# Multiple Regression Approach to Fit Suitable Model for All Share Price Index with Other Important Related Factors

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**Abstract**
This study investigates the effects of some important sectors indices such as: Bank Finance & Insurance, Manufacturing, Trading, Hotels & Travels and Services on All Share Price Index (ASPI) in emerging Sri Lankan stock market using monthly data for the period from January 2005 to December 2014. It is aimed to find a suitable multiple regression model for Bank Finance & Insurance, Manufacturing, Trading, Hotels & Travels and Services on ASPI. In this paper, multiple linear regression model, multiple log linear model and multiple first difference of log linear models are analyzed using appropriate statistical tests. The first difference of log linear model is more appropriate to fit ASPI and other important related factors.

**Keywords**: Stock Market, ASPI, Multiple Regression.

## Introduction

A stock market or equity market is a public entity for the trading of company stock (shares) and derivatives at an agreed price; these are securities listed on a stock exchange as well as those only traded privately. The ASPI is a value weighted index based on market capitalization where the weight of any company is taken as the number of ordinary shares listed in the market.

### All Share Price Index (ASPI)

It is a value-weighted price index, which incorporates all the voting ordinary shares listed on the Colombo Stock Exchange (CSE). The base year is 1985 and the base value of the index is 100. ASPI showed 7,811.82 points as its highest value on 14th February 2011. Current ASPI value is the broadest and the longest measure of the level of the Sri Lankan stock market.

As explained above the ASPI is a value weighted index based on market capitalization where the weight of any company is taken as the number of ordinary shares listed in the market. This weighting system allows the price movements of larger companies to have a greater impact on the index. Such a weighting system was adopted on the assumption that the general economic situation has a greater influence on larger companies than on smaller ones.

The ASPI indicates the price fluctuations of shares of all the listed companies and covers all the traded shares of companies during a market day. The ASPI is calculated using the following formula:

$$\text{ASPI} = \frac{\text{Market Capitalization of All Listed Companies}}{\text{Based Market Capitalization}} \text{ X } 100$$

where,

$$Market\ Capitalization = \sum_{i=1}^{n} (Current\ No.of\ Listed\ Shares\ of\ Company)i\ X\ (Market\ Price)i$$

$$Base\ Market\ Capitalization = \sum_{i=1}^{n} (No.of\ Listed\ Shares\ of\ Company)i\ X\ (Market\ Price)i$$

Base values are established with average market value on year 1985. Hence the base year becomes 1985.

$$Opening\ Base\ Market\ Capitalization = \frac{Total\ Market\ Capitalization\ in\ 1985}{No.of\ Days\ in\ 1985}.$$

**Sector Indices**

The listed companies of CSE are divided into 20 sectors and a price index for each sector is calculated on a daily basis using the same formula used to construct the ASPI. Each index indicates the direction of the price movement of the sector. By referring to these indices investors can get an idea of the stock price levels of particular business sectors. These 20 Business sectors categorized are composed into five sectors they are: Bank Finance & Insurance (BFI), Manufacturing (MFG), Trading (TRD), Hotels & Travels (H&T) and Services (SRV):

**Objective of the Research Study**

On view of the above, the general objective of this study is to detect suitable statistical model for all share price index with other related factors (Bank Finance & Insurance, Manufacturing, Trading, Hotels & Travels and Services) in Sri Lanka.

## Review of Literature

Different studies have been carried out by financial economists on the impactions of stock market development for various components of an economy. Relationships have been found to exist between stock market development and those aspects of an economy, even though some have been controversial, while other relationships have shown clear and significant correlation.

In this section, review and summary empirical findings are made of three studies, which investigated the relationships between stock market development and financing choices of firms by Demirguc-Kunt, Asli and Maksimovic (1996a, 1996b)); stock market development and financial intermediaries. Mayer (1988) argues that even large stock markets are unimportant sources of corporate finance.

Stiglitz (1985, 1993) says stock market liquidity will not enhance incentives for

acquiring information about firms or exerting corporate governance. Moreover, Devereux and Smith (1994) emphasis that greater risk sharing through internationally integrated stock markets can actually reduce saving rates and slow economic growth.
Atje and Jovanovic (1993) study of stock market trading and economic growth in two ways. First, it used indexes of stock market development that combine information on stock market size, trading and integration. Second, it controlled for initial conditions and other factors that may affect economic growth in light of the evidence that many cross county regression results are fragile to changes in the conditioning information set. Thus it gauged the robustness of the relationship between overall stock market development and economic growth to changes in the conditioning information set. It found a strong correlation between overall stock market development and long-run economic growth. After controlling for the initial level of GDP per capita, initial investment in human capital, political instability and measures of monetary, fiscal and exchange rate policy, stock market development remains positively and significantly correlated with long-run economic growth. The results are consistent with theories that imply a positive relationship between stock market development and long-run economic growth. The results are inconsistent with theories that predict no correlation or a negative link between stock market development and economic performance.

## Methodology

This study investigates the effect of 5 sectors such as Bank Finance & Insurance, Manufacturing, Trading, Hotels & Travels and Services on stock prices. A number of researchers in various countries have found significant relationship between these sectors and ASPI. These studies concerned multi-factor model of the variation in ASPI. The following methodological approach is adopted in this study for establishing the relationship between 5 sectors and ASPI in the Emerging Sri Lankan Stock Market.

### Data Collection

The study uses the existing time series data from the Annual Reports of the Central Bank of Sri Lanka. The empirical analysis is carried out by using monthly data. The sample period spans from January 2005 to December 2014 and the study was carried out by using 120 monthly observations (Central Bank Report 2014). The study uses stock price indices which were collected from the Colombo Stock Exchange.

### Research Design and Appropriate Statistical Analysis

This study is designed to forecast the share market performance in Sri Lanka in terms of 5 main sectors as mentioned above with ASPI. At the beginning the statistical relationship between these 5 sectors and ASPI was established through multiple regression analysis. Before that the test of normality using Kolmogorov-Smirnov and Shapiro-Wilk approach were tested for each of the five sector variables and ASPI variable. The parameters were estimated by ordinary least square (OLS) technique. Linear multiple regression model, log linear multiple regression model and first difference of log linear models were analyzed. Among these three models the best model is selected by checking the statistical properties and conditions of appropriate statistical tools such as: coefficient of determination ($R^2$), normality of the residuals, stationary and non-stationary test, auto correlation and serial correlation test of the residual, heteroscedasticity test of the residual, stability test.

**The Empirical Model of the Research Study**

The data of this research study is time series. The following empirical models are studied:

Linear model: $ASPI = \beta_0 + \beta_1 BFI + \beta_2 MFG + \beta_3 TRD + \beta_4 H\&T + \beta_5 SRV + \varepsilon$

Log linear model:

$$\ln(ASPI) = \beta_0 + \beta_1 \ln(BFI) + \beta_2 \ln(MFG) + \beta_3 \ln(TRD) + \beta_4 \ln(H\&T) + \beta_5 \ln(SRV) + \varepsilon$$

First difference of log linear model:

$$D(\ln(ASPI)) = \beta_0 + \beta_1 D(\ln(BFI)) + \beta_2 D(\ln(MFG)) + \beta_3 D(\ln(TRD)) + \beta_4 D(\ln(H\&T)) + \beta_5 D(\ln(SRV)) + \varepsilon$$

## Results and Discussion

### Linear Model Test

Linear model test statistical results are given in table 1.

**Table 1**. ASPI Vs Five Sectors Linear Model Test Summary Table

| Statistical Properties | ASPI = *f*(All Five Sectors) |
|---|---|
| $R^2$ Value | 99.26% |
| Adjusted $R^2$ Value | 99.23% |
| Durbin-Watson Statistics | 0.54 (positive auto correlated) |
| Model Significant | P = 0.000 (Significant) |
| $\beta_0$ | P = 0.000 (Important) |
| $\beta_1$ | P = 0.000 (Important) |
| $\beta_2$ | P = 0.0147 (Important) |
| $\beta_3$ | P = 0.0804 (Not important) |
| $\beta_4$ | P = 0.2657 (Not important) |
| $\beta_5$ | P = 0.0028 (Important) |
| Wald Coefficient Test (Testing linear restrictions in regression) | P = 0.1588 (Nonlinear) C(4) + C(5) = 0 |
| Normality Test (Histogram) | P = 0.24 > 0.05 (Normal) |
| Unit Root Test | Non Stationary |
| Breusch-Godfrey Serial Correlation LM Test | P = 0.000 (Serial correlation exist) |
| Heteroscedasticity Test (White) | P = 0.000 (Heteroscedasticity exist) |
| Stability Test (Recursive Estimation-CUSUM of Squares Test) | Not stable |

Linear multiple regression model violated most of the statistical tests. Errors have auto correlation, serial correlation and heteroscedasticity problems. Linear variables are non-stationary. Stability test also not significant.

Based on the overall statistical analysis above linear multiple regression model is not suitable for this data. Hence, the next section log linear model is tested.

**Log Linear Model Test**

Log linear model test statistical results are given in table 2.

**Table 2:** ASPI Vs Five Sectors Log Linear Model Test Summary Table

| Statistical Properties | log(ASPI) =*f*(log(All Five Sectors)) |
|---|---|
| $R^2$ Value | 99.39% |
| Adjusted $R^2$ Value | 99.36% |
| Durbin-Watson Statistics | 0.43 (Positive auto correlated) |
| Model Significant | P = 0.000 (Significant) |
| $\beta_\circ$ | P = 0.000 (Important) |
| $\beta_1$ | P = 0.000 (Important) |
| $\beta_2$ | P = 0.6089 (Not important) |
| $\beta_3$ | P = 0.0068 (Important) |
| $\beta_4$ | P = 0.7584 (Not important) |
| $\beta_5$ | P = 0.463 (Not important) |
| Wald Coefficient Test (Testing linear restrictions in regression) | P = 0.3613 (Nonlinear)<br>C(3) + C(5) + C(6) = 0 |
| Normality Test (Histogram) | P = 0.546 > 0.05 (Normal) |
| Unit Root Test | Non Stationary |
| Breusch-Godfrey Serial Correlation LM Test | P = 0.000 (Serial correlation exist) |
| Heteroscedasticity Test (White) | P = 0.000 (Heteroscedasticity exist) |
| Stability Test (Recursive Estimation-CUSUM of Squares Test) | Not stable |

Log linear multiple regression model also violated most of the statistical tests including errors have auto correlation, serial correlation and heteroscedasticity problems. Linear variables are non stationary. Stability test also not significant.

Based on the overall statistical analysis above log linear multiple regression model is not suitable for this data. Therefore, in the next section first difference of log linear model is tested.

**First Difference of Log Linear Model Test**

First difference of log linear model test statistical results are given in table 4.3.

**Table 3.** ASPI Vs Five Sectors First Difference of Log Linear Model Test Summary Table

| Statistical Properties | Dlog(ASPI) =*f*(dlog(All Five Sectors)) |
|---|---|
| $R^2$ Value | 92.3% |
| Adjusted $R^2$ Value | 92.0% |
| Durbin-Watson Statistics | 1.896 (No auto correlation) |
| Model Significant | P = 0.000 (Significant) |
| $\beta_0$ | P = 0.8906 (Not important) |
| $\beta_1$ | P = 0.000 (Important) |
| $\beta_2$ | P = 0.000 (Important) |
| $\beta_3$ | P = 0.0855 (Not important) |
| $\beta_4$ | P = 0.0003 (Important) |
| $\beta_5$ | P = 0.2312 (Not important) |
| Wald Coefficient Test (Testing linear restrictions in regression) | P = 0.0438 (Linear)<br>C(1) + C(4) + C(6) ≠ 0 |
| Normality Test (Histogram) | P = 0.000 < 0.05<br>(Not normal but peak) |
| Unit Root Test | Stationary |
| Breusch-Godfrey Serial Correlation LM Test | P = 0.4485 (No serial correlation) |
| Heteroscedasticity Test (White) | P = 0.9961 (No Homoscedasticity) |
| Stability Test (Recursive Estimation-CUSUM of Squares Test) | Approximately stable |

First difference of log linear multiple regression model satisfied almost all the statistical tests. Based on the overall statistical analysis above first difference log linear multiple regression model is the best and appropriate statistical model for this data.

## Conclusions

This study is focused to find a suitable multiple regression model for Bank Finance & Insurance, Manufacturing, Trading, Hotels & Travels and Services on ASPI. Comparing and analyzing the models properties with appropriate statistical tests as discussed in this paper the first difference of log linear model is more appropriate model.

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