"STOCK MARKET ANOMALIES AND THE PRICING OF EQUITY ON THE TOKYO STOCK EXCHANGE"

by

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1. INTRODUCTION

The purpose of this study is to examine the relationship between the average return and the risk of a sample of common stocks traded on the Tokyo Stock Exchange (TSE). Specifically, the study addresses the following question: Is the capital asset pricing model (CAPM) a valid <u>predictor</u> of common stock returns on the TSE given that this market exhibits two well-known "anomalies?" These are the size effect and the seasonal behavior of monthly common stock returns. They are both described below following a brief presentation of the CAPM and a review of the first test of that model on the TSE.

According to the CAPM (Sharpe 1964) the expected return of a risky asset i $[E(R_i)]$ is equal to the return on a riskfree asset (R_F) plus a risk premium equal to the expected return on the market portfolio in excess of the riskfree rate $[E(R_m) - R_F]$ multiplied by the relative risk (or beta coefficient) of asset i (β_i). We can write this equilibrium pricing equation as:

$$E(R_i) = R_F + [E(R_m) - R_F]\cdot\beta_i \quad , \qquad (1)$$

where the market portfolio is a portfolio that contains all outstanding assets in proportion to their market value. The beta coefficient of asset i is the risk of that asset relative to the risk of the market portfolio. It is a measure of the "market," or systematic, risk of asset i. Risk not related to the market, or unsystematic risk, is assumed to be eliminated through portfolio diversification. It is thus not priced in the market and hence does not appear in the equilibrium pricing equation.

The first test of the CAPM on the TSE was performed by Lau, Quay and Ramsey (1974). They estimated the cross sectional relationship between the average monthly return of 10 portfolios and their corresponding beta coefficient over the 5-year period from October 1964 to September 1969. They found a positive and linear relationship between average portfolio returns and betas and concluded that the CAPM is applicable on the TSE.

Is this conclusion still valid in light of the size effect and the seasonal behavior of monthly common stock returns? The size effect refers to the observed inverse relationship between common stock returns and firms' size (measured by the market value of firms' shares outstanding): small-capitalization firms seem to earn, on average, excess returns after controlling for the difference in systematic risk that may exist between small and large firms. This phenomenon, which is inconsistent with equity pricing according to the CAPM, has been observed in most stock markets around the world (Hawawini (1988)). Evidence of its existence on the TSE has been documented by Nakamura and Terada (1984), Kato and Schallheim (1985) and others.

The other so-called "anomaly" is the seasonal behavior of monthly returns: most stock market indices exhibit, on average, higher returns in January than during the other months of the year. Nakamura and Terada (1984) as well as Kato and Schallheim (1985) report a significant "January effect" on the TSE. There are no definitive explanations of these two phenomena. We do know, however, that they are related. Most of the excess return earned by small firms on the TSE occurs during the month of January (see Nakamura and Terada 1984).

Seasonality and size have also been shown to affect the estimated CAPM-risk premium, that is, the estimated slope of the equilibrium pricing equation

(1). In other words, not only do common stock returns exhibit monthly seasonality but so does the entire risk-return relationship. This phenomenon has been documented by Tinic and West (1984) and (1986) in the U.S. equity market, by Tinic and Barone-Adesi (1988) in the Canadian equity market and by Corhay, Hawawini and Michel (1987) in the Belgian, French and U.K. equity markets.

In what follows we examine the seasonal behavior of the risk-return relationship on the TSE and show that it displays a significant monthly seasonality pattern. The next section describes the data and the methodology we employ to carry out our empirical tests. Section 3 presents evidence of seasonality in the estimated risk premia inferred from alternative models of equity pricing. Section 4 reports evidence of a size effect and shows that it displays monthly seasonality. Section 5 re-examines the validity of the CAPM in light of seasonality and the size effect and looks at the implications for portfolio management. Section 6 presents evidence indicating that risk does not exhibit seasonality. Section 7 contains the concluding remarks.

2. DATA AND METHODOLOGY

2.1 Data

The data on monthly common stock returns is extracted from a tape compiled by the Japanese Securities Research Institute. Monthly returns for common stocks listed on the first section of the TSE begin on January 1955 and end on December 1985, providing a maximum of 372 consecutive monthly returns per common stock. The number of firms in the sample varies from a minimum of 373 (which traded continuously from January 1955 to December 1985) to a maximum of 566 (which traded continuously from January 1970 to December 1985). Monthly returns are adjusted for all changes in capitalization including dividend payments.

Two market indexes are calculated. A value-weighted index of all firms in the sample and an equally-weighted index of all firms in the sample. Their seasonal behavior is reported in Table 1 and discussed in Section 3.7.

2.2 Methodology

The methodology employed to test the validity of the CAPM is similar to that found in Fama and MacBeth (1973) and Banz (1981). It allows us to test the CAPM as a predictive model of portfolios' returns instead of a descriptive model of portfolios' returns. Note that the early test of the CAPM on the TSE performed by Lau et al (1974) and reported above, is of the second type: descriptive rather than predictive. They examined the relationship between average portfolio returns and beta coefficients estimated over the same sample period. A test of the predictive power of the CAPM should examine the relationship between the beta coefficients estimated over a given period and the return of portfolios realized during a subsequent period. With such a procedure one can find out, for example, if a strategy that consists in holding a high-beta portfolio constructed in period 1 yields a higher than average return in period 2.

To test the CAPM as a predictive model of portfolios' returns, we proceeded as follows. An initial period of two years of monthly returns is used to construct portfolios on the basis of size and risk (2-year construction period). The following three years of monthly returns are employed to estimate the risk of the portfolios constructed over the previous 2-year period (3-year risk estimation period). Finally, the examination of the risk-return relationship and the investigation of seasonality and size effects are performed over the sixth year of data (1-year test period). The entire procedure is then repeated after dropping the first year of data. The approach is explained below in more detail.

2.3 Portfolio construction

The first 2 years of monthly returns (1955 and 1956) are used to construct five equally-weighted portfolios ranked according to size (market capitalization). Each one of these size portfolios is then divided into four subportfolios ranked according to the magnitude of their beta coefficient. This method yields a total of twenty equally weighted portfolios constructed according to size and risk.

2.4 Risk estimation

The following 3 years of monthly returns (1957 to 1959) are used to estimate the risk of each stock in the sample. Two measures of risk are considered: systematic risk (beta coefficient) and unsystematic risk. They are both estimated using the following regression (known as the market model--see Fama (1976)):

$$\tilde{R}_{it} = \alpha_i + \beta_i \cdot \tilde{R}_{mt} + \tilde{e}_{it} \tag{2}$$

where the beta coefficient is the estimated slope coefficient β_i and unsystematic risk is the standard error of the residual returns $\left(\sigma(\tilde{e}_{it})\right)$. Both risk measures are estimated either with the equally-weighted index or the value-weighted index ($\tilde{R}_{mt}$). The risk of the portfolios is calculated by taking the arithmetic average of the risk of the individual securities that make up the portfolio.

2.5 Model testing

Finally, the sixth-year of monthly returns (1960) is used to estimate the following five pricing models:

$$R_{Pt} = \gamma_{0t} + \gamma_{1t} \cdot \beta_{p,t-1} + \mu_{p,t} \tag{3}$$

$$R_{pt} = \gamma'_{0t} + \gamma'_{1t} \cdot \beta_{p,t-1} + \gamma_{2t} \cdot \beta^2_{p,t-1} + \gamma_{3t} \cdot \sigma(e)_{p,t-1} + \mu'_{p,t} \tag{4}$$

$$R_{pt} = \gamma^{s}_{0t} + \gamma_{4t} \cdot \left[\frac{V_p - V_m}{V_m}\right]_{t-1} + \mu^{s}_{p,t} \qquad (5)$$

$$R_{pt} = \gamma''_{0t} + \gamma''_{1t} \cdot \beta_{p,t-1} + \gamma''_{4t} \cdot \left[\frac{V_p - V_m}{V_m}\right]_{t-1} + \mu''_{p,t} \qquad (6)$$

$$R_{pt} = \gamma^{*}_{0t} + \gamma^{*}_{1t} \cdot \beta_{p,t-1} + \gamma^{*}_{2t} \cdot \beta^{2}_{p,t-1} + \gamma^{*}_{3,t} \cdot \sigma(e)_{p,t-1} + \gamma^{*}_{4t} \cdot \left[\frac{V_p - V_m}{V_m}\right]_{t-1} + \mu^{*}_{p,t} \qquad (7)$$

where:

R_{pt} = realized return of portfolio p in month t;

γ_{1t} = systematic risk premium in month t;

γ_{3t} = unsystematic risk premium in month t;

γ_{4t} = size premium in month t;

$\beta_{p,t-1}$ = beta of portfolio p estimated with regression (2) over the 36-month estimation period ending in the calendar year preceding month t and updated yearly;

$\sigma(e)_{p,t-1}$ = unsystematic risk of portfolio p estimated with regression (2) over the 36-month estimation period ending in the calendar year preceding month t and updated yearly;

$\left[\frac{V_p - V_m}{V_m}\right]$ = size portfolio relative to the size of the market at the end of the calendar year preceding month t and updated yearly.

Regression (3) is the standard two-parameter capital asset pricing model (Sharpe (1964); Fama (1976)) according to which security holders are compensated only for bearing systematic risk with a linear risk-return relationship.

Regression (4) is the Fama-MacBeth (1973) version of a four-parameter capital asset pricing model. This specification provides a direct test of the linearity assumption (if the risk-return relationship is linear γ_{2t} should be statistically equal to zero) as well as a direct test of the marginal contribution of unsystematic risk to asset pricing (if unsystematic risk is not priced in the market γ_{3t} should be statistically equal to zero).

Regression (5) is run to determine if there is a size premium on the TSE. If portfolios constructed according to relative size at the end of a calendar year have different average returns over the following year, then γ_{4t} will be statistically different from zero. If portfolios of smaller firms outperform portfolios of larger firms γ_{4t} will be negative.

Regression (6) allows us to examine the combined effect of systematic risk and size on average returns. If γ''_{4t} is significantly negative, there is a size effect on the TSE even after controlling for the difference in risk than may exist between small and large firms.

Finally, regression (7) is the four-parameter capital asset pricing model in which we have added a size variable.

2.6 Model validity and seasonal behavior

For each month of the 12-month test period, we calculate the realized return of each one of the 20 portfolios (R_{pt}). These 20 portfolio returns are then cross sectionally regressed on beta (regression (3)); beta, beta squared and unsystematic risk (regression (4)); size (regression (5)); beta and size (regression (6)); and beta, beta squared, unsystematic risk and size (regression (7)). From the 12 monthly cross-sectional regressions we get 12 monthly estimates of the risk premia γ_1, γ'_1, γ''_1, γ^*_1, γ_2, γ^*_2, γ_3 and γ^*_3 and the size premia γ_4, γ''_4 and γ^*_4.

The entire procedure is then repeated using the second and third years of monthly returns (1956 and 1957) to construct portfolios, the fourth, fifth and sixth years of monthly returns (1958 to 1960) to estimate risk, and the seventh year of monthly returns (1961) to estimate the monthly relationships between realized returns, risk and size. Dropping one year of early data and adding a new one to estimate the risk and size premia, we kept on repeating the entire procedure until we reached the last year of data, 1985. This approach provides a total of 312 monthly estimates of risk and size premia; 26 estimates for each of the 12 months of the year (from January 1960 to December 1985). By examining the average value of the estimated monthly risk and size premia either over the entire period or over specific months of the year, we can test the pricing models (3) to (7) and find out whether these premia exhibit monthly seasonality.

2.7 Seasonality in the monthly returns of the market indexes

As mentioned earlier, in this study we used two proxies for the market: an equally-weighted index (EWI) and a value-weighted index (VWI). The average monthly returns for these two indexes is reported in Table 1. When average returns are calculated over the entire 372 months, the EWI has a monthly return of 1.60% and the VWI a monthly return of 1.84%. Both are significantly different form zero at the 5% level, but they are not significantly different from each other. When average returns are calculated over each of the 12 months of the year, we notice that returns exhibit monthly seasonality.

Average returns are the highest during January and higher for the EWI than for the VWI. Higher January return for the EWI than for the VWI is the manifestation of the January size premium. Since the EWI gives a relatively larger weight to smaller firms than does the VWI, the latter will exhibit a higher return than the former during January, a month where small firms outperform their larger counterparts. Note that market returns are also significantly positive in March, June, September and December. These are the last months of the first, second, third and fourth quarter of the year, respectively. This quarterly seasonality may reflect the activity of institutional investors who tend to rebalance their portfolios every quarter.

TABLE 1

Average Monthly Returns on a Portfolio Containing All the Stocks in the Sample (from 373 to 566 stocks) Over the Period January 1955 - December 1985

Average Monthly Return Over	Sample Size	Equally-Weighted Portfolio		Value-Weighted Portfolio	
		Average Return	t-statistics	Average Return	t-statistics
All Months	372	1.60% [a]	6.40	1.84%	7.55
All Months but January	341	1.24%	4.75	1.61%	6.22
January	31	5.58%	13.17	4.36%	9.85
February	31	1.00%	1.85	0.99%	1.73
March	31	2.90%	3.77	3.85%	4.48
April	31	0.51%	0.57	1.01%	1.23
May	31	0.18%	0.20	0.86%	0.91
June	31	2.51%	4.59	2.43%	4.09
July	31	0.65%	0.75	0.44%	0.51
August	31	0.92%	0.85	1.05%	1.09
September	31	0.13%	0.17	1.28%	1.85
October	31	0.52%	0.48	0.49%	0.56
November	31	1.81%	1.76	2.42%	2.27
December	31	2.48%	3.02	2.87%	3.25

a. Average return significantly different from zero at the 5 percent level.

3. EVIDENCE OF MONTHLY RISK-PREMIA SEASONALITY

3.1 Systematic risk-premia

The average values of the estimated coefficients of regression (3) are reported in Table 2. The third and fourth columns give the average values of the coefficients in the case where the beta coefficients are estimated using a value-weighted index in the market model (regression (2)). The last two columns give the average values of the coefficients in the case where the beta coefficients are estimated using an equally-weighted index in the market model (regression (12)).

We observe the following:

(1) When all 312 months are considered (from January 1960 to 1985) the relationship between average portfolio returns and estimated systematic risk is not significantly different from zero at the 0.05 level, irrespective of whether the index is equally-weighted or value-weighted.

(2) When the year is split in two parts, that is, the month of January and the rest of the year, another picture emerges: the relationship between average portfolio returns and estimated systematic risk is significantly positive in January and significantly negative during the rest of the year.

(3) When the value-weighted index is used to estimate systematic risk, the systematic risk premium is significantly negative in February. When the equally-weighted index is used to estimate systematic risk, the systematic risk premium is significantly positive in June and July and significantly negative in September. The negative September effect outweighs the positive June and July effects resulting in a negative risk-return relationship over the 11 months from February to December.

We have a clear seasonality pattern in the estimated risk-return relationship on the TSE. This phenomenon is similar to that observed in the

TABLE 2

Average Values of the Fama-MacBeth Estimates of the Intercept (γ_0) and Slope (γ_1) Coefficients of the Two-Parameter Model[a]:

$$R_{pt} = \gamma_{0t} + \gamma_{1t} \cdot \beta_{p,t-1} + \mu_{p,t}$$

Average Over	Sample Size	Value-Weighted Index[b]		Equally-Weighted Index[c]	
		$\bar{\gamma}_0$	$\bar{\gamma}_1$	$\bar{\gamma}_0$	$\bar{\gamma}_1$
All months	312	0.0150[d] 4.90	-0.0046 1.45	0.0109 3.63	0.0002 0.05
All months but January	286	0.0138 4.28	-0.0070 2.14	0.0119 3.78	-0.0047 1.86
January	26	0.0279 3.00	0.0220 2.09	-0.0009 0.10	0.0543 5.36
February	26	0.0207 2.79	-0.0185 2.22	0.0073 0.63	-0.0029 0.28
March	26	0.0261 3.01	0.0016 0.14	0.0247 2.24	0.0005 0.05
April	26	0.0061 0.45	-0.0082 -0.64	-0.0011 0.12	-0.0007 0.06
May	26	0.0014 0.15	-0.0041 0.40	0.0119 1.43	-0.0127 1.21
June	26	0.0226 2.33	-0.0011 0.10	0.0035 0.40	0.0195 1.92
July	26	0.0121 1.28	-0.0109 0.97	-0.0168 -1.90	0.0220 2.15
August	26	0.0015 0.15	0.0002 0.01	0.0104 1.29	-0.0102 -0.74
September	26	0.0130 1.21	0.0158 1.56	0.0276 3.72	-0.0318 4.15
October	26	-0.0022 0.15	0.0001 0.01	-0.0021 0.20	-0.0008 0.06
November	26	0.0359 4.14	-0.0249 0.83	0.0351 2.24	-0.0224 1.52
December	26	0.0150 4.66	0.0054 1.63	0.0308 2.93	0.0128 1.24

a. Estimated with monthly data from January 1955 to December 1985.

b. Beta coefficients estimated with a value-weighted index of all stocks in the sample.

c. Beta coefficients estimated with an equally-weighted index of all stocks in the sample.

d. Absolute values of t-statistics are below the corresponding average values. Framed coefficients are significantly different from zero at the 0.05 level.

United States (Tinic and West (1984)), Canada (Tinic and Barone-Adesi (1988)) and Europe (Corhay, Hawawini and Michel (1987)). We do not have an explanation of this phenomenon. We should note, however, that it is not the manifestation of the monthly seasonality in the returns of the market indexes. Indeed, the pattern of monthly return seasonality in the market indexes reported in Table 1, does not correspond with the pattern of monthly return seasonality in the systematic risk premium reported in Table 2, although the month of January has the highest estimates in both cases.

3.2 Linearity and the pricing of unsystematic risk

The average values of the estimated coefficients of regression (4) are reported in Table 3 with risk estimated using the value-weighted index. Qualitatively similar results were obtained with the equally-weighted index.

A look at the results reported in Table 3 shows that when unsystematic risk is introduced as an independent variable in the regression, systematic risk (beta) is no longer priced. Over the entire period, neither beta nor unsystematic risk are related to average portfolio returns. But during the months of January and June, portfolios with high levels of unsystematic risk tend to earn higher returns. The opposite occurs during the month of September where the relationship between average portfolio returns and unsystematic is negative.

The results reported in Table 3 provide no support for the CAPM as a predictor of common stock returns on the TSE: systematic risk is not priced, and unsystematic risk is priced during some months of the year. We now turn to the size effect and its implication for equity pricing on the TSE.

TABLE 3

Average values of the Fama-MacBeth estimates of the coefficients of the four-parameter model[a]:

$$R_{pt} = \gamma'_{0t} + \gamma'_{1t}\cdot\beta_{p,t-1} + \gamma_{2t}\cdot\beta^2_{p,t-1} + \gamma_{3t}\cdot\sigma(e)_{p,t-1} + \mu'_{p,t}$$

Average Over	Sample Size	$\bar{\gamma}'_0$ (Intercept)	$\bar{\gamma}'_1$ (Systematic Risk)	$\bar{\gamma}_2$ (Systematic Risk)^2	$\bar{\gamma}_3$ (Unsystematic Risk)
All months	312	0.0078 1.78	-0.0029 0.30	-0.0011 0.23	0.0947 1.56
All months but January	286	[0.0114 2.55][b]	-0.0042 0.43	-0.0002 0.03	0.0017 0.03
January	26	-0.0315 1.75	0.0117 0.31	-0.0110 0.58	[1.1176 4.62]
February	26	0.0037 0.26	-0.0067 0.36	-0.0014 0.17	0.0504 0.337
March	26	[0.0033 2.25]	-0.0066 0.22	0.0062 0.41	-0.1104 0.57
April	26	-0.0123 1.11	0.0206 0.71	-0.0106 0.71	0.0102 0.051
May	26	0.0134 1.29	-0.0087 0.33	0.0084 0.85	-0.2281 1.21
June	26	0.0012 0.07	0.0082 0.228	-0.0104 0.61	[0.3540 2.13]
July	26	0.0087 0.56	-0.0479 1.28	0.0179 0.95	0.2259 1.43
August	26	-0.0096 0.79	0.0156 0.53	-0.0097 0.68	0.1769 0.80
September	26	[0.0371 4.82]	-0.0058 0.23	0.0025 0.18	[-0.4900 3.24]
October	26	0.0004 0.02	0.0274 0.58	0.0118 0.52	0.1914 0.75
November	26	0.0167 0.84	0.0397 0.92	-0.0315 1.48	-0.0694 0.28
December	26	[0.0359 2.40]	-0.0269 1.15	0.0152 1.14	-0.0921 0.53

a. Estimated with monthly data from January 1955 to December 1985 with the independent variables estimated with a value-weighted index of all stocks in the sample.

b. Absolute values of t-statistics are below the corresponding average values. Framed coefficients are significantly different from zero at the 0.05 level.

4. THE SIZE EFFECT AND ITS SEASONAL BEHAVIOR

4.1 Size premia

Is there a size effect on the TSE and is it seasonal? The answer is found in Table 4 where the average values of the estimated coefficients of regression (5) are reported using the value-weighted index. When all months are considered, there is no significant size effect. The month-to-month results, however, reveal another picture. There is a significant size effect during the months of January, June and July but it is strongest during January. For September we have a reverse size effect: large firms outperform their smaller counterparts.

Two observations should be made. First, the absence of a size effect when all months are considered may be due to the fact that our sample tends to be biased toward larger firms. Our largest number of firms is 566 which are concentrated among the top third of all firms listed on the first section of the TSE. Despite this bias toward large firms, we do report a significant January risk premium. Second, note that two of the months where we report a size effect (January and June), are the two months where the unsystematic risk premium is positive, and the month where we report a reverse size effect (September), is the month where the unsystematic risk premium is negative. In other words, unsystematic risk and firm size are inversely correlated (the smaller the firm, the higher its unsystematic risk), and one variable may act as a proxy for the other. Which is a proxy for the other will be examined in section 6.

4.2 Risk-adjusted size premia

The size premia reported in Table 4 do not adjust portfolio returns for differences in systematic risk. This adjustment is done in regression (6)

TABLE 4

Average values of the estimated intercept and slope coefficients of the regression:

$$R_{pt} = \gamma^{s}_{0t} + \gamma_{4t} \cdot \left[\frac{V_p - V_m}{V_m}\right]_{t-1} + \mu^{s}_{p,t} ,$$

where V_p and V_m are the market values of portfolio p and the market, respectively.

Average Over	Sample Size	$\bar{\gamma}^{s}_{0}$ (Intercept)	$\bar{\gamma}_{4}$ (Relative Size)
All months	312	0.0476 1.41	-0.0010 1.16
All months but January	286	-0.0058 0.17	0.0003 0.35
January	26	[0.6359 5.96] [a]	[-0.0160 5.52]
February	26	0.0930 0.98	-0.0024 0.94
March	26	-0.0621 0.52	0.0022 0.69
April	26	-0.0775 0.59	0.0021 0.59
May	26	-0.0846 0.84	0.0024 0.88
June	26	[0.1878 2.13]	[-0.0045 1.98]
July	26	[0.2236 2.54]	[-0.0060 2.52]
August	25	0.0003 0.00	-0.0002 0.05
September	26	[-0.2468 3.17]	[0.0067 3.26]
October	26	-0.0186 0.12	0.0005 0.11
November	26	-0.0645 0.47	0.0021 0.57
December	26	-0.0148 0.16	0.0008 0.31

a. Estimated with monthly data and a value-weighted index from January to December.

b. Absolute values of t-statistics are below the corresponding average values. Framed coefficients are significantly different from zero at the 0.05 level.

whose average estimated coefficients are reported in Table 5. Here, January emerges as the only month of the year where average returns are directly related to systematic risk and inversely related to firm size (we do not report in Table 5 the results for each of the 11 months from February to December because they are all insignificant.)

The above results imply that a high-risk, small-capitalization portfolio will outperform any other portfolio and particularly so during the month of January. Indeed, the results in Table 7 show that the smallest portfolio in our sample with the highest beta (it has a size 5,337 millions of Yens and a beta of 1,648) earned an average monthly return of 11.65% during January over the 26-year period from January 1960 to December 1985. The results reported in Table 7 will be discussed further in Section 7.

5. SEASONALITY, SIZE EFFECT AND EQUITY PRICING ON THE TSE

We have seen that average portfolio returns are directly related to systematic risk and inversely related to size during the month of January only. During the other 11 months of the year, and over the entire sample period, there is no significant relationship between average portfolio returns on one hand and systematic risk and size on the other.

Is this conclusion modified where we introduce unsystematic risk as a variable in the regression? The answer is found in Table 6 where the average values of the coefficients of regression (7) are reported. Again, January emerges as the only month of the year where average portfolio returns are directly related to systematic risk and inversely related to size. Unsystematic risk is no longer priced, and the relationship between average portfolio returns and systematic risk is linear. Note, however, that there is still a pure size effect during the month of July.

TABLE 5

Average values of the estimated intercept and the slope coefficients of the regression:

$$R_{pt} = \gamma''_{0t} + \gamma''_{1t} \cdot \beta_{p,t-1} + \gamma''_{4t} \cdot \left[\frac{V_p - V_m}{V_m}\right]_{t-1} + \mu''_{p,t} ,$$

where V_p and V_m are the market value of portfolio p and the market, respectively.[a]

Average Over	Sample Size	$\bar{\gamma}''_0$ (Intercept)	$\bar{\gamma}''_1$ (Systematic Risk)	$\bar{\gamma}''_4$ (Size)
All months	312	0.0518 1.53	-0.0030 0.99	-0.0011 1.20
All months but January	286	0.0046 0.14	-0.0048 1.52	0.0002 0.17
January	26	**0.5715** **4.87** [b]	**0.0171** **2.01**	**-0.0148** **4.60**

a. Estimated with monthly data from January 1955 to December 1985 with systematic risk (beta coefficient) estimated with a value-weighted index of all stocks in the sample.

b. Absolute values of t-statistics are below the corresponding average values. Framed coefficients are significantly different from zero at the 0.05 level.

TABLE 6

Average values of the estimated intercept and slope coefficients of the regression:

$$R_{pt} = \gamma^*_{0t} + \gamma^*_{1t}\cdot\beta_{p,t-1} + \gamma^*_{2t}\cdot\beta^2_{p,t-1} + \gamma^*_{3t}\cdot\sigma(e)_{p,t-1} + \gamma^*_{4t}\cdot\left[\frac{V_p - V_m}{V_m}\right]_{t-1} + \mu^*_{p,t},$$

where V_p and V_m are the market value of portfolio p and the market, respectively.[a]

Average Over	Sample Size	$\bar{\gamma}^*_0$ (Intercept)	$\bar{\gamma}^*_1$ (Systematic Risk)	$\bar{\gamma}^*_2$ (Systematic Risk)^2	$\bar{\gamma}^*_3$ (Unsystematic Risk)	$\bar{\gamma}^*_4$ (Size)
All months	312	0.0427 0.99	-0.0055 0.61	0.0011 0.25	0.0205 0.33	-0.0008 0.74
All months but January	286	0.0086 0.19	-0.0087 0.94	0.0023 0.50	-0.0112 0.17	0.0001 0.09
January	26	[0.4171 2.89] [b]	[0.0293 2.10]	-0.0122 0.67	0.0369 0.56	[-0.0111 2.95]
February	26	0.1499 0.93	0.0137 0.66	-0.0070 0.74	-0.2521 1.11	-0.0039 0.93
March	26	0.0109 0.09	-0.0055 0.16	0.0051 0.30	-0.0942 0.49	0.0004 0.13
April	26	-0.1819 1.24	-0.0104 0.38	0.0062 0.46	0.3179 2.22	0.0044 1.16
May	26	-0.0945 0.68	-0.0331 1.89	0.0176 1.76	-0.0138 0.08	0.0030 0.86
June	26	0.1512 1.13	0.0087 0.26	-0.0066 0.40	0.0591 0.30	-0.0037 1.09
July	26	[0.3033 2.51]	-0.0361 1.04	0.0202 1.03	-0.1551 0.75	[-0.0073 2.47]
August	26	-0.1547 0.99	0.0046 0.21	-0.0106 0.89	0.2751 1.21	0.0037 0.95
September	26	-0.1298 0.96	-0.0231 0.95	0.0055 0.40	-0.1523 0.94	0.0042 1.27
October	26	0.0207 0.11	-0.0212 0.43	0.0083 0.36	0.1217 0.47	-0.0004 0.08
November	26	-0.1307 0.82	0.0186 0.51	-0.0250 1.25	0.1490 0.54	0.0038 0.91
December	26	0.1477 0.92	-0.0091 0.40	0.0121 0.89	-0.3785 1.51	-0.0032 0.76

a. Estimated with monthly data from January 1955 to December 1985 with the independent variables estimated with a value-weighted index of all stocks in the sample.

b. Absolute values of t-statistics are below the corresponding average values. Framed coefficients are significantly different from zero at the 0.05 level.

What can we conclude from these results? The CAPM is obviously not a valid predictor of common stock returns on the TSE unless we make an adjustment for size and limit ourselves to predicting returns during the month of January. During the other 11 months of the year, the CAPM is not a useful tool to predict common stock returns of the TSE.

6. DO RISK MEASURES EXHIBIT A JANUARY SEASONAL?

The return on common stocks is higher in certain months of the year because their risk may be higher during those months. Also, the seasonal behavior of the risk-return relationship may be partly due to the fact that we do not measure risk during particular months of the year. The results presented in the previous sections are based on measures of risk estimated over a 3-year period. These estimated risk-measures were then regressed against realized returns during particular months of the year. In other words, we explicitly recognize the seasonal behavior of returns but ignore the possibility that risk may also exhibit a monthly seasonal behavior.

In order to find out whether measures of risk display monthly seasonality on the TSE, we estimated the systematic risk of common stocks using only a particular month of the year instead of 36 consecutive months. For example, to estimate the January beta of common stock i we regressed the 31 January returns of that common stock (from January 1955 to January 1985) against the 31 January returns of the value-weighted index. This was done for the subsample of firms for which we had 31 years of consecutive trading. One drawback of this method is that 31 years is too long a period and hence the assumption that a firm's beta is stable over the estimation period may be violated. We have also estimated betas over the 15 most recent years (thus reducing the estimation by half). Reducing the estimation period did not significantly modify the results presented in Table 7.

Table 7 gives several characteristics of 20 portfolios constructed on the basis of size and systematic risk (beta). The securities in our sample were first used to construct 5 size portfolios (group 1 to group 5 in the first column of Table 7). Each size portfolio was then divided into 4 risk portfolios according to their magnitude of beta (see the third column in Table 7). For a given size we have a wide range of portfolio betas from about 0.20 to about 1.70 (see the third column in Table 7). The fifth column in Table 7 gives the estimated January beta for the portfolio. We do not report the estimated betas for the other 11 months of the year but we have found that they are not significantly different from January betas. Also, January betas do not significantly differ from all-month betas. Note that large portfolios tend to have <u>higher</u> January betas than all-month betas, and small portfolios tend to have <u>lower</u> January betas than all-month betas. Turning to the variance of portfolio returns, note that the January variance generally differs from the all-month variance, but the differences are not significant (the statistical tests are not reported in Table 7). It seems that the January seasonal exhibited by common stock returns and estimated risk premia cannot be explained by differences between January risk-measures and all-month risk-measures.

Finally, recall our earlier observation: the small portfolio (5,337 millions of Yens) with the highest beta (1,648) achieved the highest return during the month of January (a <u>monthly</u> return of 11.65%). This relatively large January return cannot be explained by higher January risk for smaller firms. Indeed, the January beta of the small-size, high-risk portfolios is actually <u>smaller</u> than the all-month beta (1.284 compared to 1.648).

TABLE 7

Risk and Return Characteristics of 20 Portfolios Partitioned According to Size (Market Value) and Systematic Risk (Beta): January versus All Months
(January 1955 - December 1985)

Portfolio Size in Million ¥	Number of Stocks in Portfolio	Estimated Systematic Risk (Beta)				Return Variance		Average Monthly Return			
		All Months	t-stat.	January	t-stat.	All Months	January	All Months	t-stat.	January	t-stat.
Group 1											
178735	29	1.692	53.96	1.920	8.11	0.0069	0.0031	2.16%	4.95	5.82%	5.74
174412	29	1.072	46.10	1.453	7.27	0.0029	0.0019	1.36%	4.81	3.52%	4.42
156259	28	0.681	29.47	0.631	2.99	0.0014	0.0010	1.46%	7.42	2.65%	4.66
141787	28	0.260	9.31	0.143	0.76[a]	0.0007	0.0006	1.10%	7.69	1.58%	3.54
Group 2											
48791	29	1.660	38.71	1.655	4.77	0.0073	0.0036	1.98%	4.41	6.97%	6.37
48753	28	1.068	41.01	0.745	4.11	0.0029	0.0009	1.07%	3.73	4.09%	7.60
49791	28	0.673	24.97	0.504	3.03	0.0015	0.0006	1.20%	5.83	2.95%	6.57
48304	28	0.197	5.79	-0.288	1.29[a]	0.0010	0.0009	1.15%	7.00	1.81%	3.36
Group 3											
24655	29	1.713	36.40	1.475	4.32	0.0079	0.0032	1.76%	3.75	8.83%	8.54
24384	28	1.090	31.08	0.933	4.00	0.0035	0.0014	0.97%	7.55	5.14%	7.50
24936	28	0.691	21.52	0.423	2.28	0.0069	0.0007	1.15%	5.15	3.97%	8.37
24560	28	0.198	4.92	-0.034	0.11[a]	0.0029	0.0014	1.02%	5.31	2.79%	4.07
Group 4											
12950	29	1.676	30.73	1.187	3.27	0.0014	0.0030	1.56%	3.25	10.09%	10.08
12611	28	1.096	24.93	0.646	2.36	0.0007	0.0015	0.94%	2.82	6.37%	9.07
12577	28	0.734	17.37	0.294	1.16[a]	0.0073	0.0011	0.87%	3.31	4.66%	7.66
12720	28	0.250	5.15	-0.429	1.60[a]	0.0029	0.0013	1.08%	4.65	2.96%	4.50
Group 5											
5337	29	1.648	24.38	1.284	2.47	0.0015	0.0054	1.20%	2.37	11.65%	7.94
4890	28	1.069	18.88	0.529	1.47[a]	0.0010	0.0023	0.64%	1.94	8.11%	9.26
4944	28	0.711	13.30	0.184	0.61[a]	0.0079	0.0015	0.60%	2.00	5.78%	8.09
4664	29	0.204	3.50	-0.298	1.07[a]	0.0035	0.0013	0.87%	3.19	3.85%	5.77

a. Estimated beta coefficient not significantly different from zero at the 0.05 level.

7. CONCLUDING REMARKS

For this study, we have examined the relationship between the average return and the risk of portfolios of common stocks traded on the TSE. We wanted to find out whether the CAPM is a valid predictor of common stock returns in light of the seasonal and size anomalies. We have shown that the CAPM does not provide a valid framework to predict common stock returns on the TSE, unless we make an adjustment for firms' size and limit ourselves to predicting returns during the month of January. During the other 11 months of the year, the CAPM fails to predict common stock returns on the TSE. Why this is so and are there alternative models to predict common stock returns on the TSE are questions for further research on the pricing of Japanese equity.

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