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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 fails to reject the characteristic model.

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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 document size, book-to-market and momentum in most developed countries.[2]

Fama and French (FF, 1993 and 1998) argue that the return premia associated with size and book-to-market are compensation for risk, as described in a multi-factor version of Merton's (1973) Intertemporal Capital Asset Pricing Model (ICAPM) or Ross's (1976) Arbitrage Pricing Theory (APT). 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.

Daniel and Titman (DT, 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 specifies that the expected returns of assets are directly related to their characteristics for reasons, like liquidity, that 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 FF three-factor model but not the characteristic model.

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

[2] See Chan, Hamao and Lakonishok (1991), Chiu and Wei (1998), Fama and French (1998), Heston, Rouwenhorst and Wessels (1998) and Rouwenhurst (1998a,b).

The DT 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.[3] Hence, as also argued in Davis, Fama and French (DFF, 1999), it is important to test the robustness of the DT results on different samples. Examining the results out of sample, however, is difficult because the tests require a cross-section of stocks that is large enough to allow the researcher to form diversified portfolios with cross-sectional variation in both factor loadings and characteristics. In addition, one needs to examine samples where returns are strongly related to the characteristics. Given these data requirements, the best places to look for out of sample confirmation of the DT results are probably the U.S. market prior to 1973 and in the Japanese stock market during the past 23 years. DFF 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.[4]

I. Testing Characteristic vs. Factor Models

In this section we describe our empirical framework and discuss various issues relating to the power to distinguish between a characteristic model and a factor model. In addition, we will briefly discuss possible selection biases that can arise when we select a sample based on observed return premia associated with the characteristics.

[3] Some have argued that the FF factor model implies rational behavior and the Daniel and Titman characteristics model implies irrational behavior. This need not be the case. The FF model is consistent with an irrational model in which the factor risk premia arise as a result of biased expectations. Similarly the characteristics model could be consistent with rationality if the characteristics proxy for liquidity, or for variables relevant in an agency setting.

[4] 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.

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

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

where the expected return of securities is governed by:

$$E[R_{i,t}] = a + b\,\theta_{i,t-1} + \lambda\,\beta_{i,t-1} \qquad (1)$$

and where θ and β are cross-sectionally related through the regression relationship:

$$\beta_{i,t-1} = \gamma\,\theta_{i,t-1} + e_{i,t-1} \qquad (2)$$

$\theta_{i,t-1}$ is a characteristic of security *i*, observable at time *t*-1. This could be book-to-market ratio, or some non-linear function of this characteristic. The factor model restricts b in equation (1) to be zero, giving us the standard APT equations stating that expected returns are a linear function of the factor loading. In contrast, the characteristic model restricts λ to be zero, meaning that expected returns are a direct function of the characteristic θ. However, testing these two models is complicated. The reason is that, based on equation (2), θ_i and β_i are cross-sectionally correlated, and hence expected returns will, for example, be related to β_i under both models. Therefore, discriminating between the models requires that we determine whether there is a relationship between $E[R_{i,t}]$ and $\beta_{i,t-1}$ *after controlling for* $\theta_{i,t-1}$.

Since we observe that returns are related to characteristics, if the factor model is correct, the factor loadings must be related to the characteristics, as expressed in equation (2).[5] If this is indeed the only source of correlation between characteristics and returns, then a zero-investment portfolio that is long high θ stocks and short low θ stocks, such as the FF *HML* portfolio, should have a high loading on the

[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 betas and characteristics like size and BM. Also, DT note that, under non-risk 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 BM.

priced factor. The FF results are consistent with this interpretation. First, there are strong covariances between the returns of the stocks within their size and book-to-market factor-mimicking portfolios, suggesting that these stocks load on a common, distress-related risk factor.[6] Second, the returns of their portfolios appear to do a good job of explaining the returns of other size and book-to-market sorted portfolios.

DT argue that the FF (1993) tests, which regress characteristic-sorted portfolios on other characteristic-sorted portfolios, have very little statistical power to distinguish between the factor and characteristics model and propose an alternative test, which can in fact distinguish between the models. To perform this test, assets are sorted into portfolios based on *both* characteristics and factor loadings. The goal is to form portfolios with high book-to-market characteristics, but with return covariances that resemble low book-to-market portfolios (and *vice-versa*), and to test whether their returns are different.[7]

Specifically, DT construct two sets of test portfolios:

1. *characteristic-balanced* portfolios which 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 high negative loadings on one of the three factors (*HML*, *SMB* or *Mkt*).

2. *factor-balanced* portfolios which 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 first forming a characteristic-balanced portfolio, and adding long and short positions in the *HML*, *SMB* and *Mkt* 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.

The FF three-factor model implies that the returns on the factor-balanced portfolios should average zero (since they have zero factor loadings), but that the characteristic-balanced portfolios should have negative average returns because they have negative factor loadings. In contrast, the

[6] In Section 3 of Daniel and Titman (1997) we run an alternative test and argue that the results of this test show that the high covariance is not due to the presence of a separate, distress related factor.

characteristic model implies zero average returns for the characteristic-balanced portfolios, but positive average returns for the factor-balanced portfolios because they have negative characteristics. DT perform 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 FF factor model at better than a 5% level (the one tailed p-values are 1.1%, 4.7%, and 1.5%, respectively). In contrast, they find that the average returns of the three characteristic-balanced portfolios are not reliably different from zero.

Clearly, the power to discriminate between the two hypotheses depends on whether well-diversified portfolios can be formed with similar characteristics but different factor sensitivities. This will be influenced by the length of the time series, the number of assets, the correlation between the characteristics and factor loadings, or equivalently the variance of e in equation (2), and by our ability to forecast the e's, or equivalently, the future βs. A large number of assets allow us to construct portfolios which have large positive or negative e's, but which are still well diversified. The level of diversification is important because more diversified portfolios allow us to more easily detect deviations of the returns of the characteristic-balanced and factor-balanced portfolios from 0, as does a longer test period.

The power to discriminate between the two hypotheses also depends on the characteristic/factor return premium. Intuitively, to distinguish between different theories of the book-to-market effect one requires data where the magnitude of the book-to-market effect is strong. This may be why the recent DFF study finds that the DT tests cannot reliably distinguish between the characteristics and factor

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[7] Berk (1999) shows that an errors-in-variables problem can arise if returns are regressed on measured betas. The procedure discussed in Berk is not employed in Daniel and Titman (1997) or in any of the tests presented here. Berk also discusses some power issues that also turn out to not be relevant for these tests.

models in a sample that includes more recent years, where the size and book to market effects are much smaller.

Data mining is also a concern here: to what extent will picking a country with a high *realized* (as opposed to *expected*) R_{HML} and R_{SMB} affect the probability of falsely rejecting the null (*i.e.,* the size of our tests)? To understand how the magnitude of return premia on characteristic sorted portfolios affects our tests, note that the return premium will be higher in a give sample if,

1. b, the return premium associated with the characteristic, had a higher realization in the sample period.
2. λ, the risk premium on the factor, was higher in the sample period.
3. f_t, the factor realization, had a higher realization in the sample period.

If the higher return premium comes from effect 1, which implies the factor model is false, the test will have more power to reject the factor model, because, holding everything else constant, it is easier to discriminate between $b\theta$ and 0 when b is large. However, arbitrarily picking a period with a high b will not affect the size of the test. Similarly, if the return premium comes from effect 2, which would imply the characteristics model is false, the test will have more power to reject the characteristics model, but again test size will not be affected. 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 if the higher return comes from effect 3, then the test will reject the characteristic model too often. In other words, we will reject at the 5% level more than 5% of the time when the characteristic model is in fact true. In periods where the realization of f is high, high beta portfolios will return more than low beta portfolios, even if the expected returns of high and low beta 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 is not affected by the realization of the factor in the sample period. In other words, a rejection of the factor model using a high premium period is reliable.

It is these last two factors that motivate our tests. As noted earlier, Japan has the largest equity market aside from the U.S., in terms of both capitalization and number of securities. Second, the spread between the returns of high and low book-to-market stocks is larger in Japan than in the U.S. One should also note, however, that the spread between large and small stocks as well as the return premium on the market portfolio is not particularly large in Japan during our sample period.[8] Hence, we expect to have the most power to distinguish between a characteristic and factor model with characteristic-balanced portfolios that are sensitive to the *HML* factor, which will be the main focus of our analysis.

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 (CHL, 1991), stocks listed on the TSE account for more than 85 percent of the total market capitalization of Japanese equities.[9] 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 - 1997) and the Daiwa Securities Co., Limited, Tokyo (1971 - 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 CHL 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

[8] The FF *SMB* and (excess) *Mkt* portfolios have mean returns of 0.26%/month (t=1.02) and 0.33%/month (t=1.09), respectively, for our sample. The mean return for the *HML* portfolio is 0.67%/month (t=4.14).

[9] See Chan, Hamao, and Lakonishok (1991) for a detailed description of the Japanese equity market.

risk-free interest rate. This interest rate series is taken from the PACAP databases (1975 - 1997) and Diawa Securities (1971 - 1975).

The data on book values are taken from both the PACAP databases and Nihon Keizai Shimbun, Inc., Tokyo. Though some firms publish semi-annual financial statements, we use only annual financial statements due to the tentative nature of semi-annual statements. In addition, since 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.[10,11] However, we exclude stocks which do not have at least 18 monthly returns between t = -42 to -7 before formation date (October of year t = 0). This criterion is needed in order 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 to market

[10] However, we have verified that excluding financial companies does not affect our results.
[11] 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 bias in our data.

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*.[12]

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.[13] 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 (*SZ*). We also separately break TSE stocks into five equal book-to-market equity (*BM*) groups from low to high. The 25 portfolios are constructed from the intersections of the five size and five book-to-market groups, e.g., 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 row and right-most column of this panel reports 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. The panel documents that holding book-to-market fixed, the difference in returns between the smallest and largest size quintile is large for the low BM quintile (106 basis points per month, t=2.56), but is insignificantly different from zero for all other BM quintiles (t<1.52). The average size effect, across the five BM categories, is insignificantly different from zero (T=1.53). In contrast, when size is held constant there is a large book-to-market effect. The difference

[12] 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 FF (1993) and Daniel and Titman (1997). However, previous research on the TSE firms imposes only a three-month (minimum) gap (Chan, Hamao, and Lakonishok (1991)).

[13] The construction of these 25 portfolios follows FF (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

in returns between the highest and lowest BM quintile is statistically significant ($t>2.50$) for all but the smallest quintile of firms. The average book-to-market effect, across the five size categories, is large and statistically significant ($t=4.34$).

Panels B and C of Table I separate the sample into January and non-January months. As in the U.S., the size effect is much larger and more significant in January ($t>2.20$ for all BM quintile-differences), but outside of January it is only significant for the lowest BM quintile ($t=2.05$, all other t's<0.7). The BM effect remains equally strong in non-January months, where it is significant for all but the smallest quintile ($t>2.05$). This is in contrast to the DT evidence, where the book-to-market effect is stronger in smaller firms, and is concentrated in January (see, for comparison, Table 1 in Daniel and Titman (1997)). It is, however, consistent with DFF, who find that the BM effect is stronger in large firms prior to 1963.

IV. Fama and French (1993) Tests

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

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

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_{i,HML} (R_{HML,t}) + \beta_{i,SMB} (R_{SMB,t}) + \beta_{i,Mkt} (R_{Mkt,t} - R_{f,t}) + \varepsilon_{i,t}, \qquad (3)$$

where $R_{i,t}$ is the return on size and book-to-market sorted portfolio i, and $R_{HML,t}$, $R_{SMB,t}$ and $R_{Mkt,t}$ 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.

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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.

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 α's are zero is significant, suggesting that the CAPM does not hold for the Japanese data.

The intercepts and t-statistics for the FF 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 very good job explaining the 25 portfolio returns.

V. Characteristics versus Covariances

As we discussed earlier, the tests considered in the last section are not designed to have much power against the alternative hypothesis that the expected returns are determined directly by the characteristics rather than by their factor loadings. The power problem arises because the correlation between the factor loadings and the characteristics among the 25 test portfolios is very high. As discussed in Section I, in order 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.

A. Construction of the Test Portfolios

We first rank all TSE stocks by their book-to-market ratios (*BM*) at the end of March of year *t* and their market capitalizations (*SZ*) 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 are then further sorted into five sub-portfolios based on their factor loadings (for example, $\beta_{i,HML}$) estimated from month -42 to -7 relative to the portfolio formation date in the following regression:[14]

$$R_{i,t} - R_{ft} = \alpha_i + \beta_{i,HML} R_{HML,t} + \beta_{i,SMB} R_{SMB,t} + \beta_{i,Mkt} (R_{Mkt,t} - R_{ft}) + e_{i,t}, \quad t = -42 \text{ to } -7 \qquad (4)$$

As in DT the above regression employs constant-weight factor portfolio returns. We take the portfolio weights of the FF 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.[15] 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 sub-portfolios based on estimates of $\beta_{i,HML}$ to form a set of 45 portfolios. The value-weighted returns for each of these 45 test portfolios are then calculated for

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[14] 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 (1997) discusses this problem in detail; see especially Figure 1 and the discussion on page 12.

[15] Again, see Daniel and Titman (1997) for a full description of the motivation for this method.

each month between October 1975 through December 1997. Similarly, we form 45 test portfolios based on *ex ante* $\beta_{i,SMB}$ sorts and 45 test portfolios based on the *ex ante* $\beta_{i,Mkt}$ sorts. Our tests of the factor model and the characteristic model are performed on these three sets of 45 test portfolios.

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, monotonic 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 FF three-factor model, and that, within a size/book-to-market grouping, there is no statistically significant relation between factor loadings and returns.

The lack of a strong relation between the returns and the *ex ante* factor loadings could potentially reflect the fact that *ex ante* factor loadings are weak predictors of future factor loadings. The results, not reported here, indicate that this is not the case. Our sort on *ex ante HML* factor loadings produce a monotonic ordering of the *ex post* factor loadings. It is also possible that the relation between the loadings and the returns occur because, in sorting on the *HML* factor loadings, we pick up some variation in book-to-market ratio within each *SZ* and *BM* sorted sub-grouping. Our tests of the characteristic model assume that the stocks in columns 1 and 5 have equal book-to-market ratios, so if this is not the case, our tests could be biased. However, unreported tests indicate that within each *SZ* and *BM* sorted grouping there is a slight positive relation between the *BM* ratio and the *HML* factor loading which would slightly bias our tests in favor of the factor model. Specifically, our tests have a lower probability of rejecting the three-factor model when this model is false, and there is an increased probability of falsely rejecting the characteristic model when it is true.[16]

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. Also, 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 alternative hypothesis provided by the characteristic model. Indeed, when we inspect the intercepts more closely, we find patterns that are consistent with the characteristics alternative: 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. This suggests that the returns may be related to the *BM* characteristics even after the adjustment for factor risks.

To obtain a more powerful test of the factor model against the alternative offered by the characteristic model, we form 9 characteristic-balanced portfolios. Within each of the 9 size and book-to-market groupings, we form portfolios which have a one dollar position in the high (the 4th and 5th quintile) expected factor loading portfolios and a short one dollar position in the low (the 1st and 2nd quintile) expected factor loading portfolios.[17] If the characteristic model is correct, the average returns on these portfolios should be zero, because they are long and short assets with (approximately) equal characteristics. If, however, the factor model is correct, the returns should be

[16]As a way of assessing the magnitude of this bias, we regressed the average returns reported in Table III on the logs of the average size and BM ratios. We calculated fitted returns for the characteristic-balanced portfolios whose returns are reported here. This gives us an expected return for these portfolios, under the characteristic model, assuming that this specification is correct. The fitted return for the characteristic-balanced portfolio in Panel C of Table III was 3 bp/month, confirming our impression that the bias should be small.

[17] There is a difference between the portfolios here and their counterparts in DT. The long and short positions in these portfolios are the reverse of the portfolios in DT, but are consistent with how they are reported in Davis, Fama and French (1999). The only effect of this is to change the signs of the intercepts and coefficients in our regressions.

positive because these portfolios have a high loading on one of the FF factors. In addition, the alphas obtained from regressing the returns on the three factor portfolios should be zero if the factor model is correct, and should be negative under the characteristic model. Since the alphas represent the returns of a portfolio that is factor-balanced but not characteristic-balanced we will sometimes refer to the alphas as the return on a factor-balanced portfolio.

The average returns of these zero cost portfolios as well as the regression results on the FF 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 0.05 (two-tail) level. However, since the returns of these portfolios are highly correlated, finding one out of nine positive returns does not necessarily indicate statistical significance. Indeed, the average return of a single portfolio, formed by equal weighting the nine characteristic-balanced portfolios, is not reliably different from zero (t=1.23).

The remaining columns of Panel B provide the results of the regression of the returns of the characteristic-balanced portfolio on the three factors. The intercepts on these nine characteristic-balanced portfolios are all negative except two (one of the nine intercepts is significant at the 0.05 level). The intercept from the single portfolio regression on the equally-weighted portfolio of these nine portfolios, reported in the last row of the panel, is negative and just statistically significantly different from zero (t=–1.8), which is inconsistent with the three-factor model.

As in DT we also examined the returns to zero-cost portfolio strategies that for each of the nine size/BM groupings, take a long position in the highest (5^{th} quintile) expected factor loading portfolios and a short position in the lowest (1^{st} quintile) expected factor loading portfolios. For these Japanese data, this test yielded even stronger evidence against the three factor model: the intercepts for all of the nine size/BM portfolios are negative, two of the nine at a 0.05 significance level. Also, the equal weighted combination of these nine portfolios had an intercept of –0.37%/month (t=–2.19). In contrast, this characteristic-balanced portfolio had a mean return of 0.21%/month (t= 0.98), consistent with the characteristic model.

C. Results Based on Sorting by Other Factor Loadings

Table IV replicates this analysis on portfolios sorted by *SMB* factor loadings. Consistent with the findings of DT and DFF in the U.S., these tests fail to reject either the factor model or the characteristic model. However the t-statistic on the α is –1.37, so we are close to the one-tailed level for rejection of the three-factor model.

Table V replicates this analysis on portfolios sorted by the *Mkt* factor loadings. This is where we find the most striking difference between the U.S. and Japan. Both DT and DFF 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.

D. The Power of Our Tests

It is instructive to examine how the power of these tests using Japanese data compare to the power of the tests using U.S. data reported in Daniel and Titman (1997). Recall that our ability to distinguish between factor models and characteristic models depends on our ability to construct well-diversified characteristic-balanced portfolios with significant factor loadings as well as on the magnitude of the average returns associated with the factors. The return of the *HML* portfolio in our Japanese sample is slightly larger than the U.S. *HML* return in the DT sample (67 bp/month in Japan versus 50 bp/month in the U.S.). Also, the *HML* beta of the characteristic-balanced portfolio is larger than its counterpart in the DT sample (0.586 here, and 0.362 in DT).[18]

In contrast, the return premia and factor sensitivities indicate that we are unlikely to have much power to distinguish between the characteristic and factor models using either *SMB* or *Mkt* beta sorts. The returns of the *SMB* and excess-*Mkt* portfolios are quite small in our sample period (26 and 33 bp/month, respectively, with t's of 1.0 and 1.1). In addition, we did not successfully generate characteristic-balanced portfolios with large sensitivities to either the *Mkt* or *SMB* factors – the β_{SMB}=0.305 for the *SMB*-factor loading sorted portfolio and β_{Mkt}=0.245 for the *Mkt*-factor loading sorted portfolio.

Based on these numbers, we expect to have slightly more power in our Japanese sample to distinguish between the characteristic and factor models using HML beta sorts. While we do reject the factor model with slightly less significance in Japan, this is not because the Japanese data provides less power. Rather, it is because our point estimates indicate that a higher portion of the high minus low book-to-market return spread can be attributed to factor risk in Japan.[19] The above numbers also indicate that our tests provide very little power to distinguish between the characteristic and factor models using portfolios sorted by *Mkt* and *SMB* factor loadings.

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 U.S. This is especially true for the largest quintile stocks, where high book-to-market stocks beat low

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[18] In DT, we formed the characteristic-balanced portfolios differently than we do here, buying one dollar each of the 1st and 2nd factor loading portfolio and selling one dollar each of the 4th and 5th factor loadings portfolios. We have adjusted the numbers from DT to reflect this difference.

book-to-market stocks (sorted into quintiles) by 0.994% per month in Japan but only 0.347% in the U.S. 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 the 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, Fama and French (1999) as well as 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. DT reject with characteristic-balanced portfolios that load on the *HML* factor, and that load on the *Mkt* factor; DFF 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 and risk model, while 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 in our sample period.
2. *HML* betas were predictable and not too highly correlated with book-to-market ratios.

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[19]This is evidenced by the higher return of the characteristic-balanced portfolio in Japan.

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. While 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* means 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.

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Appendix: Construction of the Portfolios

The construction of the book-to-market and size portfolios follows FF (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 (ME). 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 which have been listed on PACAP/Diawa Securities and which have prices available on PACAP/Diawa in both March of *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% and 70% breakpoints for book-to-market and a 50% 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% book-to-market breakpoint are designated *H*, the middle 40% of firms are designated *M*, and the firms below the 30% book-to-market breakpoint are designated *L*. Also firms above the 50% size breakpoint are designated *B* (for big) and the remaining 50% *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 $R_{SMB} = (R_{SL} + R_{SM} + R_{SH} - R_{BL} - R_{BM} - R_{BH})/3$, and the *HML* (*High-Minus-Low)* portfolio returns, which are defined as $R_{HML} = (R_{SH} + R_{BH} - R_{SL} - R_{BL})/2$. Also, a, value-weighted portfolio *Mkt* is formed which contains all of the firms in these portfolios, plus the otherwise excluded firms with BM values of less than zero.

Table I
Mean Monthly Excess Returns (in percent) on the 25 Size and Book-to-Market Sorted Portfolios: 1975:10 – 1997:12, 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 (ME) at the end of September of year *t*. We form 20%, 40%, 60%, and 80% breakpoints for book-to-market and ME 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.

Panel A: *All Months*							
char	Low		***Book-to-market***		High	**H-L**	**t(H-L)**
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)**
Size	-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*							
Char	Low		***Book-to-market***		High	**H-L**	**t(H-L)**
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)**
Size	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*							
Char	Low		***Book-to-market***		High	**H-L**	**t(H-L)**
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)**
Size	-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)**		

Table II
Time-Series Regressions of the 25 Size and Book-to-Market Sorted Portfolios:
1975:10 – 1997:12, 267 months.

The formation of the 25 book-to-market and size-sorted portfolios is described in Table 1. The construction of the *HML* (High-Minus-Low) factor portfolio (R_{HML}), *SMB* (Small-Minus-Big) factor portfolio (R_{SMB}) and the *Mk*t (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% and 70% breakpoints for book-to-market and a 50% breakpoint for size. The stocks above the 70% book-to-market breakpoint are designated *H*, the middle 40% of firms are designated *M*, and the firms below the 30% book-to-market breakpoint are designated *L*. Firms above the 50% size breakpoint are designated *B*, and the remaining 50% *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 $R_{HML} = (R_{HB} + R_{HS} - R_{LB} - R_{LS})/2$, and the *SMB* factor portfolio returns, which are defined as $R_{SMB} = (R_{HS} + R_{MS} + R_{HS} - R_{HB} - R_{MB} - R_{LB})/3$. 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 intercepts 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: Intercepts estimates and t-statistics from the CAPM

$$R_{i,t} - R_{ft} = \alpha_i + \beta_{,i,Mkt}(R_{Mkt,t} - R_{ft}) + \varepsilon_{i,t}.$$

	α estimates					t-statistics				
Char	Low	***book-to-market***			high	Low	***book-to-market***			high
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
Size	-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: Intercepts estimates and t-statistics from the Fama-French three-factor model

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

	α estimates					t-statistics				
Char	Low	***book-to-market***			high	Low	***book-to-market***			high
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
Size	-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										

Table III
Mean Monthly Excess Returns and Time-Series Regressions -- *HML* Factor Loading Sorted Portfolios
October 1975 - December 1997

Panel A gives the mean monthly returns (in %) for 45 portfolios formed based on size (SZ), book-to-market (BM), and pre-formation *HML* factor loadings.

Panel B presents intercepts and t-statistics from the multivariate time-series regressions:

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

The estimates of slope coefficients are not presented here. The left-hand side portfolios are formed based on size (SZ), book-to-market (BM), and pre-formation *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 forty-five return series, a zero-investment returns series is generated from each of the nine size and book-to-market categories. These portfolios are formed, in each category, by subtracting the sum of the returns on the 1st and 2nd quintile factor-loading portfolios from the sum of the returns on the 4th and 5th factor-loading portfolios, and then divided 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 consistent of an equally weighted combination of the above zero-investment portfolios. * represents significance at the 0.1 level and ** significance at 0.05 the level in a two-tailed test.

Panel A: Mean excess monthly returns (in %) 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	

Table III (Continued)

Panel B: Intercepts and their t-statistics from the Fama-French three-factor model

		Factor loading portfolio α					Factor loading portfolio – t(α)				
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
Avg		0.122	0.043	0.040	-0.002	-0.242					
F=0.946 and prob.(F)=0.574											

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

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

This table represents results on *SMB* (rather than *HLM* in Table III) factor loading-sorted portfolios. Panel A gives the mean monthly returns (in %) for the 45 portfolios, while Panel B presents the intercepts and their t-statistics from the FF time-series regressions. Panel C presents the mean returns and the regression results from the characteristic-balanced portfolio returns. * represents significance at the 0.1 level and ** significance at 0.05 the level in a two-tailed test.

Panel A: Mean excess monthly returns (in %) 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	-0.331	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 (α)				
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
Avg		0.073	0.017	-0.120	-0.080	-0.126					
F = 0.913 and prob.(F) = 0.632											

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)	

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

This table represents results on *Mk*t (rather than *HLM* in Table III) factor loading-sorted portfolios. Panel A gives the mean monthly returns (in %) for the 45 portfolios, while Panel B presents the intercepts and their t-statistics from the FF time-series regressions. Panel C presents the mean returns and the regression results from the characteristic-balanced portfolio returns. * represents significance at the 0.1 level and ** significance at 0.05 the level in a two-tailed test.

Panel A: Mean excess monthly returns (in %) 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	0.654	0.481
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

		Factor loading portfolio - α					Factor loading portfolio - **t(α)**				
BM	*SZ*	1	2	3	4	5	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
Avg		-0.068	-0.058	-0.001	0.051	-0.011					
F = 0.932 and prob.(F) = 0.599.											

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}	$\overline{R}^2$
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)	