The Fama- French Three Factor Model in Current Stock Market

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Abstract. The Fama-french three factor model is the classical statistical model to evaluate how the each factors or variabels in stock market influence the returns of stock, which allows the investors to understand market dynamics and adjust their investment strategies. In this paper, firstly, the data is been collected from the CSMAR database which is about the Fama- french three factor model is tested by the regression model and get each coefficient of different variables and value of p that reveals correlation between returns of current stock and each variables in Fama- french three factor model. Then research compares the confidence interval in 95% and 90% and finishes hypothesis testing. Results of this research is that the Fama-french three factor model is also valid in the current stock market and the three factor is highly correlated with returns of current stocks, supporting its robustness across varying market conditions and temporal fluctuations.

Keywords: Fama-french three factor model, stock market, the regression model, market dynamics, investment strategies.

1. Introduction

The stock market is the open market which is used for the issuance and trading of stocks. The stock represents the partial ownership of company and investors can buy and sell them. An effective functioning stock market is regarded as crucial to economic development as it enables companies to quickly obtain funds from the public.

Boubacar et al. studied in new estimations of the Fama-French three- and five-factor models by using the machine learning. The results about this research displayed that the Fama- French three factor model is more precise than the Fama- French five factor model [1]. Zhang added one more element, EV/EBIT, which may influence the outcomes of the Fama-french three factor model [2]. And the results of it showed that EV/EBIT affects the accuracy of the Fama-french three factor model [3]. Samreen et al took into account the time variation in the systematic risk and displayed that Fama-French model is robust after adding the extra factor which might impact the results of this model [4]. Rianty studied in reexamining the ability of the Fama-French three factor model which can explain the portfolio returns in different countries with various economic levels and also examine the effect of accounting information from book-ti-market on portfolio returns, the results of it displayed that Fama French model always consistently explain the variation portfolio returns in developed countries [5]. Duc applied the Fama French three factor model into the Australian context and the result of it is that there is a negative relationship between factor and the stocks' return, which is not consistent with the exception of Fama French three factor model.

The fama-french model is a classic one and has been applied in many literatures. Therefore, intends to verify the correlation between several factors of fama-french and the rate of return and conduct a discussion and analysis.

2. Method

2.1. Dataset preparation

The raw data is from the CSMAR database. The sample covered 2000 to 2023 and included monthly stock returns, market capitalization, book equity, market returns, trading status for identifying ST and PT stocks, and the one-year deposit rate as the risk-free rate. And the data this research collected is 691245 groups in stocks.

2.2. Multivariate regression model

A multivariate regression model is a statistical analysis method used to study the relationship between multiple independent variables (explanatory variables) and one or more dependent variables (outcome variables) [6-8], which is based on the number of dependent variables in the model and the characteristics of the data. This research the stata software to regress the Fama French three factor model and analyze the beta and confidence intervals. So, this research on the beta, the correlation coefficient and R-squared.

2.3. The change of the confidence interval

The confidence interval refers to the estimated interval of the population parameters constructed from the sample statistics. This research firstly the confidence interval in 95% and to the confidence interval in 90%, which compares the result from each other.Additionallt, Expression formula is that the $100(1-\alpha)\%$ confidence interval of the overall data average is $(\mu - Z\alpha/2\sigma, \mu + Z\alpha/2\sigma)$,in addition an average value is μ, and a standard deviation is σ, while α is the coverage area of the non-confidence level within the normal distribution,Furthermore, $Z\alpha/2$ is the corresponding standard score.

2.4. Hypothesis testing

There are two testing methods [9, 10]. 1. T-test for a single coefficient 2. F-test with multiple coefficients. Then There are some null hypotheses to test. First, the market factor coefficient β_MKT is equal to zero. Second, the market factor coefficient β_MKT is equal to 1. Third, all factor coefficients are zero simultaneously. Fourth, the scale factor coefficient β_SMB is equal to the value factor coefficientβ_HML. Fifth, the market factor coefficient β_MKT is not greater than the scale factor coefficient β_SMB

3. Results and discussion

The R-squared value from regression is 0.2624. The overall model is highly significant, with a p-value of essentially zero. Table 1, Table 2, Table 3 and Table 4 provide related results.

Table 1. The regression results about the formula

Number of obs	F (3, 691241)	Prob > F	R-squared	Adj R-squared
691245	81988.67	0.0000	0.2624	0.2624

Table 2. The regression results about each variable

Ri	Coefficient	Std. errs.	t	P>|t|	lower_ci	upper_ci
MKT	0.0100038	0.0000251	398.80	0.000	0.0099547	0.010053
SMB	0.0088249	0.0000485	182.01	0.000	0.0087299	0.0089199
HML	-0.0008635	0.00005	-17.28	0.000	-0.0009614	-0.0007656
_cons	0.0040583	0.0001691	24.00	0.000	0.0037269	0.0043898

Analyzing individual factor coefficients: First, the market factor, MKT. The estimated coefficient is very close to 1, P=0. Second, the size factor, SMB. it found a positive and statistically significant coefficient. P=0. Third, the value factor, HML. Here, the coefficient is negative and significant.P=0. Fourth, the intercept, alpha, is positive and highly significant at the 1% level. P=0

Table 3. Each variable in 90% confidence interval

RI	Coefficient	Std. errs.	lower_ci	upper_ci
MKT	0.0100038	0.0000251	0.0099626	0.0100451
SMB	0.0088249	0.0000485	0.0087452	0.0089047
HML	-0.0008635	0.00005	-0.0009457	-0.0007813
_cons	0.0040583	0.0001691	0.0037802	0.0043365

This research calculated confidence intervals in 90%. The intervals for each coefficient are slightly different with the confidence interval in 95%, but the conclusions are unchanged: all coefficients remain statistically significant, and their signs and magnitudes are consistent with the initial interpretation.

Table 4. Hypothesis testing in each null hypothesis

	F	p-value
1 null hypothesis	159041.1	0.000
2 null hypotheses	1.558e+09	0.000
3 null hypotheses	81988.668	0.000
4 null hypotheses	32563.161	0.000
	Difference (MKT - SMB)	p-value
5 null hypotheses	0.00117893	5.465e-91

For the first null hypothesis, the test resulted in an F-statistic of 159,041 with a p-value which is equal to zero. So, the null hypothesis was totally rejected. For the second null, hypotheses the F-statistic was large, and the p-value was zero, indicating that the volatility of your portfolio is significantly different from the overall volatility of the market. For the third null hypothesis, the F-statistic was large, and the p-value was zero, which means that at least one factor has a significant impact on explaining the returns of your investment portfolio. For the fourth null hypothesis, the F-statistic is over 32,000 and a p-value is equal to zero, which indicates that the scale factor and value factor have different degrees of influence on the returns of your investment portfolio. For the fifth null hypothesis, the difference was positive and significant, with a p-value near zero, confirming that β_MKT is indeed greater than β_SMB. Market factors have a greater impact on the returns of your investment portfolio than size factors

The R-squared is lower since the Fama-French three factor model is the original model to test each factor which influences the stock returns. So, some recent economic phenomenon is hard to explain. As a result, 26.24% of the variation in our asset's returns can be explained by the three factors: market, size, and value, which is relatively low level. The p-value for the whole model reject the null hypothesis that all factor coefficients are zero. This confirms the model's validity.

For the coefficient and p-value for each factor, the coefficient of MKT is the highest, which shows that the MKT is the most influential factor and portfolio's returns move almost in sync with the overall market. The coefficient of SMB is the positive, it shows that portfolio has a clear exposure to small-cap stocks. It tends to benefit when small-cap stocks outperform large-cap stocks. The coefficient of HML is negative value, it displays that portfolio leans toward growth stocks rather than value stocks. It performs better when growth stocks outperform value stocks. The coefficient of alpha is positive, which suggests the portfolio generated excess returns that cannot be explained by exposure to the three risk factors—an indication of possible abnormal performance. In conclusion, all factors are highly correlated with the returns of stocks since their p-value are all equal to zero.

There are also some limitations about this study. The data collected is little and recent, but the Fama-French three factor model needs huge amounts of data to analyse and test. As a result, the data with small range may influence the result of regression in Fama-French three factor model to lead the results not extremely accurate. Additionally, the weights of market factors, scale factors and value factors in this model are not fixed and may change with the variations in market conditions. This

model still cannot fully explain all the excess returns of stocks. There are some suggestions for the future research, using a wide range of data to regress the Fama-French three factor model makes the results more accurate. Furthermore, adding other economic factors to the Fama-French three factor model makes more in line with the modern stock market.

4. Conclusion

In this work, the research proposed the Fama- french three factor model is the classical model in the statistical model to evaluate the correlation between the returns of stock and each variable. By using regression models to test whether this model is consistent with the current stock market. The result of this research, the fama-french model is highly valid in current stock market and each variable is still correlated with current stocks' return. The market factor is the most influential variables, impacting on the returns of stock. In the future, the research proposes that using wider range of data to do the test and add other economic factors or variables in the Fama- french three factor model.

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