



**Lappeenranta University of Technology, Finland.**  
**LUT School of Business and Management**  
**Strategic Finance and Business Analytics (MSF)**

## **Master's Thesis**

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**CO-INTEGRATION OF BANGLADESH STOCK MARKET WITH  
INDIA, EMERGING AND WORLD STOCK MARKET INDICES.**

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## **ABSTRACT**

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The stock market is one of the influential indicators for the potential growth of a country. The performance of a stock market is associated with different types of variables such as economic, political, social etc. Stock return is also depending on the efficiency (strong, semi-strong and weak) of the market. This is why the investors are, nowadays, trying to diversify their investment portfolios by investing in different stock markets. However, there were not so many research work done before on the Bangladesh stock market co-integration. In this research work, India was only individual country examined, along with Emerging and World stock indices, due to the reason that Bangladesh has a large volume of trade, larger trade deficit and a neighbouring country.

In this research work of co-integration of Bangladesh stock market, the dependent variable, there are four independent variables which are Indian stock index, Emerging stock index, World stock index and Bangladesh currency exchange rate. A 10 year (2005–2014) daily price index data set was examined. First of all, ADF and KPSS test conducted on the calculated returns to find out the feasibility of the data. Then the Johansen co-integration test and Vector Error Correction Model (VECM) test were conducted to find out the linkage of Bangladesh stock market.

The finding of this research suggested that there was a long-run linkage of Bangladesh stock market with India, Emerging and World stock indices as well as a short-run linkage with Bangladesh currency exchange rate. Information of one of the discussed market can be used in the Bangladesh stock market to make a profit but, however, investors' portfolio in Bangladesh market may be affected by the other markets.

**Keywords:** Co-integration, CSE, DSE, Bangladesh, India, Emerging, World.

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Last but not least, I would like to dedicate my master's thesis to the sweet memory of my lovely late grandfather. I can clearly recall that, on the very first day of my education life, he held my hand and took me to the primary school for admission. He left us all behind just two days after my bachelor degree graduation in 2012. It is sad to lose him but I am very lucky to have had such person in my life whose love was endless for me.

**Kafil Uddin Ahmad**  
Bangladesh  
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# 1 INTRODUCTION

## 1.1 Background

The current economic situation brought the increased attention of the investors as well as the academic scholars concerning the co-integration among the capital markets in this world. Increasing co-integration and portfolio investment have important implications on the macroeconomic policies. It can influence the currency exchange rate which might lead to the sudden withdrawals and, hence, instable economy. Through the various economic channels, the stock price plays an important role. The development of the stock market is associated with the higher growth as it reduces the liquidity as well as the productivity shocks (Mohtadi, n.d.).

Stock market growth is one of the economic indicators of a country as it is playing a potential role in the most of the national economy. There is a debate in both developed and developing countries whether there is any impact of financial institutions for economic growth of a country. Capital is something that allows an owner to invest in the business for goods or service and known as a net asset or equity of the entity. On the other hand, a stock market refers to a public body that trades stocks or shares of the companies' derivatives at an agreed price. Stock markets are playing a significant role as it is one of the sources to raising capital in the market. As of April 13, 2015, world's equity market was over 70 trillion US dollar for the first time ever since 2009 (Gilbert, 2015).

Stock market performance is influenced by a number of factors due to the reason that stock market serves as a price discovery mechanism and information dissemination. A number of interests group are involved with the stock markets such as government, investors, capital market etc. Shortly, it can be said that stock market is the heart of an economy as it is performing different types of economic and political activities while providing some opportunities such as trading, investment arbitrage etc. (Bose *et al.*, 2014)

According to the financial economic theory, the efficient market hypothesis is associated with whether the historical prices at any time span fully reflect on the available information. This market efficiency is classified into three parts: *weak form*, where there past historical price information does not have any impact on future earnings, *semi-weak form* where

historical price information does not always have an impact on future earnings and *strong form*, where future earnings reflect on the historical price information (Fama, 1969).

The downturn of the stock market is not a new phenomenon. The worst stock market downturn took place in the year 1929 which was on the New York Stock Exchange (NYSE) which spread adverse consequences to the rest of the world market. This major shock hit the biggest stock markets like Germany, France, United Kingdom as well as Latin America. After 1929, there were many major and minor stock market downturn took place in the different parts of the world until now. In October 1997, Hong Kong stock market declined sharply which had affected in the Africa, North and South America and Europe. There was also a significant drop in the Mexican market, in December 1994, which had an effect on the other Latin American stock markets. Most powerful stock market tumble was in the USA, in October 1987, which had affected the major stock markets around the world. From this market decline phenomenon, it can easily be predicted that there could have some co-movement which are affect by the crush. (Forbes and Rigobon, 2002)

There are some reasons behind the stock market fall. Economic and social factors can play an important role in this aspect. Social aspect such as political turmoil can downsize the market. Inflation also has an impact on the stock markets. High inflation can lead the market to drop as companies hold back on spending and decrease in revenue. Similarly, deflation also leads the market downturn as it's the result of the weak economy though investors welcome the deflation. Moreover, interest rates have an effect on the stock market as money become more expensive to borrow once the interest rate is high. Furthermore, export-oriented country suffers from the currency appreciation, or exchange rate, as the export become expensive to the buyers as a result export decreases and stock market faces a downturn.

However, there are some other non-economic factors are involved indirectly to the tumble of the stock markets such as internal developments of the company, world events, hype etc. Internal change such as merger and requisitions, recruiting or sacking employees, dividend suspension etc. in the company could lead to the drastic stock price movement. Similarly, instant world events such as terrorists' attacks, war and political unrest could downsize the market.

The goal of this study is to find out whether there is any co-integration of Bangladesh stock market with India, Emerging and World stock markets. Co-integration is the method of measuring the connection in between the stock markets. Measuring the extent of co-integration between stock markets, we would be able to estimate the potentiality of Bangladesh stock market for the investors as co-integration has great implications on portfolio diversification. Similarly, to the check linkage of Bangladesh stock market with the Bangladesh currency exchange rate, so that it would be fruitful to know how do both stock market and exchange rate behave.

## **1.2 Objective**

The objective of my research is to find out the co-integration of Bangladesh stock market with neighbouring India as well as to the emerging and world stock indices by analysing 10 years of data from 2005 to 2014. India is the only country discussed here as India is one of the neighbouring countries of Bangladesh and there is a huge trade in between these two countries. India it is also one of the member states of the BRICS (Brazil, Russia, India, China and South Africa).

The result would be fruitful for the future investors who are willing to invest in Bangladesh. If there is any co-integration of Bangladesh stock market with India, emerging and to the rest of the world, as well as with the currency exchange rate, then I believe that the investors would be able to make a portfolio diversification wisely. Also, this paper would be helpful for the Bangladesh government for strengthening Bangladesh Securities and Exchange Commission (BSEC) which will regain the investors' confidence in the Bangladesh stock market.

## **1.4 Motivation**

The motivation to work on this topic came from my own interests. The economy of Bangladesh is growing rapidly and growth is over 6% of the GDP whereas some developed

countries are struggling with their financial condition. The unemployment rate is growing rapidly though the economic condition is performing better in Bangladesh. As a result, a huge number of educated unemployed youth are relying on the capital market to make a reasonable gain. After a certain time period, investors cannot make any gain due to having no proper knowledge about the capital market.

## **1.5 Research Questions**

My research questions are:

- i) Is the Bangladesh stock market co-integrated with India?*
- ii) Is the Bangladesh stock market co-integrated with the emerging and world market indices?*
- iii) Is the Bangladesh stock market co-integrated with the currency exchange rate?*

## **1.6 Limitation**

There are two stock markets, Dhaka and Chittagong, in Bangladesh. The idea was to get data from the both markets and find out the co-integration with both markets with India, Emerging and World stock indices. Unfortunately, the collected data from the Chittagong stock market was not feasible. Also, another idea to collect the daily interbank interest rate to find out whether does it have any effect on the stock market or not and vice versa. But the collected data was not feasible due to the reason that it is available only from 2011 in the database whereas the target of this research was from January 2005 to December 2014. Thus, it can be said that this research could be advanced and more informative in those two dimensions as well but, unfortunately, was not possible due to the data insufficiency.

On the other hand, most of the countries in this world are having the foreign reserve in the US dollar. All the authors discussed in the literature review used foreign currency exchange against US dollar. This is why there was not any another currency exchange against other big currencies was not established in the literature review section.

## **1.7 Structure of the thesis**

- Part 1: Introduction along with the background, objective, motivation, research questions and limitation.
- Part 2: Theoretical background of this thesis. There are four theories discussed in this section and those are Diversification, Market Efficiency, Arbitrage and Purchasing Power Parity.
- Part 3: Four stock markets discussed in this section. Information about Bangladesh in general before and after the independence until now. And then Bangladesh, India, Emerging and World stock markets. Analysts' opinion about Bangladesh stock market added the end of this part.
- Part 4: A literature review. This section includes previous empirical studies related to this thesis. Previous studies were in different time horizon and different types of dataset were examined from the different parts of the world.
- Part 5: It was obvious to check the data feasibility. After checking the heteroscedasticity and serial correlation, other basic tests were conducted such as descriptive statistics, ADF and KPSS test, volatility clustering and correlation on the variables. Also, this part discussed the methodology that is used in this empirical study.
- Part 6: This section exhibits the output of this empirical results corresponding to the research questions.
- Part 7: Conclusion based on this empirical study as well as the further research.
- Part 8: References that were used in this study.
- Part 9: The appendices, the output of the regression analyses added in this part.

## **2 THEORETICAL BACKGROUND**

The level of co-integration among the stock markets is important for investors in this current economic turbulence. Due to the globalisation and market liberalisation, investments across the continents are increasing. The globalisation making the economies is more and more interdependent in the long-run as well as in the short-run. Moreover, the blessing of technology is making the communication easier and faster day by day. As a result, investing in any stock market in this world is easier and faster than ever. Thus, the stock market linkage is significant among the investors to make a safe and wise investment decision of their portfolio.

### **2.1 Diversification**

Portfolio diversification is to invest in different securities in the stock markets where this is low risk to make optimum earnings. Portfolio diversification is very important for the investors for investing in the stock markets. Investors make their investment diversified in accordance to make the gain as well as reduce the risk to make risk-free earnings and, this is why they invest in different stocks and stock markets in different countries where markets are not co-integrated. In the non-co-integrated markets, all markets have their own trend and one market does not influence to the other market.

On the other hand, if there is any co-integration among the stock markets in the long-run than the return might not be the risk-free as there might be a common trend among the markets. In the co-integrated markets, the behaviour of the other markets can be detected by analysing any market in the same behavioural group. The co-integration does not allow the investors to get risk free as collapsing one stock market might affect another. This is why it can be said that portfolio is not diversified in which investors might rethink for their investment.

### **2.2 Market Efficiency**

Efficient Market Hypothesis (EMH) is one of the most important theories in the finance which is associated with the securities price adjustment. This theory is concerned with the

three segments: weak, semi-weak and strong form of the historical information of the markets (Fama, 1969).

The efficiency of a stock market is depending on several variables. Efficiency cannot be explained based on numerical figures or judging the relativity. Efficiency is depending on the development of the financial intermediaries such as investment banks and the stability of the macroeconomics variables as well as the overall outlook of the country (Arif *et al.*, 2009).

In the strong form market, the information of the historical price is free and publicly available for the investors. In this market, investors are not able to make any unexpected gain or do any monopolistic earnings. Whereas, semi-weak form market, historical price information does not always have an impact on the future earnings. However, historical price information does not have any impact on the future earnings in the weak form market (Fama, 1969).

Efficient market models are the most voluminous in terms of weak form tests as the important information cannot be immediately and completely evaluated. It is evident that the price change and returns of the common stocks are positively depending on day to day basis but, on the other hand, it is evident that it is difficult to find price change or returns longer than a day which is contradictory to the “fair game” efficient market model (Fama, 1969).

### **2.3 Arbitrage**

There is the possibility of arbitrage opportunity if the earning is excessive by trading similar types of assets at different prices in the inefficient market due to the reason that all the historical information is not available for the investors.

There are three types of arbitrage and those are pure arbitrage (making profit without any investment or risk), near arbitrage (identical cash flows that are traded in different prices where there is no price convergence guarantee) as well as speculative arbitrage (buying at cheaper price and selling at greater price of the similar but not identical goods where investors could see a misprice advantage).

The main aim of statistical arbitrage is based on the co-integration. The spread in between two prices is in the long run manner which is mean reverting. Once the deviating prices are backed to the equilibrium relation then investors have the opportunity to exploit these types of chance. Excessive profit occurs when there are price spread returns to the equilibrium. This circumstance leads to predicting the long-run behaviour of the price spread every time by the investors (Hubana, 2013).

In the security markets, analysis arbitrage plays a critical role in accordance to keep the market efficient and bring fundamental values into the market (Shleifer and Vishny, 1997). Arbitrage cushions financial distress during the state crisis but it leads to foregoing ex-ante profitable investment (Achariya *et al.*, 2010).

## **2.4 Purchasing Power Parity (PPP)**

Purchasing power parity (PPP) is a price index similar in content and estimation to the Consumer Price Index (CPI). Another word, relationship in between goods, service price and exchange rates are known as PPP. PPP shows the change in the price over time and provides a price level or exchange rate between two currencies. It is the benchmark of the exchange rate as well as prediction model of the exchange rate (Dornbusch, 1985). It can be denoted as follows:

$$S=P/P^*$$

Where, S = domestic price of a foreign currency, P= domestic price level and P\*=foreign price level.

Relative PPP shows the change in the percentage is equal to the differential in between domestic and foreign country. When PPP holds, the actual exchange rate is constant and exchange rate shows a deviation from PPP during movement. The change in the exchange rate is due to the change in the relative price rather than that of change of price level, in the short run. Thus, according to the equation above overtime short intervals of times, PPP does not hold. Moreover, PPP does not hold exactly if there are transaction costs as arbitrage will not take place for those goods where transaction cost is greater than that of arbitrage profit. The currency of the major industrialised countries appears to have shifted several times, in the both short as well as short run, in the post-war period.

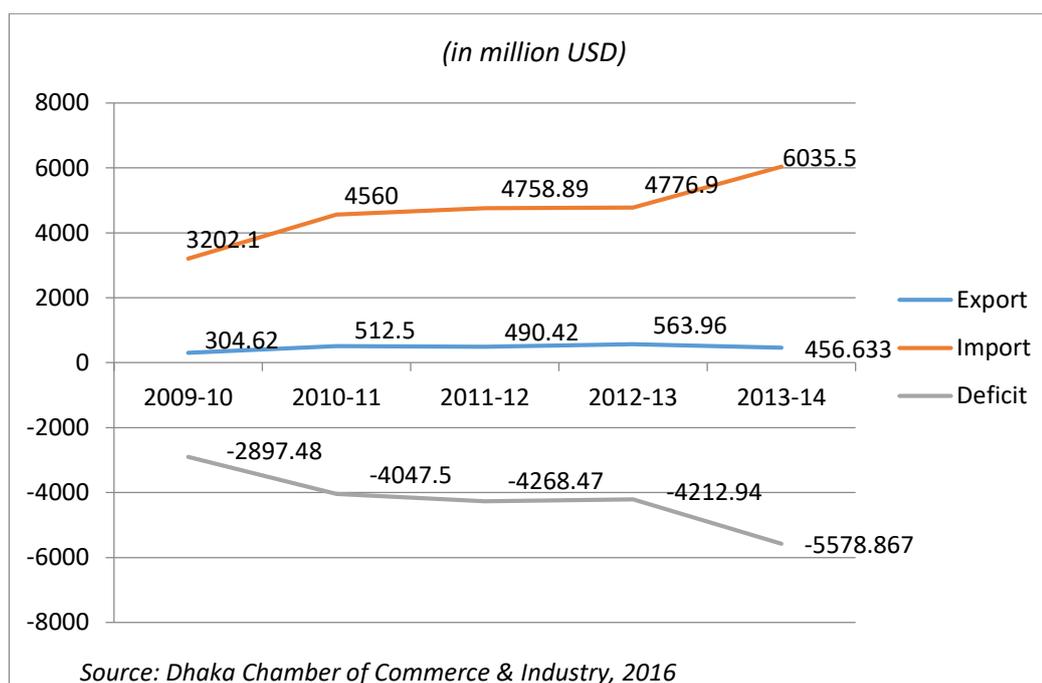
## **3 STOCK MARKETS IN BRIEF**

### **3.1 Bangladesh at a glance**

The official name of Bangladesh is The Peoples' Republic of Bangladesh. Bangladesh is situated in the South Asian region surrounded by the India on the east, west and north part as well as with the Bay of Bangle on the south. Total land area of Bangladesh is 147,570 square kilometres. In 1971, Bangladesh became an independent state whereas 26<sup>th</sup> March is Independence Day and 16<sup>th</sup> December is the Victory Day. The population of this country is approximately 160 million and the literacy rate is almost 60%. The culture of this country is influx of the religion Islam as the majority (86.6%) of this country are Muslim whereas 12.1% Hindu, 0.6% Buddhist, 0.4% Christian and 0.3% others. Bengali is the widely spoken language in this country and English is widely spoken and understood in the big cities. 98% of this population is Bengalis along with 2% indigenous minorities, such as Chakma, Garo, Manipuri, Marma, Santals, Tanchangya and Tripura etc. There are seven administrative cities (Dhaka, Chittagong, Khulna, Rajshahi, Sylhet, Barisal and Rangpur) and two sea ports (Chittagong and Mongla) in this country. (BEPB, 2015)

Principal crops of this country are jute, mustard, potato, pulses, rice, sugarcane, tea, wheat, vegetables etc. Coal, natural gas, timber and white clay are among the natural resources. Major exports of this country are Ready Made Garments (RMG), knitwear, frozen food, leather and leather goods, software and Information Technology (IT), jute and jute products, tea, ceramic, textile, pharmaceuticals, bicycle, handicrafts, agro-based products, petroleum etc. Along with major exports, major imports are machinery, wheat, fertilizer, yarn, scientific and medical equipment, milk powder, baby food, edible oil etc. Major trading partners of this country are European Union (EU) countries, USA, China, India, Pakistan, Japan, South Korea, Australia, Malaysia, Saudi Arabia, United Arab Emirates, Thailand etc. (BEPB, 2015)

**Figure - 1: Bangladesh's trade with India.**



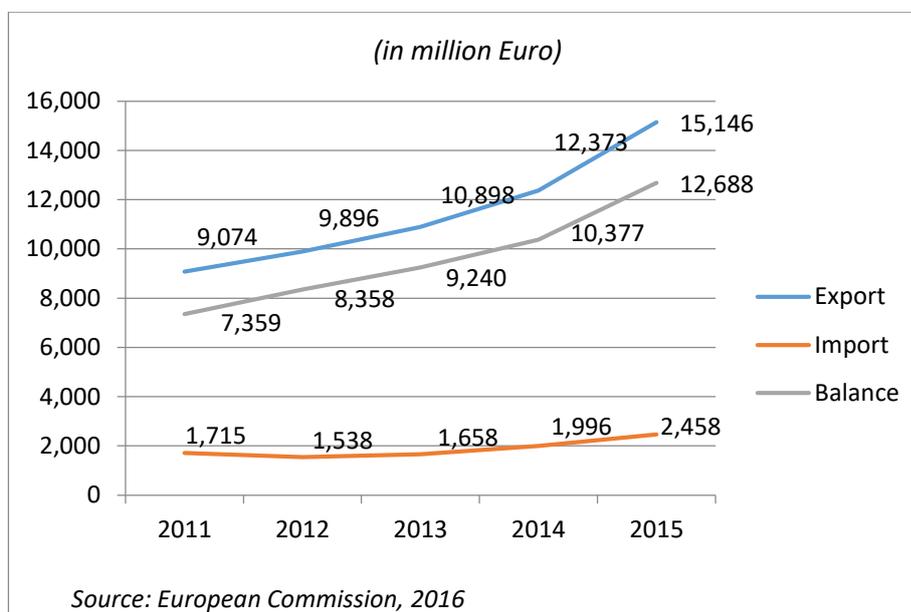
In the year 2013–2014, Bangladesh was associated with more than 6 percent growth, 1,115 US dollar per capita incomes, and equivalent to 30.19 billion US dollar export as well as 40.69 billion US dollar worth import (BEPB, 2015). The currency of Bangladesh is known as Bangladesh Taka (BD Taka) and the currency exchange rate was 77.63 BD Taka and 102 BD Taka for each US dollar and Euro respectively for the same time period (BEPB, 2015). India is Bangladesh's one of the neighbouring countries, big trade partner, and have a larger trade deficit which was offset by the other countries surplus (World Bank, 2016).

The Ready Made Garments (RMG) industry has made many contributions to the economy of Bangladesh. Bangladesh's RMG sector is booming and contributing to the economy. This sector is playing a major role in the global market after China. Customer satisfaction and flexibility of companies for accepting orders are making this sector more demanding to the rest of the world. After China, Bangladesh is the second largest clothing manufacturer in this world whereas 60% of its garments made for Europe (Spiegel and Wilson, 2013).

Bangladesh's Ready-Made Garments (RMG) industry started in the early 1970's and became a major player in the economy. RMG manufactured in Bangladesh are mainly categorised into two categories: knit and woven. In 1980's RMG focused on exporting woven products

and in the early 1990s, the knit sector of RMG has started to expand. Shirts, T-shirts, trousers, sweaters and jackets are the main products manufactured and exported by the industry.

**Figure -2: Bangladesh’s trade with the European Union.**



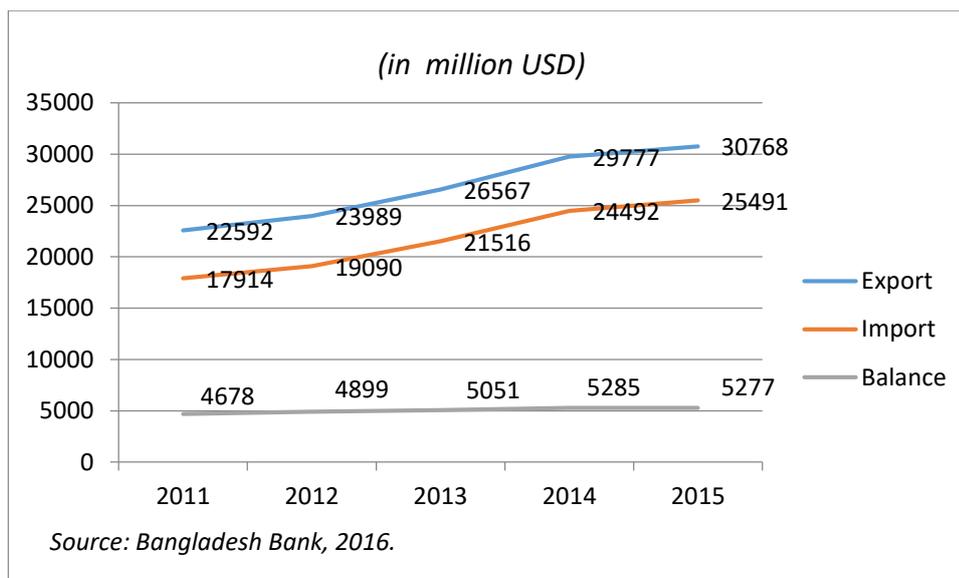
Among the eight nations (Afghanistan, Bangladesh, Bhutan, India, Nepal, Maldives, Pakistan and Sri Lanka) in the South Asian And Regional Cooperation (SAARC), the growth of Bangladesh economy was the second highest, 6.5 percent, followed by the India (Daily Star, 2015). This economic growth will be expected in the year 2016 though there are still slow export growth, modest remittance rebound and private sector weakness.

Europeans began to set up businesses in the area of Bangladesh in the 16th century. Britain later made Bangladesh their colony and the country became a part of British India. In 1947, West Pakistan and East Bengal, separated from India and, conjugated as Pakistan. The name East Bengal changed into East Pakistan in 1955 and eventually became independent in 1971.

As of 2011, the RMG sector was bestowed with the European Union’s new Generalized System of Preference (GSP) rule. GPS, for Bangladesh and other Least Developed Countries (LDC), simplifies the existing “stage-2” into “stage-1 (fabric to garment)”. GSP is granted by the all European Union member states. Bangladesh is one of the most important alternatives for outsourcing for apparel. As a result, Bangladesh’s RMG is enjoying 100

percent duty and quota-free entry into the European Union markets whereas India and Vietnam, must still, pay for their entry into the EU market (Nag, 2011). This relaxed rule resulted in an increase of over 40 percent for Bangladesh RMG export in February 2011 to a record of 1.9 billion US dollar (Nag, 2011).

**Figure - 3: Bangladesh’s trade with the World**



Due to the stable growth, the total Foreign Direct Investment (FDI) into this was 775 million US dollar in 2011 which rose to 1830 million US dollar in 2015 (BB, 2016). Furthermore, a number of Bangladeshi manpower working abroad is helping to the development of the country by sending remittance which is growing (table-1) according to the central bank of Bangladesh, The Bangladesh Bank.

**Table – 1: FDI, Foreign Exchange and Remittance of Bangladesh**

<i>In million US\$</i>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>
<b>FDI</b>	775	1191	1726	1474	1830
<b>ForEx Reserve</b>	10,912	10,364	15,315	21,508	25,021
<b>Remittance</b>	11,650.32	12,843.42	14,461.14	14,228.31	15,316.92

Source: Bangladesh Bank, 2016.

Political unrest, however, is one of the great problems of Bangladesh. Government rules the country with confidence but shows a dominating power to the opposition parties as a result opposition parties are becoming weaker gradually due to the good governance practice as well as the lack of good leadership (Khatun, 2015). Thus, political turmoil still a concern for the investors.

### **3.2 Bangladesh Stock Market**

Bangladesh, formerly known as East Pakistan, became an independent state in 1971 from the West Pakistan but the necessity of establishing a stock market in this area was decided by the government in 1952 as Pakistani shares and securities were prohibited from transacting in the Calcutta Stock Exchange in India (DSE, 2016).

The Bangladesh Securities and Exchange Commission (BSEC) was been established on 8<sup>th</sup> June 1993 as a regulator of capital market of Bangladesh aiming to protect the investors' interests, maintain transparent and efficient securities markets as well as to ensure proper issuance of securities and complaisance with securities laws. (BSEC, 2015). Existing stock exchanges in Bangladesh are Dhaka Stock Exchange (DSE) and Chittagong Stock Exchange (CSE).

Since the independence of Bangladesh in 1971, there were some political parties who ran the government few times until now. Bangladesh Awami League (AL) led the government from 1996 to 2001 as well as from 2009 to 2013 (continuing until now as of 19.05.2016) and Bangladesh Nationalist Party (BNP) led the government from 1991 to 1996 as well as from 2001 to 2006. Also, there was non-political alias caretaker government led the country due to complex political turmoil several times. It has been found that stock market performance was better with the highest market return and lowest volatility along with significant growth in the market indicators during the non-political party led governments. Similarly, BNP-led governments also showed a consistent market performance. However, AL led governments showed worse stock market performance with the negative return and highest volatility. (Rahaman *et al.*, 2013)

Though a robust capital market is one of the good economic indicators to the economy but some problems are hindering the smoothing of the Bangladesh capital market as there are four interest groups (issuer, investors, intermediaries such as banks and security exchange commission) are involved. The issuer cannot contribute significantly due to the reason that corruption, facing loss inadequate dividend etc. Also, shareholders or the investors invest in the market and most of them are not having proper knowledge about their investment. Moreover, the intermediaries, such as a bank, are issuing loans without any sound or proper solvency. Thus, intermediaries are unable to play a significant role in the market. Furthermore, the Bangladesh Security Exchange Commission (BSEC), cannot attract lucrative investors due to lack of supervising the market properly because of that they are not transparent. (Saha, 2012)

BSEC classified the listed companies from “A” to “Z” based on their dividend payment towards shareholders and governance practice. Companies that are holding annual meetings of their shareholders and paying a dividend at least 10 percent in the previous year are categorised as “A” type. Companies that are holding annual meetings of their shareholders and paying dividend less than 10 percent in the previous year are categorised as “B” type, companies neither hold annual meeting nor paying dividend payment are “Z” type. Greenfield and new companies are categorised as “G” and “N” type respectively.

### **3.2.1 Dhaka Stock Exchange (DSE)**

Dhaka Stock Exchange (DSE) is the first and main stock market of this country which was incorporated in 1954 and formal trading started in 1956 in Narayanganj, nearby Dhaka. In 1958, DSE has shifted to its new premise in Motijhil commercial area, Dhaka. Until June 2013, there were 525 securities enlisted with the DSE whereas there were 251 companies, 221 treasury bonds, 42 mutual funds, eight debentures and three corporate bonds. DSE Broad Index (DSEX) and DSE 30 (DS30) are the only indices that are traded in the DSE whereas DSE General Index (DGEN) has been omitted from the website on August 01, 2013. DSE had a physical trading platform which became into automated trading platform later on. (DSE, 2016)

There was a five-year discontinuation in DSE due to the liberation war in 1971 which was resumed in 1976. Only nine companies were listed in DSE at the resumed trading. There was a high growth in 1983 and DSE rapidly developed in the 90s along with the economy (Bose *et al.*, 2014)

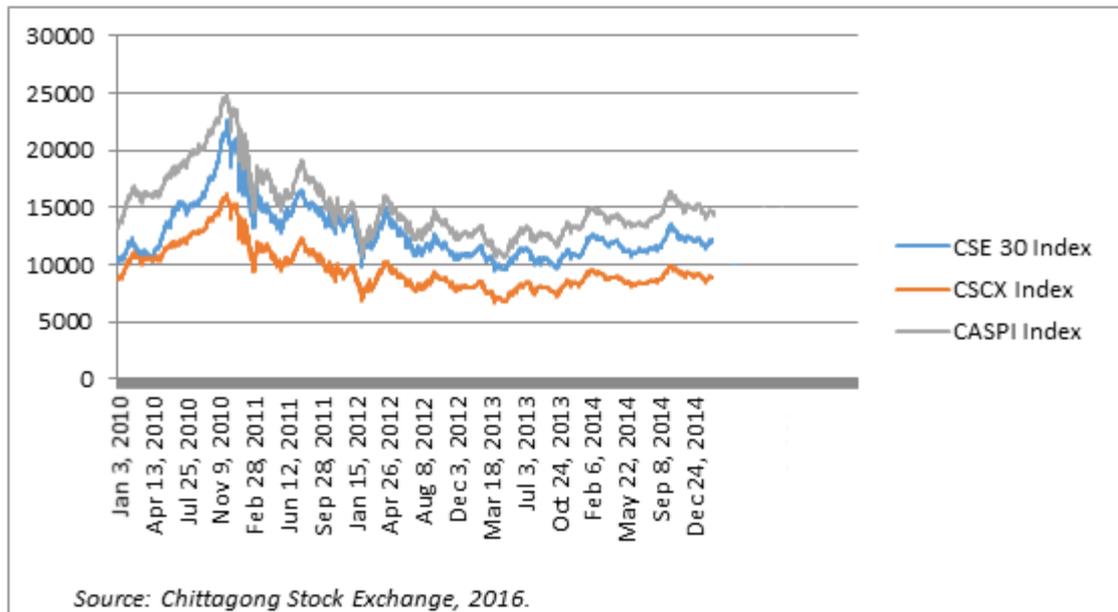
Market efficiency is always important issue toward investors as well as to the academics. Comparing to the other emerging markets, Bangladesh stock market is relatively new and gets immense focus. It can be said that the investors cannot gain a fair return on their diversified portfolio in the DSE due to the reason that it provides evidence of the weak form efficiency (Chaity and Sharmin, 2012). Gradually, Bangladesh Securities and Exchange Commission took some initiatives to make a robust market and, as a result, and due to the development, it can be said that the DSE is inefficient in terms of weak form. (Hasan, 2015)

### **3.2.2 Chittagong Stock Exchange (CSE)**

The Chittagong Stock Exchange (CSE) which is known as a vibrant and active market plays a significant role in the development of the economy of Bangladesh as it is contributing 18.29 percent to the country's GDP in average (Mazumder, 2015). Thus, it can be said that the contribution is indispensable in terms of industrialisation as well as creating employment opportunity.

Chittagong Stock Exchange (CSE) established in the second biggest city, Chittagong, of the country in 1995. CSE was established through the *cry-out trading* system where the aim was to create a *state-of-the art bourse* in Bangladesh. CSE started as a newly demutualized exchange from November 22, 2013, and registered as a public limited company under the Company Act-1994. CSE All Share Price Index (CASPI), CSE Selective Categories Index (CSCX) and CSE-30 are the major indices in CSE. There were total 287 companies listed in CSE in 2014 (CSE, 2015). CSE has automated trading platform from the very beginning and CSE network is connected with the three major cities: Chittagong, Dhaka and Sylhet. CSE is more efficient stock market comparing with DSE (Bose, 2014).

**Figure -4: Chittagong Stock Exchange (CSE) Performance (Feb 2010 - Dec 2014)**



CSE has a tight regulatory framework for the firms in accordance to safeguard the investors' interests as the market price is variable and reacts to the new information. Thus, CSE is relatively small and not a weak-form stock exchange in Bangladesh which is growing, improving and enhancing throughout its activities to influence the economy of the country (Arif *et al.*, 2009).

Also, CSE guarantees that no one can gain excessively from the market throughout the transparency, small fluctuation in the price level and narrow price spread. Moreover, CSE increasing the investment opportunity throughout its automated trading service and Over-The-Counter (OTC). In terms of the development of the CSE, a bright future of the capital market can be predicted which will be value added to the economy (Mazumder, 2015).

### 3.2.3 Bangladesh Stock Market Tumble

Stock market fall is a major systematic shock. Market downturn shows the instability of the financial system because of the significant impaired and this phenomenon is not new to the investors. It can be said that the stock market decline took place approximately 300 years ago for the first time ever. By 1710, Bank of England was the sole manager of the country's loan. During this time, England was financing soldiers throughout the lottery sales but at the

end of the War of Spanish succession, it faced a debt of 10 million British Pounds. South Sea Company, formed in 1711, wanted to buy England's outstanding debts at six percent interest rate, where prominent members of the government held the options. Prospective investors were lured with this proposal. By 1719, they spread the rumour for which a 100-pound share skyrocketed near to 1000 pounds and, as a result, insiders reaped an excessive profit. In June 1720, the share price rose to 1050 pounds as many investors started to invest and by the September in the same year, the price dropped at 150 pounds which led individuals and companies to the bankruptcy. (Business Insider, 2013)

According to the theory, the efficient market does not have any opportunity for excess gain as all the information is available whereas in the inefficient market it is possible to gain beyond the limit as the price can be manipulated. The difference between the spot price and the future price of an asset is the payment timing and delivery. If the price varying from each other due to the new information in the market than investors would like to get extra profit from the market. Misleading information also has negative price effect on the stock market interns of optimism and pessimism level as the optimists set their stock price too high whereas pessimists set their price at a lower level. Due to the different price level, pessimists make the stock riskier by predicting the future incorrectly (Bose, 2014). A 10 percent loss within a few days in a stock market is known as market decline (Tahera, 2014).

Bangladesh stock market is one of the smallest in the Asia but third largest in South Asia. Though a robust capital market is one of the good economic indicators to the economy but some problems are hindering the smoothing of the Bangladesh capital market as there are four interest groups (issuer, investors, intermediaries such as banks and security exchange commission) are involved. The issuer cannot contribute significantly due to the reason that corruption, facing loss inadequate dividend etc. Also, shareholders or the investors invest in the market and most of them are not having proper knowledge about their investment. Moreover, the intermediaries, such as a bank, are issuing loans without any sound or proper solvency. Thus, intermediaries are unable to play a significant role in the market. Furthermore, the Bangladesh Security Exchange Commission (BSEC), cannot attract lucrative investors due to lack of supervising the market properly due to the reason that they are not transparent (Saha, 2012).

Dhaka Stock Exchange (DSE) had only nine companies listed during the resumed trading activities in 1976 (Alam *et al.*, 2011) and at the end of 2014, there were 555 companies listed on the stock market (DSE<sup>1</sup>, 2016). In June 1993, with the aim of fairness, transparency, efficiency and ensuring issuance of securities, BSEC established. The aim of BSEC caught the public interests in the market and, as a result, a huge number of investors invested in the stock market gradually.

In October 1996, stock prices have been manipulated by a number of brokers, portfolio managers as well as sponsors of listed companies (Alam *et al.*, 2011) and, as a result, and within a short period of six weeks' time, All Share Price Index (ASPI) crossed from 3600 points to less than 1000 point. On the other hand, during the pratfall in 1996, the share trading was held by means of hard copies and it was not easy for the investors to detect whether the shares were fake or genuine. Moreover, DSE general index (DGEN) price index reached from 139.3 to 337 percent in the time period of 1991-1996 before the tumble. CSE also dramatically grew by 258 percent which was more than double in a one-year period of time in 1996. After the bubble burst in 1996, after losing 70 percent, DGEN dropped into its lowest point where it was 10 months before (Tahera, 2014). This types of share price manipulation resulted in a huge gain for the share price manipulators whereas a mass and general investors faced a huge loss (Bhuiyan, 2012). Moreover, Portfolio theory is crucial when it comes to investing in the stock market but, unfortunately, mass people do not know the usage and application of this theory in Bangladesh (Arif *et al.*, n.d.).

There was another stock market fall in 2010 followed by the dwindling in 2006. On the day of market fall, there was nine percent tumble in the key benchmark index within the first hour of trading. During this market fall in early January 2011, the stock market lost 8.9 billion US dollar in capital. Some of the banks invested 30 to 40 percent of their liabilities due to the belief to gain 75 percent more whereas the central bank had ruled the investment limit of 10 percent. (Chowdhury, 2011).

This was the biggest one-day tumble in the stock market in the Bangladesh stock market's history in 2011. And assumed to 3.5 million people have been affected by this fall. The turmoil started with the entrance of the biggest telephone operator, Grameen Phone, into the stock market and index increased by 22 percent on November 16, 2009. From 3rd January

2010 to 5th December 2010, the DGEN rose by 95.23 percent increase. Since January 3, 2011, the market started to fall and on January 10, 2011, the index decreased by 9.25 percent which was a one day biggest fall in the history of Bangladesh stock market. On the 10th January 2011, both DSE and CSE declined by 9 percent and 6.8 percent respectively within a trading of 50 minutes' duration. Eventually, 3.6 million people lost money due to the plunging in the share price. (Tahera, 2014).

It is evident that some of the political parties in Bangladesh manipulated the Bangladesh stock market as the stock market performed better during the non-political government ruling (Rahaman *et al.*, 2013). Two big downslide took place during the political party led government. Thus, it can be said that political parties have a significant influence on the stock market. Institute of Chartered Accountants of Bangladesh (ICAB), however, adopted the International Financial Reporting Standards (IFRS) so that all listed companies prepare their reports using this IFRS but unconsolidated reports are not prepared by many companies as they think that this is not obligatory under Companies Act. Many companies are sceptical to review their report as there is no formal process of it. (World Bank, 2009)

#### **3.2.4 Analysts' opinion about the Bangladesh Stock Market**

The stock market is the general measurement of the economy through those stocks that affecting the real economy. Higher stock price at the lower cost of equity means the investment gain in the market. Any listed company can easily finance their firm more cheaply by issuing more shares in the market. The Higher price of the stock reflects the higher profit. Another word, higher stock price develops the financial condition of the company if the price increase affects the cost of credit as well as the availability (ECB, 2012). Despite facing many challenges, Bangladesh is becoming more connected and integrated with the global trade. Kaushik Basu (2015), the chief economist and senior vice president of World Bank, mentioned that Bangladesh is going to be the next Asian tiger as it has much significant progress in economic and social aspects.

**Table - 2: World Economic Outlook**

<i>Economy growth (%)</i>	<i>2012</i>	<i>2013</i>	<i>2014</i>	<i>2015 (expected)</i>	<i>2016 (expected)</i>
World	3.4	3.4	3.4	3.5	3.8
Advance economy	1.2	1.4	1.8	2.4	2.4
USA	2.3	2.2	2.4	3.1	3.1
Euro Area	-0.8	-0.5	0.9	1.5	1.6
Emerging & Developing Economies	5.2	5.0	4.6	4.3	4.7
China	7.8	7.8	7.4	6.8	6.3
India	5.1	6.9	7.2	7.5	7.5
Bangladesh	6.3	6.1	6.1	6.3	6.8

*Data source: Bangladesh Bank, 2015.*

On the other hand, by 2014-2050, Bangladesh would be the third country in terms of average real GDP growth annually 7.3 percent in US dollar as there is 21.2 percent (2014) investment followed by a 23.2 percent (2025) of total GDP (PwC, 2015).

There was a massively over valuation of Bangladesh stock market before the dip which was started in late 2010. All of the companies that got listed before January 1<sup>st</sup>, 2005, had an increase of 974 percent over a less than six years' period. There were two major disasters in the capital market of Bangladesh which mean that Bangladesh stock market is not vibrant. Recent capital market disaster, in 2010, has shaken the whole country where there were many stockholders involved in the stock market and they became insolvent overnight (Ullah *at el.*, 2012).

There is about four percent stocks are held by the foreigners in Bangladesh and this seems as low comparing frontier markets like Pakistan, Vietnam and Sri Lanka (Springer, 2014). Even though the economy of Bangladesh shows an upward trend, despite that it might face problem to keep its growth due to the reason that major economies are struggling to get back to the upward trend after recovering from shocks as well as deficit threat. For the sustainable growth, a daunting but essential task of institutional reform has to be done to fulfil the target (Khatun, 2015).

The Chairman of the London Stock Exchange (2005) echoed that CSE, apart from DSE, is well-functioning stock exchange as it has the capability of capital mobilisation, risk distribution as well as the optimum allocation of the resources (Arif *et al.*, 2009).

In the Bangladesh stock market, every listed company is obliged to follow the rules and regulations of the Bangladesh Securities and Exchange Commission (BSEC). According to the BSEC, every listed company should have a director, chairman, managing director, secretary as well as the chief financial officer. The idea was to look after the issues of the shareholders by the individual persons assigned to those positions. Unfortunately, some companies, e.g. Global Heavy Chemical Limited, are not fulfilling the requirements imposed by the BSEC (ShareNews24, 2016). Furthermore, some companies are trying to manipulate their account statement to show the investors that buying Initial Public Offering (IPO) would give them an excessive profit. There was a rumour about Evence Textile to make money in such a way (Sujan, 2016).

However, economist and share market expert Abu Ahmed (2016) expressed his opinion regarding the continuous downturn trend of the Bangladesh stock market. He mentioned that the growth of the country is over six percent but still the share market is downturn whereas it has to be upward. Also, in the last three years' companies sold out their bonus shares in the market and took the money away from the market. Thus, he pointed out, this issue is one of the big concerns out of the two. Some companies are doing monopoly business in the market which he thinks is the other big concern.

Another Bangladesh stock market expert and ex-deputy governor of Bangladesh central bank, Ibrahim Khaled (2016), expressed his concern about the stock market as investors cannot rely on the Bangladesh stock market followed by the two slump in 1996 and 2010. He proposed the restructuring of the stock market throughout demutualization process. He argued to give a chance to the new companies into the market. However, as of 26<sup>th</sup> May 2016, he insisted that neither the Bangladesh Securities and Exchange Commission (BSEC) is transparent nor the current government is cordial to solve the problem.

### **3.3 Indian Stock Market**

Civilisation started in India around 2500 BC when commercialization and trade started in the Indus River Valley. During fourth and fifth centuries AD, a number of kingdoms governed this country. Hindu culture, language and politics grew unprecedented during the Gupta Dynasty which was known as India's golden age. Over the next 500 years, during the tenth and eleventh centuries, Islam expanded and Delhi became the capital of India after Turks and Afghans invaded this country. Britain established their first colony in 1619 in Gujrat, India. Later on, Chennai, Mumbai and Calcutta became the trading centres of East India Company in the same century. Gradually, British colony has been expanded into Pakistan and Bangladesh along within India and controlled for the next 200 years. On August 15 in 1947, India became an independent state along with Pakistan. (Dezan Shira, 2012)

With 1.2 billion people, India became the fourth largest economy of this world due to its growth and development in the recent years. Along with per capita income 1,581.5 US dollar (2014) and a GDP growth of 7.3 percent (2014). Nowadays, India is famous for globally recognised pharmaceuticals, steel, information technologies, space technologies and so on (World Bank<sup>1</sup>, 2016). India showed a 328.7 billion US dollar foreign exchange reserve, at the end of January 2015, with a movement of the stable exchange rate. Over the last 10 years, from 2004–05 to 2013–14, merchandising trade of India increased dramatically from 195.1 billion US dollar to 764.6 billion US dollar. India emerged in terms of its agricultural exports which was 18 percent contribution to the total GDP in the year 2013–14. One of the dominant sectors is service sector which contributes more than 40 percent in the Gross State Domestic Products (GSDP) for the time period. Computer service also constitutes 3.3 percent as well as real estate and dwelling sector contributes 7.8 percent to the GDP for the same period of the time. The macroeconomic condition of India has developed significantly in the recent years. Comparing with the previous year, in the year 2014–15, the economy of India emerged because of controlled inflation, increased domestic demand, increased investments, oil price decline as well as some other reforms. Also, the central bank of India, the Reserve Bank of India (RBI), controlled the monetary policy which helped the economy to be more efficient by creating demand pressure as well as creating a buffer against any shock. (KPMG, 2015)

There are some challenges to overcome in accordance with the better performance of the economy. More investment is needed in agriculture and food sector. Also, there are some gaps in the yields within the states. Nevertheless, a common platform for agricultural commodities is essential. The Indian government also took initiative, Rahtriya Krishi Vikas Yojana (RKVY), for funding components of production growth, infrastructure and assets as well as sub-schemes and flexi-fund. Also, the industrial sector shows a slow growth rate. An estimated investment of one trillion US dollar is expected for the 2012–2017 and half of it expected to come from the private sector. (KPMG, 2015)

Proper skills and low level of education is the barrier for the poor earnings in the big portion of the labour market. The challenge of the country is action planning to enhance opportunities for growth by dovetailing the improved manpower regarding the requirements to the employment of the off-firm, industry as well as service sector for both domestic and international needs (Govt. of India, 2015)

As a contributor to the Indian economy, the National Stock Exchange (NSE) and the Bombay Stock Exchange (BSE) are the main stock exchanges in India. BSE is one of the leading stock exchange in India as well as the first stock exchange in Asia which was established in 1875.

**Figure – 5: Indian Stock Market performance (2005 - 2014)**



*Source: India SENSEX stock market index, 2016.*

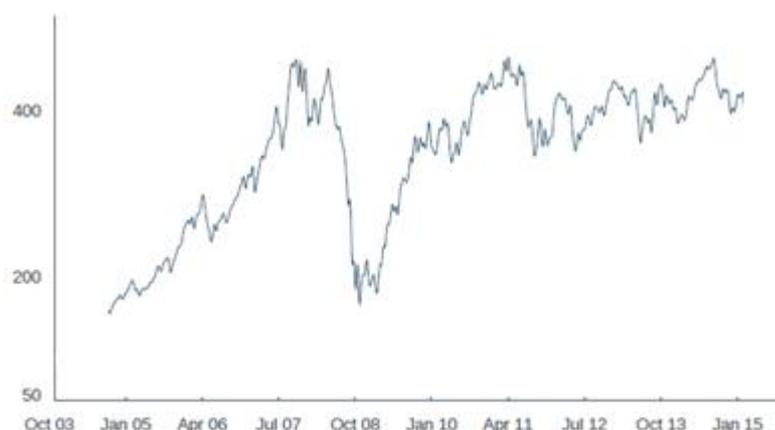
Along with trading platform for small and medium enterprises (SME), BSE ensures the trading in equity, derivatives mutual funds etc. BSE has more than 5500 companies enlisted in their stock. It is also known as the fastest stock exchange in this world in terms of six microseconds speed and, as of September 2015, BSE is the fifth-largest stock exchange in

this world constituting 1.64 US dollar in market capitalization (BSE, 2015). S&P BSE SENSEX is the most popular index which is traded in the EUREX, an international derivatives exchange, as well as in the other nations of BRICS (Brazil, Russia, India, China, South Africa). As of 31<sup>st</sup> December 2013, the capital markets show an upward trend especially with the BSE Sensex and Nifty benchmark of 29.9 and 31.4 percent corresponding growth rate respectively, year on year (KPMG, 2015).

### 3.4 Emerging Stock Market

What is emerging markets? Basically, the markets that have not emerged yet. The term "emerging markets" has been introduced first by the International Financial Corporation (IFC) in 1981. Emerging markets are operating in different ways than that of a developed market. United Arab Emirates (UAE), for instance, supposed to be the most developed economy in terms of per capita Gross Domestic Product (GDP) but it is an emerging country due to the reason that UAE's market structure is different. (Khanna and Pahepu, 2010)

**Figure – 6: Emerging Stock Markets performance (2005-2014)**



*Source: MSCI, 2016*

The emerging economy also showed a sluggish growth in the year 2015. This growth was associated with the slow recovery of the unemployment rate of Europe in the year 2015. Also, strong US dollar made the American export expensive resulted in a significant drop in the export. Moreover, a drop of oil price made the business spending curved.

China is one of the biggest markets and second largest economy in this world. Recently, the growth of Chinese economic growth was slowing. In the Chinese stock market, trading was suspended on the day when there was a continued decline. On the second day, the trading was halted once again due to the sliding currency. This slowdown could have an inevitable effect in the world market but it was not a big concern for the world investors' as there was only two percent of shares owned by the foreign investors. Some people who have borrowed money to buy shares have affected by this slowdown but it was not a disaster for mass people as only one of 30 people only trade in this share market in China. But those countries will be affected, due to this slowdown in China, who are exporting to China. People are trying to have a safe investment such as government bonds and debts but this might be seen as negligible risks of default. (BBC, 2016)

### **3.5 The World Stock Market**

At the beginning of the World War I (WWI), on 28<sup>th</sup> June 1914, an Austrian, Archduke Franz Ferdinand, was assassinated in Sarajevo for which there was a diplomatic and manoeuvring but there was a failed meeting of Austria with Hungary, Germany, France, Russia and Britain which led to the Great War the end. On July 28, 1914, Serbia was affected by the Austria-Hungary. Instead of the negotiation offered by the Russia, Germany declared war on Russia, France and Belgium on August 1, August 3 and August 4 respectively. Then England attacked Germany when Germany declared war with Belgium. (Taylor, n.d.)

The global market has shown a mediocre in the recent past years but it was challenging to the firms to generate earning. Correlation of national stock markets with a broad liberalised the capital account over the last century as some countries have higher correlation rather than that of closed countries. But yet there was small diversification in terms of the long-run (Quinn and Voth, 2008). Due to the liberalisation of the stock market is a signal of macroeconomics reform in the future and, as a result, the equity price increase (Henry, 2000). Major stock market segmentation may be helpful for the investors to take diversification decision. (Bessler and Yang, 2003)

**Figure – 7: World Stock Markets performance (2005-2014)**



*Source: MSCI, 2016*

Cables stretched across the oceans by 1914 and made the communication faster by which a trader could transfer money and order stock within a minute from one part to another part of the world. Due to the war, the stock price went down and government imposed some restriction on the large amount of outbound money flow to other countries. With this restriction London stock exchange, St. Petersburg stock exchange and Berlin stock exchange resumed their trading from January 1915, 1917 and December 1917 respectively. The New York Stock Exchange (NYSE) was closed from July 30 to December 12 in the year 1914. During this WWI, unlike the USA, the London stock exchange price declined. British companies were allowed to issue new shares to ensure that capital can be supportive of funding the growing debt during the war and interestingly most of the bonds were issued by the government. In the contrary, the foreign companies were not allowed to issue any shares during this time which have been trading in the London Stock Exchange. London Stock Exchange performed very poorly in 1918 and it showed a downturn trend during 1913–1919. Europe became more turbulent which had an impact on the European stock markets during the WWI. Many of the major stock markets became closed due to the result of the war impact but they prepared about the war impact accordingly. It can be said that the flow of capital from one country to another country was without hindrance which can be seen as the openness of the capital flow and this openness accelerated the closure of the stock markets during the WWI. During this time all the major countries were on gold standard and exchange rate were arbitrated by buying and selling of international bonds listed on the world stock markets. This arbitrage effect made the European stock markets into a single and integrated

market. Stock exchanges imposed some extensive rules and regulations on trading and Germans were not allowed to trading in the London stock market for a certain period of times after the war. Prior to the war, London stock exchange was the centre of the global finance which was passed to the New York during the war but New York was never able to perform the pivot role in the capital market. Financial market had to deal with some problems such as inflation, increased government debt, reparation payments, stock market tumble in 1929, the great depression, and debt failures etc. resulted from the WWI. And world authorities learned the lesson from this WWI which reflected during the World War II (WWII). London Stock Exchange closed only for one week whereas NYSE and Berlin's stock exchange remained opened during the WWII. The restriction imposed on the stock markets could not prevent the capital flow until the 1980s but stock markets became integrated globally after the fall of Communism. WWI left a massive destruction on the international financial market as well as global stock markets. (Taylor, n.d.)

In the recent years, the Eurozone economy is in turbulence due to some reasons such as reform and political turmoil in Ireland, Spain and Greece. Despite that, it showed a modest growth of 1.5 percent increase in the GDP which could be seen as the strongest growth in the last quarter of 2015 since 2011. In this region, only six countries out of 19 expected to rise in 2016. There is also growth prediction of 1.6 percent increase in the Eurozone. The German economy performed well in 2015 with 1.7 percent, which could rise, as well as France of 1.3 percent, Italy is 1.2 percent, and Spain is 2.7 percent in the year 2016. (Focus Economics, 2016)

To make this region more attractive towards the investors, the European Central Bank (ECB) took initiative, on 10th March 2016, to cut the interest rate of -0.40 followed by -0.30 on the deposit. To keep the Eurozone and the European Union area, The European Central Bank (ECB) took some initiative such as quantitative easing. The idea was to inject 1.1 trillion Euros (1.2 trillion USD) into the European market by asset purchasing program, until September 2016, in order to tackle deflation and raise inflation rate in this region. Yet the inflation rate is below the target and this is why ECB extended its policy until December 2016. This quantitative easing policy is not new as Federal Reserve and England took this initiative as well to make their economy robust. (Randow, 2016)

The US maintains its economy through a combination of different characteristics. It has enormous natural resources, sophisticated physical structure, well-educated and productive workforce. Both the government and the population of US, including diversified immigrants, contributing to the economy. This economy is driven by the innovation, research and development orientation. An initiative, quantitative easing has been taken into consideration and implementation in order to inject money and increase the money supply to recover from the recession of 2009. Despite that, wage stagnation, income inequality, healthcare, large current account and deficit budget etc. are deteriorating to the economy. (Focus Economics, 2016)

The economic condition in the Latin America and Caribbean area showed a downturn in the year 2015 comparing 2014 which was 0.9 percent from 1.3 percent. It is expected to make recovery of 2 percent in the year 2016. In this region Brazil was facing a serious downturn in the last two decades but, on the other hand, Mexico seems to expand by 3 percent in the year 2015. (IMF, 2015)

Sub-Saharan Africa (SSA) showed a slow growth, averaging 4.2, in the year 2015 comparing 2014, 4.6 percent, due to the reason that sharp drop of the oil price whereas Angola and Nigeria are the main oil producing countries during this reason. One of the hindrances to the development of this region is a deficit of enough supply of electricity. Political turmoil, Boko Haram insurgency, Ebola virus affect and fiscal vulnerability are among the internal as well as China's slowdown, tightening monetary of US as well as a fragile recovery in the European economy is the external risks for this SSA. (World Bank, 2016)

This research will be helpful to understand the level of dependency of Bangladesh stock market with India, Emerging and the World stock markets as well as understanding the benchmark to the current condition of Bangladesh stock markets. The booming stock markets of developing countries is disproportionately a large share of the world stock market boom.

## 4 LITERATURE REVIEW

A number of research works have been conducted to investigate the relationship among different types of stock markets in different time periods. The results vary, depending on the sample period, markets, frequency and different methodologies as well as daily, monthly and weekly observations (Ali *et al.*, 2011).

Husain and Saidi (2000) investigated, with the data set from January 1988 to December 1993, that Pakistan equity market is attractive market as there are some interdependencies with some selected markets comparing with UK, USA, France, Japan, Germany, Singapore and Hong Kong.

Ali *et al.* (2011) investigated the co-integration of Pakistan's equity markets with India, China, Indonesia, Singapore, Taiwan, Malaysia, Japan, USA and UK. The aim was to find out how risky Pakistan for the investors. They used monthly stock price for a 10-year data and the time period was from July 1998 to June 2008. This finding showed that the Pakistan equity markets are integrated with China, India, Indonesia and Japan which means that Pakistan is not an attractive investment opportunity for portfolio managers of those countries. On the other hand, Pakistan is not integrated with Malaysia, Singapore, Taiwan, UK and USA which means that Pakistan is an attractive investment opportunity for the portfolio manager from those countries.

Subha and Nambi (2010) investigated the co-integration of Indian stock market with American stock markets. They conducted time series analysis with nine years daily stock observations from January 1<sup>st</sup>, 2000 to December 31<sup>st</sup>, 2008. They concluded that there is no interdependency of Indian stock markets with the American stock markets though many of the Indian companies have their shares listed in the USA stock markets. This result confirms that there is no co-integration among those two markets over the mention time period.

Narayan *et al.* (2004) investigated that in the long run, Bangladesh, India and Sri Lanka have effect in the Pakistan stock market whereas, in the long run, there is unidirectional effect in Pakistan to Sri Lanka and India as well as in Sri Lanka to India from 1992 to 2001.

Worthington *et al.* (2003) investigated that the of price linkage among six emerging countries (Taiwan, Indonesia, Malaysia, Korea, The Philippines and Thailand) with three developed countries (Singapore, Hong Kong and Japan) which showed that there was a lower causal relationship among those emerging and developed stock markets.

Dibooglu and Cevik (2016) conducted a research, from January 2000 to July 2014, on the North Korea, one of the most reclusive governed state, as well as South Korea and Japan. They found that there was a causal link from North Korean treats to the exchange rate and stock rate returns on the South Korea and Japan. They also found that there was no significant linkage on the interest rate change overnight.

Meric *et al.* (2012) found that the diversification benefits have decreased in the Asian region during the period January 1<sup>st</sup>. 2001- January 1<sup>st</sup>. 2011. It was found that the India, Japan and Singapore stock markets are most influential whereas South Korea and the Philippines are less influential. On the other hand, Singapore, Japan and New Zealand markets are least affected and Shanghai, Australia and South Korea are most affected by the movement of the other stock markets in the Asia region.

Among the BRIC (Brazil, Russia, India and China) countries, there is no long term co-integration among the markets during the time period of 2004-2013. The sample was divided into two parts, 2004-2013 and 2007-2013, but there is no co-integration, not even pairwise (Singh and Kaur, 2016). However, those markets, excluding India, exhibit a co-movement during the crisis period.

Due to the financial liberalisation, Association of Southeast Asian Nations (ASEAN)-5 countries (Malaysia, Thailand, Singapore, Philippines and Indonesia) became more integrated in the long run. A trend shows that those markets move together driven by the common shocks and providing limited earnings for the long term international diversification in the period of 2/01/1986 to 30/06/1997 where data has been split into three parts (2/01/1986 to 31/08/1987, 1/09/1987 to 30/06/1991, 1/07/1991 to 30/06/1997) (Phuan *et al.*, 2009). Thus, it can be said that international investors might not be benefitted in the long run at ASEAN-5 region.

The Philippines and Mexico show the integration, from December 1988 to December 2008, in a nonlinear framework level into the world market (Arouri and Jawadi, n.d.). In the recent years, a number of the Asian markets made a series of reforms in accordance to make their markets modern as well as liberal and, as a result, the Asian markets are emerging. On the other hand, the market capitalization of Mexico increased in the recent years due to the different types of reforms.

The NAFTA (The North American Free Trade Agreement) signed on December 17, 1992, to make the world's biggest single market among the USA, Canada and Mexico. A research has been conducted on NAFTA where a data set has been used from June 1995-May 2005. These NAFTA countries showed a random walk which means that none of the countries can predict the future based on the past historical information (Meric et al., n.d.).

A co-integration analysis of the France, Germany and United Kingdom stock markets and MSCI was conducted by Milla and Erdinc (2009) where a data set from January 1991 to September 2006 was taken into consideration to find out the co-integration among the markets. To find out the long run data span, a monthly series was used instead of daily price index which is a large scale. From this analytical approach, it was confirmed that there was both multilateral and bilateral integration vector among the markets and, thus, these four markets including world stock index were co-integrated.

Worthington and Higgs (2010) conducted a research, panel root and multivariate co-integration and causality, on the 11 equity markets (Austria, Belgium, Denmark, France, Germany, Greece, Ireland, Italy, Netherlands, Spain and the United Kingdom) in the European Union, from January 1993 to June 2006, by using daily index. In this research, it has been shown that degree of integration varies on the market segmentation as there is a long term equilibrium correlation as well as substantial short and long run causal links among those markets.

Similarly, another research (Albert, 2014) on co-integration was conducted with a data set from November 2000 to April 2014. In this research work, the aim was to find out the countries that joined after 2004 into the EU were more integrated than that of the countries that already existed before to build co-integration network by using a rolling window

approach. Here, it has been shown that the countries performed increased stock market integration before the accession into the EU as well as a very high degree of integration beginning with the outburst of the interbank lending market.

Among the four Nordic stock markets (Denmark, Finland, Norway and Sweden) Mangeloja (2001) found that the level of integration among those four Nordic markets is ambiguous. Investors will not be benefitted from the portfolio diversification in the different Scandinavian tracking fund.

In the North African region, an integration research work was conducted where Egypt, Morocco and Tunisia were three variables to find out the evidence to long term relationship in between those stock markets. This research resulted with a strong evidence of co-integration among those three markets (Onour, 2008). In those markets, investors have to be cautious since there is a nonlinear dependency on those markets.

Another integration research was conducted on the three Northeast Asian Stock markets (China, Japan and Korea) by using the weekly data from January 1<sup>st</sup>, 2000 to September 30<sup>th</sup>, 2010 (Jeong, n.d.). It was found that China was more influenced by the regional stock markets rather than that of global markets whereas Japan shows reciprocal behaviour. On the other hand, Korea shows a balanced behaviour both regionally and globally. All of these three countries show a higher level of integration, after the financial crisis, with the global markets.

Malaysia, a relatively stable and robust to the shock stock market, and its major trading partners (China, Indonesia, Philippines, Hong Kong, USA and Japan) started to weakening after the financial crisis where a data set has been used from 1994 to 2002 (Karim and Gee, 2006).

A daily stock index dataset has been used to find out the linkage in between two emerging (Warsaw, Budapest) and two developed (Frankfurt and the US) stock markets, from 1998 to 2005, where there was a linkage in terms of return and volatility (Li and Majerowska, n.d.). However, by using asymmetric GARCH-BEKK model, it shows a weak linkage in terms of

returns of the investments in the Warsaw and Budapest where risk factors are country specific.

A trivariate VAR-GARCH model was applied to find out the linkage among the three Central and Eastern European (CEE) countries (The Czech Republic, Hungary and Poland) and UK and Russia. Those CEE countries have significant interdependencies with both Russia and UK (Caporale and Spagnolo, 2010). It also shows an increased volatility spillover between those three countries with the UK. After the EU accession, Czech Republic, Hungary and Poland became more correlated with the UK which reduced benefits of portfolio diversification.

As of 2014, the GDP growth of India is 7.3% according to the World Bank and this is one of the booming economies in this world. India, an Asian country, belongs to the BRICS. But the question is does the stock market of India has any dependency on any of the Asian stock market? To find out the dependency of India, a research was conducted on eight other stock markets (Hong Kong, Indonesia/Jakarta, Malaysia/Kuala Lumpur, Korea, Pakistan/Karachi, Japan, China/Shanghai and Taiwan). From this research by using daily data, it was found that the Indian stock market was influenced by the selected Asian stock markets either directly or indirectly during 1991-2013 time period (Bhunia and Ganguly, 2015).

An analysis conducted to find out the cointegration of Latin American countries (Argentina, Brazil, Chile, Colombia, Mexico, Peru and Venezuela) and US stock markets to find out the co-integration from January 3<sup>rd</sup>, 1995 to March 1<sup>st</sup>, 2001 by using a daily data index. This analysis showed no co-integration among those markets but short run causality could not reject (Tabak and Lima, 2002). It can be said that the US investors could be benefitted from the investment in the Latin America. However, there was causality in between Brazil and other Latin American countries as well as greater integration in between US and Mexico.

The stock market linkage among the eight stock markets Organization of Islamic Countries (OIC) with the Japan, UK and USA stock markets shows a significant co-integration. Four countries (Egypt, Kuwait, Oman and Turkey) of the Middle East and North Africa (MENA) and four countries (Bangladesh, Indonesia, Malaysia and Pakistan) from Asia considered in this research. It was evident that there was co-integration among the Asian-OIC countries,

excluding Bangladesh-Pakistan, whereas there is no evidence of integration among MENA countries but, however, those eight OIC stock markets were integrated with three largest markets Japan, UK and the USA from January 2002 to May 2006 (Majid *et al.*, 2007).

Another investigation was conducted to find out the co-movement of the five Caribbean countries (Barbados, The Bahamas, Guyana, Jamaica and the Trinidad and Tobago) by using monthly return, from 1990 to 2008, where principal component and impulse response analysis were applied. This investigation showed an evidence of co-movement in periodic order in between in the Barbados, Jamaica and the Trinidad and Tobago. (Harrison and Moore, 2010)

Turkish stock market showed a long run association with the Germany, UK and the US for the time period of March 2000 and September 2012. Turkish stock market was classified into 11 sectors to find out the co-integration separately. A long run co-integration was identified for the Turkish stock market with US stock market. Turkish commerce, paper and textile as well as commerce and chemistry sectors are co-integrated with German and English stock market respectively (Ozlen, 2015).

There are 28 countries in the European Union. Some Western vis-à-vis central European (The Czech Republic, Hungary and Poland) and South Eastern European (Croatia, Macedonia and Serbia) were taken into consideration to find out the integration, applying multivariate GARCH model, among the stock markets of those countries. A daily dataset has been used from January 2006 to mid-May 2011 by the application of BEKK-GARCH model. This research showed that the degree of integration of Western vis-à-vis central European was way much higher than that of South Eastern Europe (Horvath and Petrovski, 2012).

Financial integration is associated with the fundamental growth of the economy. For the better diversification, an integrated capital market provides the opportunity. To find out the regional integration in the African markets, a research was conducted to find out the integration of the South Africa, Nigeria, Kenya, Morocco Egypt and Tunisia by applying bivariate GARCH-BEKK model on the daily dataset for the time period of May 2004 and

May 2011. It was found that the markets have linkage one to each other's whereas South Africa found most integrated and Kenya less integrated (Saleem, 2013).

In terms of currency exchange rate and the stock market, it was evident that currency depreciation can lead the stock market to the depression which is less than one percent decline in the stock index leads to one percent of the exchange rate depreciation in the USA and the UK from 1990 to 2004 (Dimitrova, 2005).

A bunch of major currencies from Australia, Canada, Euro area, Japan, UK, Sweden and Switzerland were taken into consideration against the exchange rate of US Dollar, from January 2003 to December 2009. It was found that dollar appreciation has a negative impact on the stocks. Moreover, exchange rate volatility reduced the returns and increase the stock volatility on the US stock market (Bhargava and Konku, n.d.).

The dynamic research of stock price and exchange rate (per US Dollar) of India showed that there was not causal linkage but strong causal influence from the stock market to the currency exchange rates with possibility of mild influence in the opposite direction which was from March 1993 to December 2002 (Nath and Samantha ,2003).

From 1998 to 2009, the currency exchange rate against US dollar and stock exchange return of Pakistan shows that the exchange rates have had a significant influence on the stock market returns (Jamil and Ullah, 2013). This output showed that, if there is a fluctuation of the Pakistani rupee then it will have an adverse effect on the change of stock market return. On the other hand, KSE100 stock index from Karachi Stock Exchange (KSE), Pakistan, showed negative linkage with the currency exchange rate and bidirectional Granger causality for the time period of January 2006 to December 2012 (Aslam, 2014). Similarly, by examining monthly data, KSE100 did not show any long term linkage with Pak-US dollar exchange rate which means that they do not move together in the long run in the duration of January 01, 1995 and January 01, 2010 (Zia, 2011).

Between January 2003 and June 2006, Australian stock prices and exchange rate against US dollar was observed to find out whether there is any interaction or not. It was found that stock price has Granger causality to the currency exchange rate which is uni-directional interaction which is consistent with the portfolio balance approach (Richards et. al, 2009).

A monthly dataset was examined, from January 1983 to December 2006, to find out the linkage between the currency exchange rate, against US dollar, and stock market price of Bangladesh. In some context, it was evident that there was long run equilibrium linkage and unidirectional long-term causal flow from the exchange rate to the stock market (Benarjee and Adhkari, n.d.). This resulted in the short term but negative linkage from currency exchange rate to the stock market from which it can be said that exchange rate and stock market move independently.

Mexican stock exchange also has had an impact on the exchange rate in the short run but there was no long-term linkage in between those two variables for the time period from January 1989 to December 2006 whereas weekly closing data was examined (Kutty, 2010). This empirical evidence gives the cautious information to the decision makers in implementing the stock market regulation.

A daily observation of Turkish financial market showed that there was unidirectional linkage from the stock market to the exchange rate where exchange rate of Turkish currency against US dollar, Euro, Japanese Yen, Pound Sterling were examined which was from February 23, 2001, to November 4, 2009 (Kose *et al.*, 2010).

G-7 countries showed an interesting empirical result on the dynamic behaviour of the daily stock price and exchange rates from October 1, 1993, to February 15, 1996. During this time, German financial market was not influenced by the currency depreciation whereas Canadian and UK market had an impact on the following day. On the other hand, stock price increase created the currency depreciation in Italy and Japan on the next day (Nieh and Lee, 2001). This evident showed that both stock price and exchange rate did not predict the future path of each other for the mentioned time period.

From August 1, 1994, to May 14, 2002, a daily observation was examined from the Sao Paulo Stock Exchange Index (IBOVESPA) against Brazilian currency, Real, exchange rate per US dollar. It was showed that there was no long run linkage between nominal exchange rate and the stock exchange (Tabak, 2006).

There were two types of co-integration discussed above. Those were stock market to stock market co-integration as well as stock market and currency exchange rate co-integration. In the above citation, it was also clear that those research works were conducted in the different parts of the world and during different time horizon. Also, at the above discussion, the datasets used were different types such as daily, weekly, monthly etc. Thus, it can be assumed that result can be varied from time to time, even in the same geographical area, depending on the frequency of the dataset. In the stock market citation, it was found that there were either unidirectional or bidirectional co-integration existed with one market to another. On the other hand, it was also clear that there were some linkages among the stock markets and the currency exchange rates either in the long term or short term. Most of the time, it was found that stock markets have had an influence on the currency exchange rates. Nevertheless, in the above citation, most of the time US dollar exchange rate was considered against discussed countries' currencies due to the reason that most of the countries have had their foreign reserves in the US dollar excluding the countries in the Euro areas. Euro countries also have a good business deal with the USA and, this is why Euro countries also used US dollar exchange rates in the above discussion. However, both stock market return and foreign exchange are two different but very important variable of the economic indicator of a country.

## 5 DATA AND METHODOLOGY

Research is basically two types: qualitative and quantitative methods. Both qualitative and quantitative research work are complementary. Qualitative research is the exploratory research work where the motivation is to find out the underlying reasons opinions etc. and develop the ideas. However, quantitative research is to quantify the problem and use the measurable data to formulate facts and find out the patterns. Thus, it is easily understandable that both qualitative and quantitative research work is descriptive versus predictive.

### 5.1 Data

Time series data is the sequence of the numerical information which tracks the movement of the chosen data such as stock price over a time period and recorded on a regular basis. This time series is the great interest to the research works and the main element to finding out the inference as well as prediction. Nowadays, this type of financial data is easier to collect which was not an easy couple of decades ago. Researchers are now able to predict the future based on the historical data. This research work is based on quantitative method. Aliaga and Gunderson (2000) defined the quantitative method as follows:

*“Quantitative research is explaining the phenomenon by collected numerical data that are analysed using mathematically based methods (in particular statistics).”*

In this quantitative research work, the daily stock price has been collected for a 10 years’ period from 1<sup>st</sup> January 2005 to 31<sup>st</sup> December 2014 which is totalling of 2608 daily observations through Data Stream and Bloomberg for analysis. The data is as follows:

**Table – 3: Data Index**

	<b>Name</b>	<b>Index</b>	<b>Source</b>
1	Bangladesh	IFFMBG\$	Data Stream
2	India	BSE 30 Sensitive (IBOMSEN)	Data Stream
3	Emerging	MSCI Emerging	Bloomberg
4	World	MSCI World	Bloomberg
5	Currency (exchange rate) (BD to USD)	USDBGD BGN	Data Stream

The arithmetic return of the collected data was calculated as follows:

$$R_t = ((P_t - P_{t-1})/P_{t-1}) * 100.$$

## 5.2 Methodology

This section is the discussion of the methods that have been used to find out the result of this research work. Johansen co-integration technic is popular to find out the co-integration among the variables that have taken into consideration. After this Johansen co-integration test, Vector Error Correction Model (VECM) method would be applied if there was any long-run linkage available among the variables examined. However, Granger causality test or Vector Auto Regression (VAR) will be applied to find out the short-run linkage if there is no any long-run linkage available. Application of either VECM or VAR is depending on the outcome of the Johansen co-integration test.

### 5.2.1 Unit root test

First of all, a unit root test has been conducted to check the data stationary. It is necessary to test the series due to the reason that non-stationary and stationary can treat each other differently. According to Brooks (2008), there are three reasons as follows:

- i) “Stationary can strongly *influence its behaviours and its properties*”.
- ii) “Non- stationary data can lead to the *spurious regression*”.
- iii) “Assumption for asymptotic analysis will not be valid if the regression model is not stationary”.

Augmented Dickey-Fuller (ADF) and Kwiatkowski-Philipps-Schmidt-Shin (KPSS) test have been conducted for check the further usability of the data to identify whether this data set contains any unit root or not. To test the non-stationary, random walk model with drift as well as trend stationary process can be applied but Dickey and Fuller was the pioneer of testing unit root in the time series (Brooks, 2008).

The formula for the random walk model with drift for non-stationarity is

$$Y_t = \mu + Y_{t-1} + u_t \quad (1)$$

Where, Y = variable, t= trend, t-1= previous trend,  $\mu$  =drift term and  $u_t$  = error term.

In order to make the data stationary,

$$\Delta Y = Y_t - Y_{t-1} = \mu + u_t \quad (2)$$

In the ADF test, it is assumed that null hypothesis is not stationary or got a unit root and alternative hypothesis is stationary. We reject the null hypothesis if the probability is less than five percent.

$H_0$  = Data is not stationary.

$H_1$  = Data is stationary.

The hypothesis can be formulated as:

$$\Delta Y_t = \psi Y_{t-1} + \sum_{i=1}^p \alpha_i \Delta Y_{t-1} + u_t \quad (3)$$

Where, Y = variable, Z = coefficient, t= trend,  $\alpha$  =constant and  $u_t$  = error term.

KPSS test is another method to find out the stationary of the data. In this test, it is assumed that null hypothesis is stationary or got no unit root and the alternative hypothesis is non-stationary. Hypotheses are:

$H_0$  = Data is stationary.

$H_1$  = Data is not stationary.

Series can be expressed as:

$$r_t = r_{t-1} + u_t \quad (4)$$

In this test, the probability should be more than five percent to accept the data as stationary.

### 5.2.2 Vector Autoregression (VAR)

To find out the dynamic linkage in between Bangladesh and other stock markets as well as Bangladesh currency exchange rate, a VAR model and Vector Error Correction Model (VECM) should be applied based on the outcome of the Johansen co-integration test. VECM is a form of VAR which is restricted. Since all the variables are endogenous by the model this is why it is not necessary to identify them throughout VAR.

A VAR model can be expressed as follows:

$$Y_t = \mu + \beta_1 Y_{t-1} + \dots + \beta_k Y_{t-k} + u_t \quad (5)$$

$m \times 1 \quad m \times 1 \quad m \times m \quad m \times 1 \quad m \times m \quad m \times 1 \quad m \times 1$

Here,  $m$  = number of variables,  $k$  = number of lags,  $Y_t$  = *variable matrix*,  $\mu$  = intercept matrix,  $\beta_1 \dots \beta_k$  = coefficient of the lagged values and  $u_t$  = error term.

### 5.3 Co-integration and Error Correlation

Co-integration methods are very popular to find out the linkage among the variables. Two stock markets are co-integrated, in the long run, if the markets do not drift too far. Co-integration among the examined stock markets can be found out by using the Johansen co-integration test (1988). This test is applied to find out the stochastic trends as well as long-term integration among the stock indices. According to the theory (Arshanapalli, 1993), in the long run, two markets are not integrated if those markets are efficient collectively. More than two variables provide robust output throughout this co-integration test (Thalassinis and Politis, 2011). To find out the short-run deviation from the long-run equilibrium, vector error correction model (VECM) can be applied to capture the proportion of last period's disequilibrium which will be corrected.

Two variables can be co-integrated in the long run if:

$$Y_t = \beta X_t + u_t \quad (6)$$

If the changes in  $Y_t$  depends on the deviation in the period  $t-1$  then we get:

$$\Delta Y_t = \alpha (Y_{t-1} - \beta X_{t-1}) + u_t \quad (7)$$

Here,  $\beta$  = long run co-integration coefficient and  $\alpha$  = adjustment parameters to measure the proportion of last period's disequilibrium.

### 5.3.1 Johansen's Vector Error Correction Model

The main purpose to use the Johansen co-integration test (Johansen, 1988) is to find out the integration of a Vector Autoregression (VAR) model need to be turning appropriately to Vector Error Correction Model (VECM):

$$\Delta Y_t = \Pi Y_{t-1} + \sum_{i=1}^{k-1} \Gamma_i \Delta Y_t - i + u_t \quad (8)$$

Where,  $\Pi = \sum_{i=1}^k \beta_i - I_g$  and  $\Gamma = \sum_{j=1}^k \beta_j - I_g$

Here,  $Y_t = m$  dimensional vector,  $\Gamma$  indicates the coefficient matrices of the lagged differences of the stochastic variables. The matrix  $\Pi$  can be denoted as  $\Pi = \alpha\beta'$ , where  $\alpha$  is vector adjustment parameters and  $\beta$  is the co-integration vectors. Both of them are  $(m \times r)$  matrices.

Also, there are two methods of defining rank in the of testing co-integration: Engle and Granger two step procedure and Johansen co-integration test which is based on Vector Auto Regression (VAR) (Masood *et. al*, 2010). According to Brooks (2008), there are two test statistics, Trace and Max-Eigen, under the Johansen co-integration approach which can be derived as

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^{\infty} \ln(1 - \lambda'_i) \quad (9)$$

and

$$\lambda_{max}(r, r+1) = -T \ln(1 - \lambda'_{r+1}) \quad (10)$$

Where,  $r$  = number of co-integration vectors under the null hypothesis and  $\lambda'_i$  = value of  $i^{\text{th}}$  ordered Eigenvalue.

In this test, if the p-value is less than five percent then the null hypothesis is rejected otherwise null hypothesis is accepted. Null hypothesis ( $H_0$ ) is as follows:

$H_0$ : Number of the co-integrated equation.

$H_1$ : Number of the non-co-integrated equation.

### 5.3.2 Granger Causality

The aim of the Granger causality test is to find out the short-term dynamics and causality between the variables. The idea is that if a variable  $X_1$  Granger causes on the variable  $X_2$  then the past values of  $X_1$  contains information to predict  $X_2$ . This means that the value of  $X_1$  has the explain power on the future value of  $X_2$  (Brooks, 2008).

$H_0$ : Bangladesh does not Granger cause currency exchange rate.

$H_1$ : Bangladesh does Granger cause currency exchange rate.

We can assume the hypotheses as above. The variables must be stationary while performing the Granger causality test to find out the short run linkage.

## 5.4 Impulse Response

The impulse response is a unit shock which is applied to each variable to see the effects on the VAR system. Impulse responses identify the responsiveness of the dependent variables (endogenous variable) in the VAR (Vector Auto Regressive) when a shock is put to the error term:

$$Y_t = A_1 Y_{t-1} + u_t \quad (11)$$

Where  $A_1 = \begin{bmatrix} 0.5 & 0.3 \\ 0.0 & 0.2 \end{bmatrix}$

The VAR in a matrix form:

$$\begin{bmatrix} Y1, t \\ Y2, t \end{bmatrix} = \begin{bmatrix} 0.5 & 0.3 \\ 0.0 & 0.2 \end{bmatrix} \begin{bmatrix} Y1, t - 1 \\ Y1, t - 2 \end{bmatrix} + \begin{bmatrix} u1, t \\ u1, t \end{bmatrix} \quad (12)$$

Consider a unit shock to  $Y_{1,t}$  at  $t = 0$

$$Y_0 = \begin{bmatrix} u1,0 \\ u2,0 \end{bmatrix} = \begin{bmatrix} 1 \\ 0 \end{bmatrix} \quad (13)$$

$$Y_1 = A_1 Y_0 = \begin{bmatrix} 0.5 & 0.3 \\ 0.0 & 0.2 \end{bmatrix} \begin{bmatrix} 1 \\ 0 \end{bmatrix} = \begin{bmatrix} 0.5 \\ 0.0 \end{bmatrix} \quad (14)$$

$$Y_1 = A_1 Y_1 = \begin{bmatrix} 0.5 & 0.3 \\ 0.0 & 0.2 \end{bmatrix} \begin{bmatrix} 0.5 \\ 0 \end{bmatrix} = \begin{bmatrix} 0.25 \\ 0.00 \end{bmatrix} \quad (15)$$

Now it would be easy to exhibit a unit shock of  $Y_{1,t}$  on the graph. The unit shock gradually fades away since the system is stable. It is useful to apply one standard deviation shock instead of unit shock (Lutkepohl, 2005).

## **6 EMPIRICAL RESULTS**

This section is discussing the outcome of the research work. This research work is focused on finding out the nature and extent of those examined variables. The main idea was to find out the linkage in between stock markets including currency exchange rate which means whether those variables have had any affinity, either long-run or short-run.

### **6.1 Full sample test**

The examined data has been collected through the Bloomberg and Data Stream databases. EViews8 (student version) was used for data analysis. There were five variables collected. Among those five variables, four were stock market indices (Bangladesh, India, Emerging and World) and one was Bangladesh currency exchange rate against US dollar. The time period of those collected and examined daily data was from January 2005 to December 2014.

#### **6.1.1 Descriptive statistics**

The descriptive statistics (table-4) has been conducted to make sure about the data feasibility. According to the fifth assumption of the classical regression model, a normally distributed data must not be skewed and a kurtosis value must be three. Since all of the indices have kurtosis value more than three than we can assume that data shows a leptokurtosis trend due to the infrequent deviation. Skewness of the data shows both positive and negative direction. Both Bangladesh and India show the positive direction which is an upward trend of the stock markets. Investors in both Bangladesh and India expected to gain a positive return due to the upward trend of the stock markets. On the other hand, Emerging and World stock markets show the downward trend due to the negative skewness values. However, Bangladesh currency exchange rate against US dollar showed an upward trend due to a positive value.

**Table-4: Descriptive Statistics**

	<b>BANGLADESH</b>	<b>INDIA</b>	<b>EMERGING</b>	<b>WORLD</b>	<b>CURRENCY</b>
Mean (%)	0.045	0.056	0.031	0.021	0.011
Median (%)	0.000	0.012	0.100	0.071	0.000
Maximum (%)	24.097	20.987	10.598	9.523	5.876
Minimum (%)	-24.091	-11.226	-9.512	-7.063	-5.139
Std. Dev. (%)	1.776	1.792	1.334	1.085	0.292
Skewness	0.763	0.435	-0.294	-0.280	3.689
Kurtosis	49.815	12.948	11.496	12.502	152.423
Jarque-Bera	238318.100	10831.490	7878.065	9841.788	2431196.000
Probability	0.000	0.000	0.000	0.000	0.000
Sum	116.276	145.804	79.995	54.043	27.799
Sum Sq. Dev.	8217.136	8371.969	4634.316	3068.979	222.679
Observations	2607	2607	2607	2607	2607

From this descriptive analysis, it can be seen that Bangladesh stock market is severe (-24.091) comparing India, Emerging and the World stock indices. Return is second highest (0.045) in Bangladesh. Standard deviation is almost same for both Bangladesh (1.776 %) and India (1.792 %) whereas Emerging and World stock markets have 1.334 % and 1.085 % respectively. Among all of those above stock indices, it is also noticeable that both Bangladesh (1.776 %) and India stock market (1.792 %) have almost same volatility and World stock market (1.085 %) is less volatile whereas the currency exchange rate showed very less volatility (0.292 %).

### 6.1.2 Correlation

Correlation matrix can unveil the pattern of the linkage among the variables. The nonzero correlation among the two indices means that those indices have linkage and zero correlation means there is no linkage among those indices.

**Table – 5: Correlation matrix**

	<b>BANGLADESH</b>	<b>INDIA</b>	<b>EMERGING</b>	<b>WORLD</b>	<b>CURRENCY_EX</b>
<b>BANGLADESH</b>	1				
<b>INDIA</b>	0.027	1			
<b>EMERGING</b>	0.011	0.658	1		
<b>WORLD</b>	0.013	0.447	0.738	1	
<b>CURRENCY_EX</b>	-0.050	-0.002	-0.010	-0.008	1

A way to examine the correlation in between the variables is to distinguish the degree of linear association between the examined variables. From the table below it can be seen that Bangladesh stock market is highly segmented comparing with the other stock indices as well as with the currency exchange rate.

Without currency exchange rate, rest of the variables are poorly but positively correlated with Bangladesh stock market whereas. Since this correlation value is less than that of five percent this is why it can be said that the correlation of Bangladesh stock market with other stock markets are insignificant. However, currency exchange rate is negatively correlated with Bangladesh stock market. This matrix (table-7) shows that all the variables examined here move independently except currency exchange rate.

### 6.1.3 Unit root test

After conducting the unit root test, it was understandable from the table above that the variables coefficient of the variables is negative which means that the data is viable as the variables coefficients must be negative. Also, from the probability distribution, it is noticeable that the probability is less than that of five percent. Another guideline is, if the absolute t-statistics value is more than the critical value (absolute) then we can reject the null hypothesis and accept the alternative hypothesis. Thus, it is clear that all variables are feasible since neither of them has any unit root.

In this case, the null hypothesis is rejected for all stock markets since all of the probabilities are less than five percent. Thus, it is clear that data is stationary or does not have any unit root and feasible to conduct further tests and analysis.

**Table-6: ADF test**

	Coefficient	t-Statistics	Critical value (at 5% level)	Probability
Bangladesh	-1.091047	-55.90757	-2.862449	0.0001
India	-0.935563	-47.84011	-2.862449	0.0001
Emerging	-0.786504	-41.09617	-2.862449	0.0000
World	-0.954496	-36.55218	-2.862450	0.0000
Currency_ex	-1.073028	-13.06171	-2.862454	0.0000

In this test, the probability should be more than five percent to accept the data as stationary. The output of this test shows (appendix - 2) that the null hypothesis is accepted thus the data is feasible for further tests and analyses.

**Table-7: KPSS test**

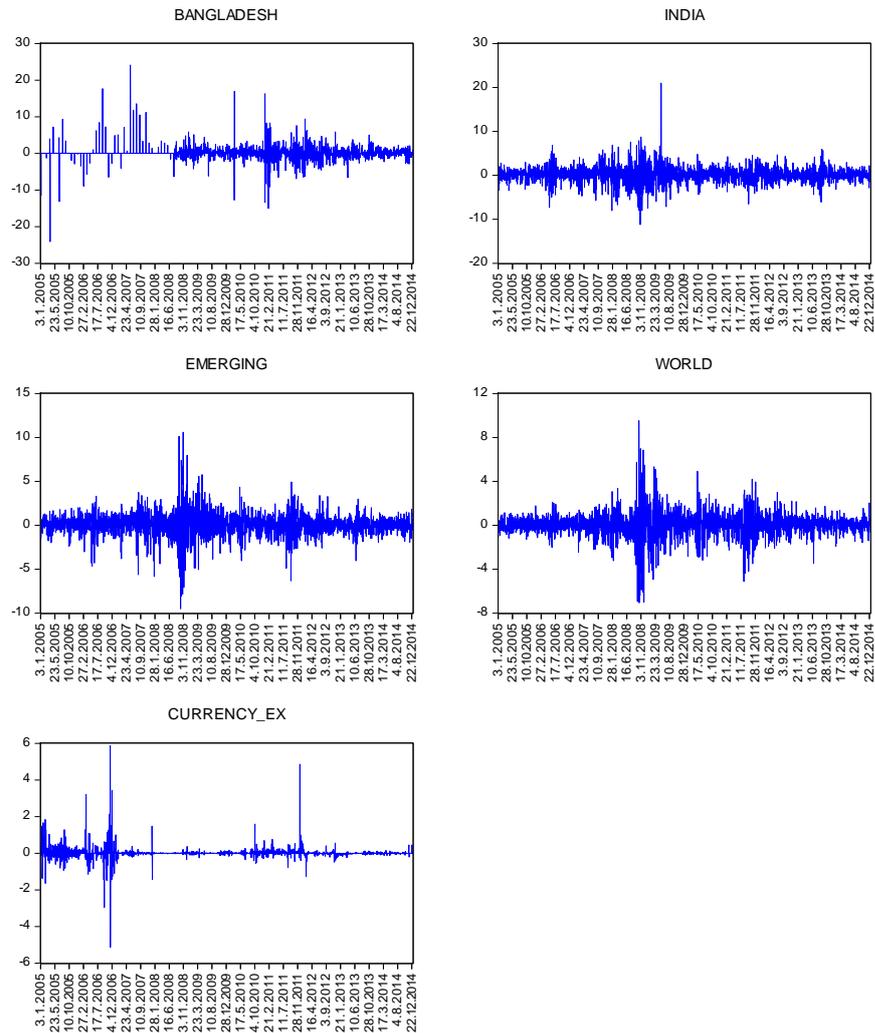
	LM stat.	Critical value at 5% level	Probability
Bangladesh	0.242267	0.463000	0.1998
India	0.129718	0.463000	0.1112
Emerging	0.150208	0.463000	0.2402
World	0.097772	0.463000	0.3295
Currency	0.294624	0.463000	0.0626

In the KPSS test, we reject the null hypothesis if the probability value is less than five percent. Since the probability is more than five percent then we can say that the variables are stationary and accept the null hypothesis. Also, if the test statistics (LM stat.) is more than critical value then we reject the null hypothesis. Thus, we can say that there is no unit root and data is feasible for further tests.

#### **6.1.4 Volatility Clustering**

Volatility clustering is the way to explain the tendency of the changes in the large volume. This results with the magnitudes of price changes. Under this volatility clustering, it can be seen that the large changes led to the large return and small changes lead to the small returns. In both cases, the return could either be negative or positive. This type of change can be seen during the extension of the high market volatility and occur in bunches instead of evenly spaced over time.

**Figure – 8: Volatility Clustering**



From the volatility clustering (figure – 8), it is visible that the volatility occurs in bursts. There was a prolonged period of tranquillity in the Bangladesh stock market from 2005 to 2008. This was evidenced with relatively small and negative return (Brooks, 2008). On the other hand, in 2008–2009, there were more positive and negative observations i.e. more volatility observed in a short period of time in the India, Emerging and the World stock markets. However, Bangladesh currency exchange rate is almost tranquil after 2006 to until 2014.

## 6.2 Johansen Co-integration Test

In the regression analysis (table-8), Trace Statistics was in the both *None* and *At most 1* cases showed that the null hypothesis is rejected due to the reason that the p-value is less than five percent. Similarly, Max-Eigen Statistics also showed the identical result.

**Table – 8: Johansen co-integration test (probability)**

	<b>Hypothesised No. of CE(s)</b>	<b>Trace Statistics</b>	<b>Max-Eigen Statistics</b>
<b>Bangladesh - India</b>	None	0.0001	0.0001
	At most 1	0.0000	0.0000
<b>Bangladesh - Emerging</b>	None	0.0001	0.0001
	At most 1	0.0000	0.0000
<b>Bangladesh - World</b>	None	0.0001	0.0001
	At most 1	0.0000	0.0000
<b>Bangladesh - Currency_Ex</b>	None	0.0001	0.0001
	At most 1	0.0000	0.0000

Since, India is a big trade partner of Bangladesh, this is why it was important to find out the co-integration. From the co-integration test above it was clear that neither country has an influence on each other. Similarly, Bangladesh currency exchange rate and Bangladesh stock exchange do not have any influence on each other as well. In this Johansen co-integration test (appendix-3), null hypothesis means that there is co-integration among the four variables.

From the test, we became to understand that there was co-integration linkage among the examined variables during the period of 2005–2014. Thus, it is obvious to test the long term linkage among the variables for which Vector Error Correction Model (VECM) was applied.

### 6.2.1 Vector Error Correction Model

From the VECM test (appendix -4) we can see that C(1) is the error correction mechanism. The error correction coefficient C(1) must be negative and probability must be significant. From the test we can see that C(1) has a negative value (-0.012716) and probability is

significant (0.0009). Thus, it is clear that there is long-run causality running from India, Emerging, World and Currency exchange rate to Bangladesh stock market.

To check the short run causality, Wald test applied and it was found that the chi-square probability is less than 5 % from India and World to Bangladesh. Otherwise, there is no short-run causality from Emerging and currency exchange rate to Bangladesh according to the following hypothesis below:

$H_0$  = there is no short run causality

$H_1$  = there is short run causality

**Table 9: Wald test (chi-square)**

<i>Test statistics</i>	India to Bangladesh	Emerging to Bangladesh	World to Bangladesh	Currency to Bangladesh
Probability	0.0031	0.4421	0.0323	0.1671

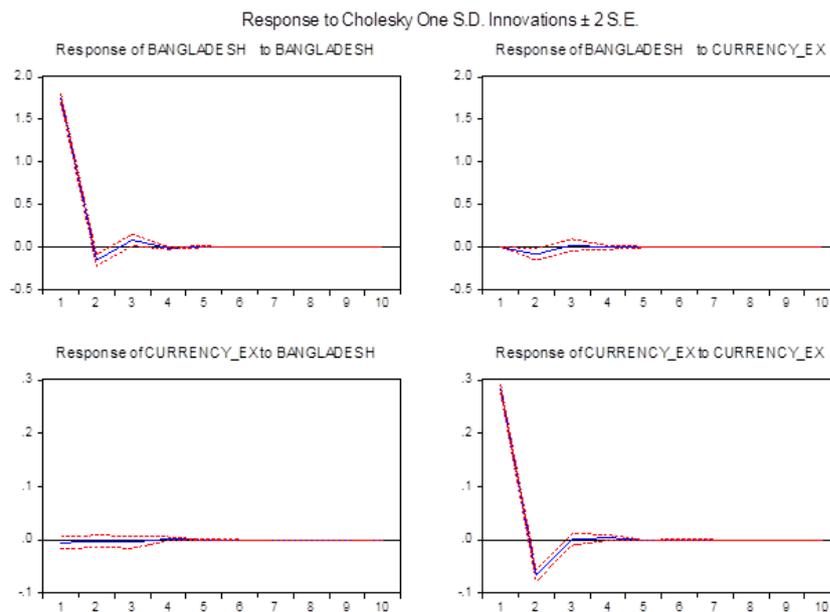
This table above shows that we can reject the null hypothesis for India to Bangladesh (0.0031) as well as World to Bangladesh (0.0323) which means that there is short-run causality from India and World to Bangladesh. However, we cannot reject the null hypothesis for Emerging to Bangladesh (0.4421) as well as currency exchange rate to Bangladesh (0.1671) which means that there is no short-run causality from Emerging and Currency to Bangladesh.

From the VECM analysis, it was clear that there is long run causality from India, Emerging, World stock markets and Currency Exchange rate to Bangladesh stock market. However, only India and World stock markets showing short run causality to Bangladesh stock market. Otherwise, Emerging and Currency exchange rate are not showing any short run causality to Bangladesh stock market.

### 6.3 Impulse Response

From the Impulse response test, it is noticeable (figure-9) that how the currency exchange rate and Bangladesh stock market affecting each other after applying a unit shock. Since daily data was examined this is why the effect was from day 0 to day 10.

**Figure – 9. Impulse response (Bangladesh – Currency\_Ex.)**



When a unit standard deviation was given to the Bangladesh stock market to observe how the exchange rate was reacting. In this case, when Bangladesh stock market had a negative reaction, currency exchange rate became negative. Similarly, if one-unit standard deviation given to the exchange rate then the Bangladesh stock market reacted. There was a negative reaction on the first day, and then became positive on the second day and became negative which was minor to notice. However, after a standard deviation change applied to the Bangladesh stock market at the beginning it reacted negatively, on the second day, which became positive on the third day.

From the scenario discussed above, it was clear that whenever currency exchange rate, or Bangladesh stock market, standard deviation has had a noticeable effect but very minor whenever shock was given to the Bangladesh stock exchange or to the currency exchange rate from currency exchange rate or from Bangladesh stock exchange respectively. More precisely, currency exchange rate and Bangladesh stock exchange have had a minor affect one to each other.

## 7 CONCLUSION

The main goal of this study was to empirically analyse the dynamic relation of Bangladesh stock market with India, Emerging and World stock indices as well as Bangladesh currency exchange rate. It can be said that the level of the global stock market integration process is found to be time varying as there are still many emerging countries are under substantial development of their stock markets. Also, major global political and economic and financial events are creating impact not only in the emerging countries but also in the developed countries. Various industry-specific factors are playing different types of market level integration. However, under the unified valuation and convergence conceptual framework, stock markets are becoming more integrated but far away from the full integration (Tam and Tam, 2012).

Corresponding to the empirical result (section 6.1.1), a descriptive statistic applied from which it was found that the Bangladesh stock market was severe (-24.091) for the mentioned time period comparing with the other indices. Also, Bangladesh stock market had similar volatility (1.776) comparing with India (1.792) whereas Bangladesh currency exchange rate exhibited very low volatility (0.292) comparing with other indices analysed.

To check out the data feasibility before regression analysis, a unit root test (ADF and KPSS) has exercised on all variables. This unit root test (appendix 1 and 2) presented that the probability and coefficient values indicate that the variables do not have any unit root.

Volatility clustering proved that it can be seen that the large changes led to the large return and small changed led to the small return under the volatility clustering. The return could either be positive to negative. Volatility clustering occurs evenly spaced over time instead of in bunch.

The main purpose of this research paper was to investigate the linkage among the variables which are the stock markets of Bangladesh, India, Emerging and the World as well as with the Bangladesh currency exchange rate. Vector Error Correction Model (VECM) was applied, to find out the long-run linkage, followed by the application of Johansson Co-integration test for the long-run linkage specification. Also, Impulse response was exercised

among Bangladesh stock market and Bangladesh currency exchange rate against the US Dollar.

For the easier representation of the co-integration investigation, among the variables, the Johansen co-integration technic was applied on the variables as pair basis. However, the result (appendix - 3) shows that the probability (Trace and Max-Eigenvalue) of the both Bangladesh and India is less than five percent. Thus the null hypothesis, number of the co-integrated equation, was rejected which means that the variables discussed have had an impact during the mentioned period. Similarly, Bangladesh currency exchange rate also expressed its integrated behaviour with Bangladesh stock market by rejecting the null hypothesis, a number of the co-integrated equation, as both of the Trace and Max-Eigenvalues probability is less than that of five percent. Also, an impulse response technic was applied on both Bangladesh stock market and Bangladesh currency exchange rate to measure one-unit standard deviation change on one to each other.

Also, from the Johansson co-integration test, it was clear that Bangladesh stock market is integrated with India, Emerging and World stock indices as well as with Bangladesh currency exchange rate. This is why Vector Error Correction Model (VECM) applied to find out the level of integration of Bangladesh with other variables discussed here.

From the VECM analysis (appendix - 4), it was clear that there is long run causality from India, Emerging, World stock markets and Currency Exchange rate to Bangladesh stock market. However, only India and World stock markets showing short run causality to Bangladesh stock market. Otherwise, Emerging and Currency exchange rate are not showing any short run causality to Bangladesh stock market which was clear from the Wald test (appendix - 5).

Since there is co-integration found among the variables, this is why any incident happen in the Indian stock market in the past did have an effect on the Bangladesh stock market. Also, Emerging and World stock markets have had an effect on the Bangladesh stock market. Similarly, Bangladesh currency exchange rate did have also effect on the Bangladesh stock market. Thus the investors who are willing to get a good return on a wisely trading portfolio

of their investment can invest in the Bangladesh stock market which will be helpful portfolio diversification as the level of correlation with Bangladesh stock market is very low.

This empirical study provides various financial perspectives of co-integration of Bangladesh stock market by inspecting the sensitivity of the different sample periods, currency denomination of the stock price as well as the frequency of the data. In this paper, regression analysis exhibits that the Bangladesh stock market is integrated which means that the Bangladesh stock market is a significant market. There is a very low-level correlation of Bangladesh found with other variables found. This research work was not anomaly than that some of the work mentioned in the literature review section. Some of the previous studies found the co-integration of Bangladesh stock market with India and other stock markets which are validating this research work.

## **Implication**

There were many studies conducted on the co-integration of stock markets across the different parts of the world and during the different time horizon. The outcome of this research is very useful for the investors who are willing to invest in Bangladesh but are not sure whether to invest or not. Portfolio managers can diversify their investment by investing in Bangladesh as the level of correlation of Bangladesh very low with India, Emerging, World and currency exchange rate.

In terms of policy making, integrated stock markets contribute to an economy as those markets are not able to deviate too much. From the perspective of portfolio diversification, arbitrage activates are not helpful for an investor to gain in the long-run. Also, this finding attributed the low-level integration of Bangladesh stock market which raises a concern for long-term portfolio diversification and was caused by the inadequate role of Bangladesh Securities and Exchange Commission (BSEC). However, there is no any substitute of good governance in Bangladesh. This is why, it can be said that this research work will be helpful to strengthening the BSEC in order to assuring a good governance on the Bangladesh stock market.

For attracting foreign direct investment, a stock market performance is taken into account and Bangladesh stock market performance is essential as foreign investors measure the performance of the stocks listed. Thus, this study will be fruitful for the investors as the level of segmentation of the Bangladesh stock market can be used foreign portfolio investors.

The purpose of this study was to find out the linkage of Bangladesh stock market with India, Emerging, World and currency exchange rate. However, a further research could be done to find out the linkage of Bangladesh stock market with the other big trade partners such as China, Germany, Saudi Arabia, European Union etc.

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# APPENDICES

## Appendix 1: Augmented Dicky Fuller (ADF) Test

Null Hypothesis: BANGLADESH has a unit root  
 Exogenous: Constant  
 Lag Length: 0 (Automatic - based on SIC, maxlag=27)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-55.89384	0.0001
Test critical values:		
1% level	-3.432667	
5% level	-2.862450	
10% level	-2.567299	

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

Augmented Dickey-Fuller Test Equation  
 Dependent Variable: D(BANGLADESH)  
 Method: Least Squares  
 Date: 05/21/16 Time: 14:53  
 Sample (adjusted): 3 2607  
 Included observations: 2605 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
BANGLADESH2(-1)	-1.091047	0.019520	-55.89384	0.0000
C	0.048675	0.034677	1.403656	0.1605
R-squared	0.545496	Mean dependent var		0.000383
Adjusted R-squared	0.545321	S.D. dependent var		2.623997
S.E. of regression	1.769358	Akaike info criterion		3.979878
Sum squared resid	8149.020	Schwarz criterion		3.984381
Log likelihood	-5181.791	Hannan-Quinn criter.		3.981509
F-statistic	3124.122	Durbin-Watson stat		1.976292
Prob(F-statistic)	0.000000			

Null Hypothesis: INDIA has a unit root  
 Exogenous: Constant  
 Lag Length: 0 (Automatic - based on SIC, maxlag=27)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-47.84011	0.0001
Test critical values:		
1% level	-3.432666	
5% level	-2.862449	
10% level	-2.567299	

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

Augmented Dickey-Fuller Test Equation  
 Dependent Variable: D(INDIA)  
 Method: Least Squares  
 Date: 05/14/16 Time: 15:26  
 Sample (adjusted): 3 2608  
 Included observations: 2606 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INDIA(-1)	-0.935563	0.019556	-47.84011	0.0000
C	0.052560	0.035067	1.498828	0.1340
R-squared	0.467776	Mean dependent var		0.000492
Adjusted R-squared	0.467571	S.D. dependent var		2.452171
S.E. of regression	1.789293	Akaike info criterion		4.002285
Sum squared resid	8336.885	Schwarz criterion		4.006787
Log likelihood	-5212.978	Hannan-Quinn criter.		4.003916
F-statistic	2288.676	Durbin-Watson stat		1.997063
Prob(F-statistic)	0.000000			

Null Hypothesis: CURRENCY\_EX has a unit root  
 Exogenous: Constant  
 Lag Length: 12 (Automatic - based on SIC, maxlag=27)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-13.06171	0.0000
Test critical values:		
1% level	-3.432678	
5% level	-2.862454	
10% level	-2.567302	

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

Augmented Dickey-Fuller Test Equation  
 Dependent Variable: D(CURRENCY\_EX)  
 Method: Least Squares  
 Date: 05/14/16 Time: 15:25  
 Sample (adjusted): 15 2608  
 Included observations: 2594 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CURRENCY_EX(-1)	-1.073028	0.082151	-13.06171	0.0000
D(CURRENCY_EX(-1))	-0.142256	0.078967	-1.801449	0.0717
D(CURRENCY_EX(-2))	-0.198273	0.076202	-2.601929	0.0093
D(CURRENCY_EX(-3))	-0.202402	0.073279	-2.762082	0.0058
D(CURRENCY_EX(-4))	-0.157493	0.070329	-2.239376	0.0252
D(CURRENCY_EX(-5))	-0.135909	0.066881	-2.032104	0.0422
D(CURRENCY_EX(-6))	-0.180785	0.062841	-2.876866	0.0040
D(CURRENCY_EX(-7))	-0.096975	0.057901	-1.674851	0.0941
D(CURRENCY_EX(-8))	-0.041869	0.052818	-0.792699	0.4280
D(CURRENCY_EX(-9))	0.007214	0.046930	0.153726	0.8778
D(CURRENCY_EX(-10))	-0.009745	0.039637	-0.245844	0.8058
D(CURRENCY_EX(-11))	0.019682	0.030744	0.640204	0.5221
D(CURRENCY_EX(-12))	-0.077466	0.019455	-3.981827	0.0001
C	0.011229	0.005522	2.033720	0.0421
R-squared	0.626478	Mean dependent var		0.000101
Adjusted R-squared	0.624596	S.D. dependent var		0.453446
S.E. of regression	0.277827	Akaike info criterion		0.281749
Sum squared resid	199.1453	Schwarz criterion		0.313381
Log likelihood	-351.4289	Hannan-Quinn criter.		0.293212
F-statistic	332.8639	Durbin-Watson stat		2.003050
Prob(F-statistic)	0.000000			

Null Hypothesis: EMERGING has a unit root  
 Exogenous: Constant  
 Lag Length: 0 (Automatic - based on SIC, maxlag=27)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-41.09617	0.0000
Test critical values:		
1% level	-3.432666	
5% level	-2.862449	
10% level	-2.567299	

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

Augmented Dickey-Fuller Test Equation  
 Dependent Variable: D(EMERGING)  
 Method: Least Squares  
 Date: 05/14/16 Time: 15:27  
 Sample (adjusted): 3 2608  
 Included observations: 2606 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EMERGING(-1)	-0.786504	0.019138	-41.09617	0.0000
C	0.024818	0.025528	0.972182	0.3311
R-squared	0.393416	Mean dependent var		0.000730
Adjusted R-squared	0.393183	S.D. dependent var		1.672487
S.E. of regression	1.302841	Akaike info criterion		3.367738
Sum squared resid	4420.014	Schwarz criterion		3.372240
Log likelihood	-4386.163	Hannan-Quinn criter.		3.369369
F-statistic	1688.895	Durbin-Watson stat		1.988716
Prob(F-statistic)	0.000000			

Null Hypothesis: WORLD has a unit root  
 Exogenous: Constant  
 Lag Length: 1 (Automatic - based on SIC, maxlag=27)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-36.55218	0.0000
Test critical values:		
1% level	-3.432667	
5% level	-2.862450	
10% level	-2.567299	

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

Augmented Dickey-Fuller Test Equation  
 Dependent Variable: D(WORLD)  
 Method: Least Squares  
 Date: 05/14/16 Time: 15:28  
 Sample (adjusted): 4 2608  
 Included observations: 2605 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
WORLD(-1)	-0.954496	0.026113	-36.55218	0.0000
D(WORLD(-1))	0.070414	0.019553	3.601141	0.0003
C	0.020398	0.021103	0.966602	0.3338
R-squared	0.448595	Mean dependent var		-3.31E-05
Adjusted R-squared	0.448172	S.D. dependent var		1.449398
S.E. of regression	1.076687	Akaike info criterion		2.986806
Sum squared resid	3016.384	Schwarz criterion		2.993561
Log likelihood	-3887.315	Hannan-Quinn criter.		2.989253
F-statistic	1058.429	Durbin-Watson stat		1.999714
Prob(F-statistic)	0.000000			

## Appendix 2: Kwiatkowski-Phillips-Schmidt-Shin (KPSS) Test

Null Hypothesis: BANGLADESH is stationary  
 Exogenous: Constant  
 Bandwidth: 9 (Newey-West automatic) using Bartlett kernel

	LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic	0.242146
Asymptotic critical values*:	
1% level	0.739000
5% level	0.463000
10% level	0.347000

\*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	3.153158
HAC corrected variance (Bartlett kernel)	2.749134

KPSS Test Equation  
 Dependent Variable: BANGLADESH  
 Method: Least Squares  
 Date: 05/21/16 Time: 14:55  
 Sample (adjusted): 2 2607  
 Included observations: 2606 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.044628	0.034791	1.282742	0.1997
R-squared	0.000000	Mean dependent var		0.044628
Adjusted R-squared	0.000000	S.D. dependent var		1.776054
S.E. of regression	1.776054	Akaike info criterion		3.987049
Sum squared resid	8217.131	Schwarz criterion		3.989300
Log likelihood	-5194.125	Hannan-Quinn criter.		3.987865
Durbin-Watson stat	2.181963			

Null Hypothesis: INDIA is stationary  
 Exogenous: Constant  
 Bandwidth: 7 (Newey-West automatic) using Bartlett kernel

	LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic	0.129718
Asymptotic critical values*:	
1% level	0.739000
5% level	0.463000
10% level	0.347000

\*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	3.211342
HAC corrected variance (Bartlett kernel)	3.454411

KPSS Test Equation

Dependent Variable: INDIA

Method: Least Squares

Date: 05/14/16 Time: 15:26

Sample (adjusted): 2 2608

Included observations: 2607 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.055928	0.035104	1.593203	0.1112
R-squared	0.000000	Mean dependent var		0.055928
Adjusted R-squared	0.000000	S.D. dependent var		1.792366
S.E. of regression	1.792366	Akaike info criterion		4.005333
Sum squared resid	8371.969	Schwarz criterion		4.007583
Log likelihood	-5219.952	Hannan-Quinn criter.		4.006148
Durbin-Watson stat	1.871034			

Null Hypothesis: EMERGING is stationary  
 Exogenous: Constant  
 Bandwidth: 5 (Newey-West automatic) using Bartlett kernel

	LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic	0.150208
Asymptotic critical values*:	
1% level	0.739000
5% level	0.463000
10% level	0.347000

\*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	1.777643
HAC corrected variance (Bartlett kernel)	2.392281

KPSS Test Equation  
 Dependent Variable: EMERGING  
 Method: Least Squares  
 Date: 05/14/16 Time: 15:27  
 Sample (adjusted): 2 2608  
 Included observations: 2607 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.030685	0.026118	1.174859	0.2402
R-squared	0.000000	Mean dependent var		0.030685
Adjusted R-squared	0.000000	S.D. dependent var		1.333539
S.E. of regression	1.333539	Akaike info criterion		3.413933
Sum squared resid	4634.316	Schwarz criterion		3.416183
Log likelihood	-4449.061	Hannan-Quinn criter.		3.414748
Durbin-Watson stat	1.572343			

Null Hypothesis: WORLD is stationary  
 Exogenous: Constant  
 Bandwidth: 9 (Newey-West automatic) using Bartlett kernel

	LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic	0.097772
Asymptotic critical values*:	
1% level	0.739000
5% level	0.463000
10% level	0.347000

\*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	1.177207
HAC corrected variance (Bartlett kernel)	1.223316

KPSS Test Equation  
 Dependent Variable: WORLD  
 Method: Least Squares  
 Date: 05/14/16 Time: 15:28  
 Sample (adjusted): 2 2608  
 Included observations: 2607 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.020730	0.021254	0.975341	0.3295
R-squared	0.000000	Mean dependent var		0.020730
Adjusted R-squared	0.000000	S.D. dependent var		1.085200
S.E. of regression	1.085200	Akaike info criterion		3.001789
Sum squared resid	3068.979	Schwarz criterion		3.004039
Log likelihood	-3911.832	Hannan-Quinn criter.		3.002604
Durbin-Watson stat	1.782558			

Null Hypothesis: CURRENCY\_EX is stationary  
 Exogenous: Constant  
 Bandwidth: 13 (Newey-West automatic) using Bartlett kernel

	LM-Stat.
Kwiatkowski-Phillips-Schmidt-Shin test statistic	0.294624
Asymptotic critical values*:	
1% level	0.739000
5% level	0.463000
10% level	0.347000

\*Kwiatkowski-Phillips-Schmidt-Shin (1992, Table 1)

Residual variance (no correction)	0.085416
HAC corrected variance (Bartlett kernel)	0.058517

KPSS Test Equation  
 Dependent Variable: CURRENCY\_EX  
 Method: Least Squares  
 Date: 05/14/16 Time: 15:24  
 Sample (adjusted): 2 2608  
 Included observations: 2607 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.010663	0.005725	1.862549	0.0626
R-squared	0.000000	Mean dependent var		0.010663
Adjusted R-squared	0.000000	S.D. dependent var		0.292316
S.E. of regression	0.292316	Akaike info criterion		0.378420
Sum squared resid	222.6791	Schwarz criterion		0.380671
Log likelihood	-492.2711	Hannan-Quinn criter.		0.379236
Durbin-Watson stat	2.446349			

### Appendix 3: Johansson Co-integration Test

Date: 05/21/16 Time: 14:56  
 Sample (adjusted): 7 2607  
 Included observations: 2601 after adjustments  
 Trend assumption: Linear deterministic trend  
 Series: BANGLADESH INDIA  
 Lags interval (in first differences): 1 to 4

#### Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.168243	933.7757	15.49471	0.0001
At most 1 *	0.160368	454.6328	3.841466	0.0000

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level

\* denotes rejection of the hypothesis at the 0.05 level

\*\*MacKinnon-Haug-Michelis (1999) p-values

#### Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.168243	479.1430	14.26460	0.0001
At most 1 *	0.160368	454.6328	3.841466	0.0000

Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level

\* denotes rejection of the hypothesis at the 0.05 level

\*\*MacKinnon-Haug-Michelis (1999) p-values

#### Unrestricted Cointegrating Coefficients (normalized by b'S11\*b=I):

BANGLADESH	INDIA
-1.249918	0.414801
-0.478257	-1.122631

#### Unrestricted Adjustment Coefficients (alpha):

D(BANGLADES H)	0.747435	0.242988
D(INDIA)	-0.282205	0.731014

1 Cointegrating Equation(s): Log likelihood -10575.36

#### Normalized cointegrating coefficients (standard error in parentheses)

BANGLADESH	INDIA
1.000000	-0.331863 (0.04182)

#### Adjustment coefficients (standard error in parentheses)

D(BANGLADES H)	-0.934232 (0.04344)
D(INDIA)	0.352733 (0.04740)

Date: 05/21/16 Time: 14:59  
Sample (adjusted): 7 2607  
Included observations: 2601 after adjustments  
Trend assumption: Linear deterministic trend  
Series: INDIA BANGLADESH  
Lags interval (in first differences): 1 to 4

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.168243	933.7757	15.49471	0.0001
At most 1 *	0.160368	454.6328	3.841466	0.0000

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level

\* denotes rejection of the hypothesis at the 0.05 level

\*\*MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.168243	479.1430	14.26460	0.0001
At most 1 *	0.160368	454.6328	3.841466	0.0000

Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level

\* denotes rejection of the hypothesis at the 0.05 level

\*\*MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b\*S11\*b=I):

	INDIA	BANGLADESH
	-0.414801	1.249918
	1.122631	0.478257

Unrestricted Adjustment Coefficients (alpha):

D(INDIA)	0.282205	-0.731014
D(BANGLADES H)	-0.747435	-0.242988

1 Cointegrating Equation(s):            Log likelihood       -10575.36

Normalized cointegrating coefficients (standard error in parentheses)

	INDIA	BANGLADESH
	1.000000	-3.013294 (0.14092)

Adjustment coefficients (standard error in parentheses)

D(INDIA)	-0.117059 (0.01573)
D(BANGLADES H)	0.310037 (0.01442)

Date: 05/21/16 Time: 15:04

Sample (adjusted): 7 2607  
 Included observations: 2601 after adjustments  
 Trend assumption: Linear deterministic trend  
 Series: BANGLADESH EMERGING  
 Lags interval (in first differences): 1 to 4

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.170072	945.3110	15.49471	0.0001
At most 1 *	0.162241	460.4428	3.841466	0.0000

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level

\* denotes rejection of the hypothesis at the 0.05 level

\*\*MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.170072	484.8682	14.26460	0.0001
At most 1 *	0.162241	460.4428	3.841466	0.0000

Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level

\* denotes rejection of the hypothesis at the 0.05 level

\*\*MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b'S11\*b=l):

BANGLADESH	EMERGING
-1.048444	-0.886112
0.832053	-1.154422

Unrestricted Adjustment Coefficients (alpha):

D(BANGLADES H)	0.623319	-0.477579
D(EMERGING)	0.365862	0.449089

1 Cointegrating Equation(s):            Log likelihood    -9757.787

Normalized cointegrating coefficients (standard error in parentheses)

BANGLADESH	EMERGING
1.000000	0.845169
	(0.06023)

Adjustment coefficients (standard error in parentheses)

D(BANGLADES H)	-0.653515
	(0.03743)
D(EMERGING)	-0.383585
	(0.02836)

Date: 05/21/16 Time: 15:05  
Sample (adjusted): 7 2607  
Included observations: 2601 after adjustments  
Trend assumption: Linear deterministic trend  
Series: BANGLADESH WORLD  
Lags interval (in first differences): 1 to 4

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.182067	984.0962	15.49471	0.0001
At most 1 *	0.162537	461.3621	3.841466	0.0000

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level

\* denotes rejection of the hypothesis at the 0.05 level

\*\*MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.182067	522.7341	14.26460	0.0001
At most 1 *	0.162537	461.3621	3.841466	0.0000

Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level

\* denotes rejection of the hypothesis at the 0.05 level

\*\*MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b\*S11\*b=I):

BANGLADESH	WORLD
0.635457	1.719855
1.178395	-0.951646

Unrestricted Adjustment Coefficients (alpha):

D(BANGLADES H)		
	-0.387756	-0.681966
D(WORLD)	-0.447435	0.221622

1 Cointegrating Equation(s):                      Log likelihood                      -9256.019

Normalized cointegrating coefficients (standard error in parentheses)

BANGLADESH	WORLD
1.000000	2.706485
	(0.12879)

Adjustment coefficients (standard error in parentheses)

D(BANGLADES H)		
	-0.246403	(0.02348)
D(WORLD)	-0.284326	(0.01368)

Date: 05/21/16 Time: 15:06

Sample (adjusted): 7 2607  
 Included observations: 2601 after adjustments  
 Trend assumption: Linear deterministic trend  
 Series: BANGLADESH CURRENCY\_EX  
 Lags interval (in first differences): 1 to 4

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.178482	958.8596	15.49471	0.0001
At most 1 *	0.158062	447.4990	3.841466	0.0000

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level

\* denotes rejection of the hypothesis at the 0.05 level

\*\*MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.178482	511.3606	14.26460	0.0001
At most 1 *	0.158062	447.4990	3.841466	0.0000

Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level

\* denotes rejection of the hypothesis at the 0.05 level

\*\*MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b\*S11\*b=l):

BANGLADESH CURRENCY_EX	
0.973422	7.174637
0.925101	-6.390915

Unrestricted Adjustment Coefficients (alpha):

D(BANGLADES H)	-0.565507	-0.546982
D(CURRENCY_ EX)	-0.093575	0.087007

1 Cointegrating Equation(s):      Log likelihood      -5786.889

Normalized cointegrating coefficients (standard error in parentheses)

BANGLADESH CURRENCY_EX	
1.000000	7.370531
	(0.41459)

Adjustment coefficients (standard error in parentheses)

D(BANGLADES H)	-0.550477	(0.03508)
D(CURRENCY_ EX)	-0.091088	(0.00568)

Date: 05/21/16 Time: 15:07  
Sample (adjusted): 7 2607  
Included observations: 2601 after adjustments  
Trend assumption: Linear deterministic trend  
Series: CURRENCY\_EX BANGLADESH  
Lags interval (in first differences): 1 to 4

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.178482	958.8596	15.49471	0.0001
At most 1 *	0.158062	447.4990	3.841466	0.0000

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level

\* denotes rejection of the hypothesis at the 0.05 level

\*\*MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.178482	511.3606	14.26460	0.0001
At most 1 *	0.158062	447.4990	3.841466	0.0000

Max-eigenvalue test indicates 2 cointegrating eqn(s) at the 0.05 level

\* denotes rejection of the hypothesis at the 0.05 level

\*\*MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b\*S11\*b=I):

CURRENCY_EX BANGLADESH	
7.174637	0.973422
6.390915	-0.925101

Unrestricted Adjustment Coefficients (alpha):

D(CURRENCY_EX)	-0.093575	-0.087007
D(BANGLADESH)	-0.565507	0.546982

1 Cointegrating Equation(s): Log likelihood -5786.889

Normalized cointegrating coefficients (standard error in parentheses)

CURRENCY_EX BANGLADESH	
1.000000	0.135675
	(0.00786)

Adjustment coefficients (standard error in parentheses)

D(CURRENCY_EX)	-0.671364	(0.04186)
D(BANGLADESH)	-4.057304	(0.25855)

## Appendix 4: Vector Error Correction Model (VECM) test

Vector Error Correction Estimates

Date: 11/11/16 Time: 00:39

Sample (adjusted): 5 2608

Included observations: 2604 after adjustments

Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
BANGLADESH(-1)	1.000000
INDIA(-1)	-12.53954 (0.41970) [-29.8775]
EMERGING(-1)	5.567615 (0.78503) [ 7.09227]
WORLD(-1)	11.55786 (0.88187) [ 13.1060]
CURRENCY_EX(-1)	16.47126 (2.13475) [ 7.71576]
C	0.068700

Error Correction:	D(BANGLADES H)	D(INDIA)	D(EMERGING)	D(WORLD)	D(CURRENCY_ EX)
CointEq1	-0.012716 (0.00381) [-3.33527]	0.077978 (0.00350) [ 22.2882]	0.000342 (0.00264) [ 0.12957]	-0.019930 (0.00229) [-8.69068]	-0.003981 (0.00063) [-6.29327]
D(BANGLADESH(-1))	-0.736984 (0.01866) [-39.4994]	-0.082358 (0.01712) [-4.81002]	-0.001093 (0.01290) [-0.08468]	0.013616 (0.01122) [ 1.21324]	0.001256 (0.00310) [ 0.40568]
D(BANGLADESH(-2))	-0.321217 (0.01850) [-17.3622]	-0.034606 (0.01698) [-2.03833]	0.012096 (0.01279) [ 0.94548]	0.023896 (0.01113) [ 2.14725]	0.000582 (0.00307) [ 0.18952]
D(INDIA(-1))	-0.132806 (0.03922) [-3.38658]	0.001925 (0.03599) [ 0.05350]	0.025572 (0.02712) [ 0.94299]	-0.159431 (0.02359) [-6.75879]	-0.033949 (0.00651) [-5.21771]
D(INDIA(-2))	-0.073369 (0.02847) [-2.57720]	-0.009142 (0.02612) [-0.34994]	0.016391 (0.01969) [ 0.83258]	-0.058313 (0.01712) [-3.40527]	-0.013966 (0.00472) [-2.95686]
D(EMERGING(-1))	0.055500 (0.04831) [ 1.14880]	-0.437326 (0.04433) [-9.86441]	-0.826147 (0.03341) [-24.7290]	-0.008648 (0.02906) [-0.29760]	0.022586 (0.00802) [ 2.81769]
D(EMERGING(-2))	0.049767	-0.265842	-0.388977	-0.056564	0.010756

	(0.04453)	(0.04086)	(0.03079)	(0.02679)	(0.00739)
	[ 1.11761]	[-6.50559]	[-12.6320]	[-2.11174]	[ 1.45587]
D(WORLD(-1))	0.137306	-0.254302	0.525043	-0.328411	0.022189
	(0.05246)	(0.04814)	(0.03628)	(0.03155)	(0.00870)
	[ 2.61742]	[-5.28258]	[ 14.4735]	[-10.4077]	[ 2.54931]
D(WORLD(-2))	0.080225	-0.052667	0.249433	-0.171735	0.010540
	(0.04762)	(0.04370)	(0.03293)	(0.02864)	(0.00790)
	[ 1.68470]	[-1.20520]	[ 7.57458]	[-5.99544]	[ 1.33396]
D(CURRENCY_EX(-1))	0.216769	-0.823347	0.099691	0.309218	-0.779358
	(0.11596)	(0.10642)	(0.08019)	(0.06975)	(0.01924)
	[ 1.86927]	[-7.73691]	[ 1.24316]	[ 4.43291]	[-40.5059]
D(CURRENCY_EX(-2))	0.099225	-0.303189	0.092290	0.184288	-0.371328
	(0.10990)	(0.10085)	(0.07600)	(0.06611)	(0.01823)
	[ 0.90285]	[-3.00620]	[ 1.21434]	[ 2.78767]	[-20.3638]
C	0.003653	0.001648	0.001128	0.000136	-2.30E-05
	(0.03985)	(0.03657)	(0.02756)	(0.02397)	(0.00661)
	[ 0.09166]	[ 0.04505]	[ 0.04094]	[ 0.00568]	[-0.00349]
R-squared	0.393217	0.423316	0.296560	0.290994	0.458188
Adj. R-squared	0.390642	0.420869	0.293574	0.287986	0.455888
Sum sq. resids	10718.71	9026.543	5125.719	3878.298	295.0725
S.E. equation	2.033545	1.866136	1.406241	1.223216	0.337401
F-statistic	152.7006	172.9696	99.34070	96.71133	199.2676
Log likelihood	-5537.171	-5313.459	-4576.659	-4213.565	-859.7030
Akaike AIC	4.262036	4.090214	3.524316	3.245441	0.669511
Schwarz SC	4.289063	4.117241	3.551342	3.272468	0.696538
Mean dependent	-9.57E-06	0.000929	0.000578	-0.000247	6.28E-05
S.D. dependent	2.605058	2.452194	1.673118	1.449635	0.457407
Determinant resid covariance (dof adj.)		1.149588			
Determinant resid covariance		1.123343			
Log likelihood		-18626.01			
Akaike information criterion		14.35562			
Schwarz criterion		14.50201			

Dependent Variable: D(BANGLADESH)

Method: Least Squares

Date: 11/11/16 Time: 00:41

Sample (adjusted): 5 2608

Included observations: 2604 after adjustments

$$D(BANGLADESH) = C(1)*( BANGLADESH(-1) - 12.5395419259*INDIA(-1) + 5.56761458253*EMERGING(-1) + 11.5578567301*WORLD(-1) + 16.4712598245*CURRENCY_EX(-1) + 0.0686999054475 ) + C(2)*D(BANGLADESH(-1)) + C(3)*D(BANGLADESH(-2)) + C(4)*D(INDIA(-1)) + C(5)*D(INDIA(-2)) + C(6)*D(EMERGING(-1)) + C(7)*D(EMERGING(-2)) + C(8)*D(WORLD(-1)) + C(9)*D(WORLD(-2)) + C(10)*D(CURRENCY_EX(-1)) + C(11)*D(CURRENCY_EX(-2)) + C(12)$$

	Coefficient	Std. Error	t-Statistic	Prob.
<b>C(1)</b>	<b>-0.012716</b>	0.003812	-3.335270	<b>0.0009</b>
C(2)	-0.736984	0.018658	-39.49937	0.0000
C(3)	-0.321217	0.018501	-17.36222	0.0000
C(4)	-0.132806	0.039215	-3.386585	0.0007
C(5)	-0.073369	0.028468	-2.577201	0.0100
C(6)	0.055500	0.048311	1.148802	0.2507
C(7)	0.049767	0.044529	1.117614	0.2638
C(8)	0.137306	0.052458	2.617421	0.0089
C(9)	0.080225	0.047620	1.684699	0.0922
C(10)	0.216769	0.115965	1.869267	0.0617
C(11)	0.099225	0.109902	0.902852	0.3667
C(12)	0.003653	0.039851	0.091657	0.9270
R-squared	0.393217	Mean dependent var		-9.57E-06
Adjusted R-squared	0.390642	S.D. dependent var		2.605058
S.E. of regression	2.033545	Akaike info criterion		4.262036
Sum squared resid	10718.71	Schwarz criterion		4.289063
Log likelihood	-5537.171	Hannan-Quinn criter.		4.271828
F-statistic	152.7006	Durbin-Watson stat		2.168757
Prob(F-statistic)	0.000000			

## Appendix 5: Wald test

### *India to Bangladesh*

Wald Test:  
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	5.775050	(2, 2592)	0.0031
Chi-square	11.55010	2	0.0031

Null Hypothesis: C(4)=C(5)=0  
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(4)	-0.132806	0.039215
C(5)	-0.073369	0.028468

Restrictions are linear in coefficients.

### *Emerging to Bangladesh*

Wald Test:  
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	0.816196	(2, 2592)	0.4422
Chi-square	1.632392	2	0.4421

Null Hypothesis: C(6)=C(7)=0  
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(6)	0.055500	0.048311
C(7)	0.049767	0.044529

Restrictions are linear in coefficients.

*World to Bangladesh*

Wald Test:  
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	3.432181	(2, 2592)	0.0325
Chi-square	6.864362	2	0.0323

Null Hypothesis: C(8)=C(9)=0  
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(8)	0.137306	0.052458
C(9)	0.080225	0.047620

Restrictions are linear in coefficients.

*Currency exchnage rate to Bangladesh*

Wald Test:  
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	1.788874	(2, 2592)	0.1674
Chi-square	3.577747	2	0.1671

Null Hypothesis: C(10)=C(11)=0  
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(10)	0.216769	0.115965
C(11)	0.099225	0.109902

Restrictions are linear in coefficients.

## Appendix 6: Impulse Response test

Vector Autoregression Estimates

Date: 05/21/16 Time: 15:43

Sample (adjusted): 4 2607

Included observations: 2604 after adjustments

Standard errors in ( ) & t-statistics in [ ]

	BANGLADESH	CURRENCY_EX X
BANGLADESH(-1)	-0.087974 (0.01944) [-4.52459]	-0.002509 (0.00316) [-0.79448]
BANGLADESH(-2)	0.039539 (0.01942) [ 2.03623]	-0.003378 (0.00315) [-1.07099]
CURRENCY_EX(-1)	-0.299326 (0.12058) [-2.48229]	-0.236368 (0.01959) [-12.0682]
CURRENCY_EX(-2)	-0.010520 (0.12073) [-0.08714]	-0.054349 (0.01961) [-2.77156]
C	0.054465 (0.03443) [ 1.58206]	0.013810 (0.00559) [ 2.46962]
R-squared	0.012483	0.053430
Adj. R-squared	0.010963	0.051973
Sum sq. resid	7982.288	210.5897
S.E. equation	1.752510	0.284653
F-statistic	8.213458	36.67585
Log likelihood	-5153.386	-420.5263
Akaike AIC	3.961894	0.326825
Schwarz SC	3.973155	0.338086
Mean dependent	0.049089	0.010508
S.D. dependent	1.762197	0.292351
Determinant resid covariance (dof adj.)		0.248751
Determinant resid covariance		0.247796
Log likelihood		-5573.348
Akaike information criterion		4.288286
Schwarz criterion		4.310808