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Optimum Portfolio Analysis of Black-Litterman Model in The Indonesian Stock Exchange on Consumer Goods Industrial Sector

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Abstract - The aim of the research was to identify the allocation of optimum portfolio formation in consumer goods sector at Indonesian Stock Exchange from 2014 to 2018 by using Black-Litterman model. This quantitative research used secondary data on stock prices of the consumer goods sector on the Indonesian Stock Exchange from January 2014 to December 2018 which was obtained from Yahoo Finance and the Indonesia Stock Exchange. Four stocks formed the optimum portfolio of consumer goods sector identified by using Black-Litterman model. Those are stocks of PT Indofood CBP Sukses Makmur Tbk, PT Kimia Farma Tbk, PT Indofarma Tbk, PT Indofarma Tbk, and PT HM Sampoerna Tbk. The results show that stock with the biggest proportion was ICBP's with proportion of 68,5379%. Meanwhile the smallest proportion was INAF's, which is 3,0277%. The mean return was calculated from this proportion, resulting in 3,678% while the risk value was 1,471%.

Keywords: optimum portfolio, Black-Litterman model, stock exchange, consumer good industries

I. INTRODUCTION

The industrial sector having a significantly strategic role, especially to prosper people's lives, is the consumer goods sector. Called their products are considered necessary in consumers daily needs, such as food and beverages, medicines, equipment, and household supplies. Inelastic demand level has been an advantage in this sector since it provides basic supplies, which people will not stop buying despite the increasing prices. The respondents of this research is consumer goods company since the investment in this industrial sector has good prospect in investment world development.

The Indonesian economy in 2015 experienced a mini economic crisis. Various external and domestic challenges hit the Indonesian economy. At the same time, uncertainties in the global financial markets had increased due to the expanding opportunities for United States (US) interest rates, fears of Greek fiscal negotiations, and being exacerbated by the devaluation of the Yuan which was not anticipated beforehand. These unfavorable global developments had a negative impact on the domestic economy, both through trade and financial channels. Pressure on the domestic economy had been compounded by the remaining domestic structural problems. These challenges triggered an increase in several risks, such as high pressure on the rupiah exchange rate, a decline in the confidence of economic actors, as well as risks in the corporate sector. Uncertainty on the global financial market had resulted in the depreciation of the rupiah during 2015. Pressure on the rupiah had been ongoing since the first quarter, and then peaked in the third quarter of 2015. Due to this, the share price in the consumer goods sector also experienced a sharp decline in the third quarter of 2015 at a price of Rp 1.951,00 per share. The consumer goods sector which used to be able to survive amid economic conditions weakened by 5,75%. The sub-sectors that experienced an emphasis on the depreciation of the rupiah were the household appliances and pharmaceutical subsectors. The slowdown in financial performance, especially net income, made almost all issuers of the consumer goods sector produce negative returns (Laporan Keuangan Indonesia, 2015).

Global economic growth in 2018 went slower with uneven growth between countries. The world

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economy recorded growth by 3,7% in 2018 which was slowing down compared to growth in 2017 by 3,8%. High global uncertainties and pressure on the balance of payments of Indonesia (NPI) were greatly influenced the dynamics of the rupiah exchange rate in 2018. This uncertainty was triggered by the continued increase in the Federal Funds Rate (FFR) and global financial market uncertainties resulting in reduced inflows of foreign capital to developing countries, including Indonesia. As a result, the rupiah exchange rate had been under pressure until October 2018 with the biggest pressure occurring in July 2018. Depreciating pressure against the rupiah was also in line with the weakening of many other developing countries' currencies, in line with the impact of rising global uncertainty. Indonesia's trade balance in the April period recorded a deficit in 2018 (Laporan Keuangan Indonesia, 2018).

Based on the factors that influence the movement of shares in the consumer goods sector, investors who plan to invest their capital in the consumer goods sector need to be aware of sentiments that might shake stock prices. Although the consumer goods sector is a defensive sector which is able to withstand economic shocks, it is not considered always true. Investors need to see negative sentiment both externally and internally that leads the Indonesian economy to fluctuation, such as uncertainty in the global economy, inflation, interest rates, the Islam K. Kabbani (IKK) index, rising gas, and electricity tariffs. The researchers assume that despite the weakening in the consumer goods sector in the third quarter of 2015 and the second quarter of 2018, investors will remain obtaining benefits by forming a stock portfolio. Hence investors are able to diversify their investment risks and allocate funds to get the maximum profit.

Optimum portfolio is a selection of various portfolio stocks efficiently. There are some models of optimum portfolio development such as Mean-Variance Model, Capital Asset Pricing Model (CAPM), and Black-Litterman Model. The principal of Mean-Variance model is the quantitative approach, linking risk that is measured by standard deviation or variance, and the expected return of mean return (Arulraj, Pvs, & Karthika, 2012). Model to assess feasibility of stock investment can be done with estimation calculation by using Capital Asset Pricing Model (CAPM). Security risk in CAPM model is shown with beta. Beta is used as measurement tool to estimate such security's investment risk. CAPM is a model that describes a systematic risk by using beta to link between risk and return (Zabarankin, Pavlikov, & Uryasev, 2013). According to Subekti (2009), Black-Litterman is a portfolio-optimizing model that leads to better performance and profitable to investors as a result of the investors' involvement, assuming that establishment of portfolio is not abandoned.

Black-Litterman model was introduced by Fisher Black and Robert Litterman at Goldman Sachs in 1990. The B-L model is often referred to as a completely new portfolio model. Much literature concerning the B-L model assumes a global asset allocation model, and because of this (Arisena, Noviyanti, & Zanbar, 2018). Litterman (2003) argues that the global Capital Asset Pricing Model (CAPM) is a good starting point for a global equilibrium model. However, the B-L model is not used only in global asset management, but also in domestic equity portfolio management and fixed income portfolio management. In such cases the equilibrium weights are easier to find by using domestic CAPM (Mankert, 2010). The view of Black-Litterman model is used to adjust the expected return of equilibrium to predict future return. This model gives two possibilities in investor's point of view, both absolute views and relative views as explained by (Idzorek, 2004).

Black-Litterman model shows the view of an investor with other investors could be different due to the view is subjective. The view is an investor's view in asserting the predicted return towards such stock (Satchell & Scowcroft, 2000). Due to these views differences, a portfolio of an investor will not be the same as other investors. This condition will possibly become a source of portfolio risk, or in other words, the views from one investor have influence on increasing the risk of portfolio. Another research about capital market was conducted by Mishra, Pisipati, and Vyas (2011) by comparing performance of Black-Litterman model and Mean-Variance with sectoral index stocks of BSE (Bombay Stock Exchange). The research reveals that an efficient portfolio of Black-Litterman achieved a better risk performance compared to Mean-Variance approach.

Ramli (2010) shows that the stock of consumer goods sector is a defensive stock. It means that when the market is inclined, the stock will also be inclined but lower than the market incline. On the contrary, when the market is declined, the stock will be declined without exceeding the market decline. Meucci (2006) uses Black-Litterman model without assuming the distribution that underlie the consideration further non-normal view from multi-assets portfolio. The performance of asset allocation resulted is aimed to minimalize the risk efficiently. Menchi (2016) formulates a synthetic indicator to evaluate the effect of investor view towards portfolio allocation based on its level of confidence.

Da Silva, Lee, and Pornrojnangkool (2009) points out that Black-Litterman model with Bayes analytical framework comes out in stronger portfolio as it has small sensitivity to incoming error in expected return. Walters (2014) explains the Black-Litterman model with Bayes approach. Ganikhodjaev and Bayram (2016) has developed a new portfolio percentage (posterior) by inputting golden asset as a safe-haven asset within Central Bank of Republic of Turkey case with Black-Litterman model by using Bayesian approach. Mahrivandi, Noviyanti, and Setyanto (2017) has conducted a research with four bank sectors in LQ-45 index by using Black-Litterman in non-normal return model. The result shows that level of confidence in investors' views is significant

to influence the results of target of returns and risks of the Black-Litterman portfolio model. A higher level of trust from the view of investors will not only result in a higher return target, but also lead to higher risks as well.

Of the nine sector stock indexes on the IDX, the research focuses on the consumption sector. This is based on a sector that is better than other sectors and is always needed by financial managers or investors as an investment option. Meanwhile, the consumer goods sector became the second largest sector contributing to the rise in the Composite Stock Price Index (CSPI). In compiling portfolios, what should be considered is an analysis of investment appraisals and investor accuracy in making optimal portfolios. In addition, no one has yet undertaken a portfolio analysis of Black-Litterman's optimal model and risk in the consumer goods sector. Based on the problem that has been described above, the purpose of this research is to identify the optimal portfolio formation allocation and expected return value in the consumer goods sector on the IDX for 60 months (2014-2018) using the Black-Litterman model. The research is expected to provide benefits to investors as a guide in making optimal portfolio investment decisions and understand the level of risk that will be borne in investing in the consumer goods industry sector.

II. METHODS

At the beginning of the research, the selection of shares joined in the consumer goods sector for five years in a row began in January 2014 to December 2018. The selection of listed companies using purposive sampling was then carried out data collection for the process of forming a portfolio using the Black-Litterman model approach. Black-Literrman model with mean based on 60-month and 12-month return data. The research framework in this research focuses on analyzing the return of the consumer goods sector and identifying the optimal portfolio formation in the IDX consumer goods sector by using the Black-Litterman model in the 2014-2018 period with the expected return from the CAPM calculation results. Through these two methods, it is expected to provide optimal portfolio formation.

This is a quantitative research by using secondary data on stock prices of the consumer goods sector on the Indonesian Stock Exchange from January 2014 to December 2018 based on Yahoo Finance and the Indonesia Stock Exchange. The sampling method uses purposive sampling researchers have determined sample criteria, namely issuers who were in the consumer goods sector from January 2014 to December 2018. The type of data used is secondary data. These include daily closing stock price data and SBI interest rate data. The total issuers examined in this research are 23 in the consumer goods sector during the research period. They are shown in Table 1.

Table 1 The Consumer Goods Sector

Subsector	Company
Cosmetics and Household Purposes	TCID, UNVR
Food and Beverages	ALTO, CEKA, ICBP, INDF, MLBI, MYOR, PSDN, ROTI, SKLT, ULTJ
Household appliances	KICI, LMPI
Pharmacy	DVLA, INAF, KAEF, KLBF, PYFA, SIDO
Cigarettes	GGRM, HMSP, RMBA

The return on individual shares is income received in the form of dividends or income from changes in market prices of stock trading transactions that are calculated within one month (Jogiyanto, 2013). The formula used to calculate the returns on individual stocks is as follows:

$$R_t = \frac{P_t - P_{t-1}}{P_{t-1}} \quad (1)$$

The Capital Asset Pricing Model (CAPM) is based on the Markowitz model–which each investor assumes–will diversify their portfolio and choose the optimal portfolio based on preference for return and risk (Tandelilin, 2010). In general, the formation of a CAPM portfolio is based on the following equation:

$$E(R_i) = R_{BR} + \beta_i [E(RM) - RBR] \quad (2)$$

The Black-Litterman Model is used to estimate inputs for portfolio optimization. This model combines two types of estimates, namely historical data on equilibrium conditions and investors' views to update the estimation results. Arisena, Noviyanti and Zanbar (2018) argue that the advantage of the Black-Litterman Model is that the investors are allowed to combine views in both assets and relative terms with preceding estimates, and to produce new posterior estimates that cover all displays. The Black Litterman model combines investor views with equilibrium returns achieved through the CAPM to generate new portfolio returns. The value of views is determined by the views of investors. The views given by investors to selected assets remain to have uncertainty, so they must be measured through confidence levels. Investors' views are formed by using previous stock price data assistance, so absolute views and relative views can be formed as follows:

Views 1 : "I predict INDF shares will give a return of 1,5% "

Views 2 : "I predict GGRM shares will give a return of 1,6%"

Views 3 : "I predict ICBP shares will give a return of 5%"

Views 4 : "I predict INAF shares will give a return of 1,8%"

Views 5 : "I predict HMSP shares will give a return of 3%"

Relative views

Views 6 : "I predict KAEF shares will return 1,2% more than ROTI shares"

Therefore, Q can be formed as a view vector:

$$Q + \epsilon = \begin{bmatrix} Q_1 \\ \vdots \\ Q_k \end{bmatrix} + \begin{bmatrix} \epsilon_1 \\ \vdots \\ \epsilon_k \end{bmatrix} \quad (3)$$

The variance of each error is expressed in the new matrix. Diagonal in the matrix shows covariance between views. The matrix will contribute significantly to the final calculation of the expected return of Black-Litterman.

Before heading to the final expected return calculation, the researchers previously discussed the matrix coefficient P. P is the matrix of k and n, where k denotes investor views and n shows the number of assets in the portfolio (Idzorek, 2004):

$$P = \begin{bmatrix} P_{1,1} & \cdots & P_{1,n} \\ \vdots & \ddots & \vdots \\ P_{k,1} & \cdots & P_{k,n} \end{bmatrix} \quad (4)$$

The Black-Litterman model, which is started with the equilibrium return achieved by CAPM, let the investors combine several assets with the investment views. The investors' confidence level is an error vector showing that investors' views remain uncertain and assumed as normally distributed. This confidence level is stated on diagonal Ω matrix (covariance of views) as follows (Idzorek, 2004):

$$\Omega = \tau P \sum P' \quad (5)$$

To calculate market equilibrium prices, risk coefficient is required with the following equation:

$$\delta = \frac{E(R_m) - R_f}{\sigma_m^2} \quad (6)$$

To calculate the equilibrium excess return, the following equation can be used:

$$\prod = \delta \sum W_m \quad (7)$$

In developing the Black-Litterman model, it involves two types of information obtained from different sources; (1) equilibrium expected return of CAPM and investor views and (2) combination of return equilibrium and investors' views based on Black-Litterman Model Theorem (Salomons, 2007). It can be stated as Black-Litterman optimum portfolio calculation:

$$E(R) = [(\tau\sum)^{-1} + P'\Omega^{-1}P]^{-1} [(\tau\sum)^{-1} \prod + P'\Omega^{-1}Q] = \mu_{bl} \quad (8)$$

The weighting of Black-Litterman model is calculated using the mean-variance model by minimizing the risk with a certain return. The following is equation for Black-Litterman weighting.

$$W_B = (\delta S)^{-1} \mu_{BL} \quad (9)$$

The formula to calculate the expected return from the portfolio is:

$$E(RP) = \Sigma W_i E(R_i) ni \quad (10)$$

III. RESULTS AND DISCUSSIONS

As the sample of the research, stocks in the consumer goods sector with positive mean return are used to calculate the expected return of the CAPM model. This model uses beta to link the risk and return together. The risk of each asset is expressed with covariance return from each stock with market return. Beta is a measure of return volatility of a security or portfolio return towards market return (Jogiyanto, 2013).

Beta shows the size of stocks return confidence towards market change. It can also be interpreted as stocks risk size; the bigger the value is, the bigger the risk within a stock. Beta with score more than one means that the return of certain stock is sensitive to all market changes. Issuers with beta score more than one are INDF and GGRM. Besides, there are some samples with beta value of less than one which means that its stock return is less sensitive than market fluctuation. Issuers having risk measure less than one are ICBP, KAEF, INAF, HMSP, ROTI, SIDO, CEKA, MYOR, KLBF, LMPI, ULTJ, INVR, RMBA, MLBI, KICI, SKLT, DVLA, PSDN, TCID, PYFA, and ALTO. After the values of the CPAM model expected return from each issuer are obtained, a portfolio would be developed using seven issuers with the highest expected return. Stocks with the highest expected return are selected since the Black-Litterman Model would use those values of CAPM expected return to develop the optimum portfolio.

The significance level of Kolmogorov-Smirnov test above is 0,05 and the data are normally distributed (see Table 3). The stocks that would have been used in Black-Litterman model portfolio calculation are seven stocks with the highest expected return from CAPM model. The Black-Litterman model combines the investors' views and equilibrium return through CAPM, and then a new portfolio return comes out as a result.

The expected return value of Black-Litterman model can be calculated after information on the CAPM equilibrium return and investors return are fulfilled. The calculation of the weight or proportion of funds for each stock is influenced by the covariance value and the expected Black-Litterman return value (Table 4). Since some portfolios have negative results, it is necessary to do another round of selecting the optimum portfolio. After the re-selection is conducted, the latest optimal portfolio results can be seen in Table 4.

Stocks with largest proportion was ICBP stocks with the proportion of 68,5379%, meanwhile the smallest one was stocks of INAF with the proportion of 3,0277%. From this proportion, the mean return and risk of Black-Litterman portfolio are to be calculated.

Table 2 Risk and Expected Return of CAPM

Number	Companies	Code	Risk (βi)	ECAPM
1	PT Indofood Sukses Makmur Tbk	INDF	1,24652	0,000387
2	PT Gudang Garam Tbk	GGRM	1,06516	0,000342
3	PT Indofood CBP Sukses Makmur Tbk	ICBP	0,97263	0,000319
4	PT Kimia Farma Tbk	KAEF	0,89731	0,000301
5	PT Indofarma Tbk	INAF	0,77979	0,000272
6	PT HM Sampoerna Tbk	HMSP	0,75727	0,000266
7	PT Nippon Sari Corporindo Tbk	ROTI	0,62522	0,000233
8	Industri Jamu dan Farmasi Sido Muncul	SIDO	0,54641	0,000214
9	PT Wilmar Cahaya Indonesia Tbk	CEKA	0,48650	0,000198
10	PT Mayora Indah Tbk	MYOR	0,44089	0,000187
11	PT Kalbe Farma Tbk	KLBF	0,43169	0,000185
12	PT Langgeng Makmur Industri Tbk	LMPI	0,31880	0,000157
13	PT Ultrajaya Milk Industry	ULTJ	0,27720	0,000147
14	PT Unilever Indonesia Tbk	UNVR	0,24913	0,000139
15	PT Bentoel Internasional Investama Tbk	RMBA	0,24559	0,000138
16	PT Multi Bintang Indonesia Tbk	MLBI	0,17999	0,000122
17	PT Kedaung Indah Can Tbk	KICI	0,14803	0,000114
18	PT Sekar Laut Tbk	SKLT	0,13438	0,000111
19	PT Darya-Varia Laboratoria Tbk	DVLA	0,12421	0,000109
20	PT Prashida Aneka Niaga Tbk	PSDN	0,09472	0,000101
21	PT Mandom Indonesia Tbk	TCID	0,06502	0,000094
22	PT Pyridam Farma Tbk	PYFA	0,02402	0,000084
23	PT Tri Banyan Tirta Tbk	ALTO	-0,03469	0,000069

Table 3 Normality of Kolomogorov-Smirnov Test

One-Sample Kolmogorov-Smirnov Test		
		Expected Return CAPM
N		23
Normal Parametersa,b	Mean	0,005091391
	Std. Deviation	0,0000253611
Most Extreme Differences	Absolute	0,178
	Positive	0,099
	Negative	-0,178
Kolmogorov-Smirnov Z		0,994
Asymp. Sig. (2-tailed)		0,277

a. Test distribution is Normal
b. Calculated from data

Table 4 Black-Litterman Portfolio

Company	Variance	Expected return BL	Weight (%)
INDF	0,000336	0,015087	-0,1285
GGRM	0,000378	0,016358	-1,9331
ICBP	0,000288	0,040664	72,3818
KAEF	0,001004	0,017173	3,7861
INAF	0,002080	0,015059	3,1976
HMSP	0,000349	0,025927	26,2429
ROTI	0,000351	0,007271	-3,5467

Table 5 Black-Litterman Optimal Portfolio

Company	Variance	Expected return BL	Weight (%)	Return Portfolio	Profitability (%)
ICBP	0,000288	0,040664	68,53	0,027870	2,519
KAEF	0,001004	0,017173	3,58	0,000615	0,012
INAF	0,002080	0,015059	3,03	0,000455	0,007
HMSP	0,000349	0,025927	24,85	0,006442	0,458
Total					2,994

Portfolio return describes the level of profit which is obtained from the formed portfolio. Portfolio with stocks formation components in Table 5 result in mean return values by 3,678% and the risk by 1,471%. By using Black-Litterman model, four stocks that formed the optimum portfolio of consumer goods sector are drawn to be the result. They are stocks of PT Indofood CBP Sukses Makmur Tbk, PT Kimia Farma Tbk, PT Indofarma Tbk, and PT HM Sampoerna Tbk. The higher the expected return is, the higher the risk will be. On the Black-Litterman model, the risk value is quite high. High risk is caused by assumption where Black-Litterman model is a subjective portfolio model depending on investors views.

New efficiencies can be obtained by comparing the profits obtained with the assets or capital that produced these profits by calculating profitability. Profitability ratios are to gain company excellence in seeking and to provide a measure of the level of management of a company. The profit ratio becomes a benchmark and consideration for investors in investing their capital since profitability indicates whether the company has good expectations in the future. However, it is not an absolute statement that the value of profitability is the return that investors will obtain. It should be kept in mind stock prices might come out different every month to be weaker or soar.

The Black-Litterman model is not only to allocate equity, but also to allocate bonds and currency. Investing in more asset classes is desirable as it gives the possibility to combine the characteristics of both classes. Besides it gives an extensive option of assets which in turn multiplies the possibilities for diversification, and thus reducing risk. Furthermore, as a global allocation model, it becomes possible to diversify even more. Unfortunately, it also opens the investors up to a new source of risk, namely the exchange risk. The investment in a foreign asset may perform well, but if the exchange rate of the currency drops relative to the domestic currency, a substantial loss on the investment may occur (Salomons, 2007).

IV. CONCLUSIONS

The Black-Litterman model as one of the portfolio optimization models results in better and profitable performance for an investor due to the involvement of investor opinion in deciding the weight of the assets in the portfolio forms is not neglected. The advantages of Black-Litterman model make efficient integration of investor knowledge into asset allocation. The Black-Litterman model with Bayes approach uses investor views as prior information. The views of Black-Litterman model are used to finish the equilibrium of expected return to predict future return. By using the Black-Litterman model, four stocks that form the optimum portfolio of consumer goods sector finally come out as a result. The portfolio with four components that form stocks in the Indonesian Stock Exchange from consumer goods sector results in mean return by 3,678 and the risk by 1,471%. Managerial implications of this research are intended for investors in the consumer goods sector. The optimal portfolio in this research is suitable for risk-averse investors since the level of risk generated turns out to be low.

Although the researchers can examine the Black-Litterman with elliptical distributions–in which the CAPM holds are used as long as return distributions are elliptical–certain limitations might appear and

become additional avenues of research. It would be interesting to apply the Black–Litterman approach the conditional value-at-risk (CVaR) as the risk measure, and to apply the Black–Litterman approach to different sectors in IDX. It would be worth revisiting the robust model within the framework of factors models.

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