International Journal of Current Science Research and Review
ISSN: 2581-8341
Volume 06 Issue 12 December 2023
DOI: 10.47191/ijcsrr/V6-i12-07, Impact Factor: 6.789
IJCSRR @ 2023

The Optimal Portfolio of Stocks for Generation Z retail investors using The Single Index Model and The Constant Correlation Model in The LQ45 Index

Erlanda Maulidia Sultana Gusta Wijaya[1], Subiakto Soekarno[2]
[1,2] Master of Business Administration, School of Business and Management, Institut Teknologi Bandung, Jl. Ganesha No.10 Bandung 40132, Indonesia

ABSTRACT: Generation Z retail investors, characterized by a higher risk tolerance for risky assets, seek to balance return and risk in their portfolio of investments. To mitigate market risk, they employ portfolio selection models to utilize Markowitz's Diversification Principle. By using a portfolio selection model (an allocation model) for a risky asset, it helps investors allocate their investment budget to their selected stocks. For that reason, this study compares the Single Index Model and the Constant Correlation Model for portfolio allocation using stocks listed in the LQ45 index during stable (2018–2019) and global crisis (2020–2021) conditions. Results indicate the robustness of the constant correlation model in the stable condition scenario. During crises, however, both models can outperform the risk-free rate. Model assumptions play a crucial role in portfolio outcomes, emphasizing the importance of aligning investments with personal risk-return preferences. While no universal model fits all, these methods offer valuable options for tailoring risk-return profiles.

KEYWORDS: Constant Correlation Model; Diversification; LQ45; Optimal Portfolio; Single Index Model

INTRODUCTION

The pandemic, known as the COVID-19 pandemic, had rapidly spread across almost 178 countries and infected more than 85 million people, resulting in a total of more than 1.8 million deaths during 2020 (*Laporan Perekonomian Indonesia Tahun 2020*). Restriction in mobility in order to lessen the spread of the outbreak affects various sectors such as tourism, trade, health, etc. (Susilawati et al., 2020). An economic crisis makes it difficult for companies to ensure that they have stable development in the global economy, as a recession, for example, limits business confidence in their future business performance (Olkiewicz, 2022). To see the implications of such a condition on the economy, macroeconomic indicators such as Gross Domestic Product (GDP), inflation rate, unemployment rate, etc. are usually used by economists and related stakeholders in order to assess the implications of the current activities and help to assess the kind of policies or actions that the government could intervene in order to ensure the economic stability of the country.

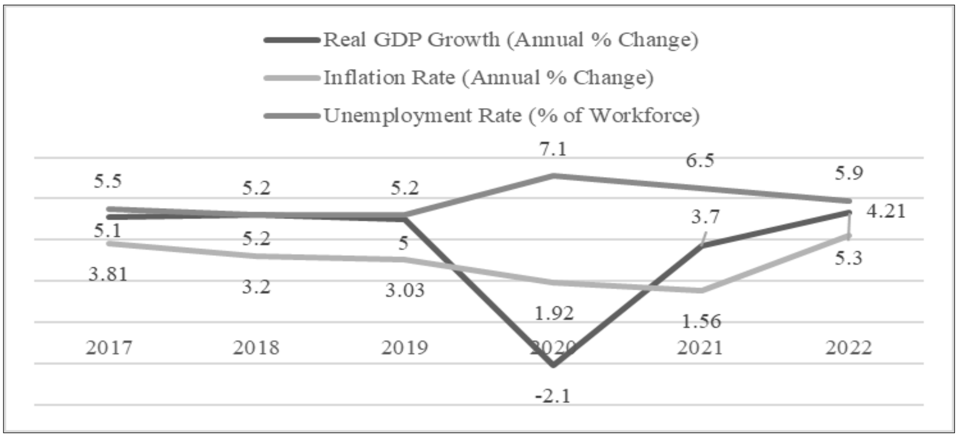

Figure 1. Macroeconomic Indicators of Indonesia (2017–2022) from IMF (International Monetary Fund) and BI (Bank Indonesia)

International Journal of Current Science Research and Review
ISSN: 2581-8341
Volume 06 Issue 12 December 2023
DOI: 10.47191/ijcsrr/V6-i12-07, Impact Factor: 6.789
IJCSRR @ 2023

It could be seen from Figure I that Indonesia experienced a decline in the real growth of GDP (Gross Domestic Product), as it experience minus 2.1% growth, a higher unemployment rate of 7.1%, and also inflation that is below its target of 3±1% in 2020, that is 1.7%. Even though the economy looks sluggish, this momentum has a positive impact on the development of investment activities in Indonesia.

The Indonesia Stock Exchange (IDX) reported that the number of overall capital market investors, by looking at the SID, or "Single Investor Identification", increased by 93% at the end of 2021. Official press releases published in November 2022 stated that of the 10,000,628 SID recorded, local retail investors dominate every investment instrument in the capital market, as they are more aware of the importance of capital market investment due to the pandemic outbreak that affects almost all sectors in Indonesia (Ramyakim & Widyasari, 2022). Retail investors are defined as individual investors who participate in the selling and buying (known as trading activities) of instruments in the capital market. The majority of these retail investors until now are young Millennials and Generation Z, with a maximum age range of 30 years (KSEI, 2023). Those investors in such a productive age suggest that the Indonesian capital markets have a very promising prospect and potential in the future, with them as the main driving force in the IDX trading activities throughout the year 2022 (Negara, 2022).

The fact that the number of investors increased by 93% in the year 2021 indicates that investors have an optimistic perception of investing in the capital market, as positive sentiment in the market grews with the development of vaccines (*Laporan Perekonomian Indonesia Tahun 2020*). This brings us to the question of whether these new and existing Generation Z retail investors received optimal (the best) returns or not from their investing-related activities. Retail investors, especially those who have not yet received investing education, might only follow what's trending in the news. This causes the "fear of missing out" phenomenon (FoMo). Researchers, such as Sudrajat (2022) and Güngör et al. (2022), conclude that individual investors in particular are under the influence of FoMo and that it has a positive and significant relationship with investor interest in stock investing. This behavior encourages investors to act according to what most other investors do, due to the uncertainty of the decisions taken by investors and the lack of the right allocation of budget strategy towards stock selection.

A survey using a questionnaire was conducted from September 20th to October 11th, 2023, with the purpose of having a general overview of retail investors behavior in stock investment on the Jakarta Stock Exchange. Its targeted participants were Generation Z (born in 1997–2012, currently between the ages of 18 and 26), who in general have a higher risk tolerance; hence, they may seek riskier instruments like stocks as compensation for delaying their gratification right now for future benefits. They have more risk tolerance, either knowingly or unknowingly, compared to, for example, someone who is the breadwinner of their family, which may lead them to seek more "safe" assets such as mutual funds or government bonds (Tollefson, 2023). Aside from Millennials (born in 1981–1996, currently between the ages of 27 and 42), this generation is the most likely to invest more in stocks compared to the previous generations, such as Baby Boomers (born in 1946–1964, currently between the ages of 59 and 77) and Generation X (born in 1965–1980, currently between the ages of 43 and 58), as they develop a more cautious risk appetite.

The survey result shows that among 99 participants, only 40% received an actual return in accordance with their expected return. The survey result also shows that on a scale from one to five, with five described as "very much affected by it", 44% of the participants chose "4" as participants felt that they were affected by FoMo in their personal investment decisions. In terms of seeing how FoMo affected other people in their investment plan, 40% of participants also chose 4, with them saying that it was because of people's lack of education and lack of their own personal research. Other than that, the reasons for the FoMo phenomenon according to the overall 99 participants (either of them seeing it from their personal experience or their own outlook on the social environment) vary. It is listed as follows:

1) Afraid of feeling left behind in the momentum,
2) Overworried,
3) People's status updates posted on social media,
4) Lack of experience and "greedy" in their expectations of return.

In choosing its stocks, the majority of 50% of participants choose whatever the stock is as long as it is a profit-maker. How they included these stocks in their portfolio varies, with the top three frequently used ones being: fundamental analysis (42.4% or 42 people), diversification (21.2% or 21 people), and following recommendations from groups on social media (15.2% or 15 people). What's interesting is that when asked if they are familiar with the definition of diversification, 39 people (or 39.4%) felt that they

International Journal of Current Science Research and Review
ISSN: 2581-8341
Volume 06 Issue 12 December 2023
DOI: 10.47191/ijcsrr/V6-i12-07, Impact Factor: 6.789
IJCSRR @ 2023

might have heard about it but were not confident enough to explain what it means, which indicates that there are still gaps in receiving the proper education on what diversification means.

Generation Z retail investors, who have a higher tolerance for risk, will aim to select the right set of stocks in their portfolio that could give them the potential reward they hoped for. Consequently, as a rational investor who seeks the best option among others, the right investing strategy is needed to ensure that he or she receives the best combination of return and risk from his or her portfolio. This could be achieved by utilizing a portfolio selection model (an allocation model) for a risky asset portfolio that is capable of allocating the investment budget to its selected stocks. That way, Generation Z retail investors could mitigate the unsystematic (uncontrollable) risk that comes from the market.

HYPOTHESES DEVELOPMENT

As this research is done to construct a risky asset portfolio with the best combination of expected return and risk for the Generation Z retail investors, it is expected that the constructed portfolio outperforms the market during a global crisis such as COVID-19 using a strategy of optimizing risky assets in its portfolio. It is also expected to find whether the single index model and the constant correlation model are useful tools for portfolio construction during the stable condition and the global crisis condition, as both of them use different assumptions in their modeling. Consequently, the expected results and risk from the constructed portfolio in stable and crisis conditions will be compared to market performance.

METHOD, DATA, AND ANALYSIS

The main objective of this research is to construct the optimal portfolio of risky assets, that is stocks, using candidates listed in LQ45 as a means to achieve the best combination of return-risk for Generation Z retail investors. In general, as Indonesian economic conditions recover from crises such as the pandemic, stocks listed in LQ45 show an improvement, although it also depends on market sentiment and economic conditions, both global and local. For that reason, stocks listed in the LQ45 index are suitable for investors of all experience levels, even to those who had just started their journey to invest in stock instruments. This is because LQ45 is composed of stocks that are resistant to market conditions due to their fundamental aspects and are easy to gather information about making it suitable for all investors who aiming for good stocks.

To fully analyze the portfolio that had been formed, it would use known performance indicator indexes, value at risk calculations to estimate the maximum loss that investors could receive from the portfolio's investment, and a comparison between the expected return and risk of the optimal portfolios with the market.

To simplify the field of the research, there are a few limitation listed as follows:

1) It will first filter out stocks that, for five years, consistently stay on LQ45 from 2018 to 2022.
2) The time horizon used to construct the optimal portfolio and calculate the value at risk is from January 2020 to December 2021 (a global crisis condition) and January 2018 to December 2019 (a stable condition).
3) It focuses on using daily data for a stock’s closing price to ensure consistency in calculating both the Value at Risk and in constructing the portfolio for Generation Z retail investors.
4) Risk-free-rate uses the BI 7-day (Reverse) Repo rate, or BI7DRR, as a proxy.
5) Market risk uses LQ45 index as a proxy.
6) The methods used to construct the optimal portfolio are the Single Index Model and the Constant Correlation Model. Both models are used when investors are sure that those two could describe the covariance (direction of the relationship) between securities (Elton et al., 2013).
7) Value at Risk uses the Variance-Covariance method.

A. Single Index Model

The Single Index Model is a model that simplifies the known Markowitz Model. In the Markowitz Model, it utilizes the covariance matrix between pairs of assets used in the portfolio, which can be complex in terms of calculating the return and risk of the constructed portfolio (Kane et al., 2013). The Single Index Model, on the other hand, differs in terms of using only one parameter to explain the return of each security (or portfolio), which is the market index. The stock price usually moves in the same direction as the market price index, which suggests that the returns of each stock might be correlated with each other as there is a common

International Journal of Current Science Research and Review
ISSN: 2581-8341
Volume 06 Issue 12 December 2023
DOI: 10.47191/ijcsrr/V6-i12-07, Impact Factor: 6.789
IJCSRR @ 2023

response to the fluctuation of the market (Elton et al., 2013). For that reason, the beta of each stock (denoted by β_i) is assumed to be important, as it measures a stock's volatility in comparison with the whole market. The steps to construct the portfolio are as follows (Elton et al., 2013):

1) Calculate the return for each stock candidate using natural logarithm

$$R_{it} = LN\left(\frac{P_{it}}{P_{i(t-1)}}\right), \tag{1}$$
$$\text{with } i = 1,2,\ldots,S \text{ and } t = 1,2,\ldots N$$

where,

R_{it}	=	Return of Individual Stock i on the Period t
P_{it}	=	Price of Stock i on the Period t
$P_{i(t-1)}$	=	Price of Stock i on the Period (t-1)
S	=	Total Stocks Used
N	=	Total Number of Period Used

2) Calculate the expected return for each stock candidate $E(R_i)$

$$E(R_i) = \frac{\sum_i^S \sum_{t=1}^N R_{it}}{N}. \tag{2}$$

3) Calculate the variance(σ^2) and the standar deviation (σ) for each stock candidate

$$\sigma_i^2 = \frac{\sum_i \sum_{t=1}^N [R_{it} - E(R_i)]^2}{N}, \tag{3}$$

$$\sigma_i = \sqrt{\sigma_i^2}. \tag{4}$$

4) Calculate market return using LQ45 index as proxy

$$R_{Mt} = LN\left(\frac{LQ45_t}{LQ45_{(t-1)}}\right). \tag{5}$$

R_{Mt} symbolize the market return on current period, while $LQ45_t$ and $LQ45_{(t-1)}$ symbolize LQ45 index adjusted closing price on the current period of t and previous period, respectively.

5) Calculate Market Expected Return $E(R_M)$

$$E(R_M) = \frac{\sum_{t=1}^N R_{Mt}}{N}. \tag{6}$$

6) Calculate Variance of The Market σ_M^2

$$\sigma_M^2 = \frac{\sum_{t=1}^N [R_{Mt} - E(R_M)]^2}{N}. \tag{7}$$

7) Calculate β_i and α_i

$$\beta_i = \frac{Cov(R_{it}, R_{Mt})}{\sigma_M^2}, and \tag{8}$$

$$\alpha_i = E(R_i) - [\beta_i . E(R_M)], \tag{9}$$

$with\ i = 1,2,3,\ldots,S$

$Cov(R_{it}, R_{Mt})$ symbolize the direction between return of individual stock i on the period t with return of the market within the same period.

8) Calculate Variance of residual σ_{ei}^2 that symbolize unsystematic risk (unique risk) of each stocks

$$\sigma_{ei}^2 = \sigma_i^2 - [\beta_i^2 . \sigma_M^2], \tag{10}$$

$with\ i = 1,2,3,\ldots,S$

9) Calculating Excess Return to Beta (ERB_i), and A_i, B_i, Cut-off rate (C^*)

International Journal of Current Science Research and Review
ISSN: 2581-8341
Volume 06 Issue 12 December 2023
DOI: 10.47191/ijcsrr/V6-i12-07, Impact Factor: 6.789
IJCSRR @ 2023

$$ERB_i = \frac{E(R_i) - r_f}{\beta_i}, and \quad (11)$$

$$C_i = \frac{\sigma_M^2 \sum_{j=1}^{i} A_j}{1 + \sigma_M^2 \sum_{j=1}^{i} B_j}, where \quad (12)$$

$$A_j = \frac{[E(R_j) - r_f].\beta_j}{\sigma_{ej}^2}, \quad (13)$$

$$B_j = \frac{\beta_j^2}{\sigma_{ej}^2}, \quad (14)$$

$with\ j = 1,2,3, \ldots, S$

It should be noted that C_i is designed as a candidate for C^* while r_f is known risk-free rate. ERB_i is calculated for each stocks then it is sort from highest to lowest. The optimum portfolio consists of all stocks with ERB_i greater than a particular cutoff point C_i, in which this particular value will act as C^*. This holds if it uses the assumption of no short sales.

10) Calculating the scaling factor (Z_i) and the proportion of each stock (W_i)

$$W_i = \frac{Z_i}{\sum_{i=1}^{S} |Z_i|}, where \quad (15)$$

$$Z_i = \frac{\beta_i}{\sigma_{ei}^2}.(ERB_i - C^*), \quad (16)$$

$with\ i = 1,2,3, \ldots, S\ and\ Z_i\ could\ be\ either\ positive\ or\ negative\ value$

11) Calculating Expected Return $(E(R_p))$ and Risk of Portfolio (σ_p)

$$\beta_p = \sum_{i=1}^{S} W_i.\beta_i, \quad (17)$$

$$\alpha_p = \sum_{i=1}^{S} W_i.\alpha_i, \quad (18)$$

$$E(R_p) = \alpha_p + \beta_p.E(R_M), and \quad (19)$$

$$\sigma_p = \sqrt{\beta_p^2.\sigma_M^2 + \left(\sum_{i=1}^{S} W_i.\sigma_{ei}\right)^2}, \quad (20)$$

B. Constant Correlation Model

The Constant Correlation Model uses the assumption that the correlation between all pairs of securities used is the same (Elton et al., 2013). What differentiates this model from the Single Index Model is that σ_i (standard deviation of each stock) is used as the risk measure, while the Single Index Model uses β_i. Aside from that, the Constant Correlation Model procedure relies on the fact that it only correlates pairs of securities to one another without involving the market index (Sari & Qudratullah, 2016). Throughout the construction of the portfolio, it uses the same equations (1) and (6) in sequence and then follows the listed steps as follows:

1) Calculate Excess Return to Standard Deviation (ERS_i) and its the Cut-off rate (C^*)

$$ERS_i = \frac{E(R_i) - r_f}{\sigma_i}, and \quad (21)$$

$$C_i = \frac{\rho}{(1 - \rho + i\rho)}.\sum_{j=1}^{i} \frac{E(R_j) - r_f}{\sigma_j}, where\ \rho\ is\ constant \quad (22)$$

International Journal of Current Science Research and Review
ISSN: 2581-8341
Volume 06 Issue 12 December 2023
DOI: 10.47191/ijcsrr/V6-i12-07, Impact Factor: 6.789
IJCSRR @ 2023

As ρ is assumed to be constant for all securities candidates, hence it uses tha average value of the correlation coefficient between pair of securities (denoted by ρ_{ij}) using the formula:

$$\rho = \frac{\sum_{i=1}^{S}\sum_{j=1}^{S}\rho_{ij}}{\left[\frac{S\,(S-1)}{2}\right]}, where\ i \neq j \tag{23}$$

It should be noted that C_i is designed as a candidate for C^* while r_f is known risk-free rate. ERS_i is calculated for each stocks then it is sort from highest to lowest. The optimum portfolio consists of all stocks with ERS_i greater than a particular cutoff point C_i, in which this particular value will act as C^*. This holds if it uses the assumption of no short sales.

2) Calculating the scaling factor (Z_i) and the proportion of each stock (W_i)

$$W_i = \frac{Z_i}{\sum_{i=1}^{S}|Z_i|}, where \tag{24}$$

$$Z_i = \frac{1}{(1-\rho)\,\sigma_i}.\left[ERS_i - C^*\right]. \tag{25}$$

$$with\ i = 1,2,3,\ldots,S\ and\ Z_i\ could\ be\ either\ positive\ or\ negative\ value$$

3) Calculating Expected Return $[E(R_p)]$ and Risk of Portfolio (σ_p)

$$E(R_p) = r_f + \sum_{i=1}^{S} W_i.\left[E(R_i) - r_f\right], \tag{26}$$

$$\sigma_p = \sqrt{\sum_{i=1}^{S} W_i^2.\sigma_i^2 + \sum_{\substack{i=1\\i}}^{S}\sum_{\substack{j=1\\i\neq j}}^{S} W_i.W_j.\sigma_i.\sigma_j.\rho_{ij}}\ . \tag{27}$$

C. Portfolio's Performances Measure

The widely used measure in practice in order to evaluate the performance of one's portfolio are the three different one-parameter perfomance measures (Elton et al., 2013).

a) Sharpe Index (Reward to Variability Ratio)

The standard deviation is used as a risk measure to capture the overall risk of the portfolio, assuming the investor is concerned about overall risk.). The formulation for calculating the Sharpe index is as follows:

$$RVA = \frac{E(R_p) - r_f}{\sigma_p}. \tag{28}$$

b) Treynor Index (Reward to Volatility Ratio)

β_p (or beta portolio) is used as a risk measure to capture portfolio volatility relative to the market, assuming the investor is concerned about market risk. The formulation for calculating the Treynor Index is as follows:

$$RVO = \frac{E(R_p) - r_f}{\beta_p}. \tag{29}$$

c) Jensen's Alpha Index (Risk-Adjusted Performance Measures)

Jensen's Alpha Index (or Jensen Index) considers the Capital Asset Pricing Model Market (CAPM) Theory, which is a financial model to calculate the expected return of an individual asset or portfolio using: the expected return of the market; beta to denote the sensitivity of the individual asset or portfolio; as well as the risk-free rate. The formulation for calculating the Jensen Index is as follows:

$$RAM = E(R_p) - \left[r_f + \beta_p.\left(E(R_M) - r_f\right)\right] \tag{30}$$

D. Value at Risk (VaR)

VaR is the estimate of the maximum potential loss, at a given confidence level, to be expected over the period (usually the next day or 10 days). This research will use the Variance-Covariance method with the assumption that the stock returns (or

International Journal of Current Science Research and Review
ISSN: 2581-8341
Volume 06 Issue 12 December 2023
DOI: 10.47191/ijcsrr/V6-i12-07, Impact Factor: 6.789
IJCSRR @ 2023

portfolio's return) have a normal distribution. The advantage of this method is that the calculation is rather simple and easy to follow for users. It also offers the benefit that, under a normal distribution, it could make VaR more informative in terms of calculating all kinds of possible maximum loss values using a given confidence level and holding period (Cerrato, 2012). However, this method is challenging to use if it is implemented into an investment instrument with non-linear payoffs (defined as a relationship between the value of the investment instrument and its underlying price that is not linear), such as options. That being the case, as the portfolio used consists solely of stocks, the mathematical formulation of VaR using the Variance-Covariance method is listed as follows (Cerrato, 2012):

$$VaR = -z_{0.95}.\sigma_{p(daily)}.I\ .\sqrt{T}\ . \tag{31}$$

RESULTS

The following is the table that showcases the candidates used in the LQ45 index based on their listing in the aforementioned index from 2018–2022.

Table 1. The Stock Candidates Use

No.	Code	No.	Code	No.	Code	No.	Code	No.	Code	No.	Code
1	ADRO	6	BBRI	11	EXCL	16	INKP	21	MNCN	26	TLKM
2	ANTM	7	BBTN	12	HMSP	17	INTP	22	PGAS	27	TOWR
3	ASII	8	BMRI	13	ICBP	18	ITMG	23	PTBA	28	UNTR
4	BBCA	9	CPIN	14	INCO	19	JPFA	24	SMGR	29	UNVR
5	BBNI	10	ERAA	15	INDF	20	KLBF	25	TBIG	30	WIKA

The first method, which is the single index model, is used to construct the optimal portfolio during a stable condition, as shown in the following table. Note that it resulted in one portfolio of risky assets composed of 16 stocks.

Table 2. Stocks Included in The Single Index Model during the Stable Condition (2018-2019)

No.	Code	ERB_i	Included?	No.	Code	ERB_i	Included?	C^*
17	INTP	115.079	Yes	10	ERAA	0.231	Yes	0.000002
12	HMSP	42.084	Yes	22	PGAS	-0.149	No	
27	TOWR	16.347	Yes	11	EXCL	-0.199	No	
20	KLBF	14.998	Yes	18	ITMG	-0.236	No	
24	SMGR	5.480	Yes	1	ADRO	-0.311	No	
30	WIKA	1.786	Yes	23	PTBA	-0.495	No	
3	ASII	1.723	Yes	28	UNTR	-0.555	No	
21	MNCN	1.616	Yes	7	BBTN	-0.609	No	
15	INDF	1.042	Yes	26	TLKM	-0.650	No	
5	BBNI	0.757	Yes	14	INCO	-0.666	No	
13	ICBP	0.694	Yes	2	ANTM	-1.261	No	
6	BBRI	0.556	Yes	31	UNVR	-1.669	No	
4	BBCA	0.425	Yes	16	INKP	-2.515	No	
9	CPIN	0.403	Yes	25	TBIG	-3.231	No	
19	JPFA	0.237	Yes	8	BMRI	-3.718	No	

Table 3. The Single Index Model Constructed Portfolio during the Stable Condition (2018-2019)

Stock	**INTP**	**HMSP**	**TOWR**	**KLBF**	**SMGR**	**WIKA**	**ASII**	**MNCN**
Proportion	3.9%	5.6%	5.1%	6.7%	4.1%	4.2%	8.6%	2.8%
Stock	**INDF**	**BBNI**	**ICBP**	**BBRI**	**BBCA**	**CPIN**	**JPFA**	**ERAA**
Proportion	8.1%	6.8%	11.4%	7.9%	17.5%	2.6%	3.3%	1.4%
Daily return	0.0182%	**Daily risk**	2.0211%		**Annual return**	4.682%	**Annual risk**	32.085%

On the other hand, the single index model applied during the global crisis (2020-2021) resulted in three constructed portfolios with three different cut-off rates (C^*) used which will be compared with ERB_i of each stock : -0.04466 (result in two stocks included), -0.04505 (result in three stocks included), and -0.04642 (result in four stocks included). The result can be seen in Table 5.

Table 4. Excess Return to Beta for Each Stock during the Global Crisis (2020-2021)

No.	Code	ERB_i	No.	Code	ERB_i	No.	Code	ERB_i
2	ANTM	-0.044	1	ADRO	-0.054	25	TBIG	-0.067
16	INKP	-0.044	11	EXCL	-0.054	4	BBCA	-0.068
39	UNVR	-0.045	3	ASII	-0.055	10	ERAA	-0.071
5	BBNI	-0.046	24	SMGR	-0.056	12	HMSP	-0.074
22	PGAS	-0.048	19	JPFA	-0.057	15	INDF	-0.077
6	BBRI	-0.048	9	CPIN	-0.058	21	MNCN	-0.078
7	BBTN	-0.048	23	PTBA	-0.060	20	KLBF	-0.087
8	BMRI	-0.049	28	UNTR	-0.062	30	WIKA	-0.089
17	INTP	-0.053	26	TLKM	-0.065	13	ICBP	-0.096
14	INCO	-0.054	18	ITMG	-0.065	27	TOWR	-0.098

Table 5. The Single Index Model Constructed Portfolio during the Global Crisis (2020-2021)

Portfolio	**Stocks Included In The portfolio (%)**				**Return (%)**		**Risk (%)**	
	ANTM	**INKP**	**UNVR**	**BBNI**	**Daily**	**Annual**	**Daily**	**Annual**
Portfolio 1	55	45			**0.113**	**32.81**	**3.815**	**60.56**
Portfolio 2	40	39	21		**0.052**	**14.03**	**3.499**	**55.55**
Portfolio 3	30	33	34	3	**0.011**	**2.84**	**3.264**	**51.82**

The next method, which is the constant correlation model, was applied using 2018–2019 data, resulting in 10 portfolios with cut-off rates from -1.38311 to -2.10643, with 2–14 stocks included (see Table 7).

Table 6. Excess Return to Standard Deviation of Each Stock during the Stable Condition (2018-2019)

No.	Code	ERS_i	No.	Code	ERS_i	No.	Code	ERB_i
10	ERAA	-1.205	30	WIKA	-2.039	20	KLBF	-2.660
16	INKP	-1.378	18	ITMG	-2.047	5	BBNI	-2.697
9	CPIN	-1.660	17	INTP	-2.048	8	BMRI	-2.778
22	PGAS	-1.663	24	SMGR	-2.076	6	BBRI	-2.888

International Journal of Current Science Research and Review
ISSN: 2581-8341
Volume 06 Issue 12 December 2023
DOI: 10.47191/ijcsrr/V6-i12-07, Impact Factor: 6.789
IJCSRR @ 2023

21	MNCN	-1.716	25	TBIG	-2.144	15	INDF	-2.923
11	EXCL	-1.803	23	PTBA	-2.146	3	ASII	-3.018
19	JPFA	-1.864	7	BBTN	-2.161	26	TLKM	-3.044
14	INCO	-1.885	27	TOWR	-2.324	29	UNVR	-3.355
2	ANTM	-1.931	12	HMSP	-2.467	13	ICBP	-3.460
1	ADRO	-1.981	28	UNTR	-2.531	4	BBCA	-4.266

Table 7. The Constant Correlation Model Constructed Portfolio during the Stable Condition (2018-2019)

Portfolio	**Stocks Included In The portfolio (%)**							**Return (%)**		**Risk (%)**	
	ERAA INCO	INKP ANTM	CPIN ADRO	PGAS WIKA	MNCN ITMG	EXCL INTP	JPFA SMGR	**Daily**	**Annual**	**Daily**	**Annual**
Portfolio 1	97	3						0.185	59.39	4.250	67.47
Portfolio 2	56	39	3	2				0.137	41.34	3.199	50.78
Portfolio 3	49.1	36.3	7.5	6.9	0.1			0.132	39.28	2.957	46.95
Portfolio 4	35	28	13	13	9	2		0.114	33.13	2.425	38.49
Portfolio 5	31	26	14	13	10	5	1	0.108	31.39	2.313	36.72
Portfolio 6	28 2	24	14	13	11	6	3	0.102	29.27	2.187	34.71
Portfolio 7	25 3	22 1	13	13	11	7	4	0.097	27.58	2.089	33.16
Portfolio 8	22 5	20 3	13 1	13	11	8	6	0.091	25.76	1.996	31.69
Portfolio 9	20 5.7	17.8 4.1	12.5 2.2	12.2 0.03	10.8	8.3	6.3	0.085	23.96	1.924	30.55
Portfolio 10	17 6	15 5	11 4	11 2	10 2	8 2	7 1	0.073	20.13	1.802	28.61

Table 8. Excess Return to Standard Deviation of Each Stock during the Global Crisis (2020-2021)

No.	**Code**	ERB_i	**No.**	**Code**	ERB_i	**No.**	**Code**	ERB_i
10	ERAA	-1.205	30	WIKA	-2.039	20	KLBF	-2.660
16	INKP	-1.378	18	ITMG	-2.047	5	BBNI	-2.697
9	CPIN	-1.660	17	INTP	-2.048	8	BMRI	-2.778
22	PGAS	-1.663	24	SMGR	-2.076	6	BBRI	-2.888
21	MNCN	-1.716	25	TBIG	-2.144	15	INDF	-2.923
11	EXCL	-1.803	23	PTBA	-2.146	3	ASII	-3.018

International Journal of Current Science Research and Review
ISSN: 2581-8341
Volume 06 Issue 12 December 2023
DOI: 10.47191/ijcsrr/V6-i12-07, Impact Factor: 6.789
IJCSRR @ 2023

19	JPFA	-1.864	7	BBTN	-2.161	26	TLKM	-3.044
14	INCO	-1.885	27	TOWR	-2.324	29	UNVR	-3.355
2	ANTM	-1.931	12	HMSP	-2.467	13	ICBP	-3.460
1	ADRO	-1.981	28	UNTR	-2.531	4	BBCA	-4.266

Conversely, the constant correlation model was applied using 2020-2021 data, resulting in 11 portfolios with cut-off rates from -0.97904 to -1.3249, with 1 to 14 stocks included as it can be seen in Table 9.

Table 9. The Constant Correlation Model Constructed Portfolio during the Global Crisis (2020-2021)

	Stocks Included In The portfolio (%)							**Return (%)**		**Risk (%)**	
	ANTM	INKP	WIKA	ERAA	TBIG	INCO	PGAS				
Portfolio	ADRO	ITMG	BBTN	JPFA	EXCL	SMGR	INTP	**Daily**	**Annual**	**Daily**	**Annual**
Portfolio 1	100							0.202	66.24	3.854	61.18
Portfolio 2	85	15						0.172	54.19	3.587	56.94
Portfolio 3	69	22	9					0.130	38.75	3.347	53.13
Portfolio 4	50	26	19	5				0.083	23.12	3.090	49.04
Portfolio 5	39	25	21	13	2			0.071	19.61	2.921	46.36
Portfolio 6	36	24	20	14	5	1		0.072	19.80	2.849	45.22
Portfolio 7	32.4 0.2	22.4	19.4	14.2	6.6	3.2	1.7	0.069	18.97	2.778	44.10
Portfolio 8	25.7 3.9	18.9 1.3	16.7 0.5	13.4 0.4	8.4	5.9	4.8	0.064	17.57	2.634	41.81
Portfolio 9	19 6	15 5	13 4	12 4	9 1	7	6	0.057	15.53	2.473	39.26
Portfolio 10	16.8 6.5	13.4 5.3	12.3 4.7	11 4.8	8.7 1.9	7.4 0.3	6.7	0.054	14.71	2.430	38.57
Portfolio 11	15 7	12 6	11 5	10 5	9 3	7 1	7 1	0.049	13.22	2.383	37.83

Based on the aforementioned results of the single index model and the constant correlation model during stable conditions and global crises, Figures 2–4 illustrate this finding. To assess the significance of portfolio performance, the Sharpe ratio is employed as a key risk-adjusted performance measure. A positive Sharpe Ratio signifies superior performance with excess return and better risk-adjusted results, while a negative value indicates an inadequate return for the assumed risk.

Results indicate that in the stable condition, the right-tailed test for outperforming the risk-free rate yielded a p-value of 0.82 only for the single index model's portfolio, while the rest were statistically significant at the 0.05 level. This suggests that, in this scenario, the constant correlation model is better suited, potentially offering additional returns compared to risk-free assets. During the global crisis, all portfolios constructed, except Portfolio 3 from the single index model, exhibited p-values less than 0.05.

The use of Figures 2-4 is evident when examining potential choices for Generation Z retail investors. Risk-taker investors might consider Portfolio 1 of risky assets during stable conditions, favoring the constant correlation model. In a global crisis, risk-

International Journal of Current Science Research and Review
ISSN: 2581-8341
Volume 06 Issue 12 December 2023
DOI: 10.47191/ijcsrr/V6-i12-07, Impact Factor: 6.789
IJCSRR @ 2023

taker investors could choose either Portfolio 1 from the single index model or Portfolio 1 from the constant correlation model. On the other hand, risk-averse investors might opt for the remaining risky portfolios with less risk. It is worth noting that while the models show a variety of possible return-risk tradeoffs to choose from, as prescribed using certain selection criteria, the "optimal portfolio chosen" will later on depend on the investor's personal return requirement and risk appetite.

This strategic approach is consistent with the separation theorem, which suggests that investors' decisions could be separated into two independent tasks: tactical and personal preferences (Kane et al., 2013), as well as the Markowitz Portfolio Theory's emphasis on diversification (in this case) in many securities. Although Markowitz (1952) implies "the right diversification," it does not mean that an undiversified portfolio is of lesser quality. As Markowitz himself mentioned, there's a possibility that one security generates an extremely higher yield with lower risk than the other portfolios, although this is somewhat rare in comparison to having diversification. All in all, stocks could give a high return to compensate for their high risk, and diversification could reduce the risk without jeopardizing the expected return (Fama & French, 2004).

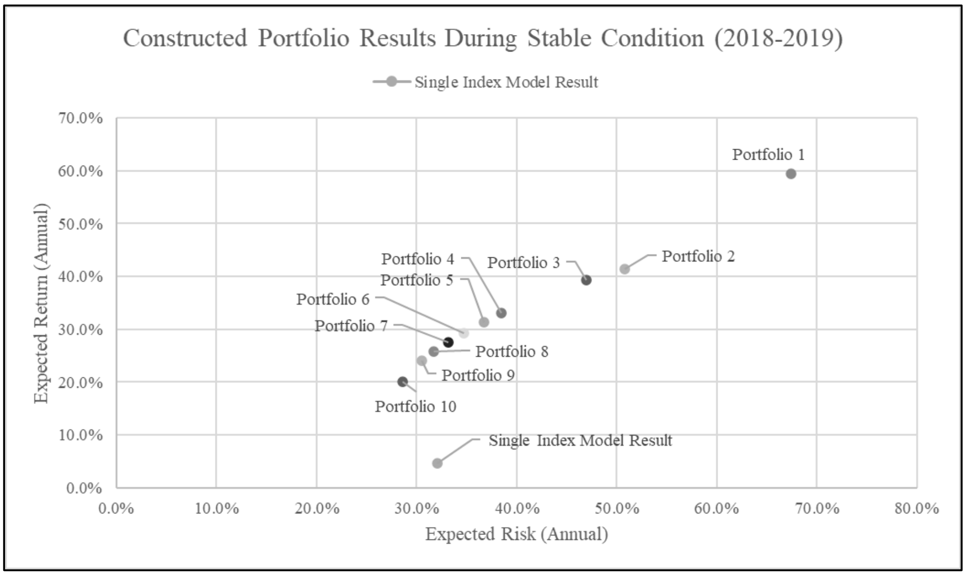

Figure 2. Illustration of the Constructed Portfolio from the Single Index Model and the Constant Corelation Model during the Stable Condition (2018–2019)

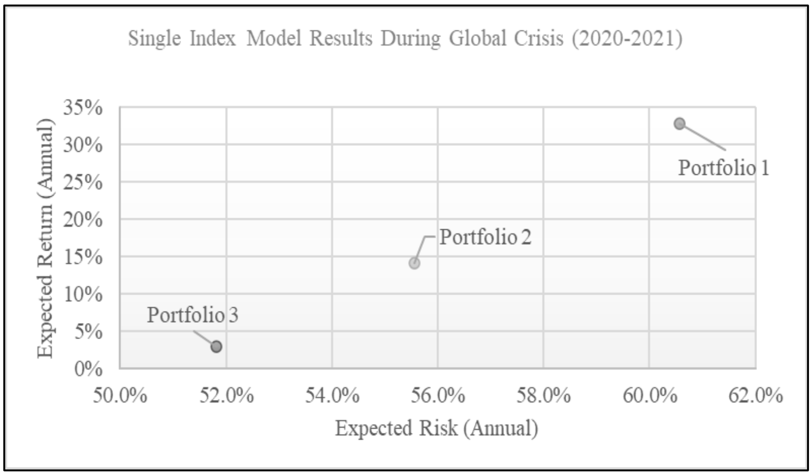

Figure 3. Illustration of the Constructed Portfolio from the Single Index Model during the Global Crisis (2020-2021)

International Journal of Current Science Research and Review
ISSN: 2581-8341
Volume 06 Issue 12 December 2023
DOI: 10.47191/ijcsrr/V6-i12-07, Impact Factor: 6.789
IJCSRR @ 2023

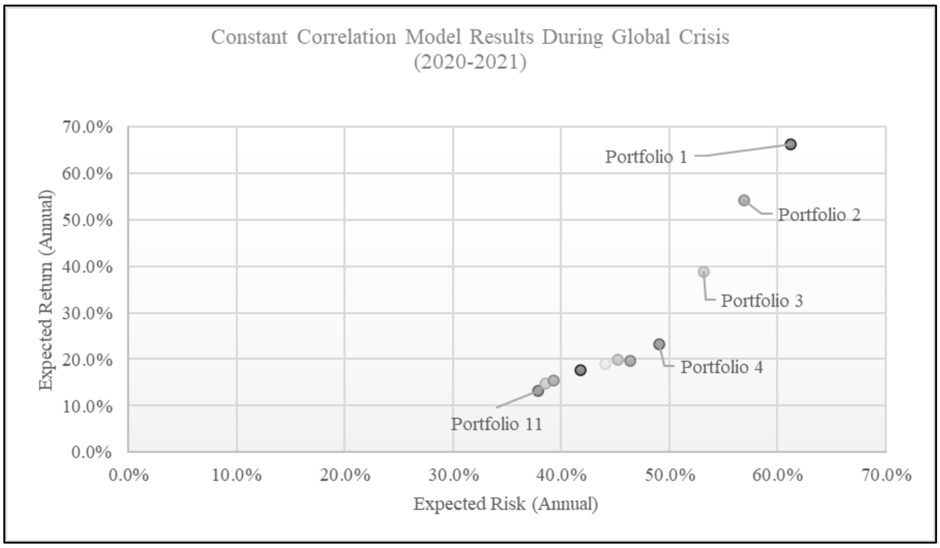

Figure 4. Illustration of the Constructed Portfolio from the Constant Corelation Model during the Global Crisis (2020-2021)

For additional comparisons between the constructed portfolios using two methods, Table 10 showcases the results of three index measures and the VaR (value at risk) during the stable condition and global crisis. It is noted that it assumes an investment of Rp10,000,000 to calculate the VaR over three different periods of time.

Table 10. Performance Measure and Value at Risk Comparison

	Stable Condition (2018-2019)		Global Crisis Condition (2020-2021)	
	Single Index Model	Constant Correlation Model Portfolio 1	Single Index Model Portfolio 1	Constant Correlation Model Portfolio 1
Sharpe Index	-0.02335	0.79985	0.477	1.019
Treynor Index	0.16029	CCM does not estimate the portfolio's beta.	0.336	CCM does not estimate the portfolio's beta.
Jensen Index	-0.01136		0.289	
VaR (in a day)	Rp332,447	Rp699,071	Rp627,469	Rp633,888
VaR (in 10 days)	Rp1,051,290	Rp2,210,658	Rp1,984,230	Rp2,004,529
VaR (in 30 days)	Rp1,820,888	Rp3,828,972	Rp3,436,787	Rp3,471,946

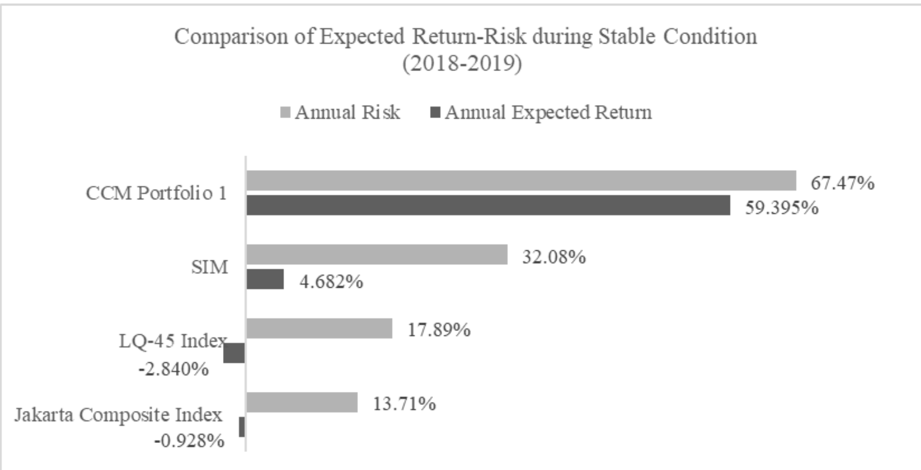

Figure 5. Comparison of Expected Return-Risk during Stable Condition (2018-2019) with Jakarta Composite Index and LQ45

International Journal of Current Science Research and Review
ISSN: 2581-8341
Volume 06 Issue 12 December 2023
DOI: 10.47191/ijcsrr/V6-i12-07, Impact Factor: 6.789
IJCSRR @ 2023

Figure 6. Comparison of Expected Return-Risk during Global Crisis Condition (2020-2021) with Jakarta Composite Index and LQ45

DISCUSSION

In contrast to the traditional Modern Portfolio Theory (MPT) introduced by Harry Markowitz, where the efficient frontier and Capital Allocation Line (CAL) define singular optimal portfolios, the single index model and constant correlation model present a departure from this conventional paradigm. While Markowitz's MPT seeks portfolios with a maximum expected return for a given risk or a minimum risk for a specified return, the single index model and constant correlation model employ an iterative, algorithmic approach grounded in risk-adjusted ratios such as the Sharpe Ratio to construct optimal portfolios. This method, guided by Kuhn-Tucker conditions, refines portfolios iteratively, potentially yielding multiple optimal choices. In deviating from the conventional MPT efficient frontier that maximizes return for a given risk or minimizes risk for a given return, this nuanced approach provides flexibility, offering a range of optimal portfolios representing diverse risk-return combinations (Kwan, 1984).

Looking at Figures 5–6 that showcase the comparison of the constructed portfolios expected return-risk with Jakarta Composite Index and LQ45 during the stable and global crisis conditions, respectively, the constant correlation model supports the term “high risk and high return” during both stable and global crisis conditions. However, in a global crisis situation, diversification results in less risk and a higher return compared to the single index model portfolio. That being the case, both the single index model and the constant correlation model provide a higher expected return compared with the Jakarta Composite Index and LQ45 during both scenarios. However, there’s a high risk that needs to be considered. Stocks, as one of those assets that could generate a high return, also align with the high risk that needs to be anticipated by Generation Z retail investors.

In terms of which method is more appropriate to use and gives a better result, the previous section showcased how the constant correlation model provides a more robust result, as shown during the stable condition, while both the single index model and the constant correlation model in general can be used during the global crisis. The possible reasons why it gives the aforementioned results are related to the different assumptions and characteristics used in both methods, as well as how known financial theories relate to the aforesaid findings. Those explanations affect how many possible portfolios it could construct for Generation Z retail investors later on.

To give an overview of the assumptions used in each of the models, the single index model looks at the volatility of each security, represented by beta, in relation to market volatility, represented by market beta. The constant correlation model, on the other hand, assumes that the returns of each asset are only correlated with one another, as opposed to correlated with the market beta as used in the single index model (Kane et al., 2013).

During stable conditions, the constant correlation ignores or does not rely on market beta. As the market is relatively calm during this condition, using the constant correlation model excels in a way that it does not overestimate the impact of the market

International Journal of Current Science Research and Review
ISSN: 2581-8341
Volume 06 Issue 12 December 2023
DOI: 10.47191/ijcsrr/V6-i12-07, Impact Factor: 6.789
IJCSRR @ 2023

index, as it assumes that stock prices tend to move in the same systematic and predictable manner. By doing so, it allows the method to formulate a potential portfolio with stocks that have lower risk but better performance by utilizing the relationship between stocks that are closer to negative 1 (or a positive correlation with a value that is closer to zero). As there are no restrictions on the number of stocks included in the portfolio as long as the correlation between stocks is constant, this allows for flexibility in formulating a risky asset portfolio for retail investors, a perfect implementation of Markowitz Portfolio Theory by utilizing the diversification process (Fama & French, 2004). This wider range of possible portfolios could, later on, be chosen based on the retail investor's personal return risk and preference using a separation theory, which states that the portfolio choice problem may be separated into two independent tasks: technical and individual preference (Kane et al., 2013).

According to Kwan's founding (2006), in analyzing the correlation matrix used in this model, the relatively stable condition of the market makes the unsystematic risk, known as firm-specific risk, have a bigger influence than the systematic risk (market risk); hence, the constant correlation model uses its fundamental assumption of capturing the co-movement of stock returns in a practical manner by having a fixed-correlation matrix in its procedure. This contributes to the reduction of noise in the formulation process and fosters the creation of more robust portfolios due to the model's simplification of the calculation process and its tendency to minimize overfitting by avoiding excessive sensitivity to current data. Note that overfitting can diminish a model's reliability when confronted with new data, making the constant correlation model's approach advantageous in promoting robust and reliable portfolio construction. Another notable advantage of this model is its avoidance of computing the inverted covariance matrix, a requirement in the Markowitz method. This characteristic makes the constant correlation model particularly suitable for constructing large-scale portfolios, as it directly utilizes a fixed correlation matrix, streamlining the computational process.

The single index model, on the contrary, may not be as effective in constructing a significant excess return of the optimal risky portfolio during the stable condition due to its relationship with systematic risk (a risk that could not be eliminated by diversification known as market risk), represented by beta. In a stable condition where stock prices tend to move in the same direction with no significant market shocks or macroeconomic factors, systematic risk might not be as impactful as unsystematic risk or firm-specific risk on the portfolio's return. This provides a possible explanation for why the single index model underperformed the constant correlation model in this condition, as the exposures to systematic risk are relatively constant.

Moving to the global crisis condition, as the volatility of the market increases, it is less likely that a stock's price movement is predictable. In times of economic turmoil, market efficiency diminishes due to the spread of contagion, whereas stable economic conditions foster informationally efficient markets (Naeem et al., 2023). This aligns with another finding that suggests the elevated inefficiency observed during the crisis is expected considering investors exhibited excessive responsiveness to both local and global news, especially negative news developments (Lim et al., 2008). However, as many sectors are affected by these crises, they are likely to move in the same direction, which means that the co-movement between stocks will also rise due to their response to market conditions.

The constant correlation model has demonstrated robustness, particularly during the COVID-19 pandemic. Research by Choi (2021) utilizing generalized Hurst exponents for the two crisis periods reveals that the average return series across all sectors exhibited a higher correlation during the COVID-19 pandemic period than in the Global Financial Crisis (GFC) period for US stocks. This heightened correlation suggests increased co-movement among stocks during the recent crisis, providing empirical support for the use of the constant correlation assumption in capturing the dynamics of the market during times of significant economic stress. While the constant correlation model assumption of a constant correlation structure between assets may not be seen as effective, it could still produce an optimal portfolio.

Investors using the constant correlation model have the advantage of allowing correlations to vary among assets over time. Capturing the increased movements among stocks can help Generation Z retail investors create a portfolio to hedge against the systematic risk from the market. In other words, during a global crisis that is dominated by the systematic risk of the market, such as economic turmoil, the constant correlation model uses its strength to formulate portfolios based on current correlations to minimize the impact of market downturns. By adapting to changing market conditions and considering the interrelationships between stocks, the constant correlation model helps construct portfolios that align with market dynamics. Portfolios that align with market dynamics, like defensive stocks, commodities, or assets that perform well during downturns, can benefit from trends during turbulent markets. Therefore, instead of eliminating positive correlations among stocks, the constant correlation model diversifies portfolios to manage risk during crises. Another finding by Choi (2021) suggests that during the COVID-19 pandemic, certain sectors, including materials and financials, experienced low market efficiency due to various economic factors. This indicates that these sectors may not fully reflect available information, a violation of efficiency market theory, creating potential opportunities for trading strategies that aim to exploit inefficiencies. This might explain why the constant correlation model displays a variety of portfolios consisting of financial stock (BBTN) and materials sectors (ANTM, INCO, INKP, SMGR, and INTP).

Due to the fact that systematic risk dominates during a global crisis, the single index model that focuses on the volatility of each stock represented by beta in the known Capital Asset Pricing Model (CAPM) becomes more relevant. Considering that the price of individual securities is influenced by market conditions, it could lead to an abnormal return on the constructed portfolio as the volatility of the market makes the beta of each stock count due to the sensitivity of the stock's price. As the market's volatility and uncertainty increase, mispricing of assets and inefficiency might occur as people tend to "panic-sell" during crises.

This phenomenon of "following the crowd" relates to the fundamentals of behavioral finance, namely the concept of prospect theory for the analysis of decision-making under risk (Kapoor & Prosad, 2017). This prospect theory emphasizes "the value function," that is, at certain times, the pain experienced in an equal amount to the amount of gain investors earned felt too intense. As a consequence, there are three major premises underlying the concept of prospect theory: (1) individuals don't display a uniform risk appetite; (2) individuals use a certain reference point to estimate the value of the prospect, usually with their current wealth level, to decide their loss or gain in a prospect; and (3) the tendency for individuals to avoid loss is greater than seeking profit, known as loss aversion. For this reason, interaction of human traits in facing uncertainty, especially in making economic decisions, emotions such as greed, fear, optimism, etc. have a considerable impact on all sorts of decisions surrounding money (Oprean & Tanasescu, 2014).

Furthermore, the single index model empowers Generation Z retail investors to construct portfolios with a strategic balance of assets possessing varying beta values. This approach helps mitigate market risk during periods of crisis by incorporating lower-beta stocks that act as a hedge against adverse market conditions, offsetting the impact of higher-beta assets within the portfolio. Aligned with the efficient market hypothesis, which stated that all relevant stock information is readily available in the market (Hunter & Coggin, 1988), crises can present opportunities for investors to capitalize on arbitrage opportunities (i.e., asset mispricing in the market) and engage in effective portfolio risk management (Naeem et al., 2023). Hence, the single index model, by incorporating systematic risk from the market, can assist in identifying stocks with the potential for abnormal returns, enabling portfolios to outperform the market during challenging times. This might explain the observation, similar to the constant correlation model, that the single index model yields diverse portfolios comprising financial stocks (BBNI) and materials sectors (ANTM and INKP).

Overall, these findings support the idea that classical models for constructing an optimal risky portfolio—the single index model and the constant correlation model—are both appropriate to use and remain relevant in helping Generation Z retail investors allocate their investments across risky assets such as stocks. Nonetheless, due to the different assumptions and procedures used in its formulation process, it seems clear that Generation Z retail investors need to consider the implications of the constructed portfolio results and align them with their expected return and risk appetite, as these methods are purely technical and will, later on, depend on the investor's preferences and needs. While no definitive "better model" exists in constructing an optimal portfolio of risky assets, it seems clear that these two methods could be one of the options for Generation Z retail investors in ensuring that they receive the best combination of return and risk in their investment effort. Investors should align it with the goals they are pursuing and whether they are willing to accept the risk in order to achieve the returns they are hoping for, as stocks are generally one of those assets that offer high returns in line with their high risk. The upcoming conclusion and recommendations further illuminate the implications for Generation Z retail investors in navigating the complexities of portfolio management.

CONCLUSION, LIMITATIONS, AND SUGGESTIONS

A. Conclusion

The constant correlation model is a more robust choice for constructing portfolios, especially during stable market conditions. However, during a global crisis, both models were effective in generating portfolios that outperformed the risk-free rate. Due to its assumptions and a different set of procedures for constructing the optimal portfolio of risky assets, Generation Z retail investors should realize the implications of such assumptions in their investment portfolio decisions and choose stocks in accordance with their personal return risk. Aside from that, Generation Z retail investors should know the drawbacks of each optimization model used, as the single index model gives a challenge in calculating the stock's beta while the constant correlation model gives a challenge in constructing the correlation matrix or stock return. Both methods also use historical data, which might not have the same performance in the future. Despite these drawbacks, however, both models are among those that are widely used as they simplify the construction of risky asset portfolios. It is still advisable for Generation Z retail investorsto update the information surrounding the market and industries and do fundamental research on stocks of interest, as optimal portfolio construction methods are only a tool to help analyze technical perspectives as there's no "one-model-fits-all" , but by considering the implications and limitations used, it could sharpen investor instincts and lead to better decision-making in assessing the current portfolio of an investor in light of the market conditions.

B. Limitations and Suggestions

Due to the use of only the classical model and not a more dynamic model to construct the optimal portfolio, such as GARCH, It is advised for future research to take into account if a dynamic model could be used by Generation Z retail investors in both stable and global crisis conditions or by using the Markowitz method. As this research only considers why model assumptions affect the result of why both models could be used during a global crisis, it is advisable that future research analyze it from different perspectives, such as analyzing the influence of specific economic and market conditions on the suitability of different portfolio construction models during crises.

REFERENCES

1. Arifin, N. and Mutasowifin, A. (2022) "Analisis Penerapan Risiko dalam Penyusunan Portofolio Optimal", Jurnal Ilmiah Akuntansi Kesatuan, 10(3), pp. 575 - 584.
2. Cerrato, M. (2012) 'Appendix 3: Value at Risk', The Mathematics of Derivatives Securities with Applications in MATLAB, pp. 217–226.
3. Choi, S. Y. (2021). Analysis of stock market efficiency during crisis periods in the US stock market: Differences between the global financial crisis and COVID-19 pandemic. Physica A: Statistical Mechanics and Its Applications, 574, pp. 125988.
4. Clarence C. Y. Kwan. (1984). Portfolio Analysis Using Single Index, Multi-Index, and Constant Correlation Models: A Unified Treatment. The Journal of Finance, 39(5), pp, 1469–1483.
5. Elton, E. J., Gruber, M. J. and Brown, S. J. (2013) Modern Portfolio Theory and Investment Analysis, 9th Edition: Ninth Edition.
6. Fama, E. F., & French, K. R. (2004). American Economic Association The Capital Asset Pricing Model: Theory and Evidence. The Journal of Economic Perspectives, 18(3), pp. 25–46.
7. Güngör, S., Tomris Küçün, N. and Erol, K. (2022) 'Fear of Missing Out Reality in Financial Investments', International Journal of Business & Management Studies, 03(10), pp. 53–59.
8. Hunter, J. E., & Coggin, T. D. (1988). Analyst judgment: The efficient market hypothesis versus a psychological theory of human judgment. Organizational Behavior and Human Decision Processes, 42(3), pp. 284–302.
9. Kane, A., Marcus, A., & Bodie, Z. (2013). Investments. McGraw-Hill Education.
10. Kapoor, S., & Prosad, J. M. (2017). Behavioural Finance: A Review. Procedia Computer Science, 122, pp. 50–54.
11. KSEI (2023) Statistik Pasar Modal Indonesia - ksei.co.id, Demografi Investor. Available at: https://www.ksei.co.id/files/Statistik_Publik_-_Mei_2023_v2_(1).pdf (Accessed: 30 June 2023).
12. Kwan, C. C. Y. (2006). Some further analytical properties of the constant correlation model for portfolio selection. International Journal of Theoretical and Applied Finance, 9(7), pp. 1071–1091.
13. Laporan Perekonomian Indonesia Tahun 2020. (2021). Www.bi.go.id. https://www.bi.go.id/id/publikasi/laporan/Pages/LPI_2020.aspx
14. Lim, K. P., Brooks, R. D., & Kim, J. H. (2008). Financial crisis and stock market efficiency: Empirical evidence from Asian countries. International Review of Financial Analysis, 17(3), pp. 571–591.
15. Markowitz, H. (1952). Portfolio Selection. The Journal of Finance, 7(1), pp. 77–91.
16. Naeem, M. A., Yousaf, I., Karim, S., Tiwari, A. K., & Farid, S. (2023). Comparing asymmetric price efficiency in regional ESG markets before and during COVID-19. Economic Modelling, 118(October 2022), pp. 106095.

17. Negara, K. S. (2022). Tutup Perdagangan BEI 2022, Wapres Ungkap Lima Alasan Tetap Optimis Sambut 2023 | SekretariatNegara. https://www.setneg.go.id/baca/index/tutup_perdagangan_bei_2022_wapres_ungkap_lima_alasan_tetap_optimis_sambut_2023
18. Olkiewicz, M. (2022). The Impact of Economic Indicators on the Evolution of Business Confidence during the COVID-19 Pandemic Period. Sustainability (Switzerland), 14(9).
19. Oprean, C., & Tanasescu, C. (2014). Effects of Behavioural Finance on Emerging Capital Markets. Procedia Economics and Finance, 15(14), pp. 1710–1716.
20. Ramyakim , R.M. & Widyasari , A. (2022) Siaran pers 10 JT investor-final 161122 RMR - KSEI, Investor Pasar Modal Tembus 10 Juta. Available at: https://www.ksei.co.id/files/uploads/press_releases/press_file/id-
21. Rosdiana, R. (2019). Comparative Analysis Of Sharia Stock Portfolio Optimization Using Single Index Method and Constant Correlation Method (On Jakarta Islamic Index 2012-2018). East African Scholars Journal Of Economics, Business And Management, 2(8), pp. 433–330.
22. Sari, I. P., & Qudratullah, M. F. (2016). Analisis Kinerja Portofolio Optimal Constant Correlation Model Pada Saham Syari'ah Dengan Menggunakan Metode Sortino, Treynor Ratio Dan M2. Jurnal Fourier, 5(2), pp. 85.
23. Sholehah, N. A., Permadhy, Y. T. and Yetty, F. (2020) 'The Comparison of Optimal Portfolio Formation Analysis with Single Index Model and Capital Asset Pricing Model in Making Investment Decision', European Journal of Business and Management Research, 5(4).
24. Sudrajat, D. (2022) 'Article Type: Research Paper Fear of Missing Out and Student Interest in Stocks Investment during Covid-19 Pandemic', Journal of Economics Research and Social Sciences, 6(2).
25. Susilawati, S., Falefi, R., & Purwoko, A. (2020). Impact of COVID-19's Pandemic on the Economy of Indonesia. Budapest International Research and Critics Institute (BIRCI-Journal): Humanities and Social Sciences, 3(2), pp. 1147–1156.
26. Tollefson, K. (2023). Coming of Age: Young Investors and the Rise in Riskier Investments. Uen.pressbooks.pub.