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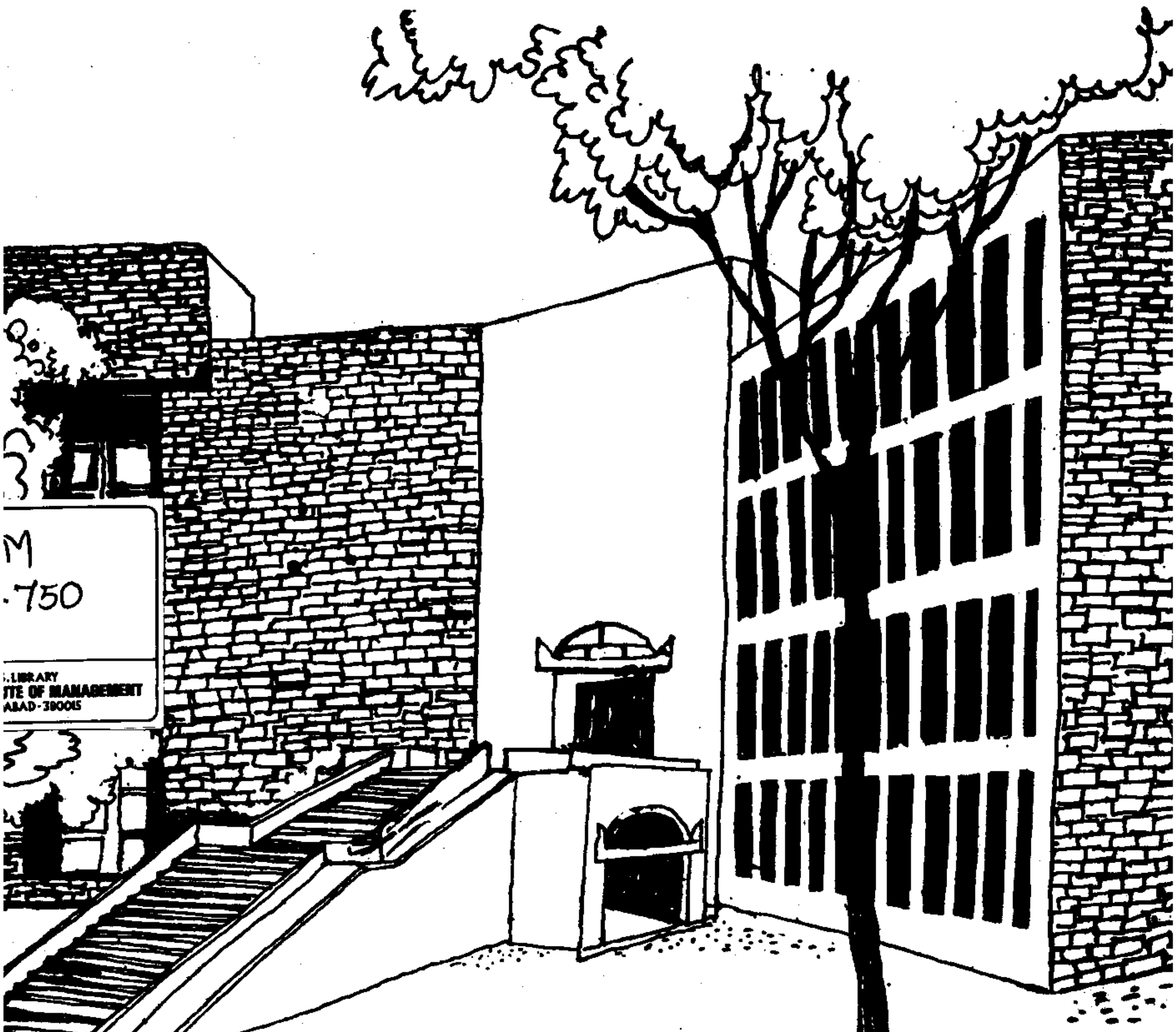

MARKET-WIDE COMMONALITIES IN CORPORATE EARNINGS AND SIGNIFICANCE TESTS OF ACCOUNTING BETA

By

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MARKET-WIDE COMMONALITIES IN CORPORATE EARNINGS AND SIGNIFICANCE TESTS OF ACCOUNTING BETA

Financial theorists have emphasized for years the importance of expectational variables in the valuation of shares. The price of share is determined primarily by investors current expectations about the firm's future performance of earnings and particularly the anticipated growth rate of earnings. During the period of earnings announcement, any change in prices is generally a reflection of how much shock or surprise they get from the recently observed earnings. Recent development in capital theory also provide justification for selecting the behaviour of security prices as an operational test of usefulness of income numbers. If information is useful in forming security prices, then the market will adjust prices to that information and then changes in prices will reflect the flow of information to that market. However, the major problem involved in determining the information content of financial report is to identify the portion of the total information that was already expected by investors prior to the information release. Since only the unexpected component of total information would be relevant to the market, the economic consequances of accounting earnings information cannot therefore be studied without obtaining a surrogate for the market's expectation of such earnings.

The development of the proxies for the markets' expectation has played pivotal role in studies testing semi-strong form of market efficiency. While deriving proxies for market expectations such studies have either made an explicit reference to empirical research concerning the time-series properties of accounting earnings or market-association based accounting beta studies. In one of the earlier studies on testing the semi-strong form of efficiency, Ball and Brown (1968) estimate unexpected earnings in two ways. First they use change in earnings as a measure of the amount of surprise or shock at the time of earnings announcement. The second estimate they suggest is the change in earnings after removing the effect of the change in a market index of earnings by using accounting beta and calculated as follows:

$$\Delta Y_{it}^{M} = \Delta Y_{it} - \left[\hat{a}_i + \hat{b}_i \quad MI_t\right] \qquad (1)$$

where $\hat{a}_i$ and $\hat{b}_i$ are parameters estimated from a regression of the change in earnings ΔY_{it} on change in market earnings index, ΔMI_t.

In the methodology used by Ball and Brown (1968) and others, much depends on the estimation of the market's expectation of earnings. The better the approximation of expectation, the more accurately are the earnings separated into unexpected increases and decreases and the more likely the hypothesized increases or decreases in share prices are

are observed. The use of market association based accounting beta model in testing the efficiency of stock market therefore depends on the empirical validity of the market model. The objective of the present study is to investigate the empirical validity of the market model by studying the influence of market earnings index on the earnings numbers of individual companies.

The Market Model

The earnings numbers of a particular firm reflect numerous events and their resulting impact on the firm's performance. Some of these events affect almost all the firms in the economy, some are specific to the firms operating within a particular industry and whereas some are specific to the individual firms. The empirical validity of the market model is based on the assumption that the influences due to economy-wide factors will create cross-sectional correlations among all firms. The market (or economy-wide) index models attempt to describe firm's earnings by capitalizing on the effects of cross-sectional dependencies with respect to firms' operations. Market index models represent attempts to use the implications of some current market phenomena in describing the operations and resultant accounting numbers of a given firm.

In order to identify the influence of market-wide factors, it is important to see that how these factors can be represented. In literature, two different approaches have been adopted. In a study on market rate of return on common shares by King (1966), factor analysis technique has been employed to identify the common factors. Alternatively, Ball and Brown (1969) and Genedes (1973) have used linear models to investigate the influence of market wide factors.

The present study also employs the linear regression technique to identify the influence of market forces on company's earnings. For that purpose the following market model has been used

$$\tilde{Y}_{it} = a_i + b_i \widetilde{MI}_t + \tilde{e}_{it} \qquad (2)$$

Where $\tilde{Y}_{it}$ is the earnings of firm i for period t, $\widetilde{MI}_t$ is the market index of earnings, a_i and b_i are parameters and $\tilde{e}_{it}$ is the standard error term with zero mean and constant variance. There is no underlying theory which explains the behaviour of earnings in market model framework. The model is simply a statement about the empirical relationship between earnings of a company and the market earnings. The model does not tell us anything about what causes earnings to be. It is hypothesized only that there is a systematic linear association between the earnings of individual companies and the market index. And the objective is to empirically test this characteristic of the model.

In addition to the use of market model in developing the proxies for the capital market expectations, Gonedes (1973) has put forward several reasons for such empirical tests. First, capitalizing the cross-sectional dependencies would provide a basis for specifying statistical models for such numbers. If the resultant model is stationary and market-wide factors can be predicted, with sufficiently small prediction errors, then these models may serve as useful forecasting device. secondly, reasons for recognizing cross-sectional dependencies is so that one can attempt to remove the effects of these dependencies on cross-sectional distributions of estimation results. One common approach used in time-series analysis of individual firm's accounting numbers involves estimation of a time-series model for each company's data and then examining, or performing tests on, cross-sectional distributions of estimates (e.g, parameter estimates or estimates of disturbances). These examinations and tests are often conducted as if the cross-sectional observations are observations on independent random variable. If, however, there are cross-sectional dependencies among company's accounting numbers, then such examinations and tests of these numbers (before adjustments, for the dependencies) has to be modified because the independence assumption is not satisfied.

Methodology and Data

The study uses a sample of 182 "manufacturing" companies from the population of companies listed on the Bombay Stock Exchange on March 31, 1974. The term 'Manufacturing' refers to the manufacturing activity that is included in the Official Directory of the Bombay Stock Exchange. This includes all industry groups with the exception of sugar companies, financial institutions, banks, insurance companies, investment and finance companies, transport, mining and trading concerns. The industry-wise clasification of the selected companies is given in Table 1. The companies included in the sample have been primarily on the basis of availability ofthe complete set of earnings and net worth record from 1966-69 to 1982-83.

The earnings variable has been measured from the shareholders' perspective and therefore earnings available to them after paying preference dividends (denoted by Y_{it}) has been empirically analyzed in the present study. This measure of earnings is most relevant because it reflects events that lead to an alteration of beliefs about the dividend paying ability of the company, and therefore posseses an important informational content. Empirical investigation of undeflated earnings series raises two types of problems. One is the heteroscadasticity problem. In order to obtain efficient parameters, some sort of deflation is commonly used. A second problem arises that falls under the general category of drift or trend in the series. In particular, the earnings series may exhibit such behaviour because of retention of earnings which causes the investment base per share to increase over time. There are several ways to deal with the problem of isolating a trend from a series, one method would be to express the earnings series as polynomial function of time. However, if the principal reason for the trend is the change in investment base over time, a more straight forward procedure would be to deflate the series by some measure of investment base. So from a substantive and a statistical point of view, the earnings available to equity shareholders' (Y_{it}) has been deflated by beginning value of equity shareholders' net worth ($NW_{i,t-1}$). This deflation results into book rate of return represented by ROR and may be expressed as follows:

$$ROR_{it} = \frac{Y_{it}}{NW_{i,t-1}} \qquad (3)$$

on the basis of above discussion the following models have been estimated using OLS method:

$$Y_{it} = a_i + b_i \; Y_t^M + e_{it} \qquad (4)$$

$$\Delta Y_{it} = a_i + b_i \Delta Y_t^M + e_{it} \qquad (5)$$

$$ROR_{it} = a_i + b_i \; ROR_{it}^M + e_{it} \qquad (6)$$

$$\Delta ROR_{it} = a_i + b_i \Delta ROR_t^M + e_{it} \qquad (7)$$

where Δ is the first difference operator, a and b are the regression parameters, Y_t^M and ROR_t^M are market-wide index series for Y_{it} and ROR_{it} series respectively, and e is the disturbance term with the property that they are cross-sectionally and serially uncorrelated and also are not related to the market index. The variants of both functional relationship (i.e.,in levels and first differences) have appeared with literature.

Constructing market index Y_t^M and ROR_t^M can take several approaches. One way of obtaining such indices is population based, using all the data which is available for companies in each year. The other approach of constructing the index is sample based by using a subset of firms from the population particularly the sample used in the study. This approach is more feasible than the population based approach and finds use in Ball & Brown (1968), Gonedes (1973), Magee (1974), and Brealey (1971). The present study uses the same approach in constructing the indices.

Using the sample data the index may be computed in two different ways. Let N denote the number of companies (the sample size) the first method uses simple arithmetic mean formula to obtain indices as follows:

$$Y_t^M = \frac{1}{N} \sum_{i=1}^{N} Y_{it} \qquad (8)$$

$$ROR_t^M = \frac{1}{N} \sum_{i=1}^{N} ROR_{it} \qquad (9)$$

Alternatively, the second scheme uses equity shareholders' net worth as weights in constructing the indices. These may be obtained as follows:

$$Y_t^{M*} = \sum_{i=1}^{N} Y_{it} \; NW_{it} \div \sum_{i=1}^{N} NW_{it} \; , \qquad (10)$$

$$ROR_t^{M*} = \sum_{i=1}^{N} ROR_{it} \; NW_{it} \div \sum_{i=1}^{N} NW_{it} \qquad (11)$$

Neither scheme is uniquely identified as being appropriate regarding the underlying motivation of market index models. Each index construction scheme emphasizes a different aspect of market. The first index takes into account the number of firms in the market, and whereas for the same number of series the second measurement emphasizes the relative size of firms in the market. Both the measures have been used in the present study.

The estimates of the parameters in the models listed above have been obtained by using ordinary least squares (OLS) method to the time series of 182 firms. The estimation procedure assumes no correlation between the market index and error term. However, this may arise because of two reasons. Firstly, while constructing the market index the company i is included in the index and secondly, the presence of the industry effect may become a source of correlation. No adjustment has been made for the presence of industry effect in the present study. The industry classification as suggested in the Official Directory of Bombay Stock Exchange cannot be used to estimate the industry effect. The market models have been estimated with the assumption that any bias in the estimates of parameters will not be significant.

Empirical Results

Tables 2 to 5 present the distributional characteristics of each parameter estimated using OLS. The distribution for each parameter has been drawn independent of the distribution relating to other parameters in each table. As a result, the values of these parameters at k-th decile may not be corresponding with the parameter estimates related to one particular company. Moreover, since we are interested in the amount of variation in company's earnings and rate of return variable that is accounted for by the market wide aggregates, the significance of R^2 has been examined. As for models 4 and 6 there is other variant in first differences, the model consistent with the assumption of zero auto-correlation in errors has been considered superior between the two variants.

The cross-sectional distribution of parameter estimates of 142 firms for the model using level earnings under un-weighted index suggest a significant amount of co-movements of company earnings with the market wide factors.

The median value of a and b are significantly high. The decile t-value of b suggest that in 85 per cent of the companies the b parameter is significant and positive. The median value of R^2 is 0.845, suggesting that on an average about 85 per cent of variation in representative company earnings is explained by market index. However, the model is not consistent with zero auto-correlation assumption of OLS. In about 70 per cent of companies the first order serial correlation in errors is significantly high. The median and mean values of serial correlation in errors are 0.5 and 0.428 respectively. The model using weighted index also suggest similar type of inconsistency with regard to serial correlation in errors. Further, the explanatory power of the weighted index model in level earnings is very low.

The other variant of the market index model that has been empirically examined in the present study uses the first differences in variables. The model in first differences has been widely emulated in empirical researches and has been found more consistent with the different assumption of OLS. The results pertaining to the first difference earnings model under the two versions of index construction have been presented in Table 3. The findings from unweighted version of the model suggest that the parameter a is not significant at any decile value. The parameter b turns out to be significant only at 9th decile. The only satisfactory characteristics of this model is the low value of serial correlation in error terms. The model seems to be consistent with the assumption about the zero auto-correlation. However, the low explanatory power of the model is causing problem. The similar results have been obtained from the first difference earnings model under weighted index version. The explanatory power of the model turns out to be slightly better than the model using unweighted index. About the poor explanatory power of the models in first differences, Granger and Newbold (1974) observe:

> "the fact that one gets a lower R^2 when forming models with changes than otherwise should be taken to be good feature allowing for more flexibility of approach rather than indicating an unsuccessful analysis".

The results pertaining to the rate of return models are presented in Tables 4 and 5. The market models in ROR under two different versions of weighting exhibit significantly low value of explanatory power. The estimated parameter b is not significant at any of the decile level except at 9th decile in unweighted version of index model. The median value of serial correlation under both weighting schemes is less than 0.20. Contrary to the first difference model for earnings, the model using first differences in rate of return exhibit higher values of serial correlation.

Conclusion

Causal models at micro level to understand the factors causing earnings and hence determine expected and unexpected components in it are impracticable. This is because the firms are subject to a multiplicity of small forces which are of particular importance and the impact of these forces may be so specific to each particular firm that nothing can be said in general terms. As an alternative to this, linear market index models both in levels and first differences have been empirically emulated in previous research. The present study has used these models to discern and quantify the influences of market-wide factors. As there is no underlying theory which explains the behaviour of earnings in market model framework, the objective has been to test for the suggested empirical relationship. The earnings and book rate of return data of 182 companies have been used to construct the market index for respective variables. The hypothesis that there is a systematic relationship between earnings of individual firms and the market index does not find empirical support in the present study. The explanatory power of the models have been found to be very low. As contrary to this, the results obtained in USA and UK find market model consistent in capturing the significant amount of cross-sectional relationships arising due to the market wide forces. For example, Ball and Brown (1969) found that on an average about 35-40 per cent of the variability of firm's annual earnings in USA can be associated with the variability of earnings numbers over all firms. However, the same is not true for the sample used in the present study. The findings from the empirical tests of the market model using Indian data suggest that the model should be used with great caution to measure the amount of unexpected component of earnings at any point of time. The predictability of individual firm's performance on the basis known outlook for corporate earnings as a whole is also doubtful.

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Table 1

INDUSTRY-WISE CLASSIFICATION OF COMPANIES FORMING THE SAMPLE SET

Code	Industry	Number of Companies
0.	Cement	5
1.	General Engineering	31
2.	Chemicals, Dyes, and Pharmaceuticals	26
3.	Metals, Alloys, Metal Products and Structurals	23
4.	Cotton Spinning and Weaving Mills	32
5.	Synthetic Fibres, Silk and Woollen Textiles	10
6.	Paper, Pulp and Hardboard	14
7.	Electric Equipment and Cables	17
8.	Miscellaneous	16
9.	Electricity	8
	Total	182

Table 2

CROSS-SECTIONAL SUMMARY STATISTICS FOR PARAMETER ESTIMATES OF 182 COMPANIES

Model: $Y_{it} = a_i + b_i \; Y_t^M + e_{it}$

Parameter	Mean (Standard Deviation)	Decile .1	.2	.3	.4	.5	.6	.7	.8	.9
$\hat{a}$	49.76 (502.39)	-129	-34	6	21	41	67	126	184	279
$\lvert t(\hat{a})\rvert$	4.57 (4.42)	0.69	1.23	1.79	2.80	3.51	4.27	5.40	6.59	8.94
$\hat{b}$	7.57 (16.89)	-0.353	0.208	0.088	1.622	2.954	4.410	6.14	9.05	16.41
$\lvert t(\hat{b})\rvert$	9.72 (6.36)	1.63	3.88	5.24	6.79	9.06	11.34	12.96	15.10	18.19
R^2	0.711 (0.296)	0.150	0.501	0.652	0.755	0.845	0.898	0.920	0.939	0.957
ρ	0.428 (0.283)	-0.016	0.184	0.364	0.431	0.500	0.533	0.604	0.657	0.719
Model: $Y_{it} = a_i + b_i \; Y_t^{M*} + e_{it}$										
$\hat{a}$	393.98 (727.29)	24	53	105	143	188	304	408	554	1051
$\lvert t(\hat{a})\rvert$	7.30 (5.05)	2.30	3.78	4.71	5.70	6.43	7.40	8.20	9.41	11.89
$\hat{b}$	0.025 (0.164)	-0.002	0.000	0.001	0.003	0.004	0.007	0.010	0.017	0.028
$\lvert t(\hat{b})\rvert$	1.43 (0.927)	0.59	0.94	1.16	1.38	1.49	1.59	1.68	1.79	1.96
R^2	0.127 (0.088)	0.023	0.055	0.087	0.112	0.129	0.144	0.158	0.176	0.203
ρ	0.523 (0.187)	0.298	0.473	0.540	0.571	0.587	0.598	0.606	0.625	0.647

Table 3

CROSS-SECTIONAL SUMMARY STATISTICS FOR PARAMETER ESTIMATES OF 182 COMPANIES

Model: $\triangle Y_{it} = a_i + b_i \triangle Y_t^M + e_{it}$

Parameter	Mean (Standard Deviation)	Decile .1	.2	.3	.4	.5	.6	.7	.8	.9
$\hat{a}$	1.31 (24.38)	-19.57	-9.68	-4.29	-2.19	-0.20	0.88	2.86	8.28	15.81
$\lvert t(\hat{a})\rvert$	0.66 (0.486)	0.08	0.20	0.36	0.46	0.57	0.70	0.88	1.06	1.25
$\hat{b}$	0.99 (2.96)	- 0.874	-0.382	-0.062	0.115	0.465	0.855	1.290	2.097	3.333
$\lvert t(\hat{b})\rvert$	0.962 (0.702)	0.15	0.31	0.49	0.66	0.82	1.02	1.19	1.50	1.91
R^2	0.082 (0.093)	0.002	0.007	0.018	0.030	0.045	0.069	0.095	0.138	0.214
ρ	-0.198 (0.267)	- 0.553	-0.471	-0.377	-0.297	-0.215	-0.143	-0.048	0.066	0.194

Model: $\triangle Y_{it} = a_i + b_i \triangle Y_t^{M*} + e_{it}$

Parameter	Mean (Standard Deviation)	Decile .1	.2	.3	.4	.5	.6	.7	.8	.9
$\hat{a}$	7.01 (23.45)	- 4.27	-0.14	0.39	1.13	2.42	4.11	5.73	10.63	22.16
$\lvert t(\hat{a})\rvert$	0.718 (0.624)	0.068	0.120	0.296	0.451	0.567	0.744	0.930	1.130	1.572
$\hat{b}$	0.000 (0.002)	- 0.002	-0.001	0.000	0.000	0.000	0.000	0.000	0.001	0.001
$\lvert t(\hat{b})\rvert$	1.098 (1.569)	0.089	0.240	0.372	0.494	0.712	0.893	1.199	1.585	2.162
R^2	0.097 (0.152)	0.001	0.004	0.010	0.017	0.035	0.054	0.093	0.153	0.250
ρ	-0.100 (0.271)	- 0.456	-0.345	-0.248	-0.190	-0.147	-0.061	0.053	0.154	0.284

Table 4

CROSS-SECTIONAL SUMMARY STATISTICS FOR PARAMETER ESTIMATES OF 182 COMPANIES

Model: $ROR_{it} = a_i + b_i \; ROR_t^M + e_{it}$

Parameter	Mean (Standard Deviation)	Decile .1	.2	.3	.4	.5	.6	.7	.8	.9
$\hat{a}$	0.096 (0.365)	-0.006	0.078	0.101	0.123	0.138	0.150	0.166	0.182	0.234
$\lvert t(\hat{a}) \rvert$	5.11 (4.70)	0.766	1.185	1.586	2.639	4.029	5.106	6.139	8.004	11.159
$\hat{b}$	0.356 (0.406)	-0.274	-0.111	-0.081	-0.042	-0.019	0.029	0.054	0.099	0.439
$\lvert t(\hat{b}) \rvert$	1.01 (0.982)	0.153	0.268	0.421	0.535	0.679	0.909	1.225	1.513	2.204
R^2	0.091 (0.134)	0.002	0.005	0.013	0.020	0.032	0.056	0.097	0.141	0.258
ρ	0.152 (0.266)	-0.216	-0.109	-0.013	0.064	0.139	0.236	0.320	0.395	0.510

Model: $ROR_{it} = a_i + b_i \; ROR_t^{M*} + e_{it}$

Parameter	Mean (Standard Deviation)	Decile .1	.2	.3	.4	.5	.6	.7	.8	.9
$\hat{a}$	0.071 (0.495)	-0.112	0.061	0.102	0.123	0.134	0.151	0.168	0.182	0.244
$\lvert t(\hat{a}) \rvert$	4.45 (3.89)	0.596	1.074	1.774	2.597	3.544	4.24	5.369	6.891	9.405
$\hat{b}$	0.023 (0.467)	-0.122	-0.055	-0.028	-0.010	-0.002	0.007	0.022	0.036	0.123
$\lvert t(\hat{b}) \rvert$	0.815 (1.386)	0.092	0.175	0.256	0.344	0.472	0.619	0.822	1.076	1.517
R^2	0.062 (0.128)	0.001	0.002	0.005	0.008	0.016	0.027	0.046	0.076	0.148
ρ	0.168 (0.271)	-0.250	-0.077	-0.003	0.119	0.197	0.252	0.316	0.396	0.500

Table 5

CROSS-SECTIONAL SUMMARY STATISTICS FOR PARAMETER ESTIMATES OF 182 COMPANIES

Model: $\Delta ROR_{it} = a_i + b_i \Delta ROR_t^M + e_{it}$

Parameter	Mean (Standard Deviation)	.1	.2	.3	.4	.5	.6	.7	.8	.9
$\hat{a}$	0.006 (0.159)	-0.024	-0.009	-0.004	0.000	0.003	0.007	0.010	0.019	0.030
$\lvert t(\hat{a}) \rvert$	0.345 (0.304)	0.023	0.080	0.138	0.200	0.261	0.332	0.406	0.550	0.817
$\hat{b}$	0.409 (5.120)	-0.286	-0.128	-0.077	-0.040	-0.016	0.000	0.040	0.137	0.482
$\lvert t(\hat{b}) \rvert$	1.152 (1.123)	0.136	0.261	0.474	0.586	0.817	1.074	1.259	1.776	2.622
R^2	0.117 (0.159)	0.001	0.006	0.017	0.026	0.049	0.082	0.109	0.195	0.348
ρ	-0.209 (0.263)	-0.546	-0.472	-0.399	-0.312	-0.220	-0.153	-0.090	0.023	0.150

Model: $\Delta ROR_{it} = a_i + b_i \Delta ROR_t^{M*} + e_{it}$

Parameter	Mean (Standard Deviation)	.1	.2	.3	.4	.5	.6	.7	.8	.9
$\hat{a}$	0.015 (0.124)	-0.025	-0.010	-0.004	0.000	0.004	0.006	0.010	0.017	0.031
$\lvert t(\hat{a}) \rvert$	0.348 (0.319)	0.018	0.073	0.125	0.176	0.224	0.326	0.428	0.599	0.852
$\hat{b}$	0.034 (0.483)	-0.094	-0.048	-0.017	-0.006	0.001	0.005	0.015	0.040	0.097
$\lvert t(\hat{b}) \rvert$	1.045 (2.296)	0.055	0.097	0.229	0.344	0.461	0.691	0.871	1.195	2.199
R^2	0.088 (0.174)	0.000	0.001	0.004	0.009	0.016	0.035	0.055	0.099	0.271
ρ	-0.196 (0.263)	-0.548	-0.463	-0.385	-0.312	-0.188	-0.110	-0.053	0.041	0.142