The Relationship between the Stock Market and Economic Indicators:
Evidence from Singapore and Hong Kong

Kahini Dalal

Abstract

This paper examines the relationship between the stock markets and economic variables of the selected countries: Singapore and Hong Kong. The quarterly data collected for Gross Domestic Product, Foreign Exchange Rates, Inflation and Current Account Balance, as well as Stock Prices ranges from January 2002 to December 2012. The analysis is focused on the results of the Co-integration and Granger Causality tests to estimate the relationship of the various economic indicators and the stock market indices. This estimation enables to assess whether the stock market index of the respective country is a good representation of the economic health of the country. Furthermore, the accurate estimation of a causal relationship assists investors to make effective financial decisions.

[a] Department of Economics, Bryant University, 1150 Douglas Pike, Smithfield, RI02917. Phone: (401) 232-6379. Email: kdalal@bryant.edu

_____

1.0 INTRODUCTION

For several years there has been extensive debate regarding the relationship of macroeconomic variables and stock market return. There has been much contradiction while assessing the influence of macroeconomic variables on stock return. Economic theory demonstrates that this interrelationship can be explained though the expectations of future corporate performance on stock return. Thus, it explains that stock returns reflect expectations about future corporate performance. While this theory holds, it is acclaimed that corporate profits in-turn relies upon, and thus reflects a country's economic activities. Therefore, it can be concluded that if stock return as well as stock prices reflect these basic theories then stock prices should be leading indicators for future economic activities, and consequently future economic health of a country. However, the International Research Journal of Finance and Economics (2009) evaluated an opposite result-economic activities reflect the movement of stock prices and therefore, economic activities should be the leading indicator of stock prices. It can therefore, be assessed that the relationship among economic variables and stock prices is extremely crucial in determining a country's macro-economic policy as well as enabling foreign investors to make better financial decisions which will help increase capital inflows in the country.

Another underlying concept studied by Chong and Koh (2003) evaluates the effect of indicators such as the money supply and interest rate on stock return, using the efficient market hypothesis. The study suggests that competition between the profit-maximizing investors, considering an efficient market hypothesis, will ensure that important information regarding these indicators will fully be reflected in stock prices, and therefore, excess profit through the prediction of future market movement is not possible. However, there are far more studies that have accumulated over the years opposing the conclusion of the efficient market hypothesis. Such studies include research

done by Fama and Schwert (1977), and Nelson (1977) which clearly demonstrate and draw evidence on the relationship (influence) of macroeconomic variables and stock returns.

The present study contributes to research in two ways. The results of the study will enable investors to make effective foreign financial decisions. It will also assist the government in designing more effective policies. The relationship and thus effect of economic variables on the stock market will help policy makers predict a better outcome, and thus will help them to design policy that can further increase capital inflows into the country's capital market. Therefore, this study will enable investors as well as government agencies to understand the depth of the stock market to make better capital decisions, but it will also enable both parties to assess the strength of the economy by evaluating the stock market index of the newly industrialized countries. In order to evaluate this relationship, the study addresses the long term and short term relationship of the variables-stock prices, inflation, gross domestic product, exchange rate, current account- using the granger causality test.

2.0 TREND

Figure 1 demonstrates the Strait Times Index fluctuations over the past decade. The stock market saw a huge drop in the index during the period of 2008 to the first quarter of 2010. This trend is also reflected in Figure 2 which indicated GDP growth for Singapore during the same period. It is important to note that this drop in the index is due to the financial crisis experienced in the euro zone, as well as the impact of the US financial crisis. Investor confidence fell not only in the respective countries but throughout Asia and other emerging markets, as the global economy faced the threat of dipping into a recession. Although, as seen by the graph there are several upturns in

the market index that cannot be seen significantly in the trend of real GDP for Singapore. This is due to the global recession, as exports for both countries fell during the past five years. GDP growth for economies during this period of sluggish growth has been low for most countries as compared to pre-crisis levels. Foreign Direct investment a huge contribution to growth also so a decline during these years for both countries. Inflation in Figure 3 represents a different trend; however, theoretically inflation is proven to be higher during economic downturns as there is a flood of money supply injected to the economy to help it expand. Also, the trend of low interest rates to spur investment and spending has led to an increase in inflation. Although, inflation enables an economy to expand the high level of inflation especially while looking at Hong Kong, reduces the purchasing power of individuals and will eventually decrease consumption and thus, confidence in the economy in the long run. Thus, it is crucial to watch the trend of inflation to see whether this high level of inflation is sustained by growth, because if growth is not increasing with inflation, the economy will face several negative consequences in the future. These trends are replicated in Figure 4, 5 and 6 for the Hang Seng Index, Hong Kong GDP growth and Inflation for Hong Kong. Therefore, it can be seen although, there is a slight gap in the trend the overall picture of growth for all three variables shows strong correlation, which is important to address in the analysis of the relationship of macroeconomic indicators and stock return.
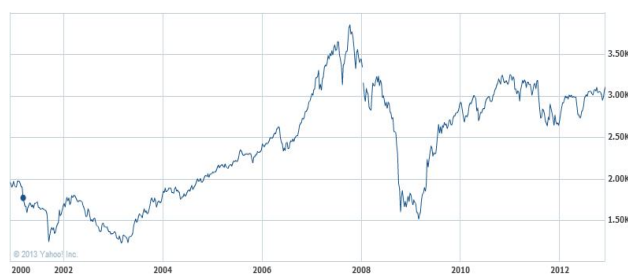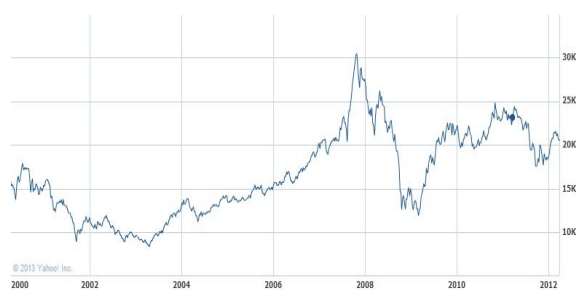
Figure 1: Strait Times Index

Figure 4: Hang Seng Index

Figure 2: Singapore Real GDP growth rate   **Figure 5: Hong Kong GDP growth rate**
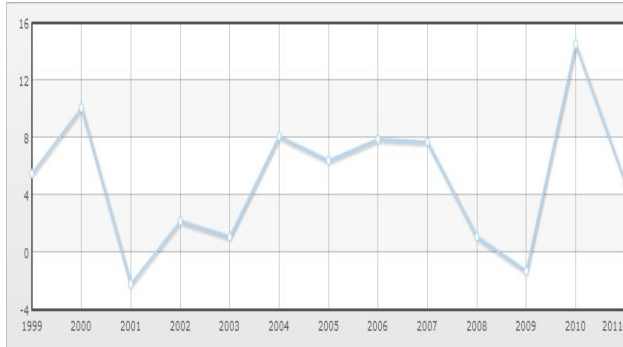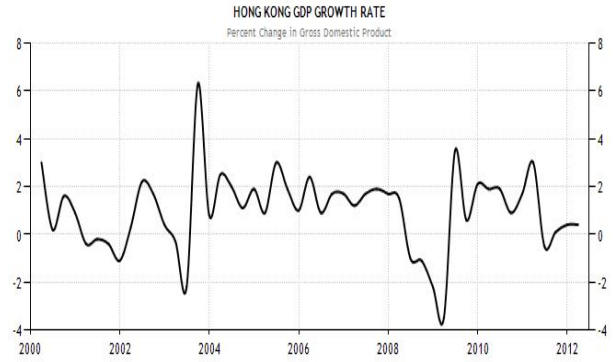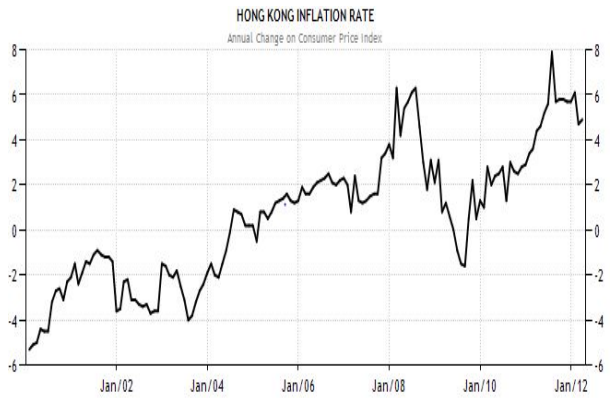

Source: World Bank   Source: Trading Economics

Figure 3: Singapore Inflation Rate   **Figure 6: Hong Kong Inflation rate**

Source: Trading Economics   Source: Trading Economics

3.0 LITERATURE REVIEW

Fama (1982) and many other research studies, Gallagher and Taylor (2002), empirically find that stock returns are negatively affected by both expected and unexpected inflation. Marshall (1992) also finds that negative effect of inflation on stock return is generated by real economic fluctuations.

Using the Engle-Granger co-integration and the Granger causality tests Kwon and Shin (1999) found that the Korean stock market was co-integrated with a set of macroeconomic variables. However, using the Granger-causality test on macroeconomic variables and the Korean stock index, the authors found that the Korean stock index was not a leading indicator for economic variables. Opposing these results is the result of co-integration of US stock markets and variables such as interest rate spreads, inflation rates, money stocks and aggregate output. Standard and Poor's S&P 500 price index suggests that among the macroeconomic variables that are considered, yield curve spreads and inflation rates are the most useful predictors of recessions in the U.S. stock market. Chen (2008).

Another study examining the long-run relationship between stock returns and three monetary variables (overnight interest rate, money supply and foreign exchange rate) in Turkey by Muradoglu, Metin and Argac (2001) pointed out that the whole sample period (1988-1995) for Turkey showed no co-integrating relationship between stock prices and any of the monetary variables.

Darat and Mukherjee (1987) applied a Vector Auto Regression (VAR) model and found that a significant causal relationship exists between stock returns and selected macroeconomic variables of China, India, Brazil and Russia which are emerging economies of the world using oil price, exchange rate, and moving average lags values as explanatory variables employed MA (Moving

Average) method with OLS (Ordinary Least Square) and found insignificant results which postulate inefficiency in market. Finally they concluded that in emerging economies the domestic factors influence more than external factors, i.e., exchange rate and oil prices. There has also been evidence from New Zealand regarding the interaction between stock market and macroeconomic variables. However, the variables used differ from the studies of Darat and Mukherjee (1987). Gan et al (2006) studied had a set of seven macroeconomic variables and used co-integration tests, johansen maximum likelihood and granger-causality tests. In addition, their paper also investigated the short run dynamic linkages between NZSE40 and macroeconomic variables using innovation accounting analyses. In general analysis it was found that the NZSE40 is consistently determined by the interest rate, money supply and real GDP but there is no evidence that the New Zealand Stock Index is a leading indicator for changes in macroeconomic variables.

4.0 DATA AND EMPERICAL METHODOLOGY

4.1 DATA

This study uses quarterly data from 2000 to 2012 for countries Singapore and Hong Kong. Data was obtained through several databases: World Bank, IMF Statistics, CIEC, Yahoo Finance, Sing Stat database. This data was publicly available. Stock return for each quarter has been calculated through the averaging of monthly returns.

4.2 Empirical Model

Following the research and model of Singh (2010), this study has adapted a linear model and has modified the data as well as the variables included to determine the relationship between the stock market indices and macro-economic variables.

$$\Delta Yit = \alpha + \sum \Delta Yt - 1 + \sum \Delta Xt - 1 + \sum \Delta Zt - 1 + \sum \Delta Wt + \sum \Delta Vt + E$$

Where Δ represents the change and can thus be re-written as β:

Stock Return $= \beta0 + \beta GDP + \beta inflation + \beta forex + \beta tradebal + e$

Yit is the return of the stock prices on the respective indices measured as an index. Although, there are several indices in Singapore, since it is one of the more developed and fast growing economies, this study aims to capture a snapshot of stock performance in all areas- thus better representing the entire economy rather than focus on the sub-sector indices in the economy. The Hang Seng Index was also chosen for the same reason. Xt is the Real Gross Domestic Product measured in billions in US dollar terms. Real GDP is extremely crucial when looking at leading indicators of an economy, as it is the very epitome of health of an economy. Therefore, it captures the production efficiency in an economy which translates in to an effectively employed economy. Zt measures the average consumer price index and is used to capture inflation. .A consumer price index (CPI) measures changes in the prices of goods and services that households consume. Such changes affect the real purchasing power of consumer's incomes and their welfare. As the prices of different goods and services do not all change at the same rate, a price index can only reflect their average movement. Wt measures the foreign exchange rate using direct quotations of one unit of US Dollar for one unit of the Singapore dollar and one unit of the Hong Kong dollar. Vt is the balance of payments for both Singapore and Hong Kong measured in billions, US Dollars. It is also known as the current account. The current account is all transactions other than those in financial and capital items. The major classifications are

goods and services, income and current transfers. The focus of the BOP is on transactions (between an economy and the rest of the world) in goods, services, and income.

5.0 Empirical Results

Many economic and financial time series exhibit trending behavior or non-stationary characteristics in the mean. Leading examples are asset prices, exchange rates and the levels of macroeconomic aggregates like real GDP. An important econometric task is determining the most appropriate form of the trend in the data. Therefore, before any testing is done to evaluate the relationship between the variables, a unit root test must be performed to de-trend the data. The empirical analysis in the present study is based on unit root test and Granger Causality tests. The first step in the analysis is to subject the macroeconomic variables to unit root tests which tests the series for stationary. The present study uses Granger Causality test for causality tests among the macro economic variables and stock market prices. The following steps are an overview of the implementation of the Granger Causality test:

1) Test for the presence of the Unit Root using the Augmented Dickey Fuller test

2) Perform the test for the second time using the first difference to eliminate the non-stationary variables, and to successfully de-trend the data

3) Eliminate any country where the variables are still non-stationary

4) Estimate the optimal lag length as taken by the Schwarz Bayesian Criterion (SBC)

5) Estimate the co-integration test to test for a short run relationship amongst variables

6) Based on the results of the co-integration test, perform the VEC to test for causality

As seen by table 3, Unit Root for first differences, all variables have been determined as

stationary and thus it is not necessary to eliminate any of the countries to examine the short run

relationship between the Stock Market Indices and Macroeconomic variables.

Table 3: Unit Root Test on Level and First Differences

Unit Root Test: Level
Singapore

Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	1.68398	0.9539	5	204
ADF – Fisher Chi-square	6.17265	0.8006	5	204
PP – Fisher Chi-square	4.28539	0.9336	5	216

** Probabilities for Fisher tests are computed using an asymptotic Chi
-square distribution. All other tests assume asymptotic normality.

Hong Kong

Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-0.95545	0.1697	5	215
ADF – Fisher Chi-square	12.4429	0.2565	5	21
PP – Fisher Chi-square	12.0140	0.2841	5	215

** Probabilities for Fisher tests are computed using an asymptotic Chi
-square distribution. All other tests assume asymptotic normality.

Unit Root Test: First Differences

Singapore

Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-5.96337	0.0000	5	202
ADF - Fisher Chi-square	73.9954	0.0000	5	202
PP - Fisher Chi-square	121.266	0.0000	5	211

** Probabilities for Fisher tests are computed using an asymptotic Chi
-square distribution. All other tests assume asymptotic normality.

Hong Kong

Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-12.1477	0.0000	5	210
ADF - Fisher Chi-square	125.465	0.0000	5	210
PP - Fisher Chi-square	139.578	0.0000	5	210

** Probabilities for Fisher tests are computed using an asymptotic Chi
-square distribution. All other tests assume asymptotic normality.

As the results of Unit Root test determine that all variables are stationary at the first difference, the co-integration test is then estimated using the variables in the same order. Stationary variables demonstrate that there is no trend in the data resulting from high correlation between variables. Thus, the estimates will be more accurate and will not include a bias. In order to test for co-integration the Johansen model (1988) was used. Table 4 demonstrates the results of the λ_{trace} and λ_{max}, trace statistics to determine if the null hypothesis rank r=0, or the alternative r=1,2,3,4…. If the rank r=0 then the variables are not co-integrated, however if rank = alternatives then the null hypothesis is rejected. As seen by table 4, the null-hypothesis of no co-integration was rejected for both countries at the maximum of one co-integrating vector using a lag of p=2. In order to test the VEC model the optimal lag length was chosen based on the Schwarz Bayesian Criterion (SBC) which suggests that for quarterly data the optimal lag length is 12. It is important to choose an optimal lag length because any value too small would lead to misspecification in the model.

Table 4: Co-Integration Results

Country	Eigenvalue	λTrace	λMax
Singapore	0.664870	96.36611*	45.91596*
Hong Kong	0.435100	59.48950*	23.98651*

*denotes significant at 5% level

Finally, Engle-Granger (1969) causality model is used to test the causality between the stock market and macroeconomic variables. The definition of Granger's concept of causality- X is said to be Granger cause Y if Y can be predicted with greater accuracy by using past values of X. Thus, by using the model:

Stock Return = $\beta 0$ + βGDP + βinflation + βforex + βtradebal + e

If βGDP = 0 then GDP does not Granger cause Stock Return. This is true for all other variables in the model. If the beta of each variable in the model = 0 then it said that each individual macroeconomic variable in the model does not granger cause stock return. If the beta coefficients are non-zero, then it is said that GDP does granger cause Stock return. Therefore, the null hypothesis can be written as $\beta = 0$ for each variable and it can be tested through the F-test.

Table 5: Results of Granger Causality Tests: Singapore

Null Hypothesis	F-Statistic	Probability	Result
GDP does not Granger Cause Stock Return	0.14307	0.8672	NO
Stock Return does not Granger Cause GDP	0.81741	0.4494	NO
Inflation does not Granger Cause Stock Return	1.74094	0.0189 *	YES
Stock Return does not Granger cause Inflation	0.19013	0.8277	NO
Forex does not Granger cause Stock Return	1.43265	0.2516	NO
Stock Return does not Granger cause Forex	0.11506	0.0891**	YES
Tradebal does not Granger cause Stock Return	0.24285	0.7856	NO

Null Hypothesis	F-Statistic	Probability	Result
Stock Return does not Granger cause Tradebal	0.30940	0.7358	NO

Table 6: Results of Granger Causality Tests: Hong Kong

Null Hypothesis	F-Statistic	Probability	Result
GDP does not Granger Cause Stock Return	1.94660	0.1571	NO
Stock Return does not Granger Cause GDP	0.21005	0.8115	NO
Inflation does not Granger Cause Stock Return	4.93898	0.0126*	YES
Stock Return does not Granger cause Inflation	0.24616	0.7831	NO
Forex does not Granger cause Stock Return	0.35718	0.7020	NO

Stock Return does not Granger cause Forex	0.89603	0.0416**	YES
Tradebal does not Granger cause Stock Return	0.03647	0.9642	NO
Stock Return does not Granger cause Tradebal	1.06760	0.3542	NO

*denotes significant at 5% level
**denotes significant at 10% level

From the analysis of the above table (5, 6) it is evident that Inflation granger causes both the Strait Times Index as well as the Hang Seng Index. This relationship has been seen in several theoretical papers as well as in Fama (1982). Fama further concluded that this negative relationship was more extensive when considering periods of contraction. The theory behind inflation negatively affecting equity prices is that when inflation is high, central banks have historically raised interest rates, thus, pushing investors to increase investment in debt instruments and move away from equity investment. Exchange rate is an indicator of a currency movement and is a monetary variable that affects stock prices in a way similar to inflation. Depreciation of the local currency makes import more expensive compared to export. Thus, production costs of import companies increase and since all the cost cannot be passed on to the consumers because of the competitiveness of the market, this reduces corporate earnings and hence negatively affects stock prices. From the analysis of the above table it demonstrates that both STI and HSI is Granger causing foreign exchange rate, i.e., there is a unilateral \relationship

between the two variables. This represents that both indices are representing future expected fluctuations in the economy.

Taken overall, the above findings stand in an agreement with the earlier studies which documented significant causal and short run interaction between inflation rates, exchange rates and current account with stock returns of emerging economics, as well developed economics.

6.0 CONCLUSION

The aim of this research is to find out and study the causality, if any, between stock market and three key macroeconomic variables in Indian economy. The results that have been found are mixed; however, there is undoubtedly strong correlation between STI, HIS with Inflation and Foreign exchange rate. Although there is strong correlation between the STI, HIS and macroeconomic variables even then the causality that has come out is just amongst two macroeconomic variables and stock market variables which further strengthens the issue that stock markets in Singapore and Hong Kong are in their emerging phase as their impact on macroeconomic variables is less as compared to developed countries and moreover effect of macroeconomic variables is weak on stock market index in the case of causality. The conclusions drawn from the study will help assess whether there exists opportunities for profit from the inefficiencies of stock market mechanisms and also whether top-down stock picking could lead to higher earnings. It also will enable policy

makers to make better and more effective decisions regarding national policies, structured to consider this relationship. This study enables policy makers to attract more capital to the economy through foreign direct investment and capital marker inflows.

Appendix A: Variable Description and Data Source

Acronym	Description	Data source
STI	Stock Return from the Strait Times Index: Calculated average per quarter	Yahoo Finance
Sing_Inflation	Consumer Price Index Average Level:100	Singapore Statistics
Sing_GDP	Real Gross Domestic Product chained in Billions (US)	IMF Statistics
Sing_Forex	Singapore/US Foreign Exchange rate (US Dollars)	Federal Reserve Economic Data
Sing_CA	Balance of Payments in Billions (US)	CIEC
HSI	Stock Return from the Hang Seng Index: Calculated average per quarter	Yahoo Finance

HK_Inflation	Consumer Price Index Average Level: 100	World Bank
HK_GDP	Real Gross Domestic Product chained in Billions (US)	IMF Statistics
HK_Forex	Hong Kong/US Foreign Exchange rate (US Dollars)	Federal Reserve Economic Data
HK_CA	Balance of Payments in Billions (US)	CIEC

BIBLIOGRAPHY

Chen, N. F., R. Roll, and S. Ross, 1986, Economic Forces and the Stock Market, *Journal of Business*, 59, pp. 383-403

Darat, A.F. and Mukherjee. T.K. (1987). "The Behaviour of a Stock Market in a Developing Economy", Economic Letters, 22, 273-278

Fama, E. F. 1981, Stock Returns, Real Activity, Inflation and Money, *American Economic Review*, 71, pp. 545-565

Fama, E. F. 1982, Inflation, Output and Money, *Journal of Business*, 55, pp. 201-31

Granger, C.W.J. (1988). Some Recent Developments in a Concept of Causality. *Journal of Econometrics,* 39: 213-28

Ibrahim, M. H. & Aziz, H. (2003). Macroeconomic variable and the Malaysian equity market: A view through rolling subsamples. *Journal of Economic Studies*, 30: 1: 6-27. http://dx.doi.org/10.1108/01443580310455241

Mukherjee. T.K. and Naka (1995), "Dynamic Relations between the Macroeconomic Variables and the Japanes Stock Market- An Application of a Vector Error Correction Model, Journal of Empirical research 18, 223-237.

Phillips, R. C. B., & Perron. (1988). *Testing for a Unit Root in Time Series Regression Biometrika*, 335-346

Poon, S., and S. J. Taylor 1991, Macroeconomic Factors and the U.K. Stock Market, *Journal of Business Finance and Accounting*, 18, pp. 619-636.

Soenen, L.A., Hennigar, E.S. (1988). "An analysis of exchange rates and stock prices: The US experience between 1980 and 1986", Akron Business and Economic Review 19, pp.71-76.