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A Closer Look at the Size Effect in the Dhaka Stock Exchange (DSE)

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ABSTRACT

The tendency of small firms to produce more returns than large firms is often referred to as 'size effect'. While this effect is evident in many research papers pursued in the context of developed markets, little attention is given to this effect in a fledgling capital market like the DSE. In this backdrop, this paper investigates the existence of size effect in the DSE. Return behavior before and after the 1996 stock market crash is also taken into account to track whether or not investors have changed their views regarding size of firms. Results show that size effect exists in the DSE; size-related risk, a measure of economy-wide risk factor, does explain the returns of portfolios of small and large firms. Before the crash, big firms produced higher return than small firms, but after the crash, the former has lost more than the latter.

Keywords: DSE, Size-effect, Return behavior

INTRODUCTION

The single-period capital asset pricing model (CAPM) postulates a simple linear relationship between the expected return and market risk of a security. To put it in other words, no factors besides market risk, which is expressed by the slope coefficient (beta), should have the power to explain security returns. But recent evidence suggests the existence of additional factors, which are relevant for asset pricing. Lintzenberger and Ramaswamy (1979) show a significant positive relationship between dividend yield and common stock return. Banz (1981) and Reinganum (1981) find that common stock of small firms, on average, produce higher risk-adjusted returns than the common stock of large firms. Lakonishok and Shapiro (1984) find that the difference in returns between the smallest and largest companies in their sample is 1.2 per cent per month, 15.5% per cent annually. This result, i.e., the difference between the returns of small firms and large firms is popularly referred to as the 'size effect'.

There are many areas in the field of finance that are open to debate. One of the few areas where there seems to be a general consensus is the relationship between company size, as measured by equity capitalization, and return. Historically, small capitalization companies have outperformed large capitalization companies over an extended period of time. Interestingly, this premium is unrelated to any increased risk inherent in holding small-capitalization stocks. As a result, this phenomenon has attracted the attention of academics and practitioners, resulting in abundant research trying to explain this so-called 'size effect'.

There are only few big firms in the DSE. Big firms are usually more transparent and disseminate more information, which is in the downstream followed by more analysts. Therefore, new information is more quickly reflected in stock prices. Again, large firms have more power to survive any economy-wide adverse event. Because of these features, large firms tend to produce lower return. This is a widespread phenomenon, which persists even in the developed markets. Furthermore, the existence of only few big firms may cause investors crowding around these stocks, which may induce even lower expected returns, hence further boost in their stock prices. Again, foreign investors are more interested in big companies and their presence in a small market might exert positive pressure on the stock prices. However, due to these reasons, large firms' returns may behave with more volatility and lagged effects.

The academicians, researchers, and practitioners have hardly ever tried to figure out whether or not size effect exists in Bangladeshi capital market. Such investigation can indicate how investors differentiate between big firms and small firms. Lack of reward for investing in riskier small firms may be very counter-developing for the market since such perception about risk is unacceptable from the theoretical viewpoint. However, theoretically, all the market risk associated with a firm regardless of its size should be incorporated in the CAPM beta. Therefore, if size in addition to beta has the power to explain returns, then this phenomenon is obviously a failure of the CAPM. That is why portfolio of small firms and big firms are made and then regression is run with three independent variables – lagged return, proxy for size risk and market return -- to investigate whether or not size-related risk matters. Returns characteristics are also analyzed to understand the difference in the basic returns properties. To figure out any change in the returns properties, total period is also divided into two sub-periods: pre-crash and post-crash period.

Rest of the paper is organized as follows. Section 2 provides empirical evidence on the effect of size on firms return, Section 3 discusses how data are collected, indexes for large and small firms are constructed, and statistical tools are used to investigate the size effect. Section 4 analyzes the results obtained from the statistical packages. Section 5 delivers some concluding remarks.

Effect of Size on Firm Returns: Empirical Evidence

Basu (1983) shows that earnings-price ratio (E/P) help explain the cross-section of average returns on U. S. stocks in tests that also include size and market, beta. Brown *et al.* (1983) find that size effects are linear in the logarithm of size, but rejects the hypothesis that the *ex ante* excess return attributable to size is stable through time. That is, due to the instability of effect, estimates are sensitive of time period studied.

Fama and French (1992a) find that when portfolios are formed on size alone, there seems to be evidence that average return is positively related to beta. The beta of size portfolios are, however, almost perfectly correlated with size, so tests on size portfolios are unable to disentangle beta and size effects in average returns. Allowing for variation in beta that is unrelated to size breaks the logjam, but at the expense of beta. Thus, when they subdivide the size portfolios on the basis of pre-ranking betas, they find a strong relation between average return and size, but no relation between return and beta.

Lo and Mackinlay (1990) documents that returns to portfolios of small company stocks tend to lag returns to portfolio of large company stocks. On the other hand, lagged returns on small company stocks are not correlated with contemporaneous returns on large company stocks. Size could be related to the number of analysts that follow a particular firm. The speed of price adjustment to private information should increase with the number of firm analysts. The prices of firms with many analysts quickly respond to private information, whereas the prices of firms with few analysts respond slowly to new information. Therefore, the returns of firms with few analysts are more likely to exhibit positive autocorrelation. Brennan *et al.* (1993) look for the effects of the number of investment analysts on the speed of adjustment after holding firm size constant. It is found that the number of analysts is positively associated with the speed of adjustment of prices to information.

Fama and French (1993) use three stock market factors – an overall market factor, factors related to firm size, and book-to-market equity – to explain returns of stock market. They find the evidence that size and book-to-market equity are indeed proxy for sensitivity to common risk factors in stock returns. Although size and book-to-market equity seem like ad hoc variables for explaining average stock returns, Fama and French (1992b) have shown reasons to expect that they proxy for common risk factors in returns. They further document that size and book-to-market equity are related to economic fundamentals.

Sadique and Chowdhury (2001) fail to obtain any prospect of lagged price and volume to predict the current and future price changes. However, they find that past trading volume and price changes can predict present and future changes in trading volume. Sadique and Chowdhury (2002) have found significant positive serial dependence in the weekly returns of the DSE over the short run. A study by Chowdhury *et al.* (2001) finds that beta simply fails to explain the cross-section of DSE-listed stocks. Chowdhury *et al.* (2003) find that, contrary to the findings in the developed markets, additional factors like size, market-to-book equity, and price-earning ratio cannot explain the cross-section of stock returns in the DSE.

DATA AND METHODOLOGY

Monthly price data for the period from January 1991 through December 2002 for the firms listed in the DSE are collected from the DSE Monthly Review. To find the size effect, two index series for small and big firms has been organized. First, market capitalization (market value) of each firm is calculated by multiplying the share price by number of share outstanding and average size is determined by averaging market capitalization across the study period. Then highest and lowest 20 firms in terms of market capitalization are separated and weighted index for each of the series has been constructed. Returns of these two size portfolios are calculated from these indexes by taking the log of differences between index at month t and $t-1$. This study has only considered those firms, which have been (to some extent) active in the stock market throughout the period from January 1991 to December 2002. Monthly size premium (small minus big or SMB) is calculated by deducting the monthly big portfolio return from monthly small portfolio return. Finally, regressions of the following form are used:

$$r_{i,t} = \quad + \quad {}_1r_{i,t-1} + \quad {}_2SMB_t + \quad {}_3r_{m,t} \qquad (1)$$

where $r_{i,t}$ is the return for either small or big portfolio at time t. SMB_t is the size premium, a proxy for risk, which may not be accounted for in the beta. $R_{m,t}$ is the return of the market at time t.

This study also use market model to verify how much additional factors are adding to the basic market model, where beta should incorporate all the market risk associated with a firm.

$$r_{i,t} = \quad + \quad {}_3r_{m,t} \qquad (2)$$

Descriptive statistics of the big and small portfolio returns and size premiums are also calculated for the entire, pre-crash, and post-crash period.

ANALYSIS OF RESULTS

Table I gives the descriptive statistics of the returns series of large firms, small firms, SMB and the market. Panel A of Table I shows the returns properties for the whole period from February 1991 through December 2002. Mean return of large firms is higher than small firms and the market. Standard deviation of large firms is also the highest among all three returns series. Conceptually, large firms are less risky due to their capability to face any unfavorable market-wide adverse movements. A large firm is also followed by more analysts, which helps to incorporate any information of a firm more quickly into its share prices. The likely consequence of these is that big firms' return as well as standard deviation, a measure of volatility or risk should be less than those of small firms. In this case, both average return and standard deviation are higher for large firms. The reason may be the scarcity of large stocks in a small market like the DSE. More investors with less financial asset valuation expertise may cause the return to be higher than it should be. This phenomenon may also make the information adjustment process slow, which may ultimately lead to noisy adjustment process with higher volatility.

Table I. Descriptive Statistics of Returns Series

Properties	*Large*	*Small*	*SMB*	**Market**
Panel A (Feb. 1991 - Dec. 2002)				
Mean	0.01022	0.00195	-0.00827	0.00590
Median	-0.00111	-0.00558	-0.00947	0.00126
Standard Deviation	0.12420	0.10301	0.11858	0.09469
Kurtosis	5.09720	2.06443	5.42207	6.58682
Skewness	1.17216	0.78858	0.32963	1.19693
Range	0.97157	0.62346	1.00687	0.77718
Minimum	-0.37109	-0.26736	-0.45082	-0.27753
Maximum	0.60048	0.35610	0.55605	0.49965
Count	143	143	143	137

Panel B (Feb. 1991 - Aug. 1996)				
Mean	0.03091	0.01524	-0.01567	0.01789
Median	0.01456	-0.00557	-0.01191	0.00616
Standard Deviation	0.10969	0.08980	0.08525	0.07028
Kurtosis	5.14818	3.10235	2.98985	4.69217
Skewness	1.28843	1.34232	0.38683	1.15122
Range	0.73305	0.53439	0.56979	0.46250
Minimum	-0.29863	-0.18975	-0.27846	-0.15300
Maximum	0.43442	0.34464	0.29133	0.30951
Count	67	67	67	67
Panel C (Jun. 1997 - Dec. 2002)				
Mean	-0.01128	-0.00825	0.00303	-0.00748
Median	-0.01799	-0.00558	-0.00635	-0.00630
Standard Deviation	0.08550	0.10291	0.12157	0.06602
Kurtosis	0.14287	1.62223	5.73215	2.19765
Skewness	0.26546	0.60873	1.48537	0.59055
Range	0.39521	0.61425	0.78884	0.36930
Minimum	-0.20718	-0.25815	-0.23280	-0.16774
Maximum	0.18803	0.35610	0.55605	0.20156
Count	67	67	67	61

In panel B and C of table I, the total period is divided into two sub-periods: pre-crash period (February 1991 – August 1996) and post-crash period (June 1997 – December 2002). During the pre-crash period, the dominance of large firms is clearly evident. The volatility of large firms was as before higher than that of small firms. After the crash, the big firms suffer a huge setback, probably more intensely

than small firms. Large firms have higher negative returns with lower volatility than small firms. So the change in the attitudes of the investors about big firms is clearly noticeable. Market returns have the lowest volatility among all the series in all the three periods. Although not reported, this study has performed Bartlett's homogeneity of variance test for the whole period. Results suggest that the variances of small, large, and market series are significantly different from one another.

Figure 1 presents a picture of the returns of both types of firms. They seem to have good correlation, as suggested by the harmony of their movements. That is why, although not reported, correlation between small and large firms has also been tested. The correlation is about 0.47, which is quite high. This is very striking since these two series represent two very different breeds of firms and their behaviors are not supposed to be similar. Figure 2 presents the size premium (small firms return minus large firms return) for the study period. From this graph, it is very hard to say whether or not there is any significant size premium in the market because the movement of this series is more or less around zero percent.

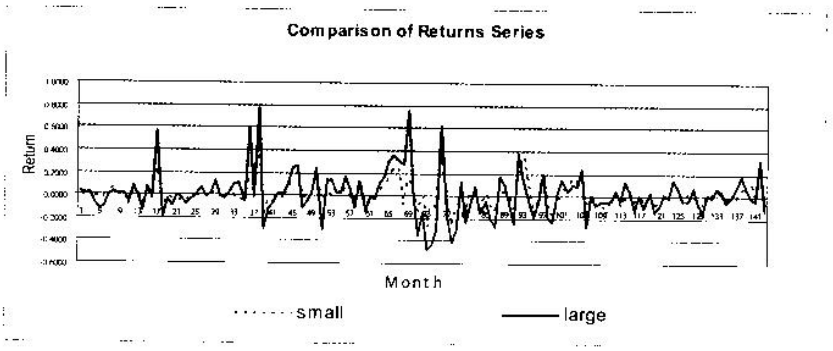


Figure – 1: Comparison of Returns Series

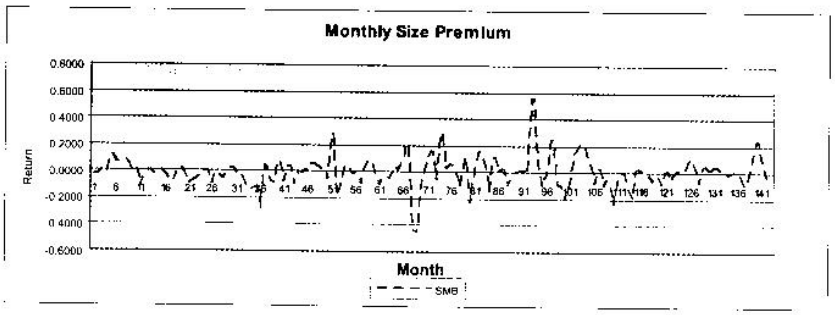


Figure – 2: Monthly Size Premium

Figure 3 shows the 36-month moving standard deviation for large and small firms. Difference between standard deviations is always almost same for the entire period. Also these two series move in a similar fashion. That is, when market perceives an increase in the volatility of large firms, same thing happens for small firms. Recently, the standard deviation of both series decreases strikingly. It is hard to explain this phenomenon. One reason may be that investors, especially foreign investors, have left the DSE after the share market scam in 1997, causing loss of investors/analysts both in terms of quality and numbers. Another reason may be the low transaction in the DSE. These factors may reduce the noise in the process of information adjustment into the stock prices, hence low standard deviation.

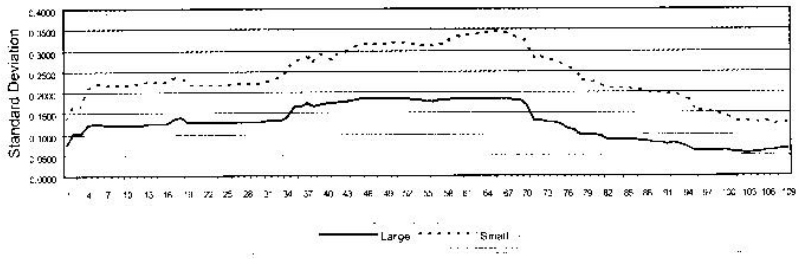


Figure – 3: Comparison of 36-month Moving Standard Deviation

Table II shows the autocorrelation structure of the four (three returns series plus size premium series) returns series have used in the study. All the returns series show high autocorrelation in the first lag while the small firms do not show strong autocorrelation. Positive autocorrelation for market and large firms is an indication of initial positive overreaction followed by some corrections by the investors. Surprisingly, small firms show very small autocorrelation, which means very low predictability of small stock returns. The findings for the large firms are discouraging but expected since this is the common feature across most of the emerging markets (Korajczyk, 1996). In fact, small stocks usually have more autocorrelation due to non-synchronous trading. In this case, the effect of such trading should be insignificant since monthly data have been used instead of daily or weekly data. Low demand and use of monthly data accompanied by transaction among few well-informed investors/brokers may cause the autocorrelation of small firms to be low.

Table II. Autocorrelation

Series	Lag1	Lag2	Lag3	Lag4	Lag5	Lag6	Lag7	Lag8	Lag9	Lag10	Lag11	Lag12
Small	.058	.028	-.093	.071	-.087	-.168	.011	.100	.046	.115	.020	.040
Large	.151	.049	.012	.093	-.130	-.160	.083	.078	-.019	-.075	.003	.161
Market	.329	.090	.036	.018	-.282	-.230	-.137	-.043	.061	.147	.151	.055
Size prem	.144	-.081	-.047	.003	-.076	-.171	-.008	.100	.016	.064	.146	.087

Table III shows the regression results. Panel A shows the results when only market return is used as independent variable in the model. Results indicate that market return explains returns of both small and large firms. However, market model explains only 9% of the small firm returns while it explains 28% of large firm returns. Results suggest for more variables to be incorporated in addition to market returns.

Table III: Regression Results

Firms	Constant	β_1	β_2	β_3	R-square
		Panel A			
		$r_{i,t} = \alpha + \beta_3 r_{m,t}$			
Small	-0.0025			0.3307	0.0914
	(-0.2902)			(3.6852)*	
Large	0.0062			0.7041	0.2845
	(0.6851)			(7.3270)*	
		Panel B			
		$r_{i,t} = \alpha + \beta_1 r_{i,t-1} + \beta_2 SMB_t + \beta_3 r_{m,t}$			
Small	0.0010	-0.1149	0.4601	0.5407	0.3243
	(0.1398)	(-1.5322)	(7.0202)*	(6.2969)*	
Large	0.0024	-0.2172	-0.5325	0.00680	0.5569
	(0.3351)	(-2.9526)*	(-8.3535)*	(6.7517)*	

Note: Figures in Parentheses are t-ratios; Asterisks indicate significance at 5% level

Panel B shows the development of the model when two additional factors – lagged returns and SMB – are introduced. Large firms' return is negatively related to firms' lag return and SMB, whereas it is positively related with the market and these relationships are statistically significant. This result implies that large firms' returns are predictable form the past returns. When the size premium increases, big firms' return decreases. Market returns, however, significantly explains the return of large firms. Adjusted R-square of .5667 indicates that high portion of large firms' return can be explained by the variables used in the model.

In case of small firms, the performance of the extended model is not that successful. Now, one-month lagged return does not explain the portfolio of small firms while two other variables – size premium and market - still explain the variability of return of the small firms. Interestingly, risk premium is positively related with returns of small firms, which means when size premium i.e., risk increases, expected return of small firms also increases. That is, when size premium increases, the economy becomes more uncertain and consequently returns of small firm increase, which in turn, according to the present value model should decrease the price of small firm stocks. This phenomenon calls for additional return (size premium) for the small companies. As already discussed before, many papers in the context of developed markets have suggested that the CAPM has failed to incorporate this risk in beta. Consequently, many financial economists argue that multifactor model should be preferred to single factor CAPM.

If SMB is really a market-wide risk phenomenon, its impact should be positive regardless of the size of firms. Therefore, the *a priori* expectation is that the effect of SMB should be in magnitude but not in direction (positive or negative). In this study it has been found that relation between this factor with small firms and big firms is significantly positive and negative, respectively. It is a deviation from theory. It may be possible that investors do not perceive SMB as a source of market risk but as a source of risk to which small firms are highly susceptible. This works as a reward for large firms because it causes decrease in the expected return of large firms, resulting in further increase in the price of stocks of large firms. In this backdrop, investors probably deem the stocks of big and small firms to be substitutes for each other. In such a case, investors may simply get rid of small stocks and invest more in large firms.

CONCLUSION

The main purpose of this paper is to find the difference of the behavior of returns just because of the difference in size, a measure of risk. Many of the previous research, as discussed above, suggest the presence of "size effect" in returns of stocks. Return behavior before and after the 1996 crash is also taken into account to locate any change in the returns behavior because of the capital market crash.

Findings show that before crash big firms produced almost twice as average return as small firms at the cost of about 2% additional standard deviation. After the crash the scenario has changed so much that large firms produce higher negative return than small firms. However, the standard deviation of large companies in this phase has dropped and become less than that of the small companies.

Again, the behaviors of large firm and small firm returns are different. Large firms' returns are negatively auto-correlated with own previous month's return. The reason may be that investors respond with some overreactions reflected in the stock prices and later adjusts with corrections in the next month. On the contrary, infrequently traded small stocks impart less information and are followed by fewer investors, causing less price mismatch, hence absence of autocorrelation in monthly return. Moreover, this study has used monthly data. Using data of weekly or daily returns may depict different scenario of price adjustments process. For example, in case of daily data, small firms may have higher autocorrelation than large firms.

Regression analyses indicate that firm size matters in explaining expected returns because size premium has negative and positive relation with returns of large firms and small firms, respectively. While analyses boil down to one finding – size matters, albeit in a roundabout manner. When divergence between small firms and large firms expands, the return of small firms increases while that of large firms decreases.

SMB, a proxy for size-related risk factor explains the returns of small and big firms. Such risk reduces the expected returns of big firms, meaning increase in the price of big firms although such risk exposure should positively affect the expected returns but in different magnitudes. Such behavior probably implies that these two types of firms are substitutes rather than complementary. The implication of this finding is the fact that investors prefer large firms when they make their investment portfolio.

However, these two types of stocks should exist in the market as complementary, but not as substitutes. For example, a portfolio manager should include a small firm in his portfolio if its inclusion improves the efficient set (i.e., better mean-variance efficient portfolio) even though this stock is otherwise unattractive. If small firms are made more transparent by introducing stringent rules and SEC supervision followed by tougher punishment for defaulters, investors may become more confident in these stocks. Consequently, these attitudes will gradually wither away. Nevertheless, Size-related risk factor may still exist in such a well-controlled and -supervised market, but it will affect in magnitude but not in (wrong) direction.

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