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Portfolio Optimization of Technology Companies in Malaysia with Mean-Gini Model

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ABSTRACT

The investors wish to generate return in their investment at minimum risk. The mean-Gini (MG) model has been introduced in portfolio optimization. The objective function of this model is to minimize Gini as a measure of portfolio risk subject to the expected rate of return. This study aims to construct an optimal portfolio with MG model to minimize Gini at the expected rate of return. The data consists of the listed companies from technology sector in Malaysia. Technology companies are important in the development of a country. In the fourth industrial revolution, the technology companies will promote the economic growth of a country. The results indicate that the investors will be able to achieve the expected rate of return at minimum risk with the MG model. This study is significant because it will increase the wealth of the investors and further boost the economy in Malaysia.

Keywords: Risk, Return, Portfolio

INTRODUCTION

In the fourth industrial revolution, technology companies play an important role in the development of economic growth of a country. The technology companies will contribute towards the accomplishment of Vision 2050 in Malaysia which is to transform Malaysian into smart communities with sustainable national economic growth (Academy of Sciences Malaysia, 2017). Investors wish to generate return from the investment of technology companies at minimum risk. The Mean-Variance (MV) model has been firstly introduced in portfolio optimization to minimize the portfolio risk by using variance as risk measure (Markowitz, 1952; Lam and Lam, 2015a, b). However, the MV model depends strictly on the assumptions that the returns of assets are normally distributed or utility function of investors is quadratic and these two conditions do not hold in practice (Wilford, 2012).

Mean-Gini (MG) model has been proposed to minimize the portfolio risk in the investment to overcome the limitations of the MV model (Yitzhaki, 1982). The MG model does not rely on normal distribution or quadratic utility function assumptions. The MG model is a portfolio optimization model that used to develop an optimal portfolio to achieve the expected rate of return at minimum risk. In MG model, the portfolio risk is measured by Gini whereas the expected rate of return is measured by the mean return. The MG model has been studied by the researchers in different countries (Agouram and Lakhnati, 2015; Cheung et al., 2007; Lam et al., 2019; Okunev, 1991; Ringuest et al., 2004; Saiful and Lam, 2012; Shalit and Yitzhaki, 1989; Shalit and Yitzhaki, 2005; Yitzhaki and Shalit, 1986). This study aims to build the optimal portfolio of technology companies with the MG model to achieve target rate of return at minimum risk.

MATERIALS AND METHODS

Data

In this study, the data consists of monthly returns of 30 listed technology companies in Malaysia for the period from January 2011 to December 2017. The MG model is employed to build an optimal portfolio in achieving the expected rate of return at minimum risk. The target return of this study is set as 0.0100. The MG model is shown as follows:

$$\text{Minimize } 2\operatorname{cov}[R_p, F(R_p)] \tag{1}$$

Subject to

$$\sum_{i=1}^{n} x_i \mu_i = E(R_p) \tag{2}$$

$$\sum_{i=1}^{n} x_i = 1 \tag{3}$$

$$x_i \geq 0, i = 1, \ldots, n \tag{4}$$

where
$F(R_p)$: cumulative probability distribution of the portfolio return,
x_i : weight of asset *i*,
$E(R_p)$:mean return of portfolio
R_p : portfolio return,
μ_i : mean return of asset *i*:

Objective function (1) defines the portfolio Gini which is the portfolio risk measure. Constraint (2) indicates that the portfolio mean return equals to the investor's expected rate of return. Constraint (3) indicates that the sum of weight for the assets to be invested equals to 1. Constraint (4) indicates that the weights of assets are positive.

RESULTS

Table 1 displays the summary statistics of monthly returns of 30 technology companies which are mean, standard deviation, skewness as well as kurtosis.

TABLE 1. Summary statistics of monthly returns of 30 technology companies.

Technology Companies	Mean	Standard Deviation	Skewness	Kurtosis
CENSOF	0.0012	0.1390	0.3467	0.2702
CUSCAPI	0.0223	0.1818	1.8836	7.7816
D&O	0.0221	0.1345	1.9750	6.5675
DATAPRP	0.0148	0.2199	4.4593	26.4791
DIGISTA	0.0047	0.1200	1.8939	5.5239
DNEX	0.0090	0.1319	0.9032	2.8158
EFORCE	0.0554	0.2704	1.7925	6.7917
ELSOFT	0.0316	0.1031	0.7529	1.9753
FRONTKN	0.0202	0.1420	0.8143	1.9453
GHLSYS	0.0357	0.1841	2.0694	8.3705
GRANFLO	0.0051	0.0583	0.8557	0.5876
GTRONIC	0.0252	0.0967	-0.1992	2.9246
HTPADU	-0.0033	0.0758	0.3560	0.5324
ITRONIC	0.0086	0.1894	1.3101	6.9669
JCY	0.0018	0.1368	1.0118	2.1770
KESM	0.0295	0.0909	1.1879	2.0842
KEYASIC	0.0312	0.2810	2.7632	12.6687
MMSV	0.0522	0.2539	1.6469	6.5642
MPI	0.0119	0.0953	1.1016	2.0335
MSNIAGA	-0.0027	0.0630	0.5371	3.9271
MYEG	0.0405	0.1124	1.9740	7.3989
NOTION	0.0022	0.1390	2.6278	13.5291
OMESTI	-0.0020	0.0985	1.8897	9.0160
PENTA	0.0782	0.3365	2.3576	8.3851
THETA	0.0010	0.1405	1.3650	2.3546
TRIVE	0.0081	0.2566	1.8189	6.5458
TURIYA	-0.0060	0.1322	1.5760	5.6700
UNISEM	0.0104	0.1127	0.4538	1.4894
VITROX	0.0794	0.3390	1.5311	3.7742
WILLOW	0.0177	0.1079	2.1330	10.4595

The mean, standard deviation, skewness as well as kurtosis of returns of each technology companies are reported in table 1. VITROX gives the highest mean (0.0794) and standard deviation (0.3390) value. DATAPRP gives the highest skewness (4.4593) and kurtosis value (26.4791). In contrast, TURIYA, GRANFLO, GTRONIC, CENSOF give the lowest mean (-0.0060), standard deviation (0.0583), skewness (-0.1992) and kurtosis (0.2702) value respectively. The investors prefer higher mean, lower standard deviation, higher skewness and lower kurtosis to reduce the probability of getting extreme loss (Lai, 1991; Mhiri and Prigent, 2010).

Table 2 shows the optimal portfolio composition of the MG model.

TABLE 2. Optimal portfolio composition of the MG model

Technology Companies	Weights (%)
CENSOF	0.00
CUSCAPI	0.00
D&O	0.00
DATAPRP	0.00
DIGISTA	1.99
DNEX	0.00
EFORCE	0.00
ELSOFT	0.81
FRONTKN	0.00
GHLSYS	0.00
GRANFLO	28.83
GTRONIC	4.07
HTPADU	0.00
ITRONIC	1.99
JCY	0.00
KESM	12.21
KEYASIC	0.43
MMSV	0.00
MPI	2.59
MSNIAGA	26.23
MYEG	5.98
NOTION	0.00
OMESTI	7.92
PENTA	1.01
THETA	2.46
TRIVE	0.00
TURIYA	2.55
UNISEM	0.00
VITROX	0.93
WILLOW	0.00

Based on table 2, the optimal portfolio consists of DIGISTA (1.99%), ELSOFT (0.81%), GRANFLO (28.83%), GTRONIC (4.07%), ITRONIC (1.99%), KESM (12.21%), KEYASIC (0.43%), MPI (2.59%), MSNIAGA (26.23%), MYEG (5.98%), OMESTI (7.92%), PENTA (1.01%), THETA (2.46%), TURIYA (2.55%) and VITROX (0.93%). It implies that 1.99% of fund is invested in DIGISTA, 0.81% of fund is invested in ELSOFT, 28.83% of fund is invested in GRANFLO, 4.07% of fund is invested in GTRONIC, 1.99% of fund is invested in ITRONIC, 12.21% of fund is invested in KESM, 0.43% of fund is invested in KEYASIC, 2.59% of fund is invested in MPI, 26.23% of fund is invested in MSNIAGA, 5.98% of fund is invested in MYEG, 7.92% of fund is invested in OMESTI, 1.01% of fund is invested in PENTA, 2.46% of fund is invested in THETA, 2.55% of fund is invested in TURIYA and 0.93% of fund is invested in VITROX. GRANFLO is the largest component while KEYASIC is the smallest component. CENSOF, CUSCAPI, D&O, DATAPRP, DNEX, EFORCE, FRONTKN, GHLSYS, HTPADU, JCY, MMSV, NOTION, TRIVE, UNISEM and WILLOW give the 0% in the optimal portfolio. It indicates that these technology companies are not included in the optimal portfolio of MG model.

Table 3 presents the statistics of the optimal portfolio of the MG model.

TABLE 3. Statistics of the optimal portfolio of the MG model

Portfolio	Measurement
Mean Return	0.0100
Risk (Gini)	0.0216

As presented in table 3, the MG model gives the portfolio mean return at 0.0100 with portfolio risk (Gini) at 0.0216. This implies that the investors are able to achieve the expected rate of return at 0.0100 which is the target return of this study at minimum risk (0.0216) by constructing the optimal portfolio with the MG model for investment.

CONCLUSION

In conclusion, the optimal portfolio is constructed in this study with the MG model. It is a pioneer study of portfolio optimization of technology companies in Malaysia by employing the MG model. This study shows that the investors are able to achieve the expected rate of return at minimum risk with the MG model. The MG model overcomes the limitations of the MV model because it does not rely on normal distribution or quadratic utility function assumptions. This study is significant because it will increase the wealth of the investors and further boost the economy in Malaysia. This study should be extended to technology companies in other countries for future research.

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