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Efficiency of the Market for Small Stocks

Abstract

We found that during the sample period 1991-99, the return differential between small and large stocks is in excess of 70% on an annualized basis. Using Fama and French (1993, 1995,1996) multi-factor model, we found that size indeed is a proxy for risk. However, the return earned by the small companies is too large given their risk exposure.

We found that transaction costs explain a large part of this return difference. Using Roll's (1984) method, we found that the bid-ask-spread difference for the small stocks is about 3%. It is less than 1% for the large stocks. Using data on 100 companies, however, we found that transaction costs completely erased the return differential.

Efficiency of the Market for Small Stocks[1]

There is now considerable evidence in the US that firm specific characteristics like size, price-to-book value, etc can explain the cross-section of stock returns. Banz (1981) and Keim (1983) found that small stocks outperform large stocks even after adjustment for systematic risk (measured by beta). Reinganum (1981a) has also reported that the excess return accruing to the small stocks continue even after adjustment for the P-E effect. Fama and French (1992,1993,1996) have found that the cross-sectional variation in US stock returns can be explained by two variables, namely, price-to-book value (PBV) and size. Davis, Fama and French (2000) found that for the sample period 1929-1997, three factors, namely market risk premium, ME/BE, and size capture the common variation in stock returns. In a related paper Reinganum (1981b) found that size can explain the cross-sectional variation in stock returns even after adjustment for factor risk premiums along the line of Arbitrage Pricing Theory of Ross (1976).

There is no consensus on whether an investor can earn risk-adjusted excess returns by investing in the small stocks. Roll (1981) suggests that the stocks of small stocks trade less frequently and hence measures of systematic risk from daily stock returns will be biased downwards. Fama and French (1993,1995,1996) have argued that size and PBV are proxies for risk and hence the excess return earned by small stocks can be explained by the high risk such stocks possess. There are others, however, who argue that the excess return earned by the small companies is overestimated in the above studies. Stoll and Whaley (1983) have examined the magnitude of transaction costs in US for the sample period the commission rate on a turnaround transaction averaged 3.84%, while for the largest stocks the turnaround commission averaged 2.02%. The total turnaround transaction cost differential was 4.06% for the sample period. Stoll and Whaley found that after adjusting for transaction costs and small price effect, the size effect vanished for low investment horizons. Schultz (1983), however, has observed that the investors can earn risk-adjusted excess returns after transaction costs by holding small firms' stocks for relatively short holding periods.

There are others, however, who argue that the excess return earned by the small sized companies is a symptom of market inefficiency. Lakonishok, Shleifer, and Vishny (1994) (LSV), have argued that the investors wrongly extrapolate the past poor-earnings growth rate for stocks and this makes stocks of small companies (and of course companies with high book-to-market ratio) undervalued.

[1] The author gratefully acknowledges the research grant obtained from the National Stock Exchange Limited for this paper.

One of the reasons why the size premium continues is the behavior of the institutional investors. Large investors do not hold stocks of small companies because they are less liquid. Large institutional investors are worried about transaction costs. The bid-ask spread is high for small stocks. Secondly, since these stocks do not generate much response among the investors, the impact costs associated with them are also high. The transaction costs associated with small stocks are also high for another reason. Since there is not much interest in these stocks, the equity researchers hardly generate reports on these stocks. Hence, if an investor wants to buy stocks of small companies he has to generate the equity research himself. Of course, some of the institutional investors have their own equity research team and they do research of the large stocks any way. However, most of the brokerage houses distribute the equity research reports free of cost to their clients.

In this paper we have attempted to find out whether the returns generated by small stocks is higher compared to those of large stocks. We use data from the Indian stock market. Using Fama and MacBeth (1973) regression, we found that size is negatively related to the average stock return in the sample period. In a different study we have also found that after one adjusts for size, other firm specific variables like price-to-book value, earnings-to-price, market leverage, etc do not have any incremental explanatory power.[2] Subsequently, we made an attempt to find out the exact causes of the size effect. We found that transaction costs can explain a large part of the excess returns accruing to the small stocks. However, if an investor has a one-year investment horizon, then he can still earn risk-adjusted excess returns.

The rest of the paper is organized as follows. The next section discusses the sample and data definitions. It also discusses the methodology used in this paper. Section II discusses the major findings. In section III an attempt has been made to understand the sources of the size effect. Finally, Section IV concludes the paper.

I Sample and Data Definitions

For the purpose of this study, the sample has been restricted to the period to September 1991 to March 2000. Data on all the companies have been collected from the Prowess database of CMIE. All the companies, for which the relevant information is available in the Prowess database, have been included in the sample. The number of companies varies from 762 companies in 1991 to 1971 companies in 1999. The number of companies is the maximum in 1997, when we have 3270 companies.

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[2] See Mohanty (2000), "Small is Beautiful", presented at the Fourth Capital Markets Conference held at UTI ICM in December 2000.

We use Fama and MacBeth (1973) (FM) regression methodology to see if size is related to the cross-section of stock returns. We have considered only those companies whose accounting year ends in March. In a few cases, the Prowess database does not give the figure for the number of shares. Such companies have also been deleted.[3]

Under Section 210 of the Companies Act of India, it is the duty of the Board of Directors to lay before the Annual General Meeting the Balance Sheet and the Profit and Loss Account of the company within six months of the accounting year-end. Hence it has been assumed in this paper that all the accounting data for the year ending March of year t are available by the end of September of year t. Therefore, the accounting data for the year ending March of year t have been matched with stock returns from September of year t to August of year t+1.

Following Fama and French (1992), the market equity at the end of September of year t has been used to estimate size. Size has been defined as the natural logarithm of market capitalization. Market Capitalization has been computed by multiplying closing stock price of September of year t with the number of shares outstanding as at the end of March of year t.

Each month the cross section of returns on stocks is regressed on size. In FM regression, we test the null hypothesis that the time series average of the monthly regression slope coefficient is zero. The average slope coefficients will tell us which variables have non-zero expected premiums during the sample period.

We have included beta also in our FM regression. Roll and Ross (1994) have argued that the true cross-sectional expected return-beta relation is exact when the index is efficient, so no variable other than beta can explain any part of the true cross section of expected returns. Conversely, if the index is not efficient, any variable that happens to be cross-sectionally related to expected returns could have discernible power when the index proxy is ex ante inefficient. Similarly, Kandel and Stambaugh (1995) show that expected returns can display essentially no correlation with betas computed against an index portfolio that has an expected return arbitrarily close to that of the efficient portfolio with the same variance. Alternatively expected returns can display a nearly perfect linear relation to betas computed against an index portfolio that is grossly inefficient. Hence, if beta gets included in the regression, we will be actually doing a joint hypothesis testing, namely, the market proxy is mean-variance efficient, and that these firm specific variables explain the variation in stock returns. However, we include beta in our cross-sectional regression because this will make our findings comparable with those of Fama and French (1992).

We use Fama and French (1992) methodology in estimating beta. We first divide our portfolio into five quintiles based on their market capitalization at the end of September of every year. Each size-sorted portfolio has been further sub-divided into five quintiles based on the pre-

[3] The database gives a figure of zero as the number of shares in the query option for some companies.

ranking betas. The pre-ranking betas are estimated based on the last thirty-six months of data for each stock. Though our original sample period is 1991-2000, we have to restrict our sample period to 1994-2000 because of the above restriction. Thus for example, in 1994, we first sort the stocks into five quintiles based on the size of the stocks. Then we further sub-divide the stocks into five quintiles based on their pre-ranking betas (estimated for 1991-94). This is done to ensure that the variability of betas is independent of that of size.

Once we create the twenty-five portfolios, we estimate the portfolio betas based on the post-ranking data that is from 1994-2000. We use monthly return data to estimate the beta. We use Sensex as our market proxy. Since the Fama Macbeth regressions have been run on individual stocks, we assign the portfolio beta (estimated based on post-ranking data) to the individual stocks.

II Results of the FM Regression

We regress the monthly returns on size. Then we took the average of the time series slope coefficients for the 103 months. Table 1 shows the time-series average of the slopes from the month-by-month FM regressions of the stock returns on size.[4] We can see that used alone, size, market leverage, earnings-to-price ratio and price-to-book value ratio are related to the cross-section of stock returns. Size is more than 4 standard errors away from zero. Market leverage is more than 3.7 standard errors away from zero.

Table 1: Output of Fama and Macbeth Univariate Regression: (103 months for all variables other than beta)

(For each year t, we regressed the monthly returns from September of year t to August of year t+1 on the different explanatory variables computed at the end of March of year t. Only size is computed at the end of September of year t. The sample period ranges from September of 1991 to March of 2000. There are altogether 103 months in the sample. This table presents the average of these 103 slope coefficients. We have used data for 67 months only to find the average of FM slope for beta.)

Variables	Mean Slope Coefficient	Standard Error	t-statistic
Size	-0.01192	0.002756	**-4.3258**
Market Leverage	0.001422	0.000383	**3.714853**
Price-to Book Value	-0.00025	8.09E-05	**-3.04634**
Earnings-price ratio	0.009823	0.003887	**2.527133**

[4] We have also included other variables namely, beta, price-to-book value, earnings-to-price ratio, market leverage, price-to-cash flow per share, price-to-book value per share in the FM regression. For details see Mohanty (2000)

Beta	0.0084	0.0062	1.35
Price-to-sales	0.000115	0.000222	0.519854
Price to cash flow	-5.2E-05	3.82E-05	-1.35
Book leverage	-0.00039	0.000233	-1.67

The interesting thing to be noted is that in the Fama and French (1992) study also, these four variables turned out to be statistically significant in the US. Each of these variables depends on the market value of equity. It is therefore possible that they capture the same information. In order to arrive at a parsimonious model, we must know if the information contained in one variable can be captured from another variable. As in Fama and French (1992) paper, we also find that returns are not related to beta. However, the relationship is more significant compared to that is US.

It is interesting to note that beta does not appear to be significantly related to the stock returns. Fama and French (1992) also got similar findings in the US, of course for a larger time period.

Like Fama and French (1992), we run multivariate FM regression for each of the 103 months. In each month we regressed the average return on two variables at a time. Then we took the average of the time series slope coefficients. For size and beta, we run the FM regression by taking data for 67 months only[5]. Table 2 presents the main findings.

Table 2: Output of Fama and MacBeth Regression (Size and Market Leverage)

(We regressed the monthly returns on two variables at a time, each month for the 103 months (excepting for beta where we include only 67 months' data). Then we estimated the average of the time series slope coefficients and the standard errors to find out if the average FM regression slope is statistically different from zero. Here, we have presented the results only for size and market leverage, size and price-to-book value, and size and price-to-earnings ratio. The other combinations, like PBV and market leverage, did not give satisfactory results. The details of that output can be obtained from the author.)

Variables	Mean Slope Coefficient	standard error	t-statistic
Size	-0.00833	0.002133	-3.90405
Market Leverage	-0.00027	0.000983	-0.27031

Output of Fama and MacBeth Regression (Size and PBV)

[5] Though beta is not significant even when used alone, we nevertheless included it in the multivariate regression to make our study comparable with that of Fama and French (1992).

Variables	Mean Slope Coefficient	standard error	t-statistic
Size	-0.00968	0.002125	-4.55658
Price-to-Book Value	-0.00019	0.000239	-0.79685

Output of Fama and MacBeth Regression (Size and Earnings-to-price)

Variables	Mean Slope Coefficient	standard error	t-statistic
Size	-0.00875	0.002013	-4.34485
Earnings-to-price ratio	0.005622	0.003521	1.596621

Output of Fama and MacBeth Regression (Size and Beta)

Variables	Mean Slope Coefficient	standard error	t-statistic
Size	-0.00875	0.002013	-4.34485
Beta	0.00362	0.003521	1.028

We find that the relationship between return and beta is not significant any standard level of significance. However, to make our findings comparable to those in Fama and French (1992), we regress return on beta and size. The regression output is included here.

Two major inferences come to one's notice here. Once size is included in the regression, the other variables, namely price-to-book value ratio, earnings to price ratio and market leverage do not have any incremental explanatory power. This of course does not mean that they are not related to the stock returns. But their apparent role is captured by size. Secondly, in the Fama and French (1992) study PBV turned out to be the most significant variable. They found that both size and PBV are necessary to explain the cross-section of stock returns. However, in India the results are different. What is more, Fama and French (1992) conjectured that both size and PBV are proxies for some unknown risk factors. If that were the case, then PBV must also be statistically significant in India[6]. However, after adjustment for size, PBV is only 0.79 standard errors from zero. This means that the PBV is probably not a proxy for any risk factor. It is also possible that PBV and size are highly correlated and hence, in the regression that also includes size, PBV is statistically insignificant. For in the bivariate regression, PBV was 3 standard errors away from zero. We have used data for a period of only 103 months. It is therefore, perfectly possible that PBV is in fact a proxy for some risk factor but we are not able to capture it because of multicollinearity in the sample. Mohanty (2000) has also arrived at similar conclusion by adopting grouping methods.

[6] There is absolutely no reason as to why PBV will be a proxy for risk only in US and not in any other country.

If stocks are divided into five groups based on size alone, the quintile containing the smallest stocks gives an average monthly return of 5.85%. This is significant both economically and statistically. The corresponding figure for the quintile consisting of the largest stocks is 1.82%. The difference between the two returns is more than 70% on an annualized basis. This is significant both economically and statistically.

III Sources of the Size Effect

In the previous section, we saw that the return difference between the small stock portfolio and the large stock portfolio is more than 70% on an annualized basis. It can have two possible interpretations. It is possible that size is a proxy for risk and hence, the return premium to the small stocks is just a compensation for that risk. In such a case, if an investor starts investing in the small stocks, then there is no guarantee that he will earn excess return in future also. If size is a proxy for risk, then it is possible that small sized stocks will generate much lower returns compared to the large sized stocks in future. However, it is also possible that it is a symptom of market inefficiency. If the market is indeed inefficient, then an investor can earn excess returns by investing in the small sized stocks.

Size Premium and Risk

In a related study, by using Fama and French (1993) methodology, we found that size is indeed a proxy for risk. Very briefly we are presenting the findings here.[7]

Fama and French (1993) have argued that if the assets are priced rationally, variables that are related to average returns must proxy for sensitivity to common risk factors in returns. Fama and French (1993,1996) found that portfolios constructed to mimic the risk factors related to size and PBV capture strong variation in stock returns. They developed a three-factor model to explain the average return variation. Other than the above two factors, the three-factor model also includes a market risk factor. They suggest that this multi-factor model is an equilibrium model such as a three-factor version of Merton's (1973) intertemporal CAPM or Ross' (1976) Arbitrage Pricing Theory.

It is possible that size is a proxy for risk in India and the entire size premium is due to this risk. Fama and French (1995) argued that controlling for book-to-market equity, small firms tend to have lower earnings on assets than big firms. Perez-Quiros and Timmermann (2000) have similarly argued that size is a proxy for risk because small firms get more adversely affected during recession than the large firms. This happens because the value of collateral gets eroded for the small firms during recession. Here, we decided to use a two-factor model in the Indian context to see if two factors namely, market risk premium and size can explain the entire cross-section of stock returns.

To study the economic fundamentals, Fama and French (1993, 1995) created six portfolios from the sorts of stocks on size and PBV. Since, PBV was found to have no incremental explanatory power, we created three portfolios from the sorts of size only. In September of each year t from 1991 to 1999, we ranked all the stocks based on size. Then the stocks were divided into three size groups based on the breakpoints for the bottom 30% (small), middle 40% (Median) and top 30% (Big) of the ranked values of size. These portfolios are value-weighted portfolios.[8]

We created a portfolio called SMB (small minus big) by taking a long position in the small stocks and a short position in the large stocks. This is the simple difference, each month, between the averages of the returns on the small portfolio and the large portfolio.

Finally, we used the excess market return (defined as R_m - R_f) as a proxy for the market risk factor. R_m is the return on a value weighted portfolio of the stocks in the three size sorted portfolios. R_f is the one-month Treasury bill. Data on R_f has been obtained from the research database of Darashaw and Company.

If size really captures sensitivity to risk, then the above two factors, namely, returns on SMB and excess market return must explain the cross-sectional variation in stock returns.

We used the excess return on five portfolios formed on size as dependent variables in the time series regression. This was done to see whether the mimicking portfolio SMB can capture common factors in stock returns related to size.

The above portfolios have been formed in the following manner. In September of each year t from 1991 to 1999, we sorted all the stocks by size. For the size sort, we have used the closing stock price figures at the end of September of year t. The excess returns on these five portfolios from September 1991 to March 2000 are the dependent variables for the time series regression.

Two-Factor Regression

<u>The dependent returns</u>: The excess returns form the five portfolios have a range of excess returns varying from 0.66% per month to 5.04% per month. We can see from table 3 that when stocks are ranked on the basis of size alone, the returns to the stocks decrease almost monotonically as we move from the smallest sized stocks to the largest sized stocks.

Table 3: Returns of the Size Sorted Portfolios

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[7] For details see Mohanty (2000)

[8] Fama and French (1993) argue that using value weighted components results in mimicking portfolios that capture the return behaviors of small and large stocks.

(Based on the market capitalization of the stocks as at the end of September of year t, we ranked the stocks into five quintiles. The first quintile consists of all the smallest stocks. The fifth quintile consists of the largest stocks. Then we estimated the average monthly returns of these stocks from the month of September of year t to August of year t+1. The following table gives the average returns for all the 103 months.)

	Small	G2	G3	G4	G5
Average Returns	5.85%	2.96%	1.73%	1.49%	1.82%

<u>The explanatory Returns</u>: The average market risk premium is 1.67% per month. However, it has a large standard error (1.08-%) and it is only 1.55 standard errors away from zero[9]. The average size risk premium (SMB) is 4.03% per month. This is 3.16 standard errors away from zero.
Following Fama and French (1993), we have run the time series regression at three levels. Initially, we regressed the excess return on the five portfolios on the market risk premium alone. Then we regressed the excess returns on the SMB returns alone. Finally, we ran the regression by including both market risk premium and SMB return as the independent variables.
Table 4 presents the regression output where we regress excess return of the five size-sroted portfolios on excess market returns alone, on SMB return alone, and on excess market return and SMB returns.

Table 4:

(Starting from September of 1991, we computed the excess return of the five size-sorted portfolios over the one-month treasury bill yield. We also estimated the monthly difference between the market return and the one-month treasury bill rate. Finally, we estimated the monthly return on the SMB portfolio. The market index was constructed by constructing a value-weighted portfolio of the three size-sorted portfolios (namely, S, M, and B). Then we regressed the excess returns of the five size-sorted portfolios on market risk premium alone, on SMB return alone and on both market risk premium and SMB return.)

A: Excess Return = a + b (Excess market return) + error

Group	Intercept (a)	t (a)	b	t (b)	Adj-R^2
Smallest	0.030646	4.786	1.167509	20.26248	0.797

[9] Fama and rench (1993) have also observed a similar problem in the US. Though the average market risk premium was large in magnitude, it was 1.76 standard errors away from zero.

G2	0.004262	1.93	1.017159	51.1946	0.96
G3	-0.00676	-2.765	0.939643	42.72059	0.84
G4	-0.00931	-3.2189	0.949521	36.47408	0.78
Largest	-0.003991	-2.676	0.852335	16.046	0.71

B: Excess Return = a + c (size risk premium) + error.

Group	Intercept (a)	t (a)	c	t (c)	Adj-R^2
Smallest	0.017419	2.535152	0.813531	8.74	0.42
G2	0.007814	2.16	0.334322	3.64	0.1
G3	0.003181	2.1	0.143	2.6	0.05
G4	0.002755	2.24	-0.094713	-2.026	0.08
Largest	0.025753	2.269	-0.18647	-2.39	0.03

C: Excess Return = a + b (Excess market return) + c (size risk premium) + error

Group	a	t (a)	b	t (b)	c	t (c)	Adj-R^2
Smallest	0.012252	4.127717	1.001814	37.50415	0.525727	20.6145	0.91
G2	0.002642	1.167	1.002566	49.19891	0.046301	2.379882	0.96
G3	-0.00189	-0.94	0.983482	54.21566	-0.1391	-8.03141	0.97
G4	0.00246	1.2	1.011	54.82983	-0.1958	-11.1197	0.97
Largest	0.012	1.1	1.001814	37.50415	-0.47	-18.5969	0.93

Here, from Panel A, we can see that the market risk premium captures a large part of the cross-sectional variation in stock returns. However, market risk premium alone does not explain everything as is obvious from the t-statistic of the intercepts. Excepting in G2, the intercept is at least two standard errors away from zero in the remaining four groups. Hence, a one-factor model cannot explain the entire variation in stock returns. By looking at the magnitude of b, we can see that its magnitude is falling as we move from the smallest stocks to the largest stocks. If we look at both the intercept and the value of b, we can see the size effect of Banz (1981). The b here can be interpreted as the CAPM beta. This is also evidence that small sized stocks have higher systematic risk than the large stocks. However, the risk premium to the small sized stocks continue to exist even after adjusting for this beta, as can be seen from the t-statistic of the intercepts of the five groups.[10]

In the second stage, we ran regression using the return of SMB alone as the independent variable. Panel B of Table 4 presents the main findings. We can see a few interesting trends here. The adjusted R^2 has come down substantially. This means that market risk premium has a more important role to play in explaining cross-section of stock returns than size. Secondly, excepting the first group, we can see that the intercepts are larger than the intercepts in the regression where only market risk premium is considered. This clearly shows that size alone cannot explain the excess returns on the stocks.

Finally, we ran a regression by including both market risk premium and SMB return as the independent variables. Panel C of Table 4 presents the regression output. Here we can see that when we include both market risk premium and size, the adjusted R^2 has increased considerably. Excepting the group containing the smallest stocks, the intercepts in the remaining groups are not statistically different from zero. As in Fama and French (1993), here also we find negative factor loading for the large companies on the size factor.

If we compare the above three regression outputs, we can get the following interesting conclusions.

- The market risk factor does capture a large part of the variation in stock returns. But it does not explain all.
- Though size is related to stock returns, it does not explain the variation in excess stock returns adequately.
- If we include both market and size risk factors in the time series regression, then almost all the variation in excess returns is explained.

But this still does not explain why the intercept was more than 4 standard errors away from zero in the smallest sized portfolio. It can have two possible interpretations. The model is mis-specified. It is possible that there is a third factor that can explain the returns better. It is also possible that the market is inefficient. We can see from Table 5 that size and market do explain the return variation quite adequately for Group 2 to Group 5. It is therefore, very unlikely that a third factor exists at all. Returns on SMB therefore, do capture sensitivity to risk. But the returns on the portfolio consisting the smallest stocks are just too large given the risk.

But the best way to test whether a third factor exists or not is to include a third risk factor in the above time series regression. If two factors are enough to explain the variation in stock returns, then

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[10] Roll (1981) suggested that the small stocks trade less frequently, and hence their betas get underestimated. However, Reinganum (1982) found that size premium continues even after adjustment is done for illiquidity.

the factor loading on the third factor will be indistinguishable from zero. To get additional evidence, we decided to include PBV risk also in the above time series regressions. We divided the stocks into three groups on September of year t based on their PBV values computed at the end of March of year t.[11] The first group consists of the 30% stocks with the lowest PBV ratio. The second group consists of the next 40% stocks. The third group consists of the remaining 30% stocks with the largest PBV ratio. Starting from September 1991, every month, we computed the returns on these three portfolios. Then we created a portfolio, called HML with a long position in the stocks with the lowest PBV and a short position in the largest PBV group. The return on this HML portfolio is supposed to capture PBV risk sensitivity. Fama and French (1995) conjectured that high price-to book value is associated with persistently higher earnings.

We ran the time series regression by including three factors, namely, market risk premium, SMB return and HML return. Table 5 presents the main findings.

Table 5:

(Here, we regressed the excess returns on the five size-sorted portfolios on three variables, namely, the excess market return, defined as the difference between the monthly return on the market proxy and the one-month treasury bill, return on SMB, and return on HML. Return on SMB is supposed to capture risk sensitivity in the size factor and return on HML is supposed to capture risk sensitivity to PBV factor.)

Excess return = a + b (market risk premium) + c (SMB return) + d(HML return) + error

Groups	a	t(a)	b	t (b)	c	t (c)	d	t (d)	Adj-R2
Small	0.01149	4.06	0.9766	36.93	00.48	17.35	0.0717	1.43	0.96
G2	0.0031	1.41	1.0181	49.49	0.0745	3.46	-0.010	-0.73	0.96
G3	-0.001	-0.71	1.0082	55.83	-0.1077	-5.74	-0.011	-0.49	0.97
G4	-0.002	-1.12	1.0161	52.886	-0.187	-9.3	-0.033	-0.91	0.97
Large	-0.001	-1.1	1.0017	37.6	-0.44	-16.62	0.0017	0.43	0.94

It is very obvious from the above table the return on the HML portfolio (capturing PBV risk) is not explaining the return variation at all. In the case of all the five groups, the PBV slope coefficient is less than two standard errors away from zero. This clearly shows that to explain the cross-sectional variation in stock returns in India, we do not require a PBV factor. The intercept for the first group continues to be more than 4 standard errors away from zero. Two factors, namely, size and market risk premiums capture most of the cross-sectional variation in stock returns. Hence,

[11] This definition follows from Fama and French (1992).

the statistically significant intercept in the first group is very likely an indication of market inefficiency as far as the small stocks are concerned.

Transaction Costs and Size Effect

The returns in the above study are gross returns. If an investor actually buys the stocks, then he will not be able to earn these returns because he will also have to incur certain transaction costs. The transaction costs will include costs like bid-ask spread, brokerage commissions, impact costs and information gathering costs. Since the transaction costs associated with small stocks are larger than that for the large stocks, it is possible that part or full of the return differential can be explained by such transaction costs. Any test of market efficiency must take into account the return that an actual trading can generate. Jensen (1978) emphasizes the importance of all costs in tests of market efficiency. Philips and Smith (1980) have observed that many authors ignore transaction costs in tests of the efficiency of the Chicago Board of Options Exchange and wrongly conclude that it is inefficient.

Hence, any test of market efficiency must consider the impact of transactions costs on the excess return computed earlier. In short, we must answer the question: "Can an investor actually earn the excess return that we estimated in Table 3?"

There will be three types of costs[12], which will reduce the net return that an investor will get (or cause friction) by adopting the strategy of buying the stocks of small companies. The first source of friction will be bid-ask spread. We buy the stocks at the ask price and sell the stock at the bid price. The second source of friction will be what is called the impact costs. Small stocks are much less liquid compared to the large stocks. Since there is not much interest in the small stocks, a trade of a given size can have an impact on the price of the stock itself. The impact can be due to adverse information contained in the trade or it could be due to a simple demand-supply imbalance. The final source of friction is information-gathering costs. Since not much information is available about the small stocks, anybody who wants to invest in the small stocks will have to spend money in collecting the necessary information about the small stocks.

Any study on the return behavior of the small stocks must necessarily address the question as to what is the actual return an investor can realize by buying the small stocks. If for example, we find that the above costs account for a substantial portion of the return difference between the small stocks and the large stocks, then we cannot call the Indian market for the small stocks inefficient.

[12] Actually there are four types of transaction costs. The fourth one, namely brokerage commission is the same for small as well as large stocks and hence has not been considered here.

In this paper, therefore we made an attempt to estimate the bid-ask spread for the small and the large stocks, the impact costs for the small and the large stocks. We could not estimate the information gathering costs despite our best effort.

From any published source, we could not collect data required to estimate the above transaction costs. The National stock exchange limited has provided us with the data regarding the limit order book and the intra-day trade data for 100 stocks for two-month period, namely June and July of 2000. We estimated bid-ask spread[13] and impact costs using this data only. There are altogether 43 trading days' data for 100 stocks that we have analyzed.

Since our original sample size is much larger than 100, this creates certain problems for interpretation. We are actually more interested in finding the transaction costs associated with the small stocks. Since we could not obtain data for these stocks, we decided to conduct the analysis at two levels.

We used Roll's (1984) model for finding the bid-ask spread for all the stocks. This way, without using the actual order data, one can get approximate values of the bid-ask spread. Secondly, using the data for the 100 stocks, we used Stoll's (2000) approach to see if the size of a company and the bid-ask spread are related. This approach does not give us a comprehensive idea about the exact relationship between size and the different components of transaction costs. But the findings are nevertheless indicative of the relationship between the two variables.

Analysis of the Transaction costs using data on 100 companies

Stoll (2000) used the following cross-sectional regression to study the behavior of bid-ask spread and the different measures of liquidity and size of the companies.

$$s = a_0 + a_1 \log V + a_2 \sigma^2 + a_3 \log MV + a_4 \log P + a_5 \log N + e$$

where,

s = half of the average reported spread between bid and ask rate[14] divided by the average opening stock price

V = Average rupee volume of the stock

σ^2 = is the variance of daily stock returns in the previous year

MV = market value of the company at the end of May 2000

P = average closing price in the month. We have used the same value of P here as well as in the definition for s

N = average number of trades per day

The logic behind including these variables is as follows. If the trading volume or the number of transactions per day or the market capitalization is high, then the risk of finding counter-party is

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[13] We estimated the implied bid-ask spread from the electronic limit order book of NSE.

low and hence the bid-ask spread will be low. One can argue that since in India we have an order driven system and not a quote driven system this argument does not apply. This is not correct however, as can be seen from the following example. Suppose, an investor believes that the intrinsic value of a stock is Rs.100. If he is buying the stock he will like to pay Rs.100 only. If the stock does not have enough liquidity, then he may not find any seller at that price. Hence, in order to lure another investor to sell his stock, he must offer something more than Rs.100. Similar arguments apply for an investor who wants to sell the stock. If the stock is highly illiquid then there will be a gap between the bid and ask rate. If the stock return has a high variance, then it is possible that the bid ask spread will be high. This happens because once one takes position in a stock, if the price moves adversely; one will have to suffer loss while squaring the trade.

We estimated "s" in the following manner. We estimated the implied bid-ask spread from the electronic limit order book in the following fashion. Thirty minutes after the beginning of the day, suppose we find the following orders yet to be executed in the limit order book.

Buy		Sell	
Price Rs.	Quantity No.	Price Rs.	Quantity No.
245	50		
246	500		
250	1000		
		252	75
		254	400
		260	5000

Here, the best buy price is Rs.250 and the best sell price is Rs.252. If some body wants, he can always buy at Rs.250 and sell at Rs.252. Hence for all practical purposes, one can look at these rates as the bid and ask rate. We computed the opening bid-ask spread for all the 43 days and used the average bid-ask spread divided by the average opening price to compute "s" in the above regression. It is important to keep in mind that we have not considered impact costs here. Thus for example if somebody wants to buy more than 75 shares, then he has to pay Rs.254 for the 76th share till the 400th share. We have adjusted for the impact cost later.

We run a cross-sectional regression based on data for these 100 stocks. The regression output is presented in Table 6.

[14] We have explained later the way we have computed the bid-ask rate in this paper.

Table 6:

We regressed the average bid-ask spread divided by the average opening price (s) on the total rupee volume of transaction (V), stock price (P), number of transactions (N), stock return of variance (σ^2), and size of companies (MV) using the following regression equation. The regression equation is given by

$$s = a_0 + a_1 \log V + a_2 \sigma^2 + a_3 \log MV + a_4 \log P + a_5 \log N + e$$

	June 2000		July 2000	
	Beta	t-statistic	Beta	t-statistic
Intercept	0.193	2.708	0.148	1.75
Log V	0.501	1.949	0.358	1.75
σ^2	0.030	0.207	0.1	0.41
Log MV	-0.325	-1.83	-0.418	-2.24
Log P	-0.301	-2.139	-0.259	-2.08
Log N	-0.591	-1.883	-0.4	-1.92

The above table clearly shows a negative relationship between proportional spread and the size of the companies. Hence, the excess return that we computed in the previous section definitely overestimates the realized return. Other than spread, there are also other transaction costs that will affect the realized return. In this paper we will only consider impact costs. We have estimated the net return and the gross return for the 100 companies using the following methodology.

Using data on the opening prices of the hundred companies, the gross returns are computed. Then we have made an attempt to find out the realized return that an investor will get by buying at the beginning of June 2000 and then selling at the end of the month and then buying again and selling at the price prevailing at the end of the month. For the sake of convenience, we have used the opening price data in our analysis. We have purchased the shares at the ask price and sold the shares at the bid price. This way we have explicitly taken the bid-ask spread into consideration. The impact cost of a particular trade will depend on the size of the trade. The impact costs will be a positive function of the size of the trade.

Since the impact costs will be different for different trade size, we have decided to sort this problem in the following manner. We created portfolios where we purchased 100 stocks of each company and then made an attempt to see what will be the impact costs of the trade. The trade is assumed to be placed thirty minutes after the beginning of the day. We have first prepared a limit order book for all the hundred stocks for all the 43 days thirty minutes after the beginning of trade. Then we have made an attempt to see how a buy order (sell order) for 100 stocks will affect the price. For the sake of comparison we have also computed the portfolio returns by placing buy orders (sell orders) for 200, 300, 500 and 1000 stocks. We used the Parchure and ***'s (1999) methodology in estimating the impact costs. Here, we have implicitly adjusted for the bid-ask spread. Hence we do not need to separately account for that.

We ranked the 100 stocks into five quintiles based on the size. Then we computed the realized return using the above criteria.

Table 7 gives the main findings.

Table 7:

We have divided the 100 stocks into five groups based on size. Then we estimated the return that an investor will be actually able to realize after taking into account bid-ask spread and the impact costs. For the purpose of computing the impact costs we created hypothetical portfolios where we purchased 100 stocks each (200 stocks and 1000 stocks) of all the twenty stocks in each portfolio. Then we estimated the average such a price-weighted portfolio would generate.

Portfolios	As-is return	Spread adjusted return	Spread and impact cost adjusted return (100stocks)	Spread and impact cost adjusted return (200stocks)	Spread and impact cost adjusted return (1000stocks)
Smallest	3%	2.34%	2.19%	2.01%	1.42%
G2	3.21%	2.5%	2.28%	2.24%	1.94%
G3	2.89%	2.51%	2.39%	2.15%	1.99%
G4	1.47%	1.32%	1.25%	1.22%	1.05%
Largest	2%	1.91%	1.91%	1.91%	1.78%

The above table shows that impact costs do reduce the realized returns considerably for small sized companies. The reduction in realized return is in fact quite dramatic for the small stock portfolio.

There are, however certain reasons as to why we cannot compare this result with our earlier findings. Here, our sample size is only 100 and these are actually all large companies. Almost all these 100 companies belong to the large portfolio in our original sample. Hence the results are not directly comparable. Secondly, to explicitly adjust for impact costs, we created price-weighted portfolios here. In our original sample, we have estimated value-weighted portfolio returns. Thirdly, we have assumed here that the investor rebalances the portfolio at the end of every month. If, instead he uses a buy-and hold strategy, he may earn excess returns. We could not test this hypothesis because we had only two months data with us.

An ideal approach would have been using net returns in the Fama and French (1993) regression to see if after adjustment for risk and transaction costs, one can still earn excess returns by investing in small stocks. However, since we have only data for two months, we could not run Fama and French (1993) regression. This has been left to our future research.

Roll's Method:

Roll (1984) has suggested that one can estimate the bid-ask spread from data on closing prices by using the following formulae. Though there are some technical problems with Roll's method[15], we decided to use it to get some rough idea about the transaction costs..

Roll (1984) has used the following formulae to estimate the bid-ask spread.

C = - square root of covariance of (r_{t-1}, r_t).

Here the market ask exceeds the frictionless market price by a percentage amount C, and the market bid is less that the frictionless market price by the percentage amount C.

Based on the daily prices, we have similarly estimated C for all the stocks for all the years. In Table 8, we have reported the average spread for small and the large stocks.

Table 8: Average Bid-ask Spread for the size sorted portfolios

(Using Roll's (1984) method, we estimated the bid-ask spread for the different stocks. Subsequently, we have estimated the simple average of the bid-ask spread (in percentage terms) for the different size-sorted groups by multiplying the value of C with two. This follows the approach adopted by Stoll and Whaley (1983).[16])

	Small	G2	G3	G4	Large
Mean Percentage Spread	3.21%	2.68%	2.11%	1.08%	0.79%

We can see that the mean difference between the spread for the small and the large stocks is about 2.42% per annum. This alone can account for half of the difference that we saw in Table 3. But Roll's (1984) model accounts for only the order processing costs. There are two other components of order-processing costs that one has to take into consideration. They are inventory costs, and adverse selection costs.[17] Hence, if one actually, estimates the actual bid-ask spread, the spread is likely to be higher.

We have interviewed two brokers to know if there is a difference between the brokerage commissions for small and large stocks. Both the brokers said that the answer depends on the type of client. For the large investors, the brokerage commission is usually very small (less than 0.5%) for any

[15] For a detailed discussion, see Campbell, Lo and MacKinlay (1997).
[16] See Stoll and Whaley (1983), p 70.

stock, small or large. But both of them agreed that most of the large investors do not trade in small stocks at all. We therefore do not believe that brokerage commission will reduce the actual realized return difference between the small and the large stocks.

Two other important transaction costs, which are important, are information gathering costs and impact costs. We interviewed the fund managers of four funds. We could gather the following information regarding the information gathering and processing costs.

- The information gathering costs are fixed per company. This cost includes calls made to the concerned managers in the company, visiting their plants, getting projections made by the management, etc. Each analyst in a particular mutual fund, for example, has been instructed to talk to the company people at least once a month, and visit the plants and the company at least once every quarter.
- Another important component of the data gathering costs will be the salary paid to the equity researchers. The equity researchers usually are assigned the responsibility of collecting information on a particular sector. Hence, if the fund starts investing in small stocks, there will not be much difference as far as the salary paid to the equity researchers is concerned.
- None of the funds keep a record of information gathering costs. The telephone calls made to the companies, for example, are included as part of administrative expenses.

But since the costs are more or less fixed in nature, the returns can be substantially less if information-gathering costs are taken into account. The information gathering costs (on a percentage basis) will be much lower for the large stocks than for the small stocks. This happens because one cannot buy a larger number of stocks of the small companies. Hence the total data gathering costs, as a percentage of the total investments made in the small companies will be large. This will not affect the findings in this study because we have assumed that we are investing in *all* the stocks of the portfolio containing the smallest stocks. Hence, here one does not have to worry about the information gathering and processing costs.

The way return is computed

Blume and Stambaugh (1983) have reported that the magnitude of size effect has been overstated in Reinganum (1982) and Keim (1983) because of the way the returns have been computed. They estimated that the magnitude of size effect is only half as large and that the entire difference comes in the month of January itself. They argue that single-period returns on individual stocks computed with recorded closing prices are upward biased. This bias arises from a bid-ask effect in closing prices. Most papers on size effect use arithmetic averages of daily (or monthly)

[17] See Amihud and Mendelson (1980), for example.

returns to estimate size effect. Since the arithmetic average of computed returns contains biases for the individual stocks, their estimates of the size effect are upward biased.

The portfolio strategy used in arithmetic averaging assumes that the portfolios are rebalanced to equal weights after a fixed time period. Blume and Stambaugh (1983) argued that returns on an alternative buy-and-hold strategy are virtually unbiased. The size effect in this paper has been estimated using monthly returns. It is therefore, possible that the magnitude of size effect has been overestimated. It is therefore possible that an investor will not be able to earn the entire excess return of 50% estimated in this paper by adopting a strategy of buying the small stocks.

We therefore decided to find out the extent to which the size effect has been overestimated by the use of average monthly returns. As before, we sorted the stocks based on the market value of equity into five quintiles based on the stock price figures as at the end of September of year t. Instead of taking the arithmetic averages of the monthly returns, we estimated the buy-and-hold return of each of the quintiles by comparing the stock prices at the end of August of year t+1 with the stock price at the end of September of year t.[18] Table 9compares the return from a buy-and-hold strategy with that of a monthly rebalanced portfolio strategy.

Table 9:

(Depending on the market value of equity at the end of September of year t, we sorted the stocks into five size quintiles. We estimated the return to the five quintiles using two different methods. As per the first method, we estimated the arithmetic average of the monthly returns from September of year t to August of year t+1 for each year in 1991-2000. Then we annualized the monthly returns. As per the second method, we computed a simple one-year buy-and-hold return by comparing the stock prices of August of year t+1 with September of year t. We have assumed that all dividends have been reinvested in the stock itself at the end of the month in which the dividend was given.)

Portfolios	Monthly average (annualised)	Buy-and-Hold Strategy
Smallest	98%	52%
G2	42%	29%
G3	23%	19%
G4	19%	14%

[18] All dividends have been assumed to be reinvested in the stock itself at the end of the month in which dividend was given.

Largest	24%	19%

We can see from the above table that the buy-and-hold strategy does in fact reduce the returns accruing to the small stocks. The reduction in returns is the highest for the small stocks, as hypothesized by Blume and Stambaugh (1983). However, there is still a significant return difference between the smallest and the largest stocks. The t-statistic for the null hypothesis that the return difference under the buy-and-hold strategy is zero is 3.98. If an investor adopts a buy-and-hold portfolio strategy for one year, then he can earn an excess return of 33%. From Table 8, we saw that bid-ask spread explains a mere 3.21% of the return difference Though, we have not considered the other transaction costs, we are sure that such a huge return difference cannot be explained by such transaction costs. Once we get the required data from the National Exchange limited, we will report the actual transaction cost adjusted returns.

Behavior of the Institutional Investors:

Institutional investors prefer to invest their money in the liquid stocks. In the case of a liquid stock, one can easily buy or sell a large number of stocks without affecting the price much. By investing only in liquid stocks, the large investors are able to reduce certain transaction costs, like the impact costs. In a small study done by the author, it was found that there is a very high correlation between liquidity of the stock and the size of the company.[19] Hence, the large investors usually invest only in the large stocks. Mr. U R Bhat, the Chief Investment Officer of Jardine Fleming, in a seminar conducted at TAPMI, has once remarked that in India, for the foreign institutional investors "Big is Beautiful"[20]. Their behavior can be justified as follows.

- Small stocks do not have liquidity. Hence the impact costs are more.
- Small stocks are not well researched. Since most of the activity is taking place in large stocks by the institutional investors, security analysts concentrate their analysis on these stocks. Hence, if an investor starts buying small stocks, then he has to spend money on information gathering required to do the equity research.

Efficient Market Hypothesis (EMH) is based on the assumption that in a rational world, the investors constantly look for profitable opportunities and this ensures that the market remains informationally efficient. But in a market where a large chunk of the investors completely ignore one part of the market, it is possible that such behavior leads to market inefficiency in that part or segment of the market. Large stocks are well researched, are highly liquid, and hence transaction

[19] See Table 1 below.
[20] "The Changing Face of Indian Equity Markets", by Mr. U R Bhat, Managing Director and Chief Investment Officer at Jardine Fleming, Seminar delivered at TAPMI on 2nd August, 1999.

costs are low. All conditions of market efficiency exist here. Small stocks are not well researched because there is hardly any interest in them. It is therefore, possible that the market for small stocks is inefficient.

In fact, Lakonishok, Shleifer, and Vishny (1994), and Shefrin and Statman (1995) have reported that institutional investment behavior is one of the reasons why this premium continues to exist.

There are 7736 companies for which the stock holding pattern data are available in the Prowess database. Out of these companies, there are 4639 companies for which the stock price data are available. We have included 464 companies in the first nine portfolios and 463 companies in the tenth portfolio. Then we found out the average number of daily transactions per day, the stake of the different institutional investors in these companies for each portfolio. Table 10 gives the details.

Table 10: Liquidity and Size

(We ranked the stocks into ten deciles based on the market capitalisation as at the end of March 2000. Then we found out the average number of transactions for each stock for the last 240 trading days. We also found out the average stake of the institutional investors in these companies. The figures for the stakes of the institutional investors are as at the end of March, 2000. Data regarding the FII's stake was collected from the RBI Bulletin.)

Portfolio Deciles	Average market cap (in Rs. crore)	average no of transactions (per day)	FI's stake	Insurance companies' stake	Mutual Funds' stake	FII's stake
1 (smallest)	0.5	1.74	0.4%	0.07%	0.8%	0.004%
2	1.16	3.87	0.6	0.2	1.07	0.04%
3	1.84	4.07	0.4	0.1	0.9	0.1%
4	2.74	5.69	2.5	0.3	0.8	0.09%
5	4.02	8.42	0.9	0.4	1.43	0.08%
6	6.13	12.44	1	0.6	1.68	2.5%
7	10.48	24.87	1.52	1	3.31	4%
8	20.72	22.48	3.18	1.58	3.28	3%
9	61.09	54.25	2.67	2.59	4.29	5.6%
10 (largest)	1823.55	599.78	2	3.46	6.1	9%

It is obvious that the liquidity (as measured by the no of transactions) is very highly correlated with the size of the companies. The institutional investors also have invested heavily in the liquid stocks (which are also the largest stocks).

One can observe the high skewness present in the data if one looks at the last row in the above table. It has been decided to look deeper into the institutional investment behavior as far as the largest stocks are concerned.

Hence, the last decile of 464 stocks have been further sub-divided into five quintiles (94 companies in the first four quintiles and 93 in the last quintile). Table 11 gives the details.

Table 11: Size and Liquidity: Further Investigation

(In this table, we have further sub-divided the tenth decile in Table 8 into five quintiles and looked at the liquidity at the institutional holdings in each quintile.)

Quintiles	size (in Rs. crore)	mean no of transactions	FI Stake	Insurance cos stake	MF Stake	FII's stake
1 (smallest)	149.7	67.69	0.09%	2.61%	2.91%	4%
2	220.31	152.26	1.84	5.39	6.27	3.9%
3	389.45	216.68	3.16	3.03	4.57	6%
4	1488.3	356.1	3.48	3.79	4.58	5.9%
5 (largest)	7490.18	2217.17	1.25	3.28	7.51	14%

One can draw the following conclusion if one compares the above two tables. As far as the institutional investors are concerned, liquidity of the stocks is a major concern up to a point but not thereafter. In the second table, for example, one can see that the smallest stocks also have got a good chunk of MF investment.

One of the reasons as to why the market for the small stocks is inefficient is probably because of the investment behavior of the large investors. Since they are showing less interest in such stocks, the market remains inefficient. We believe that if a mutual fund can create a small fund, then until such time that other comes to notice it, it will be able to earn excess returns.

Small sample:

It is a well-known fact that the high volatility associated with the stock market reduces the power of the different statistical tests. We found evidence of it in the estimation of the average market risk-premium computation. A mean risk premium of 1.67% per month was not statistically significant because of high standard error. This is a well-known problem in finance (See Merton (1980)). One can use the same argument here also by saying that evidence based on nine-years' data is not enough to invalidate market efficiency. Merton Miller has once commented that the variances of stock prices are so high that even a 200 years of data is not enough to test for the size and PBV effect.[21] "One day one may find that the small sized companies have completely eroded the net worth. Such a time has not come does not mean it will not come."

IV Conclusion

We saw in this paper that the small stocks have outperformed the large stocks in the sample period. This excess return can arise either because size is a proxy for risk or because the market for the small stocks is inefficient. Using Fama and French (1993, 1995, 1996) methodology, we found

[21] See Tanous (1997).

that size indeed is a proxy for risk. However, the return generated by the small stocks is too large given their risk exposures.

We also found that transaction costs can explain a large part of this difference. Using data on 100 companies we found that transaction costs erased the entire return difference between small and large stocks. However, the conclusions are not conclusive because all these 100 companies belong to the large stock portfolio based on our original sample. Secondly, using Roll's (1984) method, we found that though transaction costs are large for small stocks, it is not enough to explain the return differential. Further work has been left to our future research.

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