u_i, \qquad i = 1, \dots, n$

$\delta_1^-, \delta_2^- and\ \delta_3^+ \geq 0$

where

i : 1,..., k: ethical/Islamic securities

$i : k+1$,...,: Conventional securities

x_i: the proportion of the i^{th} security in the portfolio

R^{TS}: the targeted return that investors would like to achieve in order to have impact on society by donating some of this amount as a zakat

$R^{TS} = R^{TI} + Z$

R^{TI}: the targeted return from ethical/Islamic securities

Z: Zakat rate (Muslim tax; 2.5% of income)

$V:$ covariance matrix of total return on ethical/Islamic and conventional securities

x_i': a transposed vector of x_i

4. Model Results

Historical secondary data on ethical/Islamic and commercial securities such as prices, dividend and other financial data are collected from Eikon (Thomson Reuters) and other reliable resources such as financial markets, for both categories of securities. In particular, the study uses a sample of 60 securities, which include 28 ethical/Islamic securities. All 60 securities are traded in different geographical of GCC from 2006 to 2015. To solve our problem, we used the LINGO Solver 17.0 and 8GB of RAM using Windows 7. Appendix-1 contains the full list of ethical/Islamic and conventional securities used in the model. We specify our research objectives in a stochastic multiple objectives framework as:

$Min\ \delta_1^- + \delta_2^- + \delta_3^+$

$s.t.$

$$E\left(\sum_{i=1}^{60} R_i x_i\right) - \emptyset^{-1}(1-\alpha)\sigma\left(\sum_{i=1}^{60} R_i x_i\right) + \delta_1^- = 0.03 \quad i = 1, \dots, 60$$

$$E\left(\sum_{i=1}^{28} R_i x_i\right) - \emptyset^{-1}(1-\alpha)\sigma\left(\sum_{i=1}^{28} R_i x_i\right) + \delta_2^- = 0.07 + 0.025 \quad i = 1, \dots, 28$$

$$x_i V x_i' - \delta_3^+ = 0 \quad i = 1, \dots, 60$$

$$0 \le x_i \le 0.05 \quad i = 1, \dots, 60$$

$$\delta_1^-, \delta_2^- and\ \delta_3^+ \ge 0$$

Table2: Attainment of objectives

Portfolio	Portfolio 1	Portfolio 2	Portfolio 3
$\sum_{i=1}^{28} x_i$	35%	23%	15%
Probability of loss (α)	30%	20%	10%
Total Return (TR)	0.0247	0.01317263	0.00900124
Social Welfare Return (SWR)	0.04223555	0.02950256	0.01729355
Risk	0.01479697	0.01176202	0.01005761
Sharpe measure TR ((TR-0.02) ÷ Risk)	32.37%	-58.04%	-109.35%
Sharpe measure SWR ((SWR-0.02)÷ Risk)	150.27%	80.79%	-26.90%

Based on the result of our model we calculate the Sharpe performance and we consider the risk free rate in UAE as a part of GCC at 2%.

The results of the model in Table 2 show the impact of two important issues: the effect of different probability of loss [(α) equals 10%, 20% and 30%] on portfolio performance and the effect of different proportion of ethical/Islamic securities (15%, 23% and 35%) on portfolio performance. In portfolio 1 the acceptable probability of loss is 30%, and the portfolio comprised of 35% ethical/Islamic securities. The portfolio total return is 2.47% which higher than 1.32% and 0.9% total return in portfolio 2 and 3 respectively. Portfolios 2 and 3 had acceptable

probability of loss at 20% and 10% respectively with composition of 23% and 15% ethical/Islamic securities respectively. The social welfare return of portfolio 1 is 4.22% which is higher than 2.95% and 1.73% in portfolio 2 and 3 respectively.

The risk of portfolio 1 is 1.47% which is higher than 1.18% and 1% in portfolio 2 and 3 respectively. In terms of Sharpe portfolio performance measure, portfolio 1 yielded highest performance of 32.37% way higher than Portfolio 2 and 3. The results imply that that the acceptance of higher level of probability of loss and inclusion of higher proportion of ethical/Islamic securities have a positive effect on portfolio total return and social welfare objective return and such portfolio perform extremely well.

In the next step we build the Islamic portfolio based on *Shari'ah* compliant framework and examine the effect of *Shari'ah* regulation on portfolio performance. The amount of acceptable non permissible income in the portfolio is based on *Shari'ah* stipulations. According to Official Islamic Indices such as the Dow Jones, S&P and MSCI, a level of only 5% of impermissible income is acceptable (D&J, S&P& MSCI Websites 2011). However, based on the *Shari'ah* Advisory Council (SAC) of the Malaysian Securities and Exchange Commission (SEC), the percentage of impermissible income or activities can range between 5% and 25% (Cited by Rahimie, 2010). In this paper we consider only the level of 5% and 25% of impermissible activities in the portfolio by adding one more constraint as follows to our model:

$$\sum_{i=}^{28} x_i \geq 95\% \; and \sum_{i=1}^{28} x_i \; \geq 75\%$$

Table 3: Attainment of objectives of Islamic portfolio based on *Shari'a*h compliant

Portfolio	Portfolio 4	Portfolio 5
$\sum_{i=1}^{28} x_i$	95%	75%
Probability of Loss	30%	30%
Total Return (TR)	0.082803	0.054329
Social Welfare Return (SWR)	0.075692	0.066785
Risk	0.046913	0.023693
Sharpe measure TR ((TR-0.02) ÷ Risk)	133.87%	144.89%
Sharpe measure SWR ((SWR-0.02) ÷ Risk)	118.71%	197.46%

The result in table 3 indicates that inclusion of higher proportion of ethical/Islamic securities in the portfolio yield higher portfolio total return.

5. Conclusion

In this paper, we proposed a model which is based on *Shari'ah* compliant framework, stochastic environment, goal programming and chance constrained approach to solve ethical stochastic multiple objectives programming in portfolio selection. The empirical results show that the overall performance of portfolio that included more ethical/Islamic securities outperform those portfolio that included less ethical/Islamic securities. Secondly, the model results show that the acceptable higher probability of loss has a positive effect on portfolio return which is consistent with the study by Masri (2017).

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Appendix 1: List of 60 securities

Islamic securities:	**Conventional securities:**
Al-Enmaa Real Estate Company	Bahrain Car Parks
Makkah Construction and Development	Mena Holding Group
Taiba Holding	Zad Holding
Arriyadh Development	Tamdeen Real Estate
Ajial Real Estate Entertainment	Shurooq Investment Services Holding
Saudi Real Estate	Al-Arabiya Real Estate
Union Properties	Al-Massaleh Real Estate
Kuwait Real Estate Company	National Securities
Mabanee Company	Global Financial Investments Holding
Investors Holding Group	A Sharqiya Investment Holding
GFH Financial Group	United Development
Commercial Real Estate	International Resorts Company
Aayan Real Estate Company	Sanam Real Estate Company
Aldar Properties	Privatization Holding
RAK Properties	Kuwait Real Estate Holding
AWJ Holding	Al Dar National Real Estate
Dubai Financial Market	Al-Themar International Holding Company
Arkan Al Kuwait Real Estate Company	Al Deera Holding
Deyaar Development	Dlala Brokerage and Investment Holding
Jabal Omar Development	Al-Salam Group Holding
Al Argan International Real Estate	Taameer Real Estate Investment
Seef Properties	IFA Hotels and Resorts
Abyaar Real Estate Development Company	Tejoori Ltd
Dar Al Arkan Real Estate Development Company	Emaar The Economic City
First Dubai for Real Estate Development	Kingdom Holding
Taiba Kuwaiti Holding	Munshaat Real Estate Projects
Mazaya Qatar Real Estate Development	Al Safwa Group Holding
Al Mudon International Real Estate	Grand Real Estate
	Union Real Estate
	Kuwait Commercial Market Complex
	Industrial & Financial Investments
	Sorouh Real Estate