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Testing Proportion for Portfolio Profit of CAPM and LCAPM

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ABSTRACT. Liquidity Adjusted Capital Asset Pricing Model (LCAPM) is a model that takes into account the relationship of liquidity as a risk to asset returns. The aim of this study is to test the proportion of portfolio profit Capital Asset Pricing Model (CAPM) and LCAPM along with illustrative case studies using stock data in 2012. Furthermore, how the performance of profit compared LCAPM portfolio in a month with CAPM performance prediction and reality as well as differences in the proportion of test results CAPM and LCAPM maximum profit. The data used are the daily returns from January to April 2012. Descriptively, about 60% the proportion of the portfolio that is formed shows maximum LCAPM more profitable than the CAPM. But the proportion of test data shows that the proportion of the sample does not yet support LCAPM portfolio to maximize profit from the proportion of profit that was formed CAPM.

Keywords : Test for the proportion, CAPM, LCAPM

1. Introduction

CAPM is an equilibrium model that describes the relationship of risk and returns in a more modest, and only uses one variable (i.e. the variable beta). In the process of investment, an investor should first learn a few concepts from the investment policy will be the policy thinking at every stage of the investment decision will be made. The fundamental matter in the investment decision-making process is an understanding the relationship between the level of expected investment profitability (return) and the risk of an investment. Relationship of risk and expected return is a linear relationship. The greater the expected return level the greater the risk to be incurred. Therefore, we need to set up an optimal portfolio which is a combination of a number of preferred shares to obtain the highest profit and the smallest risk. A portfolio is inseparable from the existence of risks.

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Expected rate of return of a stock will be influenced by two factors namely systematic risk and stock liquidity. Liquidity is the cost of the sale or purchase of securities immediately. According to (Chordia, Roll, & Subrahmanyam, 2000), liquidity is a risk of changing every time good for individual stocks as well as for the overall market. Stock liquidity approach can be measured by the bid - ask spread of a stock. Put forward CAPM model, a new approach that takes into account the liquidity risk is called Liquidity Adjusted Capital Asset Pricing Model (LCAPM) (Acharya, 2000). In LCAPM model, the return of any security is influenced by several factors namely the price expectations of stock liquidity, covariance of stock returns, liquidity with market return and market liquidity. From the price of the sale and purchase of shares can be obtained daily stock price return. The value is obtained by calculation of stock returns given time period closing price of the previous period. Many authors proven that LCAPM has more advantages rather than CAPM such as (Minovic & Iivkoviz, 2012) and (Acharya, 2000) This mini research as simple investigation to look performance in reality of portfolio formed by LCAPM. The simple idea is to look the realized return of two models then compare them from the proportion of positive profit. So this paper aims to compare the profit proportion of portfolio which is developed using CAPM and LCAPM.

2. Literature Review

2.1 Portfolio and Investment

Portfolio is a proprietary blend of more than one securities, bonds, commodities, real estate investment, gold or assets by a host of others or the institution at a certain time with a certain conditions (for instance, the proportion division or capital funds that are cultivated). In the world of financial economics, the return into a real measure to reflect price changes. This will help investors recognize the movement in price. Return is earned from investments. There is a positive relationship between return and risk in investing, the greater the risk the greater the return incurred produced. Return could be a return realization that was happened in the past or return expectations that have not yet occurred that will hopefully happen in the future. Return of portfolio securities is the simple weighted average return of individual securities. Weight given to each fund's return is the proportion of the portfolio invested in such securities.

$$R_P = \sum_{i=1}^N w_i R_i$$

with:

R_P = return portfolio

w_i = proportion of investor funds are invested in i^{th} securities

N = number of securities

Expected return on a portfolio is the weighted average expected return of individual securities. Therefore, the expected return of portfolio can be expressed mathematically as follows:

$$\begin{aligned} \bar{R}_P &= E(R_P) = E\left(\sum_{i=1}^N w_i R_i\right) = \sum_{i=1}^N E(w_i R_i) \\ &= \sum_{i=1}^N w_i E(R_i) = \sum_{i=1}^N w_i \bar{R}_P \end{aligned} \tag{1}$$

2.2 CAPM and LCAPM

Assumed that investors can lend funds (lending) or borrowing (borrowing) funds in an amount not limited to the risk-free interest rate, following CAPM expected return,

$$\bar{R}_k = R_f + \beta_k(\bar{R}_M - R_f) \tag{2}$$

Liquidity can not be calculated or determined exactly. Therefore used an approach for calculating liquidity. There are several approaches that are used to calculate liquidity. One common approach used to calculate liquidity is bid-ask spread (B_{as}).

$$B_{as} = \frac{Ask - Bid}{Ask} \tag{3}$$

with:

bid is the price of the stock purchase

Ask is the lowest price that the seller offered to buyers

Expected return LCAPM involve the liquidity of each stock and the market so that in the model there is an additional beta

$$\beta_{1k} = \frac{\text{cov}(R_k, R_M)}{\text{var}(R_M - l_M)}$$

$$\beta_{2k} = \frac{\text{cov}(l_k, l_M)}{\text{var}(R_M - l_M)}$$

$$\beta_{3k} = \frac{\text{cov}(R_k, l_M)}{\text{var}(R_M - l_M)}$$

$$\beta_{4k} = \frac{\text{cov}(l_k, R_M)}{\text{var}(R_M, l_M)}$$

Expected return LCAPM (Acharya, 2000) is

$$E(R_k) = R_f + E(l_k) + \lambda \beta_{1k} + \lambda \beta_{2k} - \lambda \beta_{3k} - \lambda \beta_{4k}$$

(□)

with :

l_k is liquidity of the stock

2.3 Profit Portfolio

Suppose a portfolio consisting of 3 stocks namely X, Y and Z with respective weights a, b, and c then the portfolio return is $R_p = aX + bY + cZ$. Whereas if illustrated at the time when portfolio is constructed, the stock weights in the portfolio will show many strands of shares purchased by an investor at that price and value of portfolio

$$R_{p1} = AX_1 + BY_1 + CZ_1$$

with,

R_{p1}	□ initial portfolio value (portfolio value at time t □ 1)
A, B, C	□ many strands of stock □ (weight x amount of capital) □ price of stock
X_1, Y_1, Z_1	□ share price of stock □, □, and □ at time of purchase

Profit earned by portfolio is the difference between portfolio values when it is sold and initial portfolio value.

$$R_{pt} = AX_t + BY_t + CZ_t$$

with,

R_{pt} = initial portfolio value at time t

A, B, C = many strands of stock
 = (weight x amount of capital) / price of stock

X_t, Y_t, Z_t = share price of stock X, Y, and Z at time t (when it is sold)

Therefore, portfolio profit is equal with,

$$Profit = R_{pt} - R_{p1}$$

(5)

3. Application of CAPM and Portfolio LCAPM

The research object in this study is listed stocks in the LQ – 45, which are stocks that have high liquidity ratio. Application of CAPM and LCAPM will be performed on all combinations of stocks that have previously been selected to meet the assumptions of normality return. Writers use daily closing price of stock listed on the Stock Exchange, listed stocks in the LQ – 45. Closing price data is used to predict stock returns. Besides using the bid ask spread data of each stock to calculate liquidity of the stock, Bank Indonesia Certificate is used also as a non-risky asset and IHSG data as market portfolio. The description of data can be seen from the data in Table 1.

Table 1. Data Description

Data	Daily stock price, IHSG/CSPI, SBI
Source of data	www.yahooofinance.com dan www.bigo.id
Period of data	January 2012-March 2012

First of all, writers investigated some of LQ 45 stocks in general, acquired 10 shares which satisfy the assumptions of normality. Subsequently some of them will be selected to set up a stock portfolio. Writers use portfolio consist of 5 stocks

that is considered represent a variety of fields such as banking, food, and mining. For details, we choose 5 stocks from 10 stocks that normally distributed. Those 5 stocks are AALI, BBKA, PGAS, TLKM, CPIQ, ICBP, and ITMG. Because the restricted of this research, we selected 5 from 10 to get a new simple portfolio. So we have 21 combination portfolio. This is illustration step by step of one of portfolio formed.

Table 2. List of Shares Being Object Observations

No	Stock	Name of Company
1	AALI	Astra Agro Lestari Tbk
2	BBKA	Bank Central Asia Tbk.
3	CPIQ	Charoen Pokphand Indonesia Tbk
4	ICBP	Indofood CBP Sukses Makmur Tbk
5	ITMG	Indo Tambangraya Megah Tbk

Step 1. Stock return data normality test

Before calculating the expected return, it is necessary to test the normality of the return portfolio data. Normality test data is worked using SPSS software. It can be seen from the output attachment stock normality test below, all p - values ≥ 0.05 so that the data normally distributed

One-Sample Kolmogorov-Smirnov Test

	AALI	BBKA	CPIQ	ICBP	ITMG
Kolmogorov-Smirnov Z	.003	1.000	.033	.001	.020
Asymp. Sig. (2-tailed)	.300	.200	.340	.200	.355
a. Test distribution is normal.					

Step 2. Beta Counting

In relation to investment and stock trading Stock Exchange, beta is an indicator of risk level inherent in the stock market risk. Knowing beta stocks, investors can determine the sensitivity of the stock to market risk. The movement of the Composite Stock Price Index (CSPI) reflects market risk. Since market is used as one of references, the market beta is represented by CSPI and set equal to one.

Stock, which has beta equal to one, has sensitivity equal to the market sensitivity. If the CSPI index fell by one percent, then the stock is also fell down one percent and if the index rose by two per cent, then the stock is increase also by two percent. Beta stock is less than one it means that the stock price sensitivity is lower than the index.

Table 3. Beta

Stock	Beta CAPM	beta 1	beta 2	beta 3	beta 4
AALI	0,101	0,11214	-1E-05	-0,0023353	0,00315
BBCA	0,3021	0,35022	0,000331	-0,003111	-0,0115
CPI	0,2044	0,114	0,0004	-0,002324	0,01203
ICMB	0,23333	0,2322	0,0002454	-0,00122201	0,0531
ITMG	0,4115	0,41515	-0,000314	-0,00014	-0,050124

Value β_1 shows the sensitivity of a stock to market movements. So the higher the value β_1 the more stock sensitive to changes in the stock market. In this case, CPIN has the greatest β_1 value which means the stock CPIN is the most sensitive stock to changes in CSPI.

β_2 values show sensitivity of stock liquidity compare to market liquidity. Stocks with the highest β_2 value, is stock with liquidity that is very sensitive to changes in market liquidity. If the liquidity market liquidity of its stock changed it will also change. In this case, the most sensitive stock to stock market liquidity is CPI, liquidity of the stock will increase expected return of stock.

β_3 value indicates the sensitivity level of stock price to the liquidity of a stock. ICBP is the most sensitive stock to liquidity, β_3 contributed negatively to the expected return. This happens because investors will buy securities with greater liquidity and sell securities which are less liquid and this will drive up the price of liquid securities and push down prices of illiquid securities. Under these conditions the security price will be adjusted until all the securities that investors are willing to have are available.

Value of β_4 indicates the liquidity level of sensitivity to market changes. Liquidity of a stock will change if the market changes. Liquid stocks are very sensitive to changes in the stock market. ICBP has the highest value.

Step 3. Calculation of expected return using CAPM and LCAPM

Market return sensitivity to stock returns must be calculated when ones want to calculate CAPM expected return. Using excel software, value of market return

variance is 0.0000□105. The interest rate of Bank Indonesia as risk-free assets is 5.□5□. The Calculation of expected return LCAPM should measure both liquidity and return marker sensitivity to market changes. Profit rate sensitivity to changes in the market is called beta investments. □ext, expected return of each stock can be calculated using the CAPM and LCAPM.

Table 4. Expected □return of CAPM Portfolio and LCAPM Portfolio

Stock	Expected return CAPM	Expected return LCAPM
AALI	0,01□□□4□□	0,0214141□2
BBCA	0,0212□□□□	0,024□□24
CPI□	0,0052□1□5□	0,01□□□4□4
ICBP	0,04425□□2	0,05□24□3
ITMG	0,033□□□15□	0,0324□1□3□

Step 4. Weight calculation based on the CAPM and LCAPM

□sing the calculation of expected return on the above tables, the proportions of stocks in the portfolio selection can be calculated. □sing Excel software, weights for each stock can be seen in table □

Table 5. Weight using CAPM and LCAPM

Stock	Weight of CAPM	Weight of LCAPM
AALI	1,2□4□50221	0,□□□14□203
BBCA	0,100□4□□□3	0,0□□□□1□□4
CPI□	0,1□□□31□□2	0,1101143□□
ICBP	-0,445□□3214	0,01□05□011
ITMG	-0,121□55□□3	-0,0□□1124□□

Weighting results are based on weight / proportion of negative value means allowed short sale. Weight / greatest proportion in the portfolio CAPM and LCAPM is stock (aal) PT. Astra Agro Lestari Tbk, namely 1.2□□ and 0.□□□.

Step 5. □sing A□IMA forecasting stock price for the period April 2012

Forecasting stock prices using A□IMA method using MI□ITAB program

assistance. Forecasting data is needed to provide an overview of the stock price in the portfolio formed

Table 6. Stock price forecasting using AIMA for April 2012

Tanggal	AALI	BBCA	CPIN	ICBP	ITMG
02/04/2012	2211,5	101,32	215,01	524,35	4211,4
03/04/2012	22411	103,14	214,4	521,03	4211
04/04/2012	22331	104,11	203,13	523,11	4212,1
21/04/2012	22031	121,11	211,5	5311	4341,1
21/04/2012	22030,1	121,1	221,31	5311,1	4311,5

Step 1 CAPM and profit comparison LCAPM

If the capital of the investor is Rp 500,000,000.00 to buy 5 shares of each stock weights in the Table 5. Investors will buy five shares on 21 March 2012, if the investor plans to sell the shares at the date of the period 2 April 2012 until April 21, 2012 the investor can predict the value of the stock portfolio by first predicting stock prices period 2 April 2012 until April 21, 2012 using AIMA method. Predictive value of the portfolio can be calculated by multiplying the difference between the purchase price and the sale price of real stock was predicted by the amount purchased. By using the share price prediction Table 6 then we compare profit predictions LCAPM and CAPM method.

Table 7. Prediction Profit CAPM and LCAPM

Date	PROFIT CAPM	PROFIT LCAPM	Prediction profit max LCAPM/CAPM
02/04/2012	34044,11	4211,05	LCAPM
03/04/2012	-54111,1	21154,5	LCAPM
04/04/2012	-41100,25	-11513,2	LCAPM
10/04/2012	-105011,2	-214511,1	LCAPM
11/04/2012	-100111,05	-42411,51	LCAPM
12/04/2012	-112114,42	-501240,1	LCAPM
13/04/2012	-111141,01	-55142,11	LCAPM

1/04/2012	-122022	-51023	LCAPM
1/04/2012	-122000	-500030	LCAPM
1/04/2012	-1224035	-55524	LCAPM
1/04/2012	-1213050	-55200	LCAPM
23/04/2012	-110201	-550030	LCAPM
24/04/2012	-110201	-544554	LCAPM
25/04/2012	-1142204	-535000	LCAPM
2/04/2012	-11455530	-522300	LCAPM
2/04/2012	-1120502	-500304	LCAPM

Portfolio of real value can be calculated by multiplying the difference between the purchase price and the sale price of shares of shares real estate with total shares purchased sheet. By looking at the real sale price on 2 April to 2 April 2012, the profit comparison can be seen in Table 8.

Table 8. Profit real CAPM dan LCAPM

TGL	PROFIT CAPM	PROFIT LCAPM	PROFIT
02/04/2012	1000002	20.02.1000	LCAPM
03/04/2012	2004.203,04	23.20013033	CAPM
04/04/2012	11.445.044,00	0053.334,200	CAPM
10/04/2012	0355.02005	0053.110034	CAPM
11/04/2012	14.532.55022	0510053,200	CAPM
12/04/2012	0220250204	0013.440005	LCAPM
13/04/2012	10303.00040	14.004.232,33	CAPM
1/04/2012	22.000433,00	14.040415,44	CAPM
1/04/2012	24.030.000,02	1001002000	CAPM
1/04/2012	23.134.224,00	10353.42005	CAPM
1/04/2012	25.41050010	10304.00011	CAPM
23/04/2012	20020503,00	13.000.0000	CAPM
24/04/2012	00005,1302	-4.343.100,210	CAPM
25/04/2012	-11.100004,10	-0510333,242	LCAPM
2/04/2012	-25.410520,10	-10002.503,20	LCAPM
2/04/2012	15.000.531,32	14.102.221,42	CAPM

From the summary results table shows profit predictions and reality of predicted maximal profit obtained on 2 April 2012 is Rp 4,2105.00, while real gains yield maximum profit obtained on April 23, 2012 is Rp 2,2153. While the application of prediction results show that the model gives a maximum profit is LCAPM. For information on the minus indicates a loss. If observed on 25 and 2 April when the two models produces a minus profit, using LCAPM received fewer loss than CAPM loss. Based on results from the CAPM and LCAPM, it looks like the LCAPM is the good one. But how with all portfolio, is it the same result? Here is a summary comparison of 21 portfolios formed.

Table 9. Summary of profit portofolio comparison

No	Stock	Profit comparison CAPM and LCAPM
1	AALI,BBCA,PGAS,TL,M, CPI	Profit prediction dominated by LCAPM
2	AALI,BBCA,PGAS,TL,M,ICBP	Profit prediction and reality dominated by LCAPM
3	AALI, BCA,PGAS,TL,M,ITMG	Profit prediction and reality dominated by LCAPM
4	AALI,BBCA,PGAS,CPI,ICBP	Profit period dominated by LCAPM
5	AALI,BBCA,PGAS,CPI,ITMG	Profit period dominated by LCAPM
6	AALI,BBCA,PGAS,ICBP,ITMG	Profit period dominated by LCAPM
7	AALI,BBCA,TL,M,CPI,ICBP	Profit period dominated by LCAPM
8	AALI,BBCA,TL,M,CPI,ITMG	Profit period dominated by LCAPM
9	AALI,,BBCA,TL,M,ICBP,ITMG	Profit period dominated by LCAPM
10	AALI,PGAS,TL,M,CPI,ICBP	Profit period dominated by CAPM
11	AALI,PGAS,TL,M,CPI,ITMG	Profit period dominated by CAPM
12	AALI,PGAS,TL,M,ICBP,ITMG	Profit period dominated by LCAPM
13	BBCA,PGAS,TL,M,CPI,ICBP	Profit prediction dominated by LCAPM
14	BBCA,PGAS,TL,M,CPI,ITMG	Profit period dominated by CAPM
15	BBCA,PGAS,TL,M,ICBP,ITMG	Profit period dominated by CAPM
16	AALI,BBCA,CPI,ICBP,ITMG	Profit period dominated by LCAPM
17	AALI,TL,M,CPI,ICBP,ITMG	Profit period dominated by CAPM
18	BBCA,TL,M,CPI,ICBP,ITMG	Profit period dominated by LCAPM
19	BBCA,PGAS,CPI,ICBP,ITMG	Profit period dominated by CAPM
20	PGAS,TL,M,CPI,ICBP,ITMG	Profit period dominated by CAPM
21	AALI, PGAS,CPI,ICBP,ITMG	Profit period dominated by CAPM

Descriptive of 21 simulated portfolios dominated 13 from LCAPM and 8 portfolio from CAPM. The proportion of profit dominated from LCAPM is 61.9% and from CAPM is 38.1%. Then we want to check the positive return resulted from CAPM and LCAPM from all combination. The result is the number of positive profit from CAPM is 3 and we get 14.29% positive profit from LCAPM. It means the proportion profit from CAPM and LCAPM are 14.29% and 33.33% respectively.

Then we test two proportion, we get the output from Minitab below,
Hypothesis

$H_0: p_{LCAPM} - p_{CAPM} = 0$ vs. $H_a: p_{LCAPM} - p_{CAPM} > 0$
calculation by using the following Minitab output

Test and CI for Two Proportions			
Sample	X	N	Sample p
1	7	21	0.333333
2	3	21	0.142857

Difference = p (1) - p (2)
Estimate for difference: 0.190476
95% lower bound for difference: -0.0202508
Test for difference = 0 (vs > 0): Z = 1.49 P-Value = 0.069

H_0 is accepted because p - value > 0.05 so the sample is still not support the hypothesis that proportion profit LCAPM is greater than the proportion profit CAPM.

4. Conclusion

In general, a model may not be suitable for all problems as well as a formation of a financial portfolio. In this study, using ARIMA forecasting method, to predict stock price, writers compare the result of LCAPM portfolio and CAPM portfolio. Result shows that the maximum profit generated not always from LCAPM, but sometimes comes from the CAPM portfolio. From 21 combination of portfolio, 13 profits derived from CAPM portfolio and 8 derived from LCAPM. Descriptively, these results show more than 50 % the proportion of profit generated from LCAPM than CAPM but from the testing hypothesis of proportion, the conclusion is not the same. The conclusion of proportion hypothesis testing of our sample shows that both methods still have the same proportion of profit. This research is

the beginning from our idea to explore LCAPM. Some aspects related with risk have been not investigated, this research will be continued to repair and developed into others perspective.

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