Gakushuin Economic Papers, Vol.35, No.3,4, January 1999

Financial Anomalies and Market-Neutral Investment Strategies

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1. Introduction

Past decade Japanese equity market has experienced both great upswing and downswing of stock price. This urges reexamination of the relationship between fundamental variables and stock returns. This paper summarizes and integrates the empirical results derived in preceding four papers [6], [9], [10], [11] on these issues by the author and others and from their points of view contemplate the working of Japanese equity market. Then we will form and measure the performance of so-called market-neutral investment strategies.

Fundamental variables include rate of profit on equity (ROE), earnings per share (EPS), net asset per share (BPS), price earnings ratio (PER), price net asset ratio (PBR), price cash flow ratio (PCR), dividend yields (DY), and book-to-market ratio (BMR).

Since the various fundamental variables are correlated each other more or less, and univariate analysis is inappropriate to capture the effect of these variables on stock returns, it is therefore true that a multivariate regression analysis is required(1. However phenomena we will document are not simple linear relationships, rather asymmetric nonlinear relationships between the fundamental variables and stock returns. In order to carry out this object there are no other straightforward methods than univariate analysis in the light of the present state of art. As a matter of fact, Chan, Hamao, and Lakonishok [3] use a sophisticated multivariate analysis and report the findings compatibles with univariate tests, although there are substantial changes in the magnitudes of individual coefficients and their associated t-values in their case.

Because there has been no established theory which relates the fundamental variables to stock returns, it is important to report any relationships which have been uncovered by prior researches. Taking a rather orthodox method, this paper analyzes different data such as book value dividend yields, or takes a different aspect such as the performance of market-neutral investment.

In Section 2, we present the relationship between stock returns and fundamental variables other than dividend yields, which are analyzed in Section 3. In Section 4, we will discuss so-called market-neutral strategies and show the performance of them. Section 5 concludes the paper. Data description and the methodology will be presented at the beginning of each section. Finally appendix explains an estimation method of BMR.

2. The Persistence and Prevalence of Financial Anomalies

We use data compiled by Daiwa Securities, Co., Ltd, Japan of monthly earnings, cashflows and stock returns (including dividends) and also of monthly net assets, stock prices and market capitalizations for the companies, both non-financial and financial, listed[2] in the 1st and 2nd sections of the Tokyo Stock Exchanges (TSE) from December 1983 to December 1992.

Equally weighted portfolios investing in 100 stocks with the highest or lowest financial ratios are formed first. We then measure the performance of the buy-and-hold or monthly rebalanced investment, relative to the equal weight market index composed of stocks of the both sections of the TSE, multiplying the relatives from December 1983 on. For ROE, EPS and BPS, neither figures nor tables are shown for brevity, but there are no excess returns in any cases.

Figure 2－1 and Figure 2－2, both of them looking alike each other, show remarkable asymmetries. Stocks with the lowest PBR or PER can not earn particular excess returns in the long run. Only keeping investing in the lowest every month earns lots. However the performance of stocks with the highest PBR or PER does not depend on whether rebalanced monthly or not. Results for PCR (not shown) are more or less similar[3].

The fact that PBR, PER or PCR affects stocks returns in a similar fashion does not persuade us to take a way to pick up one of these variables. We instead combine them through the principal component analysis and call resulting values composite financial ratio (CFR). Figure 2－3 is the result of the same analysis applied to the CFR. No additional comments might be required on the figure. Our results are in line with those of Brown and Harlow [1] in respect that asymmetries exist between the two extremes, but different from them in respect that we find that stocks, even if judged to be losers, do not remain losers for long[4]. Therefore, stocks with lower financial ratios tend to be purchased and their undervaluation will be exploited within very short time period. On the other hand, stocks with higher financial ratios tend to remain, i.e., investors would not sell them.

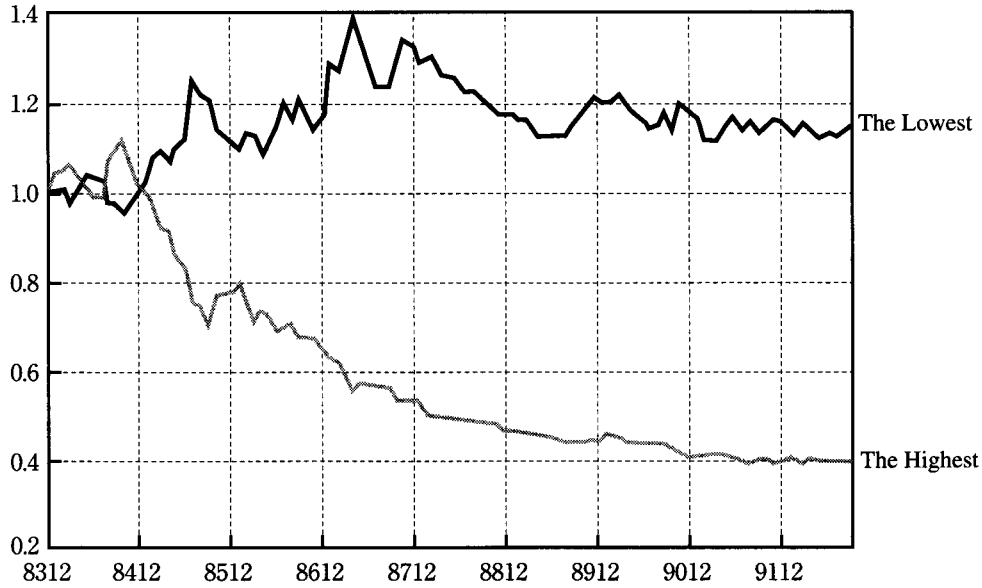
3. Dividend Yields and Book-to-Market Ratio

Next we take dividend yields (DY) into account, which show peculiar features in Japan. The anomaly analysis similar to Section 2 is applied to DY first. We then estimate the book-to-market equity ratio (BMR) and see whether and how results change in the case of book value dividend yields (BVDY) i.e., DY divided by BMR.

We use annual TSE-classified 28 industry data in this section: the number of shares outstanding at the end of March compiled by the TSE and rate of returns on stocks calculated by Japan Institute of Securities Research. We then carry out an estimation of BMR, industry by industry, the detail of which is explored in appendix at the end of the paper and take the simple average or value weighted average across 28 industries (Figure 3－1). There is no need to say about the figure as far as the present research is concerned. (For other purposes, however, see [11].)

Figure 2—1. Performance of 100 stocks with the Highest or Lowest PBR
(equal weight investing, relative to equal weight market index)

(a) Buy and Hold



(b) Monthly Rebalanced

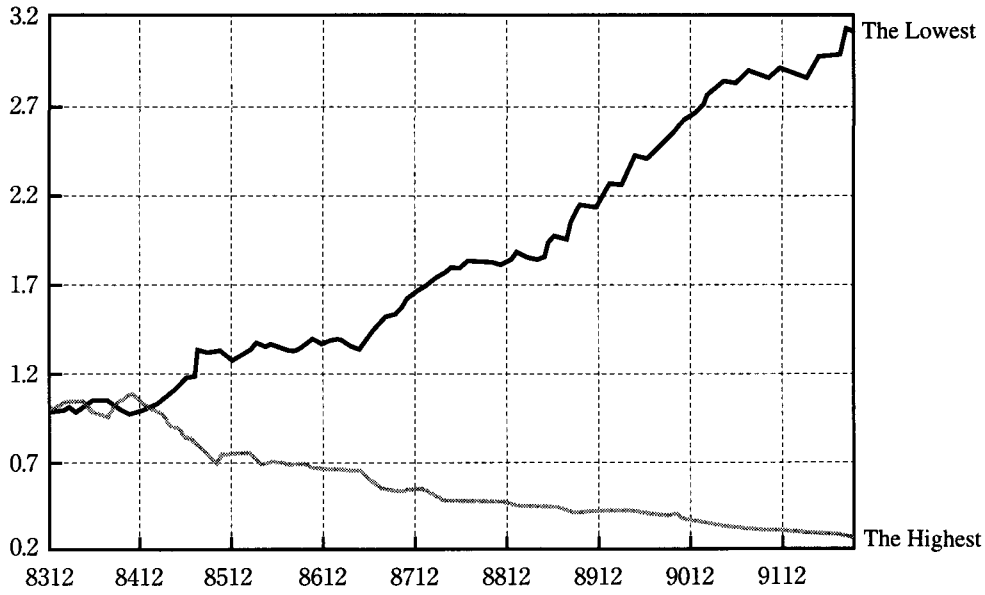


Figure 2—2. Performance of 100 stocks with the Highest or Lowest PER
(equal weight investing, relative to equal weight market index)

(a) Buy and Hold

(b) Monthly Rebalanced

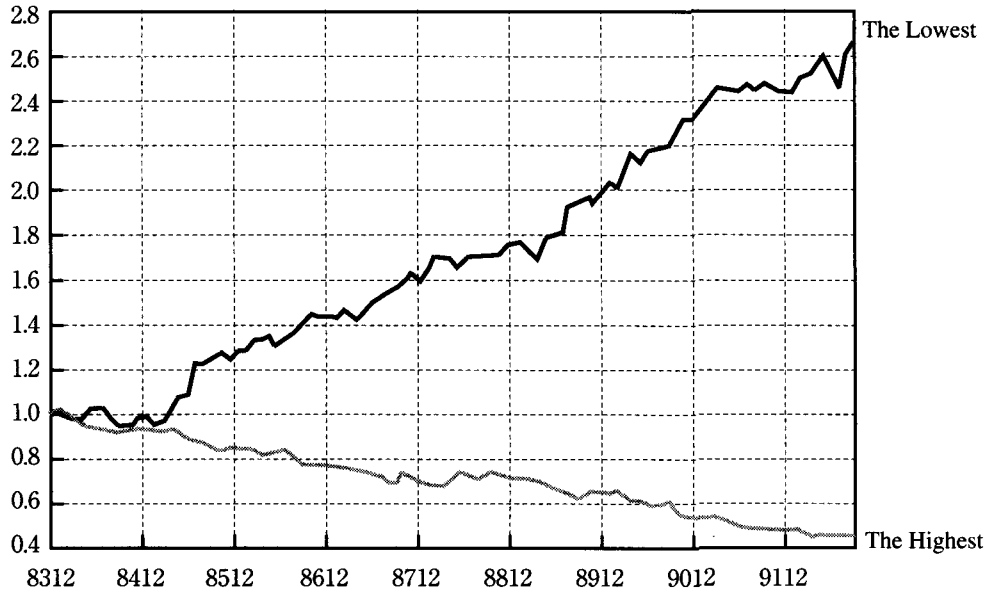
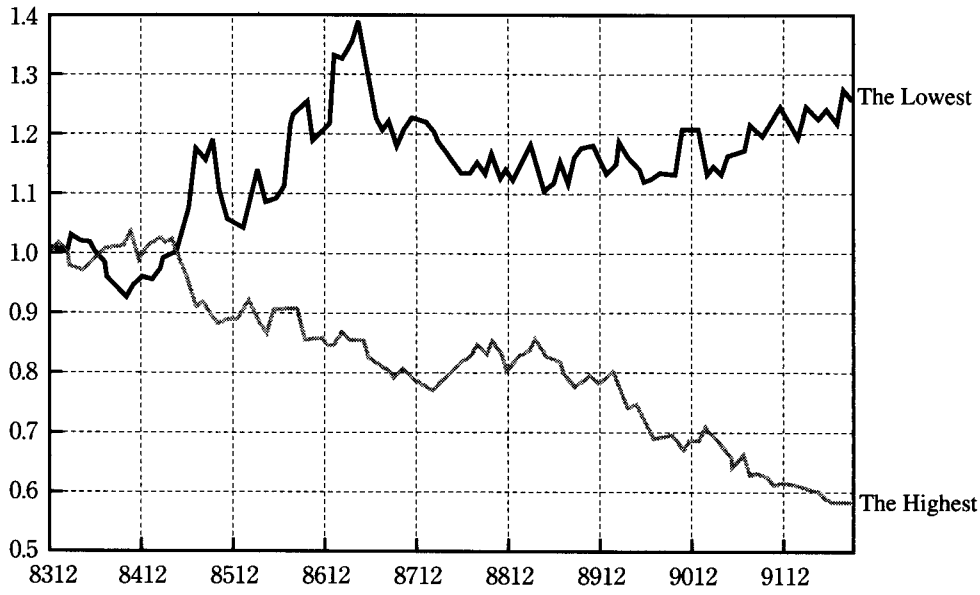


Figure 2—3. Performance of 100 stocks with the Highest or Lowest CFR
(equal weight investing, relative to equal weight market index)

(a) Buy and Hold



(b) Monthly Rebalanced

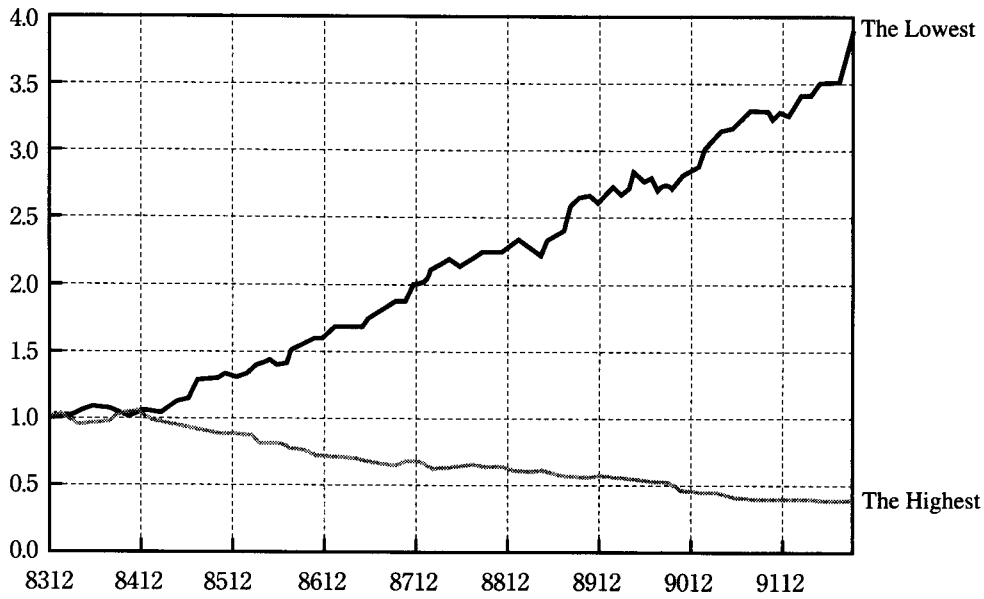
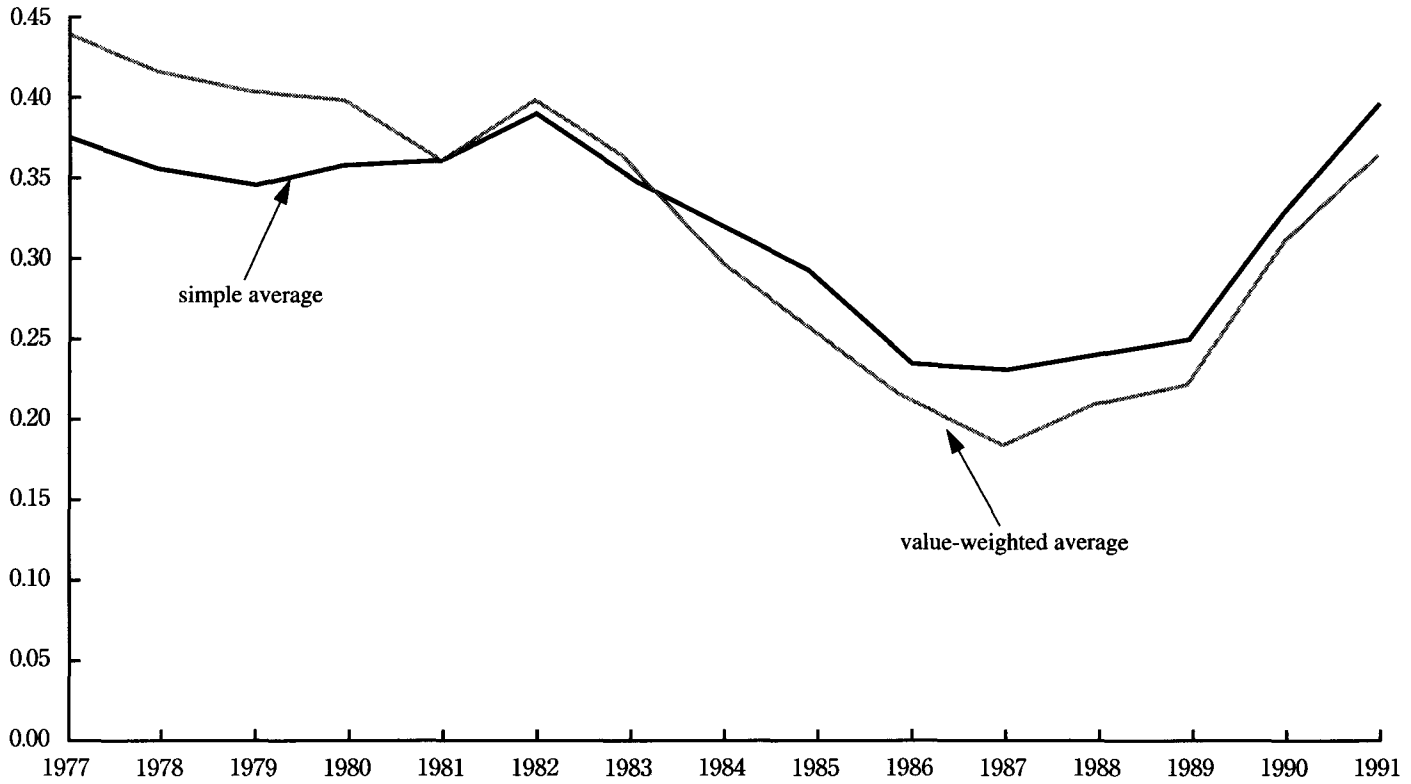


Figure 3—1. Book-to-Market Ratio for the 1st Section of TSE



Past several years BMR has received attention. Rosenberg, Reid and Lanstein [12] report that a what they call "book/price" strategy, i.e., the strategy that buys stocks with a high BMR and sells stocks with a low BMR earns the statistically significant abnormal performance. The most significant fundamental variable in explaining cross-sectional stock returns in both Chan, Hamao and Lakonishok [3] and Fama and French [5] is BMR rather than betas.

By dividing dividend yields (DY) by BMR we define book value dividend yields (BVDY), shown in Figure 3－2, and apply an anomaly analysis to both DY and BVDY. In a preliminary study where 7 (one fourth of 28) industries with the highest DY or BVDY are chosen each year and the rate of returns on equal weight portfolios of the 7 industries for 10 years afterwards are calculated, we compare them with the rate of returns on the 1st section of the TSE in the same year. The excess returns for these buy-and-hold investments vanish in 2 or 3 years for DY, in 5 or 6 years for BVDY.

If we keep investing in the highest DY or BVDY every year, Table 3－1 or Table 3－2 results. The returns of the monthly rebalanced investment in the long run are 14% higher for DY, 35% higher for BVDY than those of the TSE 1st section. In the Tables "adjustment" means statistics without shaded numbers, i.e., ignores outlying numbers.

The risk (standard deviation) of choosing the highest DY or BVDY is not tremendous as shown in Table 3－1 or Table 3－2. Its Sharpe ratio (return/risk) is rather greater than that of the 1st section of the TSE. Hence the relationship we have just observed is not that of risk-return, and requires other explanation.

Let us consider why these results are obtained. BMR is known to capture a risk factor in returns (Chan and Chen [2]). If the market judges a firm to have poor future prospects, it signals lower stock price than that of a firm with strong future prospects. It leads to higher BMR and higher expected stock return, by which the firm is penalized with higher cost of capital. Furthermore in their work in progress Fama and French find that "there is a clean separation between high and low BMR firms on various measures of economic fundamentals." (Fama and French [5, p.451]) Our results are consistent with their finding that low BMR firms are persistently strong performers and vice versa.

Our analysis tells us more. Although variables like PER, PBR, BMR, and DY are all relative scaled versions of a firm's stock price, so that they can be regarded as different ways of extracting information from stock prices about the cross-sectional characteristics of expected stock returns as suggested by Fama and French [5, p.450], book value dividend yields (BVDY) is not.

Japanese companies have had and still have a tendency to pay dividends by reference to the par value of the stock rather than to the market value, this implies that they do not care low dividend yields and investors in general buy stocks almost exclusively for capital appreciations rather than for dividend yields.

At the same time there might be clientele investors created by personal taxation (which also applies to most Japanese insurance companies) together with imperfect capital market, in the sense of Litzenberger and Ramaswany [8], who prefer dividends to price appreciations. It is more probable that regulation causes anomaly. Japanese Insurance Business Law (especially

Figure 3—2. Book Value Dividend Yields for the 1st Section of TSE

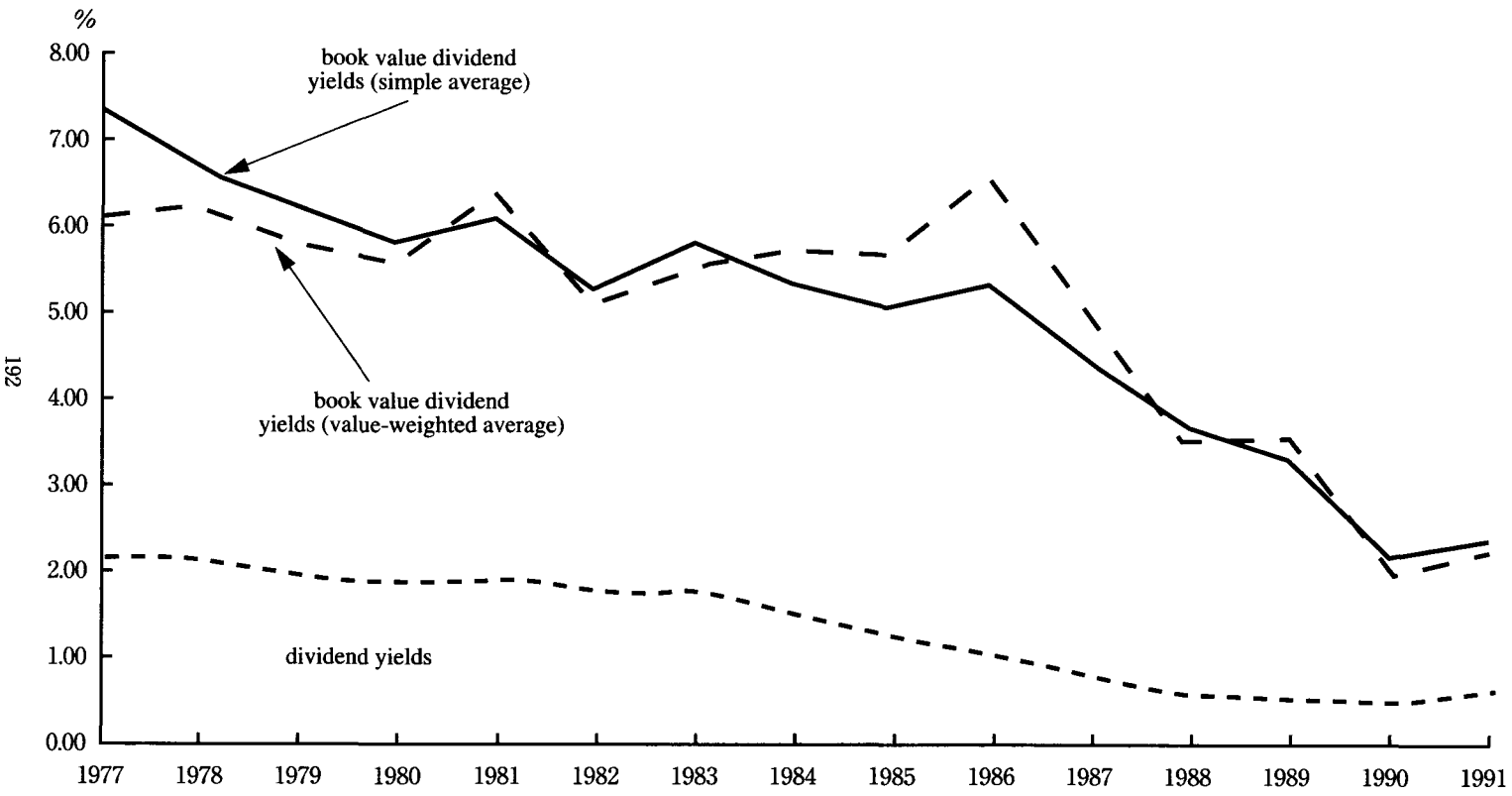


Table 3—1. Persistence of Dividend Yields Anomaly (Rebalancing Equal Weight Investing)

Years of Investment	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
(i) higher 7 industries															
1	0.2334	0.0857	0.1210	0.1316	0.2477	0.2660	0.7573	0.5674	-0.0297	0.1329	0.1557	0.2119	0.2001	0.0430	0.0729
2	0.1572	0.1032	0.1263	0.1882	0.2568	0.4916	0.6596	0.2332	0.0484	0.1442	0.1835	0.2060	0.1188	0.0578	0.1091
3	0.1450	0.1126	0.1654	0.2136	0.4054	0.5164	0.3877	0.1988	0.0830	0.1663	0.1890	0.1490	0.1033	0.0866	0.0689
4	0.1416	0.1449	0.1898	0.3313	0.4443	0.3563	0.3191	0.1879	0.1139	0.1747	0.1507	0.1295	0.1139	0.0624	0.1013
5	0.1621	0.1682	0.2863	0.3755	0.3338	0.3083	0.2847	0.1927	0.1306	0.1471	0.1347	0.1329	0.0886	0.0894	0.1151
6	0.1788	0.2504	0.3294	0.2978	0.2980	0.2815	0.2722	0.1939	0.1155	0.1344	0.1367	0.1082	0.1071	0.1028	0.1466
7	0.2480	0.2915	0.2709	0.2728	0.2767	0.2713	0.2617	0.1711	0.1093	0.1361	0.1149	0.1215	0.1162	0.1312	0.1955
8	0.2841	0.2461	0.2528	0.2575	0.2684	0.2622	0.2320	0.1583	0.1139	0.1171	0.1257	0.1277	0.1396	0.1753	0.2155
9	0.2447	0.2330	0.2416	0.2524	0.2606	0.2357	0.2132	0.1570	0.0998	0.1265	0.1308	0.1474	0.1780	0.1950	0.2330
10	0.2330	0.2250	0.2386	0.2471	0.2369	0.2184	0.2064	0.1394	0.1098	0.1310	0.1482	0.1813	0.1955	0.2125	0.2454
(ii) return on 1st section of TSE															
1	0.2830	0.0610	0.1610	0.3720	0.1230	0.1980	0.7210	0.3030	-0.1140	0.0590	0.1610	0.1170	0.1500	0.1080	0.0840
2	0.1667	0.1099	0.2621	0.2413	0.1599	0.4359	0.4975	0.0745	-0.0314	0.1088	0.1388	0.1334	0.1288	0.0959	0.1453
3	0.1648	0.1912	0.2139	0.2267	0.3229	0.3901	0.2571	0.0693	0.0289	0.1115	0.1425	0.1249	0.1137	0.1327	0.1023
4	0.2135	0.1737	0.2099	0.3350	0.3179	0.2421	0.2044	0.0915	0.0503	0.1210	0.1338	0.1145	0.1370	0.1037	0.1329
5	0.1948	0.1785	0.2983	0.3286	0.2173	0.2031	0.1956	0.0966	0.0695	0.1184	0.1236	0.1330	0.1128	0.1279	0.1634
6	0.1953	0.2553	0.2990	0.2418	0.1894	0.1960	0.1821	0.1053	0.0758	0.1126	0.1376	0.1135	0.1315	0.1540	0.1805
7	0.2592	0.2620	0.2299	0.2139	0.1853	0.1844	0.1775	0.1057	0.0770	0.1260	0.1202	0.1294	0.1534	0.1699	0.2098
8	0.2646	0.2074	0.2071	0.2071	0.1765	0.1800	0.1686	0.1029	0.0928	0.1123	0.1333	0.1488	0.1674	0.1966	0.2388
9	0.2156	0.1900	0.2019	0.1968	0.1735	0.1718	0.1588	0.1144	0.0846	0.1248	0.1502	0.1617	0.1913	0.2235	0.2281
10	0.1990	0.1870	0.1932	0.1920	0.1668	0.1627	0.1639	0.1046	0.0983	0.1407	0.1616	0.1836	0.2159	0.2155	0.2277
(iii) (i)÷(ii)															
1	0.8248	1.4052	0.7516	0.3537	2.0139	1.3434	1.0503	1.8727	[illegible]	2.2518	0.9672	1.8107	1.3343	0.3981	0.8673
2	0.9429	0.9394	0.4818	0.7801	1.6062	1.1277	1.3260	3.1324	[illegible]	1.3253	1.3218	1.5444	0.9224	0.6027	0.7510
3	0.8799	0.5890	0.7731	0.9423	1.2553	1.3237	1.5079	2.8698	2.8698	1.4912	1.3261	1.1934	0.9086	0.6527	0.6740
4	0.6635	0.8342	0.9040	0.9888	1.3974	1.4716	1.5613	2.0533	2.2654	1.4434	1.1263	1.1308	0.8317	0.6016	0.7620
5	0.8321	0.9419	0.9598	1.1428	1.5362	1.5180	1.4555	1.9952	1.8795	1.2422	1.0892	0.9992	0.7855	0.6988	0.7046
6	0.9154	0.9809	1.1014	1.2313	1.5737	1.4366	1.4949	1.8415	1.5237	1.1933	0.9931	0.9537	0.8142	0.6674	0.8119
7	0.9567	1.1124	1.1781	1.2755	1.4932	1.4718	1.4745	1.6188	1.4201	1.0800	0.9562	0.9385	0.7573	0.7721	0.9319
8	1.0735	1.1865	1.2202	1.2433	1.5204	1.4567	1.3765	1.5379	1.2278	1.0427	0.9427	0.8583	0.8338	0.8917	0.9026
9	1.1350	1.2266	1.1964	1.2826	1.5017	1.3723	1.3424	1.3730	1.1799	1.0134	0.8711	0.9116	0.9306	0.8725	1.0215
10	1.1713	1.2032	1.2352	1.2866	1.4204	1.3424	1.2596	1.3325	1.1170	0.9311	0.9171	0.9875	0.9054	0.9862	1.0777

1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991			after adjustment		
											average	s.d.	average	s.d.	
0.1466	-0.0071	0.2043	0.1724	0.3176	0.5360	0.3653	0.3823	0.3626	-0.1767	-0.1304	0.2065	0.2045			
0.0669	0.0935	0.1883	0.2429	0.4226	0.4481	0.3738	0.3724	0.0591	-0.1539		0.2079	0.1702			
0.1109	0.1192	0.2299	0.3338	0.4032	0.4258	0.3700	0.1575	-0.0082			0.2139	0.1356			
0.1260	0.1658	0.3002	0.3416	0.3980	0.4098	0.2062	0.0776				0.2168	0.1146			
0.1619	0.2319	0.3129	0.3496	0.3908	0.2660	0.1298					0.2179	0.0958			
0.2172	0.2532	0.3242	0.3518	0.2744	0.1892						0.2173	0.0806			
0.2374	0.2709	0.3297	0.2593	0.2067							0.2146	0.0695			
0.2546	0.2820	0.2523	0.2024								0.2088	0.0594			
0.2662	0.2204	0.2026									0.2021	0.0494			
0.2128	0.1798										0.1977	0.0416			
0.2100	0.0210	0.2300	0.2940	0.2700	0.4010	0.4620	0.1460	0.2240	-0.1590	-0.1130	0.1836	0.1835			
0.1115	0.1206	0.2616	0.2819	0.3339	0.4312	0.2944	0.1844	0.0146	-0.1363		0.1826	0.1429			
0.1497	0.1757	0.2644	0.3205	0.3753	0.3290	0.2705	0.0566	-0.0299			0.1877	0.1090			
0.1842	0.1986	0.2972	0.3545	0.3140	0.3019	0.1460	0.0114				0.1908	0.0929			
0.2009	0.2366	0.3286	0.3100	0.2955	0.1930	0.0887					0.1916	0.0786			
0.2321	0.2716	0.2963	0.2952	0.2055	0.1355						0.1908	0.0664			
0.2626	0.2528	0.2857	0.2177	0.1538							0.1888	0.0581			
0.2474	0.2492	0.2193	0.1704								0.1837	0.0489			
0.2448	0.1955	0.1769									0.1780	0.0402			
0.1969	0.1603										0.1747	0.0349			
0.6980	[illegible]	0.8882	0.5865	1.1762	1.3367	0.7907	2.6184	1.6186	[illegible]		1.1209	0.6435	1.2254	0.5896	-4
0.6005	0.7748	0.7196	0.8615	1.2657	1.0393	1.2696	2.0199	4.0549	[illegible]		1.1598	0.9544	1.2787	0.8111	-2
0.7409	0.6784	0.8695	1.0416	1.0744	1.2944	1.3680	2.7806	[illegible]			1.2242	0.6826	1.2654	0.6674	-1
0.6840	0.8349	1.0098	0.9636	1.2674	1.3571	1.4128	[illegible]				1.4075	1.2237	1.1620	0.4237	-1
0.8061	0.9802	0.9522	1.1279	1.3226	1.3783	[illegible]					1.1732	0.3522	1.1594	0.3547	-1
0.9360	0.9323	1.0943	1.1915	1.3356	[illegible]						1.1628	0.2932	1.1511	0.2957	-1
0.9039	1.0713	1.1538	1.1910	[illegible]							1.1551	0.2462	1.1451	0.2486	-1
1.0292	1.1316	1.1507	[illegible]								1.1481	0.2107	1.1459	0.2163	-1
1.0875	1.1277	[illegible]									1.1439	0.1803	1.1439	0.1855	-1
1.0809	[illegible]										1.1397	0.1553	1.1409	0.1600	-1

Table 3—2. Persistence of Book Value Dividend Yields Anomaly (Rebalancing Equal Weight Investing)

Years of Investment

	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	average	s.d.	after adjustment average	after adjustment s.d.
(i) higher 7 industries																			
1	0.2286	0.2151	0.2261	0.1086	0.1953	0.0406	0.4061	0.2443	0.3809	0.6600	0.3923	0.3903	0.3656	-0.1913	-0.1387	0.2349	0.2120		
2	0.2218	0.2206	0.1659	0.1511	0.1152	0.2096	0.3227	0.3108	0.5140	0.5203	0.3913	0.3779	0.0509	-0.1654		0.2433	0.1769		
3	0.2233	0.1821	0.1756	0.1130	0.2048	0.2211	0.3418	0.4182	0.4723	0.4756	0.3827	0.1536	-0.0166			0.2575	0.1432		
4	0.1935	0.1854	0.1403	0.1800	0.2146	0.2592	0.4151	0.4116	0.4514	0.4473	0.2092	0.0724				0.2650	0.1255		
5	0.1939	0.1549	0.1891	0.1926	0.2461	0.3307	0.4105	0.4073	0.4338	0.2883	0.1298					0.2706	0.1050		
6	0.1668	0.1934	0.1981	0.2221	0.3071	0.3408	0.4071	0.4003	0.3033	0.2047						0.2744	0.0845		
7	0.1984	0.2005	0.2227	0.2767	0.3190	0.3478	0.4011	0.2947	0.2284							0.2766	0.0665		
8	0.2040	0.2217	0.2703	0.2906	0.3277	0.3500	0.3081	0.2304								0.2754	0.0495		
9	0.2225	0.2641	0.2833	0.3013	0.3318	0.2753	0.2488									0.2753	0.0329		
10	0.2605	0.2763	0.2936	0.3076	0.2670	0.2262										0.2719	0.0259		
(ii) return on 1st section of TSE																			
1	0.1170	0.1500	0.1080	0.0840	0.2100	0.0210	0.2300	0.2940	0.2700	0.4010	0.4620	0.1460	0.2240	-0.1590	-0.1130	0.1630	0.1627		
2	0.1334	0.1288	0.0959	0.1453	0.1115	0.1206	0.2616	0.2819	0.3339	0.4312	0.2944	0.1844	0.0146	-0.1363		0.1715	0.1375		
3	0.1249	0.1137	0.1327	0.1023	0.1497	0.1757	0.2644	0.3205	0.3753	0.3290	0.2705	0.0566	-0.0299			0.1835	0.1147		
4	0.1145	0.1370	0.1037	0.1329	0.1842	0.1986	0.2972	0.3545	0.3140	0.3019	0.1460	0.0114				0.1913	0.0998		
5	0.1330	0.1128	0.1279	0.1634	0.2009	0.2366	0.3286	0.3100	0.2955	0.1930	0.0887					0.1991	0.0799		
6	0.1135	0.1315	0.1540	0.1805	0.2321	0.2716	0.2963	0.2952	0.2055	0.1355						0.2016	0.0658		
7	0.1294	0.1534	0.1699	0.2098	0.2626	0.2528	0.2857	0.2177	0.1538							0.2039	0.0522		
8	0.1488	0.1674	0.1966	0.2388	0.2474	0.2492	0.2193	0.1704								0.2047	0.0370		
9	0.1617	0.1913	0.2235	0.2281	0.2448	0.1955	0.1769									0.2031	0.0277		
10	0.1836	0.2159	0.2155	0.2277	0.1969	0.1603										0.2000	0.0228		
(iii) (i)÷(ii)																			
1	1.9536	1.4343	2.0939	1.2925	0.9299	[illegible]	1.7658	0.8309	1.4106	1.6459	0.8491	2.6732	1.6320	[illegible]	[illegible]	1.5250	0.4923	1.5426	0.5223
2	1.6632	1.7129	1.7291	1.0402	1.0337	1.7376	1.2337	1.1023	1.5394	1.2066	1.3291	2.0497	3.4886	[illegible]		1.5771	0.6101	1.6051	0.6244
3	1.7882	1.6018	1.3232	1.1053	1.3685	1.2584	1.2929	1.3049	1.2585	1.4457	1.4147	2.7134	[illegible]			1.4177	0.4628	1.4896	0.4059
4	1.6902	1.3529	1.3530	1.3546	1.1651	1.3052	1.3967	1.1612	1.4374	1.4815	1.4328	[illegible]				1.7900	1.3812	1.3755	0.1396
5	1.4580	1.3731	1.4788	1.1785	1.2255	1.3980	1.2492	1.3142	1.4680	1.4939	[illegible]					1.3728	0.1084	1.3637	0.1096
6	1.4700	1.4704	1.2865	1.2301	1.3233	1.2549	1.3742	1.3559	1.4759	[illegible]						1.3752	0.0964	1.3601	0.0898
7	1.5325	1.3071	1.3106	1.3192	1.2148	1.3755	1.4040	1.3533	[illegible]							1.3669	0.0914	1.3521	0.0862
8	1.3710	1.3246	1.3752	1.2173	1.3246	1.4045	1.4052	[illegible]								1.3467	0.0569	1.3460	0.0608
9	1.3761	1.3804	1.2677	1.3212	1.3558	1.4083	[illegible]									1.3593	0.0466	1.3516	0.0459
10	1.4183	1.2797	1.3625	1.3512	1.3562	[illegible]										1.3631	0.0456	1.3536	0.0441

Sentence 86) regulates risk exposure of insurance company in several aspects, setting an upper limit to the proportion invested in stocks and taking various regulatory tools to emphasize income gain such as dividends rather than capital gain.

Another interpretation might be possible. Specifically, Japanese accounting standards and issuance practices have something to do with the fact that BMR has a strong influence on stock returns. Japanese corporations, under directions of the authority sticking to classical historical cost principle, are obliged not to take mark-to-market rule. As for a new share offering, there are three ways of making: pre-emptive rights giving, third parties pre-emptive rights giving(5 and public offerings. While the granting of pre-emptive rights was used mainly until the 1970s, public offerings are now common(6. The normal method to increase paid-in capital is nowadays an issuance of new shares at an intermediate price between the par value and the market price(7. If an investor could subscribe or buy newly issued shares, he or she earns immediately a premium of the discount issue, i.e., a differential between the market price and the issuing price. Therefore once a firm announces a new issue, its stock price climbs up suddenly. Stock price goes up slowly even before the announcement, anticipating a new issue of so-called "finance stock". Since low book value of a firm means that the firm has not issued common stocks for long time and a new issue comes in the near future, BMR might capture an issuance capability. This might be a reason why low BMR firms receive investors' attention in Japanese equity market.

4. Market-Neutral Investment Strategies

We have made sure in last two sections that there are several types on anomalies and each belongs to either of them. One type is an anomaly on the price-related such as PER or PBR that lasts ten years or more. The other type of anomaly such as that of dividend yields is exploited within years. The persistency of anomalies implies that there might be corresponding risk factors in returns not captured by betas as suggested by Fama and French [5] or regulations described above.

We have presented that the effect of anomaly on returns is asymmetric between two extreme deciles of some fundamental variables. Many previous sophisticated researches as well as ours show that some of anomalies are correlated each other. This is the reason why we consider composite financial ratios, which retain the same properties as those of individual fundamental variables composed. Whether the results obtained in Sections 2 and 3 have practical implications for portfolio formation or not, will be tested next.

There are several types on so-called market-neutral (henceforth MN) investment strategies. For example, Tatsumi, Maeda and others [10] develop a sector allocation type MN model utilizing quadratic programming. Investment strategies which satisfy the following at least two conditions can be called as a MN. First, they have to be independent of the volatility of market return, which is analytically attained by imposing the portfolio beta to be zero. Second, the average returns of MN is larger and the risk of MN is very much smaller than those of market index.

On the other hand, the MN in the present section utilizes stratified sampling method with

data from Section 2. Let us turn to the detail of it.

Each month the Tokyo Stock Exchange stocks are assigned to cells on the basis of industry, size (market capitalization =a stock's price times its shares outstanding) deciles, and the composite financial ratio deciles. All stocks are reaggregated into 13 industries such as electric instruments, precision instruments, automobile, machinery and shipbuilding, pharmacy, oil and mining, retail and food, construction and estate, metal and ceramics, chemicals and fabrics, trading company and transportation, financial, electricity-gas and communication.

The reason we form portfolio on size is that many authors show the importance of size as the determinant of average stock returns. The problem raised by the inclusion of size is that size and other fundamental variables are highly correlated. The third variable CFR may play a role to mitigate the problem.

1300 cells now formed under this independent, three-way grouping method contain the different number of stocks, mostly composed of less than two stocks. If we could build a portfolio of all the TSE stocks in the same proportions as those of the cells, an index fund would be obtained and its average return and standard deviation are very close to those of TOPIX with the portfolio beta almost equal to one. Actually this experiment requires larger fund and unnegligible trading commission.

If we delete the highest decile ranking of the composite financial ratio, leaving industry and size intact, and form a portfolio in the same proportions as those of the rests of the cells, the simulated returns and other statistics of the portfolio are shown in Figure 4－1. As more the deciles are excluded, the more decrease portfolio betas and the degree of linkage to the market index (TOPIX). In a preliminary study we delete the highest 2 deciles or 3 deciles and obtain what is expected, while the index is certainly replicated without deleting any deciles. Figure 4－2 shows the performance of monthly rebalancing portfolio equal-weight-invested in 100 stocks with the lowest composite ratio, i.e., the other extreme.

In Figure 4－3 we present the relationship of the portfolios' performance on a familiar risk-return diagram, where extra return is the return differential between the market-neutral portfolios and the market index (TOPIX). By buying higher CFR stocks less and lower CFR stocks more, we earn higher returns, although at the same time risks increase, but only proportionately

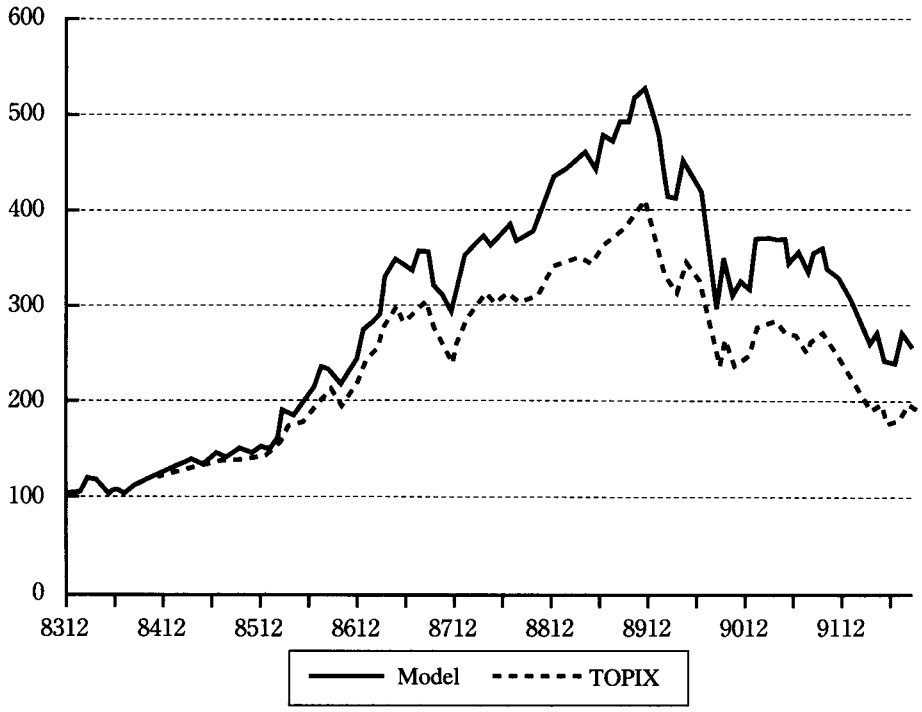
From these evidences, we become now sure that by selling higher CFR stocks, preferable MN investment strategies can be formed (For several actual examples, see [6]). A source of successful investments is persistent financial anomalies.

5. Conclusion

The analyses are based on data of individual company from December 1983 to December 1992 listed in both sections of the Tokyo Stock Exchange in Section 2, as well as data on portfolios which are constructed from industry data of the 1st section of the TSE for the year 1966－1991 in Section 3, and by grouping the first data in Section 4.

This paper tried to find numerous fundamental anomalies for these data and periods. Betting

Figure 4—1. Performance of Index without the Highest CFR Decile



Yearly Returns

	1984	1985	1986	1987	1988	1989	1990	1991	1992	average
Model	25.75	20.80	58.82	20.96	41.37	28.00	-39.28	2.59	-21.67	11.31
TOPIX	26.18	15.56	47.85	11.71	36.68	23.42	-39.06	-0.67	-23.05	7.49

Monthly Returns (%)

	mean	s.d.
Model	1.11	6.44
TOPIX	0.81	6.39

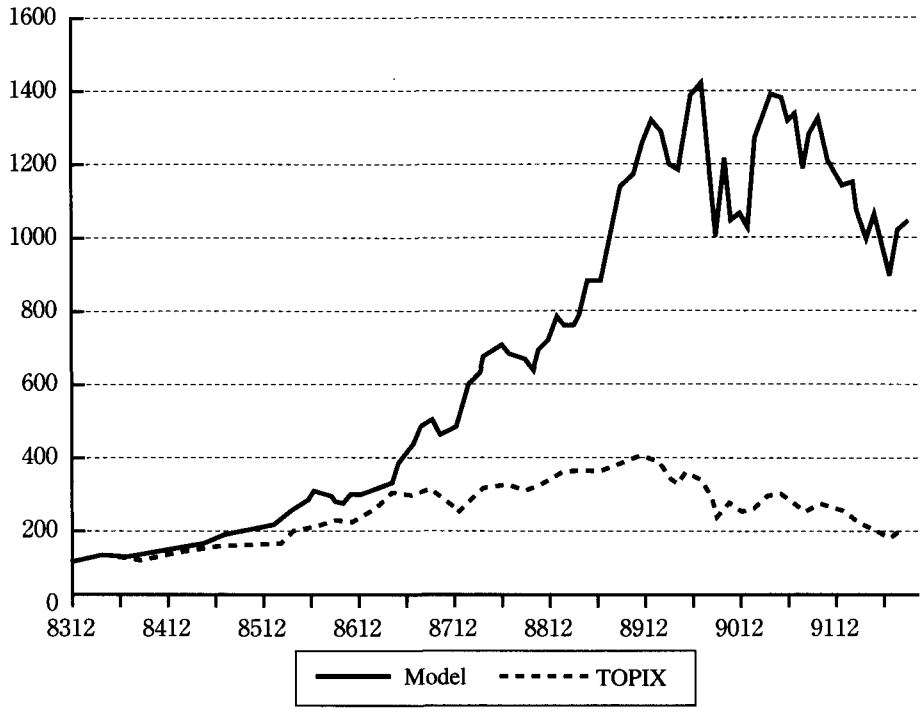
Simple Regression

α	0.00298
β	0.99967
R^2	0.98540

Yearly Turnover (%)

	1984	1985	1986	1987	1988	1989	1990	1991	1992	average
Model	125.07	46.98	66.24	121.26	17.17	12.52	13.67	13.88	14.49	38.22

Figure 4—2. Performance of 100 Lowest CFR Stocks



Yearly Returns

	1984	1985	1986	1987	1988	1989	1990	1991	1992	average
Model	36.10	45.41	44.16	61.27	52.94	81.91	-17.79	12.48	-13.03	30.21
TOPIX	26.18	15.56	47.85	11.71	36.68	23.42	-39.06	-0.67	-23.05	7.49

Monthly Returns (%)

	mean	s.d.
Model	2.48	6.90
TOPIX	0.81	6.39

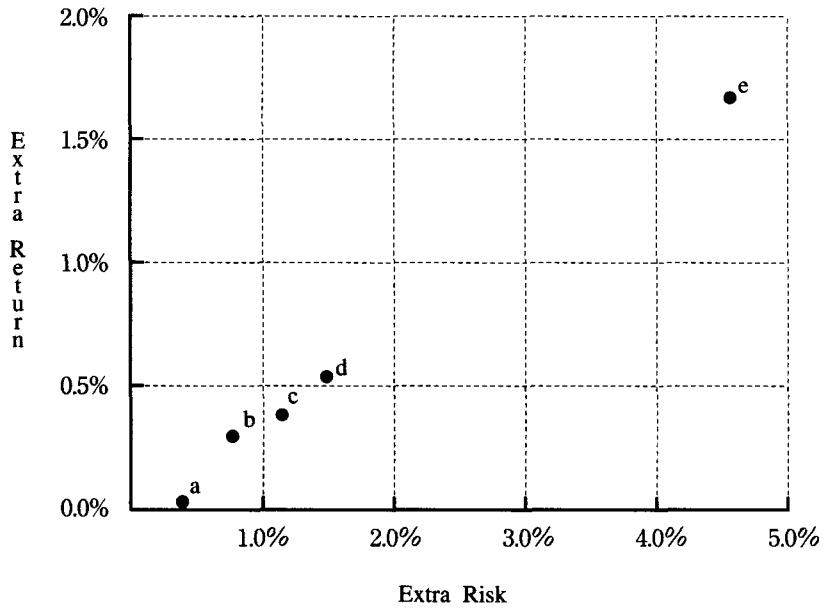
Simple Regression

α	0.01808
β	0.82343
R^2	0.58246

Yearly Turnover (%)

	1984	1985	1986	1987	1988	1989	1990	1991	1992	average
Model	624.04	559.51	598.10	574.70	604.74	544.31	736.83	656.38	527.62	614.57

Figure 4—3. Risk-Return Relationship of Market-Neutral Investment Strategies



Note)The mean and standard deviation of return differential (we call it extra return) between the return of portfolios such as: a=index fund, b=index+α (the highest CFR decile excluded), c=index+α (higher 1st and 2nd CFR deciles excluded), d=index+α (higher 1st to 3rd CFR deciles excluded), e=portfolio of 100 lowest CFR stocks, and the return of market index, where CFR is the composite financial ratio.

on MPT (modern portfolio theory) variables such as α and β does not earn abnormal returns persistently. The single factor CAPM is not appropriate to explain stock returns. Several financial ratios show very strong and persistent anomalous phenomena. They are also synchronous so that we combine them into one variable called composite financial ratio (CFR).

We then form portfolios depending on the CFR and measure the performance of them. Since the MN investment strategies utilizing the CFR are successful, we are convinced that the CFR captures a risk factor in Japanese equity market.

Appendix. An Estimation Method of the Book-to-Market Ratio

This appendix explores a systematic method to measure the ratio of the book value of common equity to its market value, i.e., book-to-market ratio (BMR). As far as we know time series data for returns on stocks and the number of shares which an investor holds, the following method would be legitimate. For investors the book value of stocks is the summation of the number of shares bought in year t times the price P_t at that time. Let x_t be the total amount of shares held in year t, $(x_{t-i}-x_{t-i-1})$ would then be net amount of new purchase in year $(t-i)$. Negative $(x_{t-i}-x_{t-i-1})$ means that absolute value of $|x_{t-i}-x_{t-i-1}|$ is sold in year $(t-i)$ at the price P_{t-i}.

We express the composition of year t stock portfolio in the order of newer acquisition,

$$\left(\frac{x_t-x_{t-1}}{x_t},\ \frac{x_{t-1}-x_{t-2}}{x_t},\ \frac{x_{t-2}-x_{t-3}}{x_t},\ \cdots\right) \tag{A1}$$

The sum of these ratios amounts to 1. The book value per share can be defined as follows,

$$P_t\frac{x_t-x_{t-1}}{x_t}+P_{t-1}\frac{x_{t-1}-x_{t-2}}{x_t}+P_{t-2}\frac{x_{t-2}-x_{t-3}}{x_t} \tag{A2}$$
$$+\cdots+P_{t-i+1}\frac{x_{t-i+1}-x_{t-i}}{x_t}+\cdots$$

where the coefficients of stock price P_{t-i+1} are the composion in (A1).

Let us call the ratio of this book value to stock price in year t as BMR_t. Then,

$$\mathrm{BMR}_t=\frac{(x_t-x_{t-1})}{x_t}+\frac{P_{t-1}}{P_t}\cdot\frac{(x_{t-1}-x_{t-2})}{x_t}$$
$$+\frac{P_{t-2}}{P_t}\cdot\frac{(x_{t-2}-x_{t-3})}{x_t}+\cdots+\frac{P_{t-i+1}}{P_t}\frac{(x_{t-i+1}-x_{t-i})}{x_t}+\cdots \tag{A3}$$

Each element of the RHS of this equation can be rewritten by using identities,

$$\frac{P_{t-i+1}}{P_t}=\frac{P_{t-i+1}}{P_{t-i+2}}\cdot\frac{P_{t-i+2}}{P_{t-i+3}}\cdots\cdots\frac{P_{t-2}}{P_{t-1}}\cdot\frac{P_{t-1}}{P_t} \tag{A4}$$

$$\frac{(x_{t-i+1}-x_{t-i})}{x_t}=\frac{(x_{t-i+1}-x_{t-i})}{x_{t-i+1}}\cdot\frac{x_{t-i+1}}{x_{t-i+2}}\cdot\frac{x_{t-i+2}}{x_{t-i+3}}\cdots\cdots\frac{x_{t-2}}{x_{t-1}}\cdot\frac{x_{t-1}}{x_t} \tag{A5}$$

Furthermore the growth rate g_{t-j} of stocks held and the rate of return on stocks R_{t-j} can be defined by

$$\frac{x_{t-j-1}}{x_{t-j}} \equiv \frac{1}{1+g_{t-j}} \qquad (j=0, 1, 2, \cdots) \tag{A6}$$

$$\frac{P_{t-j-1}}{P_{t-j}} \equiv \frac{1}{1+R_{t-j}} \qquad (j=0, 1, 2, \cdots) \tag{A7}$$

Using equations (A4) to (A7), BMR_t can be expressed by g_{t-j} and R_{t-j}.

$$\begin{aligned}\mathrm{BMR}_t = & \frac{g_t}{1+g_t} + \frac{1}{(1+R_t)} \cdot \frac{g_{t-1}}{(1+g_{t-1})} \cdot \frac{1}{(1+g_t)} \\ & + \frac{1}{(1+R_{t-1})(1+R_t)} \cdot \frac{g_{t-2}}{1+g_{t-2}} \cdot \frac{1}{(1+g_{t-1})(1+g_t)} \\ & + \frac{1}{(1+R_{t-2})(1+R_{t-1})(1+R_t)} \cdot \frac{g_{t-3}}{(1+g_{t-3})} \cdot \frac{1}{(1+g_{t-2})(1+g_{t-1})(1+g_t)} \\ & + \cdots \end{aligned} \tag{A8}$$

For the economy as a whole, $(x_{t-i} - x_{t-i-1})$ and x_t will also have different meaning. These are respectively the amount of new issue by firms and the shares outstanding.

Footnotes

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This paper is a revised version of the paper presented to the conference on Developments on Japanese Financial Markets organized by the program committee of the University of Southern California. The auther wishes to thank Mr. T. Goto and professors for the invitation to the conference.

1) Chan, Hamao and Lakonishok [3] present an U-shaped relationship between average returns and such fundamental variables as earnings to price ratio, BMR and cash yields in an univariate analysis of firms including firms with negative earnings. But when they go forward to a multivariate analysis, these nonlinearities are neglected.

2) In order to encompass a survivorship bias, the author thinks the error component model worth while to be tried rather than compiling unlisted or delisted companies data base.

3) The reason why we do not take leverage into consideration is that leverage of financial company has different meaning from that of non-financial company.

4) According to Brown and Harlow [1], "the revelation of unfavorable news may well induce traders to quickly limit their downside losses, thereby creating market pressures that depress prices." That is, the traders sell the stocks and the prices go down furthermore. Hence, "stocks that are judged initially to be losers tend to remain that way in the long run."

5) Until May 1973, third party allotments were a popular method of offering shares. Since then, they should only be made in exceptions, for example, with exchanging blocks of shares to make up an interrelated corporate group.

6) When pre-emptive rights are granted, they apply to shareholders whose name appears in the

shareholders' register on the stock closing day prior to the issue. The shareholder should be given two weeks' notice by the company that the right will elapse on a given date. If rights are not exercised to subscribe to the new share offering, then offered to the public. The issuing price is usually the stock's par value.

7) The first new equity issues at market price began only in January 1969.

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