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Stock Arbitrage on Cross-Sectional Cum-dividend & Ex-dividend Date

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ABSTRACT

This study aims to find the explanation of positive stock return on average in cross-sectional cum-dividend and ex-dividend date, which may give profit opportunity for arbitrageur. The empirical model based on Sharpe (1964) CAPM theory and Fama and French (1992) model is tested with additional variables of dividend yield, trading volume, and idiosyncratic risk. The strong positive alpha occurs on CAPM and Fama-French empirical model, meanwhile its explanatory power disappear on the final model which involves all variables. Except for the excess market return, other variables have no explanatory power to the excess stock return. It is also found that dividend yield negatively explains the excess capital gain during the ex-date.

Keywords: Ex-dividend, stock arbitrage, CAPM

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1. INTRODUCTION

Investing in stocks gives two kinds of returns namely capital gains, increasing of the stock prices, and dividend yield, cash payout from the company's profits. We can also categorize that there are two types of investors in the market. The first one is investor who actively trades the stocks in order to gain from the fluctuation of stock prices, generally known as 'trader'. The second one is investor who patiently holds the stocks for ownership purposes and gets gains from the dividend payment, generally known as 'investor'. Since the stocks are traded each day and its holder changes very frequently, so the one who has the right to earn cash dividends are they who already owned or buy the stock at the cum-dividend date and they who do not sell the stocks before the ex-dividend date.

Short-term daily stock trading during cum-dividend date and ex-dividend date may give profit opportunities to investors by doing an arbitrage. According to efficient market hypothesis proposed by Fama (1970), securities prices fully reflect all available information, thus the short-term profit will be eliminated by decreasing stock prices during ex-dividend date in the same amount of dividend per share paid. Kalay (1982) confirmed that hypothesis which suggests that an ex-dividend day price drop less than the dividend per share, thus it still gives positive returns. In contrary, Boyd and Jagannathan (1994) found that marginal price drop is not significantly different from the dividend amount. However, positive stock returns, if it includes dividend payment after tax, were found in a number of stocks in Indonesia Stock Exchange Market. This study intends to find what factors that may affect cross-sectional stock returns behavior during cum-dividend and ex-dividend date.

The basic theory that will be used in the analysis is the Capital Asset Pricing Model by Sharpe (1964), which is tested empirically by Jensen (1968).

$$R_i - R_f = \beta_i + \beta_i(R_m - R_f) + e_i$$

According to the hypothesis, there should be no abnormal return detected in the cross-sectional regression model or the alpha should be no different from zero. Meanwhile, since the market return may explain the individual stock return, so beta should be significantly positive. Cross-sectional regression on stock returns during cum-dividend and ex-dividend data shows positively significant alpha and beta. It indicates that there were other factors that may explain the stock returns.

Consistent with the arbitrage pricing model by Ross (1976), Fama and French (1992) found that there were other factors that may explain stock returns. It has strong negative relation on market value, strong positive relation on book-to-market equity, and no relation on time-series beta. The same variables are added to our cross-section empirical model.

$$R_i - R_f = \alpha_i + \beta_i(R_m - R_f) + S_i Ln(ME) + H_i Ln(BE/ME) + B_i TS\text{-}Beta + e_i$$

As a result, it still gives a significant positive alpha, market value weakly explain the stock return, meanwhile the other variables give no explanation power.

Other alternative variables that are added to developing the empirical model further are dividend yield, trading volume, and idiosyncratic risk. Kalay (1982) found positive correlation between the ex-dividend relative price drop and the dividend yield. Boyd and Jagannathan (1994) point out that arbitrageurs will enter the market only if transaction costs are low and the dividend yield is high enough. Michaely and Vila (1995) found abnormality trading volume during ex-dividend date which negatively related to the risk involved in the transaction: as the stock's variance increases, the abnormal trading volume on the ex-day decreases. Michaely and Vila (1996) found abnormal volume around the ex-dividend day is negatively related to the level of both market risk and idiosyncratic risk. Rantapuska (2008) found that market value has strong positive explanation, trading volume has strong negative explanation, dividend yield has strong positive explanation, beta has strong negative explanation, and idiosyncratic risk has negative strong explanation. Eldomiaty*et al.* (2014) found that the stock returns have association with predicted dividend growth rates, firm size or market value, time as dummy variable, and industry type as dummy variable.

$$R_i - R_f = \alpha_i + \beta_i(R_m - R_f) + S_i Ln(ME) + H_i Ln(BE/ME) + B_i TS\text{-}Beta + D_i D\text{-}Yield + V_i Ln(VOL) + I_i Id\text{-}Risk + e_i$$

The result shows disappearance of significantly positive alpha and also disappearance explanatory power of market value, meanwhile the other variables give no explanatory at all except the market return variable.

When the dependent variable is replaced with excess capital gain, we find that the alpha becomes significantly negative. It confirms that on average the capital gain is negative on ex-dividend date. Strong positive explanation from market return variable means that the market still has strong influence on stock returns regardless the ex-dividend date or other common trading day. Another interesting finding is dividend yield has negative explanatory power on excess capital gain regardless the other variables except excess market return have no explanatory power at all. It shows that larger after-tax dividend paid might cause the drop of ex-dividend stock price further.

The empirical model will be tested in Indonesia Stock Exchange, specifically the cross-section stock returns between cum-dividend and ex-dividend date. The sample is limited only to public corporation stocks which paid the dividend during January – December 2013. We hope that the result of this study might give insight for investors to consider the researched factors while doing stock arbitrage trading and also becoming useful references to the next researcher. Part two of this paper explains the method of this study, part three explains the result and the analysis, part four is the conclusion, and part five is the appendix which explains the classical assumptions test for empirical models.

2. METHOD

The data that are used in this study were collected from Indonesia Stock Exchange in the period of January – December 2013. The dependent variable used in the empirical model is excess stock return, . The cross-sectional stock returns during cum-dividend and ex-dividend date are calculated by simple stock return formula.

$$R_i = capital\ gain + dividend\ yield$$

$$R_i = \frac{closed\ price\ ex\ dividend - closed\ price\ cum\ dividend}{closed\ price\ cum\ dividend} + \frac{after\ tax\ dividend\ payment}{closed\ price\ cum\ dividend}$$

Assuming that there were no transaction cost and the dividends are paid immediately at the ex-dividend date. BI Rate which used as the risk free rate is taken from www.go.bi.id. It was divided by 365 days since the data provided is in the annual rate. The market return variableis the excess return of Jakarta composite index also during the cum-dividend and ex-dividend date for each stock. The market value variable is the natural logarithmic form of market capitalization for each stock during the-cum dividend date.

market capitalization=number of shared issued×price cum dividend

The book-to-market equity variable is the natural logarithmic form of book equity and market value ratio 31 December 2012. Book equity is the total book value equity plus deferred tax minus preferred stock.

$$BE/ME = \frac{total\ book\ equity + deffered\ tax - preffered\ stock}{market\ capitalization}$$

The beta variable is the time-series beta of weekly stock return and market return regression for 3 years period during 1 January 2010 until 31 December 2013 using CAPM empirical model by Jansen (1968).

$$R_{it} - R_{ft} = \alpha_i + \beta_i(R_{mt} - R_{ft}) + e_{it}$$

There are four empirical models that will be estimated using variation of independent variables involved, as listed in Table 1.

Table 1
Empirical Models

Model	Independent Variables Involved
Efficient Market	Alpha Intercept
CAPM	Alpha Intercept, $R_m - R_f$
Fama-French	Alpha Intercept, $R_m - R_f$, Ln(MV), Ln(BE/ME), TS-Beta
Rantapuska	Alpha Intercept, $R_m - R_f$, Ln(MV), Ln(BE/ME), TS-Beta, D-Yield, Ln(Vol), Id-Risk

The idiosyncratic risk variable is the standard error of CAPM time series regression. The dividend yield variable is the ratio of after tax dividend payment and stock price at cum-dividend date. The trading volume variable is the natural logarithmic form of trading volume during ex-dividend date.

3. RESULT AND ANALYSIS

3.1. Descriptive Statistic

The excess return of stocks during cum-dividend and ex-dividend date gives positive value both for equal weighted average and market value weighted average. It has 1.5203% equal weighted average and 0.4011% value weighted average. In other words, the investors still might get profits if they are doing arbitrage trading for all stocks which pay dividend during cum-dividend and ex-dividend date period. Consistent with Kalay (1982) that an ex-dividend day price drops less than the dividend per share, the excess return of the capital gain gives negative value. It has -0.813% equal weighted average and -1.629% value weighted average. Meanwhile, the after tax dividend yield has bigger value than its capital gain. It has 2.206% equal weighted average and 1.894% value weighted average. In this case, the capital gain return and the dividend yield has -27.632% correlation coefficient.

Table 2
Excess Stock Portfolio Returns Ranked Based on Independent Variables Quintile

Low		Independent Variable Quintile				
		2	3	4	High	
Market Value	EW	2.7178%	1.8003%	1.2674%	1.1009%	0.7151%
	VW	2.3049%	1.8553%	0.9528%	1.3965%	0.2560%
BE/ME	EW	1.1004%	1.4496%	1.7231%	0.8359%	2.4829%
	VW	-0.2748%	2.0888%	1.1940%	0.0998%	0.3311%
Beta	EW	2.2009%	2.5184%	1.4757%	0.4852%	0.9722%
	VW	-0.4982%	-0.9079%	1.2839%	1.1890%	1.3010%
Trading Volume	EW	-2.6457%	-1.2000%	-1.3817%	-1.3099%	-1.0640%
	VW	-3.2952%	0.6542%	0.7711%	-0.7571%	-0.4657%
Dividend Yield	EW	0.9691%	0.4858%	1.8962%	1.6622%	2.5880%
	VW	1.0776%	-0.3578%	0.8157%	2.2322%	-0.6735%
Idiosyncratic Risk	EW	0.6356%	1.4866%	1.2149%	1.8302%	2.5133%
	VW	-0.0921%	1.4822%	0.3299%	1.2841%	2.5410%

Notes: EW = equal weighted, VW = market value weighted

Consistent with the finding of Fama and French (1992, 1993), market value seems negatively related with the stock returns. The low market value portfolio gives highest average return both for equal weighted and value weighted and it were down trended until the high market value portfolio with the lowest average return. It is also consistent with the premise theory that the return is bigger as the compensation of higher risk of the small stocks. Book-to-market equity has no explanation for the stock returns. There were random trend on both equal weighted and value weighted average return. In consistent with the premise that high book-to-market equity stocks are undervalued, thus it might give a bigger return. Equal weighted and value weighted average portfolio have inconsistent stock return trend. Low equal weighted portfolio gives high positive return, meanwhile value weighted portfolio gives negative returns. It is suspected because of the influence of small market value stocks which rarely traded, so it will result a small and not significant beta. These small market value stocks actually might give positive returns, but its contribution become less meaning in value weighted portfolio. Trading volume seems explain a downtrend of stock return on equal weighted portfolio, and gives no explanation on value weighted portfolio, however the lowest quintile gives the biggest return. Possibly, it might consistent with the premise that highly traded volume stocks have more opportunity to adjust the price during the ex-date compared to the low traded volume stocks. Dividend yield seems explain increasing trend on equal weighted portfolio return and randomly trend on value weighted portfolio return. It might be possibly that market value has no correlation with dividend yield, so the higher return might result from the equal weighted calculation. Idiosyncratic risk seems might weakly explain the increasing trend of return on the equal weighted portfolio and more random explanation in the value weighted portfolio. However the lowest and the highest portfolio for both still give lowest and highest portfolio return. It shows that the excess return on higher idiosyncratic risk possibly can be explained with other factors than market return only.

In trying to analyze the explanatory effect of independent variables, the cross-sectional excess return of stocks are ranked based on size, BE/ME, beta, dividend yield, and value trading, then divided it into five quintile based portfolio which is provided in the Table 2.

The correlation matrix on dependent and independent variables are represented in Table 3. Almost high correlation value, 53% between market value and trading volume can be temporarily concluded that high market value stocks are more frequently traded compare to small market value stocks. High negative correlation value between market value and book-to-market ratio shows that possibly the investors have more confident in high market value stocks so it might be overvalued compare to small market value stocks. 42% positive correlation between time-series beta and trading volume shows that highly traded stocks is more relatively aggressive compare to low traded stocks. Negative correlation -33% of time-series beta and idiosyncratic risk show that the classical time-series CAPM model is better explaining stocks with higher beta compare to the lower one. Descriptive statistics on dependent and independent variables are represented in Table 4.

3.2. Empirical Results

We are trying to estimate 4 different regression models using the variation of independent variables involved and the excess return as the dependent variable. The estimated results are represented in Table 5. On the first empirical model, based on efficient market theory by Fama (1970), fail to be proved because there is strong positive significant alpha. The drop of price at the ex-dividend date seems can't compensate the amount of paid dividend. Cross-section empirical CAPM also still gives strong positive significant alpha so the excess market return can't fully explain even though the variable itself has strong positive significant value.

Explanation power of alpha decrease on Fama and French cross-section model, however market value variable has weak explanatory power, meanwhile book-to-market equity and time-series beta has no explanatory power. Inconsistent with Fama and French (1992) that found strong negative explanatory power of market value and strong positive explanatory power of book-to-market equity on the excess stock return. Following Kalay (1982), Boyd and Jagannathan (1994), Michaely and Vila (1995, 1996), the other variables are added to CAPM based empirical model which consisting dividend yield, trading volume during ex-dividend date, and idiosyncratic risk. As the result, the empirical model was successful to eliminate the explanatory power of alpha, unfortunately all of independent variables except excess market return have no explanatory power, also the explanatory power of market value become disappear.

Table 3
Correlation Matrix of Dependent and Independent Variables

	$R_i - R_f$	Cap. Gain	$R_m - R_f$	Ln(MV)	Ln(BE/ME)	TS-Beta	D-Yield	Ln(Vol)	Id-Risk
$R_i - R_f$	1.00								
Cap. Gain	0.70	1.00							
$R_m - R_f$	0.14	0.21	1.00						
Ln(MV)	-0.20	0.01	0.04	1.00					
Ln(BE/ME)	0.15	-0.05	0.00	-0.64	1.00				
TS-Beta	-0.09	-0.09	0.06	0.29	-0.05	1.00			
D-Yield	0.35	-0.28	-0.03	-0.20	0.19	0.02	1.00		
Ln(Vol)	-0.11	-0.07	0.07	0.53	-0.16	0.42	-0.05	1.00	
Id-Risk	0.05	-0.04	-0.09	-0.27	0.14	-0.33	0.07	-0.14	1.00

Table 4
Descriptive Statistic of Variables

	$R_i - R_f$	Cap. Gain	$R_m - R_f$	Ln(MV)	Ln(BE/ME)	TS-Beta	D-Yield	Ln(Vol)	Id-Risk
Mean	0.0152	-0.008131	-0.0013	28.9126	-0.6778	0.7548	0.0221	12.7174	0.0634
Median	0.0102	-0.000205	0.0004	28.9069	-0.6768	0.8234	0.0142	13.4150	0.0559
Maximum	0.3717	0.238973	0.0463	34.7619	1.9868	2.9222	0.3276	19.4004	0.3968
Minimum	-0.0636	-0.146377	-0.0560	23.3125	-3.7896	-2.9868	0.0002	6.2146	0.0056
Std. Dev.	0.0426	0.037761	0.0166	2.0496	0.9191	0.6105	0.0315	3.5765	0.0358
Observations	235	235	235	235	234	231	235	235	231

Inconsistent with Rantapuska (2008) finding that market value has strong positive explanation, trading volume has strong negative explanation, dividend yield has strong positive explanation, beta has strong negative explanation, and idiosyncratic risk has negative strong explanation. Similarly inconsistent with Eldomiaty*et al.* (2014) finding, the market value has strong positive explanation. However, our final empirical model is better than the others by comparing the adjusted R^2 and F-statistic value.

Table 5
Empirical Result Using Excess Return as Dependent Variable

Independent Variables	Expected Sign	Empirical Models			
		Efficient Market	CAPM	Fa-ma-French	Ranta-puska
Alpha		0.0152***	0.0157***	0.1192**	0.0735
		5.4740	5.6831	2.1768	1.4010
$R_m - R_f$	+		0.3674***	0.3887***	0.4145***
			2.7428	2.8538	2.9681
Ln(MV)	-			-0.0035*	-0.0020
				-1.8550	-1.0130
Ln(BE/ME)	+			0.0018	0.0007
				0.4454	0.2499
TS-Beta	-			-0.0031	-0.0044
				-0.8200	-1.0492
D-Yield	+				0.4475
					1.3104
Ln(Vol)	-				-0.0003
					-0.3011
Id-Risk	+				-0.0111
					-0.1466
Adjusted R^2		0	0.0164	0.0469	0.1410
S.E. of regression		0.0426	0.0422	0.0419	0.0398
F-statistic			4.9076***	3.8301***	6.3935***

Notes: *, **, and *** denote statistical significance at 10%, 5%, and 1% levels respectively

Table 6
Empirical Result Using Excess Capital Gain as Dependent Variable

Independent Variables	Expected Sign	Empirical Models			
		Efficient Market	CAPM	Fama-French	Rantapuska
Alpha		-0.0081***	-0.0075***	0.0016	0.0247
		-3.3008	-3.1315	0.0400	0.5666
$R_m - R_f$	+ / -		0.4843***	0.4976***	0.4791***
			3.5266	3.5762	3.5222
Ln(MV)	+ / -			-0.0002	-0.0004
				-0.1448	-0.2098
Ln(BE/ME)	+ / -			-0.0027	-0.0011
				-1.0540	-0.4362
TS-Beta	+ / -			-0.0067*	-0.0050
				-1.6851	-1.2483
D-Yield	+ / -				-0.3201**
					-2.1478
Ln(Vol)	+ / -				-0.0007
					-0.7025
Id-Risk	+ / -				-0.0389
					-0.5601
Adjusted R^2		0	0.0415	0.0436	0.1063
S.E. of regression		0.0378	0.03670	0.0372	0.0360
F-statistic			11.1212***	3.6183***	4.9076***

Notes: *, **, and *** denote statistical significance at 10%, 5%, and 1% levels respectively

In order to prove that the part of positive excess stock return is mainly come from the part of dividend yield instead of the capital gain, the dependent variable is changed with excess capital gain only by removing the dividend part of the return formula. The estimated results are represented in Table 6. The first and second empirical model shows strong negative significant alpha. It confirms the descriptive data that on average the capital gain is negative on ex-dividend date. Strong positive explanation from market return variable means that the market still has strong influence on stock returns regardless the ex-dividend date or other common trading day. Time-series beta has weak negative explanation on

Fama-French model, but its power disappears in Rantapuska model. The interesting finding is dividend yield has negative explanation on capital gain. It shows that larger after-tax dividend paid might cause the drop of ex-dividend stock price further. It also confirms the premise of efficient market that is no arbitrage profit might be taken, even though on average the dividend yield still exceeds the drop of capital gain.

4. CONCLUSION

The premise of market efficient theory seems fail to explain the positive stock return on average during cum-dividend and ex-dividend date. On the average, the dividend yield still exceed the negative capital gain during cum-dividend and ex-dividend date, thus arbitrageur still have potential profit opportunity by buying the stock on cum-dividend date then immediately selling it at ex-dividend date. The variables of empirical model based on Sharpe's CAPM (1964), and Fama and French (1992) cross-section model, which are market value, book-to-market equity, and time-series beta seem can't explain and eliminate the positive significant alpha from the regression model. While other variables, dividend yield, trading volume, and idiosyncratic risk are added to the model, may eliminate the significant alpha but all of the involved variables have no explanatory power at all, except the excess market return only. Another interesting finding is dividend yield has negative explanatory power on excess capital gain of stocks during the ex-dividend date. The suggestion that may be given to this study are added some more data for several years to proof the consistency of the model and the theory, meanwhile search other possible variables that may explain this cross-sectional phenomenon.

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APPENDIX

The classical assumption test for the empirical model will be explained in this appendix part, which shows that the empirical model of this research has pass it

A. Multicollinearity Test

To test the multicollinearty of independent variables, we are using VIF (variance inflation factor) index with help from SPSS ver. 17 statistical software. In this case, the independent variables have no problem of multicollinearity problem since the VIF index of each variable still below 5 (five) as shown in Table 7.

Table 7. VIF Index from SPSS Estimation

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
(Constant)	.073	.054		1.370	.172		
rm_rf	.414	.158	.162	2.630	.009	.986	1.014
div	.447	.085	.331	5.264	.000	.947	1.056
In_vol	.000	.001	-.027	-.348	.728	.606	1.650
Beta	-.004	.005	-.064	-.898	.370	.740	1.351
IdRisk	-.011	.080	-.009	-.139	.889	.847	1.181
In_BEME	.001	.004	.015	.181	.857	.543	1.841
In_Size	-.002	.002	-.098	-.995	.321	.386	2.594

Coefficients*

Dependent Variable : ri_rf

B. Heteroscedasticity Test

To test the heteroscedasticity problem on the error term of regression, we are using White's Test using EViews ver. 6 statistical software. As shown in Table 8, the empirical model has heteroscedasticity problem seeing that the F-statistic of white test is significant in 1%. This problem is solved by using EViews standardization help of White Heteroskedasticity-Consistent Standard Errors and Covariance.

C. Autocorrelation Test

Since the empirical model is a cross-section regression, thus we don't need to check the autocorrelation problem of regression error term. Even though it is needed, as shown in Table 9, the Durbin Watson statistic has number that close to 2 (two), so there is no autocorrelation problem.

Table 8. Heteroskedasticity Test: White

Heteroskedasticity Test: White				
F-statistic	18.69220	Prob. F(7,223)		0.0000
Obs*R-squared	85.41948	Prob. Chi-Square(7)		0.0000
Scaled explained SS	476.6796	Prob. Chi-Square(7)		0.0000
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.002605	0.002382	1.093551	0.2753
RM_RF^2	-0.141051	0.609905	-0.231266	0.8173
LN_SIZE^2	-1.50E-06	3.30E-06	-0.453492	0.6506
LN_BEME^2	-5.48E-05	0.000153	-0.359542	0.7195
BETA^2	-0.000353	0.000324	-1.088578	0.2775
DIV^2	0.362612	0.032898	11.02227	0.0000
LN_VOL^2	-2.03E-07	4.23E-06	-0.047915	0.9618
IDRISK^2	0.021388	0.028722	0.744683	0.4572
R-squared	0.369781	Mean dependent var		0.001527
Adjusted R-squared	0.349999	S.D. dependent var		0.005295
S.E. of regression	0.004269	Akaike info criterion		-8.041030
Sum squared resid	0.004063	Schwarz criterion		-7.921812
Log likelihood	936.7389	Hannan-Quinn criter.		-7.992945
F-statistic	18.69220	Durbin-Watson stat		2.092434
Prob(F-statistic)	0.000000			

Table 9. Durbin-Watson stat

Empirical Model	Durbin-Watson stat
Efficient Market	
CAPM	1.926666
Fama-French	1.933006
Rantapuska	1.917717

D. Normality Error Test

We are using Jarque-Bera criterion to test the normality error assumption.

As shown in figure 1, the Jarque-Berra is significant in one percent, it means that the regression error term doesn't follow the normal distribution assumption. But it can be waived because appealing to a central limit theorem, the test statistics will asymptotically follow the appropriate distributions even in the absence of error normality.

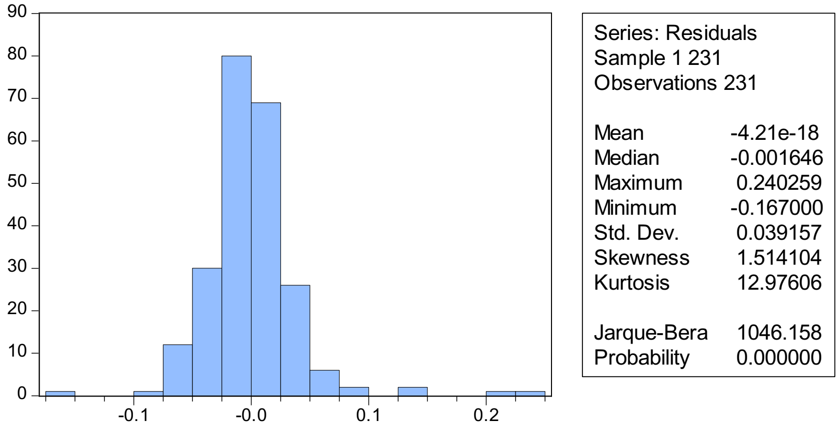

Figure 1. Histogram of Error Normality Test