by Marc R. Reinganum

Abnormal Returns in Small Firm Portfolios

The capital asset pricing model (CAPM) asserts that, in equilibrium, the expected return on any asset equals the risk-free rate plus a risk premium proportional to the asset's "beta"—a measure of the asset's covariance with the market as a whole; any two assets with the same beta will have the same expected return. In particular, the model implies that small firms will command higher risk premiums only if they have higher betas.

In order to test whether premiums that are not explained by beta exist, the author collected aggregate stock market values and returns for firms represented both on the University of Chicago's CRSP tapes and the Compustat Merged Annual Industrial tape. He ranked all firms in the resulting sample on the basis of their aggregate stock market values. Then he combined the ranked securities into 10 equal-weighted portfolios, all of which turned out to have betas near one. If the simple one-period CAPM is correct, rates of return for these portfolios should approximate the rate of return for the market as a whole.

The author analyzed performance of the resulting portfolios two ways. First, he computed for each of 10 portfolios ranked by size the average over the years from 1962 through 1975 of the rate of return in the year subsequent to formation to determine whether ranking had any effect. The portfolio containing the smallest firms realized average rates of return more than 20 per cent per year higher than those of the portfolio containing the largest firms. Then the author averaged rates of return over the second year following formation of each portfolio. The abnormal returns of the smallest firms persisted at about the same level in the second year after formation as in the first.

The simple one-period CAPM is an inadequate description of the behavior of real world capital markets.

THE SIMPLE one-period capital asset pricing models (CAPMs) of Sharpe, Lintner and Black have had an enormous influence on finance during the past decade.[1] Recent research, however, suggests that these influential models are misspecified. The most serious source of the misspecification seems to relate to the size of a firm: Data on firm size can be used to create portfolios that systematically earn "abnormal" returns.

Small firms listed on the New York and American Stock Exchanges systematically experienced average abnormal rates of return nearly 20 per cent per year greater than those of large firms during the period 1963 to 1977.[2] The persistence of these abnormal returns reduces the likelihood that the results are being generated by market

1. Footnotes appear at end of article

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inefficiency. Rather, the evidence suggests that the CAPM may not adequately describe the behavior of stock prices.

The Capital Asset Pricing Model

The allure of the CAPM is its simplicity and appeal to common sense. In words, the model states that the equilibrium expected return on any asset equals the risk-free rate of interest plus a risk premium. The exact relationship is given by:

$$E(\tilde{R}_i) = R_f + \beta_i[E(\tilde{R}_m) - R_f] , \quad (1)$$

where

$E(\tilde{R}_i)$ = the equilibrium expected return on asset i,
R_f = the risk-free rate of interest,
$E(\tilde{R}_m)$ = the expected return on the market portfolio of all assets and
β_i = $COV(\tilde{R}_i, \tilde{R}_m) / VAR(\tilde{R}_m)$, or the risk of asset i relative to the market portfolio — the "beta" coefficient.

The most important term in this equation is the second one on the right-hand side. It specifies the risk premium associated with asset i. For while the model requires in general that investors be compensated for bearing risk, the risk for which they actually receive compensation is measured in a very specific way within the model: The risk premium is related directly to an asset's beta, which is proportional to the asset's covariance with the market as a whole.

However, one can imagine a world in which a security's risk is not proportional to its covariance with the market. For example, in the arbitrage pricing model, compensation for bearing risk may be comprised of several risk premiums, rather than just one risk premium.[3] Thus there is nothing sacred about the definition of risk in the CAPM, or its explanation of risk premiums.

A Test

One implication of the CAPM as expressed by Equation (1) is that any two assets with the same beta will possess identical expected returns. In particular, since the beta of the market portfolio by definition equals 1.0, the difference between the return of another portfolio with a beta near 1.0 and that of the market portfolio measures abnormal return, which can be either positive or negative over short time periods. If the CAPM is correct, however, the average of these excess returns over longer time periods should approach zero. Hence a simple test of the CAPM is to form portfolios with betas near one and determine whether the mean abnormal returns are statistically different from zero. If the CAPM is correct, the mean excess returns will be zero, regardless of the criteria employed in selecting the portfolios.

Since portfolio betas are not known a priori, implementing this test is not as simple as it may sound. Several standard caveats should be mentioned. First, the return distributions of the portfolios must be stationary over time; otherwise the validity of our statistical tests will be undermined. Second, portfolio betas must be estimated; the estimated betas, although based on an unbiased estimator, will not necessarily equal the true betas in any given sample. Third, the market portfolio actually used in the test includes only securities listed on the New York and American Stock Exchanges.[4]

The Data

We collected stock prices, daily returns and common shares data from the University of Chicago's Center for Research in Security Prices (CRSP) daily master and return tapes. Since our test examined the relation between firm size and earnings/price ratio effects, we also required that the firms in our sample be included on a 1978 version of the Compustat Merged Annual Industrial Tape.[5] The number of firms that fulfilled the data requirements in any given year ranged from about 700 in the mid-1960s to about 1,200 in the mid-1970s.

For each year from 1962 through 1975, we ranked all firms in the sample on the basis of their December 31 aggregate stock market values. We then broke down the ranked sample into deciles and combined the daily returns of securities in each decile to form the daily returns of each portfolio 1 through 10, with 1 corresponding to the lowest decile and 10 to the highest.

In adjusting these portfolios for beta risk, equal weights were applied to all securities. Preliminary analysis of the data revealed that "market model" beta estimates were close to one. Thus the equal-weighted NYSE-AMEX market index can serve as the control portfolio against which the hypothetical returns are compared.

Results

To test the hypothesis that mean abnormal returns are zero, we analyzed the returns of each of the portfolios during the 24-month period sub-

Table I Mean Abnormal Daily Returns of 10 Market Value Portfolios During the First Year (Based on Equal-Weighted NYSE-AMEX Index)

Portfolio No.	Mean Abnormal Returns[a] (in 1/10%)	Beta	Average Percentage on AMEX[b]	Average Median Value[c] ($ in millions)	Daily Autocorrelation of Abnormal Returns 1	2	3
1	0.500	1.00	82.61	8.3	0.06	0.03	0.06
	(6.42)	(101.7)					
2	0.193	1.02	48.35	20.0	−0.05	0.01	−0.00
	(3.47)	(144.9)					
3	−0.033	1.00	23.81	34.1	0.01	−0.00	0.02
	(−0.71)	(171.3)					
4	−0.050	1.00	11.29	54.5	0.05	−0.02	0.00
	(−1.11)	(177.1)					
5	−0.115	0.94	8.59	86.1	0.09	0.04	0.01
	(−2.60)	(170.3)					
6	−0.193	0.88	4.42	138.3	0.20	0.07	0.11
	(−4.18)	(160.9)					
7	−0.189	0.90	4.35	233.5	0.27	0.17	0.16
	(−3.99)	(156.8)					
8	−0.214	0.83	2.71	413.0	0.37	0.22	0.17
	(−4.00)	(135.9)					
9	−0.292	0.83	2.46	705.3	0.38	0.23	0.21
	(−5.24)	(126.3)					
10	−0.343	0.82	1.60	1,759.9	0.37	0.25	0.21
	(−4.79)	(96.3)					

a. Average abnormal return per trading day. There are approximately 250 trading days per year.
b. Percentage of firms in portfolio listed on the American Stock Exchange.
c. The median firm size in each portfolio averaged over the 14 years included in the study.

sequent to the portfolio's formation. We calculated abnormal returns by subtracting the daily return of the equal-weighted NYSE-AMEX index from the daily returns of the portfolios.[6] If the simple one-period CAPM adequately explains returns, then the mean abnormal return for each portfolio should be zero. That is, since all the portfolios being tested have betas near one, their average rate of return should approximate the rate of return for the market as a whole.

Since we revised the composition of the portfolios annually, we could have analyzed the returns of the 10 portfolios ranked by the market values of the stocks they contained after each revision.[7] However, the results in Table I were computed by combining the 14 years of abnormal returns for each portfolio rank into one time series. Thus these results can be interpreted as illustrating the average size effect over the 14-year period.

Table I shows the abnormal returns for the portfolios during the first 12-month period. This corresponds to the year immediately following the identification of the portfolios; if portfolio membership is based upon 1962 stock market values, for example, the returns during the first 12-month period for these portfolios occur during 1963.

The results in Table I indicate that the simple CAPM does not adequately describe stock return behavior. An investor can, on the basis of firm size data, form portfolios that systematically earn abnormal returns. For example, the portfolio of smallest firms (number 1) exhibits a mean abnormal return of 0.05 per cent per trading day for the first 12-month period, or more than 12 per cent on an annual basis. As Table I also shows, the portfolios composed of small firms stand out, not only because of their positive abnormal returns, but also because each is heavily populated with firms that trade on the American Stock Exchange.

The point estimates of the abnormal returns for the portfolios composed of large firms are negative. A comparison of the performance of the portfolio containing the smallest firms with that of the portfolio of largest firms is even more remarkable: On average, the smallest firms experience returns more than 20 per cent per year higher than the returns for the largest firms.

The estimated betas of the larger firm portfolios are also slightly less than those of the small firm portfolios. However, this difference in estimated betas cannot account for the difference

Table II Mean Abnormal Daily Returns of 10 Market Value Portfolios During the Second Year (Based on Equal-Weighted NYSE-AMEX Index)

Portfolio No.	Mean Abnormal Returns[a] (in 1/10 %)	Beta	Average Percentage on AMEX[b]	Average Median Value[c] ($ in millions)	Daily Autocorrelation of Abnormal Returns 1	2	3
1	0.496 (6.38)	1.02 (104.1)	82.61	8.3	0.07	0.03	0.04
2	0.151 (2.66)	1.01 (141.1)	48.35	20.0	−0.04	−0.03	0.03
3	−0.016 (−0.33)	0.99 (161.1)	23.81	34.1	−0.01	−0.00	0.02
4	−0.042 (−0.97)	0.99 (177.9)	11.29	54.5	0.06	0.01	0.01
5	−0.088 (−1.95)	0.93 (167.4)	8.59	86.1	0.11	0.03	0.04
6	−0.229 (−4.88)	0.87 (158.5)	4.42	138.3	0.21	0.08	0.11
7	−0.231 (−4.86)	0.91 (157.2)	4.35	233.5	0.28	0.14	0.12
8	−0.262 (−4.79)	0.82 (132.2)	2.71	413.0	0.36	0.23	0.17
9	−0.334 (−5.83)	0.83 (125.1)	2.46	705.3	0.38	0.22	0.21
10	−0.408 (−5.63)	0.83 (95.4)	1.60	1,759.9	0.36	0.25	0.21

a. Average abnormal return per trading day. There are approximately 250 trading days per year.
b. Percentage of firms in portfolio listed on the American Stock Exchange.
c. The median firm size in each portfolio averaged over the 14 years included in the study.

in average returns for two reasons. First, for the difference in estimated betas — 0.18 — to account for the difference in average returns — about 20 per cent per year — the expected return on the market portfolio would have to equal the risk-free rate of interest plus 110 per cent. Clearly, the market has not more than doubled each year. Second, the sign of the difference in estimated betas reverses when a value-weighted, instead of equal-weighted, market index is used in the estimation. That is, using a value-weighted market index, the estimated betas of the larger firm portfolios are greater than those of the small firm portfolios.[8]

Persistence

Table II shows the daily returns of the 10 portfolios over the 12-month period beginning one year after the portfolios were formed. For example, the portfolios were formed on the basis of 1962 stock market values, but the returns analyzed occurred during 1964. As in Table I, the results in Table II are calculated by combining the 14 years of abnormal returns for each market value portfolio into one time series.

The evidence in this table demonstrates that, on the basis of firm size data, an investor can form portfolios that systematically earn abnormal returns that persist for at least two years. The portfolio of smallest firms continues to earn abnormal returns of about 12 per cent per year. Not only do abnormal returns for small firms persist, but they persist at about the same level in the second year as in the first. The return behavior of the larger firms in the second year is also similar to that exhibited in the first year. The persistence of abnormal returns for two years reduces the likelihood that the results are due to a market inefficiency — i.e., to relevant information being ignored.

The persistence of positive abnormal returns for small firm portfolios seriously violates the null hypothesis that the mean abnormal returns associated with the simple one-period CAPM are zero.

Investment Implications

The popular financial press has recently drawn attention to the lackluster performance of the Dow Jones industrial average as compared to broader indexes. The evidence presented in this article suggests that the superior performance of AMEX and over-the-counter stocks may not be an anomalous event. In fact, insofar as these

indexes contain many small firms, they could be expected to experience higher average advances than the Dow Jones average, which contains only very large companies.

The fact that small firms have systematically experienced average rates of return significantly greater than those of larger firms with equivalent beta risk, and that these abnormal returns have persisted for at least two years from the portfolio formation dates, indicates that the simple one-period CAPM is an inadequate empirical representation of capital market equilibrium. Alternative models of capital market equilibrium should be seriously considered and tested. ■

Footnotes

1. See W. F. Sharpe, "Capital Asset Prices: A Theory of Market Equilibrium Under Conditions of Risk," *Journal of Finance,* September 1964; J. Lintner, "The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets," *Review of Economics and Statistics,* February 1965; and F. Black, "Capital Market Equilibrium with Restricted Borrowing," *Journal of Business,* July 1972.
2. R.W. Banz also detected a small firm effect in the monthly returns of NYSE companies. "Limited Diversification and Market Equilibrium: An Empirical Analysis" (Ph.D. dissertation, University of Chicago, 1978).
3. See S.A. Ross, "Return, Risk and Arbitrage," in *Studies in Risk and Return,* I. Friend and J.L. Bicksler, eds. (Cambridge: Ballenger, 1977).
4. Problems in testing the theoretical CAPM are more fully discussed in R. Roll, "A Critique of the Asset Pricing Theory's Tests, On Past and Potential Testability of the Theory," *Journal of Financial Economics,* March 1977. The present article merely tests whether the CAPM fits the data.
5. This tape, which was created by CRSP, includes firms not doing business as of 1978, which would normally be omitted from the annual industrial tape provided by Compustat.
6. A return includes both capital gains and dividends. That is:

$$R_t = (P_t - P_{t-1} + D_t) / P_{t-1} .$$

7. The year by year results also consistently show a size effect. See Reinganum, "Misspecification of Capital Asset Pricing: Empirical Anomalies Based on Earning Yields and Market Values" (Ph.D. dissertation, University of Chicago, 1979).
8. Ibid.

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mation concerning recommendations made to such companies with regard to the purchase or sale of a security.

Rule 17j-1 and the accompanying release make clear that the term "beneficial ownership" is as defined for purposes of Section 16 of the Exchange Act (Section 17(j) in its original form), not Rule 13d-3 of the Exchange Act. Section 16 reaches securities owned by a person or held in the name of a spouse or minor children, as well as relatives living under the same roof. It also covers securities held in certain fiduciary capacities for oneself or members of one's immediate family, and in certain other circumstances. However, it generally does not reach securities over which a person otherwise has control or influence (34-7793, January 19, 1966 and Securities Exchange Act Rule 16a-8). Securities excluded from Rule 17j-1 include those issued by the U. S. government, Bankers' Acceptances, bank Certificates of Deposit, commercial paper and mutual fund shares.

Reports must be filed at least quarterly, within 10 days after the end of each quarter. Access persons are not required to report to an investment adviser if they have filed duplicate information pursuant to the rules of the Investment Advisers Act. The reporting requirements also except (1) transactions effected for any account over which a subject person does not have any direct or indirect influence or control, but in which such person has a beneficial interest, and (2) transactions by disinterested directors (independent directors) of an investment company within the meaning of the Act, except if such "director knew or, in the ordinary course of fulfilling his official duties as a director of the registered investment company, should have known that during the 15-day period immediately preceding or after the date of the transaction in a security by the director such security is or was purchased or sold by such investment company or such purchase or sale by such investment company is or was considered by the investment company or its investment adviser." The language in the new rule was changed from "actual knowledge"; the feeling was that directors might not fulfill their official duties in order to escape reporting. However, the time period for reporting was shortened from 30 to 15 days.

The subject company must maintain a variety of records for five years, including copies of the code, records of violations and any action taken thereon, copies of reports and lists of persons required to report.

Aims

The prohibitions of Rule 17j-1 are directed at two types of potential conflicts of interest — (1) the situation where an access person is in a position to profit by trading in securities in which the investment company is trading and (2) the situation in which such person may use his recommendations to the investment company to protect investments he's already made. The specific danger in the first circumstance is that the market for the securities in which the investment company is trading may be adversely affected by the conduct of the access person. In the second circumstance, the access person may improperly influence the investment strategy of the company.

There are obvious questions of degree that must be answered by the re-

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