Industry Concentration: The Case of Real Estate Investment Trusts

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A widely-accepted view in many influential real estate circles is that the consolidation of REIT assets is gaining strength and, when it has run its course, this will ultimately lead to concentration of ownership and market domination by a very small number of extremely large REITs. By implication, conventional wisdom holds that there will necessarily be fewer equity REITs within the industry sector. The proponents of these views, notably Linneman [1997], typically present two arguments to buttress their case.

First, bigger REITs will reap the advantages of lower cost of capital, economies of scale, and market power. Second, REITs will mirror the experience of other capital-intensive industries such as automobiles and petroleum that started out with several small players, grew into industries with numerous small players, and eventually came to be dominated by a few very large companies that became dominant by swallowing up smaller competitors.

The view that the REIT industry will witness sustained consolidation has not gone unchallenged, however. Vogel [1997] argues that the advantages of economies of scale for larger REITs are probably overestimated and may not lead to significantly lower operating costs for such REITs. Campbell, Ghosh, and Sirmans [1998] examine all REIT mergers that have occurred in the 1990s and argue that, while merger activity has increased over this period, REITs have also grown through seasoned equity and debt issues as well as through the formation of new REITs via initial public offerings. As a result, they argue, despite the increase in firm size, there is no strong evidence for consolidation over this time period.

Our study is similar in spirit to Campbell, Ghosh, and Sirmans [1998] in the sense that we too propose empirical tests of the assertion that concentration of REIT assets is gaining strength. We employ two classical measures of concentration, namely, the Gini concentration index and the Herfindahl index, along with a simple measure of the market share of the top three companies within the industry to gauge the extent of concentration and changes in concentration in REIT firms over the 1990s.

Additionally, we compare levels of concentration within the REIT industry to those in a few selected industries such as petroleum, automobiles, construction, and retail to study the available potential for future consolidations in the REIT industry. Using these measures, our main finding is that over the 1990s there is no evidence of an appreciable increase in the concentration of REIT assets. We also find that, compared to other industries, REITs have among the lowest levels of concentration of assets. Perhaps somewhat surprisingly, we find that industries may achieve higher levels of concentration whether the number of firms in the industry contracts or expands. Consequently, a simple count of the number of firms in an industry is unlikely to be an indicator of the extent of concentration within the industry. In our view, there may be room for some concentration among REITs in the future but the trajectory of that possible concentration is unknown and probably unknowable.

Data

The primary data for this study are the market capitalizations of equity and book value of total assets for companies in the equity REIT industry and in a few other selected industries, namely, Petroleum, Automobile, Retail, Construction, Hotel, Entertainment, and Banking. These data cover annual periods from 1990 through 1998. The market capitalization of equity for each company at the end of each year is equal to the closing stock price as of the end of the year times the number of shares outstanding. The book value of total assets for each year is obtained from Compustat.

The industry classification scheme we use is a slightly modified version of BARRA's industry classification scheme for U.S. equities. BARRA, a commercial provider of investment analytics, data, and software to institutional investors, classifies U.S. companies into 52 industries. These industry categories are designed and maintained by BARRA and are broadly consistent with other industry categories such as FactSet or SIC. Roughly the top 1,500 companies by market capitalization are classified manually by BARRA into one or more industry categories after careful analysis of their lines of business by reading S&P tear-sheet information on these companies.

The remaining companies are classified based mainly on four-digit SIC codes supplied by Compustat. The Automobile, Construction, Hotel, Entertainment, and Banking industries used in this study exactly match the BARRA scheme. However, the Petroleum and Retail industries each represent a combination of three BARRA industries. Petroleum is a combination of Energy Reserves, Oil Refining, and Oil Services; and Retail represents a combination of Diversified Retail, Specialty Retail, and Retail Apparel.

At the end of each year, we compute the aggregate market capitalization of equity and aggregate book value of each industry group. Next, we compute the proportional contribution of each company within each industry to the aggregate market equity and aggregate book value of the industry. We interpret these proportional contributions as market shares. Ideally, we would like to use the market value of total assets in our computation of market shares. However, such data are not readily available because in many cases some financial claims on assets are not publicly traded (e.g., bank loans), and, even when they are traded, accurate up-to-date pricing information is difficult to obtain (e.g., corporate bonds).

Measures of market share using market value of equity have the advantage of reflecting current market valuations, but have the disadvantage that they ignore company-level leverage information. In order to address this concern, we also compute market shares using book value of total assets. This measure will account for leverage, but suffers from the disadvantage of not using up-to-date market prices. In addition, this measure can be computed for fewer firms due to non-availability of fundamental data for smaller firms. Therefore, although the concentration indices are robust for the number of firms within each industry, the number of firms for which book-value-based measures of concentration are computed is not an accurate reflection of the actual number of firms operating in each industry.

Measures of Concentration

We use three measures of concentration to study the extent of consolidation within our group of industries. The first measure is the Gini concentration index.[1] Loosely speaking, this index measures the extent of dispersion in the distribution of market shares within each industry. The Gini measure is closely related to the Lorenz curve that plots the proportional contribution of the lowest $100p^{th}$ percentile of market shares (where p lies between 0 and 1) to the aggregate market share (which is unity by definition). Let x_p be the $100p^{th}$ percentile of market share values within an industry and let X represent the market share of a random firm within the industry. Then, the function L(p) is computed as follows:

$$L(p) = E(X|X \leq x_p) \bullet p/E(X)$$

Here, E(X) is the unconditional expectation of X and $E(X|X \leq x_p)$ is the expectation of X conditional on X being less than x_p. It is easily verified that L(p) satisfies three conditions, namely, $L(0) = 0$, $L(1) = 1$ and $L(p) \leq p$. The plot of L(p) versus p is known as the Lorenz curve.

Exhibit 1 shows three examples of Lorenz curves for industries with different levels of concentration. The 45-degree line represents the Lorenz curve for an industry that has the least amount of concentration, i.e., one in which all firms have equal market share. The upper curved line is the Lorenz curve for an industry with a moderate amount of concentration, and the lower line is the curve for an industry with a significant amount of concentration. The Gini concentration index for an industry is equal to twice the area between the Lorenz curve and the 45-degree line.

Intuitively, the Gini index measures the extent of dispersion of market shares within an industry. As mentioned above, an industry in which all firms have equal market share will have a Lorenz curve that is coincident with the 45-degree line. Such an industry will have a Gini index value of zero. By contrast, an industry this is dominated by a handful of firms, e.g., a monopoly or oligopoly, will have a Lorenz curve that is quite close to zero most of the way with a steep rise as p gets close to unity. Such an industry will have a Gini index value close to unity.

Despite its widespread use as an indicator of concentration, the Gini measure does have some shortcomings. For example, the Gini index will be equal to zero if all firms within an industry have equal market shares irrespective of the actual number of firms in the industry. For this reason, we employ two additional measures of concentration.

The first is the Herfindahl index.[2] For an industry with N firms and market shares w_1, w_2, …, w_N the Herfindahl index is computed as Σw_n^2. It is easily shown that the minimum value of this index is 1/N, when all firms have market share weights equal to 1/N. The maximum value of this index is 1, when a single firm (i.e., a monopoly) operates in the industry.

The second is the sum of the market shares of the top three companies within each industry. Although this is not a formal measure of industry concentration, we present this measure since it is a useful heuristic that can be compared to the two more formal measures discussed above.

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1 The Gini index has been used in classical economic studies to describe income distribution within the population. Recently, Forgey, Mullendore, and Rutherford [1997] employed this measure to study the extent of concentration in the residential real estate brokerage market.

2 Stigler [1968] presents a general discussion of the Herfindahl measure of industry concentration. Forgey, Mullendore, and Rutherford [1997] also employ the Herfindahl index as a supplement to the Gini concentration measure.

Industry Concentration: Empirical Results

We find that the REIT industry does not appear to have become more concentrated over the 1990s. This result is robust to our choice of the actual metric used to evaluate concentration and to our choice of which variable is used compute market share (i.e., market value of equity or book value of total assets).

a) Concentration Using the Gini Index

Exhibit 2 shows the Lorenz curve for the REIT industry and two other capital-intensive industries, Petroleum and Automobiles. Panel A shows the Lorenz curve for the year ending December 1992 and Panel B plots the curve as of December 1998. In both panels, the Lorenz curve for the REIT industry is closer to the 45-degree line than the curves for Petroleum and Automobiles. This suggests that the relative concentration of the REIT industry compared to the Petroleum and Automobile industries has not changed appreciably between 1992 and 1998.

Exhibit 3 presents the Gini concentration index using the market value of equity to compute market shares of companies within each industry. From Exhibit 3, we see that the REIT industry in fact became marginally less concentrated between 1992 and 1994. Over the 1990s it appears that, despite the explosive growth in the number and market capitalizations of REITs and the consolidation experienced in the mid- and late-1990s, the level of concentration in the REIT industry has remained fairly stable.

The Gini index values for other industries also seem to make intuitive sense. For example, the Gini index values for Petroleum and Automobile industries are much higher than that for REITs. This conforms to the widely-held belief that these industries are highly concentrated.

The time variation of Gini index values also appears to be intuitive. For example, the Gini index for the Banking industry has steadily increased over the 1990s. Once again, this result is consistent with the prevalent view that this industry has experienced strong consolidation over the 1990s.

Turning to a comparison of Gini index values across industries, we see that REITs have the lowest concentration among our selected group of industries. In fact, this is true for the broader class of BARRA's 52 industries as well (results not shown). The results in Exhibit 3 suggest that the consolidation of the mid- and late-1990s did not bring the levels of concentration in the REIT industry anywhere near the levels of other capital-intensive industries such as Petroleum and Automobiles. This is important, because the proponents of the view that concentration of REIT assets is inevitable point to the experience of other capital-intensive industries such as Petroleum and Automobiles to support their opinions. The data do not support these opinions at present, but in time they might.

Exhibit 4 displays the Gini index values when the book values of total assets are used to compute market shares. Although in theory these Gini coefficients can differ significantly from those based on market values of equity, Exhibit 5 shows that the rank-order correlation of Gini index values computed using these two measures is quite high. These rank correlations are computed across all 52 BARRA industry groups. The strong rank-order correlation between these two measures means that we should expect results based on book values of total assets to be qualitatively similar to those based on market values of equity. Indeed, Exhibit 4 shows that although there are some slight differences in the actual values of the Gini measure, the qualitative features described in the previous paragraph are applicable to the results in Exhibit 4 as well.

The trajectory along which an industry might proceed toward greater concentration can take several paths. Perhaps the most commonly understood paths are those in which many smaller firms in an industry are (1) merged into fewer, larger firms, (2) bought out by competitors, or (3) fail and disappear from the industry.

Looking at the data in Exhibit 3 for examples of these paths, we observe that the Construction industry had a decline in the number of firms between 1990 and 1994 (187 firms in 1990 to 167 firms in 1994. However, the Construction industry became less concentrated over the period (Gini index of 0.85 in 1990 and 0.75 in 1994).

Another, perhaps counterintuitive, way in which industries can become more concentrated is for there to be more firms, but a few of exceptional size relative to their competitors. In Exhibit 3 we observe that the Banking industry grew substantially from 320 firms in 1990 to 712 firms in 1998 while experiencing a large increase in concentration as shown by its Gini index value, which rose from 0.76 in 1990 to 0.92 in 1998.

Some industries may experience little or no change in concentration despite changes in the number of firms in the industry. In Exhibit 3, the Petroleum and Retail industries gained firms between 1990 and 1998, but their Gini indices increased slightly. REITs had a substantial increase in the number of firms, but over the 1990 to 1998 period moved toward *slightly* less concentration, rather than *substantially* less concentration that might be expected from the enormous increase in the number of firms.

b) Concentration Using the Herfindahl Index

Exhibit 6 shows the values of the Herfindahl index using market values of equity to compute market shares; Exhibit 7 shows the Herfindahl index when book values of total assets are used to compute market shares. In general, the Herfindahl index for an industry becomes smaller as the number of firms in the industry increases. From Exhibit 6, it is clear that the Herfindahl index for the REIT industry decreased sharply as the number of firms in the industry increased over the mid-1990s.

It is interesting to note that an increase in the number of firms in an industry does not always lead to a decrease in the Herfindahl index. For example, the number of firms in the Banking industry increased dramatically in the late 1990s but the Herfindahl index for banks actually increased substantially over this time period.

The Construction industry illustrates the same point, but in a converse way. The Construction industry witnessed a decrease in the number of firms over this time period 1990 to 1994, and also saw the Herfindahl index decline over this period

Turning to a cross-sectional comparison across industries, Exhibit 6 shows that in many years, the REIT industry has the lowest concentration across all industry groups studied. It is clear that Petroleum and Automobiles, two industries that witnessed significant consolidation in the past, have higher Herfindahl index values reflecting their higher concentration levels. The inferences from Exhibit 7 are qualitatively the same as those from Exhibit 6. The overall conclusion from these two exhibits is that the REIT industry does not appear to have become more concentrated in the 1990s.

c) Concentration Using the Market Share of Top Three Firms

Exhibits 8 and 9 present the third measure of concentration, the sum of the market shares of the top three firms within each industry. Market values of equity are used to compute market shares in Exhibit 8, and book values of total assets are used in Exhibit 9. As mentioned previously, this measure is not a formal indicator of concentration but serves as a quick heuristic gauge of the market power wielded by the top three firms.

Exhibit 10 reports the rank correlations between all three measures of concentration measured across all 52 BARRA industry groups over the 1990s. The rank correlations among all three measures are quite high. Consistent with this observation, the inferences from this third measure are strikingly similar to those obtained with the Gini and Herfindahl indices. The market share controlled by the top three REITs is among the lowest across the industry groups studied. Furthermore, over the 1990s this share appears to have diminished. These findings are consistent with the result from the more formal measures of industry concentration that the REIT industry has not become more concentrated in the 1990s.

Conclusions

Our study examines the level of concentration of the REIT industry and other selected industries over the 1990s using three measures of concentration: the Gini concentration index, the Herfindahl index, and the sum of the market shares of the top three firms within each industry. We find that all these measures of concentration suggest that the concentration level of the REIT industry has not increased appreciably over the 1990s despite the consolidation in the industry over the mid- and late-1990s. Furthermore, the concentration level of the REIT industry remains far below that of other capital-intensive industries such as Petroleum and Automobiles. In other words, in order for REIT industry concentration to approach the levels of capital-intensive industries, further consolidation would be necessary.

Interestingly, industries may become more concentrated while the number of firms in the industry increases. This may seem counterintuitive, but the conclusion is supported by the evidence of this study. Some industries follow the more intuitive pattern of increasing concentration as the number of firms in the industry decrease, but we also find that concentration may remain constant as industries either gain or lose firms. In short, concentration within an industry does not necessarily mean that there will be fewer firms within the industry. There are many paths toward more or less concentration and none appears inevitable or predictable

Some consolidation among REITs has already taken place, but not enough to indicate that combining existing REITs into larger REITs will be the dominant form of concentration. The REIT industry has suffered market declines over the past two years, which makes it difficult to accomplish consolidation, let alone think about how it might happen. Nonetheless, when some equilibrium is reached and when REIT managers think once again about how they might expand their companies, the options of either merging or expanding market share will again become viable. We suspect that mergers will occur but at only a modest pace. To gain and maintain credibility in the investor community, we believe that the stronger REITs will build on their home-grown strengths and will opt for increasing market share rather than take on the burden of blending companies, with all the complications that that strategy entails.

Given the popular belief that further consolidation within the REIT industry is inevitable, an interesting question is to determine the number and size of future mergers that will be

necessary to bring concentration in the REIT industry closer to the levels in other capital-intensive industries. This might serve as a useful reality check on the length of time it might take for the REIT industry to attain the predicted levels of concentration typical of capital-intensive industries.

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Exhibit 1

Hypothetical Lorenz Curve for Highly, Moderately, and Least Concentrated Industries

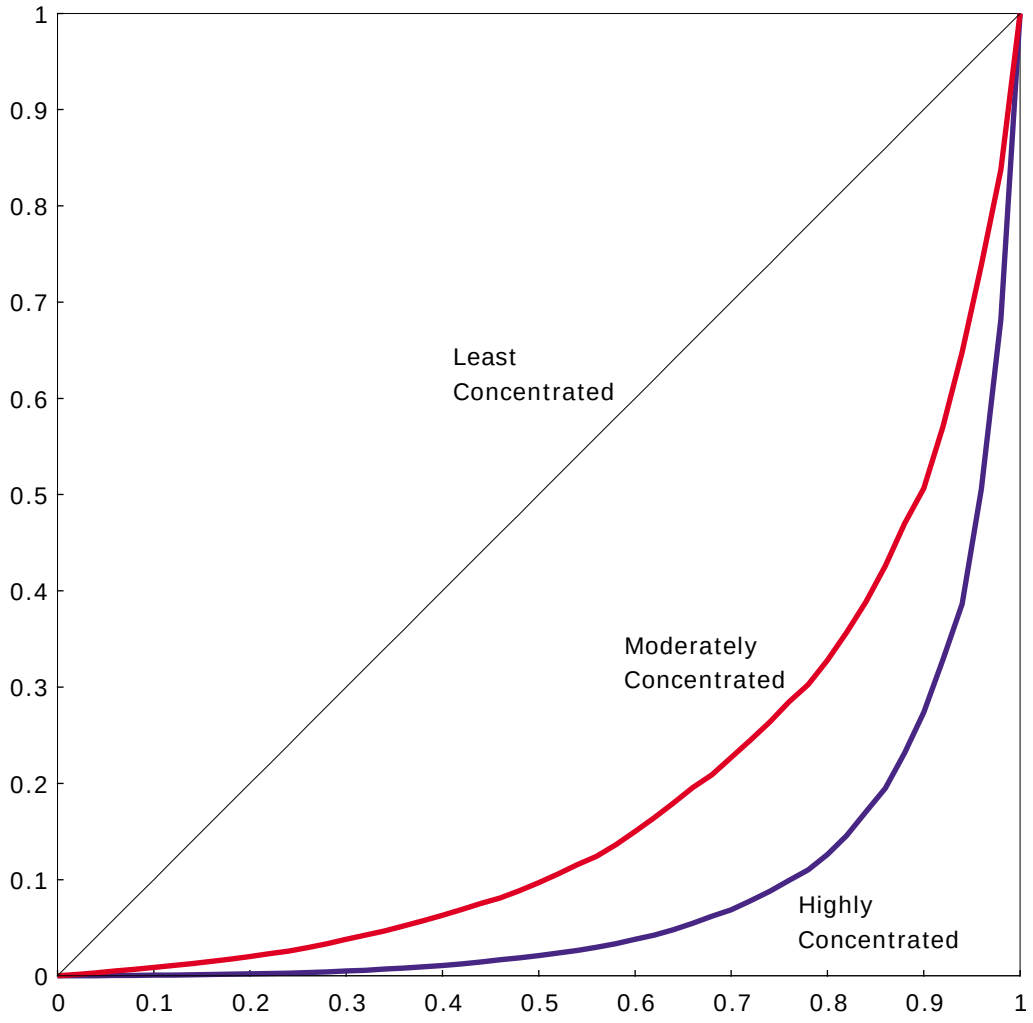
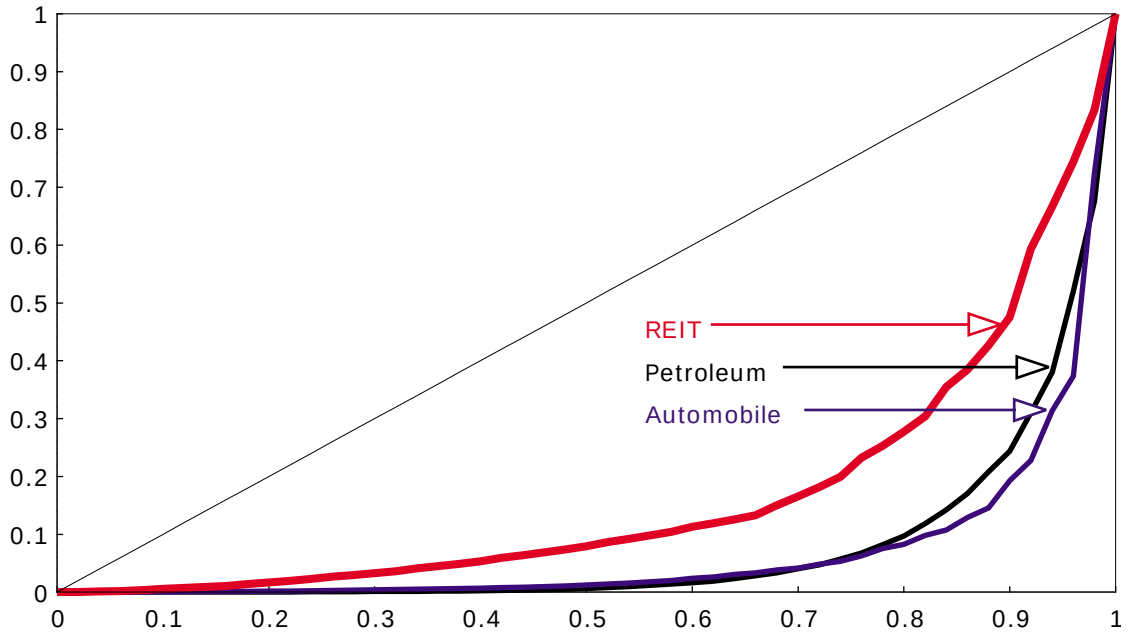


Exhibit 2

Panel A: Lorenz Curve for Selected Industries for Year Ending December 1992



Panel B: Lorenz Curve for Selected Industries for Year Ending December 1998

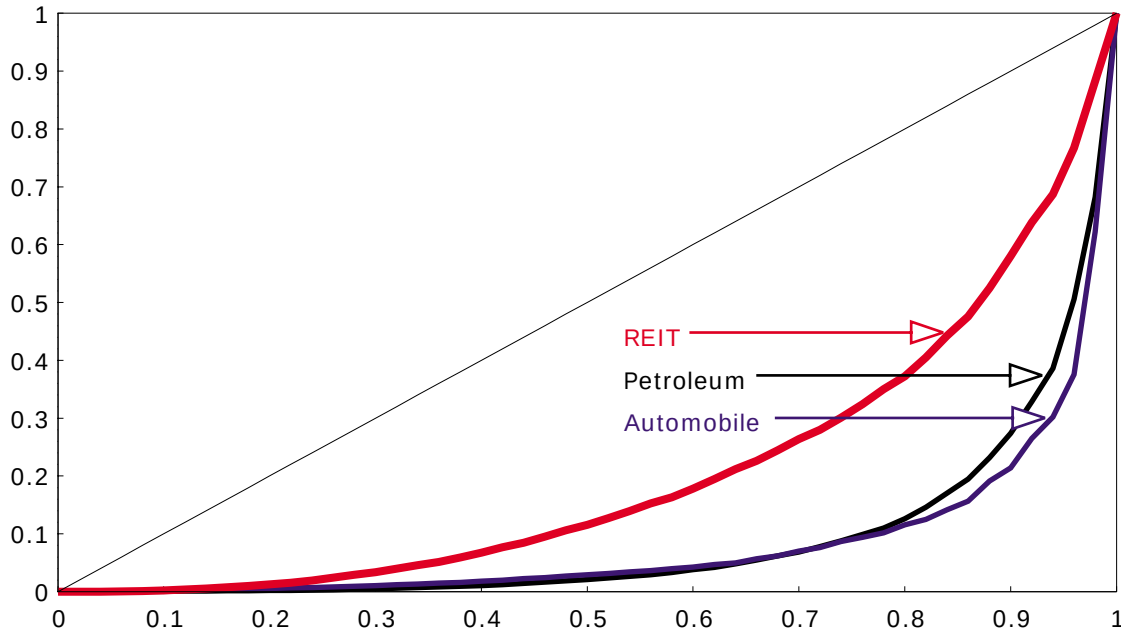


Exhibit 3

Gini Concentration Index for REITs and Other Selected Industries
Using Market Capitalization of Equity

Industry	1990 No. firms	1990 Gini Index	1992 No. firms	1992 Gini Index	1994 No. firms	1994 Gini Index	1996 No. firms	1996 Gini Index	1998 No. firms	1998 Gini Index
Petroleum	251	0.92	237	0.92	264	0.91	287	0.89	443	0.95
Automobile	71	0.91	82	0.89	93	0.88	94	0.92	131	0.92
Retail	206	0.89	211	0.87	297	0.86	325	0.86	408	0.92
Construction	187	0.85	154	0.80	167	0.75	230	0.80	343	0.83
Hotel	30	0.83	28	0.79	52	0.74	79	0.83	78	0.84
Entertainment	65	0.95	56	0.95	65	0.95	81	0.96	127	0.89
Banking	320	0.76	295	0.79	364	0.81	402	0.86	712	0.92
REITs	51	0.67	68	0.68	128	0.55	139	0.58	150	0.61

Exhibit 4

Gini Concentration Index for REITs and Other Selected Industries
Using Book Value of Total Assets

Industry	1990 No. firms	1990 Gini Index	1992 No. firms	1992 Gini Index	1994 No. firms	1994 Gini Index	1996 No. firms	1996 Gini Index	1998 No. firms	1998 Gini Index
Petroleum	248	0.93	235	0.93	263	0.90	284	0.89	343	0.88
Automobile	71	0.96	82	0.96	92	0.96	92	0.96	121	0.96
Retail	205	0.88	208	0.86	293	0.86	318	0.83	356	0.84
Construction	184	0.76	150	0.74	164	0.70	225	0.74	272	0.76
Hotel	30	0.70	26	0.66	50	0.62	76	0.75	71	0.75
Entertainment	65	0.94	56	0.95	65	0.92	81	0.94	98	0.88
Banking	194	0.69	179	0.71	362	0.84	384	0.86	378	0.88
REITs	48	0.52	66	0.59	127	0.51	136	0.55	146	0.60

Exhibit 5

Rank Correlation between Gini Concentration Index Based on
Market Value of Equity and Book Value of Total Assets
for All 52 BARRA Industry Groups

Year	Rank-order correlation
1990	0.83
1992	0.83
1994	0.87
1996	0.88
1998	0.82

Exhibit 6

Herfindahl Index of Concentration for REITs and Other Selected Industries
Using Market Capitalization of Equity

	1990		1992		1994		1996		1998	
Industry	No. firms	Herfindahl Index	No. firms	Herfindahl Index	No. firms	Herfindahl Index	No. firms	Herfindahl Index	No. firms	Herfindahl Index
Petroleum	251	0.094	237	0.107	264	0.098	287	0.084	443	0.126
Automobile	71	0.231	82	0.156	93	0.156	94	0.187	131	0.207
Retail	206	0.094	211	0.097	297	0.064	325	0.050	408	0.095
Construction	187	0.068	154	0.059	167	0.039	230	0.037	343	0.029
Hotel	30	0.213	28	0.156	52	0.081	79	0.076	78	0.096
Entertainment	65	0.284	56	0.356	65	0.317	81	0.297	127	0.078
Banking	320	0.019	295	0.021	364	0.020	402	0.028	712	0.042
REITs	51	0.069	68	0.053	128	0.017	139	0.018	150	0.019

Exhibit 7

Herfindahl Index of Concentration for REITs and Other Selected Industries
Using Book Value of Total Assets

	1990		1992		1994		1996		1998	
Industry	No. firms	Herfindahl Index	No. firms	Herfindahl Index	No. firms	Herfindahl Index	No. firms	Herfindahl Index	No. firms	Herfindahl Index
Petroleum	248	0.103	235	0.125	263	0.076	284	0.069	343	0.060
Automobile	71	0.323	82	0.339	92	0.327	92	0.345	121	0.370
Retail	205	0.192	208	0.136	293	0.107	318	0.047	356	0.045
Construction	184	0.029	150	0.031	164	0.025	225	0.022	272	0.020
Hotel	30	0.108	26	0.101	50	0.055	76	0.066	71	0.071
Entertainment	65	0.323	56	0.362	65	0.236	81	0.233	98	0.230
Banking	194	0.025	179	0.028	362	0.027	384	0.034	378	0.043
REITs	48	0.042	66	0.055	127	0.017	136	0.019	146	0.022

Exhibit 8

Aggregate Market Share of Top Three Companies for REITs and Other Selected Industries
(Share Computed Using Market Capitalization of Equity)

	1990		1992		1994		1996		1998	
Industry	No. firms	Market Share of Top 3 Firms	No. firms	Market Share of Top 3 Firms	No. firms	Market Share of Top 3 Firms	No. firms	Market Share of Top 3 Firms	No. firms	Market Share of Top 3 Firms
Petroleum	251	0.426	237	0.447	264	0.447	287	0.409	443	0.508
Automobile	71	0.700	82	0.626	93	0.650	94	0.718	131	0.660
Retail	206	0.387	211	0.417	297	0.358	325	0.310	408	0.437
Construction	187	0.391	154	0.348	167	0.273	230	0.266	343	0.194
Hotel	30	0.698	28	0.617	52	0.396	79	0.381	78	0.454
Entertainment	65	0.814	56	0.870	65	0.840	81	0.817	127	0.368
Banking	320	0.160	295	0.160	364	0.154	402	0.205	712	0.270
REITs	51	0.357	68	0.293	128	0.111	139	0.120	150	0.151

Exhibit 9

Aggregate Market Share of Top Three Companies for REITs and Other Selected Industries
(Share Computed Using Book Value of Total Assets)

	1990		1992		1994		1996		1998	
Industry	No. firms	Market Share of Top 3 Firms	No. firms	Market Share of Top 3 Firms	No. firms	Market Share of Top 3 Firms	No. firms	Market Share of Top 3 Firms	No. firms	Market Share of Top 3 Firms
Petroleum	248	0.474	235	0.515	263	0.385	284	0.365	343	0.330
Automobile	71	0.904	82	0.902	92	0.890	92	0.910	121	0.872
Retail	205	0.547	208	0.475	293	0.440	318	0.307	356	0.310
Construction	184	0.199	150	0.192	164	0.169	225	0.160	272	0.153
Hotel	30	0.472	26	0.439	50	0.297	76	0.356	71	0.360
Entertainment	65	0.786	56	0.856	65	0.780	81	0.823	98	0.603
Banking	194	0.184	179	0.210	362	0.199	384	0.233	378	0.284
REITs	48	0.237	66	0.281	127	0.131	136	0.147	146	0.187

Exhibit 10

Rank Correlation between Market-Value Based Measures
of Gini Concentration Index (GI), Herfindahl Index (HI), and
Aggregate Market Share of Top 3 Firms Within Each Industry (W3)
(For All 52 BARRA Industry Groups)

Year	GI and HI	GI and W3	HI and W3
1990	0.63	0.62	0.96
1992	0.58	0.56	0.98
1994	0.61	0.61	0.98
1996	0.70	0.72	0.98
1998	0.58	0.60	0.98