The Capital Asset Pricing Model: Evidence from the Jamaican Perspective.

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Abstract

The results of empirical tests of The Capital Asset Pricing Model (CAPM) in the Jamaican capital market are presented in this paper. The outcomes are based on monthly data of the two select indices on the Jamaican Stock Exchange. The developing Jamaican financial market has required careful examinations in methodology compared to that of developed markets such as the US. The CAPM acceptably describes the Jamaican landscape; however, comparing the same results with developed capital markets shows a much different representation of the reality.

JEL Classifications: GO, G12, .
Key Words**:** Capital Asset Pricing Model, Financial Markets, Portfolio Performance.

Introduction

Since the inception of capital markets, stakeholders have always tried to develop methods that effectively 'read' the market. The Capital Asset Pricing Model (CAPM) was borne of this innate need and was originally developed to analyze and estimate rates of return on capital market equity securities. The CAPM independently developed by Treynor (1961) and William Sharpe in 1964, "presents a powerful and intuitively pleasing forecast about how to measure risk and the relation between expected return and risk" (Fama & French, 2004, p. 1). In its various forms, it provides predictions for the equilibrium expected return on risky assets. Originally developed for use with marketable securities its use has now spread to include assets not traded publicly, such as intellectual property.

Previous research has been done, examining the plausibility of the CAPM in various markets but this research has been found to be lacking in the Jamaican context. Therefore, in order to fill the gap in the literature, the focus of this research paper will be empirical testing of the CAPM on Indices comprised of Jamaican publicly traded stocks.

CAPM takes into account that any sort of investment contains two types of risks. They include systematic risk and unsystematic risk. Systematic risk is the risk associated with the market in general, risk that cannot be eliminated through diversification. This measure of systematic risk is often referred to as "beta". The second type of risk, unsystematic risk, is specific to the particular investment or asset. In contrast to systematic risk, unsystematic risk is often mitigated through diversification.

According to M. Reingarium (1981), “the adequacy of the CAPM models of Sharpe, Lintner and Black as empirical representations of capital market equilibrium is now seriously challenged; yet, the influence of earlier empirical studies such as Fama & Macbeth, Black, Jensen and Scholes still remains” (p. 2). The results of Reingarium (1981) indicate that estimated betas are not systematically related to average returns, that is, the average returns of high-beta securities are not significantly different from those of low-beta stocks. Current evidence still points to the importance of a security’s beta in equilibrium pricing though counter-evidence also points to beta not being the sole determinant of average returns.

A number of studies have explored factors that capture the cross-sectional variation in average stock returns. A number of these studies have examined firm specific variables, such as firm size and book-to-market-value. Fama and French (1992) is in this tradition, and examines the role of size and book-to-market ratios in conjunction with beta. The Fama and French results allowed them to reject the CAPM, yet they could not reject variables like size and book-to-market. Other studies have examined the impact of the macro-economic factors (for e.g. Chen, Roll and Ross, 1986; Antonio, Garret and Priestly, 1998 and Poon and Taylor, 1992).

The purpose of this paper is to empirically examine the effect of ‘beta’ on the average rates of returns of the All-Jamaican Composite and the Select (Blue-Chip) Indices. Therefore, the paper will focus solely on the one-factor CAPM. This method is somewhat supported by Elton, Gruber & Blake (1995) who stated that the market index for stock returns is the single index that best explains the performance of individual stocks.

In previous research, estimates of β were imprecise, creating a problem of measurement errors when used to explain average returns. To improve the precision of estimated betas, researchers such as Blume (1970); Friend and Blume (1970) and Black, Jensen and Scholes (1972) worked with portfolios, rather than individual securities. Since expected returns and market betas combine in the same way in portfolios, if the CAPM explains security returns it also explains portfolio returns (Fama, 2004, p.7). Therefore, portfolios tracking the two (2) select indices on the Jamaica Stock Exchange (JSE) will be utilized in the estimations. It has also been shown where estimates of beta for diversified portfolios are found to be more precise than estimates for individual securities. Notwithstanding the fact that companies contained in each index on the JSE are usually repeated in the other index, each index represents a broad range of companies from differing industries. This difference facilitates better estimates regardless of the notion that grouping shrinks the range of betas and reduces statistical power.

An inverse relationship was derived by Friend & Blume (1970) between risk and risk adjusted performance and was found to be highly significant. “While rate of return is normally found to be positively related to risk, the adjustment of the rate of return for risk which would be expected to eliminate this relationship actually reverses it” (Friend & Bloom, 1970, p. 6).

The beta premium (risk premium) was positive, as were the intercepts in the time-series regressions of excess asset returns on the excess market return for assets with low betas (risk premium). However, there is a negative relationship between excess asset returns and the excess market return for assets with high betas (risk premium) in Friend and Blume (1970); Black, Jensen and Scholes (1972) and Stambaugh (1982).

Hypotheses & Assumptions

This paper presents tests of several hypotheses stemming from the CAPM. The first and main hypothesis being that higher risk levels (beta) are associated with higher levels of return. The second hypothesis is that there should be no added return, for bearing non-market/diversifiable risk. This second hypothesis also speaks to the adequate explanatory power of the model. Another hypothesis under consideration is whether or not returns are linearly related to beta. That is, for every unit increase in beta the same increase in return should occur.

The main hypothesis will be easily observable from the results. To test the second hypothesis, that market betas suffice to explain expected returns, one estimates the time-series regression for a set of assets (or portfolios) and then jointly tests the vector of regression intercepts against zero. In early applications, researchers used a variety of tests to determine whether the intercepts in a set of time-series regressions are all zero. The tests have the same asymptotic properties, but there is controversy about which has the best small sample properties. Gibbons, Ross and Shanken (1989) settled the debate by providing an *F*-test on the intercepts that has exact small-sample properties (Fama, 2004). The Gibbons, Ross and Shanken (1989) approach will be employed in this paper to test the regression intercepts. Additional variables were added to the first regression in order to test linearity (hypothesis 3). These variables include market portfolio squared and the residual variances from the original regression.

Due to the unavailability of comprehensive methodical data on expectations the concept of Rational Expectations will be used to determine the expected rate of return of the stock indices. This theory posits that prices change so that after an adjustment, they equal the market's best forecast of the future price. Assuming that the beta's of the securities are stable in time, and that the attitude of investors to risk is again steady in time, then, similar to previous papers, ex-post or observed data will be employed for expected values, throughout the paper.

Data & Methodology

The CAPM is based on the premise that a rational investor expects to earn a rate of return greater than a risk-free rate of return when investing in an asset, property, or business interest that has greater risk than a risk-free investment. This incremental rate of return that compensates the investor for accepting a greater level of investment risk is called a risk premium.

Working with one formulation of the original model which says that "an individual asset's (or group of assets) expected return over the risk free interest rate equals a coefficient, denoted by β, times the (mean-variance efficient) market portfolio's expected excess return over the risk free interest rate" (Leusner, Akhavein & Swamy 1996, p.2), we can deduce a model.

$$E(R_{it}) - R_{ft} = \alpha_i + \beta i(R_{PM}) + \varepsilon_{it}$$

where R_{PM} = JSE Market Index-Long Term Government Bonds

thus $$E(R_{it}) - R_{ft} = \alpha_i + \beta i(JSE_i - IRlb_i) + \varepsilon_{it}$$

$E(R_{it})$ refers to the expected rate of return on a given asset i at time t. R_{ft} is the risk free rate of interest at time t. The market portfolio will be represented by the JSE_i, which is the total return for all stocks listed on the Jamaican Stock Exchange and $IRlb_i$ represents income return on long term government bonds. (JSE_i - $IRlb_i$) represents the risk premium, adjusted by β_i, the asset's market beta, for the market in which the investment takes place. ε_{it} represents the error term and α_{it} the intercept term.

The underlying assumptions of the model include:

1. Investors are risk adverse.
2. Rational investors seek to hold efficient portfolios, (that is, portfolios that are fully diversified).
3. All investors have identical time horizons.
4. All investors have identical expectations about expected rates of return.
5. All investors pay no taxes on returns and incur no transaction costs.
6. The rate received for lending money is the same as the cost of borrowing money.
7. The market has perfect divisibility and liquidity.

The statistical analysis includes monthly time series regressions of the average returns for the JSE Select Index and the JSE All-Jamaican Composite Index on the risk premium calculated over the period January 2001- December 2007. The risk-free rate of return was derived from the rates found on the thirty (30) day Repo-rates offered by the Bank of Jamaica (BOJ). Income returns on long term government bonds came from twenty (20) year government bonds offered by the Ministry of Finance's Debt Management Unit. The information on the market indices came from the Jamaica Stock Exchange (JSE) daily index reports, from which the monthly returns were taken from the daily return as at the last day of each month.

Calculations were done using EVIEWS software. To ensure that all the assumptions of the Least Squares method were met, initial tests and corrections were done prior to the actual regressions. The Augmented Dickey-Fuller tests were used to test for the presence of unit roots and thus stationarity of all the time series. If series were found to be nonstationary, then differencing was implemented until stationarity of the variables were achieved. After the regressions using Least-Squares were run, the White Test was used to check the residual series for the presence of heteroskedasticity (that the variance of the error term $\mathrm{var}(e_t) = \delta^2$, is the same for all observations). If found to be heteroskedastic, then the White Heteroskedasticity-Consistent Standard Errors & Covariance were utilized. The Jarque-Bera (JB) statistic was also used to test the residuals for normality and the Durbin-Watson statistic was looked at to determine if autocorrelation was present.

The return on all three market indices (r_t) were calculated using the formulae taken from "Options, Futures & Other Derivatives," (2006):

- $r_t = \ln \dfrac{Si}{Si-1}$ ……………………………………….... eqn. 0

S_i: Market index at end of *ith* interval, with $I = 0, 1, \ldots, n$

The assumption of no dividends was applied in the index return calculations.

The income returns on long term government bonds were derived from twenty (20) year government bonds. Data from the Ministry of Finance highlighted the limited use of long term twenty-thirty (20-30) year bonds as part of the government's policies. However, a few cases were observed, namely the offer of a twenty year bond on May 31, 2002. This bond will become due on May 31, 2022 and has a coupon rate of 11.125%, with interest payable on a semi-annual basis. This twenty year bond possesses the ideal characteristics, from which the related income return data can be extrapolated, (taking into account the time value of money), for the period under consideration. The equity risk premium R_{PR} can then be calculated using this derived data stream.

Assuming a par value of $1000, the associated bond prices and the approximate yield to maturity can be calculated for the same bond, over the entire period. Other assumptions are that (i) calculations will be done as if the bond had just been purchased in the current month and (ii) the interest rates for the current month will be used as if they represented yearly figures. Due to the inverse relationship that exists between current interest rates and the market price of bonds, the monthly (current) bond prices were calculated from the following equation:

- Current Bond Price = Coupon Rate/Current Interest Rate………………. eqn. 1

For example in May 2002 given a 30- day Repo-rate of 13.25 %

- Current Bond Price = $111.25 / 13.25\% = 839.623$

Utilising the new bond prices from equation 1, the approximate yield to maturity was calculated from the following equation taken from "Calculating Bond Yields" (2003):

- $$\frac{\text{Interest Income + Annual Price Change}}{\text{(Purchase Price +1000)/2}} \qquad \text{……………………eqn. 2}$$

The interest income is equal to the annual yield based on the $1000 par value. From the example it would be equal to $111.25 (11.125% of $1000). The annual price change is equal to the overall increase in the value of the bond over its lifetime divided by the number of years remaining in the life of the bond. The denominator of the formulae represents the average price of the bond which is equal to the average of the current bond price and the par value of a $1000 bond.

- Continuing from the previous example the approximate yield to maturity now becomes $$\frac{111.25 + (1000 - 839.623)/20}{(839.623 + 1000)/2} * 100 = 12.967\%$$

The formulae were then applied to the entire dataset.

Analysis & Comparisons

All variables were found to be non-stationary, with the exception of short term interest rates and long term bond rates. They however became stationary upon first differencing.

All-Jamaican Composite Returns

The Durbin-Watson statistic of D=2.03 implies there is no evidence that autocorrelation exists since it is greater than the values 1.624 to 1.671. Obs*R-squared, the White Statistic, has p-value = 0.674922 > 0.05 therefore we fail to reject the null of no heteroskedasticity. The JB statistic ($p = 0.000480 < 0.05$) highlights that the residuals are not normally distributed. However, we make the assumption that in large samples the least squares estimators are approximately normally distributed. Thus the Least Square Estimates are appropriate.

The resulting equation for the All-Jamaican index is:

Allja = 0.039549 + 1.365582 ERMRKT R^2 =74.97%

(0.010935) (0.087663)

α = 0.039549, which tells us that if an investor purchased a portfolio that tracked the All- Jamaican Composite Index, then that portfolio would have performed 3.95% better than the market. ß=1.365582, which measures the slope of the CAPM equation. This positive relationship was expected. This confirms the main null hypothesis, that higher risk levels (beta) are related to higher levels of return. Previous literature emphasizes that 'beta' of the market portfolio is 1; therefore the calculated 1.365582 value for ß tells us the sensitivity of All-Jamaica index's return to variations in market return.

The R^2 tells us that market risk (ß) adequately explains 74.97% of the variation in the All-Jamaica return. This is comparable to previous models, though a 90% R^2 would have been much closer. Possible reasons for the disparity include the small size of the Jamaican capital market compared to the size of the markets used in a lot of the previous papers. However this result is adequate to confirm the second hypothesis, which states that there should be no added return, bearing non-market risk. The significance of the intercept term (α), which implies its value is significantly zero, also confirms the second hypothesis. Based on the F-Statistic we can reliably say that the model was significant.

The new regression with additional variables saw the following results: the coefficient for the squared market portfolio variable is almost negligible and the p-value is 0.0027 which tells us that it is significant. Thus we cannot make definite statement regarding the linear relationship between beta and market return for the All-Jamaica index. The significant F-Test confirms this result indicating that we cannot reject that either or all the variables in the new model had an influence on the All-Jamaica returns.

Select-Index (Blue-Chip)

The Durbin-Watson statistic of D=2.07 implies there is no evidence that autocorrelation exists since it is greater than the values 1.624 to 1.671. Obs*R-squared, the White Statistic, has p-value = 0.860734 > 0.05 therefore we fail to reject the null of no heteroskedasticity. The JB statistic (p = 0.166268 > 0.05) highlights that the residuals are normally distributed. Thus the Least Square Estimates are appropriate.

The resulting equation for the Select index is:

Select = 0.034053 + 1.336704 ERMRKT R^2 =74.41%

(0.010864) (0.087093)

α = 0.034053, which tells us that if an investor purchased a portfolio that tracked the Select Index, then that portfolio would have performed 3.40% better than the market.

ß=1.336704, which measures the slope of the CAPM equation. This positive relationship was expected and confirms the main null hypothesis, that higher risk levels (beta) are related to higher levels of return. The calculated 1.365582 value for ß tells us the sensitivity of Select index's return to variations in market return.

The R^2 tells us that market risk (ß) adequately explains 74.41% of the variation in the Jamaica Select Index return. This is comparable to previous models, though once again a 90% R^2 would have been much closer. This result is also adequate to confirm the second hypothesis, which states that that there should be no added return for bearing non-market/diversifiable risk. The statistical significance of the intercept term (α) implies its value is significantly different from zero, also confirms the second hypothesis. Based on the F-Statistic ($p = 0.000000$) we can reliably say that the model demonstrates overall significance.

The new regression with additional variables was heteroskedastic leading to use of the White Estimators. The Heteroskedastic consistent estimation results are: the coefficient for the squared market portfolio variable is once more negligible and the p-value = 0.5093 > 0.05 which tells us that it is not significant. This result allows us to agree with the linear relationship between market risk (beta) and market return for the Select index.

Comparisons

Both indices garnered almost identical results for the models put forward. The Select index, however, may have performed marginally better than the All-Jamaica Composite. In both instances the indices performed approximately 4 % than CAPM would have predicted (i.e. how much better they did than the market). Sensitivities of each index to variations in market return were also similar at approximately 135 %.

Looking at the data for January 31, 2008 the sensitivity of both the All- Jamaican and the Select Indices to the market portfolio (β), were used to predict the return on these same indices given the market portfolio, R_{PM}. After which, the actual and the calculated values were then compared to test the predictive power of the model. Given that both the 30-day Repo rate and the long term bond rates remained approximately the same for January, we continued using the December rates. The R_{PM} for January (return on the JSE Index minus the long-term bond rate) was equal to -0.1022. Using the β values derived from the regressions (1.37 & 1.34) the calculated expected rate of return for the All- Jamaican Index was -0.0746 and for the Select Index -0.0763. The actual risk adjusted rates of return on both the All- Jamaican Composite and the Select Index for the month were -0.0821 and -0.0842 respectively. In absolute terms the deviation between actual return and the predicted return turned out to be only 9.1% and 9.4%. This highlighted the high predictive power of the model, though longer periods of testing would be necessary for any real validation.

Conclusion

In his book, "Investors and Markets: Portfolio Choices, Asset Prices and Investment Advice" Sharpe shuns mean-variance analysis (the mathematically complex formula that relates rewards to risks of securities or portfolios) in favor of a "state preference" approach that relies on an easy-to-understand simulation (Chernoff, 2006). The fact that one of the developers of this very model has moved on signals to the rest of us that it is time to move pass the CAPM, especially given the myriad of empirical findings against the CAPM. However, the results from the Jamaican scenario found in this paper did not disprove the CAPM. In some ways it seems to have validated it. The simple conclusion is that more detailed study is needed in this area, especially now when international investors are seeking new, emerging markets in which to invest.

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Appendix

Stationarity Results

Null Hypothesis: RMRKT has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on AIC, MAXLAG=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.083396	0.0000
Test critical values:	1% level	-3.512290	
	5% level	-2.897223	
	10% level	-2.585861	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RMRKT)
Method: Least Squares
Date: 04/22/08 Time: 01:09
Sample (adjusted): 3 84
Included observations: 82 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RMRKT(-1)	-0.779809	0.110090	-7.083396	0.0000
C	-0.088460	0.013781	-6.418972	0.0000

R-squared	0.385440	Mean dependent var	0.001623
Adjusted R-squared	0.377758	S.D. dependent var	0.060943
S.E. of regression	0.048073	Akaike info criterion	-3.208087
Sum squared resid	0.184884	Schwarz criterion	-3.149386
Log likelihood	133.5316	F-statistic	50.17449
Durbin-Watson stat	1.952330	Prob(F-statistic)	0.000000

Null Hypothesis: D(IRLB) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on AIC, MAXLAG=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.481046	0.0000
Test critical values:	1% level	-3.512290	
	5% level	-2.897223	
	10% level	-2.585861	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(IRLB,2)
Method: Least Squares
Date: 04/22/08 Time: 01:55
Sample (adjusted): 3 84
Included observations: 82 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(IRLB(-1))	-0.946871	0.111645	-8.481046	0.0000
C	-0.000415	0.000254	-1.635554	0.1059

R-squared	0.473435	Mean dependent var	-2.23E-19
Adjusted R-squared	0.466853	S.D. dependent var	0.003086
S.E. of regression	0.002254	Akaike info criterion	-9.328459
Sum squared resid	0.000406	Schwarz criterion	-9.269759
Log likelihood	384.4668	F-statistic	71.92814
Durbin-Watson stat	2.010529	Prob(F-statistic)	0.000000

Null Hypothesis: RSELECT has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on AIC, MAXLAG=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.155211	0.0000
Test critical values:	1% level	-3.512290	
	5% level	-2.897223	
	10% level	-2.585861	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RSELECT)
Method: Least Squares
Date: 04/22/08 Time: 01:25
Sample (adjusted): 3 84
Included observations: 82 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.

RSELECT(-1)	-0.920974	0.112931	-8.155211	0.0000
C	0.013860	0.008594	1.612819	0.1107

R-squared	0.453953	Mean dependent var	0.001866
Adjusted R-squared	0.447127	S.D. dependent var	0.103117
S.E. of regression	0.076673	Akaike info criterion	-2.274442
Sum squared resid	0.470302	Schwarz criterion	-2.215742
Log likelihood	95.25213	F-statistic	66.50747
Durbin-Watson stat	1.970510	Prob(F-statistic)	0.000000

Null Hypothesis: RALLJA has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on AIC, MAXLAG=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.107270	0.0000
Test critical values:	1% level	-3.512290	
	5% level	-2.897223	
	10% level	-2.585861	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RALLJA)
Method: Least Squares
Date: 04/22/08 Time: 01:27
Sample (adjusted): 3 84
Included observations: 82 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RALLJA(-1)	-0.911406	0.112418	-8.107270	0.0000
C	0.015786	0.008798	1.794218	0.0766

R-squared	0.451031	Mean dependent var	0.001806
Adjusted R-squared	0.444169	S.D. dependent var	0.104790
S.E. of regression	0.078125	Akaike info criterion	-2.236914
Sum squared resid	0.488287	Schwarz criterion	-2.178214
Log likelihood	93.71348	F-statistic	65.72783
Durbin-Watson stat	1.983113	Prob(F-statistic)	0.000000

Null Hypothesis: D(RF) has a unit root

Exogenous: Constant
Lag Length: 0 (Automatic based on AIC, MAXLAG=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.437460	0.0000
Test critical values:	1% level	-3.512290	
	5% level	-2.897223	
	10% level	-2.585861	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RF,2)
Method: Least Squares
Date: 04/22/08 Time: 01:59
Sample (adjusted): 3 84
Included observations: 82 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(RF(-1))	-0.941734	0.111613	-8.437460	0.0000
C	-0.000551	0.000343	-1.608630	0.1116

R-squared	0.470867	Mean dependent var	0.000000
Adjusted R-squared	0.464253	S.D. dependent var	0.004162
S.E. of regression	0.003046	Akaike info criterion	-8.725720
Sum squared resid	0.000742	Schwarz criterion	-8.667019
Log likelihood	359.7545	F-statistic	71.19073
Durbin-Watson stat	2.012930	Prob(F-statistic)	0.000000

Null Hypothesis: RJSE has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on AIC, MAXLAG=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.727722	0.0000
Test critical values:	1% level	-3.512290	
	5% level	-2.897223	
	10% level	-2.585861	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RJSE)
Method: Least Squares
Date: 04/22/08 Time: 01:19
Sample (adjusted): 3 84
Included observations: 82 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RJSE(-1)	-0.730598	0.108595	-6.727722	0.0000
C	0.012209	0.005632	2.167877	0.0331

R-squared	0.361340	Mean dependent var	0.001184
Adjusted R-squared	0.353357	S.D. dependent var	0.060674
S.E. of regression	0.048791	Akaike info criterion	-3.178463
Sum squared resid	0.190443	Schwarz criterion	-3.119763
Log likelihood	132.3170	F-statistic	45.26225
Durbin-Watson stat	1.968188	Prob(F-statistic)	0.000000

Regressions- All Jamaica

Dependent Variable: ALLJA
Method: Least Squares
Date: 04/22/08 Time: 02:29
Sample (adjusted): 2 84
Included observations: 83 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.039549	0.010935	3.616687	0.0005
ERMRKT	1.365582	0.087663	15.57760	0.0000

R-squared	0.749739	Mean dependent var	-0.117471
Adjusted R-squared	0.746649	S.D. dependent var	0.076731
S.E. of regression	0.038622	Akaike info criterion	-3.646196
Sum squared resid	0.120823	Schwarz criterion	-3.587911
Log likelihood	153.3171	F-statistic	242.6617
Durbin-Watson stat	2.030424	Prob(F-statistic)	0.000000

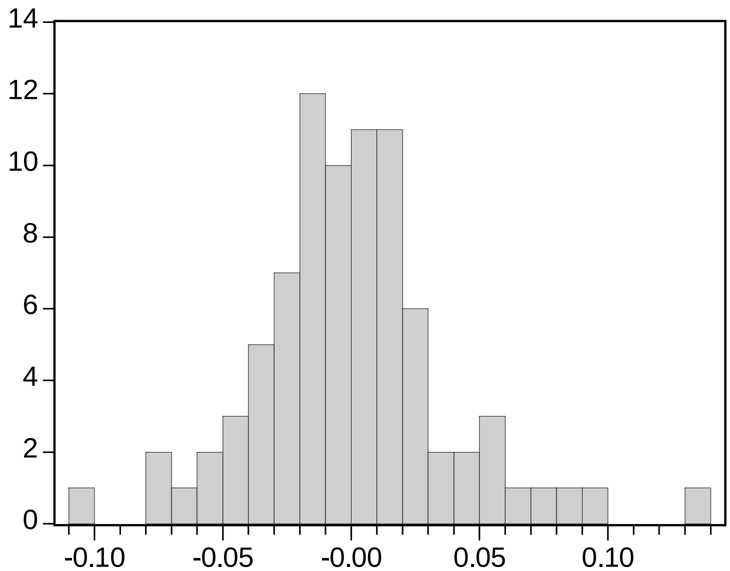
White Heteroskedasticity Test:

F-statistic	0.382572	Probability	0.683346
Obs*R-squared	0.786317	Probability	0.674922

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 04/23/08 Time: 14:22
Sample: 2 84
Included observations: 83

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.002257	0.000975	2.314579	0.0232
ERMRKT	0.011646	0.014233	0.818196	0.4157
ERMRKT^2	0.034567	0.059197	0.583938	0.5609

R-squared	0.009474	Mean dependent var	0.001456
Adjusted R-squared	-0.015289	S.D. dependent var	0.002865
S.E. of regression	0.002887	Akaike info criterion	-8.821952
Sum squared resid	0.000667	Schwarz criterion	-8.734524
Log likelihood	369.1110	F-statistic	0.382572
Durbin-Watson stat	1.976668	Prob(F-statistic)	0.683346



Series: Residuals
Sample 2 84
Observations 83

Mean	8.45e-10
Median	-0.003644
Maximum	0.137791
Minimum	-0.106335
Std. Dev.	0.038386
Skewness	0.520446
Kurtosis	4.826432
Jarque-Bera	15.28346
Probability	0.000480

Dependent Variable: ALLJA
Method: Least Squares
Date: 04/23/08 Time: 16:13
Sample (adjusted): 2 84
Included observations: 83 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.039549	2.15E-09	18352691	0.0000
ERMRKT	1.365582	2.40E-08	56841873	0.0000
ALLJARESID	1.000000	2.37E-08	42248149	0.0000
ALLJA2	1.98E-07	6.39E-08	3.097790	0.0027

R-squared	1.000000	Mean dependent var	-0.117471
Adjusted R-squared	1.000000	S.D. dependent var	0.076731
S.E. of regression	7.06E-09	Akaike info criterion	-34.65281
Sum squared resid	3.94E-15	Schwarz criterion	-34.53624
Log likelihood	1442.092	F-statistic	3.23E+15
Durbin-Watson stat	2.070086	Prob(F-statistic)	0.000000

Regressions-Select Index

Dependent Variable: SELECT
Method: Least Squares
Date: 04/22/08 Time: 02:44
Sample (adjusted): 2 84
Included observations: 83 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.034053	0.010864	3.134502	0.0024
ERMRKT	1.336704	0.087093	15.34805	0.0000

R-squared	0.744126	Mean dependent var	-0.119647
Adjusted R-squared	0.740968	S.D. dependent var	0.075391
S.E. of regression	0.038371	Akaike info criterion	-3.659253
Sum squared resid	0.119256	Schwarz criterion	-3.600967
Log likelihood	153.8590	F-statistic	235.5627
Durbin-Watson stat	2.008130	Prob(F-statistic)	0.000000

White Heteroskedasticity Test:

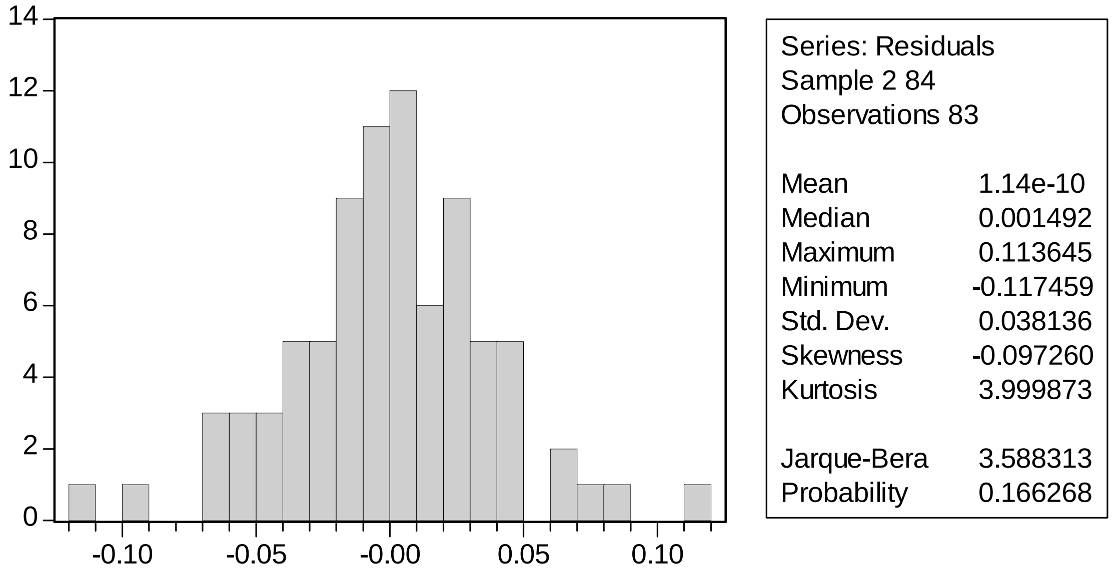
F-statistic	0.145073	Probability	0.865186
Obs*R-squared	0.299939	Probability	0.860734

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 04/23/08 Time: 14:43
Sample: 2 84

Included observations: 83

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.001864	0.000855	2.181350	0.0321
ERMRKT	0.005276	0.012476	0.422866	0.6735
ERMRKT^2	0.011508	0.051887	0.221797	0.8250

R-squared	0.003614	Mean dependent var	0.001437
Adjusted R-squared	-0.021296	S.D. dependent var	0.002504
S.E. of regression	0.002530	Akaike info criterion	-9.085529
Sum squared resid	0.000512	Schwarz criterion	-8.998101
Log likelihood	380.0494	F-statistic	0.145073
Durbin-Watson stat	1.745843	Prob(F-statistic)	0.865186



Dependent Variable: SELECT
Method: Least Squares
Date: 04/23/08 Time: 16:24
Sample (adjusted): 2 84
Included observations: 83 after adjustments
White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.034053	3.55E-17	9.59E+14	0.0000
ERMRKT	1.336704	5.17E-16	2.58E+15	0.0000
SELECT2	1.47E-15	2.21E-15	0.663015	0.5093
SELECTRESID	1.000000	4.18E-16	2.39E+15	0.0000

R-squared	1.000000	Mean dependent var	-0.119647
Adjusted R-squared	1.000000	S.D. dependent var	0.075391
S.E. of regression	6.52E-17	Sum squared resid	3.36E-31
F-statistic	3.65E+31	Durbin-Watson stat	1.556255
Prob(F-statistic)	0.000000		