# A Test of the Differential Information Hypothesis Explaining the Small Firm Effect

Dr. Siva Nathan, Accountancy, Georgia State University

**Abstract**

*Previous research has shown that, on average, small firms earn higher risk-adjusted returns than large firms. So far there has been no satisfactory empirical explanation for this pricing anomaly. Theoretical research has shown that firms for which less information is available should, ceteris paribus, earn higher returns to compensate for estimation risk. Since, on average, less information is available for small firms, this is a possible explanation for the small firm effect. Using the number of articles in the Wall Street Journal as a measure of information availability, I find that the small firm effect can be entirely explained by differential information availability among firms.* [1]

## Introduction

Empirical studies by Banz (1981), Reinganum (1981) and others have found that small firms have higher risk-adjusted stock returns, on average, than large firms. This is known as the small firm effect. Although researchers have investigated several possible explanations for the small firm effect, they have been unsuccessful to date and the phenomenon remains an anomaly in the capital asset pricing literature. Several researchers have attempted to explain the size effect in terms of errors in risk estimation [e.g., Roll (1981), Booth and Smith (1987)]. Others have tried to explain it in terms of measuring returns [e.g., Roll (1983a), Blume and Stambaugh (1983), Booth and Smith (1987)]. None of these researchers has been able to fully explain the anomaly. In addition, Badrinath and Kini (1994) found that earnings/price ratios and Tobin's q could not explain the small firm effect.

Keim (1983) found that about half of the annual size effect occurs in January. Based on this finding, several researchers put forward the tax loss selling hypothesis. This hypothesis states that investors sell securities at the end of the calendar year to establish short-term capital losses for tax purposes. After year-end the downward price pressure is relieved and the same stocks go back up to their equilibrium values thus creating large returns in January. Roll (1983b) and Reinganum (1983) tested this hypothesis but found that the January effect cannot be fully explained by tax loss selling. Zivney and Thompson (1987) were able to fully explain the January portion of the small firm effect with the stock's relative price ratio, defined as the ratio of the current stock price to the average of the highest and lowest prices over some holding period. However, they were unable to explain the small firm effect for the remaining eleven months of the year. Similarly, Eakins and Sewell (1993) find that institutional ownership can explain only the January portion of the small firm effect.

Another line of reasoning that attempts to explain the small firm effect has been in terms of differential information. This paper focuses on the differential information explanation for the size effect and tests whether the so called size effect is actually a differential information effect. I use the number of articles in the *Wall Street Journal* as a measure of information availability,. and find that differential information availability can fully explain the size effect.

The rest of the paper is organized as follows. Section 2 discusses the theoretical aspects of the differential information hypothesis, section 3 describes the data used in the study, section 4 discusses the methodology and results and section 5 presents the summary and conclusions.
The paper closes in section six by presenting some suggestions for future research.

## Differential Information and the Small Firm Effect

Banz (1981) argues that part of the small firm effect is due to the amount of information that is available about firms. He reasoned that the lack of information about small firms can cause certain investors to exclude them from their portfolios. This would then lead to higher risk-adjusted returns for the *undesirable* small firms. Reinganum and Smith (1983) argued, however, that the risk due to lack of information can only be firm specific (unsystematic) risk. If a sufficiently large number of securities are held, this risk can be diversified away and thus should not be priced.

Two theoretical models have been developed that support the differential information explanation for the small firm effect. Klein and Bawa (1977) developed a model which assumes that there are two subsets of securities. Investors have sufficient information about securities in the first subset but only minimal information about securities in the second subset. They show that because of the large estimation risk involved with the second subset of securities , it is optimal for an investor to limit diversification to only those securities in the subset with sufficient information. Since all securities must be held, this would imply higher returns for the securities with minimal information.

Barry and Brown (1985) developed the statistical implications if there is more information about one subset of stocks than another. They showed that the group of stocks for which there is less information will have higher true systematic risk measures (beta) than those for stocks with more information. This implies that since researchers do not use the true measure of systematic risk, the excess returns will be higher for those stocks about which there is little information. Barry and Brown (1984) conducted an indirect test of the differential information hypothesis. They used the length of time that a security has been listed on the stock exchange as a proxy for the amount of information available about the firm. Their sample consisted of only New York Stock Exchange firms. Their results suggest that period of listing can explain *some but not all* of the small firm effect. An alternative explanation for their result is there is too much measurement error in using period of listing as a proxy for the amount of information available about a firm. A better way to conduct the test would be to use some *direct* measure of the amount of information available. This paper uses the number of articles in the *Wall Street Journal* as a measure of information availability.

## Data

The data consists of a random sample of 200 firms traded either on the New York Stock Exchange (NYSE) or the American Sock Exchange (AMEX).[2] I studied the twenty year time period 1975 to 1994. The firms had to be continuously traded on either of the two exchanges during the entire study period in order for it be included in the sample. Stock returns were obtained from the Center for Research in Security Prices (CRSP) tapes. The *Wall Street Journal Index* was used to obtain the number of articles written about the firm in the *Wall Street Journal*. The differential information hypothesis predicts that the returns for a firm in any particular year is correlated with the amount of firm-specific information that investors expect to receive in that year. A good measure of the amount of information expected to be received in any given year is the amount of information that was received in the *previous* year. Therefore, to explain excess returns in any particular year, I use the amount of information available about that firm in the previous year as the explanatory variable. For example, the excess returns for 1975 are correlated with the number of *Wall Street Journal* articles on the firm in 1974. This variable is named WSJ.

In order to measure returns, it is necessary to consider the return interval. Blume and Stambaugh (1983) argue that studies which use daily returns overstate the size effect. Therefore, monthly returns are used in this study. Consistent with previous research on the small firm effect, market value of equity is used as a measure of firm size. The market value of equity as of the end of the year is used to explain next year's excess returns. Market value of equity is calculated as the product of the share price and the number of shares outstanding, both of which are obtained from the CRSP tapes. This variable is named MKVAL.

In order to compare this paper's results to those of Barry and Brown (1984), I also use period of listing on the stock exchange in my tests. For NYSE firms the period of listing was measured from the month of first listing on the monthly CRSP tape. The monthly CRSP tape provides returns starting in 1925. If a firm was listed on the NYSE prior to this date, my measure of period of listing would be biased downward for these firms. Therefore, for those NYSE firms in my sample which had been on the CRSP tape since 1925 I obtained the actual date of first listing directly from the NYSE. Similarly, for the AMEX firms the period of listing was obtained from the Daily CRSP tape, which provided returns starting in 1962. Using the same reasoning as above, for those AMEX firms in my sample which were on the CRSP tape since 1962 I obtained the date of first listing directly from AMEX. I called the period of listing variable as LIST. I kept track of firms which moved from one exchange to the other during the sample period and made the necessary adjustments. There were 3562 observations for which data on all variables was available.

## Methodology and Results

In order to test whether differential information explains why some firms earn higher returns than other firms for the same level of beta risk, it is necessary to generate excess returns. To estimate the systematic risk (beta) for each firm, the market model was estimated using 60 months of return data prior to the year being studied. Methodology similar to Barry and Brown (1984) was then used to generate the excess return for each month for each firm. The firms were ranked according to their systematic risk. Ten equal-sized portfolios were formed based on beta. Abnormal returns were then calculated for each firm for each month as the difference between the individual security return for that month and the mean return for the same month, of its beta portfolio. The annual excess returns were formed by continuous compounding of the monthly excess returns.

Table 1 presents descriptive statistics for MKVAL, LIST and WSJ. It shows that the average firm in the sample had a market value of $351 million dollars, had been listed for 208 months and had thirteen articles per year in the *Wall Street Journal*. Table 2 shows the correlation coefficients among these variables. Since the distributions of these three variables are highly skewed I use the natural logs of these variables. I use the prefix 'L' for these variables to indicate that the natural log version of the variable is being used.

Table 2 shows that all three variables are significantly correlated with each other. The largest correlation is between LMKVAL and LWSJ (0.4478). However, this level of correlation is not a cause of concern for multicollinearity.

Table 3 presents results from tests of the differential information hypothesis. The first row in Table 3 documents the existence of the size effect in the sample. There is a significant negative

**Table 1**

Descriptive Statistics (N = 3562)

| | MEAN | MEDIAN | STD. DEV. |
|---|---|---|---|
| MKVAL[a] | 351,342 | 68,804 | 1,435,799 |
| LIST[b] | 208.43 | 130 | 172.98 |
| WSJ[c] | 13.52 | 10 | 11.14 |

[a] MKVAL is the market value of equity of a firm at the end of each year, in thousands of dollars. [b] LIST is the number of months that the firm has been listed on the NYSE and/or AMEX. [c] WSJ is the number of articles about the firm in the *Wall Street Journal*.

**Table 2**

Pearson Correlation Matrix[a] (N = 3562)

| | LMKVAL | LLIST | LWSJ |
|---|---|---|---|
| LMKVAL | 1.00 | 0.3249 | 0.4478 |
| LLIST | | 1.00 | 0.3446 |
| LWSJ | | | 1.00 |

[a] LMKVAL, LLIST and LWSJ are the natural logs of MKVAL, LIST and WSJ, respectively which have been defined in Table 1. All three correlation coefficients are significant at the 1% level.

**Table 3**

Regression Results[a] Slope Coefficients (t-statistics)[b] (N = 3562)

| Constant | LMKVAL | LLIST | LWSJ | ADJ. $R^2$ |
|---|---|---|---|---|
| 0.041 (2.030)** | -0.003 (-5.12)*** | ------ | ------ | 0.0070 |
| 0.051 (1.78)* | -0.001 (-2.02)** | -0.007 (-3.87)*** | ------ | 0.0078 |
| 0.066 (0.169) | ------ | -0.002 (-1.15) | -0.021 (-5.87)*** | 0.0103 |
| 0.063 (0.124) | -0.001 (-0.87) | ------ | -0.022 (-5.92)*** | 0.0104 |
| 0.073 (0.116) | -0.001 (-0.84) | -0.002 (-1.12) | -0.021 (-5.89)*** | 0.0103 |

[a] The dependent variable is excess monthly returns from the market model. The independent variables LMKVAL, LLIST and LWSJ have been defined in Table 2. [b] *** (**, *) indicates significance at the 1% (5%, 10%) level, two-tailed.

Table 3 presents results from tests of the differential information hypothesis. The first row in Table 3 documents the existence of the size effect in the sample. There is a significant negative relationship between excess returns and firm size (t=-5.12). The second row serves to replicate Barry and Brown (1984). LMKVAL and LLIST are significant at the 5% level (t=-2.02) and 1% level (t=-3.87) respectively, consistent with the Barry and Brown results. The results in the third row show that when LWSJ is used as an independent variable along with LLIST, LWSJ is statistically significant at the 1% level (t=-5.87), but LLIST is no longer significant (t=-1.15). In the fourth row, when LWSJ is used as an independent variable along with LMKVAL, LWSJ is statistically significant at the 1% level (t=-5.92), but LMKVAL is no longer significant (t=-0.87). In the fifth row, when all three variables are used in the regression, LMKVAL and LLIST are no longer significant (t=-0.84 and t=-1.12 respectively), whereas LWSJ continues to be significant at the 1% level (t=-5.89). Thus, the results are consistent with the differential information hypothesis and it appears that LWSJ is a better proxy for the amount of information available than LLIST. The small firm effect has been entirely explained by the differential information hypothesis.

Since prior research has shown that about half of the small firm effect occurs in January, and tax loss selling has been advanced as a possible explanation for the small-firm-January effect, I conducted my tests separately for January excess returns. Consistent with previous research, in my sample about half of the small firm effect occurred in January. However, a separate regression analysis for January yielded essentially the same results as those for the full sample reported in Table 3. I also considered two alternative measures of information availability. First, I used the number of analysts following the firm. I collected the number of analysts following the sample firms for each year. For the years 1975 through 1977 I used the *Standard and Poors Earnings Forecaster* and for the years 1978 through 1994 I used the *Nelson's Directory of Research* (Nelson's was not published prior to 1978). I found that when I regressed excess returns for each year on the number of analysts, the slope coefficient was not significant. A second measure of information availability that I considered is the number of articles about the firm in the *New York Times*. I used the *New York Times Index* to gather this information. I found that, for the average firm, there were about 40% less number of articles in the *New York Times* than in the *Wall Street Journal*. But, surprisingly the correlation between the two measures was about 0.90, and the results using the *New York Times* measure were similar to those reported in Table 3 using the *Wall Street Journal* measure.

**Summary and Conclusions**

One theoretical explanation for the small firm effect, that has been documented in the financial economics literature, is the differential information hypothesis. Barry and Brown (1984) tested this hypothesis using period of listing on the stock exchange as a proxy for information availability. They found that period of listing can explain some, but not all of the size effect. I argue that the number of articles in the *Wall Street Journal* is a better proxy for information availability. Using this proxy I find that the differential information hypothesis is able to fully explain the size effect.

**Implications for Future Research**

First, since data on the number of articles in the Wall Street Journal had to be hand-collected, the sample of firms in this study was restricted to 200. Future research should study a larger sample of firms to test the robustness of the results reported in this study. Second, future research should explore whether information availability can be used to explain other documented pricing anomalies, for example the post-earnings announcement drift documented in the accounting literature. Finally, OTC firms were not studied in this paper because previous research has shown that the small firm effect does not exist for such firms. Since this paper has shown that the small firm effect is a proxy for the information availability effect, future research should explore whether the information availability effect exists for OTC firms. 🕮

---

*The author would like to thank Mark Zmijewski, Larry Brown, Charles Trzcinka, Ravi Shukla, Ashok Robin, and the faculty and doctorial students at SUNY Buffalo for providing comments. The author would like to thank Scott Davis for his assistance with data, Cynthia Hagerman for editorial help, and the New York Stock Exchange and American Stock Exchange for providing listing data. All errors are the responsibility of the author.*

**Endnotes**

1. I would like to thank Mark Zmijewski, Larry Brown, Charles Trzcinka, Ravi Shukla, and Ashok Robin for providing comments. I would also like to thank Scott Davis, Marie Archambault and Tian Ming for assistance with collecting the data, and the New York Stock Exchange and the American Stock Exchange for providing me the period of listing data. All errors are my responsibility.
2. I do not study Over-the-Counter (OTC) stocks because Leong and Zaima (1991) show that the small firm effect does not exist for OTC stocks.

## References


1. Badrinath, S.G. and O.Kini, "The Relationship Between Securities Yields, Firm Size, Earnings/Price Ratios and Tobin's q," *Journal of Business Finance and Accounting,* Vol. 21, No. 1, pp. 109-131, 1994.
2. Banz, R.W., "The Relationship Between Return and Market Value of Common Stocks," *Journal of Financial Economics,* Vol. 9, No. 1, pp. 3-18, 1981.
3. Barry, C.B. and S.J.Brown, "Differential Information and the Small Firm Effect," *Journal of Financial Economics,* Vol. 13, No. 3, pp. 283-294, 1984.
4. Barry, C.B. and S.J. Brown, "Differential Information and Security Market Equilibrium," *Journal of Financial and Quantitative Analysis,* Vol. 20, No. 4, pp. 407-422, 1985.
5. Blume, M.E. and R.M. Stambaugh, "Biases in Computed Returns: An Application to the Size Effect," *Journal of Financial Economics,* Vol. 12, No. 2, pp. 387-404, 1983.
6. Booth, J.R. and R.L. Smith, "An Examination of the Small-Firm Effect on the Basis of Skewness Preference," *The Journal of Financial Research,* Vol. 10, No. 2, pp. 77-86, 1987.
7. Eakins, S. and S. Sewell, "Tax-Loss Selling, Institutional Investors, and the January Effect: A Note," *The Journal of Financial Research,* Vol. 16, No. 4, pp. 377-384, 1993.
8. Keim, D.B., "Size Related Anomalies and Stock Market Seasonality: Further Empirical Evidence," *Journal of Financial Economics,* Vol. 12, No. 1, pp. 13-32, 1983.
9. Klein, R.W. and V.S. Bawa, "The Effect of Limited Information and Estimation Risk on Optimal Portfolio Diversification," *Journal of Financial Economics,* Vol. 5, No. 2, pp. 89-111, 1977.
10. Leong, K.K and J.K. Zaima, "Further Evidence of the Small-Firm Effect: A Comparison of NYSE-AMEX and OTC Stocks," *Journal of Business Finance and Accounting,* Vol. 18, No. 2, pp. 117-124, 1991.
11. Reinganum, M.R., "Misspecification of Capital Asset Pricing: Empirical Anomalies Based on Earnings' Yields and Market Values," *Journal of Financial Economics,* Vol. 9, No. 1, pp. 19-46, 1981.
12. Reinganum, M.R., "The Anomalous Stock Market Behavior of Small Firms in January: Empirical Tests for Year-End Tax Effects," *Journal of Financial Economics,* Vol. 12, No. 2, pp. 89-104, 1983.
13. Reinganum, M.R. and J.K. Smith, "Investor Preference for Large Firms: New Evidence on Economies of Size," *Journal of Industrial Economics,* Vol. 32, No. 3, pp. 213-227, 1983.
14. Roll, R., "A Possible Explanation of the Small Firm Effect," *Journal of Finance,* Vol. 36, No. 4, pp. 879-887, 1981.
15. Roll, R., "On Computing Mean Returns and the Small Firm Premium," *Journal of Financial Economics,* Vol. 12, No. 3, pp. 371-386, 1983a.
16. Roll, R., "Vas ist das? The Turn of the Year Effect and the Return Premia of Small Firms," *Journal of Portfolio Management,* Vol. 9, No. 1, pp. 18-28, 1983b.
17. Zivney, T.L. and D.J. Thompson, "Relative Stock Prices and the Firm Size Effect," *The Journal of Financial Research,* Vol. 10, No. 2, pp. 99-110, 1987.