Test of the Market Model for the Korea Stock Exchange

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I. Introduction

The market model of Markowitz[7] and Sharpe[10] has been applied extensively to stock price data in the United States and other countries with well established trading markets. The model has practical as well as academic interest because it offers a measure of systematic risk, i.e., the sensitivity of a stock's rate of return to changes in a general market returns. This measure, commonly known as the beta coefficient, enables the investor to, in principle, compare levels of nondiversifiable risk in securities, a concept which is basic to the problem of portfolio selection.

The original market model is expressed as a simple linear model:

$$R_{jt}=\alpha_j+\beta_j R_{mt}+U_{jt} \quad (1)$$

where R_{jt}=the return on security j in period t

R_{mt}= the return on a market portfolio in period t

α_j, β_j are constants for security j

U_{jt} is a random disturbance term with mean zero.

Hence, β_j is the measure of systematic risk in terms of the expected return on stock

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j. The assumption that U_{jt} and R_{mt} are uncorrelated permits us to write

$$\text{Var }(R_{jt}) = \beta_{j2}\text{Var}(R_{mt}) + \text{Var}(U_{jt}) \quad (2)$$

If Var (R_{jt}) is viewed as measuring the total risk for security j, then (2) states the relation between a security's total and systematic risk. The quantity Var (U_{jt}) can be interpreted as a measure of non-systematic, or diversifiable, risk due to factors unique to firm j.

The relative newness of the Korea Stock Exchange in its modern form gives rise to questions concerning its stability and efficiency. One way to examine these issues is by studying the behavior of the market model extimates for a sample period.

This paper reports studies of this type applied in two ways to KSE price data for the year 1979 to 1983. First, the time stability of the model parameters is considered. Next, we look at the effect of dividend announcements on the parameter during the same period. Our findings give useful insights into the performance of a market which serves a rapidly growing economy and which has been strongly influenced by government intervention.

At the same time, the limitations of the availiable data make these results somewhat preliminary while our statistical tests suggest the need for new research, some of which is currently being conducted.

II. Data base

This study employs data from a sample of 50 corporations whose common stock is traded on the KSE. The sample period was initially chosen as the five-year interval 1979–1983. A random sample of 60 corporations was selected from among the 328 corporations listed as of December 31, 1983. Of these companies, only 50 were listed as early as January 1979. 〈Table 1〉 shows these companies which formed the final sample. They represent 14 major industries found in the Korean business sector. The final sample tended to include larger than-average companies. However, these firms were found to represent a broad spectrum of characteristics in terms of size and industry type.

Price and dividend data were obtained from the Korea Daily Economic Journal. A market index R_{mt} was constructed from indexes published in the KSE Securities Statis-

〈Table 1〉 **Sample of 50 Corporations Listed cn the KSE**

Co. No.	Company	Performance Figures Jan. 1-Dec. 31, 1983 (Million Won)				
		Assets	Sales	Dividends	Net Income	Stock-holder's Equity
1	Gold Star Co.	474,077	748,312	3,840	26,610	108,927
2	Oriental Precision Co.	74,275	82,594	500	1,649	16,185
3	Sam Sung Electric Co.	412,518	707,011	3,642	21,261	94,959
4	Anam Industrial Co.	53,288	66,216	509	2,162	14,023
5	Dai Han Electric Wire Co.	244,827	192,327	1,227	3,043	70,725
6	Korea Ship Bld. Engineering Co.	447,511	230,393	1,606	2,664	45,066
7	HyunDai Motor Co.	627,204	577,416	7,515	25,694	156,996
8	Kyung Nam Enterprise Ltd.	456,974	323,955	135	3,297	35,889
9	Sam Hwan Enterprise Co.	275,480	495,831	1,352	15,271	64,922
10	Dong-A Construction Ind. Co.	619,766	446,479	2,190	564	133,292
11	Han Il Development Co.	235,612	382,682	1,500	13,815	60,765
12	Keum Kang Co.	68,227	98,583	720	2,638	19,046
13	Dae Woo Corporation	1,399,204	3,096,451	6,884	34,124	242,875
14	Lucky Gold Star Int'l	165,983	900,973	1,120	3,093	21,895
15	Kwang Ju Highway Lines Co.	60,823	50,436	750	5,095	18,126
16	The Korea Express Co.	138,973	146,183	1,233	5,078	44,943
17	KAL Co.	932,218	933,911	1,060	2,464	123,419
18	The Commerical Bank of Korea Co.	8,225,958	452,580	2,235	5,630	130,000
19	Korea First Bank Co.	7,331,121	440,860	3,428	5,940	130,000
20	The Hanil Bank	7,433,153	471,480	4,540	7,270	130,000
21	Oriental Fire and Marine Insurance Co.	53,967	28,360	273	760	2,730
22	Dae Han Fire and Marine Insurance Co.	63,100	28,910	148	160	1,850
23	Korea Tungsten Mining Co.	40,871	30,640	599	△896	26,487
24	Seoul Kyotong Co.	2,362	1,699	—	△64	98
25	Korea Automobile Insurance Co.	122,900	158,970	—	△7,210	2,810
26	Sam Mi Iron Mining	12,181	10,423	80	222	1,926
27	Sam Yang Foods Co., Ltd.	77,106	204,238	457	3,734	16,626
28	Cheil Sugar Co., Ltd.	246,238	374,804	960	6,180	54,525
29	Seoul Mi Won Co. Ltd.	86,734	128,136	800	2,178	33,062
30	Oriental Brewery Co. Ltd.	171,526	125,491	800	1,928	35,359
31	Kyung Bang Co.	60,396	61,596	288	2,549	18,522
32	Korea Hapsum Co.	290,462	113,391	—	118	29,494
33	Cheil Synthetic Textile Co.	195,028	133,484	1,012	3,552	35,972
34	Han Kook Paper Manufacturing Co.	33,028	42,087	333	1,103	9,088
35	Chon Ju Paper Manufacturing Co.	58,903	63,622	344	1,009	16,501
36	Han Kook Kaproractham Co.	39,932	55,798	347	648	21,439
37	Oriental Chemical Ind. Co.	134,105	83,778	418	2,966	38,524
38	Lucky Ltd.	368,969	376,053	2,743	11,536	102,344
39	Dong-A Pharmaceutical Co.	64,599	85,801	833	3,622	14,776
40	Pacific Chemical Ind. Co.	160,660	164,837	824	4,788	40,040
41	Korea Explosive Co.	107,758	91,778	562	1,919	33,548
42	Korea Stock Holding Co.	70,083	5,500	5,307	5,728	69,645
43	Han Kook Tire Mfg. Co.	157,575	163,397	270	2,929	29,682
44	Doo San Glass Co.	72,855	55,981	250	2,122	5,636
45	S'sang Yong Cement Co.	871,369	503,476	2,850	11,102	234,860
46	Hyun Dai Cement Co.	55,326	59,691	405	4,423	17,394
47	Byack San Corporation	41,386	44,143	296	1,708	17,184
48	Union Steel Mfg. Co.	187,272	289,156	436	5,671	47,479
49	Korea Iron & Steel Works Ltd.	79,731	89,078	249	238	13,738
50	Dae Woo Heavy Ind. Co.	432,019	270,129	4,122	7,954	116,207

tics Year Book.

Monthly rate of return was computed by using the following formula.

$$R_{jt}=\frac{P_t-P_{t-1}+D_t}{P_{t-1}} \quad (3)$$

Where R_{jt} = monthly rate of return on j stock investment of time t

P_t = price per share at time t

D_t = dividend per share at time t

P_t used in the above formula was calculated by adjusting capital increase and dividends.

This resulted in returns for the 60months January 1979 through December 1983.

III. Statistical Estimation and Tests

For each of the companies, market model parameter estimates were computed for

(1) the full 60 months

(2) subperiod I January 1979 to December 1979 (Boom period)
subperiod II January 1980 to December 1982 (Recession period)
subperiod III January 1983 to December 1983 (Recovery period)

(3) subperiods based on dividend disclosures, the months December-April (the disclosure interval) and the months May-November (the non-disclosure interval).

The disclosure interval corresponds to the tradition among Korean corporations of closing their books on or around December 31 of each year.

〈Table 2〉 presents summary results for the full 60 month period. The point estimates for the market model coefficients obtained from the least square fitted equation

$$R_{jt}=a_j+b_jR_{mt} \quad (4)$$

are not inconsistent with those reported by others for the United States and Europe.[5)8)] In particular, the estimated beta coefficients average .7140, somewhat less than would be expected for a purely random sample. This is not surprising in view of the fact that our sample includes firms which tend to be older and more well-established, suggesting a lower average level of systematic risk.

However, there is considerable variation in the b_j's with value exhibiting patterns

〈Table 2〉 **Sample Statistics for Estimated Market Model Korea Stock Exchange**
(January 1979–December 1983)

	Beta	SD(Beta)	Alpha	SD(Alpha)	R-Square	M(Return)	$S_{(R_{jt})}$	S_j
1	1.3930	.2627	.0098	.0135	.3265	.0073	.0109	.1042
2	1.2526	.5267	.0277	.0270	.0888	.0254	.0436	.2089
3	1.1222	.2397	.0103	.0123	.2742	.0083	.0090	.0951
4	.6460	.3167	.0350	.0162	.0670	.0339	.0158	.1256
5	1.3836	.2928	.0001	.0150	.2780	−.0024	.0135	.1161
6	1.4388	.3524	.0214	.0181	.2232	.0189	.0195	.1398
7	1.3003	.2176	−.0000	.0111	.3810	−.0023	.0074	.0863
8	1.5965	.4038	−.0135	.0207	.2123	−.0163	.0256	.1601
9	1.0029	.4226	.0182	.0216	.0885	.0164	.0181	.1676
10	1.3831	.2798	.0046	.0143	.2964	.0021	.0123	.1110
11	1.0382	.1997	.0152	.0102	.3178	.0133	.0063	.0792
12	1.1763	.2808	.0191	.0144	.2323	.0170	.0124	.1114
13	1.0527	.2379	.0150	.0122	.2525	.0131	.0089	.0943
14	.8894	.2331	.0122	.0119	.2006	.0106	.0085	.0925
15	.4199	.1537	.0290	.0079	.1140	.0283	.0037	.0610
16	.8842	.2835	.0128	.0122	.1915	.0112	.0089	.0946
17	1.2782	.2807	−.0014	.0144	.2633	−.0037	.0124	.1113
18	.3964	.1570	.0150	.0080	.0091	.0143	.0039	.0622
19	.4139	.1508	.0121	.0077	.1149	.0113	.0036	.0598
20	.3312	.1701	.0140	.0087	.0613	.0134	.0046	.0675
21	.1431	.1527	.0054	.0078	.0149	.0051	.0037	.0606
22	.1604	.1331	.0119	.0068	.0244	.0116	.0028	.0528
23	.4043	.1625	−.0038	.0083	.0964	−.0045	.0042	.0645
24	.1155	.2034	.0012	.0104	.0055	.0010	.0065	.0806
25	.0864	.2892	.0087	.0148	.0015	.0085	.0132	.1147
26	.3227	.2801	.0133	.0107	.0398	.0127	.0068	.0825
27	.0515	.2055	.0142	.0005	.0011	.0141	.0066	.0815
28	.3039	.1864	.0155	.0095	.0438	.0150	.0055	.0739
29	.0995	.2314	.0176	.0119	.0032	.0174	.0084	.0918
30	.6679	.2001	.0035	.0103	.1611	.0023	.0063	.0794
31	−.0070	.1288	.0115	.0066	.0001	.0115	.0026	.0511
32	.6360	.3293	.0131	.0169	.0604	.0120	.0170	.1306
33	.4492	.2095	.0142	.0107	.0734	.0134	.0069	.0831
34	.2737	.1630	.0088	.0084	.0464	.0083	.0042	.0646
35	.2684	.1556	.0176	.0080	.0488	.0172	.0038	.0617
36	.6402	.3139	.0092	.0161	.0669	.0081	.0155	.1245
37	.6977	.3671	.0208	.0188	.0586	.0195	.0212	.1456
38	1.4963	.3480	.0187	.0178	.2417	.0161	.0191	.1380
39	.1596	.1914	.0176	.0098	.0118	.0173	.0058	.0759
40	.3107	.1394	.0219	.0071	.0789	.0213	.0031	.0553
41	.9072	.2067	.0286	.0106	.2493	.0270	.0067	.0820
42	.3445	.3798	.0214	.0195	.0140	.0208	.0227	.1506
43	.7932	.2047	.0023	.0105	.2057	.0009	.0066	.0812
44	.4400	.4312	.0127	.0221	.0176	.0119	.0292	.0710
45	.7895	.2104	.0198	.0108	.1953	.0184	.0070	.0835
46	.6149	.2309	.0163	.0118	.1089	.0152	.0084	.0916
47	1.1280	.2940	.0121	.0151	.2025	.0101	.0136	.1166
48	1.0342	.2437	.0163	.0125	.2369	.0144	.0093	.0966
49	.7645	.1644	.0162	.0084	.2717	.0148	.0042	.0652
50	1.2052	.2921	.0126	.0150	.2269	.0104	.0134	.1158
Mean	.7140	.2479	.0131	.0127	.1378	.0118	.0109	.0983
SD	.4578	.0883	.0088	.0045	.1074	.0090	.0082	.0350

which might be expected for different industries.

For example, the six banking and financial companies show an average b_j of 0.26 reflecting the conservative nature of this industry.

<Table 3> shows us the value of β varies according to company assets, size, and different industries.

The two firms representing the metal and mining industries (23, 26) have low mean beta estimates: an average of 0.3635. These two companies may be less sensitive to market factors because of longstanding government support for these basic industries in Korea. The average of the five construction firms is 1.24, which seems to be reasonable for this industry because it is quite sensitive to change due to Middle-East countries' economic activities.

The eight fabricated metal product, machinery and equipment companies have a high average b_j (=1.2177).

It perhaps indicates the declining profitability of these companies each year during that period.

<Table 3>

Beta Average of Each Industry	Average(Beta)
Metal Ore, Mining	.3635
Food & Beverage Mfg.	.2807
Textile & Clothing	.3594
Paper & Paper Products	.2711
Chemicals, Coal…… & Plastic Products	.6687
Non-Metalic Mineral Products	.7431
Basic Metal Mfg.	.8994
Fabricated Metal Products, Machinery & Equipment	1.2177
General Construction	1.2394
Wholesale & Retail Trade	.9711
Transport & Storage	.6745
Financial Institutions	.3805
Insurance	.1300
Beta Average for Asset Size	**Average**
Large Corporations	1.0523
Medium Sized Corporations	0.6697
Small Corporations	0.4257

The rise of foreign exchange rates, oil prices and the decrease in product sales in domestic markets also affected profitability.

Meanwhile, the other industries were able to raise their prices as such factors fluctuated. However, the eight companies could not help keeping their present sales prices to maintain their market shares.

In considering company size based on total assets, obvious differences are shown. The 16 large sized companies' average b_j is 1.0523, the middle sized 18 companies' average b_j is 0.6697, and the 16 small sized companies' b_j is 0.4257. That means b_j is larger in a relatively large company.

These features show that the 16 large companies rely most on outside capital.

It is interesting to compare the Korean experience with that of other nations. ⟨Table 4⟩ contains market model estimates from the KSE study along with similar values based on two different studies reported by Fama (1976) and Pogue and Solnik (1974). The Fama study provides results using monthly N.Y.S.E. data for an earlier five-year period, July 1963 to June 1968. For the 30 largest U.S. firms, we see a small average beta estimate, 0.61, suggesting that these "blue-chip" firms are typically less sensitive to market fluctuations. Moreover, they are less widely dispersed than in our KSE sample, as might be expected in a relatively homogeneous group of large corporations.

In contrast to this first comparison, Fama's results for a random sample of 30 firms are more similar to the KSE results. The average estimated beta is 1.00, somewhat larger than for the 50 KSE firms, and the beta values are slightly more dispersed. While differences in these three sets of estimates are not statistically significant, the ordering seems quite reasonable.

The study of Pogue and Solnik (1974) included beta estimate average and standard deviations for the United States and four European Countries between 1966 and 1971. Their samples included firms which were typically among the largest in their respective nations, although in the U.S. sample, 50 of 65 firms were chosen randomly. From ⟨Table 4⟩ we are able to compare their results with those of the KSE listed firms. Again, the KSE b_j values are not inconsistent with those of the western nations. While the KSE b_j's have one of the lower averages, their standard deviation exceeds that of all the European countries, suggesting less homogenity among firms.

Another general observation on the KSE results is consistent with those of comparable studies: there is a positive correlation between the systematic risk measure b_j and the

〈Table 4〉 Summary Statistics for Beta Estimates from Three Market Model Studies
(All Monthly Returns)

Study	No. of Firm	No. of Months	Mean b_j	Standard Deviation	Range
KSE 1979~83	50	60	0.7140	0.4578	−0.0070 to 1.5965
Fama 1963~68					
30 largest firm	30	60	0.61	0.27	0.19 to 1.20
Random Sample	30	60	1.00	0.49	0.08 to 2.24
Pogue & Solnik 1966~1971					
U.S.	65	61	1.218	0.525	
England	40	61	1.046	0.311	
France	65	61	0.840	0.283	
Germany	36	61	1.025	0.157	
Italy	30	61	1.005	0.304	

"total" risk in security j as measured by the standard deviation of R_{jt}, denoted in 〈Table 2〉 by $S_{R_{jt}}$. One way to illuminate this issue is by considering the orthogonal decomposition of total variation in a security's rate of return. This can be written, as in Fama (1976), As

$$\sum_{t=1}^{T}(R_{jt}-\overline{R_j})^2=b_j^2\sum_{t=1}^{T}(R_{mt}-\overline{R_m})^2+\sum_{t=1}^{T}e_{jt}^2 \tag{5}$$

The first term on the right side, often called the "explained" variation, represents that part of the toal variation which is associated with market factors, the so-called "non-diversifiable" risk. The second term, the "unexplained" variation, reresents "diversifiable" risk factors unique to security j. Clearly with $\sum(R_{mt}-\overline{R_m})^2$ the same for all firms; the total risk is an increasing function of the systematic risk b_j. However, an empirical finding of Fama (1976) and others is that the non-systematic risk, as measured by $\sum e_{jt}^2$, or equivalently by S_j, also tends to increase with b_j. In other words, firms which carry greater vis-a-vis the market portfolio also seem to have unique characteristics which make their stocks inherently greater investment risks.

To test this hypothesis for the Korea Stock Exchange, the regression standard errors of estimate (S_j) were regressed with the b_j's for the 50 firms in the sample. This resulted in a positive correlation 0.5255, significant at a level smaller than 0.005. Of course, any conclusions of this type must be qualified by the knowledge that the estimates are subject to sampling error. It should also be noted that, in percentage terms, the nonsystematic risk increases less rapidly with b_j as the total risk. This can be shown algebrically from equation 5.

IV. Time Stability of Parameters

To examine the time stability of the market model parameters several tests were conducted based on a dummy variable regression model. The full 1979~1983 period was divided into three subperiods by defining the variable.

$x=0$ for subperiod I: January 1979~December 1979
 1 for subperiod II: January 1980~December 1980
$x=0$ for subperiod II: January 1980~December 1980
 1 for subperiod III: January 1983~December 1983
$x=0$ for subperiod I: January 1979~December 1979
 1 for subperiod III: January 1983~December 1983

By fitting the model

$$R_{jt}=\alpha+\beta_j R_{mt}+\delta_j X+\lambda_j X R_{mt}+\mu_{jt} \tag{6}$$

This in effect fits the data with two different regression lines:

$$R_{jt}=\alpha_j+\beta_j R_{mt}+\mu_{jt} \quad \text{(subperiod I)}$$
$$R_{jt}=(\alpha_j+\delta_j)+(\beta_j+\lambda_j)R_{mt}+\mu_{jt} \quad \text{(subperiod II and III)}$$

It was possible to (1) estimate and compare the market model coefficients for the three subperiods; (2) test for equality of coefficients across subperiods; and (3) test for equality of the interperiod disturbance variances and total variances in the returns. The marginal test $\delta_j=\lambda_j=0$ is equivalent to testing jointly the equality of the regression coefficient in the three subperiods. This was achieved by fitting separate regressions for the three subperiods computing the F-statistic for the reduction in unexplained variation from the 60 month regression.[3] In addition, F-tests were conducted to compare the total variation in a security's return for the three subperiods; and, to make interperiod comparisons of the variances of the disturbance terms.

〈Table 5, 6 and 7〉 represent the results of the subperiod regressions and F-test described above. Inspection of the coefficient estimates it possible to know some decrease in 〈Table 5〉 and some increase in 〈Table 6 and 7〉 with the mean value of

〈Table 5〉

	Subperiod Ⅰ: Jan. 1979-Dec. 1979		Subperiod Ⅱ: Jan. 1980-Dec. 1982		Joint Test	Error Var. Test	Total Var. Test
	Beta	Alpha	Beta	Alpha	(F1)	(F2)	(F3)
1	2.5668	.0415	1.0291	.0043	*3.1328	.3103	.2342
2	1.0796	.0246	1.3109	.0297	.0147	***5.2790	**4.4975
3	1.6552	.0341	.0659	.0040	.8796	.4352	.4034
4	−.1304	.0692	.9530	.0205	1.6907	1.1669	1.4303
5	2.5803	.0077	.9760	−.0034	*2.8206	.2340	.1936
6	.1555	.0131	1.8192	.0203	1.9236	.6052	1.0198
7	2.1780	−.0143	.9213	.0046	**4.0006	.8967	.3781
8	.9924	−.1235	1.6376	.0317	**3.8462	.3694	.5281
9	1.2092	−.0300	.7554	.0511	1.0412	**3.7373	*2.7091
10	1.4675	−.0170	1.2506	.0200	.6732	.9142	.8297
11	.5626	.0037	1.1252	.0261	.8480	1.9580	2.4150
12	1.4946	.0306	1.0237	.0238	.2200	.6035	.5753
13	.5581	.0060	1.1470	.0242	.5710	***4.8376	**4.6829
14	.9017	.0230	.8433	.0104	.0651	*2.1894	1.7584
15	.3376	.0114	.4480	.0276	.3418	1.1373	1.2538
16	.9190	−.0134	.8802	.0287	.8212	*2.3777	1.8157
17	1.2232	−.0157	1.2734	.0054	.1331	1.2082	1.1784
18	−.0238	.0283	.5479	.0209	1.4974	1.5512	2.0657
19	−.1765	.0240	.6312	.0172	*2.9850	1.8720	*2.5168
20	−.1564	.0244	.4650	.0210	1.4450	*2.2167	*2.6012
21	−.1205	.0001	.1788	.0121	.4202	***5.1562	***5.3050
22	.1041	.0056	.2339	.0166	.2738	***6.5992	***6.8271
23	.5953	.0133	.2934	.0018	.4497	.2359	.2466
24	.0000	.0000	.2834	−.0035	.2161		
25	−.0945	.0136	.1922	.0175	.0746	1.7360	1.8610
26	−.1823	−.0191	.3415	.0242	1.7004	*2.4400	*2.6257
27	−.0284	.0030	.0853	.0156	.3256	1.4423	1.5522
28	.3210	.0090	.3409	.0136	.0180	.5110	.5660
29	.3420	.0097	.1407	.0143	.1365	1.7729	1.6886
30	.9462	−.0136	.5366	.0067	.6482	.2113	.2341
31	−.3692	.0358	.1620	.0012	**3.8872	*2.2971	1.8105
32	1.5848	.0326	.2703	.0169	1.2512	.9043	.6713
33	.8607	.0089	.2623	.0219	.9051	1.5575	1.0850
34	.3673	.0011	.1869	.0068	.1528	.6889	.6942
35	.6693	.0374	.1408	.0170	1.1707	.6380	.5387
36	1.7817	.0566	.3211	−.0072	*2.6024	.3640	.2886
37	.6319	.0210	.7680	.0301	.0209	***7.0312	***5.9303
38	1.7426	.0367	1.4783	.0194	.0866	*2.5999	1.6303
39	.2406	.0134	.2408	.0215	.0645	.2835	.3155
40	.4645	.0189	.1953	.0271	.4760	.7416	.6794
41	.8618	.0577	.9430	.0270	.5600	.6002	.7227
42	1.5814	.0569	−.0384	.0226	1.5326	.6971	.5780
43	1.2603	−.0096	.6089	−.0068	1.0838	.3374	.3067
44	.0374	.0859	.5936	−.0211	1.7631	.0935	.1107
45	1.9317	.0580	.4000	.0101	***5.8524	1.7140	.4476
46	1.2397	−.0029	.2893	.0316	*2.7193	1.5445	.8011
47	1.7456	.0136	.8354	.0125	.7635	*2.3318	1.1042
48	.4876	−.0103	1.1199	.0119	.7401	1.3763	1.8185
49	.4938	.0280	.8283	.0088	.9886	.6849	1.0093
50	1.0305	.0016	1.2013	.0169	.0773	.8628	.9691
Mean	.7984	.0138	.6688	.0155			

* significant at .10 level
** significant at .05 level
*** significant at .01 level

〈Table 6〉

	Subperiod Ⅱ: Jan. 1980-Dec. 1982		Subperiod Ⅲ: Jan. 1983-Dec. 1983		Joint Test	Error Var. Test	Total Var. Test
	Beta	Alpha	Beta	Alpha			
1	1.0291	.0043	.7028	.0073	.0525	.3192	.2313
2	1.3109	.0297	1.2478	.0222	.0046	.0670	.0689
3	.9659	.0049	.8920	.0091	.0142	.3563	.2813
4	.9530	.0205	1.3460	.0360	.0856	.1180	.1382
5	.9760	−.0034	.9097	.0173	.2333	1.4538	1.0102
6	1.8192	.0203	3.2278	.0223	.3199	.5506	.5123
7	.9213	.0046	1.9578	.0146	.4482	1.2075	1.0108
8	1.6376	.0317	1.8112	−.0454	1.6673	.1904	.1839
9	.7554	.0511	2.4521	−.0240	1.1448	.0918	.1567
10	1.2506	.0200	2.4975	−.0146	.8314	1.9190	1.4245
11	1.1252	.0261	2.2439	−.0081	1.4657	.1981	.3388
12	1.0237	.0238	1.9015	.0003	.4635	.3369	.3651
13	1.1470	.0242	2.3577	−.0055	.8518	.2424	.3416
14	.8433	.0104	1.9557	.0105	.3402	.1294	.2393
15	.4480	.0276	.2143	−.0491	.5972	1.3456	1.0752
16	.8802	.0287	−.2782	−.0124	.9871	.5091	.3927
17	1.2734	.0054	1.3030	−.0082	.0635	.4483	.3554
18	.5479	.0209	.5132	−.0212	2.0729	.8819	.6897
19	.6312	.0172	.4814	−.0228	2.1037	.4213	.3190
20	.4650	.0210	1.2078	−.0210	2.2043	.9429	.9089
21	.1788	.0121	1.0543	−.0097	1.1014	.3538	.4370
22	.2339	.0166	−1.1453	−.0012	1.7891	1.2501	1.3153
23	.2934	.0018	1.3064	−.0317	*3.0599	*2.3196	2.2864
24	.2834	−.0035	−2.2258	.0063	2.3374	.9052	1.1370
25	.1922	.0175	−.8930	−.0288	.7942	.1086	.1239
26	.3415	.0242	2.7389	.0152	2.3478	.7856	1.2046
27	.0853	.0156	−.2079	.0191	.0518	***10.3142	***9.5817
28	.3409	.0136	−.6021	.0248	.6386	1.7653	1.5604
29	.1407	.0143	−2.5203	.0294	0.3040	***3.1403	**3.4379
30	.5366	.0067	.8245	.0157	.1420	.5004	.4520
31	.1620	.0012	.0715	.0134	.2756	.2301	.2105
32	.2703	.0169	1.1119	−.0035	.2626	.1850	.2032
33	.2623	.0219	.7749	.0032	.3365	.7702	.7394
34	.1869	.0068	1.2402	.0272	1.0949	.7324	.8553
35	.1408	.0170	.2127	.0051	.2035	.2449	.2314
36	.3211	−.0072	−.0617	.0235	.4575	.5771	.5256
37	.7680	.0301	−.5196	−.0125	.4211	.1233	.1311
38	1.4783	.0194	.3291	−.0022	.2224	.1552	.1172
39	.2408	.0215	−2.2487	.0027	***3.7959	***3.4206	**3.8630
40	.1953	.0271	1.2392	.0147	1.3733	.8889	1.0575
41	.9430	.0270	1.0824	.0042	.4258	.3113	.2681
42	−.0384	.0226	−.5917	−.0049	.1906	.2397	.2318
43	.6089	−.0068	1.1141	.0492	*2.8773	1.7752	1.4091
44	.5936	−.0211	2.7536	.0432	*2.9686	.4276	.6987
45	.4000	.0101	1.0910	.0269	.3520	.2780	.3203
46	.2893	.0316	1.6273	.0018	1.1517	1.1077	1.1635
47	.8354	.0125	2.3952	.0221	.4281	.2437	.3475
48	1.1199	.0119	3.0441	.0558	1.7395	.5863	.7296
49	.8283	.0088	1.9408	.0268	1.0368	*1.8334	1.3896
50	1.2013	.0169	2.2316	.0121	.2351	.1824	.2569
	.6688	.0155	.9210	.0071			

* significant at .10 level
** significant at .05 level
*** significant at .01 level

〈Table 7〉

	Subperiod Ⅰ: Jan. 1979-Dec. 1979		Subperiod Ⅲ: Jan. 1983-Dec. 1983		Joint Test	Error Var. Test	Total Var. Test
	Beta	Alpha	Beta	Alpha			
1	2.5668	.0415	.7028	.0073	.7498	.0990	.0542
2	1.0796	.0246	1.2478	.0222	.0111	.3539	.3101
3	1.6552	.0341	.8920	.0091	.2566	.1551	.1135
4	−.1304	.0692	1.3460	.0360	1.0558	.1377	.1977
5	2.5803	.0077	.9097	.0173	.3491	.3402	.1956
6	.1555	.0131	3.2278	.0223	1.1406	.3332	.5225
7	2.1780	−0143	1.9578	.0146	.655	1.0828	.3822
8	.9924	−.1235	1.8112	−.0454	.6290	.0703	.0971
9	1.2092	−.0300	2.4521	−.0240	.5228	.3431	.4245
10	1.4675	−0170	2.4975	−.0146	.1623	1.7544	1.1819
11	.5625	.0037	2.2439	−.0081	*2.7903	.3879	.8181
12	1.4946	.0306	1.9015	.0003	.2671	.2033	.2100
13	.5581	.0060	2.3577	−.0055	*3.1896	1.1727	1.5997
14	.9017	.0230	1.9557	.0105	.9992	.2833	.4208
15	.3376	.0114	.2143	.0491	1.0721	1.5303	1.3481
16	.9190	−.0134	−.2782	−.0124	.6908	1.2105	.7129
17	1.2232	−.0157	1.3030	−.0082	.0172	.5416	.4187
18	−.0238	.0283	.5132	−.0212	*2.8952	1.3680	1.4247
19	−.1765	.0240	.4814	−.0228	**4.5304	.7886	.8029
20	−.1564	.0244	1.2078	−.0210	**3.7682	2.0901	2.3641
21	−.1205	.0001	1.0543	−.0097	*2.9171	1.8228	2.3182
22	.1041	.0056	−1.1453	−.0012	1.7567	**8.2498	***8.9795
23	.5953	.0133	1.3064	−0317	1.1273	.5471	.5638
24	.0000	.0000	−2.2258	.0063	**3.5972		
25	−.0945	.0136	−.8930	−.0288	.9818	.1886	.2306
26	−.1823	−.0191	2.7389	.0152	**5.0552	1.9168	*3.1628
27	−.0284	.0030	−.2709	.0190	.0694	**14.8761	***14,8723
28	.3210	.0090	−.6021	.0248	.4026	.9020	.8831
29	.3420	.0097	−2.5203	.0294	2.0115	***5.5673	***5.8053
30	.9462	−.0136	.8245	.0157	.2493	.1057	.1058
31	−.3692	.0358	.0715	.0134	2.0931	.5286	.3812
32	1.5848	.0326	1.1119	−.0035	.3108	.1673	.1364
33	.8607	.0089	.7749	.0032	.0181	1.1995	.8022
34	.3673	.0011	1.2402	.0272	.7385	.5045	.5937
35	.6693	.0374	.2127	.0051	.8985	.1562	.1246
36	1.7817	.0566	−.0617	.0235	.5133	.2101	.1517
37	.6319	.0210	−.5196	−.0125	1.2987	.8671	.6709
38	1.7426	.0367	.3291	−.0022	1.0841	.4035	.1911
39	.2406	.0134	−2.2487	.0027	1.5094	.9697	1.2186
40	.4645	.0189	1.2392	.0147	.4926	.6592	.7185
41	.8618	.0577	1.0824	.0042	1.3076	.1869	.1937
42	1.5814	.0569	−.5917	−.0049	.9797	.1671	.1340
43	1.2603	−.0096	1.1141	.0492	1.0775	.5989	.4231
44	.0374	.0859	2.7536	.0432	.4562	.0400	.0773
45	1.9317	.0580	1.0910	.0269	1.2198	.4764	.1434
46	1.2397	−.0029	1.6273	.0018	.0534	1.7109	.9320
47	1.7456	.0136	2.3952	.0221	.1816	.5684	.3837
48	.4876	−0103	3.0441	.0558	**3.6836	.8069	1.3268
49	.4938	.0280	1.9408	.0268	.9338	1.2558	1.4025
50	1.0305	.0016	2.2316	.0121	.3323	.1573	.2490
Mean	.7984	.0138	.9210	.0071			

* significant at .10 level
** significant at .05 level
*** significant at .01 level

beta 0.7984 for the subperiod I, 0.6688 for the subperiod II, and 0.9210 for the subperiod III.

These three tables show, us a high value of beta during subperiod III, and a low of during subperiod II.

We can say that the subperiod I was an economic boom period, the subperiod II was a recession, and lastly the subperiod III was a recovery period.

Generally speaking, the value of beta is known to be higher during the boom period than in the recession and recovery periods. But especially in this study, it is noticeable that the beta value is higher during the recovery period than during the boom period.

During the economic recession, most of the investors hesitate to enlarge their investment activities, because it is clear that the risk would be high and the rate of return would be low.

It is certain that the investors might have waited for chances which would give them a high rate of return on investments.

This kind of outlook of many investors may have caused the higher beta value during subperiod III (recovery period) than that of the subperiod I (boom period).

As 〈Table 5〉 shows, for all except nine companies, we were unable to reject the joint hypothesis test that α_j and β_j remained unchanged at the 0.10 level of significance.

A similar series of tests was performed for the variances of the dependent variable: $S_1^2(R_{jt})$. Because $S_1^2(R_{jt})$ is a measure of total risks for security j it is interesting to test the hypothesis that the two subperiod variances are different. This is achieved using the F variable

$$F^* = \frac{S_2^2(R_{jt})}{S_1^2(R_{jt})}$$

based on $(n_2-1,\ n_1-1)$ degrees of freedom. These ratios appear in 〈Table 5〉 for the 50 KSE stocks, 9 of the stocks (marked with asterisks) showed a significant variance from subperiod I to subperiod II.

Interperiod differces in these noise characteristics were more apparent from tests comparing the error variances for the two subperiod models. For each company an F test was performed on the hypothesis $\delta_{1j}^2=\delta_{2j}^2$, where $\delta_{1j}^2=\text{var}\ (U_{jt})$ in subperiod I. The test statistic is just the ratio of the squared standard errors of estimate from the two subperiod regressions.

$$F^* = \frac{S_{2j}^2}{S_{1j}^2}$$

This variable has the F-distribution with $(n_2-2,\ n_1-2)$ degrees of freedom provided the random errors are normally distributed. ⟨Table 5⟩ shows these ratios. From this test we found that 13 companies are significant at the .10 level or lower.

In 3 of the 13 significant cases, the standard error was larger in subperiod II. Viewing S_{1j} as a measure of diversifiable risk we have marginal evidence that this element of company risk increased between 1979 and 1980–1982. In ⟨Table 5⟩ the number of companies showing significant change is much larger than those showing significant change in ⟨Tables 6 and 7⟩.

Therefore, in light of equation (2) and these empirical results, the factor of non-systematic risk, as measured by var (U_{jt}), appears to be a more significant contribution to the time instability found in the total risk for returns on the stock included in the sample.

The failure of these tests to uncover changes in the beta coefficients is due essentially to the unreliability of the beta estimates. Despite the apparent trend toward smaller b_j's in subperiod II, the large standard errors prevent detection of true differences. This suggests the need for more powerful tests, some of which are proposed below.

The above tests assume that the U_{jt}'s are normally distributed and not serially correlated, examination of the residuals revealed the presence of leptokustic (fat-tailed) distributions for most company's returns. This is similar to findings reported by others, e.g., (4). There were also a few instances of significant autocorrelation for lags of one month. This can be viewed as a sign of inefficient adjustment of prices to new information, a subject widely studied in the literature of finance, economics and accounting.[2)]

Interperiod predictability of the market model parameters is an important feature of an efficient market in which investors need to anticipate future values of systematic and total risk. To examine this issue in the Korea Stock Exchange we followed the method employed in (8) of regressing parameter estimates in subperiod III against those in subperiod I. The results shown in ⟨Table 8⟩ do not support the hypothesis that key parameters are significantly correlated across subperiods. However, this conclusion should be qualified by the observation that regressions using estimates will

〈Table 8〉 **Estimates for Subperiod Parameter Regressions:**

Subperiod Ⅰ : January 1979–December 1979
Subperiod Ⅲ : January 1983–December 1983

Parameter Estimate	Intercept	Regression Slope	Estimates Correlation	t-statistics
a_j	0.004	0.234	0.338	2.487
b_j	0.664	0.326	0.184	1.296
r_j^2	0.220	−0.062	0.072	0.502
$S_{(Rjt)}$	0.072	0.030	0.068	0.474
S_j	0.069	0.012	0.026	0.183

understate the correlation between parameters due to the measurement error contained in estimates.[8]

V. Stability with Respect to Dividend Announcements

The effects of the disclosure of new market information on stock prices has interested a number of researchers.[6][11] The dividend announcement is one important item of public information. In an efficient market the anticipation and disclosure of dividends should be rapidly assimilated into the pricing of securities without disrupting the risk characteristics of individual stocks.

To study this issue in the Korea Stock Exchange, we divided the 60-month sample into subperiods identified by a dummy variable in the manner of the time stability model discussed above:

$x=0$ subperiod A : December∼April
1 subperiod B : May∼November

Subperiod A consists of months immediately preceding and following the December 31 book closing time of Korean firms. This announcement policy is followed rigidly, in part because of government pressure for companies to appear stable and predictable.

Using this definition of x, the regression equation 6 was fitted for each of the 50 corporations in the sample. 〈Table 6〉 contains the results of this estimation together with an F-test of the type employed in the study of time stability. It seems that the mean beta estimate for the non-disclosure interval, is considerably higher (0.9908) than for the disclosure interval (0.4589). For 38 of the 50 companies, b_j is larger in

〈Table 9〉

	Disclosure Interval (December-April)		Non-Disclosure Interval(May-Nov.)		Joint Test	Error Var. Test	Total Var. Test
	Beta	Alpha	Beta	Alpha			
1	.9029	.0206	1.8844	-.0018	2.2403	.6740	1.1390
2	1.9025	.0585	1.4961	.0042	.5734	.1036	.1581
3	.5653	.0183	1.6672	.0003	**3.1916	.9004	1.5154
4	.5157	.0648	.8583	.0125	1.4654	.3385	.4208
5	1.0038	.0156	1.7860	-.0141	1.4502	.9499	1.2481
6	1.0001	.0229	1.8534	.0171	.7433	.8417	1.0862
7	1.0303	.0158	1.6009	-.0135	1.8275	.4369	.7853
8	.5572	-.0101	2.5788	-.0238	**3.4788	1.2177	1.9349
9	.2554	.0379	1.7618	-.0017	2.1474	.2588	.4221
10	.8168	.0018	1.8621	.0026	1.6160	.3820	.7494
11	.2276	.0153	1.7967	.0089	***10.2366	.6258	1.9042
12	.8507	.0501	1.5749	-.0057	2.9576	.2978	.5498
13	.5030	.0270	1.6033	.0022	**3.5693	.2983	.7211
14	.3962	.0340	1.4168	-.0073	**4.4999	.2354	.5789
15	.4446	.0502	.4613	.0139	2.7299	.7675	.7848
16	.5626	.0237	1.2182	.0024	1.3836	.1733	.3691
17	.6518	.0067	1.8887	-.0120	2.8612	.7317	1.2609
18	.0988	.0232	.6996	.0069	2.5480	.5330	.7762
19	.1155	.0176	.7097	.0058	2.3893	.5363	.8039
20	.2372	.0282	.4624	.0030	1.2923	.2783	.6550
21	.0218	.0147	.2847	-.0023	.9837	1.0282	1.0970
22	.1919	.0052	.1107	.0169	.4080	.9214	.9037
23	.6621	.0061	.1934	-.0090	1.3757	.6549	.5344
24	-.1843	-.0331	.2917	.0236	**4.5920	.5704	.5967
25	.4285	.0125	-.2217	.0085	.6191	.7330	.7230
26	.4028	.0132	.2477	.0140	.0679	.3527	.3544
27	.2709	.0376	-.0826	-.0010	1.9685	.3041	.3029
28	.2509	.0442	.4405	-.0056	**3.8015	.3720	.4271
29	.2867	.0347	.0237	.0067	.8453	**1.8738	1.8118
30	.9104	.0396	.5507	-.0207	***5.0452	.4838	.4378
31	-.0059	.0168	.0082	-.0077	.2287	.0684	.0693
32	-.1731	.0230	1.4225	-.0002	**3.5051	.5478	.7878
33	.2745	.0335	.6713	-.0011	1.8302	.2922	.3856
34	.0121	.0215	.5570	-.0024	2.6371	.5964	.7535
35	.1461	.0311	.4237	.0070	1.6038	.1768	.2388
36	-.0797	.0333	1.3866	-.0136	**4.3695	.8336	1.1552
37	.5760	.0392	.8674	.0066	.4497	***4.5175	**4.2020
38	1.6562	.0457	1.4287	.0005	.8029	.1859	.2634
39	.2053	.0292	.1520	.0096	.4755	.5860	.5905
40	.4214	.0333	.2417	.0145	.9921	.2148	.2210
41	.4745	.0485	1.3723	.0109	**4.5638	.3045	.7211
42	-1.1543	.0358	1.7899	-.0004	***10.7735	.2764	.4809
43	.7655	.0200	.8728	-.0106	1.8064	.2659	.3729
44	.2376	.0612	.7766	-.0238	2.1212	.0862	.1117
45	.6194	.0185	.9444	.0195	.2875	.9906	1.1204
46	.8258	.0242	.4418	.0121	.4374	**1.9707	1.4843
47	1.0963	.0086	1.1473	.0143	.0192	.4977	.5599
48	.4877	.0313	1.5910	.0012	**3.7037	.6983	1.2258
49	1.0720	.0292	.5164	.0092	2.0649	.3918	.3169
50	.3728	.0041	1.9568	.0124	**4.0174	.3045	.7570
Mean	.4589	.0257	.9908	.0021			

* significant at .10 level
** significant at .05 level
*** significant at .01 level

subperiod B. The difference between the subperiod estimates is based on the Wilcoxon Test significant at the 0.01 level.

Turning to individual inteperiod comparisons, the F-test statistics in ⟨Table 9⟩ show us the differences in the market model coefficients. For fourteen companies there is strong evidence that, taken jointly, either of the parameters α_j or β_j is different for the two superiods.

Interperiod differences are more clearly established for the total risk in securities as measured by the sample variance $S^2(_{Rjt})$. As seen in ⟨Table 9⟩ the F-ratio is significant for 1 company. It is accompanied by a significant ratio for the error variance S_j^2 for the same company.

In all cases, the difference is in the direction of increased variation during the nondisclosure interval, subperiod B. Hence, there is clear evidence of stability in the total risk to the investor during the months surrounding the dividend disclosure. In other words, investors put more emphasis on capital gain rather than dividend.

While it would appear that some of this instability is embodied in the systematic risk, the major factor judging by statistical methods is the element of diversifiable risk. This would seem to provide some reassurance to the investor seeking to achieve a risk-stable portfolio.

VI. Conclusions

In many respects the market model describes the behavior of security returns for our sample from the Korea Stock Exchange with the same degree of success reported in comparable studies of other stock markets.

For the five-year sample period we were unable to reject the model hypotheses that the linear equation coefficients are stable with respect to time and to public disclosure of dividend information. As in other studies, the assumption of normally distributed equation disturbances was not satisfied in the typical firm, with a modest degree of leptokurtosis observed for most companies.

The comparatively large standard errors of estimate are the most distinguishing feature of the estimates for the KSE sample. These are associated with large standard errors for the estimated beta coefficients, rendering those estimates relatively unreliable. This would also appear to account for a lack of power in the tests of coefficient equality across subperiods. It may also explain the somewhat weak interperiod predictive ability of the estimates.

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〈國 文 要 約〉

韓國證券市場모델의 檢證

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Ⅰ. 硏究方法

本 硏究에서는 分析對象期間을 1979年 1月부터 1983年 12月까지의 5年間으로 하고 있다. 特히 이 時期를 經濟學의 理論에 바탕을 두어 好況(79年), 衰退(80~82年), 回復(83年)의 3區分으로 나누어 各各의 Time Stability Test와 韓國證券市場의 效率性을 檢證하기 爲하여 配當情報(Dividend Information)를 利用했으며 마지막으로 模型의 限界를 論한다. 1979年부터 1983年까지 5年間의 50個 KSE上場株式의 收益率 資料와 市場株價指數로부터 算出된 市場收益率을 使用하여 市場模型을 추정하고 검증함에 있어서, 여기에 利用된 資料는 月別加重平均株價로부터 一般的으로 通用되는 增資 및 配當에 依한 修正을 거쳐 얻어진 것이다. 本 硏究에서 자세히 檢討하게 될 主要統計 結果(Estimation 및 Tests)의 개요는 다음과 같다. 첫번째 檢證은 $j=1, \cdots\cdots, 50$에 對하여 $R_{jt}=\alpha_j+\beta_j\times R_{mt}+U_{jt}(t=1, \cdots\cdots, 60)$의 市場模型을 적용하여 母數$(\alpha_j, \beta_j)$를 추정하고 관련된 統計量(Statistics)을 檢討하는 일이다. 두번째 檢證은 $j=1, \cdots\cdots, 50$에 對하여 推定되 市場模型의 妥當性을 검토하기 爲한 Normality 檢證 (SR test for Returns and Residuals)이다. 세번째 檢證은 市場模型의 또 다른 重要한 假定인 時系列 相關關係(Serial Correlation)에 관한 것이다. 이는 $E(U_{jt}\cdot U_{j-\tau})=0(\tau=1, 2, \cdots\cdots)$으로 나타내어지는 假定으로 이를 檢證하기 爲하여 3次까지의 自己相關(Autocorrelation)과 Durbin-Watson 統計量을 계산한다. 위와 같은 市場模型에 關한 基本的인 檢討가 끝난 뒤에 資料로부터 推定되는 母數들의 安定性을 檢證한다. 이 檢證은 5年의 對象期間을 經濟與件 變化에 따라 3個의 期間, 즉 好況(1979), 衰退(1980~1982), 및 回復(1983)으로 區分하여 2期間씩 pairwise(3 pairs)로 比較하게 된다. 母數의 安定性 檢證은 마지막으로 配當의 影響을 고려하기 爲하여 資料를 2個의 구획, 즉 配當에 影響을

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** 本 論文은 우리나라 證券市場에 上場된 株式의 收益率 資料와 市場株價指數로부터 算出된 市場收益率을 使用하여 市場모델을 추정하고 檢證하는 데 그 目的을 두고 있다.

받는 달(12月～4月)과 配當에 影響을 안받는 달(5月～11月)로 區分하고 앞의 Time Stability 檢證과 같은 方法으로 두 期間(4th Pair)의 模型 母數 差異를 檢討한다.

Ⅱ. 硏究內容

母數의 安定性을 알아보기 爲해서 1979～1983年 期間을 3區分으로 나누었다. 이미 언급한 바와 같이 1979年 1年 동안은 景氣가 好況이었고 1980～1982年은 證券市場이 不況을 겪었으며 다소나마 1983年은 回復하는 期間이었기 때문에 좀 더 세부적으로 3區分하였다. 檢證結果 1970年～1980年과 1982年 사이의 β의 움직임이 0.7998에서 0.6688로 變한 것을 알 수 있다. 이와 같이 β의 變化가 미세하기 때문에 Wilcoxon 檢證(α=0.05)에서는 유의적인 것이 못 되었다. 그리고 F檢證의 結果, 各各의 檢證(Joint Test, Error Test, Total Test)에서 假說(두 集團이 같다)을 기각할 수 있는 정도가 50個 企業 中 3個, 1個, 2個인 것은 (特히, Error Test) β의 값이 安定趨勢이었기 때문이다. 그러나 配當에 관계된 달과 관계 없는 달 사이에 있어서의 母數가 어느 정도로 不完全한 결과를 나타내고 있다. 韓國證券市場에 上場된 株式들의 市場모델의 檢證結果는 다른 先進國에서 檢證한 것과 비슷하게 나타났다.