A Test of Market Efficiency When Short Selling is Prohibited: A Case of the Dhaka Stock Exchange

by

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Abstract

This study investigates the impact of an absence of short-selling practice on stock price efficiency in the Dhaka Stock Exchange (DSE). I estimate the sign and magnitude of runs ranging from one-day to twenty-day-long runs in daily returns of the benchmark index and twenty one most liquid stocks over the sample period. I also present a similar analysis for the Dow-Jones Industrial Average Index and thirty Dow-Jones stocks for a comparative purpose. In each case of DSE and Dow-Jones, I establish the statistical significance of the results from a Monte-Carlo Simulation which illustrates the random walk price behavior of stocks. I find that unlike Dow-Jones, the number of five-day and longer runs for negative returns in DSE is statistically significant and abnormally higher than their positive counterpart. The conclusion supports prior evidence that in a market where short-selling is not allowed, prices adjust slowly for negative information because the absence of short selling suppresses the action of pessimists and not the optimists.

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Chapter I: Introduction

Short-selling is a popular practice in many developed markets and ensures improvement of market liquidity and the efficient price discovery process. Many emerging markets suffer from a lack of liquidity as a consequence of a relatively small size, inefficient market structure, high transaction costs and weak financial institutions. This illiquidity problem is further aggravated by prohibiting short-selling or making it costlier. The intuition behind imposing restriction on short-selling was always questioned by academics, primarily because of the effect such restrictions have on the efficiency of the market. Miller (1977), Diamond and Verrechia(1987) , Duffie, Garlenu and Pedersen (2002) and Bai, Cheung, and Wang(2006) all present theories suggesting that prices may not fully reflect information when agents have heterogeneous beliefs but some of them are prevented from trading to express those beliefs. Lamont (2012) finds practical evidence of large information inefficiency when he estimates 2.4 percent monthly alpha to a portfolio of short-selling-constrained stocks.

Bangladesh is one of the fastest growing emerging stock markets in South Asia. Despite having in place Dhaka Stock Exchange Short-Sale Regulation 2006, the stock market of Bangladesh has never been allowed shot-selling in its history of operation. Researchers, regulators and other market professionals share equal concern on the contribution of short-selling in improving price efficiency of listed stocks in both Dhaka and Chittagong Stock Exchanges and the overall prospect of the capital market. Although there are debates on the restriction of short-selling, prior research contains time periods with temporary bans in short-selling and also with a restricted list of stocks. There has rarely been any study on the impact of short selling on price dynamics in a market which has never experienced short-selling like the market in Bangladesh.

The motivation arises from the perception that an absence of short-selling would result in a slow adjustment of negative information. Hence, the longevity of the negative returns is a concern here. Unlike the stocks of a developed equity market like the USA where short selling accounts for roughly one-quarter of all trading and thus suggesting shorting is a key determinant

of stock prices[1], the trend in the negative returns in the stocks in Dhaka stock Exchange are expected to be longer than the trend in the positive returns. In this study, the persistence of returns is captured by the length and number of runs of both positive and negative returns. The model nests on testing hypotheses of statistical independence of prices with the actual number of runs and expected number of long runs of a random price behavior.

I have analyzed the actual number of runs in first, the benchmark index of Dhaka Stock exchange and second, the twenty one most liquid stocks of the exchange using daily price information for the sample period. I have then presented comparative statistics for Dow Jones Industrial Average Index (DJIA) and thirty blue-chip Dow Jones stocks. The behavior of a random walk in each market is depicted by results from Monte Carlo Simulations with a respected probability of success for each case. The statistical tests in this study define the boundary of estimating an abnormal number of long positive and negative runs. Our specific interest is the set of five-day and longer runs. An absence of short-selling should give rise to a greater number of long negative runs than the number long positive runs, the number of negative runs from a market allowing short-selling and also from a random-walk model. My research question is to investigate if this proposition is true.

The results from this research are very important in the advancement of the price efficiency process for the stock market of Bangladesh at a market operation and regulatory level. Experts explain that an absence of short-selling makes the market micro-structure asymmetric favoring buyers, making the market much more vulnerable to such speculative bubbles, pushing prices to extremely high levels which can then result in a much more violent collapse. Bangladesh has recently experienced a long recovery from the burst of a speculative bubble. Ever since the price debacle, Bangladesh Securities and Exchange Commission (BSEC) has been bringing new laws and amendments in regulations governing every facet of better market mechanism, transparency, and accountability and investor confidence. My conclusion holds significant evidence for BSEC to reinforce and enact the regulation of allowing short-selling, strengthen the necessary infrastructure for supervising, monitoring and updating the additional pool of information from daily lending and settlements.

My findings contribute to the literature by providing evidence of the existence of statistically significant long negative runs in a stock market where short-selling was never

[1] Diether, Lee, and Werner (2009)

allowed. Also, prior studies of runs tests present a statistical comparison of a total number of runs and do not take into consideration the magnitude and the sign of runs together. This study clearly distinguishes runs in each market's indices and stocks, ranging from a one day run to twenty-day runs and whether the runs are due to the positive returns or the negative returns. The conclusion from this study opens the platform to investigate in future the overpricing hypothesis, the speed of price adjustment to bad news and predictive power of winner and loser stocks in Bangladesh equity market and other similar emerging markets. The results also hold implications on the idiosyncratic risk of individual stocks and the benefit of portfolio diversification from an index pricing.

Chapter III: Literature Review

Miller (1977) suggests that existence of short-sale constraints could prevent the adjustment process of negative information into stock prices. His analysis is based upon the presence of heterogeneous beliefs or information regarding the value of the security and the inability of pessimists to administer their beliefs or information due either to prohibitions on or high costs of short selling. Miller concludes that stocks with short-sale constraints would be relatively overvalued. The simple explanation is shorting restrictions shuts the pessimists out of the market, and thus when setting prices optimists do not take into account the absence of pessimistic information. Prices thus become too high.

There are two main channels through which short-selling constraints can affect both stock prices and real corporate decisions. Studies in addition to Miller (1977) are Harrison and Kreps (1978), Ahmed F.M and Ali M.B. (2013),, and Postlewaite (1993), Chen, Hong, and Stein (2002), Scheinkman and Xiong (2003), and Hong and Stein (2003) all of which demonstrate that short selling constraints can lead to overvaluation by making it harder for prices to reflect negative information. Gilchrist, Himmelberg, and Huberman (2005) show that this overvaluation can cause overinvestment by artificially reducing the firm's cost of capital. All this suggests that, in the presence of overvaluation, removing short-selling constraints should lead to lower stock prices and investment.

While there is some evidence that short-selling restrictions lead to stock overvaluation (e.g., Jones and Lamont (2002), Ofek, Richardson, and Whitelaw (2004), and Cohen, Diether, and Malloy (2007)), other studies find that short selling constraints have only an insignificant effect on prices (e.g., Battalio and Shultz (2006), Diether, Lee, and Werner (2009), Beber and Pagano (2013), and Kaplan, Moskowitz, and Sensoy (2013)). In this paper, I dive into those previous studies which support the necessity of short selling to impound negative information quickly into stocks prices.

Diamond and Verrecchia (1987) clearly explains that short sellers are more likely to be informed, as they would never initiate a short sale for liquidity reasons. The empirical evidence in the literature advocates this hypothesis uniformly. Dechow et al. (2001), Desai, Krishnamurthy, and Venkataraman (2006), Cohen, Diether, and Malloy (2007), and Boehmer,

Jones, and Zhang (2008) show that in aggregate short sellers appear to trade based on) fundamental information, and they manage to earn excess returns. Aitken, Frino, McCorry, and Swan (1998) show that in Australia, short sales have a larger impact on price than regular-way sales and the market identifies short selling immediately as such upon execution.

Generally, the evidence supports the models with differences in beliefs rather than the rational expectations. When information which is possessed by the short seller is not incorporated into prices because shorting is costly, difficult, or prohibited, stocks can get overvalued as the evidence supports. For example, Lamont and Thaler (2003) and Mitchell, Pulvino, and Stafford (2002) show that during the late 1990's, spinoffs in the tech sector were so overpriced that arbitrage should have been possible, but short positions were very difficult to establish. Pontiff (1996) provides similar evidence for closed-end funds. Jones and Lamont (2002) show that in the 1920's and 1930's, stocks that were expensive to short had abnormally low future returns, even after accounting for shorting costs.

There is also growing literature on post-earnings announcement drift and impact of short selling on market efficiency around earnings announcement. Empirical work on shorting behavior in the context of post-earnings announcement drift (PEAD) is very limited. Using monthly short interest data, Cao et al. (2007) find relatively weak evidence that short sellers reduce drift, but Lasser, Wang, and Zhang (2010) argue that short interest is not related to PEAD in the expected manner. Even with intraday shorting flows, Zheng (2009) finds no evidence that short sellers affect PEAD. Berkman and McKenzie (2012) find that short selling (proxied by loaned shares in the equity lending market) increases after negative earnings shocks, but conclude that it does not remove long-term PEAD measured over the quarter following the earnings announcement. There is no regular earnings announcement date for the listed companies in Bangladesh and hence there exists a very few number of studies on post-earnings announcement for the absence of a consistent event window.

Chang, Luo and Ren (2014) studies the effect of temporary lift of ban of short selling based on a pilot scheme launched in March 2010 for stocks on a designated list. They find that stocks experience negative returns when added to the list. After the ban is lifted, price efficiency increases while stock return volatility decreases. They also conclude that intensified short-selling activities are associated with improved price efficiency and predictive future returns. Short-

sellers eliminate overpricing by selling stocks with higher contemporaneous returns followed by a downward trend.

Impact of short selling restrictions on market dynamics:

A large number of researchers have studied the effect on market dynamics due to the imposition of short sale constraints or complete prohibition of short selling. Ho (1996) finds an increase in stock return volatility when short sales were restricted during the Pan Electric crisis in the Singapore market in 1985-1986. Shorting restrictions also affect liquidity along with the adjustment of prices to new information. Diamond and Verrecchia (1987) predict that prices will adjust more slowly to negative information if there are shorting constraints. Reed (2007) finds an asymmetric price adjustment in response to information about earnings, and Bris, Goetzmann, and Zhu (2007) find that downward price moves are slower in markets where shorting is prohibited. Using weekly data on share lending supply and borrowing fees from 26 markets, Saffi and Sigurdsson (2007) show that less constrained firms (proxied by high lending supply and a low borrowing fee) are more efficiently priced in that they have shorter price delays. Boehmer and Wu (2008) document that short selling makes prices more informationally efficient and reduces post-earnings announcement drift. Using data on DotComs, Ofek and Richardson (2003) show that short sales constraints, in the form of stock option lock–ups, have considerable and persistent negative impact on subsequent stock returns, also supporting the argument that stock prices do not fully incorporate information under short sales constraints.

Hong and Stein (2003) develop a heterogeneous agent model linking short sales constraints to market crashes. They explain that if some investors are constrained from selling short, their accumulated unrevealed negative information will not manifest until the market begins to drop, which further aggravates market declines and leads to a crash. They compare their findings with the observation that the U.S. market displays negative skewness.

Diether, Werner, and Lee (2009) find that the 2005 pilot program to suspend price tests in the U.S. slightly worsens some measures of market quality, and Boehmer, Jones, and Zhang (2009) find that market quality worsens further when the uptick rule is repealed completely.

There are a few key empirical studies that seek to understand the impact of short sales regulations on return distributions and price efficiency of international markets and fewer on emerging markets. Aitken et al. (1998) offer evidence from the Australian Stock Exchange suggesting that short sales trades reflect significant bad news about companies. Biais et al. (1999) find that the spot market in the Paris Bourse, which is subject to leverage and short sales constraints, reflects good news significantly faster than bad news. Li and Fleisher (2002), using Chinese stock market data, find that the dispersion of domestic analysts' forecasts is negatively correlated to stock returns in the A-share market, where short sales restrictions are binding, and not significantly related to the return of B-shares where short sales restrictions are not binding. All of these studies have concern a large array of markets where short sale is either partially prohibited for a specific group of stocks or temporarily banned in the market.

Jain, Jain, McInish and McKenzie (2011) study short-selling restrictions around the world and stock borrowing using several datasets that capture short selling regulations, actual short-selling activity, and outstanding short interest in stocks from 82 countries. One of their findings is that portfolio of ADRs from restrictive countries underperforms the portfolio of ADRs from unrestrictive countries. Table 1 is an excerpt from their study. I have updated information on the short-selling regulation of few countries.

Fantazzini and Maggi (2011) reviews short selling practices in emerging markets and market performances during the global financial crisis. In contrast to developed markets, many emerging countries do not permit short selling, which can pose severe limitations on market liquidity. They compare market volatility, the Sharpe ratio, maximum drawdown, and skewness across different countries from May 2002 to November 2010. Moreover, they also suggest that the impact of a market crash is generally weak in countries where short selling is allowed.

Sobaci, Sensoy and Ertuk (2014) studies the stock exchange of Turkey with daily short sale data of Borsa Istanbul and examines the dynamic relationship between short selling activity and volatility, liquidity and market return from January 2005 to December 2012 using a VAR(p)-cDCC-FIEGARCH(1,d,1) approach. They suggest that short sellers are contrarian traders and contribute to efficient stock market in Turkey. They also find evidence supporting that increased

short selling activity is associated with higher liquidity and decreased volatility except during the financial crisis of 2008. Theirs results also indicate that any ban on short sales may have a detrimental effect on financial stability and market quality in Turkey.

My study contributes to the previous literature through analyzing the persistence of negative returns in the top most liquid stock of a market which never experienced the practice of short selling. The research work is also motivated from the ability to compare with the return distributions of Dow Jones Stocks.

Run Tests

Many studies have employed run tests in a similar framework for verification of the weak-form efficiency of the U.S. and other countries' stock markets, such as the studies by Fama (1965), Sharma and Kennedy (1977), Cooper (1982), Chiat and Finn (1983), Wong and Kwong (1984), Yalawar (1988), Ko and Lee (1991), and Thomas (1995). These studies typically find that in most markets (except Hong Kong, India, Kuwait and Saudi Arabia), the null hypothesis is not rejected.

Nisar and Hanif (2012) studies the weak form of efficient market hypothesis on the four major stock exchanges of South Asia including, India, Pakistan, Bangladesh and Sri Lanka by using historical index values on a monthly, weekly and daily basis for a period of 14 Years (1997-2011). They apply four statistical tests including runs test, serial correlation, unit root and variance ratio test. Their findings suggest that none of the four major stock markets of south-Asia follows random-walk and hence all these markets are not weak form efficient.

Ananzeh (2014) examines random walk hypothesis and tests the weak-form efficiency of stocks in Amman Stock Exchange (ASE) in Jordan by using several parametric and non-parametric tests including Jarque-Bera test, run tests and Phillips Peron test on daily stock prices. His results reject the random walk-hypothesis and conclude that the particular market is not weak form efficient.

Some practical market viewpoints rebuke short sellers as the main culprits who can exacerbate market crashes. Most academic researchers, nevertheless, make a strong theoretical case for allowing short sales in markets. Recent empirical evidence by researchers provides some support

for the hypothesis that difficulty or inability in short selling is associated with security mispricing thus hindering market efficiency. Bangladesh stock market is struggling to be even weak form efficient. In a market setting with a rapid pace of growth in market capitalization, advancement in regulation increasing transparency and accountability, trading technologies and financial literacy of the stakeholders, introduction of short-selling is a time's demand to bring better price discovery of the assets.

Test of Efficiency in Bangladesh Stock Market

The evidence from the wide range of studies concerning the efficiency hypothesis of Bangladesh stock market in the literature are mixed. The studies such as, Chowdhury (1994), Hassan, Islam and Basher (1999), Hassan and Maroney, (2004), Ainul and Khaled, (2005), Kader and Rahman (2005), Alam, Alam and Uddin (2007), Uddin and Alam (2007), Mobarek, Mollah and Bhuyan (2008), Uddin and Khoda (2009) do not support the weak form of efficiency of Bangladesh's Dhaka Stock Exchange market. There have been also a very few studies such as Hassan, and Chowdhury, (2008), Uddin and Shakila (2008) which support the existence of weak form efficiency of Bangladesh stock market. Basher, Hassan, and Islam (2008) used the GARCH model in order to find the relationship between risk and return over the past decades of DSE. This disagreement regarding the efficiency market hypothesis has generated research interest in this topic.

Hossain (2011) investigated the stock return behavior of DSE indices, the informational efficiency of the market, the relationship between volatility and returns using the GARCH-M model. The empirical analysis found that irrespective of the indices examined, the stock returns of DSE were skewed, had excess kurtosis and were not normally distributed. The results of ACF, ADF, PP tests and ARIMA models showed the existence of deviations from market efficiency in the pricing of equities.

Ahmed and Ali (2013) investigated a sample of stocks in Dhaka Stock exchange between November 27, 2011 and December 31, 2010. They applied Run test, L-B-Q test and Multiple Variance ratio on 2233 daily, 402 weekly and 106 monthly observations to examine whether DSE Gen index follows random walk or not. They found that for short term data i.e., daily data, DSE Gen was non-random but for longer term data, i.e., weekly and monthly data, the same

variable was found to be random. This led them to conclude that Bangladesh stock market is not weak form efficient for shorter time horizon but for longer time horizon.

Bose, Uddin and Islam (2014) designs a study to test weak form of efficiency by concentrating on following the random walk model for Dhaka Stock Exchange and Chittagong Stock Exchange. They conclude that the return series of sample stocks in both of the market do not follow the normal distribution. ARIMA (time series) forecasting strengthens the non-random nature of Dhaka stock Exchange and Chittagong Stock Exchange.

This study contributes to the existing literature of short selling, in general, and efficiency tests of the stock market of Bangladesh in the following ways. The rich pool of research on the impact of short-selling and no-short selling has been based on markets which have legal short selling practice and experienced temporary ban for a period to give rise to the research window. Other studies are based on restricted list of stocks facing a ban of short selling or higher cost of short selling so that their trading strategies, bid-ask spreads and price adjustment can be compared with similar stocks with no restriction of short-selling in the same market. For example, the dual class of shares in Chinse stock markets has different eligibility of short selling despite having prohibited short-selling environment for a long time. Previous studies of runs tests do not deal with the magnitude of runs while this study clearly distinguishes runs ranging from a one day run to twenty-day runs and whether the runs are due to the positive returns or the negative returns. This study designs a very simple model of to test the effect of no-short selling in a market that does not have a) intra-day trading data, b) regular earnings announcement dates to test for excess abnormal returns or drifts necessary for an event study c) data on margin trading and d) analyst forecasts and thus, makes it impossible to utilize the advanced empirical analytical models discussed in the literature of short selling. The findings of this study present a very compelling evidence of inefficiency due to not having short-selling in practice in Dhaka Stock Exchange and draws the attention of capital market specialists, regulators, and academicians towards the significance of short-selling as a tool to improving information efficiency in a frontier market like Bangladesh.

Chapter III: Methodology

3.1 Data

The data set consists of daily prices 30 Dow Jones stocks and 21 most liquid stocks listed in Dhaka Stock Exchange and daily index prices of Dow Jones Industrial Average and DSEX for their respective sample periods. For the sample stocks, the sample period starts from January 1999 to December 2014 creating a data set of 4000 daily prices for each case. For the indices, the sample period starts from January 2002 to December 2014. The choice of index and the construction of daily return series seek some explanation here. DS20 index was not used because it was rebalanced just once as per its criteria since its introduction to the market. The index starts from the year 2001 and consists of 20 blue chip stocks. As discussed previously, DS30 came into existence in January 2013. The returns of the two indices could not be merged and used for this particular study as the number of constituents stocks, construction and rebalancing methodology are very different for both of the indices. Hence, to gauge the characteristic of the entire market, the broad index of DSE is used which represent 97% of the market. This index is also the benchmark index for the sample of liquid stocks used in the analysis. The free-float broad index came into operation since January 2013. The previous broad index was named as DSE General Index or DGEN, return series of which is used since December 2002 till July 2013, the last day of its existence. Just the way DSEX completely replaced DGEN in the market operation since the demise of DGEN, the return series of DSEX is used from August 2013 as the return of the general (broad) index for our analysis. Therefore, from this point and onward, the term, DSEX will be representing the both DGEN and DSEX in their respective time along the sample period. The most eligible stocks for short-selling are those which are overvalued stocks. Short-sellers attempt to profit by shorting stocks which they believe are overvalued, just as traditional long investors try to profit by owning undervalued stocks. In order to identify overvalued stocks, I need average analyst forecast and factor models. One of the biggest limitations to this examination is the unavailability of analyst forecasts in Dhaka Stock Exchange. Hence, I switch my focus to stocks which have the least restriction to short sell and those which are widely followed and thus open to both favorable and contrary market opinions.

The uptick rule by US SEC and other short-selling regulation across developed stocks markets in the world indicate that the liquidity of stocks is a prime criterion which determines its eligibility for short-selling. Usually, stocks which are large and have high daily trading volume have the lowest cost of short-selling and are most suited to belong to the list of eligible stocks. Hence, market capitalization and average daily trading volume are used as input for filtering stocks. This filtering helps me to shortlist 21 most liquid stocks that existed in Dhaka Stock Exchange over the sample period. The adjusted daily prices of the stocks are used to calculate daily returns over 4000 trading days and runs starting from 1-day runs to 20-day-runs are calculated for each stock. Data for this study are collected from the secondary sources. Daily price data for the index and stocks of Dhaka Stock Exchange are collected from Dhaka Stock Exchange library. Prices are adjusted for cash and stock dividends, splits, bonus and right shares. Daily adjusted price data for the Dow-Jones Industrial Average index and Dow-Jones stocks are collected from Yahoo Finance. For the review of the literature in relevant published articles and working papers, I used the e-library of Social Science Research Network. For designing the analytical model, I read sample experiment from the book *Resampling Stats* and used a licensed version of Crystal Ball in the computer lab of the department of Finance of Auburn University to run the simulations.

3.2 Analytical Framework

I have designed a model of runs to execute non-parametric statistical tests whereby the number of sequences of consecutive positive and negative returns is tabulated and compared against its sampling distribution under the random walk hypothesis. For example, the following time series of price changes, where U is an increase and D is a decrease would result in the following runs:

UUU DD U DDD UU DD U D UU DD U DD UUU DD UU D UU D

There were 18 runs in this price series of 33 periods. A run is defined as the repeated occurrence of the same value or category of a variable. It is indexed by two parameters, which are the type of the run and the length. In the above example, there are 2-day increases and 2 day decreases in returns. Stock price runs can be positive, negative, or have no change. The length is how often a run type occurs in succession.

With the mechanism of counting daily runs for positive and negative returns as shown in figure 2, I tabulate the number of runs in the following return series:

- DSEX Index
- DJIA Index
- Each of 21 DSE Stocks
- Each of 30 Dow-Jones Stocks

For the statistical tests, a bootstrap procedure is used to create an observed distribution of runs from a random walk model. The run distribution for n day positive and negative runs is created from Monte Carlo simulation of 10,000 trials where the existence of expected number of n day positive and negative runs are estimated along with their 95% confidence interval. The runs range from 1-day run to 20-day runs. I use n+ to denote n day persistence of positive returns and n- to denote n day persistence of negative returns, e.g., 1+, 1-…5+,5-…10+,10- etc. The stock price behavior of random walk is estimated with the help of a Bernoulli distribution and a probability of a positive return (success), p, over the sample period. The value of p is customized for each set of hypothesis.

Before the simulation is executed a trial is designed with the necessary inputs which identifies not only the length of the runs but also the sign of the runs in the indices and the sample stocks of Dow Jones and DSE. With the help of Crystal Ball application, the simulation is executed and resulting run distributions are obtained.

3.3 Research Objectives

The primary objective of my thesis is to investigate the impact of an absence of short-selling practice on stock price efficiency in Dhaka Stock Exchange with a comparison from results of a developed equity market like the USA which allows short-selling. The specific objectives of my thesis are as follows:

I. To test if daily prices in DSEX and DJIA are independent and cannot be predicted
II. To identify the distribution of runs in prices of DJIA and Dow-Jones Stocks given the fact that the US market allows short-selling
III. To examine the distribution of runs in prices of DSEX and DSE stocks given short-selling is not allowed in Bangladesh
IV. To check for the existence of long negative runs in the stock prices in Dhaka Stock Exchange given short-selling is not allowed in Bangladesh

3.4 Hypotheses

In order to fulfill my research objectives, I test the following hypotheses:

$H1_a$: The prices in Dow Jones Industrial Average are statistically independent

$H1_b$: The prices in DSEX are statistically independent

$H2_a$: The numbers of negative and positive runs in the DJIA are not significantly different from expected

$H2_b$: The numbers of negative and positive runs in the DSEX are not significantly different from expected

H3: The numbers of negative and positive runs in the DJ stocks are not significantly different from expected given the probability of success of average Dow Jones Stocks

H4: The numbers of negative and positive runs in the DSE stocks are not significantly different from expected given the probability of success of average DSE Stocks

Chapter IV: Overview of Dhaka Stock Exchange

4.1 A brief historical account of the stock market of Bangladesh

The stock market history of Bangladesh refers back to 28 April 1954 when the East Pakistan Stock Exchange Association Ltd. was established. Formal trading began on the bourse in 1956. The Dhaka Stock Exchange is the prime stock exchange of Bangladesh. Dhaka Stock Exchange basically started with the formation of the Provincial Industrial Advisory Council. Initially, it was named the East Pakistan Stock Exchange Association Ltd. It was revised in 1964 and since then it has used the present name. Although the Dhaka Stock Exchange was incorporated in 1954 it started trading formally from 1956.

Trading in the Dhaka Stock Exchange discontinued for a span of five years following the liberation war of 1971. In 1976, there were nine listed companies in Dhaka Stock Exchange with a paid up capital of Tk 137.52 million. The Dhaka Stock Exchange actually witnessed high growth in 1983 when the market capitalization reached Tk. 812 million. By 1987, there was a surge in the market size with the number of listed companies shooting up to 92. With the openness of the economy in the 1990s, there has also been rapid development in the Dhaka Stock Exchange (Chaity and Sharmin, 2012). The second stock exchange of the country, the Chittagong Stock Exchange (CSE) was established in December 1995. In order to control operation of the stock exchanges and trading of stocks of listed companies, the government of Bangladesh established the Securities and Exchange Commission (SEC) of Bangladesh on 8th June 1993 under the Securities and Exchange Commission Act, 1993. The mission of the SEC is to protect the interests of securities investors, develop and maintain fair, transparent and efficient securities markets, ensure proper issuance of securities and compliance with securities laws.

Just like crashes in the US stocks markets in the year 1987 (Black Monday), 2000(Dotcom Bubble), 2007-2009, 2010 (Flash Crash), Bangladesh has had its share of stock market busts. From the inception, the stock market of the country was growing at a slow pace. There was a large surge in the stock market in the year 1996 evidenced by a 197.43%, 372.30 % and 370.51% increase in the market capitalization, total annual turnover and daily average turnover respectively in DSE and 506.63%, 210.2% and 615.15% increase in the market capitalization,

total annual turnover and daily average turnover in CSE. DSE general index grew from 832 on January 1, 1996, to 3567 on November 14, 1996, while that of CSE grew from 409.4 in 1995 to 1157.9 in 1996. The market, however, collapsed in December of 1996 and the index started to decline significantly since then, with the index of DSE assuming a value of 507.33 as of November of 1999, resulting in a cumulative decline of 83.44 %from 1996 to 1999 with the annual rate of 27.82 percent. Investors' confidence was significantly damaged because of excessive speculations, allegedly aggravated by widespread irregular activities. The government of Bangladesh undertook the Capital Market Development Program (CMDP) supported by the ADB on 20 November 1997. The CMDP aimed at (i) strengthening market regulation and supervision, (ii) developing the stock market infrastructure, (iii) modernizing stock market support facilities, (iv)increasing the limited supply of securities in the market, (v) developing institutional sources of demand for securities in the market, and (vi) improving policy coordination. Central Depository Bangladesh Limited (CDBL) was incorporated as a public limited company on 20th August 2000 to operate and maintain the Central Depository System (CDS) of Electronic Book Entry. Before the establishment of CDBL, the delivery, settlement and transfer procedures were handled manually and were obstructed by lengthy delays, risks of damage, loss, forgeries, duplication and considerable investment in time and capital. Both of the national stock exchanges adopted the Automated Trading system in the year 1998(CSE, July 1998 and DSE August 1998). This floor-less trading system put an end to the open outcry system.

Following a bull run in 2010, the Dhaka Stock Exchange (DSE) crashed in December 2010 and by March 2011 the index had fallen by half from its all-time high, wiping out large share value gains. The collapse also underscored the vulnerability of Bangladesh's capital markets and confirmed the pressing need for reforms. At the end of 2010, DSE enhanced its ICT Infrastructure Capacity to six hundred thousand trades per day. In the year 2012, the Government of Bangladesh undertook the ADB financed Second Capital Market Development Programme(CMDP2) and DSE upgraded its existing trading application to MSA plus to cope up with the potential growth of the trades. The trading session occurs in five parts- the pre-opening session, opening session, continuous or regular trading session, closing session or post-closing session (Chaity and Sharmin, 2012).

Both of the stock exchanges were demutualized in the year 2013 and Bangladesh Securities and Exchange Commission (BSEC) was also awarded level A status by International Organization of Securities Commissions (IOSCO). The comprehensive measures with support from the Government of Bangladesh have been making a positive impact on the investors' confidence and the growth of the market size as a whole. Market capitalization has increased by 25 percent to $41.1 billion (as of June 07, 2015), from $33.0 billion in February 2011 contributing to a greater percentage to the nation's GDP (25 per cent)[2].

4.2 Dhaka Stock Exchange

Table 2 provides a summary statistics of listed securities in Dhaka Stock Exchange as of August 2015. It is understood that a derivative market is non-existent in Bangladesh:

DSE computes three indices: DSE All Share price Index, DSE General Market Index and the index with the blue chip index. Two of these indices were replaced in January 2013 based on free-float methodology. Following is a summary of the composition and the construction of the old and the new indices:

DSE General Index:

- Introduced on November 27, 2001, with a base index of 817.62
- The index excludes the companies of Z categories (i.e., includes A, B, G & N)
- This is calculated on the basis of price movement of individual stocks.
- This index is a value-weighted index in nature.
- The entire market capitalization excluding Z category is taken into consideration in deriving the general index.
- Not free-float adjusted
- This index was of highest use by all types of investors to reflect the behavior of the market
- Last day of existence: 31 July 2013

DSI (All Share Price Index):

[2] "Reforms address structural deficiencies in capital markets" by Bruno Carrasco and Syed AliMumtaz H. Shah, The Financial Express, 21 June, 2015

- Re-Introduced after 1993 on March 28, 2005
- Base Index 350.00
- Consists of all the companies listed with the DSE, or more specifically, Z category share are also included in deriving the DSE All Share Price Index
- Not free-float adjusted

DSE-20 Index

- The DSE-20 index was introduced on January 01; 2001 with a base value of 1000.
- Reflects the behavior of 20 blue chips companies belonging to A category taken from different industries and having a good track of paying a high dividend.
- The other criteria for companies included minimum market capitalization worth tk.2oo million minimum, 20 percent share in public hands, minimum payment of 10 percent dividend for the last 3 consecutive years and 95 percent trading days in the last six month
- Not free-float adjusted
- Does not reflect the behavior of the overall market

On January 28, 2013, DSE Launched two indices, DSEX and DS30 based on Free Float (FF) Market Capitalization (MCAP) of the listed securities(excluding the shares of sponsor-directors, promoters and the government and strategic holding) replacing two previous indices. DSE worked with a team of Standard & Poor's (S&P) in order to formulate the two new indices using S&P methodology. There was no substitute for DSI index.

DSEX (DSE Broad Index)

- Replaced DSE General Index
- Rebalancing Date: December 31 (Once in a year)
- Minimum FF MCAP: BDT 100.0 million
- Liquidity: BDT 1.0 million ADTV
- Financial Viability: None
- Sector Classification: None
- Float Adjusted MCAP weighted
- Base Date: January 17, 2008
- Base Value: 2,951.91 points

- Based on the rebalancing reference date of December 31, 2012, 199 stocks were included in DSEX, representing 97% of the total equity MCAP of DSE

DSE30 Index (Index of 30 most liquid companies in DSE)

- Replaced DS20 Index
- Rebalancing Date: June 30 and December 31 (twice in a year)
- Minimum FF MCAP: BDT 500.0 million
- Liquidity: BDT 5.0 million ADTV
- Financial Viability: Positive Net Income over LTM as on Rebalancing Date
- Sector Classification: Maximum 10 stocks from Financial sector
- All eligible stocks are required to trade at least half of normal trading days each month for three months prior to rebalancing reference date
- There is a cap on the financial sectors: Banks, Financial Institutions, Insurance and Real Estate (sub-sector of Service & Real Estate) – 5 stocks from each sector and 10 combined
- Float Adjusted MCAP weighted
- Base Date: January 17, 2008
- Base Value: 1,000.00 points
- Reflects around 51% of the total market capitalization

Figure 1 shows the trend line of the benchmark index over the period of 16 years. The growth has been very slow from a 700 level in 1999 and reaching the peak of 8900 in December 2010. When it started its upward trend in 2007, the market was certainly undervalued, and there were fundamental economic reasons for it to go up. At that time, the average Price/Earning (P/E) ratio was in single digit and the market capitalization was less than 10 percent of gross domestic product (GDP). The sustained upward surge, however, went beyond what could be justified by economic fundamentals by early 2010.

Since mid-2010, as the index crossed the 5000 mark, the market has clearly been driven by speculative forces. During the last two-month period leading up to the peak, the index increased by more than 2000 points before crossing the 8900 level on December 5. To put it in proper perspective, the index level was at about 1500 until this recent surge started in 2007. Daily market turnover increased 30 fold about Tk. 1.0 billion to Tk. 33 billion over the three-year

period. Clearly, economic fundamentals cannot support this level of valuation gain and turnover, and the market is bound to correct itself once it runs out of steam. The recent drop in the stock market index needs to be evaluated in this context.

Even after a more than 3500 point decline, the index is still well above its mid-2010 levels. The corrections and volatility in the price index that we have experienced in recent days is nothing uncommon, and fully in line with what has been observed in many other important, and much larger stock markets across the globe. For the market to start consolidating, it needs to shed itself of speculative elements, and that can only happen once market valuations come back to their fundamental levels.

4.3 Regulatory Environment around Short Sale

Both Dhaka Stock Exchange and Chittagong Stock Exchange have introduced respective guidelines on implementation of short-sale. The regulation framing short-sale rules in DSE is called Dhaka Stock Exchange Short Sale Regulations, 2006 and was approved by BSEC in the year 2006. In section four of the gazette, *Prohibition of Short Selling*, it is dictated that "No stock dealer/ stock broker can be engaged in short selling unless authorized by DSE. There has never been one legal transaction of short-selling which was approved by DSE and/or BSEC; hence the law never saw the light.

In theory, price drop after ex-dividend date should approximately be equal to the amount of dividend paid. However, in DSE, the prices drop by a significant proportion and this has been an ongoing phenomenon. If short selling were allowed, and all the investors are made aware of the mentioned phenomenon, they would take the opportunity by selling short those stocks which would eventually eliminate 'after dividend free fall price drop' from the market. In that way, DSE will be able to establish a more accurate price in the market[3].

Day netting is another form of a short sale that was allowed earlier in the stock market but withdrawn before the introduction of automated trading.

[3] Allowing short selling in Dhaka Stock Exchange, A F M Mainul Ahsan and Salahuddin Ahmed, Editorial, Page 6, November 2008, Daily Independent

The absence of short-selling prevents a level-playing field due to the asymmetric adjustment of information by optimists and pessimists in the market and lead to a bullish course for an unrealistically long period of time from the persistence overvaluation. If short-selling was a regular practice and pessimistic traders were allowed to short-sell and cover their positions at the end of the day, the consequence would not be a drastic collapse of stock prices like that happening from an actual accelerating sales pressure. However, even in the US markets, the circuit breaker rule of short-selling halts any kind of short-sales when prices experience a significant decline, only, to prevent abusive use and manipulation. Since DSE is a frontier market and manipulation frequently takes place in DSE, short sale has to be allowed after ensuring strict vigilance and informed practice.

Chapter V: Empirical Analysis

5.1 Test of independence

A model for calculating runs is designed for the sample period of 16 years containing approximately 4,000 trading days. The daily return series of DSEX* and DJIA are used for the period of January 1, 1999, to December 31, 2014, and the number of 1 day, 2-day and up to 20-day runs are calculated. Each category of runs contains two divisions of positive and negative runs. For example, 1-day run includes separate columns for negative 1 day and positive 1-day runs. The longer runs starting from 5-day and greater are relevant for later analysis. The occurrence of the DSEX runs and DJIA runs will be compared to the behavior of runs from an experiment of randomly generated positive and negative returns.

Since the sample period contains approximately 4000 trading days, random number 1 and 0 denoting positive and negative return respective are generated 4000 times with an underlying Bernoulli distribution with probability of success of 53.06%. This probability, P= 53.06% is derived from the average percentage of positive returns in DJIA over the sample period as shown in table 3.

This percentage 53.00% is used as a benchmark for the probability of success for an observed distribution of runs from a random-walk model in this particular case because both of the indices have an almost equal probability of success (pDSEX= 52.70%) over the sample period. The source of the proportion of positive returns in the sample stocks of DSE and Dow Jones is also shown in the table and explained later. The expected number of total runs (clusters) is noted from the Monte Carlo simulation defining the random process and the 95% confidence interval is constructed. Figure 3 presents the result of the simulation and table 4 summarizes the findings from the comparisons of runs in DSEX and DJIA.

If the number of runs is significantly higher or lower than expected, the hypothesis of statistical independence may be rejected. When the actual number of runs is fewer than the expected number of runs, the daily time series signifies positive serial correlation among the daily data. When the actual number of runs is higher than the expected number of runs, the daily time series signifies negative serial correlation among the daily data. For the case of DSEX the actual

number of runs is lower than the lower tail of the 95% confidence interval of the expected number of runs, which violates the assumption of independence and exhibits positive serial correlation in daily return series. On the contrary, the actual number of runs in DJIA is higher than the upper tail of the 95% confidence interval of the expected number of runs which also rejects the hypothesis of independence in daily return series and in fact, exhibits negative serial correlation. This is in line with the earliest studies of serial correlation. In US stocks. Alexander (1964), Cootner (1962) and Fama (1965) all looked at large U.S. stocks and concluded that the serial correlation in stock prices was small. Fama, for instance, found that 8 of the 30 stocks listed in the Dow had negative serial correlations and that most of the serial correlations were less than 0.05. French and Roll (1986) repeat Fama's tests for NYSE and AMEX stocks during 1963-1982 period. They report small but significant negative serial correlation in daily returns.

5.2 Significance of 5+ runs

The presence of greater number of longer runs in return series implies positive serial correlation and slow diffusion of information. When this longer runs occur in a greater frequency for negative runs than positive runs, the indication of slow adjustment of negative price information is confirmed. This is also one of the earliest and obvious signs of prohibited short selling regulation in stock trading which hinders the pessimists from acting quickly on their differing opinion and results in long price memory of negative returns from the use of less efficient trading mechanism. Before I proceed with further analysis with five day and longer runs, I want to establish the statistical significance of using the proportion of runs which are five days and older. A run of 5 days indicates persistence of a positive or negative return of a stock for a week. This observation either implies continuous flow of similar information for the stock for a week or a longer period which is unlikely, or more obviously it indicates slow update of price with information. Hence a week or older runs are relevant for my context of analysis. Table 5 shows an excerpt of percentages of five-day and higher runs for both positive and negative returns from the simulation 10,000 trials of random walk return model with a probability of success equal to 50.00%. 5-day runs represent 6.26% of the total expected runs. Since this proportion is greater than 5.00%, my focus of analysis concerns a significant proportion of cluster of returns or runs in the indices and return series of the sample stocks.

5.3 Run distributions in Indices

Now that the significance of using five days and older runs is established, I conduct my next set of runs tests on the longer day runs for testing hypothesis 2 and 3. For approximately 3250 daily sample returns, the number of five days and longer runs in both DSEX and DJIA are tabulated for both positive and negative returns. We denote a run for n days of positive return as **n+** and that for negative returns for **n-**. From the Monte Carlo simulation executed in the previous section with 53.06% probability of success, the expected number of pair of runs ranging from 5 days to 15 days are estimated along with their confidence intervals. Runs of higher days are not considered as their count is zero in the indices and also in the simulation.

Figure 4 combines the summary of results of the Monte Carlo Simulation with p=53.06%. The bars for each run represent the lower tail (floor) and upper tail (ceiling) of 95% confidence interval of number each run resulting from the simulation. The blue and orange plots are the actual numbers of runs in DSEX index and DJIA index respectively. The number of runs keeps decreasing for higher day runs. The figure clearly portrays that there was not a single violation of a number of runs in DSEX or DJIA, i.e., the number long runs of 5 days and longer do not fall outside the 95% confidence intervals. Hence, I fail to reject the second set of hypotheses that the numbers of runs in each of the indices are significantly different from expected. However, a clear distinction between the two sets of plot arises from a higher number of DSEX runs at both of the negative and positive runs. This signifies prices in DSEX adjust over a relatively longer period for both positive and negative information than those in DJIA.

5.4 Run distributions in sample stocks

Moving to individual DSE stock and Dow Jones stocks, the composition of the sample stocks for the analysis in context is different for DSE and Dow Jones. The number of most liquid stocks which have passed the filtering for the entire sample period is 21 and that of Dow Jones is 29 (Visa Inc. was listed in Dow Jones in March 2008). Given this information, I was interested in the average percentages of positive and negative returns for the two sets of sample stocks over the sample period of 16 years.

Figure 5 and 6 illustrate the average proportion of positive and negative returns in each market along with the proportion of positive and negative returns for individual stocks. The average

percentage of positive returns among the 30 Dow Jones stocks is 51.22% and 48.78% respectively. These values are close to percentages of DJIA itself. The two straight lines help to illustrate the volatility of individual return proportions around the mean (standard deviation: 0.80%). Clearly for DSE stocks, the volatility of the individual proportions around the mean is higher (standard deviation: 1.52%). To emphasize more on the underlying problem, the percentage of negative daily returns for DSE stocks is higher at 53.50% and that of positive daily returns is 46.50%. This scenario is an absolute reversal of the case of individual indices and in partial contradiction to the case of individual Dow Jones stocks too.

I now design the test for my second hypothesis. For each of the Dow-Jones Stocks, the actual number of five-day and higher runs are tabulated for positive and negative returns. Since the sample period for the stocks is from 1999 to 2014, I create a random walk model with 4000 trading days. The number of 5+, 5- and longer runs are also calculated from the random process. Therefore, a simulation is to estimate the expected number of theses runs with the probability of success of 51.22% at 5% level of significance. Since the company Visa Inc offered its IPO in March 2008 and thus has lower than 4000 trading days, it is excluded from this analysis because the resulting number of runs for this stock will be relatively lower than other stocks in the sample. Table 6 summarizes the actual number negative and positive runs for 5 days and higher along with their 95% confidence interval. It is to be mentioned that runs for 11 days and higher are cumulated and presented together.

There are in total nine violations for the case of Dow Jones Stock when compared with the 95% confidence interval of the expected number of 5 day plus runs. Four of the number of actual runs are greater than the upper tail of the confidence interval and five are below the lower tail of the confidence interval. Thus the violations are approximately symmetrical. This is an expected outcome as I am using the average percentage of positive daily returns of Dow Jones stocks for the probability of success in the underlying Bernoulli distribution of the random process. Given a 5% confidence interval, the proportion of violations falls within the 5% of the data. Hence the runs in the Dow-Jones stocks are normally distributed. I fail to reject my null-hypothesis in this regard which as a result implies that the actual runs fall in the expected range.

Hence, for the case of Dow Jones, I cannot accept the null hypothesis that the expected number of both positive and negative long runs is equal to the actual number of positive and negative long runs. However, the violations are symmetric and four of the five violations in the negative

runs zone are attributed to the actual number of negative runs being lower than the expected number of negative runs. This also indicates that the negative returns do not cluster for abnormally long days in the Dow-Jones stock prices. This is evident that US stocks more closely reflect efficient price adjustment.

The previous scenario used an average percentage of positive returns of Dow Jones stocks over the sample period as the p for the underlying Bernoulli distribution of the random walk process of stock price to run the simulation of 10,000 trials. If prices are efficient and the adjustment of negative and positive information is not biased like prices in Dow-Jones, the outcome of similar analysis should find no violation or symmetric violation for the case of DSE sample stocks. A preceding figure shows that the average percentage of positive returns for the sample DSE stocks is 46.50% (percentage of negative returns=53.50%). I now execute another simulation with p equal to 46.50% to test my final hypothesis that the actual and expected number of positive and negative long day runs in DSE stocks were not different from zero, given the random walk stock prices with p being 46.50%.

Table 7 shows that there are in total 26 violations when the actual number of positive and negative long runs is compared to the expected runs. There are 18 violations in the 5 and higher day runs of negative returns, all of which are attributed to the actual number of negative runs of the sample stocks exceeding the upper tail of the expected number of negative runs over the sample period. Rest of the frequencies of the long negative runs are within the 95% confidence interval of the expected number of runs and absolutely none below the lower tail of the interval. This evidence rejects the hypothesis that the actual number of long runs in DSE stocks is equal to the expected number of runs. This statistical evidence indicates that the DSE has a long negative memory resulting in an abnormally higher number of negative long runs than a random walk price model with an equal underlying probability of success.

Looking at the actual number of positive long runs with the 95% confidence interval of the expected number of runs, I locate 8 violations, all of which are attributed to the number of actual runs being lower than the lower tail of the confidence interval. Rest of the frequencies of the long positive runs are within the 95% confidence interval of the expected number of runs and absolutely none above the upper tail of the interval. This result also rejects the null hypothesis that the actual number of positive runs is equal to the expected number of positive runs and violates market efficiency.

This is a clear evidence of the fact that absence of short selling suppresses the action of a pessimist and not the optimists. The positive opinions and information in the market are adjusted quickly, resulting in lower number of runs than would be expected from a random walk behavior of stocks. It is also a violation of market efficiency on a daily basis. This result clearly rejects the null hypothesis that the actual number of positive runs is equal to the expected number of positive runs. This finding is at par with the conclusion drawn by Miller (1977) and Figlewski(1981) that constraining pessimist without constraining optimist imparts an upward bias in the stock prices and the over pricing of the market prices leads to short-lived and small positive return. Diamond and Verrecchia (1986) also argue that allowing or reducing the restriction of short selling will increase the speed of adjustment of price to private information, especially to bad news. Hence, the absence of short selling negatively affects the adjustment process of bad news, evident from the higher number of long negative runs.

Figure 7 shows the distribution of the average number of runs in the sample DSE and Dow Jones stocks. The bars clearly takes our attention to a market setting where negative returns take longer to adjust. It is signified by a higher frequency of long day runs for negative returns in DSE stocks and thus indicating slow diffusion of negative information in price as a result of the absence of short selling. The blue bars are taller than the orange bars for five and longer day runs for negative returns while they are shorter than the orange bars in the case of five and longer day runs for positive returns. The bar diagram above clearly depicts two market settings with cardinal differences in the market environment.

This result is again consistent with Miller's (1977) finding stocks are overvalued in the presence of short-sale constraints, and the subsequent negative abnormal returns (indicated the long negative runs) represent a correction of this overvaluation. The long negative runs also concur Diamond and Verrechia's (1987) whose rational expectation framework provide evidence that short-selling constraint reduces adjustment speed of stock price to bad news thus leading a longer trail of negative returns.

The lower average number of positive runs in DSE stocks also support the rational story of Harrison and Kreps (1978) which says that short-sale constraints generate a pattern of overpriced stock leading subsequent low returns.

5.5 Implication for Portfolio Diversification

While the actual number of positive and negative runs in the index are within the prediction interval of the expected number of runs in the random walk model, the actual number of long negative runs are significantly greater than the expected number of negative runs in a random stock price behavior. Besides, the average percentages of positive and negative returns in the index and the sample stocks are completely reverse for the sample period (DSEX: 52.70% & 47.30%; Stocks: 46.50% and 53.50%). This observation clearly indicates important implication for diversification benefit from index returns. Although the actual numbers of 5- and longer runs in DSEX are higher than those in DJIA, their presence is not irregular or abnormal given the expected range of the number of runs. The violations are greater at the individual stock level because of the idiosyncratic risk of individual stocks and they are more skewed towards the greater number of long negative runs because of the absence of short selling in the market. Wang (2014) uses a unique exogenous event: the introduction of short-selling in a stock market to examine whether idiosyncratic risk deters investors from taking short positions on negative information. He finds that after short-selling is allowed, stocks with relatively higher idiosyncratic risk are associated with relatively less short-selling. Such findings are very important with regard to the future introduction of short-selling in Bangladesh. Moreover, the study also finds that short-selling activity immediately following the introduction causes significant and permanent price declines. For stocks with relatively higher idiosyncratic risk, the prices decline less immediately following the introduction but decline more in subsequent periods. Boehme, Danielsen, Kumar and Sorescu (2009) investigate Miller's (1977) overvaluation hypothesis and concludes in support that stocks with higher analyst dispersion and idiosyncratic volatility have negative abnormal returns when short-sale constraints are present. Idiosyncratic risk is thus more relevant for the analysis of short-interest than systematic risk. The idea that idiosyncratic risk may deter informed investors from trading has received attention in the recent literature.

Chapter VI: Conclusion

This study strongly corroborates Diamond and Verrechia's (1987) findings that prices will adjust more slowly to negative information if there are shorting constraints. The objective of this thesis is to investigate the effect of the absence of short-selling practice in the prices of stocks in Dhaka Stock Exchange, the prime bourse of Bangladesh. I have used twenty one most liquid stocks listed in Dhaka Stock Exchange over the period of 1999-2014. For the purpose of a comparative analysis with a developed market that has long allowed short-selling, a similar analysis of runs is also presented for Dow-Jones stocks. In order to examine the effect on price efficiency, I have chosen the long runs for positive and negative returns as the variables of analysis. I have not only measured the sign of runs in the indices and sample stocks over the sample period but also the magnitude of runs ranging from one day runs to twenty-day runs. For the sample period of 2002-2014, runs tests show that the daily prices in Dhaka Stock Exchange General Index (DSEX) are statistically independent and are positive serially correlated while the daily prices of Dow Jones Industrial Average (DJIA) are also not statistically significant but negative serially correlated. For the case of DSEX, the total number of runs were far lower than the lower tail of 95% confidence interval of runs from a random walk model with an underlying Bernoulli distribution.

The persistence of returns of the same sign, especially negative returns is of significant interest to the research in context. I establish the statistical importance of five-day and longer runs by simulating a random walk price model with a probability of success equal to 50.00%. I continue with categorizing individual positive and negative runs in both DSEX and DJIA and compare the actual number of runs with the expected number of from a random walk with a p equal to 53.00%. For every 5+, 5- and longer day runs, the actual number of runs in DSEX were greater than the actual number of runs in DJIA. However, the runs in both of the indices lied within the 95% confidence interval of expected number of respective runs from a random process and hence, I could not reject the first set of hypotheses of equality of actual and expected runs in both of the indices.

The second hypothesis tests for an irregularity of long positive and negative runs among the Dow-Jones stocks. The expected numbers of five-day and higher runs are generated from a

simulation that uses a probability of success of 51.22%. Although, I cannot accept the hypothesis of equality of actual and expected number of runs in this case too, the total number of violations are completely symmetric. Hence, there is no abnormal number of negative or positive runs in any of the Dow-Jones stocks.

Test of my final hypothesis conducts a similar simulation for the DSE sample stocks with an underlying probability of success of 46.50%. Out of a total of 26 violations, there are 18 violations in the 5- and higher day runs of negative returns, all of which are attributed to the actual number of negative runs exceeding the upper tail of the expected number of negative runs over the sample period and none below the lower tail. This statistical evidence indicates that the DSE has a long negative memory resulting in an abnormally higher number of negative long runs than a random walk price model with an equal probability of success. The lower number of violations in the positive long day runs clearly prove that the diffusion speed of negative information is lower in DSE than positive information and the absence of mechanism which is leading to the long clusters of negative returns is "short-selling". Further analysis of a distribution of average positive and negative runs for DSE and Dow-Jones sample stocks also accentuate this result.

The evidence that the number of long negative runs in the sample of individual DSE stocks is abnormally high while those in the DSEX are within the confidence interval of expected number of runs holds insight for the benefit of diversification. A portfolio of stocks translating into a portfolio of negative and positive information does not lead to an abnormally high persistence of negative returns. Idiosyncratic risk is thus more relevant for the analysis of short-interest than systematic risk.

This study implicates a greater research on the need of short-selling and also consequential studies after the launch of short-selling practices in Bangladesh Stock market. Relevant future research spans from checking the overvaluation hypothesis, slower speed of bad news adjustment, the predictability of returns from short-selling activities, the relationship between the cost of short-selling, idiosyncratic risk, institutional ownership and most importantly, the impact of short-selling on overall market volatility and liquidity. Future works also call for data on analyst forecasts, corporate announcement dates, the level of short interest, the cost of margin trading, implied volatility measures all of which are not available in the current market data stream.

Bangladesh stock market has recently experienced the recovery of a severe speculative bubble collapse. The absence of short-selling obstructs market liquidity and according to Miller's (1977) overvaluation hypothesis pushes the prices upwards. Hence, the chance of a future stock price bubble increases and those traders with the threat of an imminent bubble cannot also profit or escape easily in the due course because they do not have the necessary technology or permission of short-selling and later covering their position. The asymmetric adjustment of negative and positive returns prove that the market is not efficient. The results also support previous findings of positive serial correlation in the prices of Dhaka Stock Exchange. Bangladesh Securities and Exchange Commission with the support from Bangladesh Government has been in the long endeavor of reviving the stock market in terms of advanced regulation, better infrastructure, monitoring tools, transparent trading mechanisms and higher compliance to corporate governance. They are actively aiming to mature to higher global standards and planning roadmaps on introducing new financial products, commodity and derivative exchanges in the future. With ambitions this challenging, the importance of short-selling in the current scenario of Bangladesh capital market cannot be less underscored.

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Table 1: Short selling restrictions around the world

Country	Period when legal	Period when illegal	Nature of restriction and other comments
Argentina	Since 1999	Before 1999	Up-tick rule applies; Naked short selling prohibited
Australia	Pre 09/22/2008; 11/20/2008 - Present	09/22/2008 - 11/19/2008	Naked short selling prohibited since 2001 Ban on shorting financial stock: 09/22/2008 - 05/25/2009
Austria	Since inception	None	Ban on naked short selling of financial stocks: 10/27/2008 - 11/30/2010
Bahrain	None	Always	
Bangladesh	None	Always	
Barbados	None	Always	
Belgium	Since inception	August 2011-February 2012	Ban on naked short selling of financial stocks: 9/22/2008 - 9/21/2009
Bermuda	None	Always	
Brazil	Since inception	None	Naked short selling prohibited
Bulgaria	None	Always	
Canada	Since inception	None; see comments	Ban on shorting financial stocks (including inter-

			listed in U.S): 09/19/2008 - 10/08/2008; Up-tick rule applies
Cayman Islands	Since inception	None	Very little trading occurs on the stock exchange
Chile	Since 1999	Before 1999	Up-tick rule applies; Naked short selling prohibited
China	None	Always; see comments	In Sep2008, China allowed short selling of 11 brokerage firms on a pilot basis. Now only allowed for China Connect Securities
Colombia	None	Always	
Croatia	None	Always	
Cyprus	None	Always	

Table 1– continued

Country	Period when legal	Period when illegal	Nature of restriction and other comments
Czech Republic	Since inception	None	
Denmark	Since inception	None; see comments	Ban on shorting bank stocks: 10/13/2008 – Present
Ecuador	None	Always	
Egypt	None	Always	
Finland	Since 1998	Before 1998	
France	Since inception	August 2011-February 2012	Ban on naked short selling of credit institutions and insurance companies' stocks: 09/22/2008 - Present
Georgia	None	Always	
Germany	Since inception	None; see comments	Investment funds except hedge funds may not short sell; Ban on naked short selling of specified financial stocks: 09/19/2008 – Present
Greece	Pre 10/10/2008; 06/01/2009 - Present	10/10/2008 - 05/31/2009	Up-tick rule applies; Naked short selling prohibited
Hong Kong	Since 1994	Before 1994; In multiple sessions since August 2011	Permitted for specified securities (33 in 1994-95); Up-tick rule applies;

			Naked short selling prohibited
Hungary	Since 1996	Before 1996	
Iceland	Since inception	None; see comments	Ban on naked short selling of financial stocks: 11/06/2008 - 01/31/2009
India	Since 12/20/2007	Before 12/20/2007 (Badla trading existed)	Badla trading means carry over transaction with extended rolling settlements; Naked short selling is prohibited; On 10/20/2008, SEBI disapproved stock lending by FIIs of participatory notes (PNs) stocks
Indonesia	Pre Oct 2008; May 2009 – Present	Oct 2008 - Apr 2009	Legal only for specified stocks
Ireland	Since inception	None; see comments	Ban on naked short selling of financial stocks: 09/19/2008 – Present
Israel	Since inception	None	Naked short selling prohibited
Italy	Since inception	In multiple sessions since August 2011	Naked short selling ban for financial stocks: 09/22/2008 - 05/31/2009; Naked short selling ban for non-financial stocks: 10/10/2008 - 01/01/2009
Jamaica	None	Always	
Japan	Since inception	None	Up-tick rule and locate requirement apply; Ban on

			naked short selling: 10/30/2008 – Present
Jordan	None	Always	
Kazakhstan	None	Always	
Kuwait	None	Always	
Latvia	None	Always	

Table 1 – continued

Country	Period when legal	Period when illegal	Nature of restriction and other comments
Lebanon	None	Always	
Lithuania	None	Always	
Luxembourg	Since inception	None	Ban on naked short selling of banks and insurance companies: 09/19/2008 – Present
Malaysia	Pre 1997; Jan 2007 – Present	Sep 1997 to Dec 2006	Naked short selling prohibited; Uptick rule applies; Legal only for specified stocks
Malta	None	Always	
Mauritius	None	Always	
Mexico	Since inception	None	Naked short selling prohibited; Up-tick rule applies
Morocco	None	Always	
Netherlands	Since inception	None	Naked short selling ban: 09/22/2008 - 06/01/2009
New Zealand	Since 1992	Before 1992	Since Apr 1992, specified securities eligible for short selling; After Jul 2000, all liquid securities eligible. Short selling is hindered by tax legislation.
Nigeria	None	Always	
Norway	Since 1992	None; see comments	Ban on naked short selling of 5 specified financial stocks: 10/08/2008 - Present
Oman	None	Always	

Pakistan	Since inception	None	"Regulations for Short Selling under Ready Market" introduced in 2002: Naked short selling is prohibited; Up-tick rule applies; Short selling allowed only in prescribed securities
Panama	None	Always	
Peru	None	Always	
Philippines	Since 1998	Before 1998	Naked short selling prohibited; Up-tick rule applies; Legal only for specified stocks
Poland	Since 2000	Before 2000	Shorting allowed only in the permitted securities
Portugal	Since inception	None	Ban on naked short selling of specified financial stocks: 09/24/2008 - Present
Qatar	Since inception	None	
Russia	Pre 09/18/2008; and 06/16/2009 - Present	09/18/2008 - 06/15/2009	Up-tick rule applies
Serbia	None	Always	
Singapore	Since inception	None	Ban on naked short sales in buy-in market. Onshore lending is limited while offshore lending is active
Slovakia	None	Always	
Slovenia	Since inception	None	

Table 1 – continued

Country	Period when legal	Period when illegal	Nature of restriction and other comments
South Africa	Since inception	None	Naked short selling prohibited
South Korea	Sep 1996 to 09/30/2008; and 06/01/2009 -Present	Before 1996; 10/01/2008 - 05/31/2009	Ban on shorting financial stocks: 10/1/2008 – Present; Naked short selling ban from June 2000 to Present; Up-tick rule applies
Spain	Since 1992	Before 1992;	Naked short selling prohibited; In multiple sessions After August 2011
Sri Lanka	None	Always	
Sweden	Since 1991	Before 1991	
Switzerland	Since inception	None; see comments	09/19/2008 - 01/16/2009: Swiss Federal Banking Commission and SIX Swiss Exchange prohibited naked short selling; SWX-Europe also prohibited creation or increase of a net short position in certain specified UK and Swiss financial stocks
Taiwan	Pre 10/01/2008; 11/28/2008 - Present	10/01/2008 - 11/28/2008	Up-tick rule applies
Thailand	Since Jan 2001	Before Jan 2001	Only specified securities are eligible (underlying securities of SET 50 index, ETF, and underlying

			securities of ETF); Up-tick rule applies; Naked short selling prohibited
Tunisia	None	Always	
Turkey	Since inception	None	Up-tick rule applies; Only specified stocks eligible
Ukraine	None	Always	
UAE	None	Always	
United Kingdom	Since inception	None; see comments	Ban on short selling of specified financial stocks: 09/19/2008 - 01/16/2009
United States	Since inception	None; see comments	Up-tick rule effective: 02/01/1938 - 07/03/2007; Ban on naked short selling of 19 financial stocks: 07/21/2008 - 08/12/2008; Ban on short selling of specified financial stocks: 09/19/2008 - 10/08/2008; Quote based restrictions imposed in 2010.
Venezuela	None	Always	
Zambia	None	Always	
Zimbabwe	None	Always	

† These countries do not have any local home market borrowing.

Source: Jain, Jain, McInish and McKenzie (2011), "Worldwide short selling: Regulations, activity, and implications"; Updated by the Author

Table 2: Number of listed Securities in Dhaka Stock Exchange as on August 2015

Total Number of Listed Securities	555
Total Number of Companies	283
Total Number of Mutual Funds	41
Total Number of Debentures	8
Total Number of Treasury Bonds	221
Total Number of Corporate Bonds	2
Total Number of Sectors	22

Table 3: Proportion of Positive and Negative returns in the indices and sample stocks

Indices/ Sample Stocks	Period	Average Proportion of Positive returns	Average Proportion of Negative Returns
DJIA	January 2002- December 2014	53.06%	46.94%
DSEX	January 2002- December 2014	52.70%	47.30%
30 Dow Jones Stocks	January 1999- December 2014	51.22%	48.78%
21 DSE Stocks	January 1999- December 2014	46.50%	53.50%

Table 4: Results of test of statistical independence

Indices	Actual Number of runs	Lower tail,95% CI	Upper Tail, 95% CI
DSEX	1399	1942	2067
DJIA	2119	1942	2067

Confidence interval is constructed from a random-walk model with a probability of success=53.00%

Table 5: Proportion of five day and longer runs in a random-walk model

-5	**5**	**-6**	**6**	**-7**	**7**	**-8**	**8**	**-9**	**9**	**-10**	**10**
3.14%	3.13%	1.56%	1.56%	0.78%	0.78%	0.39%	0.39%	0.20%	0.20%	0.10%	0.10%
6.26%		3.12%		1.55%		0.78%		0.39%		0.20%	

Table 6: Comparisons of number of actual runs in Dow Jones stocks with expected runs in a random walk

95% Confidence	0	0	0	0	2	7	19	23	11	4	1	0	0	0
Interval	5	3	5	7	12	22	39	45	24	15	9	6	4	7
								Runs						
Stocks	**-11+**	**-10**	**-9**	**-8**	**-7**	**-6**	**-5**	**5**	**6**	**7**	**8**	**9**	**10**	**11+**
Apple	0	0	0	0	6	9	28	29	20	6	7	4	3	1
AXP	0	0	0	4	4	14	29	26	**8**	9	3	3	1	0
BA	0	0	3	1	5	10	36	38	**25**	4	4	1	2	0
CAT	0	1	1	1	7	21	30	31	**25**	6	4	2	2	0
CSCO	0	0	1	2	2	9	24	39	15	5	5	3	0	1
CVX	1	0	1	2	**1**	12	27	44	14	5	5	5	1	1
DD	1	1	3	4	7	15	30	30	13	9	1	3	0	1
DIS	0	2	1	5	6	13	19	33	19	8	2	2	0	1
GE	0	1	0	5	9	16	30	27	8	5	1	3	2	0
GS	1	0	1	4	3	12	30	33	16	4	3	0	0	2
HD	1	0	1	4	6	12	22	41	10	10	4	1	0	0
IBM	1	0	1	4	6	12	22	41	10	10	4	1	0	0
INTC	0	0	1	2	5	8	**44**	31	20	7	4	3	1	1
JNJ	0	1	1	3	6	12	27	35	13	7	5	2	1	1
JPM	0	1	0	2	8	14	30	29	12	**3**	1	0	1	0
KO	1	0	2	2	8	15	35	32	20	7	8	1	1	0
MCD	1	0	2	1	5	13	26	43	14	11	**0**	2	0	1
MMM	0	2	0	1	8	10	26	42	19	11	1	1	1	2
MRK	1	2	0	5	6	18	25	35	23	4	2	1	0	1
MSFT	0	1	0	3	9	17	27	28	13	8	4	1	0	1
Nike	0	0	0	0	7	12	23	35	14	6	3	1	0	1

PFE	0	1	5	1	9	24	26	31	16	6	1	3	0	0
PG	0	1	0	2	2	16	29	28	17	4	4	1	0	1
TRV	1	0	0	4	5	22	28	28	17	5	2	3	2	0
UNH	0	1	0	4	11	13	**18**	30	17	11	5	4	2	1
UTX	0	1	1	2	9	10	**17**	30	15	7	1	1	1	0
VZ	0	0	2	2	4	18	35	27	15	9	4	1	0	0
WMT	1	1	2	2	4	15	27	27	16	10	3	0	0	2

Table 7: Comparisons of number of actual runs in DSE stocks with expected runs in a random walk

95% Confidence	0	0	0	0	2	7	18	17	6	2	0	0	0	0
Interval	8	4	6	10	16	28	48	49	27	16	10	6	4	8
							Runs							
Stocks	**-11+**	**-10**	**-9**	**-8**	**-7**	**-6**	**-5**	**5**	**6**	**7**	**8**	**9**	**10**	**11+**
Square Pharma	2	1	3	8	16	21	38	26	25	13	5	1	1	3
Heidelberg	0	2	4	3	13	27	38	25	19	7	5	3	0	1
Shinepukur	7	1	10	10	17	28	46	15	6	4	0	0	0	0
National Bank	3	2	5	8	17	27	39	36	15	4	5	2	0	0
Beximco Pharama	8	4	4	12	16	17	46	22	10	7	0	0	0	1
Fu-Wang Ceramic	6	2	11	4	14	24	44	22	9	4	1	0	0	0
Olympic Industries	0	2	4	5	14	22	57	22	14	3	4	2	0	0
Apex Foods	0	1	8	9	14	19	41	18	9	5	4	1	0	0
ACI	4	2	5	8	17	23	36	16	16	6	3	2	0	0
Aramit Limited	1	2	4	3	9	30	36	26	6	0	1	0	0	0
BATBC	1	3	4	9	11	15	35	19	9	8	7	1	1	2
Islami Bank	7	1	5	4	14	26	42	36	13	7	8	3	5	4
Padma Oil	4	1	4	6	7	16	31	13	9	3	1	2	1	0
Confidence Cement	2	1	3	11	11	27	52	24	9	4	2	2	0	0
Square Textile	2	0	3	4	9	27	31	14	9	1	1	2	1	0
Keya Cosmetics	5	2	6	3	13	31	47	17	5	2	1	0	0	0
Bangladesh	3	0	3	5	8	19	49	22	10	7	3	1	0	1

Lamps														
Monno Ceramic	2	6	2	4	10	19	48	24	12	3	1	0	0	0
Quasem Drycells	5	3	6	11	25	37	52	16	5	7	0	0	0	0
Meghna Cement	0	1	1	5	11	25	42	25	12	5	3	0	0	0
Bata Shoes	3	0	3	12	9	18	28	20	15	7	5	1	0	1

Figure 1: DSE benchmark index level

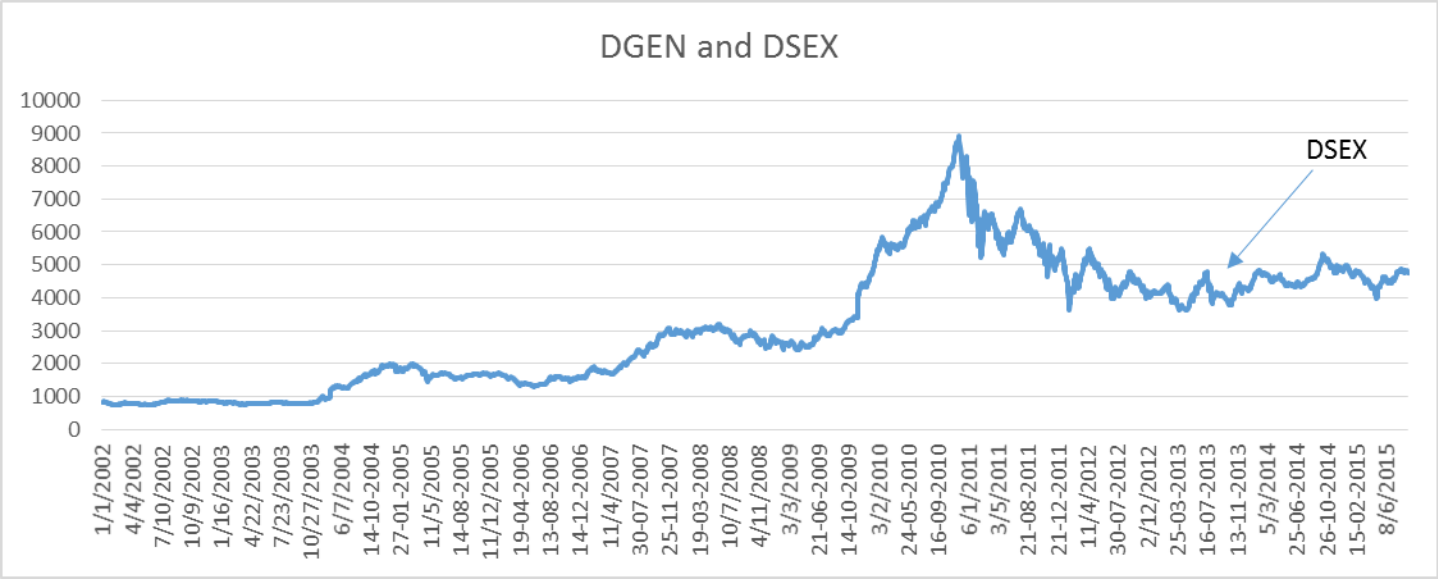
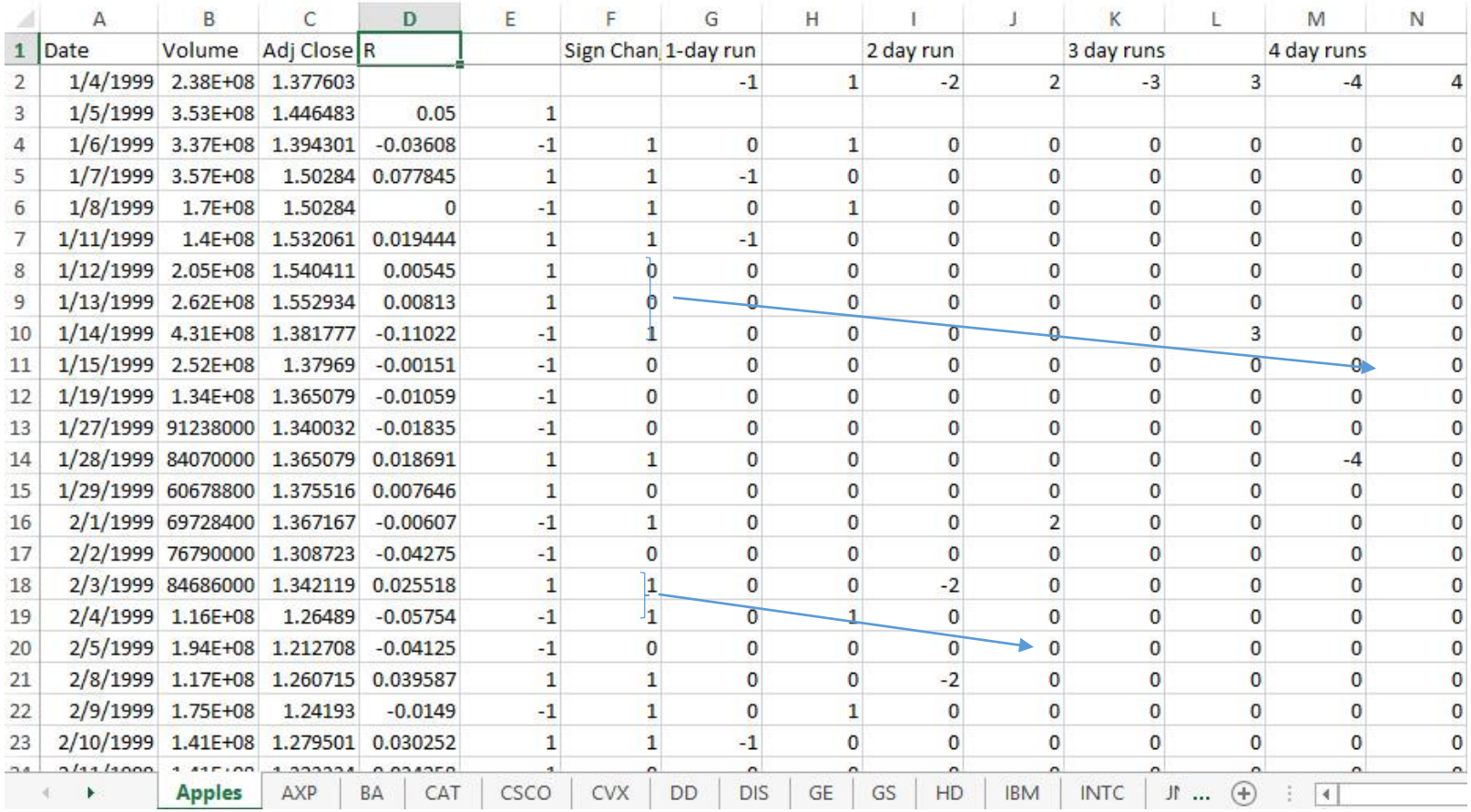


Figure 2: Daily run calculation



	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Date	Volume	Adj Close	R		Sign Chan	1-day run		2 day run		3 day runs		4 day runs	
2	1/4/1999	2.38E+08	1.377603				-1	1	-2	2	-3	3	-4	4
3	1/5/1999	3.53E+08	1.446483	0.05	1									
4	1/6/1999	3.37E+08	1.394301	-0.03608	-1	1	0	1	0	0	0	0	0	0
5	1/7/1999	3.57E+08	1.50284	0.077845	1	1	-1	0	0	0	0	0	0	0
6	1/8/1999	1.7E+08	1.50284	0	-1	1	0	1	0	0	0	0	0	0
7	1/11/1999	1.4E+08	1.532061	0.019444	1	1	-1	0	0	0	0	0	0	0
8	1/12/1999	2.05E+08	1.540411	0.00545	1	0	0	0	0	0	0	0	0	0
9	1/13/1999	2.62E+08	1.552934	0.00813	1	0	0	0	0	0	0	0	0	0
10	1/14/1999	4.31E+08	1.381777	-0.11022	-1	1	0	0	0	0	3	0	0	0
11	1/15/1999	2.52E+08	1.37969	-0.00151	-1	0	0	0	0	0	0	0	0	0
12	1/19/1999	1.34E+08	1.365079	-0.01059	-1	0	0	0	0	0	0	0	0	0
13	1/27/1999	91238000	1.340032	-0.01835	-1	0	0	0	0	0	0	0	0	0
14	1/28/1999	84070000	1.365079	0.018691	1	1	0	0	0	0	0	0	-4	0
15	1/29/1999	60678800	1.375516	0.007646	1	0	0	0	0	0	0	0	0	0
16	2/1/1999	69728400	1.367167	-0.00607	-1	1	0	0	0	2	0	0	0	0
17	2/2/1999	76790000	1.308723	-0.04275	-1	0	0	0	0	0	0	0	0	0
18	2/3/1999	84686000	1.342119	0.025518	1	1	0	0	-2	0	0	0	0	0
19	2/4/1999	1.16E+08	1.26489	-0.05754	-1	1	0	1	0	0	0	0	0	0
20	2/5/1999	1.94E+08	1.212708	-0.04125	-1	0	0	0	0	0	0	0	0	0
21	2/8/1999	1.17E+08	1.260715	0.039587	1	1	0	0	-2	0	0	0	0	0
22	2/9/1999	1.75E+08	1.24193	-0.0149	-1	1	0	1	0	0	0	0	0	0
23	2/10/1999	1.41E+08	1.279501	0.030252	1	1	-1	0	0	0	0	0	0	0

Apples | AXP | BA | CAT | CSCO | CVX | DD | DIS | GE | GS | HD | IBM | INTC | JI ...

Figure 3: Expected number of total runs for the sample period

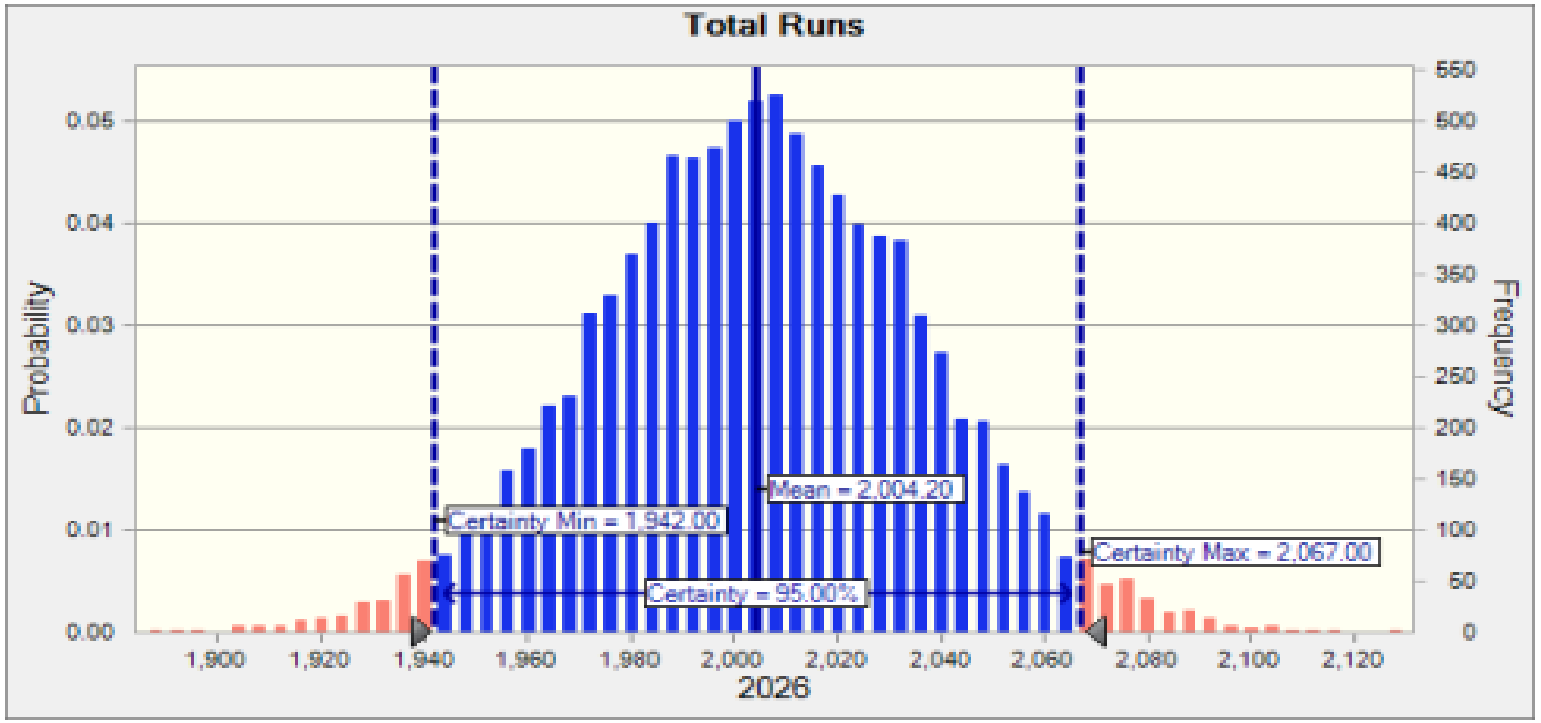


Figure 4: Five days and higher runs in DSEX and DJIA returns and the confidence intervals

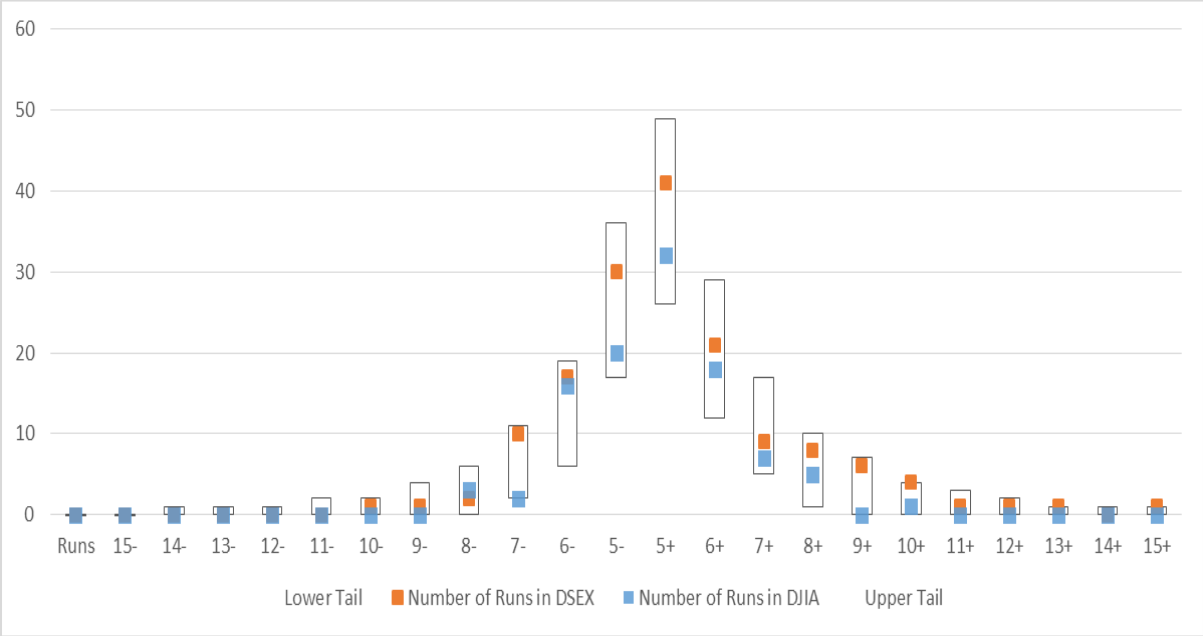


Figure 5: Distribution of proportion of positive and negative returns in each of the 30 Dow-Jones Stocks

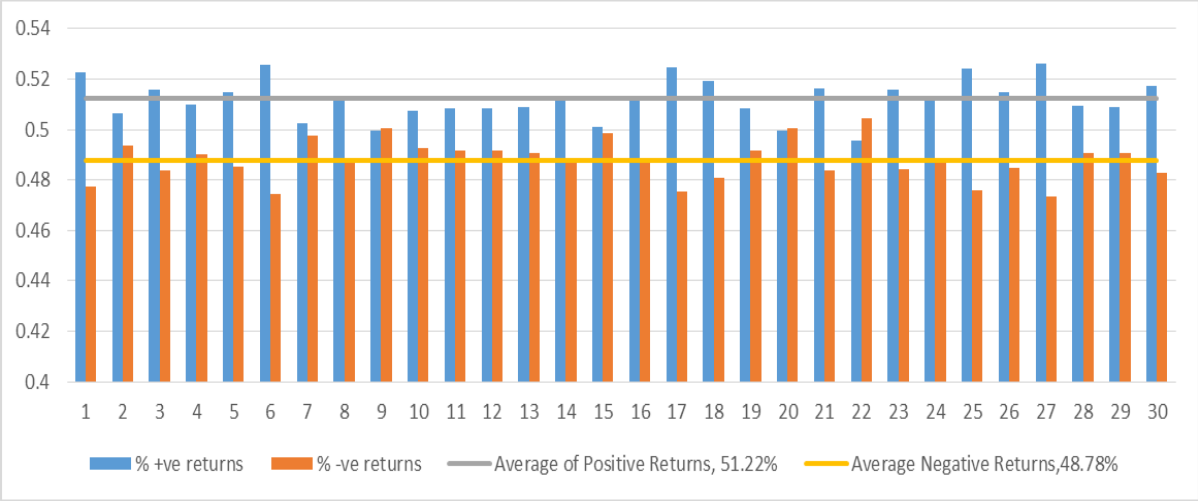


Figure 6: Distribution of proportion of positive and negative returns in each of the 21 DSE Stocks

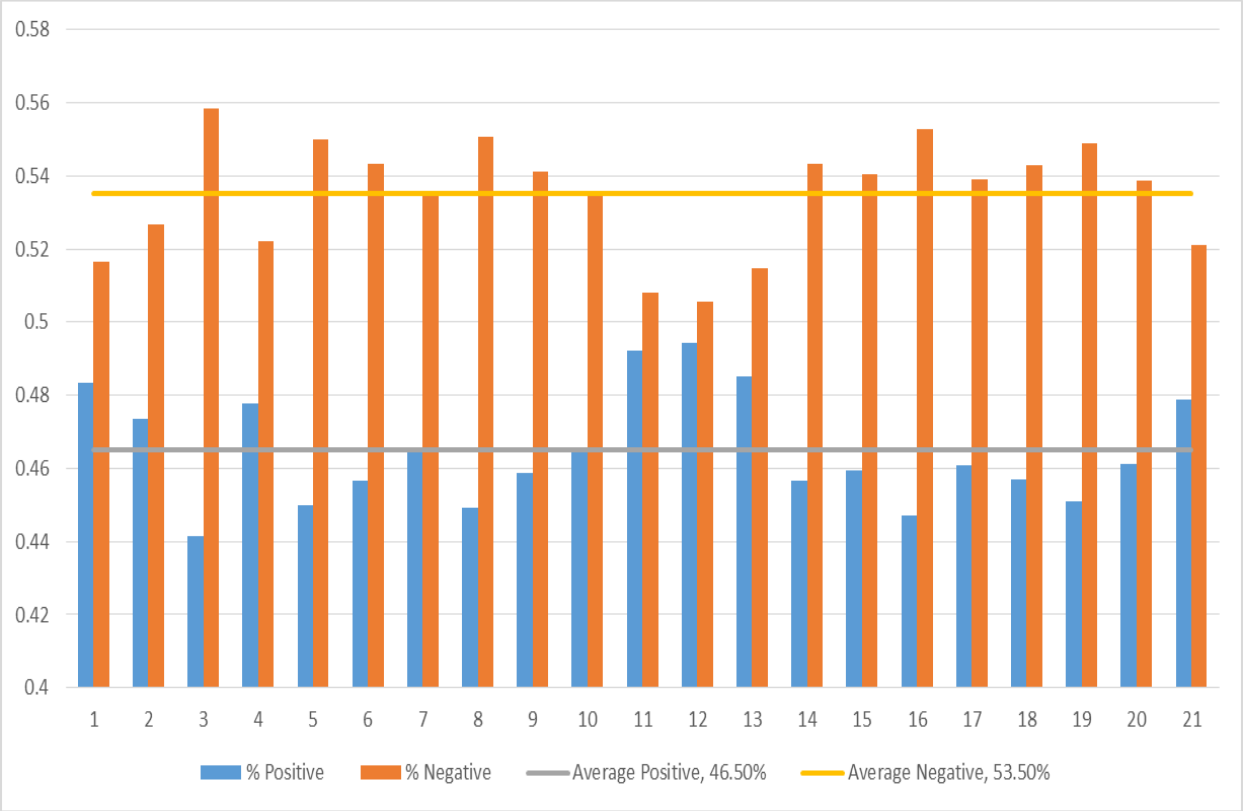


Figure 7: Average Run comparisons between DSE and Dow Jones Stocks