

## PORTFOLIO OPTIMIZATION OF THE CONSTRUCTION SECTOR COMPANIES IN MALAYSIA WITH MEAN-SEMI ABSOLUTE DEVIATION MODEL

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### ABSTRACT

Portfolio optimization is an important investment strategy to find the trade-off between the risk and return. In mean-semi absolute deviation model, semi absolute deviation is employed as risk measure while the expected return of the investors is represented by the mean return. The objective of this paper is to construct the optimal portfolio that will minimize the portfolio risk and can achieve the investors target rate of return by using the mean-semi absolute deviation model. The data of this study comprises 20 construction sector companies that listed in Malaysia stock market from July 2011 until June 2016. The results of this paper show that the constructed optimal portfolio can minimize the portfolio risk at the expected rate of return. In addition, the composition of the companies invested in the optimal portfolio is different.

**Keywords:** portfolio risk; return; investment; investors.

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## 1. INTRODUCTION

Risk and return are two important parameters to be considered in the investment. Investors wish to minimize the risk of loss and achieve the target rate of return in their investment. Portfolio optimization is an important strategy in investment to construct the optimal portfolio that will minimize the portfolio risk at the expected rate of return. Konno and Yamazaki [1] have proposed the mean-absolute deviation model in portfolio optimization to minimize the portfolio risk and can get the expected rate of return. The absolute deviation is used as risk measure in the mean-absolute deviation model. On the other hand, the expected return of the investors is represented by the mean return. The mean-absolute deviation model has been studied by the past researchers in portfolio optimization [2-5]. Speranza [6] has further introduced the mean-semi absolute deviation model. The semi absolute deviation model is employed to measure the portfolio risk. The mean-semi absolute deviation model has been studied in the past [7-9]. The mean-semi absolute deviation model is an optimization model with its objective function to minimize the portfolio risk which is semi absolute deviation. The optimization models have also been applied in different areas other than portfolio such as supply chain [10], production [11], harvesting [12] and palm oil [13]. The researches on portfolio optimization have not been actively studied in Malaysia using the mean-semi absolute deviation model. The objective of this study is to construct the optimal portfolio that will minimize the portfolio risk and can achieve the investors target rate of return by using the mean-semi absolute deviation model in the portfolio optimization of the construction sector companies that listed in Malaysia stock market. The rest of the paper is structured as follows. The next section describes the materials and methods. Section 3 discusses about the empirical results of this paper. Section 4 concludes the paper.

## 2. MATERIAL AND METHOD

### 2.1. Material

The data of this study consists of 20 construction sector companies that listed in Malaysia stock market. The period of this study covers from July 2011 until June 2016. Table 1 presents the name list of 20 construction sector companies in this study with abbreviation.

**Table 1.** Name list of 20 construction sector companies

Abbreviation	Name of Companies
ASUPREM	ASTRAL SUPREME BERHAD
AZRB	AHMAD ZAKI RESOURCES BERHAD
BENALEC	BENALEC HOLDINGS BERHAD
BPURI	BINA PURI HOLDINGS BHD
CRESBLD	CREST BUILDER HOLDINGS BERHAD
EKOVEST	EKOVEST BERHAD
FAJAR	FAJARBARU BUILDER GROUP BHD
GADANG	GADANG HOLDINGS BHD
GAMUDA	GAMUDA BERHAD
HSL	HOCK SENG LEE BERHAD
IJM	IJM CORPORATION BERHAD
JAKS	JAKS RESOURCES BERHAD
KEURO	KUMPULAN EUROPLUS BERHAD
KIMLUN	KIMLUN CORPORATION BERHAD
MITRA	MITRAJAYA HOLDINGS BERHAD
MUDAJYA	MUDAJAYA GROUP BERHAD
MUHIBAH	MUHIBBAH ENGINEERING (M) BHD
PRTASCO	PROTASCO BERHAD
PUNCAK	PUNCAK NIAGA HOLDINGS BERHAD
WCT	WCT HOLDINGS BERHAD

## 2.2. Mean-Semi Absolute Deviation Model

Konno and Yamazaki [1] have introduced the absolute deviation as the risk function, which is shown as follows:

$$w(x) = E \left[ \left| \sum_{j=1}^n R_j x_j - E \left[ \sum_{j=1}^n R_j x_j \right] \right| \right] \quad (1)$$

The mean-absolute deviation model [1] is formulated as follows:

$$\text{Minimize } w(x) = E \left[ \left| \sum_{j=1}^n R_j x_j - E \left[ \sum_{j=1}^n R_j x_j \right] \right| \right] \quad (2)$$

subject to

$$\sum_{j=1}^n E[R_j]x_j \geq \rho M_0 \tag{3}$$

$$\sum_{j=1}^n x_j = M_0 \tag{4}$$

$$0 \leq x_j \leq u_j, j = 1, \dots, n \tag{5}$$

where  $R_j$  is the return of asset  $j$ ,  $x_j$  is the amount invested in asset  $j$ ,  $\rho$  is a parameter representing the minimal rate of return required by an investor,  $M_0$  is the total amount of fund and  $u_j$  is the maximum amount of money which can be invested in asset  $j$ .

Konno and Yamazaki [1] assume  $r_{jt}$  be the realization of random variable  $R_j$  during period  $t$  ( $t = 1, 2, \dots, T$ ), then

$$r_j = E[R_j] = \sum_{t=1}^T \frac{r_{jt}}{T} \tag{6}$$

$w(x)$  can be approximated as follows:

$$E\left[\sum_{j=1}^n R_j x_j - E\left[\sum_{j=1}^n R_j x_j\right]\right] = \frac{1}{T} \sum_{t=1}^T \left| \sum_{j=1}^n (r_{jt} - r_j) x_j \right| \tag{7}$$

where

$$a_{jt} = r_{jt} - r_j \tag{8}$$

Then, model (2)-(5) converts to the following model:

$$\text{Minimize } \sum_{t=1}^T \left| \sum_{j=1}^n a_{jt} x_j \right| / T \tag{9}$$

subject to

$$\sum_{j=1}^n r_j x_j \geq \rho M_0 \tag{10}$$

$$\sum_{j=1}^n x_j = M_0 \tag{11}$$

$$0 \leq x_j \leq u_j, j = 1, \dots, n \quad (12)$$

Model (9)-(12) are equivalent to the following linear programming model:

$$\text{Minimize } \sum_{t=1}^T y_t / T \quad (13)$$

subject to

$$y_t + \sum_{j=1}^n a_{jt} x_j \geq 0, t = 1, \dots, T \quad (14)$$

$$y_t - \sum_{j=1}^n a_{jt} x_j \geq 0, t = 1, \dots, T \quad (15)$$

$$\sum_{j=1}^n r_j x_j \geq \rho M_0 \quad (16)$$

$$\sum_{j=1}^n x_j = M_0 \quad (17)$$

$$0 \leq x_j \leq u_j, j = 1, \dots, n \quad (18)$$

Speranza [6] has further proposed the mean-semi absolute deviation model by using semi absolute deviation as risk measure instead of absolute deviation. This model is equivalent to the mean-absolute deviation model [1], but halves the number of required constraints. The mean-semi absolute deviation model [6] is formulated as follows:

$$\text{Minimize } \sum_{t=1}^T y_t / T \quad (19)$$

subject to

$$y_t + \sum_{j=1}^n a_{jt} x_j \geq 0, t = 1, \dots, T \quad (20)$$

$$\sum_{j=1}^n r_j x_j \geq \rho M_0 \quad (21)$$

$$\sum_{j=1}^n x_j = M_0 \quad (22) \quad 0 \leq x_j \leq u_j, j = 1, \dots, n \quad (23)$$

The optimal portfolio is constructed using the mean-semi absolute deviation model (19)-(23) to minimize the portfolio risk and achieve the expected rate of return. The summary statistics of the optimal portfolio are also generated in this study.

### 3. RESULTS AND DISCUSSION

Table 2 displays the mean and standard deviation of the weekly stocks returns of the 20 construction sector companies in this study.

**Table 2.** Mean and standard deviation of the 20 stocks returns

<b>Stock</b>	<b>Mean</b>	<b>Standard Deviation</b>
ASUPREM	0.0010	0.0918
AZRB	0.0009	0.0476
BENALEC	-0.0031	0.0457
BPURI	-0.0038	0.0372
CRESBLD	0.0014	0.0439
EKOVEST	-0.0006	0.0480
FAJAR	-0.0019	0.0354
GADANG	0.0054	0.0498
GAMUDA	0.0012	0.0294
HSL	0.0005	0.0329
IJM	-0.0013	0.0405
JAKS	0.0029	0.0580
KEURO	0.0005	0.0421
KIMLUN	0.0008	0.0400
MITRA	0.0041	0.0532
MUDAJYA	-0.0041	0.0493
MUHIBAH	0.0034	0.0578
PRTASCO	0.0027	0.0402
PUNCAK	-0.0006	0.0669
WCT	-0.0018	0.0411

On the other hand, Table 3 displays the skewness and kurtosis of the weekly stocks returns of the 20 construction sector companies in this study.

**Table 3.**Skewness and kurtosis of the 20 stocks returns

<b>Stock</b>	<b>Skewness</b>	<b>Kurtosis</b>
ASUPREM	0.1361	2.9697
AZRB	2.5456	14.0829
BENALEC	0.2797	1.4396
BPURI	0.3916	2.1582
CRESBLD	3.2929	24.7405
EKOVEST	-3.7395	43.6247
FAJAR	0.3483	1.8876
GADANG	1.6259	5.3104
GAMUDA	0.8359	5.7328
HSL	1.2212	6.1952
IJM	-7.4293	92.6757
JAKS	0.9512	3.1958
KEURO	1.2848	6.8147
KIMLUN	0.7264	5.9849
MITRA	-0.7646	7.3628
MUDAJYA	0.0537	5.3372
MUHIBAH	1.0180	5.4558
PRTASCO	0.7073	1.9684
PUNCAK	0.5093	13.7999
WCT	0.0878	2.6896

Table 2 and Table 3 show that the mean, standard deviation, skewness and kurtosis of the stock returns are different. Table 4 presents the optimal portfolio composition of the mean-semi absolute deviation model in percentage.

**Table 4.** Optimal portfolio composition of the mean-semi absolute deviation model

<b>Stocks</b>	<b>Composition (Percentage)</b>
ASUPREM	0.95
AZRB	0.00
BENALEC	0.00
BPURI	0.00
CRESBLD	7.48
EKOVEST	1.19
FAJAR	0.00
GADANG	15.62
GAMUDA	38.60
HSL	8.38
IJM	3.74
JAKS	0.00
KEURO	3.13
KIMLUN	0.45
MITRA	0.00
MUDAJYA	0.00
MUHIBAH	2.93
PRTASCO	17.52
PUNCAK	0.00
WCT	0.00

As shown in Table 4, the weight of each company that invested in the optimal portfolio is different. The optimal portfolio of the mean-semi absolute deviation model comprises ASUPREM (0.95%), CRESBLD (7.48%), EKOVEST (1.19%), GADANG (15.62%), GAMUDA (38.60%), HSL (8.38%), IJM (3.74%), KEURO (3.13%), KIMLUN (0.45%), MUHIBAH (2.93%) and PRTASCO (17.52%). AZRB, BENALEC, BPURI, FAJAR, JAKS, MITRA, MUDAJYA, PUNCAK and WCT are not selected to be invested because these construction sector companies give the composition value 0.00% in the optimal portfolio. GAMUDA (38.60%) is the largest component stock in the optimal portfolio.



Table 5 displays the summary statistics of the mean-semi absolute deviation optimal portfolio.

**Table 5.** Summary statistics of the mean-semi absolute deviation optimal portfolio

Summary Statistics	Optimal Portfolio Value
Portfolio Mean Return	0.0020
Portfolio Risk	0.0080
Portfolio Skewness	0.9692
Portfolio Kurtosis	7.1922

As reported in Table 5, the mean-semi absolute deviation optimal portfolio gives the mean return at the rate of 0.0020 with the risk of 0.0080. It implies that the investors can achieve the expected rate of return with the minimum risk by using the mean-semi absolute deviation model. Furthermore, the optimal portfolio gives the skewness and kurtosis value at 0.9692 and 7.1922 respectively.

#### 4. CONCLUSION

In this paper, the mathematical formulation of the mean-semi absolute deviation model is discussed. The optimal portfolio is constructed by using the mean-semi absolute deviation model. The results of this study show that the constructed optimal portfolio can minimize the portfolio risk and can achieve the investors target rate of return. Furthermore, the composition of each stock invested in the optimal portfolio is different. This study is significant because it will give impact to the investors in portfolio management by minimizing the portfolio risk and can achieve the expected rate of return. The future research of this study should be extended to other sectors besides construction sector companies in Malaysia.

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