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The CAPM with Human Capital: Evidence from Japan

by

Ravi Jagannathan, Keiichi Kubota, Hitoshi Takehara

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Ravi Jagannathan
University of Minnesota and
Hong Kong University of Science and Technology

Keiichi Kubota
Musashi University

Hitoshi Takehara
University of Tsukuba

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Abstract

We find that the CAPM beta has little ability to explain the cross section of average returns on Japanese stocks when the TOPIX return is used as the proxy for the return on the aggregate wealth portfolio. The relation between average return and beta is flat, with an R-Square of less than 3%. The empirical performance of the CAPM improves substantially when human capital is also taken into account when measuring the return on the aggregate wealth portfolio -- the R-Square rises to 75%. There is little evidence against the CAPM specification with human capital. It performs almost as well as the linear factor model which uses the TOPIX return and the payoffs on portfolios that capture the size and book to price effects found in the data as the three factors.

1. INTRODUCTION

1. INTRODUCTION

The Sharpe-Lintner-Black Capital Asset Pricing Model[1] (CAPM) is viewed as one of the most important contributions of academic finance to practicing managers. Over the past twenty years a number of empirical studies have examined the CAPM using return data on stocks traded in exchanges in the U.S.A. These studies find that when the return on the value weighted index of stocks is used as a proxy for the return on the market portfolio of all assets in the economy, there is little empirical support for the CAPM.

The reaction to this lack of empirical support for the CAPM has been to focus on alternative asset pricing models. Several asset pricing models have been proposed in the literature. These models can be classified into three classes: (a) linear factor models which owe their origin to Ross (1976); (b) dynamic versions of the CAPM that owe their origin to Merton (1973); and (c) consumption based intertemporal asset pricing models that owe their origin to Breeden (1977) and Lucas[2] (1978). The empirical support for the consumption based models has been equally weak[3]. The support for the linear factor models and the dynamic version of the CAPM has been more promising[4]. The relatively more successful empirical implementations of the dynamic CAPM and the linear factor models use technical or macro-economic variables identified using prior analysis of the data as the state variables or factors. Prominent among this class of models is the three factor model proposed by Fama and French (1993) which uses two technical variables as factors, in addition to the return on the stock index portfolio. The two technical factors were designed by Fama and French (1993) to capture the well documented size and book to price effects found in the data[5].

In contrast, we take the stand that the lack of empirical support for the CAPM may be due to the inappropriateness of the auxiliary assumptions that had been made to facilitate the empirical analysis of the CAPM. In empirical studies of the CAPM it is generally assumed that the return on the aggregate wealth portfolio is a linear function of the return on some portfolio of actively traded stocks. Hence there is some value to examining if the empirical performance of the CAPM can be improved by considering better proxies for the aggregate wealth portfolio. This is the motivation for our study.

Following Mayers (1972), Fama and Schwert (1977) and Jagannathan and Wang (1993), we take the stand that it is important to include human capital when empirically examining the CAPM. The reason we do this is because human capital probably forms over two third of the total wealth in most developed countries in the world. The importance of human capital is also illustrated by the observation that the better educated persons tend to earn relatively more [see Becker[6] (1993)]. We assume that the growth rate in aggregate per capita labor income is a measure of the return on human capital, as in Jagannathan and Wang (1993). The CAPM, with this assumption leads to a two beta model -- one of the betas is computed using the return on the stock index portfolio and the other using the growth rate in aggregate per capita income.

Like all models, the CAPM is also only an approximation to reality. Hence, to examine how well it performs, we need a bench mark to compare its performance against. In view of its recent empirical success, we use the 3 factor linear beta pricing model proposed by Fama and French (1993) as the bench mark. The two technical factors identified by Fama and French (1993) can also be justified on theoretical grounds. However, these theoretical arguments suggest that these two factors may be able to explain the cross section of expected returns on stocks even when the expected return differentials arise for no fundamental reasons and reflect mispricing or fads[7].

In our study we use stock return data for Japan. Our interest in Japan arises from the fact that although the Japanese equity market is second only to the USA in size[8], there has been relatively fewer studies examining the cross section of average returns on Japanese stocks when compared to those that use data for the USA. This is despite the fact that Japan is the second largest economy in the world with a per capita GNP that surpasses that of the USA[9]. Hence, if we were to find empirical support for the CAPM specification with human capital, it would be difficult to attribute the findings to "data snooping"[10].

One of the earliest studies that used Japanese data was by Maru and Yonezawa (1984). They used the Fama and MacBeth (1974) methodology and monthly returns data from 1953 to 1981 for stocks traded in the Tokyo Stock Exchange (TSE). They found that beta as well as idiosyncratic risk mattered in explaining the cross section of average returns on stocks. For smaller firms, idiosyncratic risk was relatively more important, i.e., the data did not support the CAPM. They conjectured that this may be evidence in support of the view that investors, for some reason, were not holding well diversified portfolios. Chan, Hamao and Lakonishok (1991), using data for the period July 1971 to December 1988 found that, in addition to betas, cash flow yield and the ratio of book value to market value of equity were helpful in explaining the cross section of average returns on stocks -- which can be viewed as additional evidence against the CAPM. Kubota and Takehara (1995a) examined the ability of the CAPM to explain the cross section of average returns on 100 portfolios of stocks traded in the first section of the TSE where the portfolios were constructed using the procedure described in Fama and French (1992). Using data for the period 1981-93 they found that the relation between average return and beta is flat -- but Book to Price Ratio and Log Size explained the cross section of average returns rather well.

To summarize, the consensus appears to be that the data do not support the CAPM when the return on the index portfolio of stocks traded in the Tokyo Stock Exchange (TOPIX) is used as the proxy for the return on the aggregate wealth portfolio for Japan. The data appear to favor the linear multi-beta models, which is similar to the findings for the USA. For example, Elton and Gruber (1988) using factor analytic methods found empirical support for a four factor model whereas Sakuraba (1987)[11] found that even seven factors may not be enough to explain the cross section of stock returns. Hamao (1988) used monthly return data on the first section of TSE stocks for the period January 1975 to December 1984 and found that the CAPM beta does not explain what is left unexplained by betas computed with respect to Japanese macro economic variables. Kubota and Takehara (1995b) sort stocks based on size, book to price ratio, leverage and earnings to price ratio. They then form 'factors" that capture these effects by taking the return differential between portfolios in the highest and lowest deciles for each of the four attributes. They find that a linear combination of the book to price factor and the size spread factor betas help in explaining the cross section of average returns across the 100 size-beta sorted portfolios.

As we argued earlier, one interpretation of this lack of empirical support for the CAPM is that the stock index portfolio is probably a poor proxy for the aggregate wealth portfolio. There are some a priori reasons to suspect that this may indeed the case, i.e., the return on the index portfolio of stocks traded in Japan may be a poor proxy for the return on the aggregate wealth portfolio in Japan. For example, the total value of financial assets at the end of 1991 was ¥3,804,276 billion. Of this ¥586,500 billion (15%) was stocks of corporations. Hence, stocks formed less than a fifth of the total value of physical and financial assets. In Japan, larger companies purchased about 70% of their parts from subcontractors (as opposed to the 30% in the USA). These subcontractors typically employ less than 30 employees. [see Hsu (1994)]. Of the total of 55.014 million employed by private establishments in Japan in 1991, 30.317 million (55%) were employed by firms with less than 30 employees. The value of these companies fluctuate relatively more with the business cycle in Japan and they are also more prone to go bankrupt during business downturns.

Jagannathan and Wang (1993) pointed out that human capital forms a substantially large part of the aggregate capital stock, in the USA. This observation is true for Japan as well. Total national income in Japan in 1991 was ¥355,799 billion [see Japan Statistical Year Book, 1993/94]. Of this, ¥251,966 billion (71%) was wages and salaries and ¥43,003 (12%) was property income and ¥60,830 billion (17%) was entrepreneur's income. Dividends income (which is included in property income) amounted to only ¥9,993 billion (3%). These numbers are comparable to the ones for the USA reported in Jagannathan and Wang (1993).

In view of these observations, we assume that the return on the aggregate wealth portfolio is a linear function of the return on the index portfolio of stocks listed in the TSE, and a measure of the return on human capital[12]. With these modifications we find that the CAPM is able to explain the cross section of average returns on TSE stocks about as well as the 3-factor bench mark we use.

The rest of the paper is organized as follows. In Section 2, we describe the econometric specifications and the statistical tests. We describe the data and the empirical results in Section 3 and conclude in Section 4.

2. ECONOMETRIC SPECIFICATIONS

We need the following notation. Let R_{it} denote the month t gross return on any asset i and R_{mt} denote the corresponding gross return on the market portfolio of all assets in the economy. The CAPM is given by:

$$E[R_{it}] = \gamma_0 + \gamma_1 \beta_i \qquad (1)$$

where E[.] denotes the expectation operator. Let Cov[.] denote the covariance operator and Var[.] denote the variance operator, and β_i denotes,

$$\frac{\beta_i = Cov[R_{it}, R_{mt}]}{Var[R_{mt}]} \qquad (2)$$

In the Black (1972) version of the CAPM given in (1) above, the borrowing and lending rates can be different and hence, the zero beta rate, γ_0, will in general be different from the short term interest rate. The slope coefficient, γ_1 represents the expected return on the market portfolio in excess of the zero beta rate, γ_0. Equation (1) forms the basis for our empirical work.

There is one major difficulty in empirically examining the specification given in (1). As Roll (1977) pointed out, the return on the aggregate wealth portfolio of all assets in Japan is not observed by the econometrician. Hence we need to use a proxy for the return on the market portfolio, R_{mt}.

2.1 The proxy for the return on the market portfolio

Following the practice in the USA, empirical studies of the CAPM in Japan typically assume that the return on the value weighted index of stocks traded in the TSE, R_t^s is a reasonable proxy for the return on the market portfolio of all assets in the economy. The implicit assumption is that there are constants a_0 and a_1 such that:

$$R_{mt} = a_0 + a_1 R_t^s \qquad (3)$$

Let *S-beta* be given by, $\beta_i^s = \dfrac{Cov[R_{it}, R_t^s]}{Var[R_t^s]}$. Substituting the expression for R_{mt} into (1) and (2) gives:

$$E[R_{it}] = c_0 + c_s \beta_i^s \qquad (4)$$

The specification in (4) is commonly used in empirical studies of the CAPM. Hence, empirical rejection of the specification in (4) can be viewed as the rejection of either the model given in (1) or the assumption given in (3). In this empirical study we examine whether the latter possibility is more likely.

The total value of corporate stocks at the end of 1991 in Japan was ¥586,500 billion of which ¥365,939 billion was due to stocks listed in the TSE. Hence the total value of TSE stocks formed a major part of the value of stocks as a whole in Japan. However, stocks alone accounted for less than 10% of total financial and tangible assets in Japan at the end of 1991[13]. When we take human capital also into account, stocks form an even smaller fraction of the total wealth.

As we pointed out earlier, labor income is the single largest component of income (about 70%), suggesting that human capital is probably the largest component of the capital stock of Japan. Hence we need to include a measure of the return on human capital while constructing a proxy for the return on the aggregate wealth portfolio[14]. Following Jagannathan and Wang (1993) we assume that the return on human capital is a linear function of the growth rate in per capita labor income, R_t^{labor}, where:

$$R_t^{labor} = \frac{L_t - L_{t-1}}{L_{t-1}},$$

and L_t is *per capita labor income during month t.* A similar specification was considered by Fama and Schwert (1977). Campbell (1993) arrived at a related measure of return on human capital based on some what different arguments. Hence we also consider the specification where the return on the market portfolio of all assets is a linear function of the return on the stock index portfolio and the growth rate in per capita labor income, i.e.,

$$R_{mt} = a_0 + \mathrm{a}_s \mathrm{R}_t^s + \mathrm{a}_{\mathrm{labor}} \mathrm{R}_t^{\mathrm{labor}} \tag{5}$$

Let Labor-beta be given by:

$$\beta_i^{labor} = \frac{Cov[R_{it}, R_t^{labor}]}{Var[R_t^{labor}]}$$

Then equation (5) implies that:

$$\beta_i = b_s \beta_i^s + b_{labor} \beta_i^{labor} \tag{6}$$

for some constants b_s and b_{labor}. Substituting the expression for β_i given in equation (6) into the CAPM relation in equation (1) gives the following CAPM specification in terms of betas computed with respect to observable variables.

$$E[R_{it}] = c_0 + c_s \beta_i^s + c_{labor} \beta_i^{labor} \tag{7}$$

In our empirical work we examine the specification given in equation (7) using (a) the cross sectional regression approach and (b) the generalized method of moments.

2.2 Statistical Tests

According to equation (7) the expected return on every asset, i, is linear function of only S-beta and Labor-beta. One way to examine whether equation (7) describes the cross section of expected returns is to check if there are any residual size effects. The use of relative size of the firm to detect model mis-specification is common in the empirical finance literature. Theoretical justification for such an approach is given in Berk (1992). For this purpose we consider the following empirical specification:

$$E[R_{it}] = c_0 + c_{size} \log(ME_i) + c_s \beta_i^s + c_{labor} \beta_i^{labor} \tag{8}$$

where ME_i denotes the average market value of the equity of firm i and log(.) denotes the natural logarithm. *$Log(ME_i)$* is *measured as deviations from the average value of the corresponding variable in the cross section.* If the CAPM specification given in (7) holds then c_{size} given in (8) should be zero, i.e., whatever cross sectional variation in expected return that is left unexplained by S-beta and Labor-beta should be unrelated to the size variable.

The parameters in (8) can be consistently estimated by the intuitively appealing cross sectional regression method of Black, Jensen and Scholes (1972) and Fama and MacBeth (1973). Notice that the specification in (8) nests the standard version of the CAPM specification given in equation (4). Following Jagannathan and Wang (1993), we use the cross sectional R-Square as an informal measure to compare the different model specifications[15]. We also examine whether (a) the estimated values of the parameter, c_{size}, is different from zero only because of sampling errors, and (b) if the parameter c_{labor} is positive. For this purpose we compute standard errors of the parameters in (8) using the standard Fama-MacBeth procedure as well as the Jagannathan-Wang (1995) method[16]. The latter method corrects for the bias in the Fama-MacBeth procedure that arises due to ignoring the measurement error in estimated betas.

An alternative way to examine whether data support the specification in (7) is to use the Generalized Method of Moments of Hansen (1982). For this purpose, we follow Jagannathan and Wang (1995) and consider the stochastic discount factor representation of the linear beta model given in equation (7)[17]:

$$E[R_{it}(\delta_0 + \delta_s R_t^s + \delta_{labor} R_t^{labor})] = 1, \ i = 1,2 \ldots N \qquad (9)$$

where, δ_0, δ_s, and δ_{labor} are constants given below:

$$\delta_0 = \frac{1}{c_0} + \frac{1}{c_0}\left[\frac{c_s E[R_t^s]}{Var[R_t^s]} + \frac{c_{labor} E[R_t^{labor}]}{Var[R_t^{labor}]}\right]$$

$$\delta_\alpha = -\frac{c_\alpha}{c_0 Var[R_t^\alpha]}, \alpha = s, labor.$$

Equation (9) can be written as $E[R_{it}d_t - \mathbf{1}] = \mathbf{0}$, where d_t is commonly referred to as the stochastic discount factor or pricing kernel, **1** is a N vector of ones and **0** is a N vector of zeros and N is the number of assets available to the econometrician. Let δ denote the K vector of parameters, δ_0, δ_s, and δ_{labor}, with K = 3. Define $w_t(\delta) = \mathbf{R}_t . d_t(\delta) - \mathbf{1}$ where $\mathbf{R}_t$ denotes the N vector of date t returns on the N assets. Then, equation (9) can be written compactly as $E[w_t(\delta)] = 0$. The left side is usually referred to as the vector of model pricing errors and it should equal the right side, the zero vector, if the model is true.

When the parameter vector, δ, as well as the expectations of agents are known we can evaluate the different competing model specifications by the vector of pricing errors. It is more convenient for comparison purposes to convert the vector of pricing errors into a scalar measure, even though some information is lost when a vector is converted into a scalar. For this purpose, we follow Hansen and Singleton (1982) and consider the quadratic form, $E[w_t(\delta)]' A E[w_t(\delta)]$, where A is a positive definite weighting matrix . Since we do not observe $E[w_t(\delta)]$, for any given value for the parameter vector δ, we replace $E[w_t(\delta)]$ by its sample analogue, $w_T(\delta)$, which is the average of $w_t(\delta)$, computed using a time series of length T. We then estimate δ by δ_T that minimizes $T w_T(\delta)]' A E[w_T(\delta)]$.

Hansen (1982) and Hansen and Singleton (1982) suggested using the *optimal* weighting matrix, A $= (Var[w_t(\delta)])^{-1}$. Hansen (1982) showed that when this weighting matrix is used, and the model specification is true, the minimized values of the quadratic form has an asymptotic Chi-Square distribution with N-K degrees of freedom. While the minimized value of this quadratic form can be used to test the null hypothesis that the model is true, it may at times be misleading to compare the minimized value of the quadratic form across models to determine which model performs better. The difficulty arises from the fact that the weighting matrix is model dependent. A model with more "noise" will typically result in a smaller value for the quadratic form and it will indeed be incorrect to conclude that a model performs better only because it has more "noise" and hence there is little evidence against it. Hansen and Jagannathan (1994) suggested using the weighting matrix, $A = E[RR']^{-1}$. Jagannathan and Wang (1993) showed that, when the model is true, the minimized value of the quadratic form with this choice of the weighting matrix is asymptotically distributed as a weighted sum of K Chi-Square (1) random variables.

Fama and French (1993) demonstrated that the book to market and size effects can be captured by two factors which they refer to as the HML and SMB factors. Kubota and Takehara (1995b) constructed similar factors by taking the return differential between (a) TSE stocks in the highest and the lowest book to market price ratio deciles (book to price spread factor -- BSPR for short) and (b) TSE stocks in the largest and the smallest size deciles (size spread factor -- SSPR for short). Kubota and Takehara (1995b) reported that the correlation between these two factors is -0.1009 which is not much different from the correlation of -0.08 between the HML and SMB factors for the USA reported by Fama and French (1993). Let R_t^{bspr} denote the BSPR factor and R_t^{sspr} denote the SSPR factor. Let β_i^{bspr} and β_i^{sspr} denote the corresponding betas for any portfolio, i, i = 1,2...N. We examine whether the three factor (TOPIX, BSPR and SSPR) model is able to explain cross section of expected returns using the GMM, by considering its stochastic discount factor representation given by:

$$E[R_{it}(\delta_0 + \delta_s R_t^s + \delta_{bspr} R_t^{bspr} + \delta_{sspr} R_t^{sspr})] = 1,\ i = 1,2..N \qquad (10)$$

We examine the performance of the three factor model using the cross sectional regression methods, i.e., the specification given by:

$$E[R_{it}] = c_0 + c_s \beta_i^s + c_{bspr} \beta_i^{bspr} + c_{sspr} \beta_i^{sspr} \qquad (11)$$

We also compare the relative performance of our CAPM specification with human capital and the three factor model given above by considering the following specifications which nest the two models.

$$E[R_{it}(\delta_0 + \delta_s R_t^s + \delta_{labor} R_t^{labor} + \delta_{bspr} R_t^{bspr} + \delta_{sspr} R_t^{sspr})] = 1,\ i = 1,2..N$$

$$E[R_{it}] = c_0 + c_s \beta_i^s + c_{labor} \beta_i^{labor} + c_{bspr} \beta_i^{bspr} + c_{sspr} \beta_i^{sspr}$$

If the SSPR and BSPR variables are proxying for the risk associated with labor income, then the p-values associated with the estimates of the coefficients in the above two equations should be larger than that for corresponding coefficients in (10) and (11).

In addition to the size and to book to price spread factors mentioned above, we also consider one additional macro economic factor that has not been considered in the earlier academic literature. Unlike in the USA, firms in Japan subcontract out a relatively larger fraction of the work. In addition to direct subsidiaries which act as subcontractors to parent companies, there is also an informal group of subcontractors called Kyouryokukai (cooperative group). Firms typically have long-run relations with companies included in such a group. These groups (Kyouryokukai) are formed at the branch or factory level of the firm concerned and include all major subcontractors. These firms are typically small and employ between 10 to 50 persons. According to the Japan Statistical Year Book 1993/94 18.671 million of the total

55.014 million persons who worked during 1991 worked for firms with 10 to 49 employees, suggesting that the physical assets as well as human capital of these subcontracting firms when taken together may contribute to a substantial part of the aggregate wealth in Japan. These firms are not publicly traded and hence we do not observe their market value. It appears reasonable to conjecture that betas computed with respect to any measure of the return on the wealth invested in such firms may be an indicator of the level of aggregate risk in an asset. We therefore consider the growth rate in the number of business failures as a possible additional macro economic factor that may explain the cross section of average returns in Japan, and which may serve as another benchmark to compare the performance of our CAPM specification with human capital.

The use of this variable can be justified as follows. Suppose the number of firms in the economy that go bankrupt at date t is given by BN_t. If the average value of a firm that goes bankrupt does not change much, then $BN_t - E_{t-1}[BN_t]$ will provide a measure of the unanticipated amount lost from investments made in the companies that went bankrupt at date t. If the number of bankruptcies is less than expected then the amount lost will be negative (i.e., it will represent a gain). To convert this into a rate of return measure, we need to divide $BN_t - E_{t-1}[BN_t]$ by the wealth invested in these companies at date t-1. Since we do not have observation on the wealth invested in these companies, we arbitrarily chose to divide $BN_t - E_{t-1}[BN_t]$ by $E_{t-1}[BN_t]$. This standardization is likely to convert $BN_t - E_{t-1}[BN_t]$ into a stationary series. To the extent there $E_{t-1}[BN_t]$ is correlated with the wealth invested at date t-1 in these firms, $(BN_t - E_{t-1}[BN_t])/E_{t-1}[BN_t]$ is likely to contain information about the rate of return on assets employed by these firms. We therefore consider the following additional factor:

$$R_t^{bkr} = \frac{BN_t - E_{t-1}[BN_t]}{E_{t-1}[BN_t]}.$$

Smaller firms that act as subcontractors to larger firms are more likely to go bankrupt than larger firms and their subsidiaries. Whereas parent companies typically help out direct subsidiaries to which they subcontract work, this is not the case with members of the Kyouryokukai. During business downturns, the smallest companies that are not members of the Kyouryokukai go under first, followed by members of the Kyouruokukai[18]. Hence the bankruptcy variable we defined above is likely to capture the return on the assets employed by relatively small firms that act as subcontractors to larger companies whose shares trade in the TSE. Since this variable is likely to be correlated with the financial risk of firms, it is also likely to proxy for the forecastable part of the expected returns on stocks and bonds of TSE firms.

We therefore consider the following additional cross sectional regression and stochastic discount factor specifications:

$$E[R_{it}] = c_0 + c_{size}\log(ME_i) + c_s\beta_i^s + c_{bkr}\beta_i^{bkr} + c_{labor}\beta_i^{labor}$$

$$E[R_{it}(\delta_0 + \delta_s R_t^s + \delta_{bkr}R_t^{bkr} + \delta_{labor}R_t^{labor})] = 1, \text{ i } = 1,2\ldots N$$

3. EMPIRICAL RESULTS

3.1 Description of the Data

We use monthly returns on manufacturing and nonmanufacturing firms listed in the First Section of the TSE for the period September 1981 to June 1993 . We consider two sets of portfolios of stocks. In the first set, firms are first sorted into 10 size deciles based on the market value of their equity and next into 10 book value to market value of equity ratio (BPR) deciles. In order to keep the dimensionality of the estimation problem reasonable, we pick the 25 portfolios that belong to size and BPR deciles 1, 3, 5, 7 and 10. Each portfolio formation year begins in September. For each portfolio formation year, firms are assigned to one of the 25 portfolios based on information that was available as of the beginning of September of the previous year. For example, book value to market value ratios are computed based on book value at the end of the fiscal year that ended on or before the 31st of March and market values were based on the prices of shares at the end of August of the year. Portfolio returns are obtained by equally weighting the return on all stocks that are assigned to a particular portfolio for that month. This gives a time series of monthly return on 25 portfolios with portfolio composition changing once every year. The second set of portfolios are obtained in a similar way but by first sorting stocks into six size classes and then into six historical beta classes. Historical betas are estimated using time series data for the immediately preceding 36 months. This gives a time series of monthly returns on 36 portfolios where the portfolio composition is changed once a year.

The accounting variables for firms are from the Nikkei NEEDS (PORTFOLIO) data base supplied by the Nihon Keizai Shinbun Inc (Economic Information Department, Data Bank Bureau). Unlike the COMPUSTAT, this data base has no survivorship bias. The return data for the period 1978 to 1989 are from the Japan Securities Research Institute monthly stock return tape. For the period 1990 onwards the return data is from Nikkei NEEDS data service. Nikkei provides on-line data service and the return data were updated once every month on a continuing basis by Mitsubishi Trust and Banking Co. We obtained the data from Mitsubishi Trust Company for use in this research study. The data included returns on TSE firms that were delisted. Hence there is no survivorship bias in this data set either. The number of firms in the intersection of the two data bases varies from 792 in 1981 to 1023 in 1993. This gives us a time series of 142 monthly returns for each set of portfolios.

The number of bankruptcies (business failures) is released by Tokyo Shookoo Research Ltd. The data goes back to January 1955. It covers firms with a total asset value of more than ¥10 million. The data is released once every month with a delay of not more than 2 weeks. Since the number of bankruptcies has a strong yearly seasonal pattern, we define the percentage growth rate in bankruptcy as:

$$R_t^{bkr} = \frac{BN_t - BN_{t-12}}{BN_{t-12}} \times 100$$

There is also the question as to when this information gets impounded in stock prices. If financial markets are informationally efficient in the strong form, then stock prices will reflect this information at the time the bankruptcies occur. We take the stand that financial markets are semi-strong form efficient, and hence assume that the information in g_t is reflected in stock prices at date t+1. We therefore match the return, R_{it} on security i with R_{t-1}^{bkr} while computing the β_i^{bkr} of asset i.

Labor income data is from the monthly survey, MOL. The data series starts in January 1970 and normalized in such a way that the average value for 1990 is 100. The survey covers organizations employing 30 persons or more. It is rather difficult to pin down when the data is available to investors. There are over 10 kinds of labor income indices. Nikkei provides a "prompt" report on a couple of these indices with about a month of reporting delay. The regular reports follow with a 2 month lag -- i.e., data for December is typically reported in February. As before, let L_t denote *per capita* labor income for month t. Following Jagannathan and Wang (1993 and 1995) we define the percentage growth rate in labor income as:

$$R_t^{labor} = \frac{\frac{1}{2}(L_t + L_{t-1}) - \frac{1}{2}(L_{t-1} + L_{t-2})}{\frac{1}{2}(L_{t-1} + L_{t-2})} \times 100$$

As before, we assume that financial markets are only semi-strong efficient and hence the information in R_t^{labor} is fully reflected in prices of securities only at date t+2. We therefore match R_{it} with R_{t-2}^{labor} while computing β_i^{labor}.

Table 1 gives the summary statistics for the monthly rates of return on TOPIX, SSPR, BSPR, the growth rate in the number of bankruptcies, and the growth rate in per capita labor income. The average percentage change in the number of bankruptcies, R_t^{bkr}, is 1.22 with a standard deviation of 7.00. Figure 1 gives a plot of the time series of values for R_t^{bkr}. There is a large shock during the 1990-91 period -- otherwise the series appears to be stationary, possibly an AR(1) process. The percentage change in per capita labor income, R_t^{labor}, has a mean of 0.25 and a standard deviation of 0.43. In contrast to these variables, the stock index (TOPIX) return series exhibits hardly any serial correlation.

Table 2 summarizes the characteristics of the 25 size-BPR sorted portfolios. The average return on these portfolios vary from a low of 0.14% to 2.33% per month. The book to price ratio varies from a low of 5.83% to a high of 74.26%. It is interesting to note that all the 25 average book to price ratios are less than 100%. In contrast, the book to price ratios for the 25 USA stock portfolios considered by Fama and French (1993) varies from a low of 29% to a high of 180%. The earnings to price ratios vary from a low of 1.91% to 8.45% -- in contrast, the corresponding numbers for the 25 US portfolios studied by Fama and French (1993) are 2.42% and 13.92%. These differences are to be expected since the US interest rates were higher than Japanese interest rates during this period. The portfolio S-betas do not exhibit much dispersion -- they vary from a low of 0.77 to a high of 1.03. Firms with high BPR tend to have lower leverage and lower S-beta in this sample. Labor betas vary from a low of -0.2.421 to a high of 1.787. Larger firms have a negative labor beta whereas smaller firms have a positive labor beta. As is to be expected, all the BKR-betas are negative. They range from a low of -0.0593 to a high of -0.0133. The bankruptcy variable, R_t^{bkr}, is substantially more volatile than the monthly return series and this results in a relatively small absolute value for BKR-betas. However, the cross sectional variation in BKR-betas is comparable in magnitude to the cross sectional variation in other attributes.

Table 3 summarizes the characteristics of the 36 size-beta sorted portfolios. The average monthly returns exhibit a some what smaller dispersion when compared to the 25 size-BPR sorted portfolios. They vary from a low of 0.48% to a high of 2.20%. The book to price ratios do not show much dispersion -- they vary from a low of 28.37% to a high of 42.94% only. The dispersion in earnings to price ratios is also smaller when compared to the 25 size-BPR sorted portfolios. However, the S-betas of the portfolios vary from a low of 0.66 to a high of 1.12 -- a some what larger dispersion than that for the 25 portfolios. As in the case of the 25 size-BKR sorted portfolios, all the BKR-betas are negative, but they show a somewhat larger dispersion. The largest value is -0.0134 and the smallest value is -0.0640. Low S-beta firms irrespective of whether they are large or small, tend to have smaller (larger in absolute value) BKR-betas. Labor betas are negative except for firms in the smallest size class. Smaller firms tend to have larger labor betas, indicating that they are more prone to Labor risk.

3.2 Empirical Results

Tables 4 and 5 give the results for the 25 Size-BPR sorted portfolios. As can be seen from panel A of Table 4, the standard CAPM (with the stock index portfolio as the market proxy) does rather poorly. The relation between average return and S-beta is flat. The R-Square is 2.78 percent which is not different from zero after taking sampling errors into account. When log(ME) is also included in the cross sectional regressions, the R-Square rises to 55 percent. These result are similar to those reported by Fama and French (1992) and Jagannathan and Wang (1993) for the USA.

Including a measure of the return on human capital, R^{labor}, improves the performance of the CAPM remarkably, as can be seen from panel B of Table 4. The R-Square goes up to 75.5 percent. The slope coefficient for Labor is positive as predicted by theory and is statistically significantly different from zero. There is no evidence against this CAPM specification using the GMM test with the standard or the HJ weighting matrix. However, the slope coefficient corresponding the S-beta remains negative, although not statistically significantly different from zero. If we take this model at face value then stocks, save those in the smallest size decile, provide a good hedge against erosion in the value of human capital (see Tables 2 and 3).

Panel C of Table 4 gives the result for the linear factor specification with stock index portfolio return and BKR as the two factors. This specification does almost as well as the model with Labor. The R-Square is 75.2 percent. The slope coefficient corresponding to BKR is negative, as predicted by theory and statistically different from zero. As in the case of the model with Labor, the slope coefficient for S-beta remains negative. The GMM-Dist and HJ-Dist measures for this specification are larger and to that extent the data is less favorable to this specification when compared to the CAPM specification with human capital. When both variables are included, the data tends to favor Labor over BKR (see panel D).

The corresponding results for the linear factor models with the stock index portfolio return plus either the BSPR or the SSPR factors are given in Table 5. The R-Square for the linear factor model with the stock index portfolio and BSPR variable is 60 percent. Unlike in the case of the specifications with Labor or BKR, the slope coefficient becomes positive and is different from zero even after taking sampling errors into account. In a way this suggests that the BSPR variable may be capturing some thing that is missing in the CAPM that is not captured by the Labor variable. Also, the GMM-Dist and the HJ-Dist measures are lower for the S-beta plus BSPR-beta specification than for any of the other specifications. The R-Square for the S-beta plus SSPR-beta model is 59 percent -- not much different than that for the S-beta plus BSPR-beta model. However the GMM-Dist and HJ-Dist measures are larger. The slope coefficient corresponding to S-beta remains negative as with the Labor or BKR specification.

Panel C gives the results for the model with both BSPR-beta and SSPR-beta (in addition to S-beta). The R-Square goes up to 88.4 percent. The coefficient corresponding to SSPR-beta is not significant at the conventional levels indicating that both variables are capturing to some extent the same aspect of reality that is missing in the standard CAPM specification. Panel D give the results for the case when Labor, BSPR and as well as SSPR are included at the same time. The R-Square does not change much but the p-value for SSPR goes up from 8.67 percent to 21.8 percent. Including the Labor-beta when the other three variables are already present does not change the R-Square either, but increases the p-values of both BSPR and SSPR, suggesting that all three variables, SSPR, BSPR as well as BKR may be proxying for Labor. The slope coefficient corresponding to BSPR-beta remains significant at the 1 percent level, once again confirming the view that it may be capturing an aspect of reality that is probably not captured by Labor or SSPR in this data set.

Tables 6 and 7 give the results for the 36 Size-Beta sorted portfolios. The standard CAPM specification has an R-Square of 2.39 percent -- the relation between average return and S-beta is once again flat. When log(ME) is also included in the cross sectional regressions, the R-Square rises to 70 percent -- a much larger number when compared to corresponding number for the 25 Size-BPR sorted portfolios. There is no evidence against the CAPM specification with human capital (Labor). The R-Square goes up to 76 percent, and the slope coefficient corresponding to labor is positive as predicted by theory. The slope coefficient for S-beta is also positive -- though not statistically different from zero after taking sampling errors into account. The linear factor model with S-Beta and BKR-beta has an R-Square of 74 percent -- not much different from the CAPM specification with Labor. However, when both Labor as well as BKR betas are included the slope coefficient corresponding to BKR-beta is not statistically significant at the conventional levels. Log(ME) has no residual explanatory power either. There is also not much evidence against the CAPM specification with Labor using the GMM test statistics. When both Labor and BKR are included, the results favor Labor.

Unlike in the case of the 25 Size-BPR sorted portfolios, BSPR-beta has little ability to explain the cross section of average returns in the 36 Size-Beta sorted portfolios. The R-Square goes up to 17 percent.

However, this specification performs almost as well as the CAPM specification with Labor or the linear factor model with BKR using the GMM-Dist and the HJ-Dist measures. Hence this specification can explain the features that are most anomalous from the point of the standard CAPM about as well as the other specifications -- although, it does rather poorly on average. The R-Square for the specification with SSPR is 75.4 percent -- not much different from that for the model with Labor. There is evidence against the specification using HJ-Dist even though the HJ-Dist itself is smaller than that for Labor. This suggests that we are probably measuring everything more precisely when SSPR is included. When both BSPR as well as SSPR are included, the coefficient corresponding to BSPR-beta is not different from zero at conventional significance levels. When Labor, SSPR as well as BSPR betas are included in the specification at the same time, only the slope coefficient corresponding to Labor is marginally significant in the cross sectional regressions. However, in the GMM tests with the standard weighting matrix or HJ weighting matrix, the coefficient corresponding to the SSPR factor is the most significant. In this data set, when all the four additional betas are included, the slope coefficients corresponding to Labor-beta and S-beta are the most statistically significant ones in the cross sectional regressions. However, once again, the results using the GMM method are mixed. While the results for the HJ weighting matrix are similar to those obtained using the cross sectional regressions, the results when the standard weighting matrix is used favor the SSPR and BKR factors.

4. CONCLUSIONS

The CAPM is a theoretically attractive model. However, the empirical support for the CAPM is rather weak. This has resulted in a variety of multifactor models being considered. The prominent among the multifactor models are those that use variables that are related to firm size and book to price ratios. The use of firm size and book to price ratios has some theoretical support. Berk (1992) showed that these variables will be able to explain the cross sectional variation in expected returns even when these expected return differentials are not related to economic fundamentals and arise due to fads. In view of this, it is of interest to find out whether the observed average return differentials across different assets are related to perceived differences in the risk characteristics of these assets.

Empirical studies of the CAPM use the stock index return as the proxy for the return on the market portfolio of all assets in the economy. Mayers (1972) argued that it is important to take human capital also into account while studying the CAPM. Jagannathan and Wang (1995) found some empirical support for the CAPM with human capital using stock return data for the USA. In this study, we follow Mayers (1972) and Jagannathan and Wang (1995) and assume that the return to aggregate wealth is a linear function of the return on the stock index portfolio and the growth rate in aggregate per capita income. Our objective is to examine whether the size and book to price effects are proxying for the risk in the return on human capital that has been omitted from consideration in earlier studies of the CAPM.

Our objective in this study is to use a data set that is less subject to the data snooping bias pointed out by Lo and MacKinlay (1990). Hence we chose to use the stock return data for Japan. While the Japanese economy is second only to the USA in size, with a per capita GNP that surpasses that of the USA, there have been relatively fewer studies of the Japanese capital markets. Hence if we were to find support for the CAPM with human capital using this data set, our findings are less likely to be due to the data snooping bias.

We examined the empirical performance of the CAPM using monthly returns on stocks traded in the First Section of the Tokyo Stock Exchange for the period September 1982 to June 1993. We find that there is little empirical support for the standard CAPM, which assumes that the index portfolio of stocks traded in the Tokyo Stock Exchange is a reasonable proxy for the market portfolio of all relevant wealth. The relation between average return on stocks and betas is flat -- which is similar to the results reported in the literature by studies that use data for the USA. We also find that log size as well as the size and book to price factors similar to the ones identified by Fama and French (1993) are able to explain the cross section of average returns on Japanese stocks also rather well.

However, the CAPM specification with human capital performs almost as well. Including Labor-beta in the standard CAPM specification substantially improves the performance of the CAPM. There is little empirical evidence against the CAPM with this modification. The three factor linear beta pricing model with stock index beta, size-spread factor beta, and the book-to-price-spread factor beta also performs well in the two data sets we considered. It appears that the size-spread factor beta may be proxying for the risk associated with the return on human capital as measured by our Labor-beta variable. However, the book-to-price-spread factor may be proxying for some aspect of reality not entirely captured by our Labor variable.

In our work we also considered a new measure of aggregate risk in the economy -- the aggregate percentage change in the number of business bankruptcies, BKR. We found that the beta computed with respect to this variable is also able to explain the cross section of average return on stocks.

Our empirical work is in the spirit of most of the empirical work in this area that examine the ability of linear factor models to explain the cross section of average return on various assets. However, in order to convincingly argue that the cross sectional variations in average returns that we observed are related to economic fundamentals, we need to relate the observed risk premium for the various measures of aggregate risk in a quantitative way to the risk-preferences of agents and the underlying technological shocks that affect the real side of the economy. For this we need a model that facilitates measuring the return on human capital in a better way. We intend focusing on this issue in our future work.

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TABLE 1

Summary Statistics for the Factors

The data consists of 142 monthly observations for the period September 1981 to June 1993. TOPIX represents the value weighted index of stocks traded in the Tokyo Stock Exchange (TSE), First Section. S-SPR represents the return spread between the TSE First Section stocks in the smallest size decile and the largest size decile. B-SPR represents the return spread between TSE First Section stocks in the lowest Book to Price Ratio decile and the highest Book to Price Ratio decile. BKR denotes the percentage change in the number of business failures reported in month t when compared to month t-12. LABOR denotes the percentage growth rate in two month moving average of per capita income in Japan.

	TOPIX	S- SPR.	B-SPR.	BKR	LABOR
Average	0.78%	1.40%	-1.24%	1.22%	0.25%
Std.Dev	5.97%	6.56%	3.89%	7.00%	0.43%
Lag		**Auto-Correlation**			
1	0.00	0.09	0.13	0.96	0.21
2	0.04	-0.18	0.14	0.93	-0.40
3	0.01	-0.02	0.00	0.90	-0.23
4	-0.03	0.03	-0.09	0.86	-0.09
5	0.12	0.05	0.08	0.82	0.08
6	-0.05	-0.05	-0.04	0.76	0.11
7	-0.02	0.03	0.11	0.70	0.08
8	0.03	-0.01	-0.09	0.63	-0.07
9	0.05	0.06	-0.02	0.56	-0.19
10	0.08	-0.17	-0.08	0.49	-0.34
11	0.01	-0.08	-0.19	0.42	0.15
12	0.01	0.15	0.08	0.35	0.80

TABLE 2
Characteristics of the 25 Size-BPR Sorted Portfolios

Average Monthly Return

	Low	3	5	7	High
Small	1.62	1.75	2.23	2.33	2.21
3	0.87	1.46	1.51	1.67	1.81
5	0.19	0.82	1.48	1.11	1.43
	0.68	1.02	1.13	1.17	1.39
Large	0.14	0.63	0.78	0.84	1.25

Standard Deviation of Monthly Return

	Low	3	5	7	High
Small	9.28	8.81	9.00	8.56	8.07
3	7.53	7.54	7.74	7.47	6.80
5	7.42	7.02	6.89	6.36	6.64
7	7.29	6.58	6.38	6.15	5.95
Large	6.48	6.47	6.33	5.66	5.95

Sample Average of Ln(Market Value)

	Low	3	5	7	High
Small	8.98	9.07	9.09	9.13	9.11
3	9.89	9.94	9.96	9.95	9.94
5	10.49	10.56	10.62	10.57	10.59
7	11.29	11.32	11.36	11.34	11.32
Large	12.81	12.89	12.94	12.79	12.95

Sample Average of B/P (in Percent)

	Low	3	5	7	High
Small	5.83	25.43	35.54	49.25	74.26
3	12.98	28.60	37.64	49.43	74.05
5	14.21	28.30	37.47	48.10	73.20
7	14.66	28.79	37.98	47.20	66.51
Large	11.83	24.15	30.97	39.99	58.88

Sample Average of E/P (in Percent)

	Low	3	5	7	High
Small	1.91	3.98	4.07	6.77	5.89
3	3.52	4.30	5.42	5.75	7.27
5	3.36	4.59	5.32	5.79	6.77
7	3.34	5.08	5.42	6.75	8.45
Large	3.70	4.73	5.85	6.50	7.94

Sample Average of D/P (in Percent)

	Low	3	5	7	High
Small	0.12	0.62	0.72	1.14	1.29
3	0.41	0.77	1.04	1.06	1.26
5	0.42	0.85	1.06	1.21	1.19
7	0.49	0.92	0.98	1.18	1.30
Large	0.44	0.78	0.98	1.15	2.11

Sample Average of Leverage Ratio (in Percent)

	Low	3	5	7	High
Small	86.18	80.15	73.86	67.32	58.58
3	79.45	69.98	65.64	56.55	54.81
5	77.82	65.56	60.97	56.78	52.08
7	68.94	66.12	63.42	55.98	51.66
Large	64.68	63.12	62.56	62.52	61.66

S-Beta

	Low	3	5	7	High
mall	0.98	1.01	0.95	0.93	0.78
3	0.87	0.93	0.86	0.85	0.77
5	0.93	0.92	0.90	0.78	0.81
7	1.03	0.96	0.90	0.86	0.79
Large	0.84	0.99	0.97	0.84	0.77

Labor Beta

	Low	3	5	7	High
mall	0.506	1.1901	0.0948	1.787	0.924
3	-1.420	0.0771	0.1491	-0.586	-0.418
5	-1.907	-0.7799	-0.8687	-0.519	-0.773
7	-0.649	-1.4736	-0.6356	-1.011	-1.651
Large	-2.421	-1.6686	-1.3827	-1.697	-0.235

BKR Beta

	Low	3	5	7	High
mall	-0.0549	-0.0477	-0.0524	-0.0518	-0.0593
3	-0.0207	-0.0410	-0.0381	-0.0508	-0.0457
5	-0.0153	-0.0439	-0.0384	-0.0377	-0.0376
7	-0.0291	-0.0206	-0.0316	-0.0300	-0.0274
Large	-0.0157	-0.0177	-0.0133	-0.0193	-0.0310

SSPR-Beta

	Low	3	5	7	High
Small	0.97060	0.8708	0.953	0.846	0.8148
3	0.59249	0.6408	0.628	0.653	0.5717
5	0.41356	0.4877	0.455	0.499	0.4316
7	0.28266	0.2836	0.322	0.274	0.2796
Large	-0.00688	-0.0641	-0.118	-0.136	-0.0355

BSPR-Beta

	Low	3	5	7	High
Small	0.554	0.366	0.242	0.0739	-0.2120
3	0.693	0.364	0.193	0.1563	-0.0408
5	0.827	0.429	0.292	0.0327	-0.1233
7	0.629	0.411	0.194	0.2187	-0.1123
Large	0.874	0.594	0.390	0.2876	-0.1223

TABLE 3
Characteristics of the 36 Size-Beta Sorted Portfolios

Average Monthly Return

	Low	2	3	4	5	High
Small	2.00	1.92	2.20	2.00	1.79	1.85
2	1.13	1.64	1.37	1.53	1.44	1.70
3	0.75	1.21	1.14	1.24	1.33	1.10
4	1.04	1.18	1.23	1.02	0.82	0.86
5	1.07	0.91	0.91	1.02	0.92	0.95
Large	1.08	0.92	0.97	0.60	0.65	0.48

Standard Deviation of Monthly Return

	Low	2	3	4	5	High
Small	7.61	7.63	7.85	8.09	8.16	8.48
2	6.24	7.11	6.58	7.18	7.71	8.03
3	6.06	6.50	6.48	6.79	7.21	7.29
4	6.30	6.31	6.45	6.88	7.11	7.64
5	6.41	6.17	5.88	6.17	6.65	7.59
Large	5.89	5.80	5.77	6.25	6.79	7.34

Sample Average of Ln(Market Value)

	Low	2	3	4	5	High
Small	9.19	9.24	9.23	9.22	9.22	9.26
2	9.82	9.85	9.85	9.86	9.86	9.87
3	10.30	10.33	10.31	10.33	10.33	10.32
4	10.82	10.85	10.84	10.84	10.83	10.83
5	11.42	11.40	11.43	11.47	11.47	11.46
Large	12.50	12.55	12.52	12.53	12.68	12.68

Sample Average of B/P (in Percent)

	Low	2	3	4	5	High
Small	37.79	39.32	40.41	37.42	37.40	35.31
2	36.97	40.27	42.94	41.54	40.88	35.97
3	39.68	41.55	40.37	40.59	39.22	34.17
4	37.44	42.37	41.85	40.02	38.64	33.91
5	35.92	40.15	39.79	38.68	37.14	33.88
Large	35.24	37.35	33.08	31.39	30.77	28.37

Sample Average of E/P (in Percent)

	Low	2	3	4	5	High
Small	4.15	4.68	5.20	4.67	4.65	4.48
2	4.94	5.34	5.77	5.63	5.51	4.62
3	4.66	5.54	5.30	5.43	5.69	5.06
4	5.39	5.74	5.66	5.29	5.49	5.34
5	6.41	5.88	6.29	6.07	5.87	5.63
Large	5.99	6.84	5.73	5.33	5.09	5.18

Sample Average of D/P (in Percent)

	Low	2	3	4	5	High
Small	0.67	0.82	0.89	0.85	0.89	0.79
2	0.87	0.93	1.00	1.04	0.99	0.86
3	0.82	1.00	1.01	1.03	0.96	0.89
4	0.91	1.07	1.07	0.97	0.97	0.91
5	0.91	1.05	1.01	0.97	0.97	0.85
Large	1.06	1.29	1.00	0.97	0.98	0.83

Sample Average of Leverage Ratio (in Percent)

	Low	2	3	4	5	High
Small	71.46	70.73	70.72	71.57	71.15	71.53
2	65.58	65.28	63.45	63.96	66.72	66.54
3	64.36	62.30	64.16	64.38	62.45	65.52
4	63.18	60.49	61.44	60.38	62.79	64.31
5	60.45	58.85	58.55	58.76	60.31	65.43
Large	56.93	59.94	61.11	63.36	65.73	67.46

S-Beta

	Low	2	3	4	5	High
Small	0.78	0.87	0.94	0.91	0.95	0.98
2	0.66	0.84	0.86	0.89	0.98	0.91
3	0.66	0.83	0.82	0.90	0.94	0.93
4	0.78	0.89	0.89	0.97	1.01	1.07
5	0.86	0.86	0.88	0.92	0.97	1.12
Large	0.72	0.83	0.90	1.00	1.06	1.05

Labor-Beta

	Low	2	3	4	5	High
Small	1.2895	0.422	0.218	0.201	0.486	0.121
2	-0.1898	-0.266	-0.133	-0.217	-0.305	-0.799
3	-0.4017	-0.615	-0.517	-0.748	-1.289	-1.951
4	-0.4142	-1.116	-1.195	-1.750	-1.728	-1.747
5	-0.2319	-1.059	-1.085	-1.507	-2.312	-2.042
Large	-0.0885	-1.051	-1.533	-1.638	-2.416	-2.491

BKR-Beta

	Low	2	3	4	5	High
Small	-0.0640	-0.0619	-0.0580	-0.0368	-0.0475	-0.0484
2	-0.0392	-0.0526	-0.0370	-0.0403	-0.0340	-0.0331
3	-0.0433	-0.0349	-0.0344	-0.0372	-0.0332	-0.0326
4	-0.0382	-0.0331	-0.0315	-0.0333	-0.0312	-0.0186
5	-0.0384	-0.0268	-0.0272	-0.0256	-0.0186	-0.0220
Large	-0.0345	-0.0251	-0.0169	-0.0152	-0.0163	-0.0134

SSPR-Beta

	Low	2	3	4	5	High
Small	0.8555	0.8072	0.79329	0.882	0.8533	0.852
2	0.6206	0.7024	0.57120	0.629	0.6668	0.614
3	0.5483	0.5252	0.55925	0.556	0.5351	0.461
4	0.4027	0.4098	0.44748	0.400	0.3918	0.344
5	0.3339	0.2799	0.25532	0.255	0.2245	0.204
Large	0.0319	0.0705	0.00452	-0.041	-0.0876	-0.134

BSPR-Beta

	Low	2	3	4	5	High
Small	0.13993	0.1722	0.109	0.260	0.254	0.416
2	0.06753	0.0492	0.236	0.261	0.375	0.535
3	0.08428	0.0236	0.101	0.330	0.354	0.521
4	-0.00776	0.2588	0.189	0.365	0.469	0.666
5	0.01171	0.0621	0.251	0.353	0.486	0.745
Large	-0.08555	0.0902	0.302	0.602	0.633	0.888

TABLE 4

Comparing the Performance of the Three CAPM Specifications using the 25 Size-BPR sorted portfolio returns

This table gives the estimated values of the parameters in the cross sectional regression model,

$$E[R_{it}] = c_0 + c_{size}\log(ME_i) + c_s\beta_i^s + c_{bkr}\beta_i^{bkr} + c_{labor}\beta_i^{labor}$$

and the stochastic discount factor model for moments,

$$E[R_{it}(\delta_0 + \delta_s R_t^s + \delta_{bkr} R_t^{bkr} + \delta_{labor} R_t^{labor})] = 1,\ \mathrm{i} = 1,2..25$$

, where R_{it} denotes the return on portfolio i, R_t^s denotes the month t return on TOPIX, R_t^{bkr} denotes the growth rate in the number of business failures lagged by one month, R_t^{labor} denotes the growth rate in per capita labor income lagged by 2 months. Betas represent the slope coefficient in the univariate regression of R_{it} on the relevant variable. The cross sectional regression model parameters are estimated using the Fama-MacBeth procedure. The corrected t-values and p-values are computed using the procedure described in Jagannathan and Wang (1995). The stochastic discount factor models for moments are estimated using Hansen's (1982) generalized method of moments. GMM refers to the use of the optimal weighting matrix described in Hansen (1982) and HJ refers to the use of the inverse of the second moment matrix of returns as the weighting matrix. Dist refers to the minimized value of the criterion function. We use 142 monthly observations from September 1982 to June 1993.

Table 4, Panel A

Coefficient	c_0	c_s	c_{bkr}	c_{labor}	c_{size}	%R-Square
Estimate	2.46	-1.28				2.78
t-value	2.61	-1.10				
%p-value	0.91	27.10				
Corrected t-value	2.55	-1.08				
Corrected p-value	1.08	28.00				
Estimate	6.46	-1.73			-0.32	54.70
t-value	3.33	-1.51			-2.44	
%p-value	0.09	13.20			1.46	
corrected t-value	3.19	-1.46			-2.35	
corrected p-value	0.14	14.50			1.89	
Coefficient	δ_0	δ_s	δ_{bkr}	δ_{labor}		**GMM-Dist**
Estimate	0.99	-0.04				0.466
t-value	36.27	-0.17				
%p-value	0.00	98.68				9.85
Coefficient	δ_0	δ_s	δ_{bkr}	δ_{labor}		**HJ-Dist**
Estimate	0.99	-0.04				0.521
t-value	36.27	-0.16				
%p-value	0.00	98.73				1.32

Table 4, Panel B

Coefficient	c_0	c_s	c_{bkr}	c_{labor}	c_{size}	%R-Square
Estimate	0.59	-0.65	-37.74			75.20
t-value	0.57	-0.54	-3.24			
%p-value	57.20	59.00	0.12			
Corrected t-value	0.33	-0.32	-1.92			
Corrected p-value	74.10	75.30	5.51			
Estimate	1.10	-0.73	-35.20		-0.31	75.30
t-value	0.52	-0.66	-3.69		-0.22	
%p-value	60.10	51.00	0.03		82.77	
corrected t-value	0.32	-0.40	-2.29		-0.13	
corrected p-value	75.00	68.90	0.02		89.43	
Coefficient	δ_0	δ_s	δ_{bkr}	δ_{labor}		**GMM-Dist**
Estimate	0.98	-0.50	2.69			0.400
t-value	16.72	-0.19	2.73			
%p-value	0.00	85.10	0.64			36.60
Coefficient	δ_0	δ_s	δ_{bkr}	δ_{labor}		**HJ-Dist**
Estimate	0.97	-0.97	2.93			0.461
t-value	14.36	-0.37	2.76			
%p-value	0.00	75.90	0.58			34.00

Table 4, Panel C

Coefficient	c_0	c_s	c_{bkr}	c_{labor}	c_{size}	%R-Square
Estimate	3.38	-1.96		0.51		75.50
t-value	3.32	-1.67		3.57		
%p-value	0.09	9.44		0.04		
Corrected t-value	2.06	-1.04		2.26		
Corrected p-value	3.92	29.55		2.39		
Estimate	4.45	-1.97		0.42	-0.10	77.9
t-value	2.33	-1.69		3.61	-0.71	
%p-value	1.96	9.17		0.03	47.53	
corrected t-value	1.61	-1.17		2.55	-0.49	
corrected p-value	10.73	24.09		1.07	62.23	
Coefficient	δ_0	δ_s	δ_{bkr}	δ_{labor}		**GMM-Dist**
Estimate	1.45	3.41		-187		0.351
t-value	8.45	0.92		-3.71		
%p-value	0.00	35.70		0.21		69.20
Coefficient	δ_0	δ_s	δ_{bkr}	δ_{labor}		**HJ-Dist**
Estimate	1.40	1.50		-171		0.438
t-value	8.09	0.40		-3.21		
%p-value	0.00	69.10		0.14		66.40

Table 4, Panel D:

Coefficient	c_0	c_s	c_{bkr}	c_{labor}	c_{size}	%R-Square
Estimate	1.97	-1.31	-19.94	0.28		80.60
t-value	1.54	-1.03	-1.46	2.13		
%p-value	12.30	30.40	14.40	3.35		
Corrected t-value	1.08	-0.72	-1.02	1.50		
Corrected p-value	27.90	47.10	30.50	13.32		
Estimate	2.40	-1.39	-17.85	0.28	-0.03	80.70
t-value	1.15	-1.17	-1.70	2.10	-0.19	
%p-value	25.20	24.30	8.87	3.56	85.30	
corrected t-value	0.82	-0.84	-1.23	1.52	-0.13	
corrected p-value	41.00	40.00	21.84	12.73	89.40	
Coefficient	δ_0	δ_s	δ_{bkr}	δ_{labor}		**GMM-Dist**
Estimate	1.30	1.10	1.73	-130.80		0.364
t-value	7.89	0.33	1.39	-2.46		
%p-value	0.00	74.10	16.50	1.38		54.70
Coefficient	δ_0	δ_s	δ_{bkr}	δ_{labor}		**HJ-Dist**
Estimate	1.29	0.62	1.60	-129.16		0.422
t-value	7.54	0.18	1.24	-2.28		
%p-value	0.00	85.90	21.60	2.23		56.30

TABLE 5

Comparing the Performance of the Size Spread Factor and Book to Price Spread Factor using the 25 Size-Book to Market sorted portfolio returns

This table gives the estimated values of the parameters in the cross sectional regression model,

$$E[R_{it}] = c_0 + c_s \beta_i^s + c_{bspr} \beta_i^{bspr} + c_{sspr} \beta_i^{sspr}$$

and the stochastic discount factor model for moments,

$$E[R_{it}(\delta_0 + \delta_s R_t^s + \delta_{bspr} R_t^{bspr} + \delta_{sspr} R_t^{sspr})] = 1,\ i = 1,2..25\ ,$$

where R_{it} denotes the return on portfolio i, R_t^s denotes the month t return on TOPIX, R_t^{bkr} denotes the growth rate in the number of business failures lagged by one month, R_t^{bspr} and R_t^{sspr} respectively denote the book to price spread factor and the size-spread factor. Betas represent the slope coefficient in the univariate regression of R_{it} on the relevant variable. The cross sectional regression model parameters are estimated using the Fama-MacBeth procedure. The corrected t-values and p-values are computed using the procedure described in Jagannathan and Wang (1995). The stochastic discount factor models for moments are estimated using Hansen's (1982) generalized method of moments. GMM refers to the use of the optimal weighting matrix described in Hansen (1982) and HJ refers to the use of the inverse of the second moment matrix of returns as the weighting matrix. Dist refers to the minimized value of the criterion function. We use 142 monthly observations from September 1982 to June 1993.

Table 5, Panel A

Coefficient	c_0	c_s	c_{bspr}	c_{sspr}	c_{size}	%R-Square
Estimate	-1.30	3.61	-2.02			60.00
t-value	-1.30	2.57	-4.46			
%p-value	19.10	1.02	0.00			
Corrected t-value	-1.09	2.15	-3.76			
Corrected p-value	27.80	3.17	0.02			
Estimate	2.51	2.20	-1.57		-0.24	86.20
t-value	1.27	1.82	-3.80		-1.81	
%p-value	20.50	6.89	0.01		7.02	
corrected t-value	1.15	1.66	-3.52		-1.65	
corrected p-value	25.00	9.74	0.04		10.01	
Coefficient	δ_0	δ_s	δ_{bspr}	δ_{sspr}		**GMM-Dist**
Estimate	1.20	-6.62	10.70			0.358
t-value	16.49	-2.44	4.03			
%p-value	0.00	1.46	0.00			65.00
Coefficient	δ_0	δ_s	δ_{bspr}	δ_{sspr}		**HJ-Dist**
Estimate	1.18	-5.65	10.40			0.404
t-value	15.79	-1.95	3.79			
%p-value	0.00	5.12	0.00			50.50

Table 5, Panel B

Coefficient	c_0	c_s	c_{bspr}	c_{sspr}	c_{size}	%R-Square
Estimate	2.43	-1.92		1.39		58.90
t-value	2.57	-1.67		2.52		
%p-value	1.01	9.51		1.18		
Corrected t-value	2.40	-1.57		2.40		
Corrected p-value	1.63	11.61		1.65		
Estimate	-3.20	-2.15		3.23	0.44	61.10
t-value	-0.78	-1.85		2.28	1.41	
%p-value	43.80	6.49		2.25	15.90	
corrected t-value	-0.66	-1.59		1.98	1.21	
corrected p-value	50.70	11.14		4.80	22.80	
Coefficient	δ_0	δ_s	δ_{bspr}	δ_{sspr}		**GMM-Dist**
Estimate	1.03	1.00		-3.42		0.443
t-value	24.38	0.36		-2.57		
%p-value	0.00	71.78		1.02		14.40
Coefficient	δ_0	δ_s	δ_{bspr}	δ_{sspr}		**HJ-Dist**
Estimate	1.03	0.18		-3.10		0.482
t-value	24.34	0.06		-2.29		
%p-value	0.00	94.95		2.19		3.99

Table 5, Panel C

Coefficient	c_0	c_s	c_{bspr}	c_{sspr}	c_{size}	%R-Square
Estimate	-0.42	1.95	-1.53	1.04		88.40
t-value	-0.45	1.60	-3.68	1.87		
%p-value	65.40	10.90	0.02	6.18		
Corrected t-value	-0.41	1.45	-3.40	1.71		
Corrected p-value	68.60	14.70	0.07	8.67		
Estimate	-4.12	1.74	-1.50	2.28	0.30	89.30
t-value	-0.99	1.43	-3.63	1.62	0.95	
%p-value	32.00	15.20	0.03	10.50	34.40	
corrected t-value	-0.87	1.25	-3.25	1.42	0.83	
corrected p-value	38.70	21.10	0.12	15.50	41.00	
Coefficient	δ_0	δ_s	δ_{bspr}	δ_{sspr}		**GMM-Dist**
Estimate	1.20	-5.79	9.38	-2.14		0.343
t-value	16.74	-2.13	3.58	-1.66		
%p-value	0.00	3.33	0.03	9.71		68.50
Coefficient	δ_0	δ_s	δ_{bspr}	δ_{sspr}		**HJ-Dist**
Estimate	1.19	-5.09	9.63	-2.39		0.375
t-value	15.80	-1.73	3.49	-1.80		
%p-value	0.00	8.41	0.05	7.12		59.10

Table 5, Panel D

Coefficient	c_0	c_s	c_{labor}	c_{bspr}	c_{sspr}	%R-Square
Estimate	0.27	1.28	0.12	-1.28	0.83	89.30
t-value	0.26	1.00	0.94	-2.77	1.35	
%p-value	79.70	32.00	34.80	5.67	17.70	
Corrected t-value	0.23	0.90	0.85	-2.54	1.23	
Corrected p-value	81.60	37.00	39.60	1.10	21.80	
Coefficient	δ_0	δ_s	δ_{Labor}	δ_{bspr}	δ_{sspr}	**GMM-Dist**
Estimate	1.36	-3.61	-70.19	9.12	-0.99	0.319
t-value	9.97	-1.01	-1.24	2.98	-0.70	
%p-value	0.00	31.16	21.40	2.85	48.20	77.20
Coefficient	δ_0	δ_s	δ_{Labor}	δ_{bspr}	δ_{sspr}	**HJ-Dist**
Estimate	1.34	-5.69	-76.06	8.09	-1.71	0.360
t-value	9.22	-1.85	-1.28	2.52	-1.14	
%p-value	0.00	6.44	19.90	1.17	25.40	70.20

Table 6, Panel B

Coefficient	c_0	c_s	c_{bkr}	c_{labor}	c_{size}	%R-Square
Estimate	-1.02	1.25	-34.50			73.50
t-value	-1.11	1.16	-3.01			
%p-value	26.90	24.50	0.26			
Corrected t-value	-0.67	0.71	-1.85			
Corrected p-value	50.20	47.80	6.42			
Estimate	1.53	0.90	-21.23		-0.16	78.70
t-value	0.73	0.93	-2.30		-1.05	
%p-value	46.60	35.40	2.13		29.60	
corrected t-value	0.57	0.72	-1.81		-0.81	
corrected p-value	57.10	47.00	7.02		41.60	
Coefficient	δ_0	δ_s	δ_{bkr}	δ_{labor}		**GMM-Dist**
Estimate	0.95	0.22	1.67			0.548
t-value	27.04	0.12	2.27			
%p-value	0.00	90.60	2.35			8.91
Coefficient	δ_0	δ_s	δ_{bkr}	δ_{labor}		**HJ-Dist**
Estimate	0.99	-1.17	1.71			0.587
t-value	24.32	-0.53	2.10			
%p-value	0.00	59.70	3.56			4.50

Table 6, Panel C

Coefficient	c_0	c_s	c_{bkr}	c_{labor}	c_{size}	%R-Square
Estimate	-0.64	1.99		0.52		75.60
t-value	-0.08	1.83		3.20		
%p-value	93.71	6.72		0.13		
Corrected t-value	-0.05	1.16		2.06		
Corrected p-value	96.00	24.42		3.88		
Estimate	2.15	1.45	0.34		-0.17	83.70
t-value	1.16	1.55	2.60		-1.18	
%p-value	24.80	12.10	0.94		23.90	
corrected t-value	0.91	1.22	2.07		-0.93	
corrected p-value	36.30	22.10	3.82		35.40	
Coefficient	δ_0	δ_s	δ_{bkr}	δ_{labor}		**GMM-Dist**
Estimate	1.37	-3.37		-127.00		0.527
t-value	8.86	-1.53		-2.69		
%p-value	0.00	12.50		0.72		15.60
Coefficient	δ_0	δ_s	δ_{bkr}	δ_{labor}		**HJ-Dist**
Estimate	1.25	-1.91		-93.70		0.595
t-value	8.64	-0.86		-1.99		
%p-value	0.00	39.20		4.61		8.51

Table 6, Panel D

Coefficient	c_0	c_s	c_{bkr}	c_{labor}	c_{size}	%R-Square
Estimate	-0.73	1.86	-17.60	0.31		81.40
t-value	-0.79	1.76	-1.80	2.76		
%p-value	43.10	7.88	7.14	0.58		
Corrected t-value	-0.55	1.24	-1.28	1.96		
Corrected p-value	58.00	21.43	20.18	4.95		
Estimate	1.31	1.51	-8.70	0.27	-0.13	84.70
t-value	0.62	1.62	-1.19	2.36	-0.83	
%p-value	53.50	10.40	23.50	1.85	40.40	
corrected t-value	0.50	1.31	-0.96	1.92	-0.67	
corrected p-value	61.80	19.0	33.70	5.52	50.20	
Coefficient	δ_0	δ_s	δ_{bkr}	δ_{labor}		GMM-Dist
Estimate	1.13	-1.74	1.65	-64.94		0.548
t-value	9.13	-0.87	2.15	-1.57		
%p-value	0.00	38.50	3.13	11.56		7.00
Coefficient	δ_0	δ_s	δ_{bkr}	δ_{labor}		HJ-Dist
Estimate	1.22	-1.90	1.64	-88.33		0.564
t-value	8.39	-0.79	1.96	-1.90		
%p-value	0.00	43.20	5.02	5.79		18.10

TABLE 7

Comparing the Performance of the Size Spread Factor and Book to Price Spread Factor using the 36 Size-Beta sorted portfolio returns

This table gives the estimated values of the parameters in the cross sectional regression model,

$$E[R_{it}] = c_0 + c_s\beta_i^s + c_{bspr}\beta_i^{bspr} + c_{sspr}\beta_i^{sspr}$$

and the stochastic discount factor model for moments,

$$E[R_{it}(\delta_0 + \delta_s R_t^s + \delta_{bspr} R_t^{bspr} + \delta_{sspr} R_t^{sspr})] = 1,\ i = 1,2..25\ ,$$

where R_{it} denotes the return on portfolio i, R_t^s denotes the month t return on TOPIX, R_t^{bkr} denotes the growth rate in the number of business failures lagged by one month, R_t^{bspr} and R_t^{sspr} respectively denote the book to price spread factor and the size-spread factor. Betas represent the slope coefficient in the univariate regression of R_{it} on the relevant variable. The cross sectional regression model parameters are estimated using the Fama-MacBeth procedure. The corrected t-values and p-values are computed using the procedure described in Jagannathan and Wang (1995). The stochastic discount factor models for moments are estimated using Hansen's (1982) generalized method of moments. GMM refers to the use of the optimal weighting matrix described in Hansen (1982) and HJ refers to the use of the inverse of the second moment matrix of returns as the weighting matrix. Dist refers to the minimized value of the criterion function. We use 142 monthly observations from September 1982 to June 1993.

Table 7, Panel A

Coefficient	c_0	c_s	c_{bspr}	c_{sspr}	c_{size}	%R-Square
Estimate	-0.02	1.90	-1.38			16.80
t-value	-0.03	2.17	-2.22			
%p-value	97.46	3.01	2.67			
Corrected t-value	-2.96	2.02	-2.07			
Corrected p-value	97.64	4.31	3.83			
Estimate	3.47	1.76	-0.89		-0.31	75.70
t-value	1.96	2.02	-1.48		-2.35	
%p-value	5.00	4.36	13.80		1.88	
corrected t-value	1.87	1.94	-1.42		-2.24	
corrected p-value	6.16	5.27	15.70		2.50	
Coefficient	δ_0	δ_s	δ_{bspr}	δ_{sspr}		**GMM-Dist**
Estimate	1.08	-2.70	4.98			0.522
t-value	18.67	-1.31	1.75			
%p-value	0.00	19.20	8.10			17.60
Coefficient	δ_0	δ_s	δ_{bspr}	δ_{sspr}		**HJ-Dist**
Estimate	1.06	-2.19	4.08			0.610
t-value	18.23	-1.03	1.36			
%p-value	0.00	30.40	17.50			0.89

Table 7, Panel B

Coefficient	c_0	c_s	c_{bspr}	c_{sspr}	c_{size}	%R-Square
Estimate	0.34	0.36		1.41		75.40
t-value	0.39	0.33		2.57		
%p-value	70.00	74.20		1.01		
Corrected t-value	0.38	0.32		2.57		
Corrected p-value	70.70	74.80		1.03		
Estimate	-5.61	0.58		3.22	0.44	78.00
t-value	-1.33	0.58		2.16	1.26	
%p-value	18.40	56.00		3.08	20.90	
corrected t-value	-1.19	0.52		1.96	1.12	
corrected p-value	23.50	60.10		5.04	26.10	
Coefficient	δ_0	δ_s	δ_{bspr}	δ_{sspr}		**GMM-Dist**
Estimate	1.07	-0.72		-4.28		0.502
t-value	24.57	-0.38		-3.30		
%p-value	0.00	70.60		0.10		27.60
Coefficient	δ_0	δ_s	δ_{bspr}	δ_{sspr}		**HJ-Dist**
Estimate	1.05	-1.22		-3.32		0.581
t-value	25.50	-0.63		-2.49		
%p-value	0.00	52.80		1.28		3.29

Table 7, Panel C

Coefficient	c_0	c_s	c_{bspr}	c_{sspr}	c_{size}	%R-Square
Estimate	-0.44	1.47	-0.62	1.34		78.10
t-value	-0.75	1.68	-1.01	2.38		
%p-value	45.20	9.37	31.20	1.71		
Corrected t-value	-0.71	1.60	-0.96	2.31		
Corrected p-value	47.60	11.00	33.70	2.10		
Estimate	-3.81	1.22	-0.41	2.47	0.27	78.80
t-value	-1.11	1.40	-0.69	2.03	1.02	
%p-value	26.80	16.10	49.00	4.23	30.90	
corrected t-value	-1.01	1.29	-0.63	1.88	0.93	
corrected p-value	31.00	19.70	52.70	5.96	35.20	
Coefficient	δ_0	δ_s	δ_{bspr}	δ_{sspr}		**GMM-Dist**
Estimate	1.07	-0.97	0.60	-4.10		0.505
t-value	18.10	-0.46	0.20	-3.06		
%p-value	0.00	64.80	84.20	0.22		22.20
Coefficient	δ_0	δ_s	δ_{bspr}	δ_{sspr}		**HJ-Dist**
Estimate	1.09	-1.90	2.64	-3.12		0.577
t-value	17.30	-0.87	0.85	-2.31		
%p-value	0.00	38.40	39.70	2.09		3.45

Table 7, Panel D

Coefficient	c_0	c_s	c_{labor}	c_{bspr}	c_{sspr}	%R-Square
Estimate	-0.31	1.70	0.27	-0.21	0.81	84.80
t-value	-0.53	1.93	2.21	-0.35	1.23	
%p-value	59.20	5.33	2.74	72.60	19.40	
Corrected t-value	-0.44	1.59	1.83	-0.29	1.08	
Corrected p-value	66.00	11.12	6.70	77.30	28.10	
Coefficient	δ_0	δ_s	δ_{Labor}	δ_{bspr}	δ_{sspr}	**GMM-Dist**
Estimate	1.23	-2.10	-57.88	0.62	-3.81	0.505
t-value	8.58	-0.91	-1.22	0.20	-2.60	
%p-value	0.00	36.20	22.10	83.90	0.94	19.0
Coefficient	δ_0	δ_s	δ_{Labor}	δ_{bspr}	δ_{sspr}	**HJ-Dist**
Estimate	1.23	-2.38	-60.49	2.60	-2.54	0.567
t-value	8.30	-1.01	-1.23	0.82	-1.72	
%p-value	0.00	31.40	22.10	41.30	8.58	7.52

[1] See Black (1972), Lintner (1965), and Sharpe (1964)

[2] Sundaresan (1989), Constantinides (1990), Abel (1990) obtain related models by taking different stands regarding the form of the period utility function of the representative agent in the economy. However, all these models assume that the representative agent's preferences satisfy the Expected Utility axioms. Epstein and Zin (1991) derive an asset pricing model where the representative agent's preferences do not satisfy the Expected Utility axioms.

[3] See Hansen and Singleton (1982, 1983), Brown and Gibbons (1985), Dunn and Singleton (1986), Cochrane (1992), Jagannathan (1985), Harvey (1989), Ferson and Harvey (1992), Eichenbaum, Hansen and Singleton (1988), Ferson and Constantinides (1991), Hansen and Jagannathan (1991, 1994), and Heaton (1993).

[4] See Connor and Korajczyk (1988), Lehmann and Modest (1988) and Chen, Roll and Ross (1986), Ferson and Harvey (1992), Bansal and Viswanathan (1993), Bansal, Hsieh and Viswanathan (1993) and Jagannathan and Wang (1995)

[5] The size effect was first documented in a systematic way by Banz (1981). The book to market effect was documented by Rosenberg, Reid and Lanstein (1984). Kato and Schallheim (1985) study the size effect in Japan

[6] According to Becker (1993), "The outstanding economic records of Japan, Taiwan, and other Asian economies in recent decades dramatically illustrate the importance of human capital to growth. Lacking natural resources -- e.g., they import practically all their sources of energy -- and facing discrimination from the West, these so-called Asian tigers grew rapidly by relying on a well-trained, educated, hard-working, and conscientious labor force".

[7] . Berk (1992) pointed out, relative size and relative book to price ratio of firms will in general be correlated with the expected return on stocks of the firms, in the cross section. However, Berk's (199.) arguments do not explain why the size and the book to price *factor betas* can explain the cross section of expected return on stocks.

[8] According to the Tokyo Stock Exchange Fact Book (1994), at the end of 1992, the total market value of stocks listed in the Tokyo Stock Exchange was $2,321 billion. The corresponding number for New York Stock Exchange was $3,878 billion. The total market value of stocks listed in the London Stock Exchange, which was the third largest, was $933 billion.

[9] The per capita GNP in Japan was $19,959 ($15,760 if inflation adjusted and a 3 year average exchange rate was used) in 1987 and rose to $28,937 ($26,930 if inflation adjusted and a 3 year average exchange rate was used) in 1991. The corresponding numbers for the USA are $18,530 and $22,240 [see R.C. Hsu (1994)]. In 1993 the GDP per capita was $37,040 in Japan and $25,790 in the USA (source: EIU)

[10] See Lo and MacKinlay (1990) for an excellent discussion of "Data-snooping biases in tests of financial asset pricing models".

[11] Sakuraba (1987) used 208 stocks and the Nikkei 225 index return for the period 1963 to 1984.

[12] Stambaugh (1982) was the first to empirically compare the relative performance of various market proxies. He found that the inferences about the CAPM was not sensitive to the choice of the proxy used. However, he did not consider the return on human capital in his otherwise extensive study.

[13] See the table giving "Closing stocks of Assets and Liabilities", Japan Statistical Year Book 1993/94.

[14] See Mayers (1972) for the development of a version of the CAPM which takes the return on human capital into account.

[15] The limitations of the OLS R-Square metric is discussed in Jagannathan and Wang (1993) and Kandel and Stambaugh (1995). However, these limitations do not invalidate the use of the OLS R-Square for the purposes we use in this article.

[16] The Black, Jensen and Scholes (1972) and the Fama and MacBeth (1972) procedure for computing the sampling errors associated with the parameters estimated using the cross sectional regression method ignores the error introduced by replacing the betas by their estimates. Shanken (1992) was the first to show how to overcome this difficulty, under normality. Jagannathan and Wang (1995) provide asymptotic justifications that do not rely on normality.

[17] See Hansen and Jagannathan (1991 and 1994), Jagannathan and Wang (1993) and Bansal and Viswanathan (1993), Bansal, Hsieh and Viswanathan (1993) and MacKinlay and Richardson (1991) for a discussion of empirically examining linear factor models using their stochastic discount factor representation and the GMM.

[18] Private communication from Professor Banri Asanuma, Kyoto University.