EMPIRICAL STUDY ON HOW TEA AND RUBBER PRICES EFFECT TO PLANTATION SECTOR INDEX: EVIDENCE FROM COLOMBO STOCK EXCHANGE

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ABSTRACT

This study examined the effect of price level changes in tea and rubber industries to the volatility of Plantation Sector Index (PSI) in Sri Lanka. Monthly data for 20 years (240 moths) from February 1996 to January 2016 were used as the sample. Fitted Autoregressive Conditional Heteroscedasticity (ARCH) and the Generalized Autoregressive Conditional Heteroscedasticity (GARCH) were occupied for the analysis. Analysis contains two parts. First part of the study analyzed the combine effect of price level changes in tea and rubber to the volatility of PSI. While second part analyzed the individual effect towards PSI. Results for part one showed PSI made a significance volatile due to price level changes of Tea and rubber. The second part indicated though the Tea and Rubber prices were significant factors, they have totally different influences. Price changes of Tea industry showed a negatively effect on volatility of PSI while rubber prices showed the positive effect.

Keywords: ARCH Model, GARCH Model, Plantation Sector Index (PSI), Tea Price (TP), Rubber Price (RP)

Introduction

Tea and Rubber Industries have historical binding with the Share market of Sri Lanka. Initiation of share market was happened in 1896 as a mechanism to raise fund for Tea industry. In 1904, Rubber estate owners also registered under share market as companies and issue shares to the public. By the end of 1948, there were 140 Rupee companies in Sri Lanka, out of those, 121 companies were plantation companies. Therefore, movements in Plantation sector index causes significantly to the share market performances.

When looking at the history of financial market movements, it evident that share prices volatile due to various reasons. Generally, when the economic condition is favorable to investors, share prices make upward movement and leads to an upward trend in share indexes. Most of the scholar works show one of the main determinant factors for the share market movement is price.

Muhammad J., Ghuslan M.I. and Jusoff K. (2009) have showed there is a positive long run relationship between the plantation sector index and agricultural sector performance. Further, Ray (2013), stated stock price and commodity market in Indian stock market has a co-integration. Nordin S., Nordin N. and Ismail R. (2014) stated that Palm oil prices are significantly influence on Malaysian Stock Market Index. Therefore, evidences the importance of price of commodity on changing the share market indexes.

Therefore, this study attempt to investigate the effect of price level changes in tea and rubber into the performance of plantation sector index.

Methodology

Data collection, Sample and Variables

Secondary data for price level changes in tea and rubber industry for 20 years (240 months) from February 1996 to January 2016 were used. Tea and rubber prices were the independent variables while changes in Plantation Sector Index (PSI) was the dependent variable.

Modeling process and Mean Equation

Augmented Dickey–Fuller (1979) test was done to identify the stationarity of the data set. Main equation occupied was;

$$Yt = \mu + \phi1Yt\text{-}1 + \Theta1\mathcal{E}t\text{-}1 + \mathcal{E}t \qquad (1)$$

Where, Yt explains the Plantation Sector Index for the period of t, μ represents the Constant, $\phi1$ says the Autoregressive Coefficient, $\Theta1$ shows the Moving Average Coefficient and $\mathcal{E}t$ indicates the the Error Term.

Three models of ARMA (1,0), ARMA (0,1) and ARMA (1,1) were tested. And Log likelihood estimate value, Akaike Info Criterion (AIC) and Schwarz Criterion (SIC) were used as a decision criterion to select the best fitted model.

Testing for the ARCH Effect

Because of higher volatility in PSI, ARCH was tested with the help of Lagrange Multiplier test (ARCH LM) of Engle (1982).

Volatility Regression

Generalized ARCH (GARCH) modeling technique was used to develop the volatility series.

Analysis and discussion

Descriptive Statistics

According to the results for descriptive analysis, all the variables (both independent and dependent) are significantly skewed and normally distributed because the values of kurtosis are sign

Table 3.1.1 Descriptive Statistics

	Mean	Median	Maximum	Minimum	Std. Dev.	Skew-ness	Kurt-osis	Prob.
PSI	2.16	-0.44	356.34	-200.55	65.41	0.92	9.66	0.000
TP	2.37	2.35	2.74	1.94	0.18	-0.08	2.27	0.000
RP	1.82	1.89	2.49	1.25	0.35	-0.08	1.67	0.000

Correlation of the key variables

Correlation diagram showed a positive correlation between dependent and independent variables.

Unit Root Test

Unit root test proves data series has a unit root (time series is non stationary). Therefore, first difference was taken. And results showed PSI has no unit root (time series is stationary).

ARCH LM Test

Three econometric models of ARMA (1, 0), ARMA (0, 1) and ARMA (1, 1) were considered to fit a mean model for PSI. Log likelihood estimate, AIC and SIC were used to select the most fitted model. According to the results, it was selected the best fit model is ARMA (1, 1) mean model.

Table 3.4.1 Mean Model for Plantation Sector Index

Variable	Coefficient	Std. Error	t-Statistic	Prob.
AR(1)	-0.932415	0.048953	-19.04709	0.0000
MA(1)	0.975604	0.029487	33.08617	0.0000

With the results for ARMA (1,1), study expanded to tested the ARCH effect and found there is an ARCH effect in the developed model.

Table 3.4.2 ARCH LM test for the fitted model

F- Statistic	Prob.F	Obs*R-squared	Prob. Chi Square(1)
11.5081	0.0008	11.06782	0.0009

Volatility Regression

Hence, there was an ARCH effect, it was move forward to run the GARCH model. As shown in bellow table, both the ARCH and GARCH terms were significant at 95% confidence level.

Table 3.5.1 GARCH (1,1)

	Coefficient	Std. Error	z-Statistic	Prob.
C	65.52391	26.45251	2.477039	0.0132
RESID(-1)^2	0.352381	0.089301	3.945993	0.0001
GARCH(-1)	0.697531	0.059655	11.69277	0.0000

Identifying the Individual effect

In order to identify effect of individual variables over PSI, conditional heteroscedasticity was regressed with Tea Price (TP) and Rubber Price (RP) separately. And found that all the variables are significant at 95% of confidence level confirming rubber prices are positively affecting for the volatility of the plantation sector index and tea prices are negatively effects for the volatility of the plantation sector index.

Table 3.6.1 volatility regression model

	Coefficient	Std. Error	z-Statistic	Prob.
C	32.82225	30.78213	1.066276	0.2863
RESID(-1)^2	0.310678	0.069387	4.477440	0.0000
GARCH(-1)	0.711435	0.047242	15.05949	0.0000
RP	2.632088	0.730314	3.604047	0.0003
TP	-0.491079	0.169753	-2.892898	0.0038

Conclusion

Study investigated the effect of tea and rubber prices to plantation sector index. Analysis was done through fitting a ARMA (1,1) model with testing ARCH and GARCH effects on volatile sectors.

Results, indicated both tea and rubber prices were significant for the PSI movements. Among these two variables, tea prices have a negative effect, while rubber prices have a positive influence over the PSI volatility. This gives an indication to the investors that doing market analysis in tea and rubber industries are crucial prior to invest in plantation sector because these to works opposite to each other on PSI volatility.

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