1996年度日本オペレーションズ・リサーチ学会
春季研究発表会

Common Risk Factors of Tokyo Stock Exchange Firms

Keiichi Kubota, Musashi University
Hitoshi Takehara, University of Tsukuba

Abstract: On the basis of the findings in Kubota and Takehara (1995) where we rejected the single risk CAPM specifications in an unconditional form for Japanese non-financial firms listed in the first section of Tokyo Stock Exchanges, in the current paper, we empirically try to find mimicking portfolios that can approximately span the locally mean-variance efficient set in the sense of Grinblatt and Titman (1987). Then, we trasform these initially estimated mimicking portfolios based on the principal component analysis. We hope that this portfolio set can generate insignifinant alpha estimates with robust corresponding multiple betas so that this portfolio set can be used as a good benchmark portfolio set.

Our original data is the monthly observations between September 1981 through June 1993 as in Kubota and Takehara (1995) and new observation will be added as a control sample. We initially use cluster analysis to form 14 portfolios from the set of 41 attribute portfolios. We, then, test whether these 14 base portfolios can approximately span the local mean-variance efficient set of the universe, where three benchmark universe is used; the mean-variance efficient sets formed by the original 41 portfolio set, the larger universe of 71 portfolios expanded from the above 41 portfolios, and 100 portfolios ranked by the size and the book to price ratios used in Kubota and Takehara (1995). For this purpose we use the test statistics generated by Gibbons, Ross and Shanken(1987) and Kandel and Stambaugh(1991).

Then, we run principal components analysis, under the non-full rank conditions as is advocated in Anderson(1958), on the sample of 776 individual securities. We rely on the result, proven by Grinblatt and Titman (1985), that the principal components analysis can get correct factor numbers and factor loadings under the approximate factor structure defined by Chamberlain and Rothchild (1983). Then, we compare these 14 base portfolios and our factor loading estimates in terms of correlation strucutre so that the initial 14 portfolios can possess the asymptotic consitency up to the deteministic linear transforms.

Based on these result we conclude that the first factor must be predominantly the market factor whose finding is in par with Fama and French (1993) and other well known results. However, because of the high pair-wise correlations between these 14 base portfolios, we re-trasform the original 41 base portfolios into 5 factor models where these portfolios are tranformed to reduce the colliniarity based on further principal component analylsis. In this final model, one of the market index, TOPIX, is substituted for the first factor, and the second factor is the return difference between the largest decile portfolio and the smallest decile portfolio. Similary, the third factor is the return difference in book to price ratio ranked portfolios, the fourth, the difference in the leverage, and the fifth, in the earnings to price ratios excluding negative earnings group. Thus derived 5 mimicking factor portfolios can represent correct factor loading estimates in a probabiity sense up to the deterministic linear transformaions, as these factors are chosen to be highly associated with factor loading from principal components analysis result.

Finally, the robustness of our five factor model is tested against the several sets of control portfolios and it is found that the alphas are insignificantly zero most of the time,

Regression Coefficients						
Var.	Intercept	Market (TOPIX)	Spread			
			Size	BPR	Leverage	EPR
Average	-0.077	0.942	0.426	-0.055	0.088	0.049
Maximum	3.511	1.804	1.405	1.115	1.801	1.341
Minimum	-2.299	0.079	-0.616	-1.250	-1.299	-1.559
Median	-0.083	0.950	0.470	-0.051	-0.104	0.066
t value						
Var.	Intercept	Market (TOPIX)	Spread			
			Size	BPR	Leverage	EPR
Average	-0.141	7.260	3.133	-0.288	0.482	0.128
Ave. $\|t\|$	0.651	7.260	3.650	1.039	2.600	1.189
Maximum	2.393	14.255	10.008	3.948	10.100	4.605
Minimum	-2.866	0.356	-6.569	-5.471	-7.780	-5.668
Median	-0.103	7.367	3.661	-0.200	0.482	0.246

(Average Adjusted $R^2 = 0.398$, Average DW statistics $= 2.167$)

Table 1: Summary of Time Series Individual Regressions

and we conclude that our five factor model can be used as a good benchmark portfolios to be tested against Japanese funds where the timing information would be suppressed.

References

[1] Grinblatt, M., and S. Titman, "The Relation between Mean-Variance Efficiency and Arbitrage Pricing," *Journal of Business* **60** (1987) 97-111.

[2] Kandel and Stambaugh, "A Meean-Variance Framework for Tests of Asset Pricing Models," *Review of Financial Studies* **2** (1989) 125-156.

[3] Kubota, K., and H. Takehara, "The Cross-Section Risk and Return of Tokyo Stock Exchange Firms," to appear in T.Boss and T. Fetherstone eds., *Advances in the Pacific Basin Capital Market Reseach II.*, JAI Press Inc. (1995).

[4] Kubota, K., and H. Takehara, "Common risk Factors of Tokyo Stock Exchange Firms: In finding the Mimicking Portfolios," Working Paper, Musashi University (1995)