Capital Structure: New Evidence of Optimality and Pecking Order Theory

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INTRODUCTION

Ever since Stewart Myers' article on the capital structure theory appeared in 1984, interests in the capital structure analysis of firms have increased manifold, particularly in recent years. Before Myers, the prevailing theory was the optimal capital structure where the debt of a firm would increase so that it could take advantage of the corporate tax shields, but after a point the costs of expected bankruptcy would outweigh the benefits of tax advantage in such a way that a firm would reach the optimal capital structure which would maximize the total value of the firm in the long run. Here Myers (1984) proposed his Pecking Order Theory (POT), which states that "the firm has no well-defined target debt-to-value ratio," and that firms in general prefer internal financing (first), then external debt-financing (second), and external equity financing (third). This implies that if a firm has little debt and is in a strong financial position relative to the others in the same industry, it will, most likely, use internal equity for capital expansion projects. Similarly, a firm which uses debt financing for tax and other benefits, will use the common stock capital only as the last resort, due to latter's relative higher costs and dilution of ownership problems. This implies that such a firm often moves its capital structure away from, rather than closer to, the industry's mean.

Bowen, Daley and Huber, Jr. (BDH here, 1982) introduced a new methodology for analyzing the optimal capital structure. Their main hypothesis was that individual firm's debt structures tend to converge to the industry mean over time. The conclusion of their study was that firms exhibit a statistically significant tendency to move toward their industry mean over both five and ten year time periods. March (1982) concluded that "companies do appear to make their choice of financing instrument as though they had target levels in mind for both long term debt ratios and the ratio of short-term to total debt." Jalilvand and Harris (1984) also concluded that "the firms' targets are a driving force (one of several) in the firms' financial behavior."

Myers' (1984) pecking order theory, on the other hand, provides alternatives to the traditional target capital structure hypothesis. Here Taggart (1986) used POT in his study and found that the pecking order hypothesis was more valid than the optimal capital structure hypothesis.

Claggett, Jr. (1992) tested both hypotheses with the *Compustat* data and found that firms' long-term debt to total assets ratio, for the most part, tended to move toward the most recent previous industry mean within one year. In general, in more firms with above-industry average long-term debt ratios adjusted toward the mean than with below- average ratios. Also, firms normally behave in a manner consistent with the pecking order theory; however, some industries may not adjust during periods of severe turmoil. Clagget, Jr. concludes his study by saying that perhaps a hybrid theory between the optimal capital structure theory and the POT is the next step in the ongoing quest to explain how firms manage their capital structure.

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The objective of our paper is to analyze empirically whether the firms do converge toward the optimal capital structure (that is, the industry mean) over time or follow the Pecking Order Theory (POT) as expounded by Myers. For that, we have used a new data set and improved upon the existing methodology. We have, thus, extended Claggett, Jr.'s study with new data and also by expanding the time period to the latest decade. Section II describes the data source and methodology. Section III presents the results, and section IV provides the summary conclusions.

DATA SOURCE AND METHODOLOGY

Most of the previous studies had used annual *Compustat* files for the data source. We have used, on the other hand, *Fortune* magazine's list of the largest 500 manufacturing companies in the U.S. manufacturing industries. Our sample was composed of 256 surviving firms, divided into 21 industries covering 1974-1992, but no survival bias in the data was detected. Thus our study was confined to large(mature) firms. Our main purpose is to examine whether the results obtained by the *Compustat* files are corroborated by *Fortune*'s list of largest 500 companies. Also, by selecting the 1974-1992 time period for our analysis, our study will focus on the capital structure of the large U.S. firms as undergone during the latest two decades.

The methodology we have used was first introduced by BDH and later advanced by E. Tyler Claggett, Jr., where a two-by-two contingency table, and later more than two, were formulated. The nonparametric Fisher Exact Probability (FEP) test and later the Goodman-Kruskal gamma measures were used to analyze the data. We have employed the same techniques, particularly the gamma values, for our measurements along with the appropriate test statistics.

For the measurement of capital structure, we have used long-term debt to total assets (LTD/TA), total debt to total assets (TD/TA), and total equity to total assets (TE/TA). While Claggett's study calculated the first ratio, BDH's study measured the last two ratios. Ours will be the only study which calculated all the three ratios as measures of capital structure. Industry average ratios for all the three measures were calculated and firms were designated as above or below their respective industry's capital structure average. Also, each firm was examined to determine if it were passive, an issuer of external long-term debt, an issuer of external equity or an issuer of both during 1974-1992. For that, issuance of long-term debt and sale of common stocks were compared to the firms' total assets (TA). If neither figure exceeded five percent of TA, the firm was considered an issuer of both debt or equity.

To examine whether firms move (converge) their capital structure toward their industry's mean, a two-by-two matrix was analyzed for each year (across industry), for each industry (across year), and for all observations (pooled across both industries and years). Figure 1 describes the following matrix:

FIGURE 1

Number of Firms below (L) that did correct	Number of firms below (L) that did not correct
Number of firms above (H) that did not correct	Number of firms above (H) that did correct

For the statistical calculations, following Claggett, Jr., we have estimated Gamma for the Goodman-Kruskal gamma measure and the associated test statistic (Z) were also calculated. The hypothesis tested by this procedure is that gamma is significantly different than zero. If there is no statistical significance, we conclude that there is no discernable trend to move toward or away from the industry mean capital structure. The results are shown in Tables 1 and 2.

If there is convergence (or divergence), an analysis of a similar but different two-by-two matrix determines whether the movement was by firms from both sides of (symmetric), by firms below (asymmetric), or by firms above (asymmetric) of their industry mean LTD/TA ratios. The matrix is described below by Figure 2:

FIGURE 2

Number of firms below (L) that did correct	Number of firms below (L) that did not correct
Number of firms above (H) that did correct	Number of firms above that did not correct

For each Figure 2 matrix, an estimate of G and associated test statistic (Z) were calculated. The hypothesis, again. is that G is significantly different than zero. If there is significance with convergence and the sign of G is positive (+), the conclusion is that the movement was by those firms with the measurement ratios below the industry means, and vice versa if the sign is negative (-). The results are shown in Tables 3 and 4.

To test the POT, a two-by-four matrix was analyzed for each industry (across year), for each year (across industry), and for all observations pooled. Figure 3 describes the matrix.

For each Figure 3 matrix, an estimate of G and the associated test statistic (Z) were calculated. Here the hypothesis is that G is significantly different from zero. If there is no significance, we conclude that there is no support for Pecking Order Theory. But if G is significant and the sign is positive (+), we will

FIGURE 3

Number of firms below (L) that passive (P)	Number of firms below (L) that issued debt (D)	Number of firms below (L) that issued equity(E)	Number of firms below (L) that issued both (B)
Number of firms above (H) that were passive(P)	Number of firms above (H) that issued debt (D)	Number of firms above (H) that issued equity(E)	Number of firms above (H) that issued both (B)

interpret that as a corroboration of the POT. The result is shown in Table 5 and 6.

THE RESULTS

Table 1 has shown the value of gamma and the test statistic (Z). We find that for the measure of LTD/TA, 19 out of 21 industries had Z statistics which were significant either at the 0.01 percent or 0.05 percent level (two-tail test). For the measure of TD/TA, 17 industries had significant Z statistics while for the measure of TE/TA, 19 industries had significant Z statistics either at the 0.01 percent or 0.05 percent level (two-tail test). This proves that the overwhelming majority of firms had convergence toward the industry mean over one-year interval. The pooled data also showed this tendency toward convergence when the Z statistics for all the three measures were significant at the 0.01 percent level.

Table 2 also shows this strong tendency toward convergence when the gamma values and Z statistics for all three measures were calculated for 1974-1992. Here, also, we find that the Z statistics for LTD/TA were positive and significant in 15 out of 19 one-year periods. For TD/TA, the Z statistics were significant in 12 out of 19 years, while for TE/TA, they were significant in 15 out of 19 years, either at the 0.01 percent or 0.05 percent levels. Thus both Tables 1 and 2 support the conclusions reached by Jalilvand and Harris (1984), Lev (1969), March (1882), and Clagget, Jr. (1992), but not by BDH (1982), where they found no

TABLE 1
Summary of Capital Structure Symmetric Convergence, By Industry 1974-1992

LTD/TA-- Long term debt over total assets; TD/TA--- Total debt over total assets; TE/TA--- Total equity over total assets.

		LTD/TA		TD/TA		TE/TA	
Industry	Obs.	Gamma	Z-Test	Gamma	Z-Test	Gamma	Z-Test
Aerospace	342	0.145	1.87615	0.355	4.34003**	0.372	4.5155939**
Apparel	990	0.493	3.01786**	0.122	0.85196	0.571	3.2981656**
Beverage	114	0.623	3.67936**	0.237	1.73840	0.245	1.7934062
Building Materi	120	0.317	2.32892*	0.193	1.46692	0.094	0.7249253
Chemicals	224	0.425	4.07151**	0.334	3.33186**	0.293	2.9648492**
Computers, Offi	264	0.474	4.79539**	0.351	3.77625**	0.518	5.0908833**
Electronics, El	385	0.351	4.56025**	0.374	4.81265**	0.431	5.3961697**
Food	350	0.432	5.15424**	0.42	5.04247**	0.441	5.2361553**
Forest Products	432	0.457	5.97433**	0.447	5.87689**	0.531	6.6132117**
Industrial & Fa	270	0.255	2.86499**	0.358	3.88404**	0.254	2.8545378**
Metal Products	246	0.401	4.07423**	0.251	2.69471**	0.302	3.1930794**
Metals	278	0.014	0.16504	0.415	4.45172**	0.355	3.9129317**
Mining, Crude	146	0.287	2.34906*	0.572	4.00887**	0.439	3.3701931**
Motor Vehicles	378	0.261	3.46392**	0.403	5.07071**	0.215	2.8867511**
Petroleum Refin	1006	0.278	5.98935**	0.361	7.55070**	0.358	7.4972402**
Pharmaceuticals	299	0.521	5.43760**	0.482	5.16385**	0.572	5.7369596**
Publishing, Pri	554	0.386	5.92665**	0.426	6.41478**	0.467	6.8730964**
Sci. & Photo Eq.	242	0.396	4.00005**	0.373	3.80704**	0.352	3.6243339**
Soaps, Cosmetic	180	0.499	4.10259**	0.443	3.76792**	0.319	2.8683022**
Textile	138	0.064	0.53055	-0.036	-0.2988	0.179	1.4629284
Tobacco	97	0.347	2.26651	-0.035	-0.2436	0.388	2.4905201*
Total	6164	0.326	17.1101**	0.38	19.5142**	0.400	20.353212**

* significant at 5% level.
** significant at 1% level.

significant convergence over one-year intervals.

Table 3 depicts the summary of the asymmetric convergence by industry during 1974-1992. This Table strongly corroborates the conclusion of Table 1 — that the majority of the firms had converged their LTD/TA ratios toward their industry's means. For the measure of LTD/TA, 18 industries had convergence with the Z statistics either at the 0.01 percent or at the 0.05 percent level of significance, while for the measure of TD/TA, 14 industries had convergence with the Z statistic significant either at the 0.01 or 0.05 level of significance. But in the case of TE/TA, only 9 industries had convergence either at the 0.01 or 0.5 percent level of significance. Also, in the majority of industries the negative values meant that the convergengence came from above. This again corroborates the results obtained by Claggett, Jr. (1992) who found the convergence came most often from firms above their industry mean LTD/TA ratios. The pooled data also confirms the result of convergence which was significant at 0.01 percent level.

When we calculate the gamma values and the Z statistics for the asymmetric convergence by year, as shown in Table 4, we find that the Z statistics were significant for only 16 out of 19 years for the measure of LTD/TA, either at the 0.01 percent or 0.05 percent level of significance. For the measure of TD/TA, in 11 out of 19 years the gamma values and their respective z-statistics were significant, while for the TE/TA measure, the test statistics were significant for 13 out of 19 years, either at the 0.01 percent or 0.05 percent level of significance. Also, the negative signs for the majority of years which were statistically significant, meant that the convergent movement came from above, as seen in the case of the majority of industries. Except for the measure of TD/TA, the pooled data for the other two measures also showed significant z-test values with the negative signs, meaning thereby that the convergence came from above for most years covered by our study.

Table 5 shows the results for pecking order preference by industry during 1974-1992 for the LTD/TA measure. Here we find that all the industries had positive and significant z-test for their gamma values at the 0.01 percent level of significance. The pooled data also corroborates this result which was highly significant at the 0.01 percent level.

Table 6 presents the results for the pecking order preference by year during 1974-1992 for the LTD/TA measure. Here, also, all the years had positive and significant gamma values at the 0.01 percent level of significance. Furthermore, the pooled data showed that the gamma values were significant for all the years covered by our study at the 0.01 percent level of significance.

The results of Table II, IV, and VI are derived from

TABLE 2
Summary of Capital Structure Symmetric Convergence, By Year 1974-1992

LTD/TA-- Long term debt over total assets; TD/TA--- Total debt over total assets; TE/TA--- Total equity over total assets.

	LTD/TA			TD/TA		TE/TA	
Year	Obs.	Gamma	Z-Test	Gamma	Z-Test	Gamma	Z-Test
1974	287	0.365	4.07169**	0.352	3.94772**	0.357	3.995696**
1975	294	0.376	4.22180**	0.301	3.47818**	0.264	3.085497**
1976	294	0.363	4.10363**	0.309	3.56542**	0.464	4.986722**
1977	296	0.257	3.02069**	0.114	1.37744	0.128	1.543953
1978	297	0.265	3.11535**	0.101	1.22509	0.246	2.907053**
1979	299	0.358	4.09031**	0.145	1.75553	0.139	1.684358
1980	299	0.054	0.65980	0.183	2.20146*	0.178	2.143309*
1981	301	0.341	3.9321**	0.118	1.43728	-0.042	-0.51472
1982	305	0.097	1.19131	0.172	2.09080*	0.079	0.971792
1983	319	0.399	4.62090**	0.277	3.36164**	0.284	3.43926**
1984	328	0.149	1.88608	0.111	1.41215	0.208	2.604413**
1985	341	0.068	0.88559	0.097	1.26022	0.174	2.236678*
1986	342	0.901	5.10769**	0.022	0.28741	0.181	2.326147*
1987	357	0.343	4.30744**	0.317	4.01945**	0.375	4.647585**
1988	358	0.237	3.08134**	0.901	5.23092**	0.991	1.775314
1989	359	0.199	2.61253**	0.196	2.57474*	0.326	4.128603**
1990	363	0.077	1.03363	0.167	2.21687*	0.317	4.047891**
1991	363	0.178	2.35827*	0.061	0.81975	-0.014	-0.18847
1992	363	0.286	3.69210**	0.251	3.27326**	0.336	4.263486**
Total	6164	0.326	17.1100**	0.381	19.5568**	0.401	20.39431**

* significant at 5% level.
** significant at 1% level.

TABLE 3
Summary of Capital Structure Asymmetric Convergence, By Industry1974-1992

LTD/TA-- Long term debt over total assets; TD/TA--- Total debt over total assets; TE/TA--- Total equity over total assets.

		LTD/TA		TD/TA		TE/TA	
Industry	Obs.	Gamma	Z-Test	Gamma	Z-Test	Gamma	Z-Test
Aerospace	342	-0.483	-5.5306**	-0.226	-2.8789**	0.133	1.72381
Apparel	99	-0.464	-2.8919**	-0.377	-2.4568*	0.043	0.30226
Beverage	114	0.375	2.62468**	0.059	0.44468	-0.472	-3.141719**
Building Materi	120	-0.422	-2.9635**	0.041	0.31733	-0.128	-0.98336
Chemicals	224	-0.205	-2.1235*	-0.167	-1.7426	-0.206	-2.133424*
Computers, Offi	264	-0.137	-1.5592	0.027	0.31010	-0.076	-0.870682
Electronics, El	385	-0.397	-5.0556**	-0.171	-2.3376*	0.01	0.138742
Food	350	-0.244	-3.1303**	-0.152	-1.9874*	0.008	0.105830
Forest Products	432	0.031	0.45540	-0.01	-0.1469	-0.146	-2.122844*
Industrial & Fa	270	-0.255	-2.8649**	-0.189	-2.1564*	-0.074	-0.857479
Metal Products	246	-0.365	-3.7689**	-0.134	-1.4727	-0.024	-0.266107
Metals	278	-0.427	-4.5524**	-0.329	-3.6630*	-0.165	-1.918733
Mining, Crude o	146	-0.148	-1.2506	-0.122	-1.0346	-0.124	-1.051321
Motor Vehicles	378	-0.216	-2.8995**	-0.21	-2.8227**	0.132	1.798891
Petroleum Refin	1006	-0.364	-7.6039**	-0.233	-5.0820**	-0.142	-3.152579**
Pharmaceuticals	299	-0.495	-5.2590**	0.019	0.23228	-0.108	-1.312846
Publishing, Pri	554	-0.255	-4.1039**	-0.194	-3.1675**	0.043	0.7150287
Sci. & Photo Eq.	242	-0.454	-4.4498**	-0.194	-2.0935*	0.35	3.6066276**
Soaps, Cosmetic	180	-0.232	-2.1409*	0.199	1.85019	0.277	2.5251235*
Textile	138	-0.492	-3.5581**	0.364	2.81629**	0.098	0.810162
Tobacco	97	-0.532	-3.1372**	0.452	2.80801**	0.136	0.938367
Total	6164	-0.314	-16.5504	0.168	9.19444**	0.066	3.6561946**

* significant at 5% level.
** significant at 1% level.

TABLE 4
Summary of Capital Structure Symmetric Convergence, By Year 1974-1992

LTD/TA-- Long term debt over total assets; TD/TA--- Total debt over total assets; TE/TA--- Total equity over total assets.

		LTD/TA		TD/TA		TE/TA	
Industry	Obs.	Gamma	Z-Test	Gamma	Z-Test	Gamma	Z-Test
1974	287	-0.182	-2.1443*	0.567	5.59616**	-0.66	-5.94109**
1975	294	0.163	1.94871	-0.646	-5.9752**	0.459	4.9413747**
1976	294	-0.645	-5.9801**	-0.344	-3.9188**	0.209	2.4796592*
1977	296	-0.561	-5.6481**	-0.259	-3.0425**	0.051	0.6194639
1978	297	-0.534	-5.5045**	0.292	3.40489**	-0.41	-4.559242**
1979	299	-0.611	-5.9186**	0.024	0.29359	-0.342	-3.932526**
1980	299	-0.282	-3.3106**	-0.209	-2.5009*	0.093	1.133060
1981	301	-0.431	-4.7704**	-0.401	-4.5059**	0.139	1.688432
1982	305	-0.097	-1.1913	-0.617	-5.9916**	0.265	3.1531219**
1983	319	-0.658	-6.2580**	-0.512	-5.5547**	0.292	3.5272674**
1984	328	-0.483	-5.4139**	-0.085	-1.0841	-0.199	-2.496488*
1985	341	-0.171	-2.1992*	-0.205	-2.6191**	-0.306	-3.802796**
1986	342	-0.021	-0.2743	0.03	0.39184	0.08	1.042 0476
1987	357	-0.126	-1.6710	0.096	1.27751	-0.486	-5.678479**
1988	358	-0.316	-4.0122**	-0.123	-1.6335	-0.085	-1.133415
1989	359	-0.134	-1.7789	-0.123	-1.6352	-0.08	-1.068267
1990	363	-0.223	-2.9268**	0.122	1.63030	-0.19	-2.511516*
1991	363	-0.041	-0.5515	-0.383	-4.7634**	0.281	3.6308779**
1992	363	-0.147	-1.9688*	-0.084	-1.1276	-0.066	-0.887226
Total	6164	-0.314	-16.550**	0.168	9.19442**	-0.066	-3.65618**

* significant at 5% level.
** significant at 1% level.

TABLE 5
Summary of Test for Pecking Order Preference, By Industry 1974—1992

Industry	Obs.	Gamma	Z-Test
Aerospace	342	0.729	6.5256644**
Apparel	99	0.653	3.4796371**
Beverage	114	0.609	3.6470199**
Building Materi	120	0.622	3.772718**
Chemicals	224	0.766	5.2114439**
Computers, Offi	264	0.703	5.7444023**
Electronics, El	385	0.716	6.9352674**
Food	350	0.605	6.3727587**
Forest Products	432	0.636	7.2134553**
Industrial & Fa	270	0.713	5.8088887**
Metal Products	246	0.473	4.6220792**
Metals	278	0.457	4.7925903**
Mining, Crude o	146	0.068	0.5796701
Motor Vehicles	378	0.677	6.8502177**
Petroleum Refin	1006	0.684	11.191072**
Pharmaceuticals	299	0.642	6.0186727**
Publishing, Pri	554	0.658	8.2468502**
Sci. & Photo Eq.	242	0.719	5.4970499**
Soaps, Cosmetic	180	0.711	4.7433131**
Textile	138	0.545	3.7958409**
Tobacco	97	0.601	3.3453724**
Total	6164	0.623	27.0555**

* significant at 5% level.
** significant at 1% level.

TABLE 6
Summary of Test for Pecking Order Preference, By Year 1974—1992

Year	Obs.	Gamma	Z-Test
1974	287	0.631	5.862247**
1975	294	0.581	5.725191**
1976	294	0.668	6.030979**
1977	296	0.601	5.842086**
1978	297	0.686	6.085425**
1979	299	0.629	5.983488**
1980	299	0.728	6.107226**
1981	301	0.685	6.121405**
1982	305	0.564	5.747072**
1983	319	0.541	5.746621**
1984	328	0.725	6.392186**
1985	341	0.739	6.498972**
1986	342	0.739	6.505883**
1987	357	0.587	6.353402**
1988	358	0.587	6.359842**
1989	359	0.638	6.581362**
1990	363	0.541	6.125918**
1991	363	0.592	6.423764**
1992	363	0.571	6.315258**
Total	6164	0.623	26.24650**

* significant at 5% level.** significant at 1% level.

the period of 1974 to 1992. These results might be affected by the characteristics of the time series. Since both pooled data and time series data show the convergence, it is telling us that the time series impact, if any, is at the minimal in our test results.

CONCLUSIONS

We have found that the overwhelming number of firms had convergence toward their respective industry means during 1974-1992, by all the measures of capital structure, thus confirming the optimal capital structure anew. The same tendency had also been observed in the case of asymmetric convergence; however, for the pooled data in the case of LTD/TA, the convergence toward the mean came from above while for both TD/TA and TE/TA, the convergence toward the mean came from below. Our result also supports strongly the pecking order hypothesis as for all the industries and for all the years the gamma values had significant positive z-tests which was also confirmed by the pooled data.

Our study thus shows that both the optimal capital structure hypothesis and the pecking order hypothesis coexist. As Myers (1984) pointed out that the pecking order theory "performs at least as well as the static trade-off theory" in explaining capital structure, our study suggests that optimal capital structure and pecking order theorem are not mutually exclusive. But the pecking order hypothesis is more pronounced than the optimal capital structure hypothesis as the former was significant for *all* the industries and for *all* the years, while the latter was significant for the majority of the industries and for the majority of the years covered by our study.

Several problems have emerged during our research that we have not attempted to solve. Some of them are mentioned below for further study in future. First, as has been discussed above, our results are derived from large company data. It is interesting to know whether we will get the same conclusions from small company data. Second, we used accounting data in our research. Will we get different results by using market data? Finally, we used industry mean as a predicator of a firm's capital structure. The results may vary using stochastic models.

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