THE JOURNAL OF FINANCE • VOL. LVI, NO. 2 • APRIL 2001

Explaining the Cross-Section of Stock Returns in Japan: Factors or Characteristics?

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ABSTRACT

Japanese stock returns are even more closely related to their book-to-market ratios than are their U.S. counterparts, and thus provide a good setting for testing whether the return premia associated with these characteristics arise because the characteristics are proxies for covariance with priced factors. Our tests, which replicate the Daniel and Titman (1997) tests on a Japanese sample, reject the Fama and French (1993) three-factor model, but fail to reject the characteristic model.

Financial economists have extensively studied the cross-sectional determinants of U.S. stock returns, and contrary to theoretical predictions, find very little cross-sectional relation between average stock returns and systematic risk measured either by market betas or consumption betas. In contrast, the cross-sectional patterns of stock returns are closely associated with characteristics like book-to-market ratios, capitalizations, and stock return momentum.[1] More recent research on the cross-sectional patterns of stock returns documents size, book-to-market, and momentum in most developed countries.

Fama and French (1993, 1996, and 1998) argue that the return premia associated with size and book-to-market are compensation for risk, as described in a multifactor version of Merton's (1973) Intertemporal Capital Asset Pricing Model (ICAPM) or Ross's (1976) Arbitrage Pricing Theory. They propose a three-factor model in which the factors are spanned by three zero-investment portfolios: *Mkt* is long the market portfolio and short the risk-free asset; *SMB* is long small capitalization stocks and short large capitalization stocks; and *HML* is long high book-to-market stocks and short low book-to-market stocks.

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[1] See, for example, Banz (1981), Keim (1983), DeBondt and Thaler (1985), Fama and French (1992, 1996), and Jegadeesh and Titman (1993), among others.

Daniel and Titman (1997) argue that the Fama and French tests of their three-factor model lack power against an alternative hypothesis, which they call the "Characteristic Model." This model indicates that the expected returns of assets are directly related to their characteristics for reasons, such as behavioral biases or liquidity, which may have nothing to do with the covariance structure of returns. Using alternative tests, which they apply to U.S. stock returns between 1973 and 1993, Daniel and Titman reject the Fama and French three-factor model but not the characteristic model.

The Daniel and Titman (1997) results are clearly controversial; they reject a model that captures the central intuition of traditional asset pricing models in favor of a model that is almost completely ad hoc. Hence, as also argued in Davis, Fama, and French (2000), it is important to test the robustness of the Daniel and Titman results on different samples. However, examining the results out of sample is difficult because the tests require a cross section of stocks that is large enough to allow the researcher to form diversified portfolios with independent cross-sectional variation in factor loadings and characteristics. In addition, one needs to examine a sample in which returns are strongly related to the characteristics. Given these data requirements, the best places to look for out-of-sample confirmation of the Daniel and Titman results are probably the U.S. market prior to 1973 and the Japanese stock market during the most recent years.[2] Davis et al. examine whether average U.S. stock returns are better explained by characteristics or factors in the pre-1973 period. We consider this same issue for Japanese stocks in the 1975 to 1997 period.[3]

The paper proceeds as follows. In Section I we describe the characteristic and factor models, and discuss our empirical tests and power and selection bias issues related to these tests. Section II describes our data, and Section III summarizes the return patterns in Japanese portfolios. In Sections IV and V we replicate the Fama and French (1993) tests, and then test the characteristic and factor models using our more powerful tests. Section VI concludes.

I. Testing Characteristic Versus Factor Models

Our tests examine a nested version of a characteristic and factor model that assumes that asset returns are generated by the following process (for simplicity, we assume a single priced factor f_t; the argument is equivalent when there are multiple factors):

$$R_{i,t} = E[R_{i,t}] + \beta_{i,t-1} f_t + \epsilon_{i,t}$$

[2] One other possibility would be to examine the momentum effect (something not studied by Daniel and Titman, Davis et al., or this paper). Grundy and Martin (1998) do this, and find that, in the United States, the momentum characteristic (as opposed to the momentum-factor loading) is responsible for the momentum premium.

[3] This issue is also explored in Jagannathan, Kubota, and Takehara (1998). They find that a book-to-market factor is priced within book-to-market sorted portfolios, even after controlling for the book-to-market characteristic. However, they do not control for the size characteristic, which is a strong determinant of average returns over their time period. The results in this paper suggest that their book-to-market factor loadings may proxy for size in their tests.

where $E_{t-1}[\epsilon_t] = E_{t-1}[f_t] = E_{t-1}[\epsilon_t f_t] = 0$ and where expected returns are determined by

$$E_{t-1}[R_{i,t}] = a + \delta\theta_{i,t-1} + \lambda\beta_{i,t-1} \tag{1}$$

where $\theta_{i,t-1}$ is a characteristic of security i (such as its size or book-to-market ratio) observable at $t-1$.

The traditional factor model assumes that δ in equation (1) equals zero, implying that expected returns are a linear function of just the factor loading. In contrast, the characteristic model restricts λ to be zero, implying that expected returns are determined exclusively by the characteristic.[4] Of course, it is also possible that both δ and λ could be nonzero, meaning that expected returns would be a function of both the factor loadings and the characteristic.

A. Power Considerations

Distinguishing between the factor and characteristic models can be difficult, because θ_i and β_i are likely to be cross-sectionally correlated.[5] In other words, in a firm-by-firm cross-sectional regression,

$$\beta_{i,t-1} = \gamma\theta_{i,t-1} + \nu_{i,t-1} \tag{2}$$

both γ and the regression R^2 are likely to be significantly different from zero.

This multicollinearity problem is likely to be exacerbated by the Fama and French (1993) test procedure that forms diversified test portfolios based on characteristic sorts. For example, a portfolio of all stocks with (roughly) the same book-to-market ratio will have a portfolio β equal to $\gamma\theta$, as expressed in equation (2), because the positive and negative νs of the individual securities will average out to zero. This will result in a set of test portfolios for which the average factor loading is almost perfectly correlated with the average characteristic, and tests of equation (1) with such portfolios will have almost no power to discriminate between the two hypotheses. To eliminate this multicollinearity problem, Daniel and Titman (1997) point out the need

[4] In general, the assumption of linearity is innocuous—because the characteristic model does not impose linearity, we can always transform the characteristic to make the relationship in equation (1) linear. However, the factor alternative imposes linearity, whereas the characteristics alternative does not. Thus, if there were a perfect linear relationship between factor loadings and characteristics, but the relationship between the factor loading/characteristic and expected return was nonlinear, we could reject the factor model but not the characteristic model.

[5] There are several arguments for why characteristics and factor loadings should be correlated. Under a rational model, firms with a high loading on a priced factor will tend to have lower prices because their future cash flows are discounted at higher rates; this will induce a correlation between factor loadings and characteristics like size and BM. Also, Daniel and Titman (1997) note that, under nonrisk models, similar firms are still likely to become mispriced at the same time, and this will induce a relationship between the factor structure and mispricing measures like size and book-to-market.

to somehow create test portfolios with βs that are substantially different from $\gamma\theta$ (i.e., with both substantially positive and negative νs). For example, to test the Fama and French three-factor model against the alternative that the book-to-market characteristic is priced, one should form a set of high book-to-market (high θ) portfolios with both high and low loadings (βs) on the *HML* factor, as well as a set of low θ portfolios with both high and low loadings (βs) on *HML*.[6]

This is essentially the Daniel and Titman approach, which forms two sets of test portfolios:

1. *Characteristic-balanced* portfolios are zero-cost portfolios for which the long and short positions include stocks with similar book-to-market ratios and capitalizations, but are constructed to have large loadings on one of the three factors (*HML*, *SMB*, or *Mkt*). According to the characteristic model, the expected return of any characteristic-balanced portfolio is zero.
2. *Factor-balanced* portfolios have zero loadings on each of the three factors, but are tilted towards high book-to-market or small stocks. These portfolios are constructed by combining a characteristic-balanced portfolio with long and short positions in the *HML*, *SMB*, and *Mkt* portfolios so as to set the factor loadings to zero. Since *HML* and *SMB* are tilted towards the relevant characteristics, the resulting portfolio will also be tilted towards those characteristics.[7] According to the factor model, the expected return of any factor-balanced portfolio is zero.

Of course, if individual stocks have βs and θs that are perfectly correlated, it will not be possible to construct either a characteristic-balanced portfolio with a factor loading different from zero, or a factor-balanced portfolio that is significantly weighted towards a specific characteristic. However, if such portfolios can be formed, then it is straightforward to distinguish between the competing models. It is clear from equation (1) that, under the factor model null, the expected return of a factor-balanced portfolio is zero, and under the characteristic model null, the expected return of a characteristic-balanced portfolio is zero. Thus, one can directly evaluate each of these two hypotheses by testing whether the average returns of these two portfolios are indeed zero.

[6] Berk (2000) shows that an errors-in-variables problem can arise if returns are regressed on measured betas. This procedure is not employed in Daniel and Titman (1997), nor in any of the tests presented here. Berk also discusses some power issues that do not apply to the Daniel and Titman tests or the tests here. We discuss the Berk paper in detail in Daniel and Titman (1999).

[7] Daniel and Titman (1997) never directly form factor-balanced portfolios, and do not discuss their tests in terms of factor-balanced portfolios. However, the alphas of the combined portfolios in their Tables VI, VII, and VIII can be interpreted as the mean returns of the factor-balanced portfolios, and the corresponding t statistics can be interpreted as tests of whether the mean returns of these factor-balanced portfolios differ from zero.

Daniel and Titman provide three sets of tests using characteristic- and factor-balanced portfolios based on *HML*, *SMB*, and *Mkt* factor sorts. They find that the average returns of the factor-balanced portfolios are all reliably positive, and can therefore reject the Fama and French factor model at better than a 5 percent level (the one-tailed p values are 1.1 percent, 4.7 percent, and 1.5 percent, respectively). In contrast, they find that the average returns of the three characteristic-balanced portfolios are not reliably different from zero. As we mentioned earlier, Davis et al. (2000) replicate these tests over the entire 1926 to 1997 period and also fail to reject the characteristic model. However, they can reject the factor model in only one out of their three tests.[8]

A key question for the analysis in this paper is under what conditions will these tests have power against the factor or characteristic alternative, and specifically, whether our Japanese data are likely to allow us to discriminate between the two hypotheses. Statistical power is defined as the likelihood of rejecting the null when the alternative is true. Because the Daniel and Titman (1997) tests involve simply testing whether the mean return of a portfolio is different from zero, the power of their tests is based on the expected t statistic under the alternative hypothesis. For example, for the book-to-market characteristic, the expected return of the characteristic-balanced (CB) portfolio under the factor alternative, and the absolute value of the expected return of the factor-balanced (FB) portfolio under the characteristic alternative are both equal to $\beta_{\mathrm{CB}}E(R_{\mathrm{HML}})$, where β_{CB} is the loading of the characteristic-balanced portfolio on the *HML* portfolio. Therefore, from equation (1), the plim of the (absolute value of the) t statistic for both tests (under the appropriate alternative) will be approximately

$$plim[|t\text{-stat}|] = \beta_{\mathrm{CB}}E(R_{\mathrm{HML}})T^{1/2}/\sigma \tag{3}$$

where σ is the standard deviation of the portfolio (factor-balanced or characteristic-balanced) returns, and T is the number of observations.[9] This equation shows that the power of these tests depends on three variables: (1) the standard errors of the mean estimates of the characteristic- and

[8] Davis et al. (2000) find that the average returns of the factor-balanced portfolios based on *HML* and *SMB* sorts are not reliably different from zero. However, the mean return of the factor-balanced portfolio based on the *Mkt* sort is statistically different from zero.

[9] The *HML* portfolio has a β_{HML} of 1, and therefore under the factor hypothesis, $E[R_{\mathrm{HML}}] = \lambda_{\mathrm{HML}}$, and from equation (1) the expected return of the characteristic-balanced portfolio, under the factor alternative, is $\beta_{\mathrm{CB}}E(R_{\mathrm{HML}})$. The way that we construct the factor-balanced portfolio is by simply combining the characteristic-balanced portfolio with just enough *HML* to make the factor loading zero (ignoring the *Mkt* and *SMB* for the moment). Thus, the expected return of the factor-balanced portfolio, under either hypothesis, is $E(R_{\mathrm{FB}}) = E[R_{\mathrm{CB}}] + w_{\mathrm{HML}}E[R_{\mathrm{HML}}]$. Because $w_{\mathrm{HML}} = -\beta_{\mathrm{CB}}$, and because under the characteristics hypothesis $E[R_{\mathrm{CB}}] = 0$, $E[R_{\mathrm{FB}}] = -\beta_{\mathrm{CB}}E[R_{\mathrm{HML}}]$. Thus the absolute value of the expected return in both cases is $\beta_{\mathrm{CB}}E(R_{\mathrm{HML}})$, and the expected t statistic is roughly just this expected mean return divided by the standard error of the mean estimate (equal to $\sigma/T^{1/2}$).

factor-balanced portfolios; (2) the ability to form characteristic-balanced portfolios with high factor loadings; and (3) the expected return of the characteristic sorted portfolio.

Variables (1) and (2) are influenced by the number of assets, the correlation between the characteristics and the factor loadings, and the variance of the *HML* portfolio return. The number of assets is important because larger portfolios are generally more diversified and thus have lower return variance. The correlation between characteristics and factor loadings determine the maximum factor sensitivity of characteristic-balanced portfolios and similarly the maximum characteristic tilt of factor-balanced portfolios. If there are, for example, very few stocks that have high factor loadings and low characteristics, then it will be impossible to form well-diversified (and therefore low σ) portfolios with a high β_{CB}.[10] Similarly, if the *HML* premium is highly variable, the test portfolios are also likely to have high σs. The final variable, $E(R_{\mathrm{HML}})$, is intuitive; to distinguish between different theories of the book-to-market effect requires data where there is in fact a strong book-to-market effect.

These power considerations also motivate why our Japanese data provide a reasonable setting for replicating this experiment. As noted earlier, Japan has the largest equity market aside from the United States in terms of both capitalization and number of securities. Second, over our sample period the spread between the returns of high and low book-to-market stocks is 65 percent larger in Japan than in the United States, and has about the same variability. One should also note, however, that the return spread between large and small stocks as well as the market risk premium is both small and variable in Japan during our sample period.[11] We will also see in Section V that the data allow us to form characteristic-balanced portfolios with high βs on the *HML* factor. Hence, we expect to have the most power to distinguish between a characteristics and factor model with characteristic-balanced portfolios that are sensitive to the *HML* factor, which will be the main focus of our analysis.

B. Potential Selection Bias

As we just noted, our selection of a Japanese sample was partly motivated by the high book-to-market premium in Japan. Given this motivation, before we proceed, we must consider the biases that can be introduced from this

[10] These arguments implicitly assume that the individual firm βs are predictable based on past returns. If no ex ante instruments (other than the characteristic itself) are helpful in forecasting future βs, then it is impossible to form characteristic-balanced portfolios with nonzero factor sensitivities.

[11] Our Japanese versions of the Fama and French *SMB* and (excess) *Mkt* portfolios have mean returns of 0.26 percent/month (t = 1.03) and 0.33 percent/month (t = 1.10), respectively, for our sample. In contrast, the mean return for the *HML* portfolio is 0.68 percent/month (t = 4.14). For comparison, in the United States in the same period, the mean returns and t statistics for the *SMB*, *Mkt*, and *HML* portfolios are, respectively, 0.21 percent/month (t = 1.33), 0.75 percent/month (t = 2.90), and 0.41 percent/month (t = 2.67).

selection criterion. In particular, we must determine the extent to which picking a country (or time period) with a high *realized* (as opposed to *expected*) average R_{HML} and R_{SMB} affects the probability of falsely rejecting the null (i.e., the size of our tests). Equation (1) reveals that the average R_{HML} will be higher in a given sample if:

1. $\delta\theta$, the return premium associated with the characteristic, was higher in the sample period.
2. λ, the risk premium on the factor, was higher in the sample period.
3. f_t, the factor realization, was higher in the sample period.

In case 1, the increased premium increases the test's power to (correctly) reject the factor model, because, holding everything else constant, it is easier to discriminate between $\delta\theta$ and 0 when δ is large. Similarly, if the return premium comes from effect 2, the test will have more power to (correctly) reject the characteristic model. In either case 1 or 2, we are more likely to learn the true cause of the return premium when the premium is higher. In contrast, in case 3, our tests will (falsely) reject the characteristic model too often, that is, it will reject at the 5 percent level more than 5 percent of the time when the characteristic model is in fact true. Intuitively, when the average realization of f is high, high β portfolios will return more than low β portfolios, even if the expected returns of high and low β portfolios are the same. Thus, picking a period where the *HML* premium is large may give us power to discriminate between the two models, but it may also cause us to falsely reject the characteristic model. However, the probability of falsely rejecting the factor model is not affected by the magnitude of the factor realization in the sample period.

II. Data Description

Our study examines monthly data on common stocks listed on both sections of the Tokyo Stock Exchange (TSE) from January 1971 to December 1997. As noted in Chan, Hamao, and Lakonishok (1991), stocks listed on the TSE account for more than 85 percent of the total market capitalization of Japanese equities. Our data are from several sources. Monthly returns including dividends and market capitalization are from databases compiled by PACAP Research Center, the University of Rhode Island (1975 to 1997), and the Daiwa Securities Co., Limited, Tokyo (1971 to 1975). The monthly value-weighted market returns of both sections of the TSE are also from these two data sources. There are no risk-free rates in Japan that are comparable to the U.S. Treasury bill rates. As a result, we follow Chan et al. by using a combined series of the call money rate (from January 1971 to November 1977) and the 30-day Gensaki (repo) rate (from December 1977 to December 1997) as the risk-free interest rate. This interest rate series is taken from the PACAP databases (1975 to 1997) and Diawa Securities (1971 to 1975).

The data on book values are taken from both the PACAP databases and Nihon Keizai Shimbun, Inc., Tokyo. Although some firms publish semiannual financial statements, we use only annual financial statements because of the tentative nature of semiannual statements. In addition, because there is a substantial delay in the release of the consolidated financial statements and both the PACAP and Nihon Keizai Shimbun only provide the unconsolidated financial statements, we use unconsolidated annual financial data to obtain the book values of the firms.

Our sample includes all listed stocks from both sections of the TSE.[12,13] However, we exclude stocks which do not have at least 18 monthly returns between $t = -42$ to -7 before the formation date (October of year $t = 0$). This criterion is needed to calculate the ex ante factor loadings for individual stocks. We also exclude stocks with negative book equity.

We form test portfolios based on sorts on market size (SZ) and book-to-market ratio (BM). We wish to ensure that the accounting data that we use in forming portfolios are publicly available at the time of portfolio formation. Most firms listed on the TSE have March as the end of their fiscal year and the accounting information becomes publicly available before September. Therefore, we form portfolios on the first trading day of October, and hold them for exactly one year. For portfolios formed in October of year t we use the book equity (BE) of a firm at the fiscal year end that falls between April of year $t-1$ and March of year t. BM is set equal to the ratio of BE to the market equity at the end of March of year t and SZ is set equal to market equity at the end of September of year t.[14]

III. Return Patterns of Size and Book-to-Market Sorted Portfolios

This section examines the return patterns of 25 size and book-to-market sorted portfolios from the universe of TSE stocks.[15] At the end of each September from 1975 to 1997, all TSE stocks in the sample are sorted into five equal groups from small to large based on their market equity. We also separately break TSE stocks into five equal book-to-market equity groups

[12] However, we have verified that excluding financial companies does not affect our results.

[13] The PACAP data does not include firms which were delisted (due to merger, acquisition, or bankruptcy) prior to 1988. However, very few firms were delisted between 1975 and 1988 (an average of 6.7/year). Also, we are using value-weighted portfolios in our analysis. Thus, there should be no appreciable survival or backfill bias in our data.

[14] The six-month (minimum) gap between the fiscal year end and the first return used to test the model is conservative and is consistent with Fama and French (1993) and Daniel and Titman (1997). However, previous research on the TSE firms imposes only a three-month (minimum) gap (Chan et al. (1991)).

[15] The construction of these 25 portfolios follows Fama and French (1993). However, there are two exceptions: (1) the portfolios are formed each year at the end of September (rather than at the end of June), and (2) we use the universe of TSE firms to determine the size and book-to-market breakpoints in Japan. These two exceptions will apply to all attribute-sorted portfolios and the pervasive factors throughout the paper.

from low to high. The 25 portfolios are constructed from the intersections of the five size and five book-to-market groups, for example, the small size/low book-to-market portfolio contains the stocks that have their size in the smallest quintile and their book-to-market ratios in the lowest quintile. Monthly value-weighted returns for each of these 25 portfolios are calculated from October of year t to September of year $t + 1$.

Panel A of Table I presents the mean monthly excess returns for the 25 size and book-to-market sorted portfolios for the October 1975 to December 1997 period. The bottom rows and right-most columns of this panel report the differences between the average returns of the smallest and largest stocks, holding book-to-market constant, and the differences between the highest and lowest book-to-market stocks, holding size constant, and the t statistics for these differences. The average size effect across the five *BM* categories, holding book-to-market fixed, is 0.54 percent/month. However, this size effect is quite variable, with an annualized standard deviation of 20.2 percent, so this mean is not significantly different from zero (t = 1.53). However, the average book-to-market effect, across the five size categories, is 0.74 percent/month—a bit larger than the average size effect. Moreover the book-to-market effect is considerably less variable—the annualized standard deviation is 9.7 percent—and therefore this mean is strongly statistically significant (t = 4.34). As discussed in Section I, the higher mean and considerably lower standard deviation of book-to-market sorted portfolios suggest that we are likely to have more power to discriminate between the factor and characteristic models with book-to-market rather than size-sorted portfolios.

Panels B and C of Table I separate the sample into January and non-January months. As in the United States, the size effect is considerably larger in January than in other months. The book-to-market effect remains equally strong in non-January months. This is in contrast to the U.S. evidence, where the book-to-market effect is stronger in smaller firms, and is concentrated in January (see, for comparison, Table I in Daniel and Titman (1997)).

IV. Fama and French (1993) Tests

In this section we replicate the Fama and French (1993) tests on our sample of Japanese stocks. Our construction of the factor portfolios follows Fama and French (1993), and is described in the Appendix.

We start by examining the returns of 25 characteristic-sorted portfolios using the Fama and French three-factor asset-pricing model:

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_{i,\mathrm{HML}}(R_{\mathrm{HML},t}) + \beta_{i,\mathrm{SMB}}(R_{\mathrm{SMB},t}) + \beta_{i,\mathrm{Mkt}}(R_{\mathrm{Mkt},t} - R_{f,t}) + \epsilon_{i,t}, \tag{4}$$

Table I

Mean Monthly Excess Returns (in Percent) on the 25 Size and Book-to-Market Sorted Portfolios: October 1975 to December 1997 (267 Months)

We first rank all TSE firms by their book-to-market at the end of March of year t (1975–1997) and their market capitalization (SZ) at the end of September of year t. We form 20 percent, 40 percent, 60 percent, and 80 percent breakpoints for book-to-market and SZ based on these rankings. Starting in October of year t, we place all TSE stocks into the five book-to-market groups and the five size groups based on these breakpoints. The firms remain in these portfolios from the beginning of October of year t to the end of September of year $t + 1$.

	Book-to-market						
	Low				High	H-L	t(H-L)
Panel A: All Months							
Size							
Small	0.868	0.825	0.981	0.828	1.194	0.326	(1.56)
	0.230	0.515	0.822	0.662	0.953	0.723	(3.48)
	−0.095	0.345	0.475	0.496	0.936	1.031	(4.76)
	−0.089	0.157	0.258	0.608	0.570	0.659	(3.19)
Big	−0.193	0.220	0.441	0.709	0.801	0.994	(2.56)
S-B	1.061	0.605	0.540	0.119	0.393		
t(S-B)	(2.56)	(1.51)	(1.40)	(0.32)	(1.06)		
Panel B: January Only							
Size							
Small	4.172	4.420	4.571	4.436	4.384	0.212	(0.34)
	3.960	4.278	3.326	3.786	3.687	−0.273	(−0.40)
	3.295	3.326	3.661	3.249	3.300	0.005	(0.01)
	2.582	2.239	1.968	2.543	2.858	0.276	(0.39)
Big	1.287	0.560	0.815	1.322	1.156	−0.131	(−0.18)
S-B	2.885	3.860	3.756	3.114	3.228		
t(S-B)	(2.28)	(3.23)	(3.32)	(2.85)	(2.66)		
Panel C: Non-January Months							
Size							
Small	0.571	0.503	0.659	0.504	0.908	0.337	(1.52)
	−0.105	0.177	0.597	0.381	0.707	0.812	(3.73)
	−0.399	0.077	0.189	0.248	0.724	1.123	(4.97)
	−0.329	−0.030	0.104	0.434	0.365	0.694	(3.25)
Big	−0.326	0.190	0.408	0.653	0.769	1.095	(2.05)
S-B	0.897	0.313	0.251	−0.149	0.139		
t(S-B)	(2.05)	(0.74)	(0.62)	(−0.38)	(0.36)		

where $R_{i,t}$ is the return on size and book-to-market sorted portfolio i, and $R_{\mathrm{HML},t}$, $R_{\mathrm{SMB},t}$, and $R_{\mathrm{Mkt},t}$ are, respectively, the returns on the *HML*, *SMB*, and *Mkt* factor portfolios at time t. $R_{f,t}$ is the risk-free rate at time t; and $\beta_{i,j}$ is the factor loading of portfolio i on factor j.

For comparison purposes, we also consider a one-factor (CAPM) model using a value-weighted benchmark. The results of both sets of tests are presented in Table II. Panel A of Table II reports the intercepts and t statistics for a test of the traditional CAPM. The results indicate that small firms and high book-to-market firms earn very high CAPM risk-adjusted abnormal returns. The difference between the S/H (small size and high book-to-market) portfolio and B/L (large size and low book-to-market) is over 1.44 percent per month. The F statistic testing whether all αs are zero is significant, suggesting that the CAPM does not hold for the Japanese data.

The intercepts and t statistics for the Fama and French three-factor model are presented in Panel B of Table II. Only 5 out of 25 t statistics for the intercepts are over 2, and the F test cannot reject the hypothesis that all the intercepts are equal to zero. It is especially noteworthy that the large low book-to-market portfolio, shown to have negative average excess returns in the previous table, has a three-factor alpha that is virtually zero. These tests indicate that the three-factor model does a good job explaining the 25 characteristic-sorted portfolio returns. However, as discussed in Section I, these tests are not designed to discriminate between the factor and characteristic models. We show in the next section that the three-factor model does not fare as well with test portfolios designed to have power to discriminate between the two models.

V. Characteristics Versus Covariances

A. Construction of the Test Portfolios

As discussed in Section I, to distinguish between the factor model and the characteristic model we must form portfolios with sufficiently low correlation between their factor loadings and their characteristics. To form such portfolios, we first rank all TSE stocks by their book-to-market ratios at the end of March of year t and their market capitalizations at the end of September of year t and form 1/3 and 2/3 breakpoints based on these rankings. Starting in October of year t, all TSE stocks are placed into the three book-to-market groups and the three size groups based on these breakpoints. The firms remain in these portfolios from the beginning of October of year t to the end of September of year $t+1$. Each of the individual stocks in these nine portfolios is then further sorted into five subportfolios based on their factor loadings (for example, $\beta_{i,\mathrm{HML}}$) estimated from month -42 to -7 relative to the portfolio formation date in the following regression:[16]

[16] As in Daniel and Titman (1997), we do not use the month -6 to 0 returns in estimating these loadings because the factor portfolios are formed based on stock prices existing 6 months previously (as of the end of March of year t). An implication of this is that *HML* returns are very negative up to $t = -6$, but are positive between $t = -6$ and $t = -1$. This "step function" in the return pattern would add noise to our factor loading estimates, so we exclude it from our estimation period. Daniel and Titman discuss this problem in detail; see especially their Figure 1 and the discussion on page 12.

Table II

Time-Series Regressions of the 25 Size and Book-to-Market Sorted Portfolios: October 1975 to December 1997 (267 Months)

The formation of the 25 book-to-market and size-sorted portfolios is described in Table I. The construction of the *HML* (High-Minus-Low) factor portfolio (R_{HML}), *SMB* (Small-Minus-Big) factor portfolio (R_{SMB}) and the *Mkt* (market) factor portfolio (R_{Mkt}) is as follows. We first exclude from the sample all firms with book values of less than zero. We take all TSE stocks in the sample and rank them on their book-to-market and size as described in Table I. Based on these rankings, we calculate 30 percent and 70 percent breakpoints for book-to-market and a 50 percent breakpoint for size. The stocks above the 70 percent book-to-market breakpoint are designated *H*, the middle 40 percent of firms are designated *M*, and the firms below the 30 percent book-to-market breakpoint are designated *L*. Firms above the 50 percent size breakpoint are designated *B*, and the remaining 50 percent *S*. These two sets of rankings allow us to form the six value-weighted portfolios L/S (R_{LS}), M/S (R_{MS}), H/S (R_{HS}), L/B (R_{LB}), M/B (R_{MB}), and H/B (R_{HB}). From these six portfolio returns, we calculate the *HML* factor portfolio returns, which are defined as $R_{\text{HML}} = (R_{\text{HB}} + R_{\text{HS}} - R_{\text{LB}} - R_{\text{LS}})/2$, and the *SMB* factor portfolio returns, which are defined as $R_{\text{SMB}} = (R_{\text{HS}} + R_{\text{MS}} + R_{\text{HS}} - R_{\text{HB}} - R_{\text{MB}} - R_{\text{LB}})/3$. A value-weighted portfolio *Mkt* is formed that contains all of the firms in these six size and book-to-market sorted portfolios plus the otherwise excluded firms with book values of less than zero. Note that we have variation in the number of firms in each six size and book-to-market sorted portfolios formed in this way. This table presents each of the intercept estimates and *t* statistics from both the CAPM and the Fama-French three-factor asset-pricing model. The estimation method is ordinary least square (OLS). *F* is the *F* statistic to test the hypothesis that the regression intercepts for a set of 25 portfolios are all 0. $p(F)$ is the *p* value of *F*.

Panel A: Intercept Estimates and *t* Statistics from the CAPM:
$R_{i,t} - R_{ft} = \alpha_i + \beta_{i,\text{Mkt}}(R_{\text{Mkt},t} - R_{ft}) + \epsilon_{i,t}$.

	Book-to-market					Book-to-market				
	Low				High	Low				High
Size										
Small	0.540	0.524	0.699	0.552	0.923	1.45	1.53	2.20	1.77	2.87
	−0.099	0.168	0.494	0.350	0.650	−0.34	0.60	1.87	1.37	2.42
	−0.430	0.009	0.143	0.178	0.608	−1.77	0.04	0.65	0.79	2.43
	−0.445	−0.191	−0.083	0.274	0.230	−2.33	−1.15	−0.48	1.59	1.15
Big	−0.520	−0.129	0.106	0.373	0.495	−3.41	−1.17	0.90	2.50	2.31

$F = 2.04,\ p(F) = 0.0033$

Panel B: Intercept Estimates and *t* Statistics from the Fama-French Three-factor Model:
$R_{i,t} - R_{ft} = \alpha_i + \beta_{i,\text{HML}}(R_{\text{HML},t}) + \beta_{i,\text{SMB}}(R_{\text{SMB},t}) + \beta_{i,\text{Mkt}}(R_{\text{Mkt},t} - R_{ft}) + \epsilon_{i,t}$

Size										
Small	0.249	0.182	0.271	0.064	0.269	1.43	1.16	1.95	0.48	2.03
	−0.204	−0.099	0.146	−0.031	0.026	−1.55	−0.91	1.34	−0.34	0.31
	−0.394	−0.118	−0.126	−0.239	−0.019	−3.37	−1.12	−1.18	−2.67	−0.16
	−0.260	−0.187	−0.298	−0.050	−0.233	−2.11	−1.61	−2.55	−0.46	−1.81
Big	0.008	0.032	0.037	0.024	−0.119	0.08	0.32	0.40	0.23	−0.74

$F = 1.30,\ p(F) = 0.160$

$$R_{i,t} - R_{ft} = \alpha_i + \beta_{i,\mathrm{HML}} R_{\mathrm{HML},t} + \beta_{i,\mathrm{SMB}} R_{\mathrm{SMB},t} + \beta_{i,\mathrm{Mkt}} (R_{\mathrm{Mkt},t} - R_{ft}) + e_{i,t},$$
$$t = -42 \text{ to } -7. \tag{5}$$

As in Daniel and Titman (1997) the above regression employs constant-weight factor portfolio returns. We take the portfolio weights of the Fama and French factor portfolios at $t = 0$ (the end of September of year t) and apply these constant weights to the individual stock returns from date -42 to -7 to calculate the returns of constant weight factor portfolios. Using these returns, we calculate ex ante factor loadings for each stock, which we use as instruments for their future expected loadings.

The ex ante estimates for each of the three factor loadings are then used to further subdivide the nine size and book-to-market sorted portfolios. This is done separately for each of the three sets of factor loadings. For example, each of the stocks within the nine size and book-to-market sorted portfolios are placed into five subportfolios based on estimates of $\beta_{i,\mathrm{HML}}$ to form a set of 45 portfolios. The value-weighted returns for each of these 45 test portfolios are then calculated for each month between October 1975 and December 1997. Similarly, we form 45 test portfolios based on ex ante $\beta_{i,\mathrm{SMB}}$ sorts and 45 test portfolios based on the ex ante $\beta_{i,\mathrm{Mkt}}$ sorts. Our tests of the factor model and the characteristic model are performed on these three sets of 45 test portfolios.[17]

B. Empirical Results on the Size, Book-to-Market, and HML Factor Loading Sorted Portfolios

Panel A of Table III presents the mean monthly excess returns of the 45 test portfolios formed with the *HML* factor-loading sorts. Each of the five columns provides the monthly excess returns (in percent) of portfolios of stocks that are ranked in the particular quintile with respect to the *HML* factor loading (with column 1 being the lowest and column 5 being the highest). The results reveal a positive relation between average mean excess returns and ex ante factor loading rankings. However, we will show that this relationship is considerably weaker than predicted by the Fama and French three-factor model, and that, within a size/book-to-market grouping, there is no statistically significant relation between factor loadings and returns.

In Panel B we report the intercepts and the t statistics from the three-factor regressions applied to each of the 45 test portfolios. On first glance, these do not appear to provide much evidence against the three-factor model. Only 4 out of the 45 alphas have t statistics with an absolute value greater than 2, and an F test of the hypothesis that all intercepts are equal to zero is not rejected. However, the F test is not very powerful against the specific

[17] A possible concern here is the variation over time in the number of firms and hence the diversification of these 45 portfolios over time. There is indeed some variation, but it is not a severe. Portfolio size ranges from a minimum of nine firms, in the early years for the smallest portfolio, to a maximum of 49.

Table III

Mean Monthly Excess Returns and Time-Series Regressions—*HML* Factor Loading Sorted Portfolios: October 1975 to December 1997

Panel A gives the mean monthly returns (in percent) for 45 portfolios formed based on size (SZ), book-to-market (BM), and preformation *HML* factor loadings. Panel B presents intercepts and t statistics from the multivariate time-series regressions:

$$R_{i,t} - R_{ft} = \alpha_i + \beta_{i,\mathrm{HML}}(R_{\mathrm{HML},t}) + \beta_{i,\mathrm{SMB}}(R_{\mathrm{SMB},t}) + \beta_{i,\mathrm{Mkt}}(R_{\mathrm{Mkt},t} - R_{ft}) + e_{i,t}.$$

The estimates of slope coefficients are not presented here. The left-hand side portfolios are formed based on SZ, BM, and preformation *HML* factor loadings. Panel C presents the regression results from the characteristic-balanced portfolio returns, described below, on the *HML*, *SMB*, and excess-*Market* portfolio returns. From the resulting 45 return series, a zero-investment returns series is generated from each of the nine SZ and BM categories. These portfolios are formed, in each category, by subtracting the sum of the returns on the first and second quintile factor-loading portfolios from the sum of the returns on the fourth and fifth factor-loading portfolios, and then dividing by 2. The first nine rows of the panel give the mean returns (in percent) and the regression coefficients for the characteristic-balanced portfolio that has a long position in the high expected factor loading portfolios and a short position in the low expected factor loading portfolios that have the same size and book-to-market rankings. The bottom row of the right panel provides the coefficient estimates as well as the t statistics for this regression for a combined portfolio that consists of an equally weighted combination of the above zero-investment portfolios.

Panel A: Mean Excess Monthly Returns (in Percent) of the 45 Portfolios Sorted by *HML* Factor Loading

Char. Port.		Factor Loading Portfolios: Mean Excess Return					
BM	SZ	1	2	3	4	5	Avg.
1	1	0.453	0.675	0.743	0.561	0.659	0.618
1	2	−0.169	0.197	0.111	0.225	0.124	0.097
1	3	−0.136	−0.337	0.217	0.085	0.303	0.026
2	1	0.803	0.801	0.719	1.063	0.919	0.861
2	2	0.419	0.474	0.523	0.522	0.576	0.503
2	3	0.306	0.291	0.397	0.617	0.526	0.427
3	1	0.816	0.845	1.009	1.262	1.002	0.987
3	2	0.535	0.769	0.694	0.766	0.836	0.720
3	3	0.629	0.792	0.823	0.800	0.610	0.730
Average		0.406	0.501	0.582	0.656	0.617	

Panel B: Intercepts and Their t statistics from the Fama-French Three-factor Model

		Factor Loading Portfolio α					Factor Loading Portfolio $t(\alpha)$				
BM	SZ	1	2	3	4	5	1	2	3	4	5
1	1	0.110	0.105	0.192	−0.051	−0.072	0.54	0.58	1.07	−0.29	−0.35
1	2	−0.360	−0.056	−0.285	−0.163	−0.453	−1.69	−0.35	−1.83	−1.25	−2.66
1	3	0.326	−0.145	0.227	−0.118	−0.152	1.50	−1.01	1.68	−0.82	−0.81
2	1	0.284	0.119	0.030	0.327	0.098	1.61	0.74	0.21	2.11	0.54
2	2	0.084	−0.046	−0.030	−0.085	−0.298	0.46	−0.32	−0.24	−0.68	−1.75
2	3	0.332	0.056	0.099	0.055	−0.383	1.58	0.39	0.70	0.39	−1.88
3	1	0.148	0.073	0.176	0.335	−0.076	1.08	0.57	1.33	2.30	−0.51
3	2	−0.087	0.083	−0.077	−0.102	−0.290	−0.66	0.60	−0.59	−0.75	−1.57
3	3	0.264	0.196	0.025	−0.221	−0.559	1.13	1.09	0.15	−1.18	−2.50
Average		0.122	0.043	0.040	−0.002	−0.242					

Panel C: Mean and Regression Results from the Characteristic-balanced Portfolios Sorted by HML Factor Loading

Portfolio		Characteristic-balanced Portfolios: Mean Return and Regression Coeff.					
BM	SZ	Mean	α	β_{HML}	β_{SMB}	β_{Mkt}	$\bar{R}^2$
1	1	0.046	−0.169	0.338**	0.028	−0.063*	0.089
1	2	0.160	−0.100	0.468**	−0.054	−0.126**	0.195
1	3	0.430	−0.225	0.973**	0.143**	−0.118**	0.375
2	1	0.189	0.011	0.272**	0.013	−0.029	0.064
2	2	0.103	−0.210	0.477**	0.045	−0.063**	0.216
2	3	0.273	−0.358	0.938**	0.086	−0.078*	0.325
3	1	0.301**	0.019	0.391**	0.044	0.018	0.176
3	2	0.149	−0.194	0.484**	0.111**	−0.040	0.245
3	3	−0.005	−0.620**	0.937**	0.033	−0.081	0.247
Single Portfolio		0.183 (1.23)	−0.205* (−1.80)	0.586** (14.14)	0.050* (1.87)	−0.064** (−2.89)	0.456

**, * denote significance at the 5 and 10 percent levels, respectively.

alternative hypothesis provided by the characteristic model. If we had no priors on which of the 45 portfolios were likely to be mispriced by the factor model, the F test would be appropriate. However, the characteristic alternative implies that the low-factor-loading portfolios should have positive intercepts (alphas), and the high-factor-loading portfolios should have negative intercepts, which suggests a more powerful test. Specifically, the intercepts decrease with the *HML* factor loadings within the *SZ* and *BM* groups, and every one of the nine column 1 entries is higher than the corresponding column 5 entry. These patterns suggest that the returns are related to the *BM* characteristic even after adjusting for factor risks.

To formally test the factor model against the alternative offered by the characteristic model, we form nine characteristic-balanced portfolios. Within each of the nine size and book-to-market groupings, we form portfolios that have a one dollar position in the high (fourth and fifth quintile) expected factor loading portfolios and a short one dollar position in the low (first and second quintile) expected factor loading portfolios.[18] If the factor model is correct, then the intercepts (alphas) obtained from regressing the returns on the three-factor portfolios should be zero. In contrast, these intercepts should be negative under the characteristic model. Because the intercepts represent the returns of a portfolio that is factor-balanced but not characteristic-balanced, we will sometimes refer to the intercepts as the mean returns on factor-balanced portfolios.

Analogously, a powerful test of the characteristic model against the alternative of the factor model is based on the average returns of the characteristic-balanced portfolios. Under the null of the characteristic model, the mean returns should be zero, because the characteristic-balanced portfolios are long and short assets with (approximately) equal characteristics. If, however, the factor model is correct, the returns should be positive because these portfolios are designed to have a high loading on one of the Fama and French factors.

The average returns of the characteristic-balanced portfolios as well as the regression results testing the Fama and French three-factor model are reported in Panel C of Table III. The mean returns of these nine characteristic-balanced portfolios, reported in the first column, reveal that eight of the nine portfolios have positive mean returns, and that one of these means is significantly different from zero at the five percent (two-tail) level. However, because the returns of these portfolios are highly correlated, finding eight out of nine positive returns does not necessarily indicate statistical significance. Indeed, the average return of a single portfolio, formed by equally weighting the nine characteristic-balanced portfolios, is not reliably different from zero (t = 1.23). In other words, this test does not reject the characteristics model.

[18] Note that there is a minor difference between the portfolios here and their counterparts in Daniel and Titman (1997). The long and short positions in these portfolios are the reverse of the portfolios in Daniel and Titman, but are consistent with how they are reported in Davis et al. (2000). This has no effect on our results other than changing the signs of the intercepts and coefficients in our regressions.

This failure to reject could conceivably result from low test power: specifically, if the *HML* beta of the characteristic-balanced portfolio were low, the average characteristic-balanced return would be low even if the factor model were correct. If the ex ante factor loadings were weak predictors of future factor loadings, then betas of the high and low factor-loading portfolios would be similar, making it impossible to construct a characteristic-balanced portfolio with a high factor loading. However, our results indicate that this is not the case. Our sort on ex ante *HML* factor loadings produces a monotonic ordering of the ex post factor loadings (not reported), and Panel C of Table III shows that the loading of our characteristic-balanced portfolio on the *HML* factor is 0.586, with a t statistic of 14.14.

The remaining columns of Panel C provide the results of the regression of the returns of the characteristic-balanced portfolio on the three factors. Seven of the nine intercepts are negative (one of the nine intercepts is significant at the five percent level). As a joint test, we evaluate the returns of a single, equal-weighted portfolio of the nine characteristic-balanced portfolios. The three-factor model predicts an intercept of zero. In fact, as the characteristic model predicts, the estimated intercept is negative, -0.205, and is 1.80 standard errors from zero. This shows that the average return differential between the high-loading and low-loading portfolio is too low, relative to what would be predicted by the Fama and French (1993) model, and this large difference allows us to reject the Fama and French model.

As in Daniel and Titman, we also examine the returns to zero-cost portfolio strategies that, for each of the nine size/BM groupings, take a long and short position in the highest (fifth quintile) and lowest (first quintile) expected factor loading portfolios (as opposed to the (4,5–1,2) strategy discussed above.) Daniel and Titman find that, with U.S. data, these more extreme portfolios yield equally strong evidence against the factor model. For the Japanese data evaluated here, the extreme portfolios yield even stronger evidence against the factor model: the intercepts for all of the nine characteristic-balanced portfolios are negative, two of the nine at a five percent significance level. Also, the equal-weighted combination of the nine portfolios had an intercept of -0.37 percent per month ($t = -2.19$). In contrast, the characteristic-balanced portfolio formed with the more extreme characteristics has a mean return of 0.21%/month ($t =$ 0.98), which is consistent with the characteristic model.[19]

[19] To test for robustness, we separately ran our tests on the first and second half of our sample period. Over the earlier October 1975 to October 1986 period (133 months), the intercept in the equation (4) regression was 0.15 percent/month, ($t = 1.16$). Over the later November 1986 to December 1997 period (134 months), the intercept was -0.6 percent/month ($t = -3.55$). Over the same subperiods, the mean return on the characteristic-balanced portfolio was, respectively, 0.57 percent/month ($t = 3.17$) and -0.19 percent/month ($t = -0.89$). Thus, in the earlier subsample, the data are consistent with the factor model and reject the characteristic model, and in the latter period, the data are consistent with the characteristic model and reject the factor model. This is not a result of variation in the average return on HML, as the mean HML returns are 0.76 and 0.60 percent/month, respectively, in the earlier and later subperiods. The t statistic testing whether this difference is zero is (0.49). The results are very similar with the SMB-sorted portfolios. The lack of robustness of these results is somewhat disturbing, but is consistent with observations by Davis et al. (2000).

Table IV

Mean Monthly Excess Returns and Time-Series Regressions—*SMB* Factor Loading Sorted Portfolios: October 1975 to December 1997

This table represents results on *SMB* (rather than *HML* in Table III) factor loading sorted portfolios. Panel A gives the mean monthly returns (in percent) for the 45 portfolios, and Panel B presents the intercepts and their t statistics from the Fama and French time-series regressions. Panel C presents the mean returns and the regression results from the characteristic-balanced portfolio returns.

Panel A: Mean Excess Monthly Returns (in Percent) of the 45 Portfolios Sorted by SMB Factor Loading

Portfolio		Factor Loading Portfolios: Excess Mean Return				
BM	SZ	1	2	3	4	5
1	1	0.451	0.661	0.799	0.606	0.519
1	2	0.208	0.205	0.079	−0.011	−0.056
1	3	−0.031	0.293	0.346	0.128	0.004
2	1	0.784	0.915	0.821	0.909	0.930
2	2	0.502	0.516	0.363	0.667	0.454
2	3	0.502	0.349	0.236	0.558	0.310
3	1	0.845	1.014	1.040	0.931	1.101
3	2	0.730	0.690	0.613	0.840	0.715
3	3	0.791	0.524	0.575	0.561	0.776
Average		0.500	0.574	0.507	0.576	0.528

Panel B: Intercepts and Their t Statistics from the Fama-French Three-factor Model—SMB Factor Loading Sort

		Factor Loading Portfolio α					Factor Loading Portfolio $t(\alpha)$				
BM	SZ	1	2	3	4	5	1	2	3	4	5
1	1	−0.055	0.103	0.214	−0.006	−0.053	−0.31	0.53	1.11	−0.03	−0.26
1	2	0.015	−0.153	−0.316	−0.482	−0.461	0.09	−1.10	−2.10	−3.20	−2.60
1	3	−0.030	0.256	−0.071	−0.060	−0.180	−0.21	1.81	−0.51	−0.37	−0.93
2	1	0.167	0.280	0.033	0.201	0.210	1.05	1.86	0.22	1.42	1.06
2	2	−0.055	−0.066	−0.197	0.090	−0.184	−0.34	−0.51	−1.50	0.62	−1.17
2	3	0.329	−0.054	−0.296	−0.097	−0.264	1.97	−0.40	−2.34	−0.58	−1.58
3	1	0.127	0.144	0.110	0.068	0.148	0.92	1.12	0.86	0.52	0.88
3	2	−0.007	−0.118	−0.163	−0.060	−0.177	−0.04	−0.88	−1.18	−0.47	−1.10
3	3	0.162	−0.242	−0.391	−0.381	−0.176	0.79	−1.51	−2.22	−1.93	−0.81
Average		0.073	0.017	−0.120	−0.080	−0.126					

Panel C: Mean and Regression Results from the Characteristic-balanced Portfolios Sorted by SMB Factor Loading

Portfolio		Characteristic-Balanced Portfolios: Mean Return and Regression Coeff.					
BM	SZ	Mean	α	β_{HML}	β_{SMB}	β_{Mkt}	$\bar{R}^2$
1	1	0.007	−0.053	−0.067	0.254**	0.120**	0.112
1	2	−0.240	−0.402**	0.097	0.267**	0.084**	0.138
1	3	0.076	−0.232	0.299**	0.399**	0.010	0.227
2	1	0.070	−0.018	0.009	0.218**	0.078**	0.109
2	2	0.051	0.013	−0.063	0.219**	0.071**	0.119
2	3	0.008	−0.318	0.273**	0.537**	0.007	0.362
3	1	0.087	−0.027	0.041**	0.241**	0.073**	0.156
3	2	0.067	−0.056	0.079	0.185**	0.068**	0.095
3	3	0.011	−0.239	0.129	0.423**	0.161**	0.158
Coefficient		0.015	−0.148	0.088**	0.305**	0.074**	0.368
(t value)		(0.12)	(−1.37)	(2.25)	(12.06)	(3.52)	

**, * denote significance at the 5 and 10 percent levels, respectively.

Table V

Mean Excess Monthly Returns and Time-Series Regressions—*Mkt* Factor Loading-Sorted Portfolios: October 1975 to December 1997

This table represents results on *Mkt* (rather than *HML* in Table III) factor loading sorted portfolios. Panel A gives the mean monthly returns (in percent) for the 45 portfolios, and Panel B presents the intercepts and their t statistics from the Fama and French time-series regressions. Panel C presents the mean returns and the regression results from the characteristic-balanced portfolio returns.

Panel A: Mean Excess Monthly Returns (in Percent) of the 45 Portfolios Sorted by *Mkt* Factor Loading

Portfolio		Factor Loading Portfolios: Excess Mean Return				
BM	SZ	1	2	3	4	5
1	1	0.467	0.588	0.616	0.688	0.761
1	2	−0.145	0.038	0.220	0.182	0.122
1	3	−0.203	−0.176	0.036	0.241	0.159
2	1	0.883	0.563	0.901	1.176	0.838
2	2	0.335	0.451	0.572	0.065	0.048
2	3	0.377	0.551	0.314	0.509	0.527
3	1	0.901	1.002	0.901	0.973	1.122
3	2	0.544	0.843	0.708	0.705	0.793
3	3	0.572	0.694	0.905	0.636	0.700
Average		0.415	0.506	0.574	0.641	0.611

Panel B: Intercepts and Their t Statistics from the Fama-French Three-factor Model

BM	SZ	Factor Loading Portfolio α 1	2	3	4	5	Factor Loading Portfolio $t(\alpha)$ 1	2	3	4	5
1	1	−0.090	0.033	0.042	0.097	0.234	−0.50	0.16	0.22	0.46	1.22
1	2	−0.408	−0.364	−0.191	−0.232	−0.177	−2.70	−2.51	−1.29	−1.46	−0.92
1	3	−0.161	−0.179	0.127	0.300	0.033	−0.91	−1.29	−0.77	1.96	0.16
2	1	0.301	−0.119	0.185	0.429	0.121	1.63	−0.68	1.19	2.96	0.68
2	2	−0.229	−0.098	−0.018	0.024	−0.085	−1.62	−0.66	−0.15	0.17	−0.45
2	3	0.067	0.121	−0.013	0.108	−0.035	0.36	0.71	−0.09	0.70	−0.18
3	1	0.161	0.217	0.052	0.016	0.162	0.99	1.62	0.37	0.13	1.04
3	2	−0.136	0.007	−0.135	−0.116	−0.120	−0.89	0.05	−0.96	−0.86	−0.72
3	3	−0.112	−0.139	−0.057	−0.163	−0.227	−0.52	−0.78	−0.31	−0.85	−1.14
Average		−0.068	−0.058	−0.001	0.051	−0.011					

Panel C: Mean and Regression Results from the Characteristic-balanced Portfolios Sorted by *Mkt* Factor Loading

Portfolio		Characteristic-balanced Portfolios: Mean Return and Regression Coeff.					
BM	SZ	Mean	α	β_{HML}	β_{SMB}	β_{Mkt}	$\bar{R}^2$
1	1	0.197	0.194	−0.235**	0.281**	0.269**	0.229
1	2	0.205	0.181	−0.148**	0.070	0.318**	0.237
1	3	0.390*	0.337	−0.004	−0.086*	0.236**	0.103
2	1	0.284	0.184	−0.062	0.263**	0.221**	0.189
2	2	0.174	0.133	−0.088	0.126**	0.205**	0.139
2	3	0.054	−0.058	0.090	−0.003	0.157**	0.038
3	1	0.096	−0.100	0.104*	0.175**	0.241**	0.214
3	2	0.055	−0.054	−0.030	0.069*	0.216**	0.157
3	3	0.035	−0.069	0.033	0.000	0.245**	0.062
Coefficient		0.165	0.083	−0.031	0.099**	0.234**	0.245
(t value)		(1.11)	(0.62)	(−0.64)	(3.14)	(8.85)	

**, * denote significance at the 5 and 10 percent levels, respectively.

C. Results Based on Sorting by Other Factor Loadings

Table IV replicates this analysis on portfolios sorted by *SMB* factor loadings. For the *SMB* factor loading sorted Japanese data, we fail to reject either model: Panel C reveals that the mean return on the characteristic-balanced portfolio is almost identical to what is predicted by the characteristic model, 0.015 percent/month ($t = 0.12$). However, the mean return of the factor-balanced portfolio (the alpha) is -0.148 percent/month ($t = -1.37$). Panels B and C show that, although we are indeed able to construct characteristic-balanced portfolios with high loadings on the *SMB* factor, because the size premium is relatively small and variable in this period in Japan, we have little power to distinguish between the two models (see footnote 11).

Table V replicates this analysis on portfolios sorted by the *Mkt* factor loadings. Both Daniel and Titman (1997) and Davis et al. (1999) reject the three-factor model using the β_{Mkt}-sorted U.S.-stock portfolios. For the Japanese data, neither the three-factor nor the characteristic model can be rejected with these tests. However, as discussed in the Section I, this is not particularly surprising, as the market premium in Japan in this period is small and variable relative to the market premium in the United States (again, see footnote 11).

VI. Conclusion

This paper examines Japanese stock returns in the 1975 to 1997 period. The findings indicate that the value premium in average stock returns is substantially stronger in Japan than in the United States. This is especially true for the largest quintile stocks, where high book-to-market stocks beat low book-to-market stocks (sorted into quintiles) by 0.994 percent per month in Japan but only 0.347 percent in the United States. Because this sample exhibits a high value premium along with the large cross-section of available stocks, it offers an ideal setting for testing whether the value premium represents compensation for bearing factor risk.

To test the factor model, we follow Daniel and Titman (1997) and form zero cost portfolios that are characteristic-balanced but are sensitive to at least one of the Fama and French (1993) factors. The Fama and French factor model predicts that this portfolio should have a significantly positive return. However, an alternative characteristic model, which posits that returns are directly related to book-to-market ratios, predicts that this portfolio should have a return of zero on average. Consistent with the results for U.S. stocks in Davis et al. (2000) and Daniel and Titman, we are able to reject the factor model but not the characteristic model. There are, however, some important differences between the U.S. and Japanese evidence. First, we reject the three-factor model in only those tests that form characteristic-balanced portfolios that load on the *HML* factor. The Daniel and Titman results are more conclusive in that they reject with characteristic-balanced portfolios that load on the *HML*, *SMB*, and *Mkt* factors. However, in the longer 1926 to 1977 sample, Davis et al. reject only with tests that sort on the *Mkt* factor.

The paper also includes a discussion of the power of tests that attempt to distinguish between factor models and characteristic models. Our analysis explains why some tests are able to distinguish between a characteristic model and a factor model, whereas others are not. For example, in Japan, we were able to distinguish between a factor model and a characteristic model using portfolios based on *HML* beta sorts because (1) the *HML* return was high and not too variable in our sample period, and (2) *HML* betas were predictable and not too highly correlated with book-to-market ratios. In samples where the return associated with a characteristic is not particularly high, and where one cannot form diversified characteristic portfolios with returns that are sensitive to the factors, one will not be able to distinguish between the theories.

It should also be stressed that our tests examine a very specific characteristic model and factor model. Because of limited power, it is difficult to make more general statements about the importance of covariances and characteristics in determining expected returns. Although we report tests that reject the Fama and French (1993) factor model, it is possible that a variant of their factor model may explain returns much better. For example, we know that any ex post mean-variance efficient portfolio will explain our test portfolio returns perfectly. A more relevant question is whether any ex ante reasonable set of factors can explain the returns we observe. This is an open question that should continue to stimulate research.

Appendix: Construction of the Portfolios

The construction of the book-to-market and size portfolios follows Fama and French (1993). Using the merged PACAP/Diawa Securities/Nihon Keizai Shimbun files, we form portfolios of common shares based on the ratio of the book equity to market equity (book-to-market) and on market equity (*SZ*). Book value is defined to be stockholder's equity from either PACAP or Nihon Keizai Shimbun. In calculating book-to-market, we use the book equity from any point in year t, and the market on the last trading day in year t, where the market equity, from PACAP, is defined as the number of shares outstanding times the share price. We only include firms in our analyses that have been listed on PACAP/Diawa Securities and which have prices available on PACAP/Diawa in both March of year t and September of year t. The book-to-market ratios and sizes of the firms thus determined are then used to form the portfolios from October of t to September of $t + 1$. The end of September is used as the portfolio formation date because the annual report containing the book-equity value for the preceding fiscal year is virtually certain to be public information by that time.

To form the portfolio, we first exclude from the sample all firms with book-to-market values of less than zero. We take all TSE stocks in the sample and rank them on their book-to-market and size as described above. Based on these rankings, we calculate 30 percent and 70 percent breakpoints for book-to-market and a 50 percent breakpoint for size. We then place all TSE stocks into the three book-to-market groups and the two size groups based on these breakpoints. The stocks above the 70 percent book-to-market breakpoint are designated *H*, the middle 40 percent of firms are designated *M*, and the firms below the 30 percent book-to-market breakpoint are designated *L*. Also firms above the 50 percent size breakpoint are designated *B* (for big) and the remaining 50 percent *S* (for small). Note that the number of firms in each of the six portfolios varies.

These two sets of rankings allow us to form the six value-weighted portfolios S/L, S/M, S/H, B/L, B/M, and B/H. From these portfolio returns we calculate the *SMB* (*Small-Minus-Big*) portfolio returns, which are defined to be $R_{\mathrm{SMB}} = (R_{\mathrm{SL}} + R_{\mathrm{SM}} + R_{\mathrm{SH}} - R_{\mathrm{BL}} - R_{\mathrm{BM}} - R_{\mathrm{BH}})/3$, and the *HML* (*High-Minus-Low*) portfolio returns, which are defined as $R_{\mathrm{HML}} = (R_{\mathrm{SH}} + R_{\mathrm{BH}} - R_{\mathrm{SL}} - R_{\mathrm{BL}})/2$. Also, a value-weighted portfolio *Mkt* is formed that contains all of the firms in these portfolios, plus the otherwise excluded firms with book-to-market values of less than zero.

REFERENCES

Banz, Rolf W., 1981, The relationship between return and the market value of common stocks, *Journal of Financial and Quantitative Analysis* 14, 421–441.

Berk, Jonathan, 2000, Sorting out sorts, *Journal of Finance* 55, 407–427.

Chan, Louis K. C., Yasushi Hamao, and Josef Lakonishok, 1991, Fundamentals and stock returns in Japan, *Journal of Finance* 46, 1739–1764.

Daniel, Kent, and Sheridan Titman, 1997, Evidence on the characteristics of cross-sectional variation in stock returns, *Journal of Finance* 52, 1–33.

Daniel, Kent, and Sheridan Titman, 1997, Sorting out "Sorting out Sorts," Working paper, Northwestern University, available at http://kent.kellogg.nwu.edu/.

Davis, James, Eugene F. Fama, and Kenneth R. French, 2000, Characteristics, covariances, and average returns: 1929–1997, *Journal of Finance* 55, 389–406.

DeBondt, Werner F. M., and Richard H. Thaler, 1985, Does the stock market overreact? *Journal of Finance* 40, 793–805.

Fama, Eugene F., and Kenneth R. French, 1992, The cross-section of expected stock returns, *Journal of Finance* 47, 427–465.

Fama, Eugene F., and Kenneth R. French, 1993, Common risk factors in the returns on stocks and bonds, *Journal of Financial Economics* 33, 3–56.

Fama, Eugene F., and Kenneth R. French, 1996, Multifactor explanations of asset pricing anomalies, *Journal of Finance* 51, 55–84.

Fama, Eugene F., and Kenneth R. French, 1998, Value versus growth: The international evidence, *Journal of Finance* 53, 1975–2000.

Grundy, Bruce D., and J. Spencer Martin, 1998, Understanding the nature of the risks and the source of the rewards to momentum investing, Working paper, Wharton School.

Heston, Steven L., K. Geert Rouwenhorst, and Roberto E. Wessels, 1999, The role of beta and size in the cross-section of European stock returns, *European Financial Management* 4, 4–28.

Jagannathan, Ravi, Keiichi Kubota, and Hitoshi Takehara, 1998, Relationship between labor-income risk and average return: Empirical evidence from the Japanese stock market, *Journal of Business* 71, 319–347.

Jegadeesh, Narasimhan, and Sheridan Titman, 1993, Returns to buying winners and selling losers: Implications for stock market efficiency, *Journal of Finance* 48, 65–91.

Keim, Donald B., 1983, Size related anomalies and stock return seasonality: Further evidence, *Journal of Financial Economics* 12, 13–32.

Merton, Robert C., 1973, An intertemporal capital asset pricing model, *Econometrica* 41, 867–887.

Ross, Stephen A., 1976, The arbitrage theory of capital asset pricing, *Journal of Economics Theory* 13, 341–360.