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Cross-section Risk and Return of Tokyo Stock Exchange Firms

by

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Abstract :

We reject the single risk CAPM specifications in an unconditional form for Japanese stocks listed on the first section of Tokyo Stock Exchanges with data between 1981 and 1993. As in Fama and French (1992a), for Japanese data, β is not be able to explain cross-section return differences of individual securities both at the sample portfolio level and the individual securities level, and we find the relationship between the β and the realized average returns is completely flat. We also find that book-to-market equity ratio and size are strongly significant as is the case with US firms and confirm Fama and French result is, indeed, robust with respect to the new data with possibly less survivorship bias as Japanese firms went through less mergers and acquisitions than US. firms during this period. We also find that leverage ratios, earnings-to-price ratios and return-on-equity ratios are significant with non-financial firm data, depending on the stages of Japanese business cycles, and thus extend the findings by Chan, Hamao and Lakonishok (1991) for Japanese firms.

I. Introduction

Recently Fama and French (1992a) found that the traditional β cannot well explain cross-sectional variations of security returns both conditionally and unconditionally, and thus it is not suitable in assessing average returns and cannot be considered to be a pertinent risk factor. They claim that size and book-to-market-equity ratios of individual firms are suffice to explain cross-sectional variations of security returns. The results imply that the traditional β previously supported by empirical studies like Fama and MacBeth (1973) no longer work as a useful single risk measure, and empirical foundations of the traditional capital asset pricing theory are subject to serious scrutiny.

In a continuing paper to Fama and French (1992a), Fama and French (1992b) and Fama, French, Gooth and Sinquefield (1993) identify a set of mimicking portfolios that would constitute multiple risk measures in explaining security returns for US. firms. They find that three factor model can well explain time-series security returns. In their three factor model, the value-weighted market index , size and book-to-market-equity ratios enter as significant risk factor variables that can explain the time-series variations of security returns. Note that this model applies only for time-series variations of security returns, and not for cross-section security returns.

As for Japanese empirical evidence Maru and Yonezawa (1984), using a methodology similar to Fama and MacBeth but without using their grouping procedures, found that both systematic and unsystematic risk components can significantly explain Japanese security returns, contrary to the accepted evidence for US firms, with data period between 1956 and 1976. With data period between 1971 and 1988, Chan, Hamao and Lakonishok (1991) found that firm specific financial variables such as cashflow-to-price ratios significantly explain security returns when SUR estimation was conducted on the set of financial variables and two market indices simultaneously.

However, the former study employs limited number of cross-section computations at the individual firm level, and also the data observation periods belong to times when Japanese capital markets were neither fully developed nor liberalized under the strong regulatory guidance by the Ministry of Finance. The similar criticism would apply to the first half of the sample period used in the study by Chan, Hamao and Lakonishok (1991), where they extensively checked the explanatory power of many financial variables for the first time in the literature. However, during their estimation processes they always included the set of two market indices in their regression equations, and thus the investigations of financial variables as alternative proxies for the market index were never explored. Also, by imposing SUR estimation on their sample, time variations of the market price of risk were ignored and also the time-series variations in the variable selection were not allowed.They use all companies, including manufacturing, non-manufacturing and financial, listed on both the first and the second sections of Tokyo Stock Exchanges for their data, and our conjectures are that many firms in the second sections have serious non-trading problems and also financial firms have different capital structures and show drastically different return behaviors during the 1980s from other firms.

In the current study in view of the shortcomings of these previous studies we investigate return behavior of Japanese manufacturing and non-manufacturing firms listed on Tokyo Stock Exchange First Section only, and thus reduces the possible non-trading problems, and also aims for homogeneity in the data. Up until early 1990s only several firms were delisted from the first section of Tokyo Stock Exchanges and our study is subject to less survivorship biases than the study which include both the first section and the second section firms. It is true that some newly listed firms were added into the data and it may produce some forward-looking biases, but again the sample drawn only from the first section firms will produce less errors of this kind as larger numbers of firms were added to the smaller universe in the second section of Tokyo Stock Exchanges.

Also, noting that two previous literature cited as the representative research works on Japanese capital markets were basically tests of unconditional asset pricing theory, we, instead, taking care of the drastic business cycle turnarounds of Japanese economy between late 1980s and early 1990s, we estimate regression equations by allowing time variations both in the market price of risk and in the choice of explanatory variable *per se*, and, thus, test the conditional change of asset pricing specifications. During these estimation processes we also pay particular attention to the observations from the sample period when negative *ex post* market price of risk were observed.

The paper outline is as follows. Section II elaborates motivations of the current study and summarizes our research design. Section III defines the data we utilize and describe procedures of sample portfolio formations. In Section IV overall observations of our sample portfolio both by one way and two way classifications according to financial attributes of each firm is discussed. In Section V first we run period-by-period stepwise regressions to find sets of explanatory variables that explain cross-section security returns. Finally, based on these results we run extensive Fama-MacBeth regressions both for individual securities and ranked portfolios and get the final multifactor regression model. Section VI concludes.

II. Research Background and the Research Design

The current study is originally motivated by Fama and French (1992a) and we will apply a somewhat similar methodology to data observations on Japanese non-financial firms during the 1980s and the 1990s. Given the relative scarcity of empirical studies on Japanese data, the current study would be subject to less data-snooping bias in the sense of Lo and McKinlay

(1990), and also is subject to less survivorship bias because only a few firms from the first section of Tokyo Stock Exchanges were either delisted or merged. However, several firms were newly listed during our sampling period and added to our sample, and this may induce some forward-looking bias. Our prior judgment is that these biases are very small if we look at only firms from the first section of Tokyo Stock Exchanges.

In relation to our current research we summarize Fama and French (1992a) study as below. Fama and French, first of all, reject empirical implications of traditional capital asset pricing theory with the data observations from NYSE , AMEX and NASDAQ firms between the time period of June 1963 through December 1990. In their study it is found that βs are not associated with concurrent cross-sectional variations of security returns. On the other hand, book-to-market equity ratios and size are found to be two most significant variables to explain cross-section variations of security returns. Although they find leverage ratios and earnings-to-price ratios are also significant on their own, they rightly claim that the former is better captured by book-to-market ratios and the latter is a weaker proxy for the size variable. In the sense that the sample averages are computed from cross-sectional regression estimates, this test is interpreted to be the unconditional test of the asset pricing theory. However, they also conduct additional tests for conditional versions of the asset pricing theory on the same sample and obtain results that support the same tendencies. Thus, on the basis of their findings, we conclude that β is neither a single relevant risk measure nor a subset of variables in multivariate specifications when explaining cross-section security return variations of US firms. Thus, the empirical supports for capital asset pricing theory, for example, the one by a classic study by Fama and MacBeth (1973), for example, are not sustained.

Interestingly enough for Japanese firms, the evidence relating to implications of the traditional asset pricing theory have not been in favor of the capital asset pricing model, contrary to previous findings for US. firms. For example, Maru and Yonezawa (1984) found that, using a methodology similar to Fama and MacBeth (1974), both systematic risk variable and the surrogate variable for unsystematic risk components are significant with Japanese data between 1956 and 1976. Also, Chan, Hamao, and Lakonishok (1991) found that the set of firm specific financial variables do significantly explain cross-sectional security returns when used in addition to two sets of market indices in their SUR regressions for the data between 1971 and 1988. The two indices they always include in their estimation procedures are the value weighted index and the equal weighted index.

The reasons why one obtains these findings against the traditional capital asset theory for Japanese data might be either due to imperfections of Japanese capital market during these testing periods or misspecifications of the capital asset pricing model *per se* for Japanese capital markets, or could be both. The current study sheds some new light on this topic with a different estimation and testing methodology on the new data starting from 1981, after when Japanese capital markets began experiencing lifting of many of the previous government regulations.

Our research design is summarized as follows. We conduct cross-sectional tests in finding explanatory powers of the traditional β. In the event that it is found that cross-section returns cannot be well explained by the β, we test alternative sets of financial variable that can better explain cross-sectional variations of security returns in lieu of the traditional β, and thus try to find a suitable empirical multifactor model with firm-specific financial variables.

The sample design we use is similar to the study by Fama and French (1992) and Chan, Hamao and Lakonishok (1991), though our testing methods are somewhat different in terms of allowing time variations in our estimated models. We rank securities according to size to account for the size effect that is known to exist among Japanese stocks, and will form 10 size-ranked portfolios . At this 10 portfolio level we find that size covaries with estimated β in a remarkable opposite direction from US firms case with the similar correlation magnitude but with opposite sign. Then, as in Fama and French (1992a), in order to separate the working of these two variables, size-ranked portfolios are further divided into sub-portfolios by the order of estimated individual βs computed from the pre-testing period. In this way we construct sample 100 portfolios that can possess wide variations in these two attribute variables. These grouping procedures may produce portfolios with reduced estimated errors in β originally estimated at the individual firm level.

Given these sample portfolios we try to investigate explanatory power of β as well as ones of other financial variables. On the basis of our initial sample tests as discussed in Section IV and also on previous findings both on Japanese data by Chan, Hamao, and Lakonishok (1991) and US. data by Fama and French (1992a), we choose book-to-market ratio as a strong candidate to replace the β variable in addition to size. In view of this point we also form ranked-portfolios based on size and book-to-market equity ratios for comparison purposes whenever necessary. This new sample set is also composed of 100 portfolios and we compare the results on these size-β ranked portfolios and size-book-to-market equity ratio ranked portfolios. This is especially interesting when the size variable can be considered to be a proxy for the β but not in case of the book-to-market equity ratio.

After thoroughly analyzing cross-section behavior of portfolio returns in relation to the sets of possible explanatory financial variables and β, we conduct cross-sectional regressions both for individual securities and ranked portfolios to obtain final estimated coefficients that would represent estimates of the *ex post* market price of risk for those variables chosen in the regression equations.

It is well known that, when sample is classified by *a prior* information like size and β, the estimated coefficients will be biased toward the acceptance of the explanatory power of these variables(Lo and McKinley (1990)). Accordingly, even if the significance of the β is ever rejected with this sample design, the direction for rejection would be an acceptable one, though we cannot rely on the magnitude of their t-values. The results on our ranked portfolios are biased toward the acceptance of size and book-to-market equity ratios when these variables are used for classifications. In view of this problem we also cite results on individual securities and compare these results.

The reason why we use both ranked portfolios sample and individual securities sample in our estimation is that the former can gives us the sample size small enough to be able to describe the data behavior in a very illuminating way with less estimation errors on β variables. The point have been fully discussed in previous literature like, for example, in Black, Jensen and Scholes (1972). On the other hand, the analysis with individual securities sample can give us final estimates with larger sample size, with less data-snooping bias by prior information, and with clearer definitions of individual financial variables than with portfolio sample. However, this procedure possibly possesses severe estimation errors at individual β level. Indeed, in the end we find our result is robust with respect to these alternative sample designs.

As a final remark of the current section, when we refer to the underlying asset pricing theory in the sense that only pre-determined variable are used to explain next periods' cross-sectional returns, these estimations can be considered as the one based on the conditional version of the asset pricing theory, although in the current study we do not explicitly utilize a set of predetermined informational instruments as a part of the equilibrium envelope conditions. Also, in the sense that we take time-series averages or compute βs over the total sampling period our tests are broadly classified as an unconditional test as is true with Fama and MacBeth (1974) study, except that at initial stage we allow for time variations on variable selections and allow for some conditional change of the estimated models.

III. The Data and the Portfolio Formation Method

In the current study we use monthly return series of approximately 1,100 Japanese manufacturing and non-manufacturing firms listed each year on Tokyo Stock Exchange First Section between September 1981 through June 1993. The return data dates back further three years until October 1978 to compute necessary β estimates.

Portfolio formation month is the beginning of September each year when all firm-specific accounting variables become publicly available to most institutional investors in a machine readable form as is provided by Nikkei Data Services. As most of the Japanese companies have March 31st as their fiscal year end, we classify each security into ranked portfolios based on accounting variable computed as of the previous fiscal year end, most of which is the end of March and on the corresponding stock price as of the beginning of September. For example, book-to-equity ratios are computed based on the end of March book value and the beginning of September price for March fiscal year end companies for the first portfolio formation month and their market values are updated every month. Also, when we refer to the earnings figures we exclusively use current earnings which we believe are less subject to accounting manipulations than net profit and also are known to be more widely used by financial analysts. As for this number, Nikkei Data Services provides forecast numbers updated monthly in recent years, and this is the current earnings figures we use. Again, it is known that most of the analysts use these forecast numbers when they conduct financial analysis, and we use these numbers as the pertinent earnings numbers, which contrasts our study with Chan, Hamao and Lakonishok (1991) where they use the realized earnings from previous fiscal year and find earnings-to-price ratios are not significant in their cross-sectional tests. Each portfolio will be formed on every September 1st and it is equal-weighted. The constructed portfolios will be regrouped every year on September 1st, and in this way the continuous monthly observations of ranked portfolios is constructed and the composition of each portfolio will be different every year.

As was discussed above, we are primarily interested in finding whether β is significantly related to the average return of securities. However, as the strong size effect is known to be predominant among Japanese firms as is the case with US firms, controlling for the size effect seems imperative. Also in the previous empirical study from practical viewpoints, Capful, Rowley and Sharpe (1992) show that average returns are related to book-to-equity market ratios(denoted as book-to-price or BPR below) for Japanese firms, too. These observations and our main interest into the workings of the traditional β *per se* are the main reasons why we choose a research design similar to Fama and French (1992a), and rank securities based on size and either one choice of β or BPR.

We rank each security according to the size in the natural log of the total market value of each firm and form 10 portfolios as our first step. We then further rank these size-ranked 10 portfolios into another 10 sub-portfolios based on rankings of pre-β estimates within each 10 portfolios, and thus construct 100 portfolios as of the beginning of September each year as mentioned before. These constructed portfolios will be regrouped every year and thus compositions of each portfolio are different every year. In this way we construct continuous return series of 100 portfolios. This portfolio set will constitute a sample size large enough to conduct all kind of preliminary tests and also possess enough variations in the independent variables of our interest, the size and the β. Also, we rank initial size ranked 10 portfolios further by book-to-market equity ratios when necessary for comparison purposes, and form alternative sets of the testing sample.

The characteristic of our current study is further highlighted by the fact that we use period-by-period cross-section regressions to allow both for changes in variable selections and changes in estimated risk premiums for each risk proxy variable. In case of Fama and French (1992a) the former is not explicit, and in case of Chan, Hamao, and Lakonishok (1991) the time variations of estimated risk premiums are not allowed as they impose once-for-all SUR estimations in their main research framework, though they also add Fama and MacBeth tests in the end.

IV. Overall Sample Observations

A . Classification by Single Variable

First we look at the sample statistics when 10 portfolios are formed every year by each variable of interest. That is, we classify securities into 10 portfolios based on, size, individual β computed from the previous period, book-to-market equity ratio(BPR or B/P) , leverage defined on book values, return on equity (ROE), cashflow-to-price ratio, and earnings-to-price ratio. Numbers in the Table 1 are time series averages of 142 monthly observations. Note that some of the variables, for example, the β and the leverage, vary only once a year. Definitions of each ranking variable is as follows. Size is measured by natural log of the total market value of equity. Individual β is estimated from previous sample period of 36 months. The book-to-market equity ratio is computed from book value of fiscal year end and the market value of each month updated. Leverage ratios are defined as the total debt divided by the total assets. For return-to-equity ratios (ROE) and earnings-to-price ratios earning numbers are measured by published current profit forecasts as was explained above. Cashflow is computed as the current profits plus depreciation. Also, in computing earnings-to-price ratios the firms with negative earnings were all assigned zero values instead of negative values and classified as a separate group.

By looking at the first panel titled Stocks Sorted on Size in Table 1 following observations can be done. When we look at return differences between the smallest(P1) and the largest(P10) portfolios classified according to size, we find size variable shows return differential of $1.682(= 2.501 - 0.819)$ per cent each month. Indeed, the classification by other variables seen on other tables of Table 1 only produce smaller return differentials between P1 and P10 portfolios (including P0 in case of EPR). However, we also find that return differences in case of classifications by book-to-market equity are rather large with 1.231 per cent In fact those two variable are the only ones that generate the return differences of more than one percent per cent, while the estimated β of our main interests generates only 0.4 per cent return differentials.

Another remarkable observations are on the relationships between size and β. As is seen from the third row in the top panel of Table 1 on average β values of size ranked portfolios where 10 stocks were ranked by size, we find that the smaller firms have smaller estimated β values, of which result is completely opposite to previous findings on American firms. On the second panel titled Post Ranking Betas of the next Table 2, we computed once-for-all portfolio βs for 100 size-β ranked portfolios ex post, which we call post-β values, and the numbers in each cell are these post-βs. Again, the similar tendency can be pointed out by reading through each column from top to bottom, though the relationship is not so uniform as was the case with the individual pre-β. Also, because we form each portfolio with equal weight while we compute βs on value weighted TOPIX index, aggregate β turns out to be 0.883 as seen in the right bottom cell of Table 2, which is not a surprising result considering the fact that larger firms possess larger βs and losing their weights when equal weighted portfolios are formed.

Another point to note is that book-to-market equity ratio that produced large return differentials are associated with other financial variables. As is seen from the third panel titled Stocks Sorted on BPR on Table 1, BPR and earnings-to- price are uniformly positively associated with, and BPR and leverage are uniformly negatively associated with. This suggests these variables might be explaining the same phenomenon, and maybe a single or two out of these three variables are enough to explain pertinent risk factors of security returns when we run multivariate regressions.

Final point to be suggested from Table 1 is found on panel 5 titled Stocks Sorted on ROE and panel 6 titled Stocks Sorted on CF/P where classification variables are all related to earnings. Notice that the smallest rank group P1 of both panels have rather high returns than P2 or even higher Ps. The further ranking can be found on panel 7 of EPR ranking where negative earnings group was extracted separately as P0 which shows extremely high returns and P1 group no longer shows high returns. This observation is in common with Fama and French (1992a) and Chan, Hamao, and Lakonishok (1991), and this observation is called u-shaped phenomenon of earning numbers. It is meant to signify some kind of mean reversions for the worst performers in the short run, at least for 12 months after the portfolio formation month. In our regressions below we assign zero value uniformly for each negative EPR firm and form portfolios from P1 through P10, instead of adding additional dummy variable for negative earnings firms as Fama and French (1992a) did. Our procedure partially corrects for the ambiguity of negative EPRs , and yet can keep the sample information on the possible mean reversions of EPR numbers for all firms.

In sum, by this one way classification scheme, we find that pre-β rankings do not seem to produce strong and systematic variations in average returns, while size and book-to-market equity ratio can explain wide variations in cross-section returns. However, as size and β are highly associated, we further rank portfolio by two way classification scheme and observe sample behavior further in the next subsection.

Table 1. The Behavior of Security Returns Ranked by Each Variable

(a) Stocks Sorted on Size

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
Return	2.501	1.937	1.800	1.503	1.285	1.295	1.137	1.193	0.993	0.819
β	0.461	0.484	0.526	0.555	0.553	0.646	0.672	0.739	0.863	1.004
Ln(ME)	9.535	10.039	10.372	10.656	10.956	11.282	11.626	12.032	12.555	13.617
B/P	39.115	41.948	41.904	40.913	41.091	40.710	41.328	39.099	35.855	33.507
Leverage	77.577	70.784	68.420	68.115	66.558	65.932	65.002	64.013	64.211	65.736
ROE	4.051	13.253	14.211	14.696	14.936	15.184	14.966	16.716	19.551	20.087
CF/P	7.601	9.069	9.263	9.024	9.383	9.423	10.203	9.663	10.098	11.017
E(+)/P	4.695	5.654	5.747	5.663	5.698	5.811	6.251	6.028	6.609	6.121
E/P Dummy	0.197	0.100	0.076	0.063	0.054	0.041	0.042	0.035	0.024	0.017

(b) Stocks Sorted on Pre-β

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
Return	1.328	1.713	1.664	1.610	1.508	1.454	1.590	1.317	1.356	0.928
β	-0.159	0.191	0.343	0.451	0.555	0.661	0.781	0.960	1.162	1.568
Ln(ME)	10.897	10.956	11.014	11.051	11.090	11.210	11.278	11.382	11.733	12.033
B/P	37.623	40.749	43.744	42.353	42.717	39.843	40.944	39.029	36.386	32.100
Leverage	68.912	67.755	67.001	67.244	66.909	67.819	66.796	66.999	67.671	69.304
ROE	8.841	13.726	14.774	13.452	15.307	14.315	15.670	16.786	16.109	18.677
CF/P	8.028	9.566	9.667	9.979	10.182	9.723	9.637	9.720	9.452	8.777
E(+)/P	5.112	6.066	6.048	6.160	6.120	5.946	5.960	5.951	5.523	5.380
E/P Dummy	0.127	0.082	0.065	0.066	0.055	0.060	0.063	0.049	0.044	0.038

(c) Stocks Sorted on B/P

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
Return	0.741	1.165	1.245	1.386	1.417	1.428	1.535	1.681	1.912	1.972
β	0.700	0.790	0.734	0.719	0.659	0.643	0.630	0.574	0.561	0.484
Ln(ME)	11.300	11.416	11.363	11.449	11.351	11.350	11.209	11.191	11.133	10.869
B/P	11.255	21.528	26.907	31.183	35.485	39.986	44.990	50.806	58.446	75.552
Leverage	80.499	74.383	71.093	70.054	68.213	66.289	64.187	63.109	60.918	57.497
ROE	14.000	19.170	17.881	16.188	15.996	14.836	14.175	13.299	12.575	9.357
CF/P	4.484	6.892	7.995	8.328	9.425	9.818	10.812	11.709	12.993	12.343
E(+)/P	3.238	4.369	4.905	5.214	6.000	5.979	6.442	6.905	7.638	7.620
E/P Dummy	0.141	0.060	0.058	0.059	0.053	0.049	0.052	0.051	0.043	0.084

(d) Stocks Sorted on Leverage

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
Return	1.190	1.065	1.270	1.364	1.363	1.500	1.583	1.648	1.758	1.739
β	0.680	0.711	0.665	0.670	0.649	0.677	0.657	0.655	0.585	0.546
Ln(ME)	11.555	11.638	11.414	11.186	11.226	11.174	11.209	11.261	11.092	10.872
B/P	47.985	46.596	45.185	43.429	41.613	40.219	39.528	36.101	31.143	23.490
Leverage	33.416	47.270	55.140	61.685	67.672	72.728	77.372	81.775	86.573	93.489
ROE	15.281	16.341	16.259	15.195	16.712	14.665	15.588	13.933	14.951	8.538
CF/P	8.745	9.681	9.873	9.680	10.506	9.972	10.624	9.819	9.482	6.323
E(+)/P	6.496	6.712	6.570	6.030	6.215	5.494	5.866	5.058	5.144	4.656
E/P Dummy	0.018	0.018	0.025	0.031	0.036	0.049	0.066	0.114	0.122	0.174

(e) Stocks Sorted on ROE

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
Return	1.648	1.442	1.507	1.462	1.427	1.372	1.470	1.344	1.293	1.510
β	0.467	0.554	0.600	0.635	0.640	0.694	0.737	0.694	0.715	0.764
Ln(ME)	10.540	10.935	11.231	11.304	11.389	11.380	11.512	11.534	11.508	11.307
B/P	40.583	48.132	44.662	44.563	43.332	41.339	39.200	36.979	32.355	24.232
Leverage	74.889	66.204	65.537	65.046	63.218	64.986	64.856	65.788	68.642	77.296
ROE	-20.118	5.560	9.588	11.794	14.155	16.089	18.753	21.517	25.710	44.888
CF/P	2.201	7.506	8.772	9.570	10.006	10.430	10.702	11.289	11.578	12.741
E(+)/P	0.964	2.645	4.066	5.095	6.036	6.505	7.176	7.787	8.268	9.802
E/P Dummy	0.529	0.069	0.014	0.009	0.004	0.005	0.003	0.001	0.003	0.013

(f) Stocks Sorted on CF/P

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
Return	1.120	0.895	1.080	1.230	1.450	1.494	1.538	1.742	1.870	2.065
β	0.468	0.728	0.748	0.716	0.700	0.653	0.662	0.639	0.589	0.595
Ln(ME)	10.749	11.253	11.337	11.365	11.368	11.337	11.260	11.294	11.258	11.417
B/P	27.587	29.814	32.283	35.898	38.709	40.867	43.629	45.934	49.398	51.686
Leverage	76.333	68.651	66.816	65.292	64.534	64.281	65.464	65.995	67.159	71.899
ROE	-13.511	13.282	15.628	16.223	17.045	17.381	18.204	19.612	19.895	23.955
CF/P	-0.516	4.758	6.244	7.371	8.317	9.440	10.638	12.205	14.412	22.020
E(+)/P	1.059	2.843	3.977	4.714	5.401	6.172	6.882	7.660	8.815	10.829
E/P Dummy	0.398	0.072	0.040	0.025	0.023	0.018	0.019	0.015	0.016	0.023

(g) Stocks Sorted on E/P

	P0	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
Return	1.640	0.989	1.352	1.076	1.249	1.285	1.395	1.611	1.544	1.724	2.064
β	0.440	0.613	0.695	0.711	0.714	0.735	0.713	0.670	0.645	0.627	0.567
Ln(ME)	10.377	11.054	11.264	11.406	11.402	11.415	11.411	11.425	11.302	11.296	11.239
B/P	32.947	30.743	32.007	34.302	35.805	37.581	41.588	42.790	44.852	48.435	51.880
Leverage	81.846	74.767	71.313	68.139	66.707	65.509	62.853	61.926	63.498	63.668	68.516
ROE	-31.624	6.645	12.133	14.767	16.484	17.626	18.009	19.404	21.036	23.236	30.035
CF/P	-0.031	5.109	6.596	7.850	8.369	9.283	9.989	10.744	11.982	13.911	18.547
E(+)/P	0.421	1.464	2.779	3.818	4.618	5.368	6.191	6.974	8.132	9.648	13.686
E/P Dummy	0.818	0.078	0.025	0.014	0.008	0.007	0.002	0.002	0.002	0.000	0.002

B. Return Behavior of Two Way Classified Portfolios

Table 2 is the summary of the portfolio statistics when 100 portfolio was formed by the two way classification scheme by size and pre-β as was introduced in the previous section. Average returns are shown on the top panel, post-βs are on the second panel, and size distribution are on the third panel of Table 2, respectively. By reading through columns of each β classification on top panel of Table 2 we find the difference in size from M1 through M10 almost uniformly explain the differences in returns for every β classification between β1 and β10. On the other hand, by reading through rows for each size classification, one notices the differences in pre-βs do not necessary produces uniform differences in average return on 100 portfolios. Thus, we conjecture, on the basis of these casual observations of two way classification portfolios, that cross-sectional behavior of portfolio returns would be related to size variable, but not so much so with βs.

Secondly, from the second panel of Table 2 we can observe how the post-βs of 100 portfolios defined above are related to pre-βs estimated from individual firms. From the bottom row of the table one finds that the initial orderings of pre-βs are basically preserved even if post-βs are computed only once for each portfolio based on its time-series observations. Of course, it is to some extent expected as pre-βs are computed by rolling regressions of three year observations and post-βs are computed once for all from the same sample. However, this finding would give us at least a good clue as to how we can safely use this post-β as a substitute for this rolled forward pre-β estimates without worrying about non-stationarity of β for our sample. In fact, the motivation for using this once-for-all post-β is based on the arguments and empirical observations by Chan and Chen (1989) for US. data. Fama and French (1992a) also employ this method, but their way of using post-βs for their tests are slightly different from what we do, and the difference will become clearer later.

Going back to the original motivations of producing 100 two way classification portfolios let us investigate whether we have succeeded in producing wide spread variations in the regressors: that is, size and β. In Fama and French (1992a) study the correlation between size and β when 10 portfolios were pre-classified only by size was -0.98, and the correlation was reduced to -0.50 when 100 portfolios were formed by further classifications by β. Similarly, in our study the correlation for the corresponding 10 portfolios was 0.98 where it should be noted that the sign of the correlation was completely opposite from Fama and French (1992a), and corresponding correlations were 0.72 between size and pre-β and 0.67 between size and post-β for the size-β classified portfolio sample. With this degree of associations between pre-β and post-β we can confirm that the degree of multicollinearity between size and β was greatly reduced, though still high. More intuitive insight can be given on Figure 1, and one can observe the general tendencies of average returns of these 100 portfolio series that should be related to post-β and size. One can easily see how the differences in size are related to the differences in average returns, while the same tendency for β is obscure and sometimes even opposite for a particular size (M) classification.

On the basis of these observations, as a cross-examination sample, we also construct another set of 100 portfolio series by classifying securities first by size and then by book-to-market equity ratio as the latter variable showed relative strength in explaining average returns through data observations in the previous sub-section. Table 3 shows this result. When top panels of Table 2 and Table 3 are compared pairwise, the difference is remarkable. By reading through every

Table 2. Characteristic of Size-β Sorted Portfolio

Average Monthly Returns (in Percent)

	β 1	β 2	β 3	β 4	β 5	β 6	β 7	β 8	β 9	β 10	All
M1	2.320	2.522	2.598	2.689	2.855	2.359	2.742	2.125	2.288	2.499	2.503
M2	2.090	2.073	1.811	2.057	1.980	1.774	2.068	1.714	1.789	2.009	1.934
M3	0.926	1.907	1.815	1.718	1.953	1.605	1.964	2.059	2.221	1.870	1.793
M4	1.013	1.711	1.179	1.318	1.495	1.750	1.526	1.854	1.590	1.641	1.498
M5	0.763	1.233	1.382	1.773	1.391	1.441	1.475	1.404	1.242	0.656	1.282
M6	1.064	1.389	1.418	1.427	1.801	0.990	1.179	1.275	1.544	0.747	1.294
M7	1.049	1.271	1.432	1.188	1.460	1.279	0.808	0.884	1.092	0.892	1.141
M8	1.136	1.271	1.107	0.815	1.276	1.479	1.055	1.358	1.157	1.284	1.188
M9	1.209	1.001	1.083	0.962	1.322	0.642	0.842	1.132	0.909	0.879	0.998
M10	1.090	1.170	0.825	1.128	0.818	0.528	0.770	0.783	0.562	0.585	0.837
All	1.263	1.554	1.464	1.509	1.638	1.380	1.441	1.464	1.439	1.316	1.447

Post Ranking β's

	β 1	β 2	β 3	β 4	β 5	β 6	β 7	β 8	β 9	β 10	All
M1	0.833	0.876	0.855	0.879	0.984	0.904	0.903	0.914	0.943	0.994	0.907
M2	0.628	0.728	0.844	0.783	0.830	0.834	0.869	0.930	0.870	0.939	0.823
M3	0.560	0.738	0.870	0.796	0.791	0.868	0.857	0.981	0.777	0.941	0.816
M4	0.588	0.720	0.832	0.846	0.784	0.826	1.006	0.823	0.737	1.058	0.816
M5	0.621	0.733	0.830	0.797	0.842	0.912	0.851	0.930	0.963	0.929	0.837
M6	0.784	0.699	0.881	0.893	0.802	0.914	0.929	1.007	1.102	1.095	0.906
M7	0.684	0.910	0.859	0.876	0.892	0.976	0.946	0.992	0.996	1.014	0.911
M8	0.952	0.843	0.784	0.947	0.865	0.924	0.827	1.111	0.988	1.184	0.938
M9	0.793	0.819	0.996	0.797	1.004	0.963	0.917	1.177	1.027	0.991	0.945
M10	0.656	0.778	0.814	0.855	0.939	1.015	1.013	1.151	1.048	1.119	0.933
All	0.709	0.784	0.858	0.847	0.873	0.914	0.911	1.002	0.946	1.025	0.883

Average Size [ln(ME)]

	β 1	β 2	β 3	β 4	β 5	β 6	β 7	β 8	β 9	β 10	All
M1	9.441	9.519	9.508	9.564	9.569	9.554	9.544	9.523	9.548	9.602	9.536
M2	10.081	10.048	10.022	10.067	10.032	10.046	10.042	10.023	10.026	10.006	10.040
M3	10.320	10.364	10.375	10.382	10.381	10.369	10.368	10.402	10.401	10.374	10.373
M4	10.614	10.674	10.648	10.640	10.658	10.679	10.661	10.680	10.663	10.661	10.657
M5	10.912	10.949	10.952	10.977	10.972	10.980	10.972	10.976	10.941	10.943	10.958
M6	11.252	11.266	11.304	11.290	11.303	11.283	11.300	11.281	11.306	11.256	11.285
M7	11.614	11.625	11.641	11.627	11.655	11.629	11.611	11.638	11.633	11.615	11.629
M8	11.997	11.997	12.012	12.037	12.043	12.050	12.047	12.069	12.053	12.056	12.035
M9	12.548	12.527	12.596	12.552	12.548	12.502	12.541	12.636	12.577	12.602	12.562
M10	13.501	13.504	13.550	13.512	13.502	13.624	13.655	13.645	13.785	13.682	13.592
All	11.227	11.252	11.256	11.264	11.267	11.268	11.269	11.283	11.293	11.263	11.264

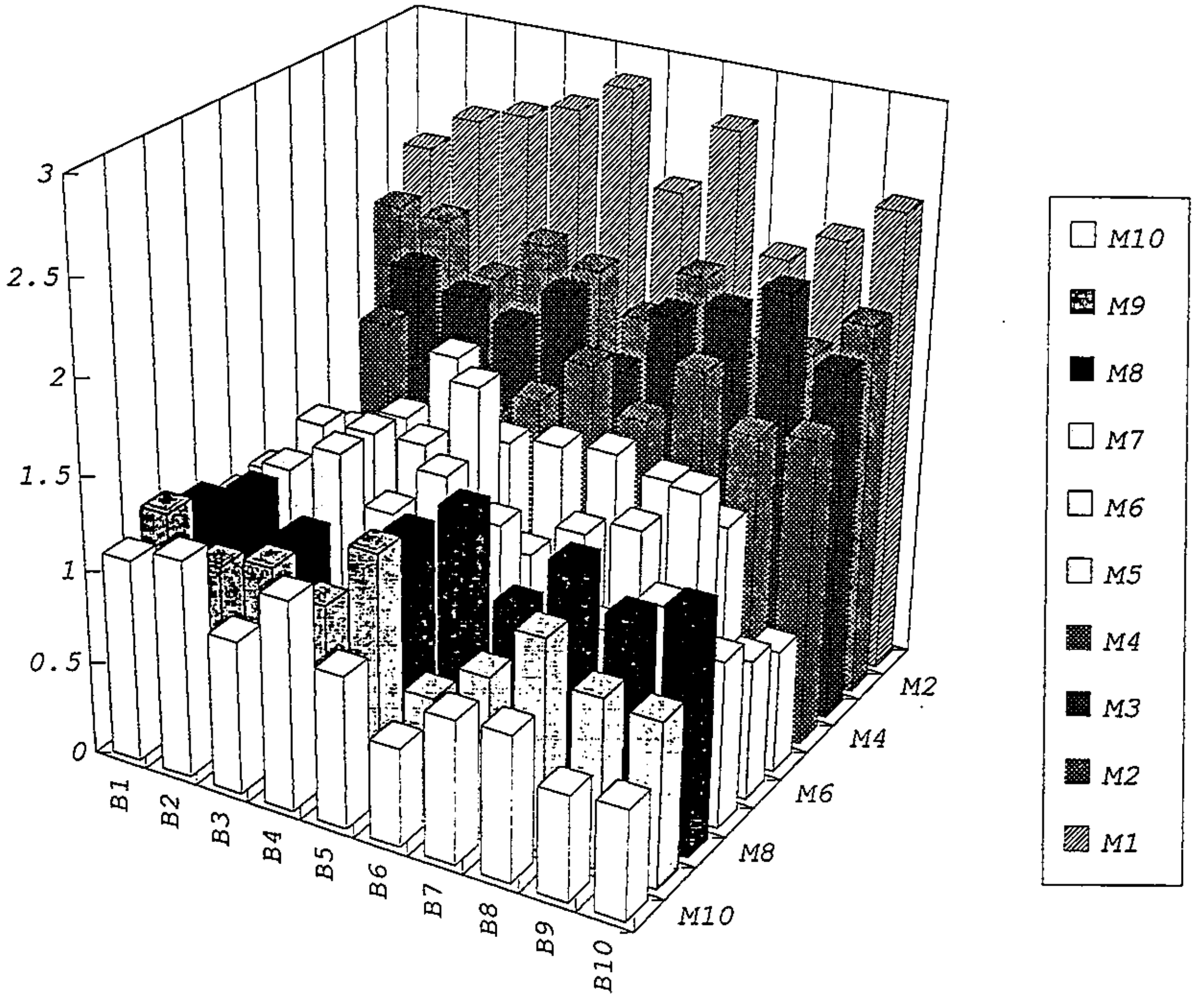

Figure 1. Average monthly return : Size-β sorted portfolios

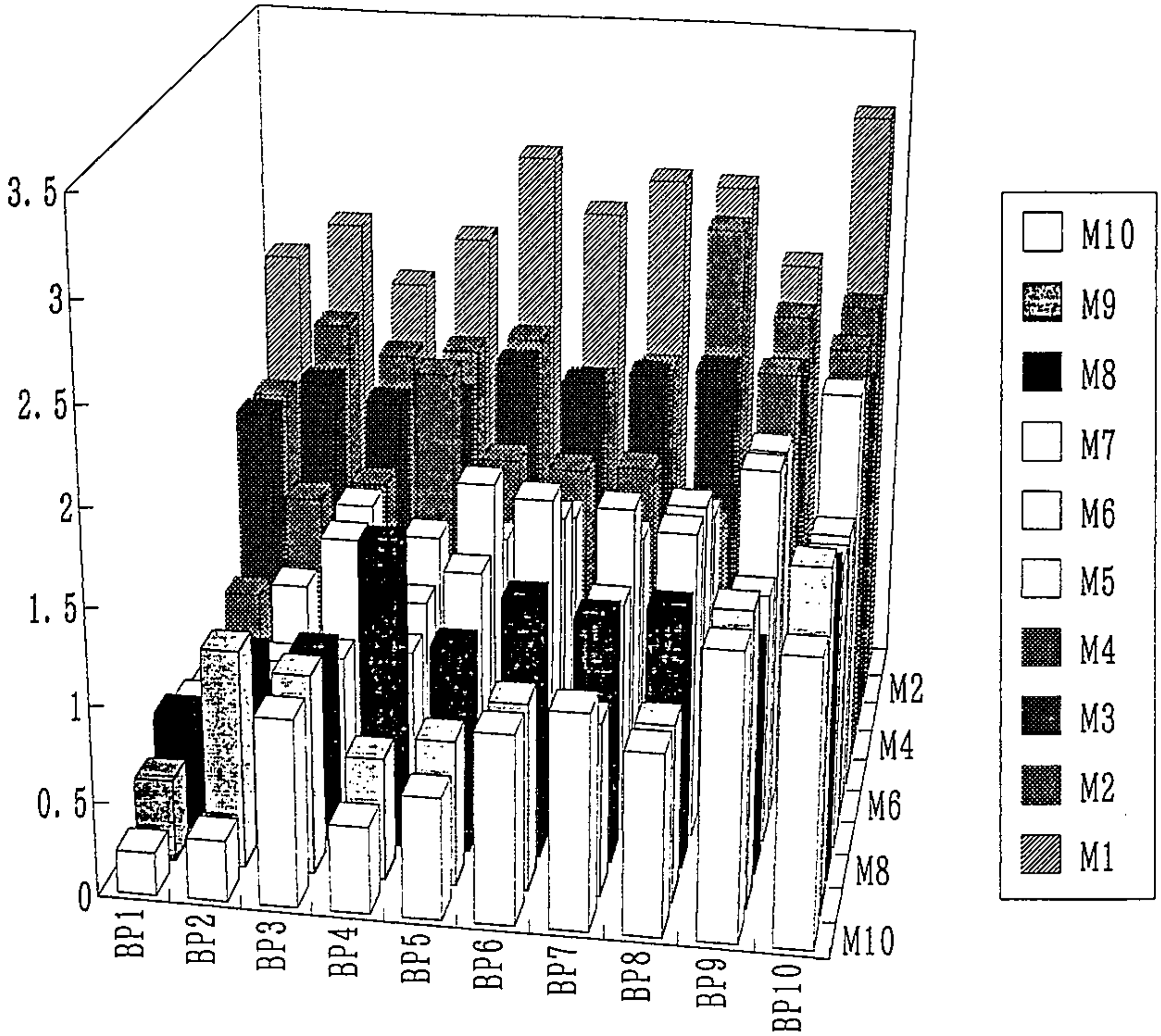

Figure 2. Average monthly return : Size-BPR sorted portfolios

row, one finds that book-to-market equity ratio can produce much larger differences in average returns than β. For example, for the smallest portfolio group (M1), smallest B/P 1 and largest B/P 10 portfolio produce return difference of 0.923 per cent, and similarly for the largest group (M10) the difference is 1.263 per cent, while the corresponding figures for size-β classified portfolio are 0.179 per cent and −0.505 per cent with negative signs. Figure 2 plots average returns that are related to size and this time to the book-to-market equity ratio, and we clearly observe this uniform tendency for average returns to increase according to both of these variables .

V. Cross-section Risk and Returns

A. Optimal Set of Proxy Variables to Explain Risk and Return

As seen from informal observations of the data in the previous sub-section, size was strongly related to average returns, while both pre-β and post-β were not. Also, book-to-market equity ratio had a strong explanatory power. To confirm this assertion more formally, we conduct

Table 3. Characteristic of Size-BPR Sorted Portfolios

Average Monthly Returns (in Percent)

	B/P 1	B/P 2	B/P 3	B/P 4	B/P 5	B/P 6	B/P 7	B/P 8	B/P 9	B/P 10	All
M1	2.188	2.387	2.074	2.342	2.808	2.514	2.713	2.694	2.288	3.111	2.503
M2	1.526	1.936	1.790	1.835	1.918	1.702	1.793	2.573	2.120	2.192	1.934
M3	1.545	1.742	1.652	1.698	1.904	1.826	1.883	1.931	1.943	1.889	1.793
M4	0.657	1.227	1.337	1.955	1.511	1.478	1.508	1.206	2.061	2.205	1.498
M5	0.448	0.884	1.355	1.205	1.218	1.360	1.270	1.414	1.787	2.100	1.282
M6	0.467	0.611	1.313	0.991	1.655	1.498	1.565	1.603	1.818	1.506	1.294
M7	0.526	0.671	0.819	0.877	1.327	1.730	1.207	1.602	1.307	1.506	1.141
M8	0.612	0.957	1.005	1.595	1.082	1.356	1.281	1.353	1.161	1.611	1.188
M9	0.431	1.142	1.044	0.640	0.760	0.980	0.906	0.925	1.536	1.779	0.998
M10	0.223	0.319	0.981	0.457	0.636	0.911	1.125	0.948	1.490	1.486	0.837
All	0.862	1.187	1.336	1.363	1.482	1.534	1.525	1.628	1.754	1.942	1.447

Post Ranking β's

	B/P 1	B/P 2	B/P 3	B/P 4	B/P 5	B/P 6	B/P 7	B/P 8	B/P 9	B/P 10	All
M1	0.931	1.143	0.882	0.911	0.889	0.886	0.879	0.841	0.883	0.791	0.907
M2	0.890	0.887	0.845	0.855	0.850	0.861	0.827	0.749	0.688	0.768	0.823
M3	0.865	0.753	0.879	0.849	0.716	0.889	0.773	0.854	0.799	0.766	0.816
M4	0.770	0.857	0.922	0.818	0.850	0.698	0.861	0.821	0.770	0.771	0.816
M5	0.978	0.856	0.874	0.896	0.760	0.804	0.888	0.721	0.809	0.767	0.837
M6	0.999	0.977	1.039	0.822	0.902	0.922	0.906	0.804	0.863	0.784	0.906
M7	1.011	0.912	0.841	0.951	0.953	0.907	0.967	0.896	0.867	0.783	0.911
M8	1.073	1.067	0.902	1.017	0.927	0.969	0.947	0.833	0.789	0.826	0.938
M9	1.039	0.942	1.005	0.979	0.950	0.940	0.926	0.880	0.874	0.878	0.945
M10	0.863	1.087	1.106	0.928	0.996	0.990	0.936	0.777	0.914	0.701	0.933
All	0.942	0.948	0.930	0.903	0.879	0.886	0.891	0.818	0.826	0.782	0.883

Average Size [ln(ME)]

	B/P 1	B/P 2	B/P 3	B/P 4	B/P 5	B/P 6	B/P 7	B/P 8	B/P 9	B/P 10	All
M1	9.422	9.559	9.532	9.521	9.547	9.535	9.569	9.565	9.526	9.587	9.536
M2	10.024	10.035	10.037	10.055	10.040	10.049	10.045	10.050	10.030	10.037	10.040
M3	10.343	10.370	10.388	10.374	10.374	10.375	10.393	10.370	10.375	10.367	10.373
M4	10.630	10.631	10.654	10.690	10.651	10.677	10.656	10.640	10.684	10.667	10.657
M5	10.916	10.952	10.940	10.959	10.971	10.955	10.940	10.968	10.995	10.990	10.958
M6	11.218	11.254	11.314	11.282	11.308	11.314	11.259	11.300	11.324	11.277	11.285
M7	11.578	11.596	11.635	11.616	11.639	11.670	11.643	11.626	11.649	11.646	11.629
M8	11.991	12.038	12.012	12.087	12.056	12.038	12.046	12.032	12.025	12.026	12.035
M9	12.570	12.621	12.561	12.555	12.544	12.564	12.548	12.495	12.586	12.569	12.562
M10	13.475	13.489	13.666	13.652	13.683	13.585	13.626	13.510	13.566	13.684	13.592
All	11.216	11.256	11.267	11.279	11.282	11.275	11.268	11.253	11.277	11.267	11.264

cross-section stepwise regressions each month. We employ the algorithm called Adjusted R-square Maximization Routine available in IMSL library. In this algorithm the optimal regression equations in the sense of maximizing adjusted R-square are sequentially searched in an iterative way to arrive at a final model. In this way we get separate estimated equations each month, and can have time-series observations of estimated coefficients.

On Table 4 we have results for three separate regressions. The top panel is the result for 100 portfolios ranked by size and β. Second panel is the result for portfolios ranked by size and book-to-market equity ratio, and the final panel is for individual securities cross-section regressions. With this algorithm one can either pre-specify the number of explanatory variables or can choose the optimum number of variables as a free parameter. On the top panel of Table 4 from row 1 to 7 we have the results where the numbers of the explanatory variables are pre-imposed when the algorithm is employed. On row 1, one explanatory variable model (plus intercept term) is imposed and it shows that 38.73 percent of the time of our 142 time-series observations in our cross-section stepwise regressions the size was chosen to be the single variable that can explain return variations best. Similarly β was chosen 40.14 per cent of the time and leverage 11.97 per cent. Surprisingly, contrary to the previous observations book-to-market equity ratio was never chosen when one variable model was imposed. Of course, this estimation process would be classified as a typical case for missing variable problem, but the result would give us the informal view on the workings of one factor model in relation to the conventional CAPM.

As one reads through from rows 2 through 7 in this way, in case of three variable models, for example, the magnitudes of the frequency chosen in descending order are size, β, leverage, dividend yield, and book-to-market equity ratio, and this tendency is similar even if we increase the number of variables.

Eighths row, this time, is the case where the number of explanatory variables in the estimated model is also a free parameter in the estimation process. The result is that variables chosen in frequencies in descending order were size (77.46%), β (69.01%), leverage (66.20%), dividend yield (50.70%), and the book-to-market equity ratio and the earnings-to-market equity ratio at the same frequency of 41.55 per cent, and it is quite compatible with previous regression results where the number of explanatory variables is imposed.

With this result thus far one may wonder why the result seems variables is imposed somewhat contradictory to the casual observations in the previous sub-section. However, when one takes into account of both the sign of the estimated coefficients as is considered reasonable with *a priori* economic reasoning's and the significance of individual coefficients from these stepwise regressions, this apparent contradictory puzzle is reconciled. Notice that in the algorithm we use R^2 is maximized, but the significance of each coefficient is not fully taken care of.

As for the sign of estimated coefficients, they are considered to be the estimated *ex post* market price of risk. Let us employ *a priori* reasoning that the size, where smaller firms are considered to be riskier, could be negatively related to average returns and other variables could be positively related to returns, as these latter variables are considered to signify risk as the values become larger. That is, variables where the numerator is related to the current profits or the past profit, earnings-to-price ratio, cashflow-to-price ratio, ROE, and book-to-market equity ratio, would be positively related to returns and thus to risk. Also denominator in these variables except ROE are meant to denote market price and it is a market perception of the risk and the price would be lower as the risk higher. Also, the denominator in ROE is considered to be the surrogate for the market value of equity. Obviously, β and leverage are considered to be risk variables of their owns.

A caveat here. Although the data includes the period when the market return was *ex post* lower than the risk free rate, overall sample had an average positive market risk price in our study. Besides, one does not know *a priori* the sign of these variables when the risk price is negative, without a definite theory to explain it, though we can not deny its possibility both in theory (Cox, Ingersoll and Ross (1985, p.372) and empirical investigations(Baudoukh, Richardson, and Smith (1993)). We pay attention to this sign problems later in the next subsection.

Thus when we look both the significance and the size of estimates, we find necessary statistics on row 9 through 12 of Table 4. That is; row 9 for positive signs, row 10 for significant positive signs, row 11 for negative signs and row 12 for significant positive signs. For the size variable with only negative signs considered, one can see from row 12 in the top panel of the Table 4 that the size variable turns out to be significant 40.85 per cent of the time with the right sign. On the other hand, one get mislead by the wrong sign (row 10) only 23.94 per cent of the time. Hence, out of the time period for the size variable to be significant 63 per cent of the time the sign is the right one. So, by paying attention to both significance and the sign we get a completely different picture from above. Also, for book-to-market equity ratio, the significant frequencies with the right sign is 16.20 per cent while with the wrong sign is 10.56 per cent, and again 60 per cent of the time when significant coefficient have right signs. This would be an important result from the practical point of view for a portfolio manager, as he/she can be significantly right two out of three times by tilting towards the size variable ceteras paribus. However, we strongly have to reject the implications of the traditional β measure, as the percentage with significant wrong signs is 26.06 per cent while the right sign is only 26.76 per cent, and a portfolio manager who follows β for his/her risk control purposes is only 50 per cent of the time right and 50 per cent of the time wrong. One would surely do not want to rely on these β as a pertinent risk measure.

For other variables, one finds on row 10 that leverage variable ranks second to size at 28.17 per cent. Then follows β with 26.76 per cent, book-to-market equity ratio with 16.20 per cent, dividend yield with 16.20 per cent, and earnings-to-price ratio with 12.68 per cent. However, dividend yield and earning-to-price ratio also show high percentage of wrong signs, while leverage is right more than 60 per cent of the time when significant. From the analyses of these basic statistics, one conjecture that book-to-market equity ratio and leverage ratio would potentially serve as pertinent risk factor proxy variables for our final cross-sectional regression estimations. Also, one finds that cashflow-to-price ratio might be a slightly more stable variable than earnings-to-price ratio when one considers the proportion of the percentage right relative to wrong; that is, 65.37 per cent versus 54.56 per cent.

The second and the third panel of Table 4 confirms the same result with different sample designs as explained above. Second panel is the case when the sorting of securities was done by size and book-to-market equity ratio instead of size and β to form portfolios. Basically the results are comparable between these two panels, but the magnitudes of significant frequencies for book-to-market equity ratio, earnings-to-price ratio, and cashflow-to-earnings ratio were increased, respectively, while the ones for leverage, β and dividend yield were decreased. The risk related to book-to-market equity ratio might be associated with the risk related to leverage and β, though we cannot give any definite inferences at this stage. Note that the percentage of the book-to-market equity ratio (row 10 of each) with right significant coefficients was increased from 16.20 per cent to 21.13 per cent for this β-BPR ranked portfolio. Actually this magnitude gives us a rough estimate of the order of the possible bias induced by pre-rankings by the variable of the interest, of which point was pointed out by Lo and McKinlay (1990).

The third panel is the result on individual securities and the only difference is that the β will be a more reliable measure, where the significant percentage is 33.10 per cent with right sign and 27.46 per cent with wrong sign. This result, however, is not to be accepted literally as we expect the existence of the estimation errors on individual β estimates as usual is the case. However, good points in using individual regressions are that the individual financial ratios have more practical meanings than at portfolio level, and that the cross-correlations of these explanatory variables becomes smaller and thus can reduce multicollinarity problems (see, for example, correlation matrix of Table 6).

B. Risk and Returns: Sub-period Results and Final Model

Table 5a is the result on three sub-periods corresponding to the total period result from the top panel of Table 4. That is; it corresponds to the case for 100 portfolios ranked by size and pre-β. At this stage in order to compare the results based on pre-β and post-β, we also present a similar table Table 5b where the once-for-all post β is used for the same cross-section regressions applied to the same 100 portfolios.

First sub-period we have chosen is from September 1981 through August 1985, which can be classified as the typical up market period of Japanese market. Second sub-period is from September 1985 through August 1989, which can be easily termed as the infamous "bubble" period of Japan. The last sub-period is September 1989 through June 1993, and this sub-period can be called as the long adjusting period which Japan has experienced for the first time in the post-war stock market history.

The remarkable point is that during the "bubble" period the leverage variables were strongly significant with 39.58 per cent (See also Figure 3), and it suggests that highly leveraged firms were pumping their excess liquid fund into "bubblish" income generating activities to increase both its security risk and return. In retrospect, it is common knowledge that many of the Japanese firms were putting their excess fund into real estate investments, lending activities mainly to finance companies, and stock investments with high turnover rate, instead of real investments into their own productive activities. As we are using only non-financial manufacturing and non-manufacturing firms as our dataset and excluding banks, insurance companies and other financial companies, the above finding is very illuminating in spotlighting the behavior of typical Japanese non-financial firms during this period, as most of the "bubble" stories are more often referenced to banks as its main causing source. That is; Japanese non-financial firms were significantly incurring higher leverage, in general, at this time by issuing huge amount of bonds with warrants and convertible bond, and were actually increasing the return and risk of their equity positions as can be seen from our sub-period cross-section results.

On the other hand, during the long adjusting period, earnings-to-price ratio and cashflow-to-price ratio turn out to be strongly significant relative to other sub-periods both at 17.39 per cent while, other periods' figures are 12.50 per cent and 8.33 per cent for the former variable and 8.33 per cent and 10.42 per cent for the latter. This observation can be described as

Table 4. Results on Adjusted R^2 Maximizing Regressions

(4a) Size-β ranking Portfolio

	Size	Beta	BPR	ROE	CFPR	Dividend	Leverage	EPR(+)
1 Best Reg.	38.73	40.14	0.00	0.70	0.70	4.23	11.97	3.52
2 Best Reg.	60.56	52.11	11.97	9.15	9.15	16.90	30.99	9.15
3 Best Reg.	69.72	61.97	28.17	16.90	16.20	31.69	50.00	25.35
4 Best Reg.	78.87	70.42	40.14	32.39	34.51	48.59	59.15	35.92
5 Best Reg.	85.21	82.39	57.75	44.37	47.89	61.27	72.54	48.59
6 Best Reg.	89.44	89.44	66.90	61.97	65.49	75.35	83.80	67.61
7 Best Reg.	94.37	95.77	83.10	80.99	79.58	89.44	91.55	85.21
Overall	77.46	69.01	41.55	35.21	39.44	50.70	66.20	41.55
$Coef. \geq 0$	29.58	33.80	24.65	19.72	26.06	25.35	38.03	21.83
$(\|t\| > 1.98)$	23.94	26.76	16.20	7.75	11.97	16.20	28.17	12.68
$Coef. < 0$	47.89	35.21	16.90	15.49	13.38	25.35	28.17	19.72
$(\|t\| > 1.98)$	40.85	26.06	10.56	5.63	6.34	14.08	16.20	10.56

(4b) Size-BPR Ranking Portfolio

	Size	Beta	BPR	ROE	CFPR	Dividend	Leverage	EPR(+)
1 Best Reg.	47.18	21.83	6.34	3.52	2.82	5.63	7.75	4.93
2 Best Reg.	59.86	34.51	23.94	10.56	14.08	19.01	26.06	11.97
3 Best Reg.	70.42	50.00	36.62	20.42	28.87	26.06	38.03	29.58
4 Best Reg.	76.06	57.04	54.23	33.10	40.14	45.07	49.30	45.07
5 Best Reg.	81.69	75.35	67.61	52.82	50.70	53.52	61.97	56.34
6 Best Reg.	87.32	80.99	84.51	66.90	68.31	64.79	75.35	71.83
7 Best Reg.	93.66	91.55	92.96	82.39	81.69	84.51	88.73	84.51
Overall	75.35	61.97	52.82	40.14	42.25	45.07	52.82	47.89
$Coef. \geq 0$	26.06	33.80	30.28	17.61	27.46	25.35	33.80	28.87
$(\|t\| > 1.98)$	21.83	16.90	21.13	5.63	16.20	11.27	19.01	15.49
$Coef. < 0$	49.30	28.17	22.54	22.54	14.79	19.72	19.01	19.01
$(\|t\| > 1.98)$	41.55	16.20	11.97	11.97	4.93	7.04	9.15	9.86

(4c) Individual Securities

	Size	Beta	BPR	ROE	CFPR	Dividend	Leverage	EPR(+)
1 Best Reg.	35.92	30.28	2.82	1.41	0.70	7.04	14.79	7.04
2 Best Reg.	52.11	44.37	14.08	7.04	7.75	21.13	31.69	21.83
3 Best Reg.	64.08	55.63	29.58	15.49	17.61	29.58	50.70	37.32
4 Best Reg.	76.06	66.20	42.96	24.65	28.87	40.85	68.31	52.11
5 Best Reg.	81.69	76.76	60.56	32.39	47.89	59.15	78.17	63.38
6 Best Reg.	88.03	80.28	74.65	54.93	65.49	71.83	83.80	80.99
7 Best Reg.	96.48	87.32	83.10	78.17	85.92	85.92	90.85	92.25
Overall	85.21	77.46	65.49	42.96	55.63	61.27	76.76	66.90
$Coef. \geq 0$	30.99	40.14	41.55	23.94	37.32	34.51	47.89	39.44
$(\|t\| > 1.98)$	23.94	33.10	28.87	9.15	24.65	23.94	35.21	32.39
$Coef. < 0$	54.23	37.32	23.94	19.01	18.31	26.76	28.87	27.46
$(\|t\| > 1.98)$	47.89	27.46	14.08	7.75	9.86	14.08	22.54	19.72

Table 5(a). **Subperiod Results for the Case where Number of the Explanatory Variable are Free (Pre βs are used)**

	Size	β	BPR	ROE	CFPR	Dividend	Leverage	EPR(+)
Sep. 1981 through Aug. 1985								
$d_j > 0$	27.08	35.42	27.08	16.67	20.83	25.00	37.50	25.00
$(\|t\| > \alpha)$	(18.75)	(27.08)	(20.83)	(4.17)	(8.33)	(16.67)	(20.83)	(12.50)
$d_j < 0$	43.75	35.42	27.08	14.58	10.42	33.33	25.00	10.42
$(\|t\| > \alpha)$	(31.25)	(29.17)	(12.50)	(6.25)	(4.17)	(22.92)	(12.50)	(2.08)
$\|d_j\| > 0$	70.83	70.83	54.17	31.25	31.25	58.33	62.50	35.42
$(\|t\| > \alpha)$	(50.00)	(56.25)	(33.33)	(10.42)	(12.50)	(39.58)	(33.33)	(14.58)
Sep. 1985 through Aug. 1989								
$d_j > 0$	29.17	31.25	25.00	22.92	27.08	25.00	45.83	18.75
$(\|t\| > \alpha)$	(22.92)	(25.00)	(16.67)	(10.42)	(10.42)	(12.50)	(39.58)	(8.33)
$d_j < 0$	50.00	39.58	10.42	4.17	18.75	16.67	25.00	22.92
$(\|t\| > \alpha)$	(47.92)	(25.00)	(8.33)	(2.08)	(6.25)	(6.25)	(16.67)	(14.58)
$\|d_j\| > 0$	79.17	70.83	35.42	27.08	45.83	41.67	70.83	41.67
$(\|t\| > \alpha)$	(70.83)	(50.00)	(25.00)	(12.50)	(16.67)	(18.75)	(56.25)	(22.92)
Sep. 1989 through Jun. 1993								
$d_j > 0$	32.61	34.78	21.74	17.39	30.43	28.26	32.61	21.74
$(\|t\| > \alpha)$	(28.26)	(28.26)	(10.87)	(6.52)	(17.39)	(19.57)	(23.91)	(17.39)
$d_j < 0$	50.00	32.61	15.22	26.09	10.87	26.09	32.61	28.26
$(\|t\| > \alpha)$	(43.48)	(23.91)	(10.87)	(6.52)	(6.52)	(13.04)	(19.57)	(13.04)
$\|d_j\| > 0$	82.61	67.39	36.96	43.48	41.30	54.35	65.22	50.00
$(\|t\| > \alpha)$	(71.74)	(52.17)	(21.74)	(13.04)	(23.91)	(32.61)	(43.48)	(30.43)
Sep. 1981 through Jun. 1993								
$d_j > 0$	29.58	33.80	24.65	19.01	26.06	26.06	38.73	21.83
$(\|t\| > \alpha)$	(23.94)	(26.76)	(16.20)	(7.75)	(11.97)	(16.90)	(28.17)	(13.38)
$d_j < 0$	47.89	35.92	17.61	14.79	13.38	25.35	27.46	20.42
$(\|t\| > \alpha)$	(40.85)	(26.76)	(10.56)	(5.63)	(5.63)	(14.08)	(16.90)	(10.56)
$\|d_j\| > 0$	77.46	69.72	42.25	33.80	39.44	51.41	66.20	42.25
$(\|t\| > \alpha)$	(64.79)	(53.52)	(26.76)	(13.38)	(17.61)	(30.99)	(45.07)	(23.94)

the investors' conservative preference to the stable income generating firms with high profit or cashflow relative to their stock price during the downturn of the market.

Also, we notice that the first sub-period result is, in general, representative of the total period result of our sample, as can be seen by comparing this result with the total period result at the bottom of the table. Also, it is very comparable to the finding by Chan, Hamao, and Lakonishok (1991), where the earlier sample period is covered with substantive weight in the total sample.

When we compare the result on Table 5a and b, regardless of using either pre-β and post-β, the results are remarkably similar and it suggests that the risk of using once-for-all portfolio post-β instead of pre-β in cross-section regressions is not large. It is true, however, the explanatory power of β is somewhat mitigated when post-β is used.

Finally on Table 6 we have final estimates of cross-section regressions for individual securities, size-β ranked portfolios, and size-BPR ranked portfolios, where the set of explanatory variables are held constant for all consecutive regressions. Our choices of predetermined variables are based on both our previous stepwise variable regression results and pairwise multicollinearity possibilities as can be seen on the correlation coefficient matrices in Table 6. As was mentioned before, previous sub-section corresponds to the conditional test where variable inclusions were changed over time. Regressions in this sub-section allow for time changes in the estimated market price of risk, but in computing the time-series averages of estimates our model eventually results in the unconditional test as in Fama and MacBeth (1973).

In every panel of Table 6 one notice that size are strongly significant, but βs are most of the time not significant, while book-to-market equity ratios are significant in all of our regression equation choices. This confirms our previous conjectures above. Also, one finds that

Table 5(b). Subperiod Results for the Case where Number of the Explanatory Variable are Free (Post βs are used)

	Size	β	BPR	ROE	CFPR	Dividend	Leverage	EPR(+)
Sep. 1981 through Aug. 1985								
$d_j > 0$	29.17	37.50	27.08	20.83	22.92	25.00	41.67	18.75
$(\|t\| > \alpha)$	(20.83)	(18.75)	(18.75)	(4.17)	(8.33)	(12.50)	(35.42)	(12.50)
$d_j < 0$	39.58	35.42	25.00	20.83	12.50	31.25	33.33	12.50
$(\|t\| > \alpha)$	(31.25)	(27.08)	(14.58)	(4.17)	(4.17)	(20.83)	(22.92)	(2.08)
$\|d_j\| > 0$	68.75	72.92	52.08	41.67	35.42	56.25	75.00	31.25
$(\|t\| > \alpha)$	(52.08)	(45.83)	(33.33)	(8.33)	(12.50)	(33.33)	(58.33)	(14.58)
Sep. 1985 through Aug. 1989								
$d_j > 0$	29.17	29.17	31.25	22.92	27.08	22.92	50.00	14.58
$(\|t\| > \alpha)$	(27.08)	(14.58)	(16.67)	(12.50)	(10.42)	(14.58)	(43.75)	(10.42)
$d_j < 0$	45.83	25.00	12.50	8.33	18.75	22.92	31.25	16.67
$(\|t\| > \alpha)$	(43.75)	(12.50)	(6.25)	(4.17)	(6.25)	(10.42)	(20.83)	(10.42)
$\|d_j\| > 0$	75.00	54.17	43.75	31.25	45.83	45.83	81.25	31.25
$(\|t\| > \alpha)$	(70.83)	(27.08)	(22.92)	(16.67)	(16.67)	(25.00)	(64.58)	(20.83)
Sep. 1989 through Jun. 1993								
$d_j > 0$	34.78	30.43	28.26	21.74	30.43	26.09	32.61	19.57
$(\|t\| > \alpha)$	(32.61)	(21.74)	(15.22)	(8.70)	(19.57)	(17.39)	(19.57)	(15.22)
$d_j < 0$	50.00	28.26	15.22	17.39	17.39	28.26	30.43	28.26
$(\|t\| > \alpha)$	(43.48)	(23.91)	(4.35)	(8.70)	(8.70)	(15.22)	(17.39)	(13.04)
$\|d_j\| > 0$	84.78	58.70	43.48	39.13	47.83	54.35	63.04	47.83
$(\|t\| > \alpha)$	(76.09)	(45.65)	(19.57)	(17.39)	(28.26)	(32.61)	(36.96)	(28.26)
Sep. 1981 through Jun. 1993								
$d_j > 0$	30.99	32.39	28.87	21.83	26.76	24.65	41.55	17.61
$(\|t\| > \alpha)$	(26.76)	(19.72)	(16.90)	(8.45)	(13.38)	(15.49)	(33.80)	(13.38)
$d_j < 0$	45.07	29.58	17.61	15.49	16.20	27.46	31.69	19.01
$(\|t\| > \alpha)$	(39.44)	(21.83)	(8.45)	(6.34)	(6.34)	(16.20)	(22.54)	(8.45)
$\|d_j\| > 0$	76.06	61.97	46.48	37.32	42.96	52.11	73.24	36.62
$(\|t\| > \alpha)$	(66.20)	(41.55)	(25.35)	(14.79)	(19.72)	(31.69)	(56.34)	(21.83)

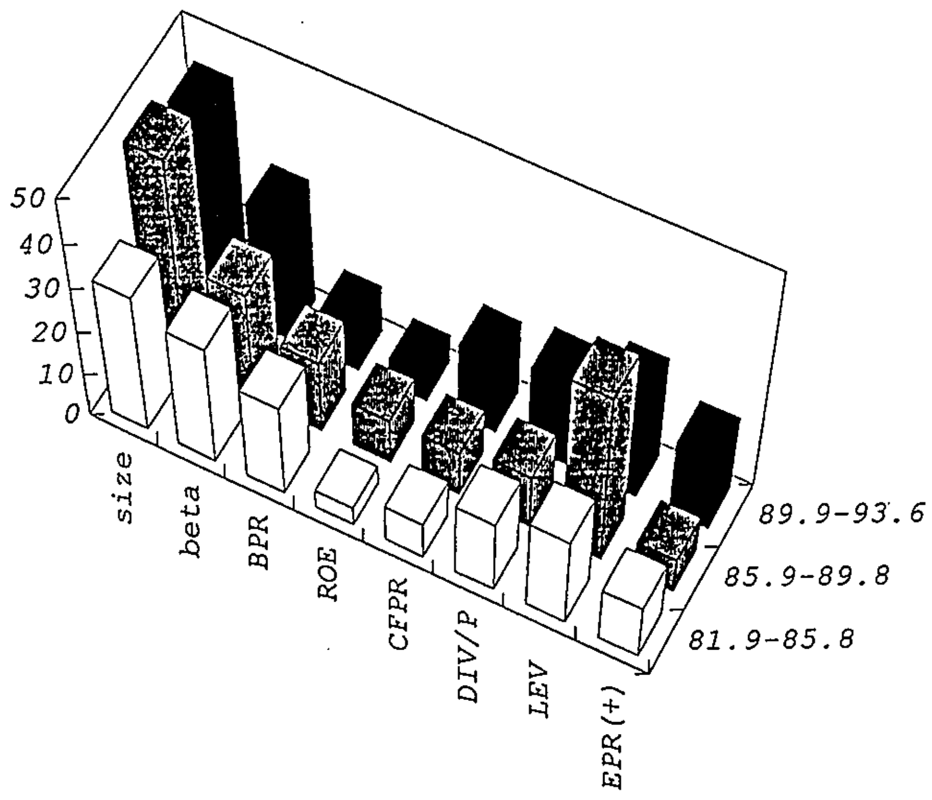

Figure 3. Significance of each variable : Results on three sub-periods.

the leverage and the earnings-to-price ratios are significant. Most puzzling result, however, is in the reduction of t-values of β coefficients when size-β sorting is used, relative to individual regressions and size-BPR sorted portfolio regressions. This is quite contrary to the assertions by Lo and McKinlay (1990). However, so far we have ignored the information on error variance-covariance matrix, and this may be influencing the final estimates. By all means, the difference between size-β portfolio result and size-BPR portfolio result is small enough to be ignored. On the other hand, t-values for book-to-market equity ratio increase dramatically when size-BPR sort is used relative to size-β portfolio, but again is smaller than the increase for the case of individual regressions. However, as individual β estimation errors are well known for years in finance literature, we tend to put more confidence on the results for our two set of 100 portfolios.

Overall, by comparing different specifications of candidate models on Table 6 we conclude that two variable model that consists of size and book-to-market equity ratio, three variable model where leverage is added to the above two variable model, or four variable model where earnings-to-price ratio is added, would constitute candidates for our finally accepted model that can account for cross-section return differences of securities. Our temporary conclusion is that the three variable model can be safely used and the four variable model also with special caution on firms with their negative earnings numbers.

Also, we find the general tendencies in rejecting explanatory power of β is universal throughout this study. We have observed this uniform result both at portfolio level and individual level. We, thus, reject the traditional capital asset pricing model at a cross-section level. In other words, in explaining cross-sectional returns in an unconditional form, the market wide risk factor is neither the only variable to be included nor the single variable to be included in the multifactor model. However, this is not to say, the market factor is not important in explaining the time-series behaviors of security returns. In fact, Fama and French (1992b) suggest there will be three factors to explain stock return time variations: the market factor, the size factor, and the BPR factor, though the first factor cannot explain cross-section variation of each security's return variations. Our result is also comparable to Miyake and Yonezawa (1993) where quarterly observations were used for individual securities for Japanese data from the similar sample period.

Also, as we have mentioned above, we also pay attention to the possible negative risk premium problems. Table 7 are the results where the model estimates were classified based on the sign of *ex post* excess returns to get a cursory view of this problem. We notice that β is significant both positive and negative excess return cases with different signs. It means, during the up market period, high β tilted portfolios produce higher returns, and, during the down market period, high β portfolios produce larger negative returns and thus high risk on both sides. We do not know of any theory to predict the behavior of β when *ex ante* risk premium is negative and we do not conjecture of any kind further, but it should be pointed out that other financial variables have same signs both at negative and positive excess returns, and high risk portfolio become low risk one when the sign of *ex post* excess returns change. So, we find β is a symmetrical risk measure, while other variables are asymmetrical risk measures.

As a final remark, notice that we have not controlled for the possible cross-sectional covariance structures of the return series both at portfolio level and individual level. This would induce inconsistency in the large sample as was pointed out by Shanken (1991), and the finer refinements of our investigation to this direction is a subject for further research.

Also, based on the observations from the current study we would pursue to construct the

Table 6(a). Coefficients of Fama-MacBeth individual regressions (Sep. 1981 ~ Jun. 1993)

Size	β	BPR	Leverage	EPR(+)
−0.46	0.41			
(−3.52)	(1.41)			
−0.41		0.024		
(−3.03)		(4.750)		
−0.44	0.49	0.024		
(−3.38)	(1.60)	(5.070)		
−0.34		0.035	0.022	
(2.61)		(6.800)	(2.880)	
−0.37	0.34	0.033	0.021	
(−2.81)	(1.26)	(6.910)	(3.200)	
−0.39		0.025	0.022	0.14
(−2.91)		(4.820)	(2.960)	(4.58)

Numbers in the parentheses are t-values and the correlations among these variables are tabulated as below.

	Size	β	BPR	ROE	CFPR	Div.	Lev.	EPR(+)
Size	1.000	0.255	-0.111	0.117	0.110	0.098	-0.151	0.077
β	0.255	1.000	-0.108	0.058	-0.010	0.010	0.016	-0.023
BPR	-0.111	-0.108	1.000	-0.133	0.359	0.513	-0.371	0.290
ROE	0.117	0.058	-0.133	1.000	0.354	0.086	0.009	0.442
CFPR	0.110	-0.010	0.359	0.354	1.000	0.505	-0.052	0.700
Div.	0.098	0.010	0.513	0.086	0.505	1.000	-0.163	0.431
Lev.	-0.151	0.016	-0.371	0.009	-0.052	-0.163	1.000	-0.147
EPR(+)	0.077	-0.023	0.290	0.442	0.700	0.431	-0.147	1.000

Table 6(b). Coefficients of Fama-MacBeth Regression.
(Size-β Sorted Portfolios)

Size	β	BPR	Leverage	EPR(+)
−0.37	0.11			
(−2.76)	(0.35)			
−0.37		0.017		
(−2.67)		(1.521)		
−0.37	0.19	0.016		
(−2.71)	(0.54)	(2.153)		
−0.27		0.031	0.032	
(−2.00)		(3.425)	(2.133)	
−0.28	0.09	0.025	0.024	
(−2.08)	(0.31)	(3.171)	(2.250)	
−0.32		0.021	0.033	0.12
(−2.37)		(2.198)	(2.255)	(2.78)

Correlation Matrix :

	Size	β	BPR	ROE	CFPR	Div.	Lev.	EPR(+)
Size	1.000	0.295	-0.188	0.287	0.297	0.264	-0.340	0.348
β	0.295	1.000	-0.280	0.152	-0.040	-0.002	0.012	0.010
BPR	-0.188	-0.280	1.000	-0.184	0.393	0.510	-0.310	0.286
ROE	0.287	0.152	-0.184	1.000	0.371	0.105	-0.143	0.560
CFPR	0.297	-0.040	0.393	0.371	1.000	0.619	-0.178	0.793
Div.	0.264	-0.002	0.510	0.105	0.619	1.000	-0.161	0.525
Lev.	-0.340	0.012	-0.310	-0.143	-0.178	-0.161	1.000	-0.355
EPR(+)	0.348	0.010	0.286	0.560	0.793	0.525	-0.355	1.000

Table 6(c) Coefficients of Fama-MacBeth Regression.
(Size-PBR Sorted Portfolios)

Size	β	BPR	Leverage	EPR(+)
−0.37	0.19			
(−2.72)	(0.43)			
−0.36		0.019		
(−2.67)		(3.652)		
−0.43	0.74	0.022		
(−3.18)	(1.85)	(4.476)		
−0.29		0.033	0.026	
(−2.11)		(4.920)	(3.043)	
−0.36	0.71	0.033	0.024	
(−2.61)	(1.82)	(5.115)	(2.928)	
−0.34		0.025	0.030	0.15
(−2.51)		(3.693)	(3.488)	(4.44)

Correlation matrix :

	Size	β	BPR	ROE	CFPR	Div.	Lev.	EPR(+)
Size	1.000	0.452	-0.074	0.270	0.247	0.199	-0.296	0.290
β	0.452	1.000	-0.234	0.220	-0.074	-0.119	-0.066	0.001
BPR	-0.074	-0.234	1.000	-0.328	0.656	0.787	-0.622	0.500
ROE	0.270	0.220	-0.328	1.000	0.063	-0.125	0.094	0.243
CFPR	0.247	-0.074	0.656	0.063	1.000	0.814	-0.452	0.820
Div.	0.199	-0.119	0.787	-0.125	0.814	1.000	-0.529	0.682
Lev.	-0.296	-0.066	-0.622	0.094	-0.452	-0.529	1.000	-0.488
EPR(+)	0.290	0.001	0.500	0.243	0.820	0.682	-0.488	1.000

Table 7(a). Results on Fama-MacBeth individual regressions when model estimates are classified based on the sign of *ex post* excess returns

Case	Size	β	PBR	Leverage	EPR(+)
$r_M - r_f \geq 0$	-0.477	1.720			
	(-2.438)	(4.031)			
$r_M - r_f < 0$	-0.444	-1.057			
	(-2.633)	(-2.758)			
$r_M - r_f \geq 0$	-0.361		0.013		
	(-1.816)		(2.081)		
$r_M - r_f < 0$	-0.461		0.036		
	(-2.602)		(4.655)		
$r_M - r_f \geq 0$	-0.472	1.801	0.014		
	(-2.407)	(4.308)	(2.439)		
$r_M - r_f < 0$	-0.412	-0.974	0.034		
	(-2.428)	(-2.618)	(4.795)		
$r_M - r_f \geq 0$	-0.252		0.036	0.045	
	(-1.274)		(4.827)	(4.831)	
$r_M - r_f < 0$	-0.458		0.033	-0.005	
	(-2.635)		(4.906)	(-0.412)	
$r_M - r_f \geq 0$	-0.337	1.523	0.034	0.042	
	(-1.716)	(3.968)	(4.887)	(5.252)	
$r_M - r_f < 0$	-0.405	-0.967	0.032	-0.003	
	(-2.404)	(-2.928)	(4.975)	(-0.322)	
$r_M - r_f \geq 0$	1.058		-0.496	0.275	1.462
	(1.853)		(-0.535)	(0.331)	(1.815)
$r_M - r_f < 0$	2.184		1.873	0.400	0.604
	(2.681)		(2.479)	(0.552)	(0.597)

set of locally mean variance efficient base portfolios that can explain the time series behavior of the returns in the sense of Grinblatt and Titman (1993). We do not find Fama and French (1992b)'s approach is appropriate as they are not using the concept of portfolio efficiency. This investigation is again subject to further research.

Table 7(b). Results on Fama-MacBeth regressions :
For Size-β Sorted Portfolios

Case	Size	β	PBR	Leverage	EPR(+)
$r_M - r_f \geq 0$	-0.337	1.209			
	(-1.704)	(2.771)			
$r_M - r_f < 0$	-0.411	-1.113			
	(-2.307)	(-2.623)			
$r_M - r_f \geq 0$	-0.303		-0.007		
	(-1.510)		(-0.488)		
$r_M - r_f < 0$	-0.441		0.042		
	(-2.395)		(2.580)		
$r_M - r_f \geq 0$	-0.341	1.266	0.003		
	(-1.701)	(3.003)	(0.281)		
$r_M - r_f < 0$	-0.399	-1.007	0.031		
	(-2.227)	(-2.455)	(3.062)		
$r_M - r_f \geq 0$	-0.146		0.040	0.072	
	(-0.733)		(3.079)	(3.643)	
$r_M - r_f < 0$	-0.410		0.021	-0.013	
	(-2.310)		(1.698)	(-0.620)	
$r_M - r_f \geq 0$	-0.166	1.043	0.032	0.057	
	(-0.825)	(2.801)	(2.912)	(3.795)	
$r_M - r_f < 0$	-0.414	-0.986	0.017	-0.014	
	(-2.335)	(-2.747)	(1.546)	(-1.059)	
$r_M - r_f \geq 0$	2.784		-0.042	1.261	2.424
	(2.528)		(-0.035)	(1.122)	(2.102)
$r_M - r_f < 0$	2.875		3.826	1.446	1.487
	(2.463)		(2.683)	(1.251)	(1.058)

Table 7(c) Results on Fama-MacBeth regressions :
For Size-BPR sorted Portfolios

Case	Size	β	PBR	Leverage	EPR(+)
$r_M - r_f \geq 0$	-0.405	1.720			
	(-1.970)	(2.858)			
$r_M - r_f < 0$	-0.337	-1.519			
	(-1.919)	(-2.623)			
$r_M - r_f \geq 0$	-0.296		0.005		
	(-1.491)		(0.827)		
$r_M - r_f < 0$	-0.439		0.035		
	(-2.419)		(4.318)		
$r_M - r_f \geq 0$	-0.460	2.163	0.010		
	(-2.280)	(4.005)	(1.625)		
$r_M - r_f < 0$	-0.401	-0.850	0.035		
	(-2.257)	(-1.620)	(4.810)		
$r_M - r_f \geq 0$	-0.178		0.030	0.047	
	(-0.886)		(3.235)	(4.052)	
$r_M - r_f < 0$	-0.410		0.036	0.003	
	(-2.290)		(3.782)	(0.262)	
$r_M - r_f \geq 0$	-0.352	2.150	0.031	0.043	
	(-1.717)	(3.997)	(3.406)	(3.790)	
$r_M - r_f < 0$	-0.366	-0.907	0.035	0.002	
	(-2.050)	(-1.865)	(3.895)	(0.147)	
$r_M - r_f \geq 0$	2.295		0.071	1.122	2.230
	(2.217)		(0.054)	(1.023)	(2.223)
$r_M - r_f < 0$	3.416		3.303	1.316	1.455
	(3.021)		(2.575)	(1.435)	(0.966)

VI. Conclusion

We found β cannot successfully explain cross-section variations of Tokyo Stock Exchange First Section manufacturing and non-manufacturing firms. We have found that size, book-to-market equity ratio, leverage ratio, and earnings-to- price ratio significantly explain cross-section variations of security returns. The result is robust in the sense that it is supported both at the individual level and the portfolio level and also both in pre-β and post-β used for our estimation procedures.

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