Long run determinants of sectorial stock returns: Evidence from Colombo Stock Exchange

Dayaratne D.A.I and Wijethunga A.W.G.C.N
Department of Accountancy & Finance, Faculty of Management Studies, Sabaragamuwa University of Sri Lanka

ABSTRACT

It is widely known fact that there is a relationship between stock prices and macro-economic variables. This paper attempts to establish the existence of long run macroeconomic determinants of aggregate industry returns in the industries listed in Colombo Stock Exchange. For this purpose 20 sector indices are subjected to model with the seven macro-economic variables. These variables are exchange rate (ER), Gross Domestic Product (GDP), Gold Prices (GP), Industrial Production Index (IPI), Interest Rates (IR), Inflation (IN), and Oil Prices (OIL). The sample period covers 2004 1st quarter to 2015 2nd quarter. The Cointegration test was applied to determine the long run relationship between the sector indices and the applied macro-economic variables. The unit root properties of the variables are determined with Augmented Dickey Fuller Test (ADF), Phillip Perron Test (PP) test and Kwiatkowski-Phillips Schmidt Shin Test (KPSS). The findings revealed long run equilibrium between all the sector indices and macro-economic variables. These findings imply that the sector returns of CSE can be determined by using the past data of the above macro-economic variables.

Keywords: *Sector returns, unit root, Cointegration test, Colombo Stock Exchange*

1. Introduction

Investment in stock markets is very popular among the investors as it is an enjoyable game as well as a pain taking excess for the investors. This is because there will be winners as well as losers in the stock markets. It is widely known fact that uncertainty is very high in investing in the stock market in comparison to the other modes of investment available for the investors. This nature of uncertainty in the market induced the researchers and the investors to measure the risk factors of stock market investments. As a result several financial models have been emerged in the past to obtain scientific evidence for the investors to choose securities in the stock markets. The Capital Assets Pricing Model (CAPM) of Sharpe (1964) most notable invention and subsequently other researchers started to explore more powerful models with various risk factors among them the land mark study of Fama and French (1996) commendable and they added two more factors in addition to the market portfolio of Sharpe (1964) that is size and BE/ME. Importantly, these models have been heavily, tested both in developed markets and emerging markets and contended mixed evidences. The dearth of common consciences among the researchers led to further investigations to seek more powerful models. The focus gradually turned into the macro level determinants of stock prices rather than fundamental factors. The relationship between stock market returns and macro-economic

factors originated with the contribution of Ross (1976) the Arbitrage Pricing Theory (APT). He argued that the stock prices are affected by several macroeconomic variables. Subsequently, Fama (1981) contended the relationship between stock market and macroeconomic factors. He showed a strong positive relationship between equity returns and real economic activities such as industrial production, capital expenditures and GNP. Moreover, the same researcher proved a significant positive relationship between current and expected future output growth on the one side and stock market returns on the other (Fama, 1990).

In the past three decades, academics and practitioners have very extensively investigated the relationship between stock prices and macro-economic variables both in developed markets and emerging markets. Majority of previous evidences have established a close link between stock prices and macro-economic variables. However, still wealth of empirical evidences is very vague in emerging economies compared to developed economies. Interestingly, the past researchers have subjected the same variables stated below for their investigations with the market index as the proxy for stock market returns. The generalizations are made for the whole market as they used market portfolio as the proxy for the stock returns. However, impact of macroeconomic variables on sector wise returns is very limited in the past studies.

Thus, purpose of this paper is to model the sector returns as a function of macro variables. Authors model various macro-economic variables to examine the long run relationship between stock returns and Marco variables. These variables are exchange rate (ER), Gross Domestic Product (GDP), Gold Prices (GP), Industrial Production Index (IPI), Interest Rates (IR), Inflation (IN), and Oil Prices (OIL). As the proxy for the stock market this research applies 20 business sectors and the CSE maintains separate sector index for each business sector in CSE. These sectors considered in modeling as the proxy variables in each sector.

As previously mentioned, this paper applies the sector indexes prepared by the CSE as the proxy for the stock market variables. This enables us to determine the long run relationship between particular sector indexes and macro-economic variables. All other previous studies have focused on only the market portfolio. Thus, conclusions given are applicable for the entire market not for different sectors. However, this paper attempts to explore the sector specific long run relationship between the sector returns and macro-economic variables. This approach avoids the limitations of applying the market index because sector wise long run relationship can be prevailed in some sectors and for other sectors may not. The findings of this study will be important for the portfolio managers and investment advisors to form security portfolios across sectors.

What made us to examine the relationship between stock returns and macro-economic factors is that in the post war scenario it seems that CSE is in an upward move in several aspects such as market capitalization, new listing of firms, foreign participation and very importantly, the new government's policy approach to enhance the capital market. The research based approach to guide the investors very important to develop a market. This research aims to fill this gap by exploring the long run relationship between stock prices and macro-economic variables in Sri Lanka by using sector indices.

The rest of this paper is organized as follows. Section 2 reviews the related literature in global as well as country specific perspectives. The variables used in the paper and the

econometric methodology adopted in the paper is presented in section 3. The section 4 reports the results and discussions derived from the statistical tools applied in the paper. The concluding remark is given in section 5. Finally, the list of references citied in the text is arranged in section 7.

2. Previous Studies

There is voluminous of literature on the relationship between stock returns and macro-economic variables. As previously highlighted, the first thought of this relationship emerged with the land mark discovery of Ross (1976), Arbitrage Pricing Theory (APT) it attempted to link macro-economic variables to stock returns. In his study the suggested variables are unanticipated shifts in risk premium, changes in industrial production, unanticipated inflation, and unanticipated movement of term structure of interest rates. Subsequently, Chen, Roll and Ross (1986) investigated the impact of macroeconomic variables on stock returns out of seven variables they found that consumption index and oil prices are not related to financial market while industrial production change in risk premium and yield curve significantly related to stock prices. Moreover, Vejzagic and Zarafa (2013) examined the long run relationship between macro variables and FTSE Bursa Malaysia HijrahShariah Index and shows significant relationship with interest rates, exchange rate and money supply; it's negatively affecting interest rate and exchange rate while positively money supply in the case of disequilibrium. CPI has been statistically proven insignificant. Another study based in Nigeria by (Osamwonyi and Evbayiro-Osagie 2012)(2012) examined the relationship between stock returns and several other macroeconomic variables using annual data and they applied Vector Error Correction Model (VECM) to show short run and long run dynamics and established a long run relationship and stock market returns.

Moreover, (Pramod Kumar and Puja 2012) examined the relationship between stock returns and macroeconomic variables in India and analysis revealed that macroeconomic variables and stock returns are co-integrated. Further they contend that there is a bidirectional relationship between stock prices and industrial production. Unidirectional causality from money supply to stock price, stock price to inflation and interest rates to stock prices are found. Another work of (Acikalin, Aktas and Unal (2008) in Istanbul Stock Market in Turkish examined the relationship between stock market between several macro variables by using Cointegration test and Vector Error Correction Model (VECM) and found a long run equilibrium stock market movements and four macro-economic variables namely, GDP, exchange rate, interest rate, and current account balance. It is evidenced that the long run relationship between stock prices and macro-economic variables is well established in the previous literature. The researchers further extended the wealth of evidences by relating the stock prices to different economic conditions and policy regimes. For example, Brahmasrene and Jiranyakul (2007) studied the relationship between stock market index and selected macroeconomic variables during the post financial liberalization (pre-financial crisis) and post-financial crisis in Thailand. In the empirical analysis, they perform unit root, cointegration and Granger causality tests. The results established that that money supply has a positive impact on the stock while the industrial production index, the exchange rate and oil prices have a negative impact in the post-financial liberalization period with respect to the

post-financial crisis.

In Sri Lanka Gunasekarage Pisedtasalasai and Power (2004) examined the long run relationship between All Share Price Index (ASPI) as the proxy for the stock market and several other macro variables. The study was pertained to short run as well as long run relationships and the findings suggest that lagged values of macro variables such as the consumer price index, the money supply and the Treasury bill rates have a significant influence on share prices. The Treasury bill rate demonstrates the strongest influence on changes compared to other variables. However, the current study some unique features compared to their studies. They have considered market index only. But this study considers 20 sector indices and they have used 4 variables and the current study used 7 variables including gold prices and oil prices. According to our knowledge there are no previous studies which have subjected these two variables for the analysis of relationship. To bring novelty to the current study the authors dropped money supply and that was considered by them for the regression model. On the other hand, theory suggests that the money supply highly correlates with the inflation and interest rates that will lead to multicollinearity issue.

3. Methodology

First, this section discusses the theoretical and empirical validity of the variables concerned in this paper. As previously mentioned, this paper used 20 sector indexes and seven macro-economic variables. Before, moving to statistical modeling the relevance and applicability of these variables should be well established.

Exchange Rates (ER)

Economic theory postulates that the exchange rate is well relevant variable to explain the stock returns. The traditional economic theory suggests that changes in exchange rates directly impact on the firm's profitability. In a situation where the local currency is depreciating against Dollar or any other hard currency the companies that exports products or services will be making profit. On the other hand firms that are mostly relying on imports of raw materials and other finished goods will be losing. This will directly impact on the profitability of the firm. The profitability is one of the key indicators of stock returns and ultimately it will influence on the sector index where the respective firms are listed. These explanations suffice to consider exchange rate as an endogenous variable for the statistical analysis. Also, it is evidenced that most of the previous researchers have applied this variable in several countries.

Gross Domestic Product (GDP)

The relationship between stock market returns and GDP is subjected to several empirical investigations. The results are not conclusive enough to rely on policy decisions. There are conflicting results on the relationship between stock returns and GDP. Majority contends a negative relationship between these two variables. However, we develop a hypothesis that there is a long run relationship between stock market returns and GDP.

Interest Rates

The theoretical relationship between interest rate and stock price can be explained as the following ways. When the companies finance their capital equipment and inventories through borrowings, a reduction of interest rate means leads to the reduction of the cost of capital. This may serve as an incentive for expansion via the increased investment capacity of the companies which in turn increase their stock prices. Alternatively, as

Maysami et al. (2004) explain, when a substantial amount of stocks is purchased with borrowed money, an increase in interest rate would make stock transaction more costly. Investors will expect a higher rate of return before investing which results the demand to fall and hence leads to price depreciation.

Industrial Production Index (IPI)

This is important variable which captures the economic activities. This index rises during economic expansion and falls during recession. Several researchers have used this index as a proxy for the economic activities and empirical evidences suggest that documented IPI and future cash follows have positive relationship. Authors also consider this variable for the statistical specifications in this paper.

Inflation Rate (IN)

Large number of studies has contended the relationship between inflation and stock returns in both developed markets and emerging markets. Theoretically, these two variables have a negative relationship and interestingly, majority of the empirical evidences have confirmed it. Therefore, inflation rate is a well relevant variable for the study.

Oil Prices (OIL)

Conventional wisdom suggests that rise in oil prices will increase the cost of the firms and it will directly impact on the profitability of the firm and the opposite will occur when the oil prices decline. Modeling the oil prices against the stock returns very relevant as it is very much sector specific variable. Several studies have related the oil prices with the determinants of stock prices. See for example Chueng and Ng (1998) documented that oil prices are co-integrated with the stock prices for several countries such as Canada, Germany, Italy, Japan and the USA.

Gold Prices (GP)

It is generally, believed that stock prices and gold prices have a negative relationship. When the stock market coming down investors pulling out their investment and putting their money somewhere else. The most popular investment is gold market. According to the market forces high demand for the gold in stock market down turn prices of gold will increase and vice versa.

Data and Sample Periods

Mainly data was gathered from two sources. The sample period covers 2004 first quarter to 2015 second quarter. This study examines the relationship between 20 sector indexes with the selected macroeconomic variables. The sector indexes were gathered from the CD of Data library 2013 issued by the CSE. This study also applied seven macroeconomic variables for the various econometric tests. All the macroeconomic data were gathered from Central Bank data sources.

Unit Root Tests

In time series econometric modeling, it is necessary to enhance data series stationary because of non-stationary time series data misleading parameter estimates of the variables. In order to achieve data series stationary, this research utilized three commonly used unit root tests, namely, Augmented Dickey Fuller Test (ADF), Phillip Perron Test (PP) and Kwiatkowski -Phillips-Schmidt-Shin Test (KPSS).

The null hypothesis of a unit root (non-stationary) tested against the alternative hypothesis of no unit root (stationary) for the ADF test and PP test. On other hand the null hypothesis of no unit root (stationary) tested against the alternative hypothesis of unit root (non-stationary)

Cointegration Test

The application of cointegration test is useful for investigating long run relationship between macro-economic variables and sector returns. Cointegration test developed by Johansen's 1988 is used in the analysis to check whether presence of long term relationship between variables. Presence of cointegration indicates that predictability of one variable by observing another available. Authors tested null hypothesis of no cointegration against the alternative hypothesis of cointegration under Trace statistic and Maximal Eigenvalue statistics.

4. Results and discussion

The results of the unit root tests for comprising the ADF, PP and KPSS test statistics are presented in the Table 4.1 and Table 4.2. Table 4.1 shows the unit root tests results regarding the macro-economic variables and Table 4.2 represents the unit root tests results for sector series. The results depict that level series of both sector series and macro-economic series are stationary (no unit root) under all unit root tests and no need for data transformation. Optimal lags obtained as one through the lowest value of Akaike Information criterion (AIC) for both macro variables and sector return series.

Table 4.1 Results of Unit Root Tests for Macro Variables

Series	ADF	PP	KPSS
ER	-4.1167*	-4.4580*	0.0622*
GDP	-6.7276*	-23.657*	0.1625*
GP	-3.529**	-6.3656*	0.5423*
IN	-5.4617*	-5.0241*	0.2653*
IR	-4.1219*	-4.0719*	0.1856*
IPI	-7.4758*	-7.7077*	0.1030*
OIL	-5.9940*	-5.8739*	0.33436*

Notes: * (**) shows significant at 1% (5%) significant level. The test critical values for the ADF and PP test statistics at the 1%, 5%, and 10% levels are -3.58, -2.93 and -2.60 respectively. The test critical values for KPSS test at the 1%, 5%, and 10% levels are 0.7390, 0.4630 and 0.3470 respectively.

Table 4.2 Results of Unit Root Tests for Sector Series

Series	ADF	PP	KPSS
BFI	-5.3736*	-5.3587*	0.0606*
BFT	-6.3987*	-6.4080*	0.0873*
C&E	-5.7089*	-5.7014*	0.1953*
C&P	-7.0937*	-7.0715*	0.1737*
DIV	-5.6817*	-5.6582*	0.0955*
F&T	-5.2681*	-7.3901*	0.0895*
HLT	-7.8601*	-7.8377*	0.1956*
H&T	-5.8856*	-5.8856*	0.1254*
INV	-6.6181*	-6.6520*	0.1778*
IT	-6.4377*	-6.4352*	0.1500*
L&P	-5.2849*	-7.6281*	0.1537*
MFG	-6.0553*	-6.0508*	0.0866*
MTR	-3.418**	-5.9688*	0.1874*
OIL	-6.1798*	-6.1717*	0.1308*
P&E	-6.2979*	-6.3084*	0.0713*
PLT	-6.0022*	-5.9719*	0.1944*
SRV	-6.4488*	-6.4481*	0.0847*
S&S	-3.462**	-4.8591*	0.0860*
TLE	-5.7921*	-5.7617*	0.0864*
TRD	-4.7339*	-4.7958*	0.0794*

Notes: * (**) shows significant at 1% (5%) significant level. The test critical values for the ADF and PP test statistics at the 1%, 5%, and 10% levels are -3.58, -2.93 and -2.60 respectively. The test critical values for KPSS test at the 1%, 5%, and 10% levels are 0.7390, 0.4630 and 0.3470 respectively.

Table 4.3 illustrates the test statistics of Johansen's cointegration test at vector zero and vector one for the concerned variables. Table 4.3 shows the both properties of Trace statistic and Maximum eigenvalue, there existence of cointegration with each macro-economic

variable for each sector. In other words presence of long run relationship between business sectors and each selected macro-economic variables. Existence of cointegration implies that by observing macro-economic variables we can predict sector returns in CSE and vice versa.

Table 4.3 Results of Co-integration Test

Sector	Test	H_0	EX	GDP	GP	IN	IR	IPI	OIL
BFI	Trace	r = 0	36.57	49.99	26.80	38.32	24.07	56.98	45.34
		r ≤ 1	15.27	14.08	10.90	9.95	8.48	12.23	15.11
	Max	r = 0	21.30	35.91	15.90	28.36	15.58	44.75	30.23
	Eigen	r ≤ 1	15.26	14.08	10.90	9.95	8.48	12.23	15.11
BFT	Trace	r = 0	36.37	54.03	27.63	42.75	24.21	56.89	41.70
		r ≤ 1	13.62	13.97	11.69	11.22	8.54	14.37	13.76
	Max	r = 0	22.74	40.06	15.93	31.53	15.66	42.52	27.93
	Eigen	r ≤ 1	13.62	13.97	11.69	11.22	8.54	14.37	13.76
C&E	Trace	r = 0	31.55	51.63	26.56	39.20	24.22	48.64	36.87
		r ≤ 1	11.52	12.22	8.15	13.33	8.79	11.09	9.52
	Max	r = 0	20.03	39.41	18.40	25.86	15.42	37.55	27.34
	Eigen	r ≤ 1	11.52	12.22	8.15	13.33	8.79	11.09	9.52
C&P	Trace	r = 0	39.92	54.73	29.63	38.93	29.49	53.36	42.02
		r ≤ 1	14.53	14.74	9.59	14.31	9.02	13.69	14.03
	Max	r = 0	25.39	39.99	20.03	24.61	20.47	39.68	27.98
	Eigen	r ≤ 1	14.53	14.74	9.59	14.31	9.02	13.69	14.03
DIV	Trace	r = 0	38.37	54.04	28.39	43.81	25.72	55.16	43.04
		r ≤ 1	16.62	16.13	10.66	14.32	8.20	15.25	14.27
	Max	r = 0	21.74	37.90	17.73	29.48	17.52	39.90	28.76
	Eigen	r ≤ 1	16.62	16.13	10.66	14.32	8.20	15.25	14.27
F&T	Trace	r = 0	49.08	60.56	35.38	48.87	32.27	60.83	48.85
		r ≤ 1	16.73	18.19	11.46	15.39	8.53	21.99	19.02
	Max	r = 0	32.34	42.37	23.92	33.48	23.74	38.84	29.82
	Eigen	r ≤ 1	16.73	18.19	11.46	15.39	8.53	21.99	19.02
HLT	Trace	r = 0	39.91	58.36	30.36	43.89	28.88	51.24	49.58
		r ≤ 1	19.34	18.18	11.28	17.31	8.29	18.32	18.66
	Max	r = 0	20.57	40.18	19.07	26.58	20.59	32.92	30.91
	Eigen	r ≤ 1	19.34	18.18	11.28	17.31	8.29	18.32	18.66
H&T	Trace	r = 0	39.07	48.95	25.88	38.99	24.13	50.76	40.84
		r ≤ 1	14.48	11.47	10.71	11.07	8.40	12.04	11.23
	Max	r = 0	24.58	37.48	15.17	27.91	15.72	38.72	29.61
	Eigen	r ≤ 1	14.48	11.47	10.71	11.07	8.40	12.04	11.23
INV	Trace	r = 0	38.95	52.99	28.07	42.66	27.31	48.01	43.25
		r ≤ 1	15.94	15.42	10.80	16.90	8.46	12.22	15.32
	Max	r = 0	23.00	37.57	17.26	25.75	18.84	35.79	27.93
	Eigen	r ≤ 1	15.94	15.42	10.80	16.90	8.465	12.22	15.32
IT	Trace	r = 0	23.74	19.18	18.66	16.44	25.56	21.92	19.39
		r ≤ 1	7.25	8.54	3.52	7.59	9.50	8.36	5.94
	Max	r = 0	16.49	10.63	15.14	8.85	16.05	13.55	13.44
	Eigen	r ≤ 1	7.25	8.54	3.52	7.59	9.50	8.36	5.94
L&P	Trace	r = 0	49.17	64.58	35.28	45.53	33.73	54.94	51.23
		r ≤ 1	17.37	18.31	11.70	15.53	8.56	21.68	22.83

MFG	Max	r = 0	31.79	46.27	23.57	30.00	25.17	33.25	28.39
	Eigen	r ≤ 1	17.37	18.31	11.70	15.53	8.56	21.68	22.83
	Trace	r = 0	34.51	53.25	23.68	36.40	27.44	46.84	37.09
		r ≤ 1	12.05	10.56	9.49	11.35	10.14	10.74	9.38
MTR	Max	r = 0	22.45	42.68	14.18	25.04	17.30	36.09	27.71
	Eigen	r ≤ 1	12.05	10.56	9.49	11.35	10.14	10.74	9.38
	Trace	r = 0	31.86	46.84	21.54	33.10	23.84	48.63	40.14
		r ≤ 1	8.93	8.63	5.99	8.77	11.30	8.69	9.23
OIL	Max	r = 0	22.91	38.20	15.55	24.32	12.54	39.94	30.91
	Eigen	r ≤ 1	8.93	8.63	5.99	8.77	11.30	8.69	9.23
	Trace	r = 0	35.16	51.96	26.97	42.42	25.63	50.35	41.90
		r ≤ 1	13.47	13.89	11.26	13.57	9.34	9.38	12.83
P&E	Max	r = 0	21.68	38.07	15.70	28.85	16.28	40.97	29.07
	Eigen	r ≤ 1	13.47	13.89	11.26	13.57	9.34	9.38	12.83
	Trace	r = 0	35.06	48.60	28.09	40.77	30.10	49.36	41.29
		r ≤ 1	15.41	12.58	12.38	14.20	10.04	13.06	14.05
PLT	Max	r = 0	19.65	36.02	15.70	26.56	20.05	36.30	27.23
	Eigen	r ≤ 1	15.41	12.58	12.38	14.20	10.04	13.06	14.05
	Trace	r = 0	48.85	64.57	44.14	72.63	72.63	58.02	47.92
		r ≤ 1	19.02	23.65	9.34	20.98	20.98	22.40	17.61
SRV	Max	r = 0	29.82	40.91	34.79	51.65	29.67	35.61	30.31
	Eigen	r ≤ 1	19.02	23.65	9.34	20.98	7.42	22.40	17.61
	Trace	r = 0	43.86	49.26	30.26	40.55	28.77	61.40	48.04
		r ≤ 1	16.86	15.00	11.45	14.11	8.71	14.59	17.60
S&S	Max	r = 0	27.00	34.25	18.81	26.44	20.05	46.81	30.43
	Eigen	r ≤ 1	16.86	15.00	11.45	14.11	8.71	14.59	17.60
	Trace	r = 0	34.37	42.43	19.38	31.60	16.37	55.62	36.33
		r ≤ 1	7.33	6.61	7.34	7.17	7.13	7.80	7.05
TLE	Max	r = 0	27.03	35.81	12.04	24.42	9.23	47.81	29.27
	Eigen	r ≤ 1	7.33	6.61	7.34	7.17	7.13	7.80	7.05
	Trace	r = 0	37.21	52.21	28.12	41.70	24.89	49.03	43.63
		r ≤ 1	15.43	15.63	11.59	13.82	7.71	16.69	15.56
TRD	Max	r = 0	21.77	36.58	16.52	27.87	17.17	32.33	28.06
	Eigen	r ≤ 1	15.43	15.63	11.59	13.82	7.71	16.69	15.56
	Trace	r = 0	29.69	44.38	21.82	36.89	18.15	54.16	34.83
		r ≤ 1	8.30	7.25	7.35	7.94	8.92	8.32	6.54
	Max	r = 0	21.39	37.12	14.47	28.95	9.23	45.84	28.29
	Eigen	r ≤ 1	8.30	7.25	7.35	7.94	8.92	8.32	6.54

5. Conclusion

The purpose of this paper was to examine the long run relationship between stock returns in CSE and the macro-economic variables. As the proxy for the stock market returns Authors used 20 sector indices listed in CSE. These 20 sector indices were subjected to cointegration tests separately with the seven macro-economic variables. Interestingly, all sector indices proved the existence of cointegration with the concerned seven variables. The general view of long run relationship between stock prices and macro-economic variables is well established in CSE with this remarkable finding. This finding will be immensely important as it is strong scientific evidence for the economic policy makers as well as for the prospective investors of the CSE.

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