A Study of Size Effect on the Returns in the Indian Stock Market

Nikita Agarwal*
Deepak Danak**

Various combinations of factors affect the risk-return relationship in the stock market. Traders and investors are constantly on a lookout for trading strategies, which are superior to others, with the motive of earning superior returns. The investment strategies used to design so called winning portfolios are based on a number of variables like size, leverage, price-earnings ratio, book-to-market ratios, etc. These are, however inconsistent with the Capital Asset Pricing Model (CAPM). The model developed by Sharpe and Lintner establishes a linear relationship between the returns on a security and its non-diversifiable risk measured with respect to the market portfolio. However, when other factors apart from market risk contribute in explaining the returns on a security, those situations are characterized as CAPM anomalies. This paper attempts to examine whether size anomaly exists in the Indian stock market. Towards that, it studies differences in returns in small-cap stocks, mid-cap stocks, and large-cap stocks. The presence of size effect, if established, will contradict the model.

** MBA Student, Institute of Management, Nirma University, Ahmedabad*

*** Professor, Institute of Management, Nirma University, Ahmedabad*

Literature Review

Many studies have explored the size effect. We present below a review of the research by grouping them on the basis of their results. We also review studies conducted on the Indian market.

Banz (1981) was the first to document the size effect for U.S. stocks. A significant negative relationship existed between excess returns and the market value of NYSE common equities. Roll (1981) studied the possible reasons for the existence of the small size effect and concluded that, because of infrequent trading of small firms, the risk for small firms is ill assessed which leads to large excess returns even after adjusting for risk. Kiem (1982) examined the month-to-month stability of the size anomaly over the period 1963-79 in the NYSE and AMEX common stocks. The conclusion was that almost 50 per cent of the average size anomaly can be attributed to January excess returns. Lustig and Leinbach (1983) investigated the small size effect from 1931 to 1979 in the New York Stock Exchange and confirmed that small firms in terms of market valuation had higher cumulative excess return than large firms. Kato and Schallheim (1985) in their study tried to test the existence of January and size-effect in the Japanese stock market. They found out that both anomalies were present in the Japanese stock market. They found many similarities between U.S. and Japanese stock markets in terms of these anomalies. Chan and Chen (1991) argue that small firms are characterized by structural factors such as inefficiency and high financial leverage which make them riskier than large firms, but such riskiness of small firms is not captured in a market index dominated by large firms. Fama and French (1992) studied the cross-section variation of expected stock returns. They concluded that market beta does not alone capture the variation in stock returns. Two other easily measurable variables — size and book-to-market value ratio — also influence average stock returns. In their study, they found a positive correlation of the average return with book-to-market ratio and size. This phenomenon was popularized as the Fama-French Three Factor Model. The traditional asset-pricing model, CAPM, uses only one variable to describe the returns of the stock. In contrast, the Fama-French model uses three variables — beta, SMB (small capitalization minus big), and HML (high book-to-market minus low) — to define stock returns. Fama and French (1995) further support the risk hypothesis by showing that size and book-to-market factors are reflected in earnings as well as stock returns. Rutledge, Zhang, and Karim (2008) examined the size effect in the bull and bear market phases for six years in the Chinese stock market. The results confirm the presence of size effect. Moreover, small firms exhibited greater positive returns than large firms did during bull market conditions: the small firms reacted strongly to the direction of the market than the large firms. On the other hand,

significant negative returns or no significant different returns were found in small firms during the bear market phase. Wu (2011) did further research in the Chinese stock market. Using the Fama-MacBeth two-stage regression methodology, he found no size effect in the two stock exchanges studied by him. However, some evidences of value effect was found in the Shanghai Stock Exchange.

In contrast some studies have found absence of size effect in foreign markets. Shafana, Rimziya, and Jariya (2013) found significant negative relationship between book-to-market equity and stock returns, but no size effect in the behaviour of stock returns in the Sri Lankan stock market. Foerster and Porter (1992) found that dual class shares in which two classes were identified by selecting those shares having equal dividend and liquidation treatment did not exhibit size effect. The implication is that size effect may be the result of incomplete risk adjustment. Schwert (2003) studied different effects — size effect, value effect, dividend yield effect, and weekend effect — and discovered that all seemed to have had weakened or disappeared after research papers highlighted the existence of market anomalies. These anomalies failed to hold up in different sample periods, may be because traders began to formulate investment strategies based on the research findings. Van Dijk (2011) examined Schwert's findings and identified important gaps in the literature on size effect. He concluded that the available empirical evidence was not sufficient to explain the robustness of the effect convincingly.

We now turn our attention to some studies of the Indian stock market, Mohanty (2002) studied the effect of four firm-specific characteristics that could explain cross-section variation in stock returns. Four variables— size, market leverage, price-to-book value, and earnings-to-price ratio—were found to have high correlation with stock returns. His study was divided into two time periods: pre-1995 and post-1995. He found that size and price-to-book value were negatively correlated with returns while market leverage and earnings-to-price ratio had positive correlation with stock returns. Further, these effects were more predominant in the post-1995 era than in the pre-1995 era. Sehgal and Tripathi (2005) studied the size effect in the Indian stock market. Using six measures of company size, they found strong size effect in the Indian stock market. Further, size effect could not be attributed to any seasonal or business cycle factors, meaning that it is persistent. In Taneja (2010)'s study, size and average monthly returns showed positive relationship whereas an inverse relationship was found to exist between value and average monthly returns. He also found that though the CAPM cannot be ignored, the Fama French Three Factor Model better explained the common variation in stock returns.

Methodology

Data for the study were obtained from the Ace Equity Database. We have largely depended on the classification adopted by it.

The database contains lists of companies categorized as mid-cap and small-cap. However, no separate list of large-cap companies is available. We could have chosen SENSEX or NIFTY companies, but that would have left us with smaller number of companies to analyse. So, we considered BSE 100 as the index for large-cap companies. Again, the data for BSE 100 contained those companies which were already classified as mid-cap by the Ace Equity Database. Such companies were dropped from the list, ultimately leaving us with 61 companies in the large-cap class. There were 113 companies in the mid-cap class and 175 companies in the small-cap class.

The basic data consisted of the month-end market returns of the sample companies for thirteen years from April 2000 to March 2013. Based on it, average yearly returns were calculated.

For the purpose of this study, we have preferred to evolve our own method of analysis rather than going by popular methods. Since return is a reward for risk, we directly modelled return as a function of risk on the lines of Jensen's alpha.[1] Accordingly, average returns during the period are being explained as a function of risk measured as standard deviation in the same set of returns. This approach not only brings in simplicity as opposed to the complexity in popular approaches, but, by relating investors' risk to the return, makes the comparison more direct and meaningful.

First, we compared the three classes based on the risk adjusted return for the investors measured as coefficient of variation (CV) to see whether there is any primary evidence for the size effect. Then, for checking whether the return and risk go hand in hand or not across the three classes, we subjected the return and risk data to two types of mutually reinforcing analyses. We applied ANOVA for finding any statistically significant differences among the three classes; constructing a panel and conducting regression analysis, we have tried to see what excess returns a particular class showed after standardizing for risk. The analyses were conducted using MS Excel software.

Results

Using the return and risk values, CV were calculated for each year for each class (see Table 1). The difference between large-cap and small-cap classes is eye catching. This makes a case for further inquiry.

Table 1: Class-wise Return, Risk, and Coefficient of Variation

Year	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13
LARGE-CAP													
Large Cap Returns_Avg	0.48	2.05	0.88	10.13	5.75	5.05	1.18	3.60	-2.66	7.88	1.34	-0.13	0.18
Large Cap_SD	10.3873	3.20824	3.72501	14.7429	21.212	3.09434	3.27436	3.52303	2.62639	3.66241	1.80715	1.8666	1.99475
Lsrge Cap_CV	21.4634	1.56722	4.21799	1.45517	3.68837	0.61283	2.764	0.97831	-0.9863	0.46477	1.34889	-14.845	11.3903
MID-CAP													
Mid Cap Returns_Avg.	-1.11	2.89	1.29	9.56	5.34	5.81	0.64	2.44	-3.66	9.24	1.87	0.79	0.22
Mid Cap Returns_SD	6.12936	4.17371	4.04768	11.2384	4.50189	4.51056	4.07549	3.73261	3.23984	4.01689	3.04671	2.56261	2.71749
Mid Cap_CV	-5.5368	1.4466	3.12576	1.17514	0.84352	0.77586	6.41015	1.52895	-0.886	0.43452	1.62751	3.22794	12.4571
SMALL-CAP													
Small Cap Returns_Avg	-1.90	1.95	2.22	9.05	7.20	5.95	0.55	2.39	-4.98	10.27	0.80	-0.13	-0.16
Small Cap_SD	7.20014	4.22057	4.60198	5.57405	5.31833	4.6343	5.08326	4.962	3.40104	4.03203	3.48241	2.73993	3.62996
Small Cap_CV	-3.798	2.16095	2.07142	0.61588	0.73912	0.77918	9.27045	2.07189	-0.6824	0.39275	4.32964	-20.677	-22.33

For this purpose we conducted ANOVA and panel data analysis. Since we wanted to go for a balanced panel, and since the maximum observations available in the large-cap class were only 61, we had to trim the sample companies in mid-cap and small-cap classes to the same number. Towards that, first 61 companies in the list were selected. In our view, even after this trimming, randomness in the samples is completely retained because the companies were listed in alphabetical order and not on any economic parameters like market valuation. Then, ANOVA was conducted to see whether the apparent difference between the three classes on the basis of the relationship between return and risk as differentiated by CV values was statistically significant. The results are presented in Table 2.

Table 2: ANOVA for Testing Differences in Coefficient of Variations

SUMMARY						
Groups	*Count*	*Sum*	*Average*	*Variance*		
Large_CV	61	134.127	2.198803	2.611308		
Mid_CV	61	124.0853	2.034185	0.639683		
Small_CV	61	196.8892	3.227692	10.38623		
ANOVA						
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	51.04011	2	25.52005	5.614059	0.004314	3.046148
Within Groups	818.2332	180	4.54574			
Total	869.2733	182				

The ANOVA results very clearly show the difference in the average CV values resulting from disproportionate relationship between return and risk across the three classes. This can be interpreted as different sets of responses of return to risk across the three classes. To further examine the ability of risk to explain the difference in returns, we take a novel approach of running a panel regression. It is modelled on the premise of standard models like CAPM that the return is a positive function of risk, and on the lines of Jensen's Alpha to filter out any excess returns as shown below.

When a panel regression is run with 'fixed effect for cross-section', the class specific intercepts stand for the 'omitted variables.' In our model, because that a part of return is explained by risk, the remaining part stands for the 'omitted variable' of class effect. So, in our case, the differing intercepts show the differing magnitude of excess returns. Using MS Excel software, the output of panel analysis is presented in Table 3.

Table 3: MS Excel Output of Panel Regression Analysis

Regression Statistics	
Multiple R	0.854596
R Square	0.730334
Adjusted R Sq.	0.725815
Standard Error	0.848191
Observations	183

ANOVA

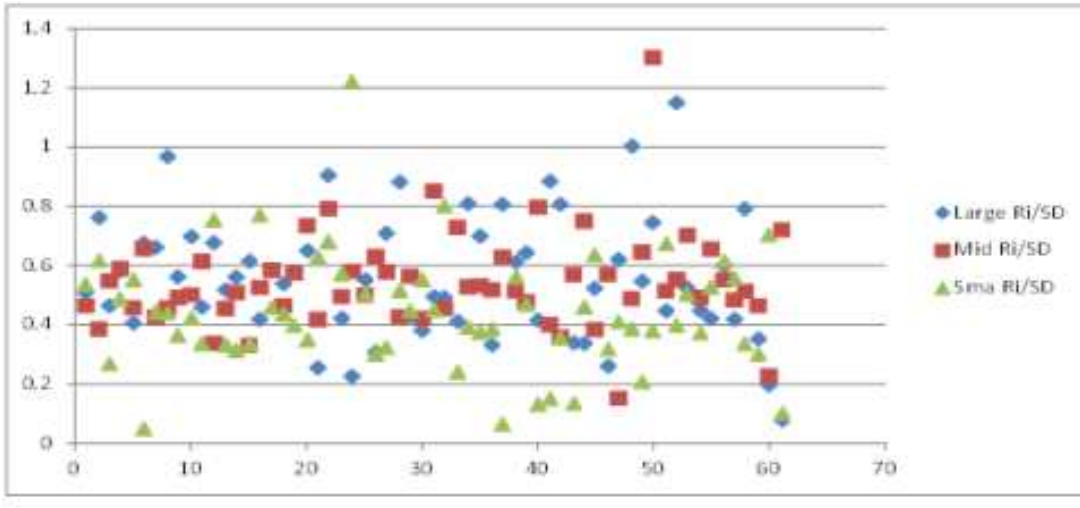
	df	*SS*	*MS*	*F*	*Significance*
Regression	3	348.7671	116.2557	161.5948	1.05E-50
Residual	179	128.7775	0.719427		
Total	182	477.5446			

	Coefficients	*Std. Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95%*	*Upper 95%*
Intercept	0.548486	0.139397	3.934697	0.000119	0.273412	0.823559	0.273412	0.8235589
Risk	0.32273	0.014713	21.93501	1.30E-52	0.293697	0.351764	0.293697	0.3517637
S1	0.384085	0.153651	2.499719	0.013329	0.080884	0.687287	0.080884	0.6872866
S2	0.476065	0.154077	3.08978	0.002323	0.172024	0.780107	0.172024	0.7801069

Intercepts	
Large-cap	0.932571
Mid-cap	1.024551
Small-cap	0.548486

It can be seen that the results satisfy all the requirements of good model fit. The R^2 value of more than 70 per cent shows that the model explains quite a large part of the variation. In fact, it is comparable to or rather more than the explanatory power shown by the popular models in many other studies. Both the intercept and beta are statistically significant even for α value of less than 1 per cent (with the intercept for large- cap showing marginally higher value). The output for the fixed effect is also appended at the end of the table, which shows the excess returns for three different classes during the period. The size effect becomes quite evident, as there is a perceptible difference in the excess returns to different classes. Here, a line of caution is necessary while interpreting the differences in excess returns. It should be understood that our excess returns are not same as the abnormal returns under the popular approach. Rather, the excess return under our methodology has an opposite interpretation. When we explain market returns as a function of the risk measured as variability in the same stream of returns and under the fixed-effect method, when we estimate a common beta as a measure of influence of variability in returns on the market returns, financial risk gets factored in. Thus, the differing intercepts represent the differing rates of growth in market value vis-à-vis their book values. In this sense, higher the intercept, better is the market return and, for that matter, market response. Figure 1 shows the risk/return ratio (denoted as Ri/SD) across the classes. It clearly shows that our 'excess return' should be interpreted on the lines of Jensen's alpha.

Figure 1: Graph showing Excess Returns across Three Classes



Conclusion

The results shows that mid-cap excess returns are highest, followed by large-cap and small-cap excess returns. How do we interpret these results? As far as the comparison between large-cap and small-cap is concerned, the conclusion is obvious and in line with the findings validating the size effect. It is so because the required rate of return being lower in the case of large-cap manifest higher market value-to-book value ratio in comparison to small cap. However, going by that argument, mid-cap should have shown only average excess return. Since it is not so, it emerges as a mystery. As a matter of fact, no theory can explain such an aberration. So, we are trying to search for an intuitive explanation. Our intuition (of course, with somewhat support of field observations) takes us to look at the excess return as the equilibrating 'price' of the capital. If we assume that the large-cap segment witnesses more competition among capital providers as compared to the mid-cap segment, the price of capital becomes lower. This is not only a mere assumption. We find that for those stocks in which foreign institutional investors are active, their price levels are higher. However, with this argument how can we explain the difference in excess returns between small-cap on the one hand and other two classes on the other? Probably, behavioural finance can come to our help. Since small-cap is a neglected class in terms of level of activity and level of investment by big investors, it does not command the 'price' that rationally it should.

To reinforce, our intuition of differing levels of activism/competition in the three classes can be summarized as follows. The large cap segment has higher supply of capital since all big investors play in this class making it a very competitive segment. The mid-cap segment is less competitive than large-cap because of which investors are able to earn higher returns. The small-cap segment has the lowest returns because it is a neglected class. Small retail investors mainly dominate it and there is less supply of capital. The market does not grant it the fair return by increasing the price to the fair level.

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