# Using the Monte Carlo Method to Determine Value at Risk in Hotel Stocks

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## Abstract

This study uses the Monte Carlo simulation method to calculate a stock portfolio's Value at Risk (VaR). Value at risk (VaR) is a standard method for evaluating the risk of loss in a portfolio of financial assets. The research findings predict the maximum loss that portfolio participants may incur. This study experimented 500 times to characterize the risk associated with invested assets. The hotel stocks portfolio on the Indonesian Stock Exchange consists of PT. Eastparc Hotel Tbk (EAST), PT Hotel Sahid Jaya International Tbk (SHID), and PT Dafam Property Indonesia Tbk (DFAM).. The VaR calculation assumes a 200,000,000 IDR capital investment in each share. According to the analysis, the results are unfavorable; thus, investors who purchase the three stocks would lose money. The VaR for EAST is -0.1886 with a maximum loss of IDR 371,242.76, the VaR for SHID is -0.5144 with a maximum loss of IDR 1,028,735.06, and the VaR for DFAM is -0.5339 with a maximum loss of IDR 1,077,704.16.

## Keywords
Hotel stocks, Monte Carlo, Value at Risk

## 1. Introduction
Risk is an essential characteristic of financial activity. Risk is the potential for the actual return or rate to vary from anticipated (the actual return is different from the expected return). Almost all investments in the business sector include uncertainty or risk (Ganzach, 2000). Investors cannot predict with certainty the outcomes of their investments. Investors will also encounter additional challenges. When making financial choices, investors examine both prospective gains and potential hazards.

The value at risk is a standard method for assessing value at risk (VaR). The Value at Risk (VaR) is the highest estimated loss realized over a particular time under normal market circumstances and within a specified confidence range. VaR can be calculated using the parametric method (also known as the variance-covariance method), the Monte Carlo simulation method, or the historical simulation method (Suhobokov, 2007)

The capital market's investment operations are among the most in-demand economic activity among the general populace. Cash market investing is the allocation of sources of capital to generate future profits.(Aleskerova & Fedoryshyna, 2018). One of the several forms of securities offered on the capital market is shares. Due to their susceptibility to external and internal influences, stocks are categorized as high-risk investments. These adjustments may favor or negatively affect the capital market's share values. The fundamental and technical methodologies may be used to analyze these changes: the fundamental and technical approaches (Lui & Mole, 1998).

A series of government-implemented reforms left hospitality issuers with a positive attitude. Initially, there was a decline in PPKM. Second, antigen or PCR test results are no longer required for domestic travel for those who have had two vaccine doses and a booster. The Hotel PT Eastparc (EAST) This policy positively impacts EAST. Small and medium-sized meeting venues and events have excellent occupancy rates. Current hotel occupancy rates range from 75 to 85 percent. This year, EAST hopes to achieve an average hotel occupancy rate between 75% and 85%. Eastparc predicts a revenue range of IDR 55 billion to IDR 65 billion, with a net profit range of IDR 15 billion to IDR 25 billion. EAST included extra family-friendly vacation features, such as mini-trains and wave pools to satisfy performance goals. This issuer is also refurbishing existing facilities to boost hotel occupancy and room revenues, especially for direct-booking consumers (Puspitasari, 2022).

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Shares of PT Hotel Sahid Jaya International Tbk (SHID) grew by 243.59 percent from IDR 780 per share at the start of 2022 to IDR 2,680 per share following trading on February 14, 2022. SHID shares started the first trading day unchanged at IDR 2,680 per share. In the next ten minutes of trading, SHID shares fell 4.85% to IDR 2,550(Desfika, 2022). PT Hotel Sahid Jaya International Tbk (SHID) is optimistic about its success in 2021. Even more optimistically, the company forecasts that revenues for this year might increase by more than 55 percent compared to 2020. Several sources, notably the company's business unit Grand Sahid Jaya Jakarta, which reported a 45 percent occupancy rate rise in the second quarter of 2021, advocated for this target (Kontan.co.id, 2022).

PT Dafam Property Indonesia Tbk (DFAM), through its subsidiary PT Dafam Hotel Management (DHM), saw PPKM's policy relaxation as a positive indicator. The lowering of PPKM and deletion of PCR test findings for domestic travel is outstanding and will increase the occupancy rate of Dafam hotels in Indonesia while keeping regulatory standards compliance. The average hotel occupancy rate in Dafam is now between 50 to 70 percent, which is an improvement and growth over the previous year but is still superior. There are also government or business initiatives within the MICE sector  (Puspitasari, 2022).

## 1.1 Objectives
This study's objective is to determine the value at risk of the hotel company's assets, namely PT. Eastparc Hotel Tbk (EAST), PT Hotel Sahid Jaya International Tbk (SHID), and PT Dafam Property Indonesia Tbk (DFAM). in addition to the portfolio constructed by the three assets using the Monte Carlo method.

# 2. Literature Review

## 2.1 Stocks
Stocks are one of the most sought-after products among investors due to their favorable rate of return. Stocks indicate ownership in a corporation or limited liability firm. (Galema et al., 2008). Investors are referred to as shareholders (shareholders or stockholders). On the reverse page of the share sheet, where the corporation has recorded the shareholder's name, is further documentation (issuer). Investors should analyze their chosen stocks before buying to prevent making costly blunders. Due to the volatility of share values, which might increase and decrease. With sound judgment, shareholders may obtain expectedly beneficial returns.

## 2.2 Hotel Stocks
The following hotel stocks are evaluated in this study:

PT. Hotel Sahid Jaya International Tbk (SHID) is in the business of hotels and accommodation and hotel-related leasing. In addition, the corporation participates in direct or indirect activities with the companies mentioned above. 1974 marked the beginning of commercial activities (Idnfinancials, 2022b).

Yogyakarta saw the birth of PT. Eastparc Hotel Tbk (EAST) on July 26, 2011. The company collaborates with five- and four-star hotels, restaurants, bars, and event planners. Since October 2013, the firm has owned and operated 1 (one) 5-star hotel, the Eastparc Hotel in Yogyakarta.(Idnfinancials, 2022a).

PT Dafam Hotel Management is a hotel operator with a reputation for Indonesian hospitality and a willingness to give exceptional service. Indonesian hospitality services have been doing well since 2010 (Dafamhotels, 2022). PT Dafam Hotel Management is a subsidiary of PT Dafam Property Indonesia Tbk (DPI), a local developer symbolizing Indonesia's high morals and hospitality. Since its inception in 2011, they have constructed commercial and residential structures, as well as five-star hotels and resorts, from Sabang to Merauke. They have grown into a complete real estate solution to fulfill the needs of the residential and commercial sectors or hotels and resorts (dafamproperty, 2022).

## 2.3 Portfolio
A portfolio is a collection of assets held by investors, comprising stocks, bonds, mutual funds, and cash on hand. (Tola et al., 2008). Buildings, works of art, and jewelry are also considered invested assets since their future worth may grow (gain).

### 2.4 Investment return and risk

When investing, investors will meet both profit and risk. The return is the increase or decrease in value investors acquire via their investment over a specific period. (Olsen, 1997). The return on investment may be realized via dividends and capital gains. Generally, stock returns fall into two categories: a) Realized returns, or returns calculated using the company's historical information. This performance may be used to gauge the company's current and future performance; b) Expected return, the return investors anticipate getting in the future. Various possibilities for the company's future might influence expected returns. In addition to profitability, it is evident that investors may bear some risks. Investing risk is the possibility of incurring a loss via investment activity. There are two types of investing risk: systematic and unsystematic (Olsen, 1997). Systematic risk is an external and uncontrollable sort of risk, while the unsystematic risk is a controllable type of risk (Vongphachanh & Ibrahim, 2020)

### 2.5 Return and risk of the portfolio

The projected return and risk must be considered when making investment choices. By merging them in a portfolio, these two variables may be determined. Portfolio returns include actual and anticipated returns. (Tola et al., 2008). The portfolio's realized return is the average of each security's realized return, whereas the portfolio's anticipated return is the average of each security's expected return. The same holds for estimating the risk of each portfolio component.

### 2.6 Value at Risk Monte Carlo Simulation

Value at risk is a metric for measuring the most significant risk or loss that may be tolerated in a portfolio with a certain degree of confidence or trust. There are two fundamental considerations for Value at Risk: a) time horizon, a period for computing Value at Risk that might be daily, weekly, or monthly; b) confidence level, the size of potential losses. Three approaches exist for calculating the Value at Risk: a) Variance Covariance, a calculating approach that assumes the portfolio is generally dispersed such that the portfolio's return is typically distributed. Requires information on the standard deviation and covariance of the portfolio's securities; b) Historical Simulation, a technique that leverages historical data with a non-parametric approach (Chen et al., 2019). This approach is accomplished by watching the portfolio's performance over time; c) Monte Carlo, a method that estimates the Value at Risk by generating random numbers depending on the qualities of the data to be created. Normally distributed data is required for the Monte Carlo simulation

## 3. Methods

**Types of research**

This study category encompasses descriptive research. This research will outline the development of an optimum portfolio of real estate equities using a single index model and calculate the portfolio's value at risk using Monte Carlo simulations.

## 4. Data Collection

### 4.1 Data source

This research utilizes secondary data, which consists of the daily closing prices of PT. Eastparc Hotel Tbk (EAST), PT Dafam Property Indonesia Tbk (DFAM), and PT Hotel Sahid Jaya International Tbk (SHID) from March 1, 2020, to July 1, 2022, as published on the website of the Indonesian Stock Exchange. This investigation was conducted by obtaining Internet data rather than physically visiting the place. The accessed site is www.idx.co.id.

### 4.2 Data analysis procedure

1. Describe the development of the share prices for PT. Eastparc Hotel Tbk (EAST), PT Dafam Property Indonesia Tbk (DFAM), and PT Hotel Sahid Jaya International Tbk (SHID) from March 1, 2020, to July 1, 2022, including two years and five trading months.

Determine the achieved return and predicted return for each security. The following formula is used to estimate the risk and return of each security:

## 4.3 Calculation of market return and expected market return

$$Rm = \frac{IHSG_t - IHSG_{t-1}}{IHSG_{t-1}} \quad E(Rm) = \frac{\sum_{i=1}^{n} Rm}{n}$$

Information:
Rm     = Market return
$IHSG_t$   = Composite Stock Price Index for the current period
$IHSG_{t-1}$ = Previous Period Composite Stock Price Index
E(Rm)   = Expected market return
n       = Observation period

## 4.4 Calculation of the standard deviation of stocks and the market

The standard deviation measures the absolute risk of a portfolio of investments, combining market risk and portfolio risk. The greater the standard deviation, the greater the acceptable level of risk. Excel's STDEV formula may be used to calculate the standard deviation, or it can be calculated manually.:

$$\sigma i = \sqrt{\frac{\sum_{i=1}^{n} [Ri - E(Ri))]^2}{n}} \, , \sigma M^2 = \frac{\sum_{i=1}^{n} [(R_M - E(R_M)]^2}{n-1}$$

Information :
i         = Stock standard deviation i
M2       = Standard deviation of market return
Ri       = Return on shares i
$R_M$     = Market return
E(Ri)    = Expected return of share i
E($R_M$) = Expected Market return
n         = Observation period

## 4.5 Calculation of the beta of each share

Beta (βi) is the unique risk of individual stocks, calculating the slope of a stock's realized return with the market's (JCI) realized return within a given period. Beta is used to calculate the Excess Return to Beta (ERB), and Bj is needed to calculate the Cutoff Point (Ci). Beta can be calculated with the Excel program using the Slope formula.

$$\beta i = \frac{\sigma i}{\sigma m2}$$

Information:
βi       = beta stock i
σi       = stock standard deviation i
σm2     = market standard deviation i

## 4.6 Calculation of the alpha of each share

*Alpha* (α) s the intersection of the realized return of stock i with the realized return of the market (IHSG), comparing the calculation of the realized return of stock i with the realized return of the market (CSPI) within a certain period. Alpha is used to calculate the error variance ("αi "). Alpha is calculated with the Excel program using the Intercept formula or using the formula:
αi = E(Ri) - (βi.E(Rm))
Information:
αi   = *alpha* stock i
βi   = *beta* stock i
Rm = market *return*

### 4.7 Calculation of residual error variance ($\sigma ei^2$)

The residual error variance indicates the magnitude of unsystematic risk unique to the firm. Constant values of y make the residual error is expected value equal to zero. The magnitude of the unique unsystematic risk ($\sigma ei^2$) is calculated using the formula:

$\sigma ei^2 = \sigma i^2 - (\beta i^2 . \sigma m^2)$

### 4.8 Optimal portfolio formation

The optimal portfolio is formed using a single index model, while the calculation uses the Microsoft Excel program. The stages of forming the optimal portfolio using the single index model are as follows::

A.  Calculation of excess return to beta (ERB)

   $\text{ERBi} = \dfrac{E(Ri) - R_{BR}}{\beta i}$

   Information:

   ERBi = *excess return* to beta sekuritas ke-i

   E(Ri) = *expected return based on a single index model for the ith security* RBR $R_{BR}$ = *return of the risk-free asset*

   βi = Beta security-i

B.  Calculation of the cutoff point

   1.) Sort the values from the most significant ERB value to the smallest one. Stocks with the highest ERB values are candidates for inclusion in the optimal portfolio.

   2.)

   3.) Calculation of the values of Ai and Bi for each of the i values

   $\text{Ai} = \dfrac{[E(Ri) - R_{BR}] . \beta i}{\sigma ei^2}$

   and

   $\text{Bi} = \dfrac{\beta i^2}{\sigma ei^2}$

   Information:

   $\sigma ei^2$ = variance of the residual error of the I-th value, which is also the unique or unsystematic risk.

   4.) Calculation of the value of Ci

   $\text{Ci} = \dfrac{\sigma m^2 \sum_{j=i}^{i} \frac{[E(Ri) - (R_{BR})] . \beta i}{\sigma ei^2}}{1 + \sigma m^2 \sum_{j=i}^{i} \frac{\beta i^2}{\sigma ei^2}}$

   a.  The cutoff point (C*) is the Ci value, where the last ERB value is still more significant than the Ci value.

   b.  The securities that make up the optimal portfolio are those whose ERB value is greater than or equal to the ERB value of point C*. Stocks with a smaller ERB with an ERB of point C* are not included in the formation of the optimal portfolio.

   5.) Determine the proportion of each security in the portfolio.

   Securities that make up the optimal portfolio have been determined, proportion calculation of each of these securities in the optimal portfolio is carried out with the formula:

$$Wi = \dfrac{Zi}{\sum_{j=1}^{K} Zj}$$

   the value of Zi is equal to

   $\text{Zi} = \dfrac{\beta i}{\sigma ei^2} (\text{ERBi} - \text{C*})$

   Information:

   Wi  = Safety ratio to i

   Zi  = weighted scale

   K  = number of stocks in the optimal portfolio

   $\beta i$  = Beta security

   $\sigma ei^2$ = variance of the residual safety error at i

   ERBi = *Excess return* to beta stock i

   C*  = Value of the cutoff point that is the highest value of Ci

6.) Calculation of portfolio returns
The following is a calculation or formula for calculating portfolio returns::
$$E(IDR) = \sum_{i=1}^{n} \quad [Wi.E(Ri)]$$
Information:
E(IDR) = expected return on the portfolio
wi = portion of stock i to all securities in the portfolio
E(Ri) = expected return of the i-th security
n = number of individual values

7.) Calculation of portfolio risk
Portfolio risk is the variance of the return of the securities that make up the portfolio. The risk level of a stock portfolio expressed as the portfolio variance can be determined by the following equation:

$$\sigma p2 = \left(\sum_{i=1}^{n} \quad Wi.\beta i\right)^2 \sigma m^2 + \left(\sum_{i=1}^{n} \quad Wi.\sigma ei\right)$$

## 5. Results

They were using Microsoft Excel, the expected return on PT. Eastparc Hotel Tbk (EAST), PT Dafam Property Indonesia Tbk (DFAM), and PT Hotel Sahid Jaya International Tbk (SHID) were calculated. The expected results using Microsoft Excel are as follows: (Tables 1 -3)

| Table 1. Return Eastparc Hotel Tbk (EAST) | | | |
|---|---|---|---|
| Year | Month | Stock Price | Stock Return |
| 2020 | March | 56 | |
| | April | 59 | 0.0536 |
| | May | 52 | -0.1186 |
| | June | 64 | 0.2308 |
| | July | 55 | -0.1406 |
| | August | 53 | -0.0364 |
| | September | 52 | -0.0189 |
| | October | 54 | 0.0385 |
| | November | 63 | 0.1667 |
| | December | 60 | -0.0476 |
| 2021 | January | 54 | -0.1000 |
| | February | 56 | 0.0370 |
| | March | 76 | 0.3571 |
| | April | 75 | -0.0132 |
| | May | 66 | -0.1200 |
| | June | 67 | 0.0152 |
| | July | 62 | -0.0746 |
| | August | 62 | 0.0000 |
| | September | 66 | 0.0645 |
| | October | 97 | 0.4697 |
| | November | 91 | -0.0619 |
| | December | 96 | 0.0549 |
| 2022 | January | 86 | -0.1042 |
| | February | 89 | 0.0349 |
| | March | 91 | 0.0225 |
| | April | 92 | 0.0110 |
| | May | 92 | 0.0000 |
| | June | 90 | -0.0217 |
| | July | 92 | 0.0222 |

| Table 2 Return PT Hotel Sahid Jaya International Tbk (SHID) | | | |
|---|---|---|---|
| Year | Month | Stock Price | Stock Return |
| 2020 | March | 3980 | |
| | April | 3500 | -0.1206 |
| | May | 3500 | 0.0000 |
| | June | 3650 | 0.0429 |
| | July | 4000 | 0.0959 |
| | August | 3600 | -0.1000 |
| | September | 3600 | 0.0000 |
| | October | 3500 | -0.0278 |
| | November | 2420 | -0.3086 |
| | December | 2600 | 0.0744 |
| 2021 | January | 2620 | 0.0077 |
| | February | 2700 | 0.0305 |
| | March | 2240 | -0.1704 |
| | April | 2300 | 0.0268 |
| | May | 2600 | 0.1304 |
| | June | 2110 | -0.1885 |
| | July | 1475 | -0.3009 |
| | August | 950 | -0.3559 |
| | September | 1100 | 0.1579 |
| | October | 1310 | 0.1909 |
| | November | 1300 | -0.0076 |
| | December | 780 | -0.4000 |
| 2022 | January | 1650 | 1.1154 |
| | February | 2680 | 0.6242 |
| | March | 2670 | -0.0037 |
| | April | 2230 | -0.1648 |
| | May | 2260 | 0.0135 |
| | June | 2170 | -0.0398 |
| | July | 1720 | -0.2074 |

Table 3  Return PT Dafam Property Indonesia Tbk (DFAM)

| Year | Month | Stock Price | Stock Return |
|---|---|---|---|
| 2020 | March | 338 | |
| | April | 424 | 0.2544 |
| | May | 400 | -0.0566 |
| | June | 334 | -0.1650 |
| | July | 346 | 0.0359 |
| | August | 348 | 0.0058 |
| | September | 350 | 0.0057 |
| | October | 332 | -0.0514 |
| | November | 236 | -0.2892 |
| | December | 206 | -0.1271 |
| 2021 | January | 185 | -0.1019 |
| | February | 187 | 0.0108 |
| | March | 176 | -0.0588 |
| | April | 160 | -0.0909 |
| | May | 156 | -0.0250 |
| | June | 138 | -0.1154 |
| | July | 135 | -0.0217 |
| | August | 320 | 1.3704 |
| | September | 370 | 0.1563 |
| | October | 368 | -0.0054 |
| | November | 382 | 0.0380 |
| | December | 384 | 0.0052 |
| 2022 | January | 370 | -0.0365 |
| | February | 406 | 0.0973 |
| | March | 615 | 0.5148 |
| | April | 555 | -0.0976 |
| | May | 374 | -0.3261 |
| | June | 159 | -0.5749 |
| | July | 123 | -0.2264 |

## 5.1 Numerical Results

The value output at risk calculation The Monte Carlo simulation method may be executed using Microsoft Excel. The following are the findings of the Microsoft Excel simulation. (Table 6)

Table 6:Value at Risk (VaR)

| | EAST | SHID | DFAM |
|---|---|---|---|
| Expected Return | 2.6% | 0.41% | 0.45% |
| Std. Deviation | 0.1373 | 0.2959 | 0.3284 |
| First Simulation | 0.2282 | 0.2012 | 0.1801 |
| | | | |
| Expected Return | 0.0290 | -0.0097 | -0.0062 |
| Std. Deviation | 0.1301 | 0.3059 | 0.3319 |
| VaR | -0.1856 | -0.5144 | -0.5539 |
| VaR @ IDR 200.000.000 | (371,242.76) | (1,028,735.06) | (1,107,704.16) |

According to the study, the findings are unfavorable, suggesting that investing in the three equities may result in losses in the VaR produced by PT. Eastparc Hotel Tbk (EAST), PT Dafam Property Indonesia Tbk (DFAM), and PT Hotel Sahid Jaya International Tbk (HSJ) (SHID). The VaR for EAST is -0.1886 with a maximum loss of IDR 371,242.76, the VaR for SHID is -0.5144 with a maximum loss of IDR 1,028,735.06, and the VaR for DFAM is -0.5339 with a maximum loss of IDR 1,077,704.16.

### 5.2 Proposed Improvements
The following are possible recommendations:

a. When advising prospective investors who want to invest in the three companies, it is recommended that they observe the hotel industry's recovery and wait for the optimal time.
b. Additionally, investors might monitor hotel news to buy sooner at lower average prices.

## 6. Conclusion
The following conclusions may be taken from the discussion on PT's value-at-risk (VaR) assessment. Eastparc Hotel Tbk (EAST), PT Dafam Property Indonesia Tbk (DFAM), and PT Hotel Sahid Jaya International Tbk (SHID) daily equity portfolios using the simulation approach from Monte Carlo:

a. The prior three hotel acts produced a negative value at risk.
b. Investors are willing to assume risk while investing 200,000,000 IDR in shares. The VaR for EAST is -0.1886 with a maximum loss of IDR 371,242.76, the VaR for SHID is -0.5144 with a maximum loss of IDR 1,028,735.06, and the VaR for DFAM is -0.5339 with a maximum loss of IDR 1,077,704.16.

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