by Ivan L. Lustig and Philip A. Leinbach

The Small Firm Effect

Tests using the Capital Asset Pricing Model show that, in six of nine five-year periods between 1936 and 1979, the portfolio composed of the bottom fifth of all stocks on the New York Stock Exchange in terms of market value outperformed the portfolio composed of the largest capitalization stocks, even after adjusting for risk. For the period 1951 to 1979, the "small firm" portfolio had a cumulative abnormal return of 20.65 per cent, versus 1.53 per cent for the portfolio of large firms.

These results may be taken as evidence that small capitalization stocks yield higher returns than large capitalization stocks. But a more realistic conclusion may be that the Capital Asset Pricing Model, upon which the results are based, is misspecified. If the opportunity cost of obtaining information about small capitalization stocks were included in the purchase price of the stock, the abnormal return would probably disappear.

EMPIRICAL RESEARCH over the past 15 years has overwhelmingly bolstered the efficient market hypothesis. Both academics and practitioners tried myriad intricate investment strategies, none of which yielded significant abnormal returns over the long run. The implication is that the best one can hope to do, on average, is to match the risk-adjusted market return.

Recently, however, a number of studies have apparently revealed a simple way to reap excess returns. One used a generalized asset pricing model to show that the common stock of small New York Stock Exchange (NYSE) firms earned higher risk-adjusted returns, on average, than the common stock of large NYSE firms.[1] Another duplicated these results using arbitrage pricing theory (APT) to show that market capitalization is a powerful predictor of return.[2]

The explanation for this "small firm effect" is not obvious. It could be that the risk of small firms is being underestimated. Perhaps the small number of outstanding shares for small firms, or inadequate information about those firms, causes market inefficiencies. Some feel that the capital asset pricing model (CAPM) and APT fail to model fully the complexities of the market pricing mechanism. Indeed, other critics maintain that risk measures, such as beta, seriously understate the risk of holding a small firm portfolio, whatever the model used, while still others conclude that the large difference in returns over 40 years constitutes evidence that the CAPM is misspecified.

This article attempts to replicate the results of previous academic studies by investigating the small firm effect within the framework of the CAPM. The two key issues are:

- Does the CAPM adequately describe the return behavior of both large and small stocks?
- Are the abnormal returns on small stocks significantly greater than the abnormal returns on large stocks?

1. Footnotes appear at end of article.

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The Study

The data base for our study constituted the monthly returns on stocks listed on the New York Stock Exchange (NYSE) from 1926 to 1979 (obtained from the University of Chicago's Center for Research in Securities Prices). The actual time

Table I Average Number of Stocks in Each Five-Year Portfolio

Year	*Top Portfolio*	*Bottom Portfolio*
1931–35	34.0	18.0
1936–40	118.0	38.1
1941–45	135.6	38.0
1946–50	142.2	60.0
1951–55	156.8	72.8
1956–60	184.1	71.9
1961–65	189.8	61.0
1966–70	202.9	52.3
1971–75	213.9	52.1
1976–79	323.3	56.2

Table II Risk and Return of Top and Bottom Portfolios

	Top Portfolio		*Bottom Portfolio*	
Year	*Average Beta*	*CAR*	*Average Beta*	*CAR*
1931–35	1.0830	34.5%	1.8126	296.0%
1936–40	1.4548	−3.3	1.7597	30.8
1941–45	1.0370	7.1	1.8915	137.3
1946–50	1.0220	1.8	1.9897	−60.1
1951–55	1.0187	−9.5	1.3965	−64.4
1956–60	0.9694	3.3	0.7936	2.6
1961–65	0.9360	3.3	0.8405	37.2
1966–70	1.0069	3.0	1.0944	35.5
1971–75	0.9896	13.4	1.3062	18.9
1976–79	1.0423	−4.3	1.2222	94.1

horizon under investigation, 1931 to 1979, was divided into nine five-year periods and one four-year period (1976–79).

Defining the size of a stock in terms of its market value, we formed two portfolios for each time period. The top portfolio consisted of those stocks in the upper quintile of all stocks on the NYSE when ranked by market value; the bottom portfolio was composed of those stocks in the lowest quintile. Equal dollar amounts were invested in each portfolio, and in each stock within each portfolio. Table I gives the average number of stocks in each portfolio.

Using the Sharpe-Lintner model of the CAPM, we computed the abnormal returns earned by the portfolios in each of the 528 months from 1931 to 1979. From these data, we calculated the cumulative abnormal return (CAR) for each portfolio in each of the 10 time periods. (The method is detailed in the appendix.)

Results

Table II summarizes the performance of the top and bottom portfolios in each of the 10 time periods. Note that the CAR for the period 1931–35 is significantly higher than the CAR for any other

Table III Average CAR Over Selected Time Intervals

Portfolio	*1936–79*	*1951–79*
Top	1.64%	1.53%
Bottom	25.77	20.65

five-year period. Since the CAR for that period was based on comparatively few stocks, we concluded that this period was an outlier and focused on the remaining periods from 1936 to 1979. Because the economy and investment environment of the 1930s and 1940s differed substantially from those of today, we also analyzed the data for 1951–79 separately.

Inasmuch as the CAR of each portfolio is based on risk-adjusted returns, we would expect to find no correlation between the average beta of the portfolio and its CAR. Subsequent testing confirmed this: The correlation between the average beta and CAR was only 0.11 for 1936–79 and −0.13 for 1951–79. So even though the betas of the top and bottom portfolios for each time interval differ, that difference does not explain the difference between the portfolios' observed CARs.

Figure A compares the CARs of the top and bottom portfolios in each five-year time period. In six of the nine periods, the portfolio of small stocks outperformed the portfolio of large stocks on a risk-adjusted basis, usually by a substantial margin. The average CARs presented in Table III show that, while the magnitude of the small stocks' superior performance decreases when the data from 1951–79 are considered alone, the relative difference between the top and bottom portfolios changes little. The small stocks consistently outperform the large stocks, even after adjusting for risk.

Table IV, summarizing the results of statistical tests of the significance of these abnormal returns, tells us that we can be confident at the 95 per cent level that the abnormal returns on the large stocks were not different from zero, and confident at the 90 per cent level that the abnormal returns of the small stocks were greater than the abnormal returns on the large stocks.

Implications

The implications of these results for investment strategy are not completely clear, as the empirical test was a test both of a particular strategy and of the CAPM. They do suggest that a sure profit scheme would be to obtain a portfolio of small

Figure A Cumulative Abnormal Returns for Top and Bottom Portfolios

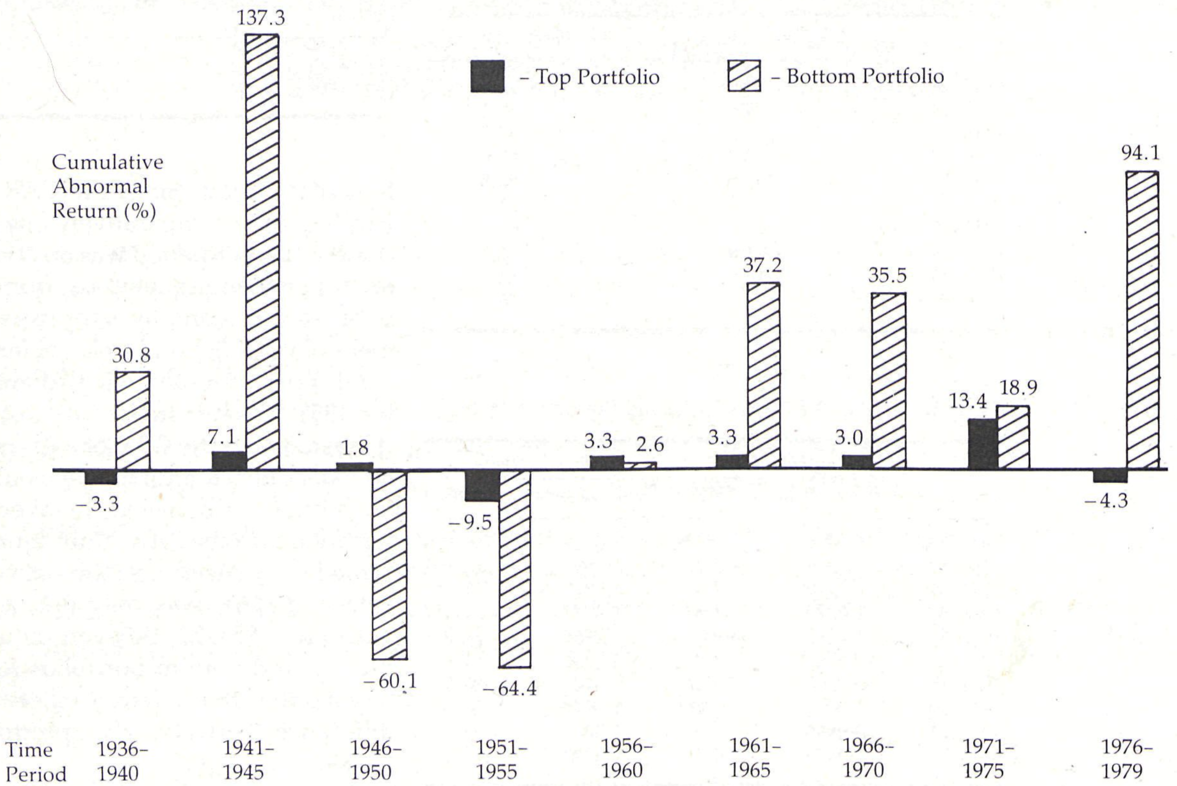

Table IV Abnormal Return Summary Statistics

	Mean Monthly Abnormal Return (basis points)	*Standard Deviation of Monthly Abnormal Return (basis points)*
Top Portfolio	2.8	3.5
Bottom Portfolio	43.9	44.9
Difference between Top and Bottom Portfolios	41.1	24.0

capitalization stocks, granting the heroic assumptions of the CAPM. However, it would be a mistake to conclude that the CAPM is a fine-tuned model of the vagaries of the stock market.

Among the assumptions underlying the CAPM is the particularly troublesome postulate that all investors are endowed with the same knowledge of the market. The activities of such giant firms as AT&T and IBM are widely reported in the news, whereas the policies of the smallest firms usually are not. The abnormal return garnered from small stocks may just be compensation for the effort required to gather the information needed for prudent investment. If the opportunity cost of this additional effort were included in the purchase price of the stock, the abnormal return might disappear.

The CAPM clearly does not model correctly the behavior of small capitalization stocks, although it does quite well for large stocks. Part of the reason the model does well for large stocks is that the total market is defined (in this study, at least) as the sum of the market-value-weighted returns of each stock on the NYSE. Since large stocks account for most of the value of the stock market, the calculated beta becomes essentially a regression of the returns of large stocks against itself, in the form of the market return. Thus it comes as no surprise that the CAPM works well for large stocks. The true test of the model is whether it can predict the returns of small stocks. According to our results, the model fails this test. We therefore conclude that the CAPM is misspecified and that the small firm effect is one manifestation of this.

This conclusion implies that there are no real abnormal returns to be gotten from investing in small stocks. The apparent abnormal returns predicted by the CAPM are not so much proof of the lack of efficiency of the stock market as they are an indication of the bounds of usefulness of the CAPM. ■

Footnotes

1. See R.W. Banz, ''The Relationship Between Return and Market Value of Common Stocks,'' *Journal of Financial Economics*, March 1981, pp. 3–18.
2. M.R. Reinganum, ''A Simple Test of the Arbitrage Pricing Theory'' (Graduate School of Business, University of Southern California, August 1980).

Appendix

Calculating Cumulative Abnormal Return

We computed abnormal returns using the following form of the Sharpe-Lintner model of the CAPM:

$$R_{it} = R_{ft} + B_i(R_{mt} - R_{ft}) + U_{it} \quad , \qquad \text{(A1)}$$

where

R_{it} = the return on stock i in month t,
R_{ft} = the return on the risk-free asset in month t,
R_{mt} = the return on the market portfolio in month t,
B_i = the beta of stock i,
U_{it} = the residual return (normally distributed and with a mean of zero).

The abnormal return of stock i in month t is simply the residual in Equation (A1):

$$U_{it} = (R_{it} - R_{ft}) - B_i(R_{mt} - R_{ft}) \, . \qquad \text{(A2)}$$

Thus, to determine if abnormal returns exist, we must calculate the coefficients of the Sharpe-Lintner model—the beta of each stock, the risk-free rate and the market portfolio return. The risk-free rates were approximated by using the returns on newly issued 90-day Treasury bills. The return on the market portfolio was the market-value-weighted return on the entire NYSE (taken from the CRSP tapes).

We estimated the beta for each stock using ordinary least squares regression on the market model:

$$R_{it} = a_i + B_i R_{mt} + e_{it} \quad , \qquad \text{(A3)}$$

where

a_i = zero, and
e_{it} = an error term due to regression (normally distributed and with a mean of zero).

We used the returns in the five years preceding the time period under study to estimate the beta for that time period. In order to obtain reasonable estimates from ordinary least squares regression, we had to exclude from the portfolios any stocks that did not have return data for at least 36 months out of the 60-month period. (This requirement resulted in the exclusion of a number of stocks, especially from the bottom portfolio (see Table I). This in turn resulted in a bottom portfolio that was less diversified than the top portfolio and in a violation of the pure investment strategy based only on market value.) Once a beta for a stock was calculated, it was assumed to remain constant over the entire five-year time period.

To calculate the abnormal return of a portfolio in month t, we summed the residuals over all stocks in the portfolio:

$$CAR_{jt} = \sum_{i \epsilon j} U_{it}/n_j \; , \qquad t = 1, 2, \ldots, 528, \qquad \text{(A4)}$$

where

CAR_{jt} = the cumulative abnormal return of portfolio j in month t and
n_j = the number of stocks in portfolio j.

The total cumulative abnormal return for a portfolio over each of the 10 time periods is merely the equally weighted sum of the monthly CARs of that portfolio. This implies that the returns over the course of the time periods are not reinvested, so the compound effects of random errors are kept to a minimum.