# Nonlinearities in the Impact of Industry Structure: The Case of Concentration and Intra-Industry Variability in Rates of Return

Omar N. Toulan

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## *Abstract*

This paper addresses the issue of industry concentration and intra-industry variability in rates of return. An inverted "U" relationship is hypothesized and tested in which one observes low levels of variability both at high and low levels of concentration, in one case as a result of collusion and the other as a result of competition. In the process, the paper highlights the benefits associated with combining both industry and firm levels of analyses.

## *1. Introduction*

The objective of this paper is twofold. On one level, it attempts to address the issue of the relationship between industry concentration and intra-industry variability in rates of return. On a higher level, this paper has a second goal, which is to show that while certain aspects of industry structure can have common effects across industries, this relationship between structure and conduct, and eventually performance, need not be linear but rather can differ across industry groupings as defined using firm level variables.

Each of these goals is aimed at making a separate contribution to the literature. On the empirical side, the issue of concentration and intra-industry variability in rates of return is one which, despite the proliferation of research in the general area, has received little attention on to itself. On the more theoretical level, the paper highlights the fact that by combining the industry focus of the "classical tradition" in economics with the firm focus of the "revisionist school" one can arrive at richer conclusions than either alone can provide.

## *2. Concentration and Intra-industry Variability in Rates of Return*

The issue of what explains a firm's economic performance has a long history in both the economics and business strategy literatures. The conventional approach adopted by many in decomposing firm performance is to break it down into that component which is explained by the nature of the industry in which the firm operates, and that component attributable to firm specific characteristics. What this can be interpreted as meaning is that simply being in an industry provides a firm with a certain level of returns and that any deviations from that industry average are the result of the specific strategy the firm decides to adopt.

As Porter (1985, pp. 1-2) clearly states, there are "two central questions [which] underlie the choice of competitive strategy. The first is the attractiveness of industries for long-term profitability.... The second central question in competitive strategy is the determinants of relative competitive position within an industry. In most industries, some companies are more profitable than others regardless of what the average profitability of the industry might be." An implication of this

claim is that a firm can still be highly profitable even in an unattractive industry. Porter asserts that a firm can accomplish this by differentiating itself from its competitors, be it on a cost or product feature basis. The normative implication of such a claim is that firms *should* try to differentiate themselves.

In arriving at this conclusion, Porter most likely had in mind industries in which the number of players is large, each with limited market power. Under these conditions, economic theory predicts that competition would drive profits to zero, and as such developing differentiating measures which would limit competitive pressures is rational from the point of view of the firm. However, this prescription does not necessarily hold when one starts out with a situation of imperfect competition. One can easily envision market conditions in which one would *not* want to differentiate oneself from one's competitors so as not to disturb a profitable yet tenuous collusive equilibrium. Doing so could result in market share changes and thus spark competitive reprisals from other firms in the industry, resulting in lower profits for all.

As such, I propose that, on average, at high levels of seller concentration, where the balance of market power favors the seller over the buyer, it will be not only easier, but there will also exist incentives for players in the industry to collude to preserve existing market shares. What this implies is that in these industries one would expect to find smaller firm effects, as players would not be attempting to differentiate themselves for the reason given above. Following the same logic, one would expect common industry effects to account for a majority of returns, and as such, firms in these industries should have relatively similar rates of return. This leads to the following proposition:

> ***Proposition 1: Industries with high levels of seller concentration will tend to have smaller variances in their intra-industry distribution of returns.***

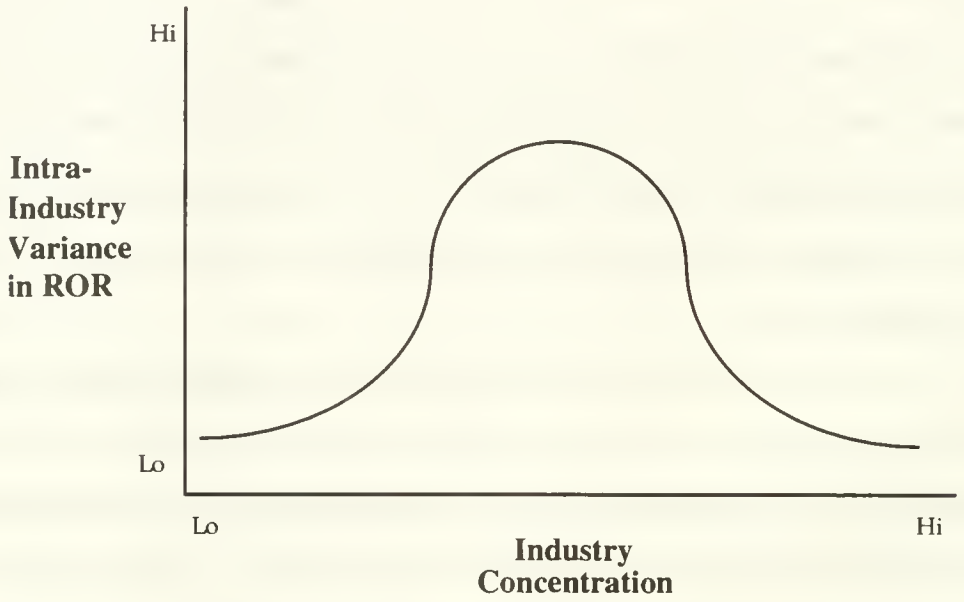
A second, more generally accepted proposition is as follows:

> ***Proposition 2: Industries with very low levels of seller concentration will also tend to have smaller variances in the distribution of intra-industry returns.***

This claim is based on the theory that competition results in a leveling of profits among firms. As Stigler (1963, p. 54) states, "there is no more important proposition in economic theory than that under competition, the rate-of-return on investment tends towards equality."

The implication of these two propositions is that one would expect to find lower levels of variation in intra-industry returns at the two ends of the concentration spectrum than in the intermediary range, where there are too many players to facilitate collusion but at the same time not so many that it prevents firms from differentiating themselves (See Chart 1).

**Chart 1 - Hypothesized Correlation Between Concentration and ROR Variance**




The above statements regarding highly concentrated industries and variability in rates of return is predicated on the potential for and existence of collusive behavior. As has been shown by others, however, high levels of concentration do not automatically imply collusion. For the purposes of the claims being made in Proposition 1, however, it is assumed that the existence of high levels of concentration facilitates collusion and as such, on average, one would expect greater levels of collusive behavior associated with higher degrees of concentration. As will be discussed in the paper, though, if one extends the detail of the theory several layers down, one can refine and conditionalize Proposition 1 even further. In addition, it will be shown that under certain circumstances, even when competition prevails over collusion, and concentration is the result of efficiency, the outcome predicted in Proposition 1 can still hold.

The next section of the paper will lay the foundation for the discussion which follows by reviewing the literature on the concentration-profitability debate and showing how there has been relatively little work done on comparing intra-industry variances in rates of return across concentrated and unconcentrated industries. Section 4 will then refine and extend the theoretical assumptions made in Proposition 1 by highlighting the industry, market, and firm conditions which interact with concentration to produce low variability in rates of return across firms in an industry. This will be followed by an empirical test of the basic relationships described in the above propositions through the use of data from COMPUSTAT, the U.S. Census, and the FTC. While certain of the factors described in Section 4 will be controlled for in the analysis, data limitations will force most of the empirical tests to be conducted at the higher level of analysis as described in the current version of Proposition 1.

## *3. Laying the Foundations*

The literature on the effect of seller concentration on performance can be traced back to Joe Bain, who in his 1951 paper stated that higher industry concentration was correlated with higher average industry returns. His data showed that of the 42 industries studied, profit rates were higher for those in which the eight largest firms accounted for at least 70% of industry value added. The reasoning placed on this observation was that equilibrium profitability is determined by two factors: the ability of firms to restrict competition among themselves, and the effectiveness of market entry barriers. The corollary which came out of this was that increases in industry concentration tend to raise industry-wide profits by facilitating collusion.

Bain's use of concentration as a measure of competition was picked up by many who followed him, including Stigler (1963) who used it as a proxy in his work. His rationale for doing so was based on the defining conditions for competition: 1) a considerable number of firms; and 2) free entry and exit. While unconcentrated is not a euphemism for competitive, it takes into account the first requirement of numerous independent firms and also indirectly addresses the second requirement. Stigler, in attempting to replicate Bain's result, claimed that the average rate of return of monopolistic

industries should be higher than that of competitive industries, as players in these industries could always enter competitive ones and as such would never accept less than the average rate of return in the long run. His and the results of others who followed helped to provide supporting evidence for Bain's claim that higher levels of concentration lead to higher profit rates through more effective collusion. Weiss (1974)[1] in an examination of 46 studies that had been published by the early 1970s found that 42 of them had shown a positive relationship between seller concentration and profitability.

This claim is held by many to be true on average, but not necessarily in all cases. "Some [concentrated] industries have very high rates of return if they can preserve their position because of favorable demand and cost conditions, whereas others will earn only as much as competitive industries because of uncertain demand and cost conditions" (Stigler 1963, p. 69). Hence, traditional theory implies that the variance of average rates of return will be greater *across* concentrated industries than unconcentrated ones.

Though this is a related issue to the one which is the focus of this paper, it reflects the bias of the "classical" tradition in which industrial economists treated industry as the only unit of analysis. Differences among firms were assumed transitory or unimportant for the most part. However, this claim by adherents to the classical tradition that the variance of profit rates among concentrated industries is greater than among unconcentrated ones does not contradict the one being made here, that the variance within highly concentrated industries should be less than that within less concentrated ones. The two questions address different levels of analysis. The "classical" approach assumes away firm effects and as such by definition one would expect a null result to the propositions being made here. However, if one assumes that firm effects exist, for which there is support as will be shown, then the question of intra-industry variance becomes relevant and important.

The 1970s and 1980s saw the emergence of another school of thought, the "revisionist school," which challenged both the findings of Bain as well as the underlying assumption that the unit of analysis should be the industry. Authors of this school claimed that all markets are competitive and that scale economies are negligible. The basis for a firm's level of profits is not what industry it is a member of but rather how efficient it is within that industry. Ravenscraft (1983), by asserting that

greater levels of efficiency translate into higher market shares, attempted to test this hypothesis. He found that when one included market share in the regression of profitability, the importance of concentration as an explanatory variable changes from positive to negative, and concludes that the significance of concentration in traditional industry-level cross-sections arises because it is correlated with share (firm) differences and not because it facilitates collusion.

Demsetz (1973) found a similar result when he looked at the effect of concentration on firm profitability by asset size. He concluded that the rate-of-return for small firms does not increase with concentration, thus implying that it is efficiency and not collusion which is behind the concentration of industry. Furthermore, though he does not look at the variability of profit levels per se, his data imply that the variability of rates of return is higher across concentrated industries than unconcentrated ones.

Again, however, the level of analysis used by these authors does not quite match that which is the focus of this paper. Ravenscraft and other revisionists compare profitability variance of firms *across* industries. They are guilty of falling into the opposite trap fell into by those in the classical school. They essentially assume away industry effects. The objective here is to combine these two schools of thought and look at the variance of *firm* rates of return within *industries.*

If either of the two extreme points of view discussed above is correct then the question at hand becomes irrelevant. The question, by its very nature, implies the existence of both industry and firm effects, and as such a brief argument must be made in support of this. A number of authors have undertaken work in this area, among them Schmalensee (1985) and Rumelt (1991). These two come out on opposite sides regarding the importance of industry versus firm effects, both using the same data set, the FTC Line of Business Database. Schmalensee, in his analysis of 1975 data, comes to the conclusion that firm effects are negligible and that industry effects account for 20% of the variance in business unit returns. By contrast, Rumelt in analyzing data covering the entire database period, 1974-1977, finds quite different results, with only 8% of business unit variance due to industry effects and 46% attributable to firm effects. Rumelt reconciles the differences in results by claiming that by using only one year's worth of data, Schmalensee is including not only on-going industry but

also business-cycle effects. By looking over the entire four year period Rumelt is able to single out the stable effects which he claim give support to the importance of firm effects.

While firm effects in actuality may not be as large as implied by Rumelt, he and others do at least find support for their existence. Furthermore, from a less theoretical approach, it is relatively easy to conceive of a list of conditions which would facilitate the existence of firm effects. Among the factors which might be on such a list are the following: product specific reputation; team specific learning; a variety of first mover advantages; and causal ambiguity which limits competitor imitation (Rumelt 1991). As for the presence of industry effects, there seems to be little debate as to their existence, though their relative size is still questionable.

Another assumption made here is that firms in highly concentrated industries will tend to follow relatively similar strategies so as not to provoke competitive responses. This is consistent with the argument made by Caves and Pugel (1980). They claim that seller concentration in an industry is directly reflective of the riskiness of market entry by smaller players and as such indirectly describes the viability of small firms in the industry. "The risk to the entrant is a direct function of barriers to entry into the industry. Thus the viability of alternative strategies that permit small firms to avoid direct confrontation with particular entry barriers should reduce the riskiness of entry and result in a lower equilibrium level of seller concentration" (Caves and Pugel 1980, p. 31).

The implication of their claim is that in concentrated industries one should expect to find a smaller set of alternative strategies. In addition to this limitation in the number of strategies resulting from the nature of the industry, I also am making the further qualification that there is actually an incentive for players in the industry to keep the number of alternative strategies low so as not to foster competitive reprisals by other players. And, while Caves and Pugel do not find any confirmatory support for their primary test of whether concentration leads to higher rates of return, they do find a tendency for profit rates to be more homogeneous among firms in concentrated industries than in unconcentrated ones. They claim that the strongest statistical relationship found is that the absolute levels of the profit slopes (which summarizes the performance of large relative to small firms) tend to be lower in more concentrated industries.

This last claim made above is dependent on the ability of an industry's members to effectively collude. I posit that collusion is more readily attained at high levels of concentration rather than intermediary levels. This is a claim which on the surface may seem noncontroversial. However, recent empirical evidence as well as theoretical models (Bernheim and Whinston, 1990) have posited that this is not necessarily the case and that one can have high levels of competition in concentrated industries. As such, it is important to more formally outline the concentration-collusion discussion. In doing so, though, it is essential to remember that the claim being made at this level of analysis is that *on average* collusion is facilitated by high levels of concentration and not that it is guaranteed by it. The next section of the paper will highlight those specific conditions under which one would expect to witness collusion and those in which one would expect competition.

In general, though, the concentration-collusion claim can be backed up by using a game theoretic approach as applied by Tirole (1988). He presents the example of a homogenous-good industry with "n" firms facing the same constant marginal cost. In a collusive equilibrium, firms would charge the monopoly price and each would receive $\pi_m/n$, which is a decreasing function of n. As such, a large number of firms reduces the profit per firm and thus the cost of being punished for undercutting. In contrast, the short-run gain from undercutting the monopoly price slightly is $\pi_m(1 - 1/n) - \varepsilon$, which increases with n. If the discount factor of future returns, $\delta$, exceeds $1-1/n$, collusion is sustainable according to this model. It implies that as the number of firms increases, the value a firm holds for future earnings, $(\pi_m/n)(\delta/(1-\delta))$, must increase through an increase in $\delta$ for collusion to be sustainable, and as such collusion itself is a decreasing function of n, and thus an increasing function of concentration.

Having provided a theoretical explanation for why one might expect on average to find the predicted variabilities in high concentration industries, it is necessary to only briefly go over why the claim for low concentration industries is low variability in returns, as it is a relatively common held assumption. As mentioned earlier, economic theory predicts that high levels of competition should result in a harmonization of profit rates. Furthermore, while not a perfect euphemism, low levels of concentration can serve as a relatively good proxy for competition. With complete free entry and exit,

firms are forced to share product spaces with other firms and as such cannot earn the differentiation rents of those firms in the medium concentration group. Empirically there is also support for this claim of low variability among unconcentrated industries. McEnally (1976) finds that industries with low entry barriers do in fact conform to this expectation.[2]

Having discussed the reasoning (summarized in Table 1) for why the question being posed in this paper is credible and why one might expect the hypothesized relationships, the next section attempts to refine the basic relationship described in Proposition 1 by highlighting those industry, market, and firm factors which may interact with concentration to conditionalize its impact on ROR variability.

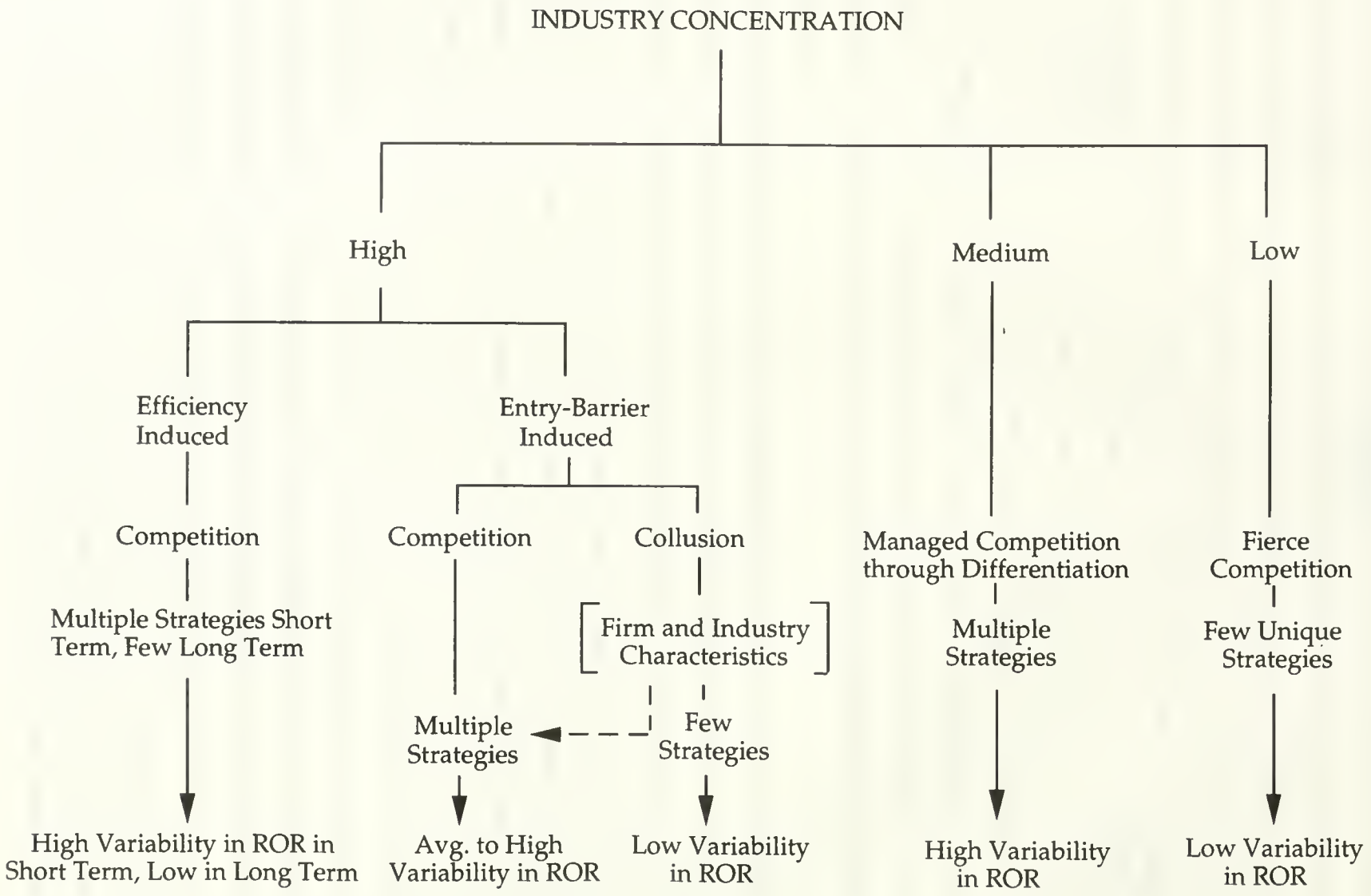
**Table 1 - Summary of Theoretical Reasoning**

| Concentration Level | Market Relations | Number of Unique Strategies | Profit Variability |
|---|---|---|---|
| High | Collusion (or Competition) | Low | Low |
| Medium | Differentiation | High | High |
| Low | Competition | Low | Low |

## *4. Extending Proposition 1*

Having argued in favor of the general relationship described in Proposition 1, the following section attempts to refine and extend the detail of this proposition by identifying the specific conditions under which high levels of concentration would predict lower levels of variability in rates of return. On the one hand, it will be shown under which conditions collusive behavior is facilitated by concentration and of those which ones support Proposition 1. On the other hand, it will also be shown under which conditions competition in concentrated industries also supports the low variability relationship. A diagrammatic version of the discussion which follows can be found in Chart 2.

**Chart 2 - Elaborated Concentration - ROR Variability Relationship**



Two additional levels of disaggregation will be expanded upon beyond the basic concentration argument. The first level analyzes the distinction between efficiency induced and entry-barrier induced concentration and what impact this distinction has on the claim made in Proposition 1. The second level then breaks down the latter group of industries whose concentration stems from entry barriers into those in which collusion is likely to occur and those in which competition persists based on a set of industry and firm attributes. The effect on intra-industry variance in rates of return is then discussed for each case.

**Efficiency vs. Entry Barriers**

As mentioned, the first level of disaggregation focuses on the distinction between efficiency and entry-barrier induced concentration. There are two key ideas which will be highlighted in what follows. The first is that even in industries in which concentration is the result of Schumpetarian efficiencies and not collusion per se, an argument can still be made as to why one would expect Proposition 1 to still hold. Secondly, it will be shown that only those entry barriers which keep new entrants out *and* at the same time discourage differentiation amongst incumbents will result in lower variability in rates of return.

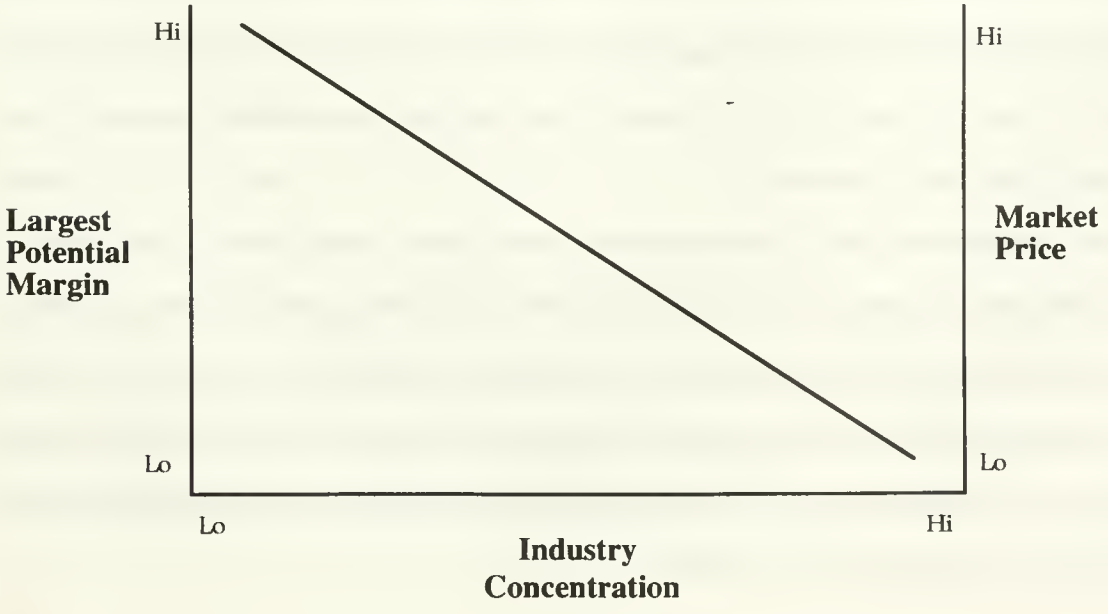
The distinction between efficiency and entry-barrier induced concentration is extreme both philosophically and normatively. The former approach views high levels of concentration as the outcome of a competitive process in which the efficient firms in the industry eventually drive out, or discourage entry by, other firms. These efficiencies can come from a host of areas, including technical superiority, better organization and management, or other firm specific characteristics. However, the key is that they are rooted in competition and not collusion.

This distinction, as advocated by Demsetz (1973), implies that efficient firms will earn Schumpetarian rents as rewards for their intrinsic efficiencies vis-a-vis their competitors. The size of these rents is in some ways correlated with the level of concentration, however. By charging a higher per unit price, the efficient firm allows more firms to enter the market, as the level of efficiency needed to have non-negative profits is decreased. Conversely, if the market leader were to charge a

price close to its unit cost, it would raise the level of concentration by driving less efficient firms out of the market. Which option is chosen will depend on the market leader's trade-off between market share and margin.

This trade-off also has implications for the disparity in rates-of-return within these industries. Working backwards, very high levels of concentration in such industries would imply, in the absence of entry barriers, that the efficient firm has opted for market share as opposed to margin, resulting in a majority of the inefficient firms exiting the market. In the long run, the only firms left in this market will be those which can meet the high efficiency standards set by the industry leader. By contrast, lower levels of concentration in these types of industries would imply the case in which the efficient firm opted for margin in lieu of market share, thus allowing less productive firms to enter the market. What this implies for the variability of rates of return within these industries is that higher levels of concentration should translate into smaller distributions of profit rates because the tail-end of the distribution is essentially cut out in the long run. This can be seen graphically in Chart 3, in which the potential variance in rates of return is proxied by the size of the largest potential margin in the industry (price - unit cost of efficient firm). The assumption of non-persistent negative profits is made.

**Chart 3 - Potential Variance in ROR vs. Market Price vs. Industry Concentration**



Therefore, in the long-run equilibrium, one would expect to find lower variability in rates of return even among highly concentrated efficiency-based industries.

The above conjectures regarding efficiency-based concentration implied the presence of a leading firm which was able to exercise considerable market control. Similar outcomes in terms of rate of return variability can also be achieved in instances in which there exist evenly distributed oligopolies. Nelson and Winter (1982) claim and show in their simulations that evenly distributed oligopolies (in the Nelson and Winter model this corresponds to the experiments run with 4 firm groupings) tend to have more stable market structures over time than evenly distributed competitive markets (16 firm groupings according to Nelson and Winter). They do claim, however, that this is dependent on the levels of two factors: productivity growth (or more generally technological change) and imitatability.

In their model, they assume half of the firms are successful innovators while half are successful imitators. In periods of low productivity growth, their model predicts a relatively stable market structure, as the critical factor in the model is itself technological change. This result is true regardless of the level of imitatability in the industry. By contrast, those industries in which productivity growth levels were high could go either of two ways. If the ability of firms to imitate is low (be it the result of patent protection, tacit knowledge, etc.), there is a tendency for those successful at innovation to be more profitable and grow faster than their rivals. Thus, in the short run, rate of return variability would increase. In the long run, however, this case would collapse down into the lopsided oligopoly described previously.

The other situation described by Nelson and Winter is the one in which productivity growth is high and imitatability is also high. In this case, one again tends to observe stable market structures with imitators being only slightly more profitable than innovators (as they do not incur the up-front costs). This difference in profitability is relatively small, however, for if it were to grow large enough that innovators started to exit the market, the engine of growth in the industry would disappear and one would end up back at the low growth scenario.

As such, the Nelson and Winter model points to imitatability as a key variable in determining the variability of profitability rates across industry competitors in concentrated industries. In two of the three cases, the low variability of returns hypothesis is supported both in the short and long run, while in the third one sees high variability in the short run but compression in the long run. Therefore, even without collusion, rationales can be presented for why industries whose concentration levels are high due to efficiency could be expected to have relatively low variability in rates of return in the long run.

The second class of concentrated industries are those in which concentration is due to entry barriers rather than efficiency. It is here that the potential for collusion among industry players is greatest, as compared to the previous set of industries in which competition over efficiency was the characteristic behavior. Barriers to entry here can take a number of forms, among them the following: legal restrictions/regulation which control entry; patents/property rights; control of scare resources; and product differentiation.

However, the simple presence of one of these barriers does not in and of itself imply that one will automatically witness collusion. They may reduce competitive pressures from new players, but they do not necessarily preclude competition among incumbents. As such, it is necessary to differentiate among these entry barriers as to those which encourage collusive behavior and those which by themselves do not. The first step in doing so is to arrive at a comprehensive list of barriers. The general approach put forth by Bain simply breaks them down into three groupings: those attributed to absolute cost advantages; those attributed to scale economies; and those resulting from product differentiation.

This breakdown, however, is still relatively crude and needs elaboration as well as extension. At this higher level of aggregation, I deem it important to also include legal entry barriers. In general, those barriers which keep potential entrants out and which at the same time do not encourage differentiation within the pool of incumbents will be supportive of Proposition 1. As such, the following discussion of entry barriers will be framed in the context of highlighting this aspect.

Starting with the traditional barriers first, one can further break down absolute cost advantages down into several subgroups. Those which have a bearing one way or another on Proposition 1 include the following: control of key resources and valuable knowledge regarding production.

With respect to the control of strategic resources, this barrier to entry also tends to limit movement within the industry. This is most easily seen in the case of mining or other resource-constrained industries. Each player has his/her own supply which reduces competitive pressures at the back end of the production process. Furthermore, in mining the end product is for the most part homogenous across firms and as such there is more incentive for firms to collude as opposed to the situation in which the potential exists for firms to differentiate themselves. In essence, the impact of key resource barriers on the likelihood of collusion is dependent on two conditions: 1) whether the barrier applies to incumbents and their desire to expand capacity; and 2) whether the final product is homogeneous across firms. If both of these conditions are met, one is both more likely to witness collusion as well as lower variability in rates of return as firms are not attempting to differentiate themselves. Anecdotal support for this claim is provided by the aluminum industry which is both the most concentrated industry in the sample as well as the one with the lowest variability in rates of return among concentrated industries.

Turning to valuable production knowledge as an entry barrier, the key is whether this knowledge is common across all incumbents or whether each has a differentiated approach. In order for the former to be the case, there must be an interaction effect with another entry barrier, e.g., scale, to prevent that knowledge from being disseminated to new entrants. As such, given the absence of any other entry barrier, one could expect to find differentiated processes amongst incumbents and as such the ability of collusion to homogenize rates of return is drastically reduced. This example need not be restricted to production knowledge. It is extendible to organizational and other tacit skills which are embedded in the histories of firms and which tend to differentiate incumbents one from another.

The second major class of barriers relates to scale economies. This type of barrier has two mechanisms by which it operates. On the one hand, scale economies can increase the size of investment needed by new entrants in order to compete in the market. This in turn will exclude those

firms which cannot obtain the needed financing. The impact on ROR variability, however, is indeterminate in this case. On the other hand, demand conditions could make it such that the market could profitably sustain only "n" players (each producing X/n). If the number of firms was to increase to n+1, the volume each would be producing could drop below the break even point. The latter reasoning serves as a stronger entry barrier as it forces incumbents to lower their rate of return to deter potential entrants, for the fear of being put into an untenable position. In such an instance, scale economies would tend to squeeze down the dispersion in rates of return as a result of threatened competition. The former reasoning regarding scale economies, without other conditionings, says nothing either way with regards to the dispersion of returns.

The third traditional group of entry barriers revolves around product differentiation (though this could also be expanded to include service differentiation). The most talked about entry barrier in this class (though sometimes disputed as to whether it really is a barrier) is advertising intensity. While advertising may serve as an effective barrier against entrants it also usually serves to differentiate incumbents one from another, thus working against Proposition 1. As such, one would not necessarily expect there to be low variability in rates-of-return amongst advertising-intensive concentrated industries. Industries which fit this criteria usually include consumer and other branded goods industries.

However, it has been shown by others such as Gisser that advertising intensity follows an inverted "U" relationship with respect to concentration so long as demand is relatively inelastic. As such, one might still find Proposition 1 holding for industries which are advertising intensive at lower levels of concentration but whose inelasticity of demand fosters collusion and lower advertising intensity at higher levels of concentration. Other differentiating factors such as high R&D expenditures tend to have the same effect of not only excluding new players from entering the market, but also of highlighting the differences amongst incumbents, and thus go against Proposition 1.

Another set of entry barriers classified under the broad heading of "legal" include government regulation, patent protection, and long-term contracting. On the one hand, certain industries, usually those deemed to be natural monopolies, are regulated as to who may enter the market. In such cases,

**Table 2 - Effect of Barriers to Entry on ROR Variability**

| General Barrier Class | Specific Barrier | Market Relations Encouraged | Effect on ROR Variab. |
|---|---|---|---|
| COST ADVANTAGES | Control of Strategic Resources | | |
| | - Homogen. End Product | Collusion | Decrease |
| | - Different. End Product | Competition | Increase |
| | Valuable Production (Tacit) Knowledge | | |
| | - Diff. Across Incumbents | Competition | Increase |
| | - Same Across Incumbents | Collusion | Decrease |
| SCALE ECONOMIES | Size of Investment (Unlimited Market) | Uncertain | Uncertain |
| | Size of Investment (Constrained Market) | Collusion | Decrease |
| PRODUCT DIFFERENTIATION | Advertising | Competition | Increase |
| | R&D | Competition | Increase |
| LEGAL | Regulation | Neither | Decrease |
| | Patent Protection | Competition | Increase |
| | Long-Term Contracting | Neither | Increase |

regulation often also covers pricing structures, and as such one could expect the variability in rates of return to be particularly low especially in the cases where it is a cost-plus pricing structure as with certain utilities. Such legal restrictions are meant to preserve homogeneity amongst incumbents. By contrast, patent protection serves to do just the opposite by fostering differentiation and as such variability in rates of return. The final form of legal constraint described here relates to long-term contractual obligations. In certain industries, where supply contracts are made for multiple years, it is all but impossible for a new entrants to enter the market. This barrier, however, also tends to reduce

the mobility of incumbents, for the longer the term of the contract, the more the situation tends to resemble the first case discussed of local monopolies with high intra-industry mobility barriers. As such, variability in rates of return would not necessarily be expected to decrease as there is neither a great incentive for collusion nor continuous competitive pressure.

To summarize, those entry barriers which tend to foster low variability in rates of return amongst incumbents are those which differentiate incumbents from potential entrants but which at the same time encourage homogeneity amongst incumbents. Caves and Ghemawat (1992) provide related support for this claim when they find that industries in which non-price attributes (indicative of product differentiation) are important, have larger variances in intra-industry profit rates. Barriers which meet the above criteria include control of strategic resources/ knowledge, scale economies under certain conditions, and government regulation. A complete summary of these conditions is shown above in Table 2.

**Firm and Other Industry Attributes**

Having identified entry barriers which foster collusive behavior, the following section attempts to identify other industry and firm attributes which conditionalize the effectiveness of the above barriers in fostering collusion and low variability in rates of return. Those factors which will be analyzed include the relative size distribution of firms in the industry; the degree of market contact; and the age of the industry structure. The analysis of the first factor is aimed at identifying the importance of symmetry in sustaining collusion. The aim of analyzing the second and third factors is to show that repeated market contact among the players in the industry is needed to help maintain a collusive equilibrium.

A key element in conditionalizing the ability of firms in concentrated industries to collude is the distribution of firm sizes within an industry, or industry symmetry. As in most studies in this area, the primary measure of concentration which will be used here is the Herfindahl index. For a given market share, it weights more heavily those industries in which one or two firms account for the majority of the market share. However, even with Herfindahl indices, one could have two different

market structures producing the same Herfindahl index (e.g., 30%, 30%, 30% =2700 vs. 50%, 10%, 10% =2700). A question which arises out of this is whether the internal market structure of concentrated industries, as not measured by the Herfindahl, affects the ability of its members to collude. Is it easier for firms of relatively equal size to collude or does the presence of an industry leader facilitate collusion?

The issue is essentially whether having one large dominant firm and several smaller ones has different implications from the situation in which there are 2-3 equally sized firms in the market. On the one hand, the presence of one dominant firm might make it easier to enforce a collusive equilibrium as compared to the situation of multiple equally-powerful firms. On the other hand, one might also presume that the market power which allows the dominant firm to foster collusion would also enable it to earn rents above and beyond those of its competitors. Such a situation would go contrary to Proposition 1, as it would lead to greater disparity in rates of return. As such, it is hypothesized that industry symmetry may be required for concentration to have the effect on the variability of rates of return which is predicted by Proposition 1.

A second influential determinant of collusive potential is the degree to which firms in the industry actually have market contact. This is true both in terms of geography and product space. On the one extreme, there is the situation in which firms in an industry occupy essentially monopolistic niches. This is most easily conceptualized in geographic terms in which firms hold monopolistic control over their local markets. Similarly, however, one could have the case of products which are classified as being in the same industry but which are not direct substitutes for each other and as such do not compete. In such cases, the presence of collusion and the resulting hypotheses on rate of return variability depend on the level of intra-industry mobility barriers. Where these barriers are high, one has something which is in reality not collusion, as individual players have no ability to influence the demand of other firms' products, but which to someone outside the industry might appear to be collusion as it promotes a stable market equilibrium. In such cases, however, where the impact of other players is weak, one is essentially in the position of comparing different industries and as such one would not expect to necessarily view lower variability in rates of return across firms.

Turning to the situation in which intra-industry mobility barriers are low, the implication is for lower variability in rates of return whether collusion is present or not. On the one hand, if firms are competing and yet firms still hold local monopolies, barring the presence of any other entry barriers, the implication is that the rates of return in the various markets should be relatively similar or else entry by players from the lower return market into the higher return one would be encouraged. The other case is when there does in fact exist collusive behavior and the rationale for low rate of return variability described earlier in the paper applies.

The counter-example to the cases described above is that in which there is a heavy degree of multimarket contact among players in the industry. Again, this can be true in terms of geography and/or product space. As in the previous case, there is the potential for either competition or collusion. As many, including Spence (1989) and Bernheim and Whinston (1990), have shown, though, multimarket oligopolistic situations tend to foster collusive behavior. As Bernheim and Whinston (p. 3) put it, "when markets are not inherently linked, it is easy to see that multimarket contact cannot reduce firms' abilities to collude. Since firms can always treat each market in isolation, the set of sub-game perfect equilibrium cannot be reduced by the introduction of multimarket contact." On the contrary, multimarket contact can help reduce the incentive constraints governing the implicit agreements between firms, thus potentially improving firms' abilities to sustain collusive outcomes. As such, one would expect to have the collusive rationale for low rate of return variability being invoked more often than in the no market contact situation.

Multimarket contact can also help to explain why collusion can lead to lower variability in rates of return even in the face of differing cost structures. Bernheim and Whinston point to "spheres of influence" as the result of collusion in a multimarket context among firms with differing cost structures. The clearest example of this is in terms of geography, where producers selling to markets outside their home market must endure transport costs which put them at a cost disadvantage relative to their competitors based in that market. The result is that firms will tend to specialize in certain areas. In the extreme case, this collapses into the no-market contact/ low intra-industry mobility barriers case. The reasoning can also be applied to the product space context in which firms will produce those

products for which their resources are better suited and for which they can earn the highest markup. As such, firms which would otherwise earn lower rates of return if they competed on all fronts, are able to specialize in just those products which earn them rates of return closer to the market leaders. As such, of the cases discussed here, the only one which goes counter to Proposition 1 is the one in which there are high intra-industry mobility barriers and as such one is essentially dealing with different industries. All others provide varying degrees of support for the idea that concentrated markets will have lower variability in rates-of-return.

Another important industry characteristic which can have a significant impact on an industry's ability to collude is how long the players in an industry have been in their current market positions and have been facing the same competitors. In concentrated industries, one might expect to find greater degrees of collusion amongst firms which have been exposed to each other for an extended period of time. This is to be expected for two reasons. On the one hand, repeated interaction by firms over time has the same impact as increased multimarket contact. It allows them to learn to cooperate and predict their competitors' reactions. On the other hand, industries in which the players are stable over time should tend to value future earnings more than industries with rapid turnover. As such, the future benefits from collusion become larger relative to the short term benefits from defecting. This is easily seen mathematically in which the partial derivative of the benefit from collusion with respect to the future discount rate, $\delta$, is positive :

$$\text{Benefit from Defecting (BD)} = \pi_m(1 - 1/n) - \varepsilon$$

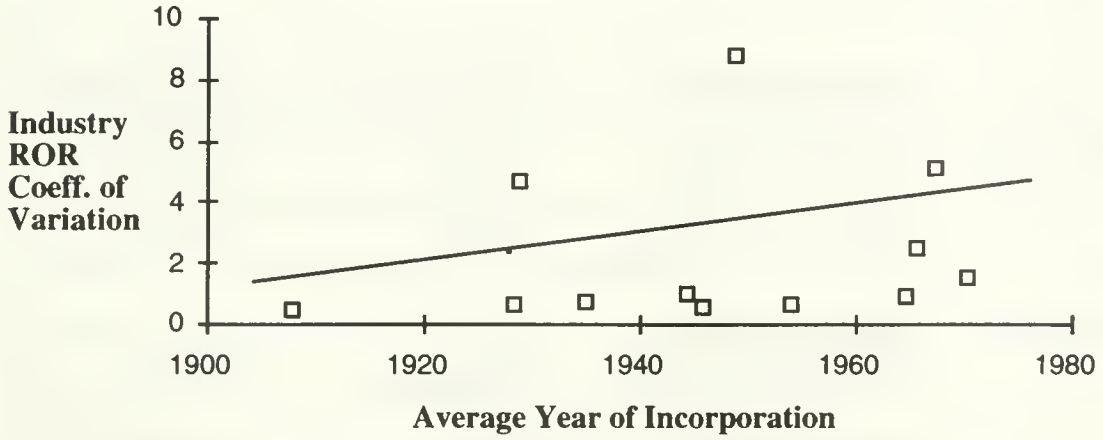
$$\text{Benefit from Collusion (BC)} = (\pi_m/n)(\delta/(1-\delta))$$

$$\partial BC/\partial\delta = (\pi_m/n)(1/(1-\delta)^2) > 0$$

The implication is that industries with "older industries" on average should tend to have lower variability in rates of return. In addition to being true as a result of increased collusive ability, a similar result would also be expected in the case of Shumpeterian competition, as the presence of older players in a competitive market would tend to imply the existence of a longer run equilibrium which, as discussed earlier, implies lower variability in rates of return.

While the age of the industry makeup and relationships within it are not necessarily equated by average firm age, it is used here as a proxy to get a rough indication of the correlation between rate of return variability and the age of the market structure. Unfortunately, due to the size of the data set, it is not credible to run any regressions solely on the concentrated industries, but as Chart 4 shows, there does appear to be a positive correlation between the youthfulness of an industry and the variability of its returns.

**Chart 4 - Industry Age vs. Variability of ROR for Concentrated Industries**
(Herfindahl>1000)




Another issue related to industry age is the rate of growth. As several authors have shown, older firms tend to grow more slowly. As such, if one translates this to the industry level, industries with older firms will tend to grow slower than ones with younger firms. Given the correlation discussed above, the implication is that industries characterized by lower growth rates will tend to have lower variability in rates of return, while those with rapid growth should expect the opposite. This is consistent with the idea that it is easier to enforce collusion under a stable equilibrium as compared to a rapidly changing one.

In addition to the age of the players, another time-related factor which affects an industry's ability to collude is the age of the market structure. Players in a recently concentrated industry may find it difficult to collude even if those players have been in the market for a long period of time

because the prior market structure did not allow it. As implied earlier, there may exist a lag in the concentration-collusion relationship. As such, one could expect greater levels of collusion and thus lower variability in rates of return from industries which not only have older players on average, but also which have been concentrated for a longer period of time.

A summary of the industry and firm attributes discussed above and their effect on rate of return variability can be found in Table 3.

**Table 3 - Effect of Industry and Firm Attributes on ROR Variability**

| Industry/ Firm Attributes | Operationalization | Market Relations Encouraged | Effect on ROR Variab. |
|---|---|---|---|
| SIZE DISTRIBUTION OF FIRMS | Lop-sided Oligopoly | Collusion | Increase |
| | Evenly-Distrib. Oligopoly | Collusion | Decrease |
| MARKET CONTACT | Low Market Contact | | |
| | - High Mobility Barriers | Neither | Increase |
| | - Low Mobility Barriers | Competition | Decrease |
| | High Market Contact | Collusion | Decrease |
| AGE | Old Firms | Collusion | Decrease |
| | Historically Concentrated | Collusion | Decrease |

## *5. Methodology*

Having laid the theoretical foundations for the proposition that highly concentrated as well as very unconcentrated industries have low variances in rates of return, this section turns to an empirical test of this claim.

### Definition of Terms

*Rate of Return:* Profitability can be interpreted and measured in a number of ways. In his review of the literature on this topic, Schmalensee (1989) lists a number of measures which have been used by authors in the field, among them rate of return on equity, rate of return on assets, price-cost margins, Tobin's q, and the value of firm securities. For the purposes of this paper, the principal measure of profitability is taken to be the pre-tax rate of return on total assets. While ideally a measure such as Tobin's q adjusted for intangible capital would be preferred, the inability to obtain accurate firm level data on advertising and R&D expenditures needed in the calculations makes the use of ROA a second best option,[3] and one which has been used by others in addressing similar topics (Schmalensee, 1985; Wernerfelt and Montgomery, 1988). Furthermore, the problems associated with using ROA are not as severe in this case in which deviations from industry averages are used as the dependent variable as opposed to absolute levels. This is because whatever common industry biases exist in terms of the reporting of profit or asset values are removed in the calculation of the dependent variable. Therefore, while this procedure does not correct for individual firm biases, it does go part of the way towards improving the quality of the data.

To measure the variance of returns by industry, the simplest measure is the standard deviation, which incorporates differences in the number of firms in each industry. However, this would still give biased results if the absolute levels of returns are not the same across industries. To correct for this problem, a coefficient of variation is developed which normalizes the standard deviation by the mean rate of return for each industry and then takes the absolute value.

$$\text{Coefficient of Variation} = \left|\text{Standard Deviation}/\text{Mean ROA}\right|$$

*Concentration:* Concentration can also be measured in a number of ways, the most common focusing around market shares. In this case, the principal concentration measure is taken to be the Herfindahl index for the market shares of the top 50 firms in each industry as reported by the U.S. Census.

*Degree of Symmetry:* A similar measure to that used in assessing the variability in rates of return is used to reflect the degree of symmetry within an industry. A coefficient of variation which divides the standard deviation of sales within an industry by the average of industry sales is calculated and serves as a proxy for the level of sales symmetry. A large coefficient implies a high degree of variability among firms in terms of size and implicitly market power, while a low coefficient would imply an evenly distributed market structure.

*Control Variables:* Aside from the primary variables described above, three control variables are also introduced. The first two are traditional industrial organization controls: advertising and R&D to sales ratios. In the context of this paper, these variables represent the degree to which the industry is dependent on the ability of firms to differentiate themselves, which according to the theory laid down here would imply higher variability in returns. The last control variable is a proxy for the degree to which the industry is exposed to competitive pressures from abroad, which would not be reflected in the Herfindahl index as it is based solely on domestic production. In this case, the value of imports as a share of total domestic production is used to proxy the level of competition from abroad.

The above variables are for the most part standard accepted proxies. And, while each has recognized drawbacks, the contribution which this paper strives to make relates to the testing of a new theoretical construct and not necessarily to the development of new measures.

Having defined the critical variables, the last major definitional challenge was to select the industries which would be included in the analysis. Unfortunately, in this instance due to limitations on the availability of data on a cross section of industries, it was necessary to use four digit SIC code definitions. It is common knowledge that the use of such classifications is imprecise for a number of reasons. As Benston (1985, p. 37) points out, "SIC definitions tend to be supply (production) rather

than demand determined, include non-homogenous products, and exclude sales of similar products that are included in different SIC groups or are imported." Furthermore, companies are classified under their primary industry code, which for diversified conglomerates could pose a problem. In this case, however, such flaws in the data work against the hypotheses posited here, for the blurring of industry boundaries would only serve to homogenize returns across SIC codes, thus leaning in favor of finding a null result. As such, these problems decrease the likelihood of finding the predicted result but do not necessarily challenge its credibility if it is found.

**Data**

The data used in the analysis come a number of sources: COMPUSTAT, the U.S. Census, and the Foreign Trade Commission. The first provided firm level data on pre-tax returns, asset values, and sales for 1987, sorted by four digit SIC code, from which coefficients of variation for rates-of-return and symmetry were calculated. From the sample of all manufacturing industries in the COMPUSTAT database, only those with data on three or more companies were put into the sample, with the range running from three to over fifty firms per industry.

The concentration measures come from the 1987 U.S. Census of Manufactures which provides Herfindahl measures for the top 50 companies in each four digit SIC code. Import figures for 1987 were obtained from a Foreign Trade Commission data bank which converts import figures from the HTSUSA classification scheme to SIC equivalents. The advertising and R&D ratios were obtained from the FTC Line of Business database for 1976. While the year does not correspond to that of the rest of the sample, this convention has been used by others (Wernerfelt and Montgomery, 1988; Acs and Audretsch, 1988) under the assumption that these ratios are relatively standard over time and in any case superior to the only other option which is to use COMPUSTAT advertising and R&D figures. The constraints imposed by the two data sets resulted in a sample size of 61 industries[4], containing over 700 firms. In addition, a second subsample was also analyzed, which included 21 industries (and over 200 firms), whose "coverage ratio" exceeded 95%. Coverage ratio, as defined by the Census, measures the extent to which all shipments of primary products in an SIC code are made

by plants classified in that SIC code. This is an attempt to obtain a list of more homogenous industries, ones in which most of the actual players in the industry are captured in the figures. However, it still does not exclude those players from also participating in other secondary industries.

**Model**

With the above variable definitions and data sets, the following quadratic regression was run:

$$R = \alpha + \beta_1 C + \beta_2 C^2 + \beta_3 S + \beta_4 SC + \beta_5 IM + \beta_6 AD + \beta_7 RD + \varepsilon$$

where R represents the coefficient of variation of returns, C the Herfindahl index of concentration, S the degree of variability of intra-industry sales, SC the interaction term between S and C, IM the ratio of imports to domestic production, AD the advertising-to-sales ratio, RD the R&D-to-sales ratio, $\alpha$ a constant, and $\varepsilon$ the error term.

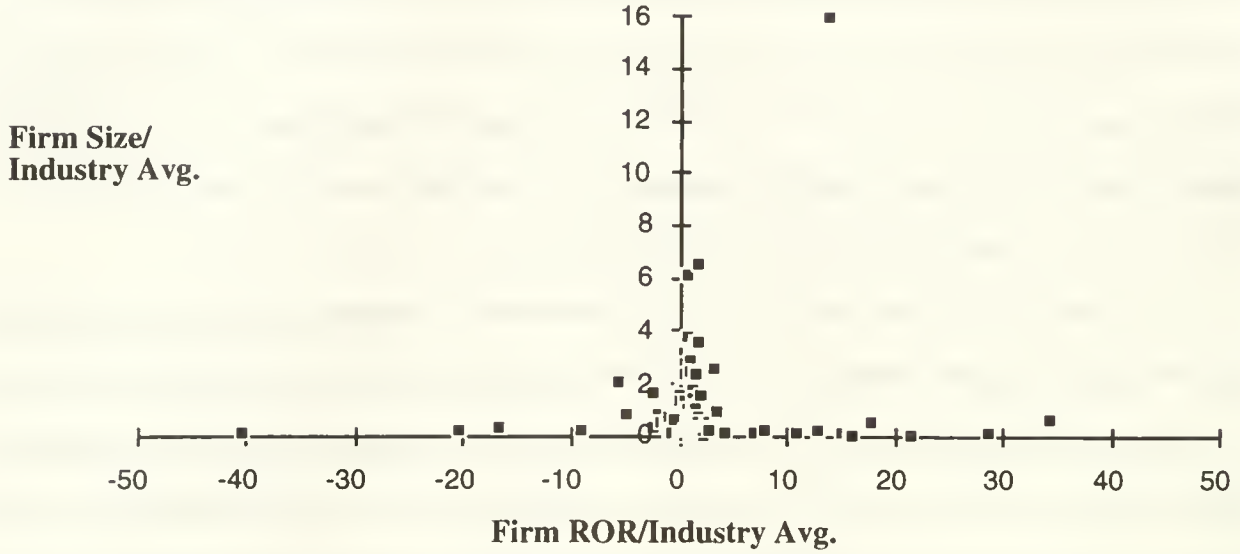
This functional form accommodates the hypothesis that industries with high levels of concentration as well as very low levels, have smaller variances in returns than those in the middle. For this hypothesis to be verified, one would expect the sign on $\beta_1$ to be positive and that on $\beta_2$ to be negative. Furthermore, for the regression curve to take the parabolic form, the absolute value of $\beta_1$ must be greater than that of $\beta_2$. In addition, given the above discussion on firm symmetry, one would expect the coefficients on $\beta_3$ and $\beta_4$ to be positive. Furthermore, higher levels of imports would tend to break down collusive potential and as such increase performance variability, thus $\beta_5$ is expected to be positive. Lastly, it is expected that the coefficients on the control variables of advertising and R&D ratios would also be positive as they represent modes by which firms attempt to differentiate themselves.

## *6. Results*

Despite the problem regarding the purity of the data, the hypothesis that high levels of industry concentration as well as low ones are correlated with lower variation in returns is generally supported. Using the main sample of 61 industries one finds that the signs of the coefficients on the concentration variables are in the directions predicted. Furthermore, the coefficient on C is significant at the 97% confidence level, while that on $C^2$ is less so at the 86% level.

As for the other variables, the sign on the symmetry term is positive as expected, implying that in general there is greater variability in returns when firms are less similar in size. However, contrary to what was expected, the coefficient on the interaction term between the symmetry and concentration variables turned out to be negative and highly significant, implying that at higher levels of concentration increases in the size differential amongst the firms actually cause the rate of return variability to decrease. Earlier in the paper it was hypothesized that an evenly distributed oligopoly would result in more similar rates of return across players as no one firm would have the market power to extract rents at the expense of its competitors. However, what these results seem to imply is that it is perhaps more difficult than was originally hypothesized for equally sized firms to collude and that it may be necessary for there to be a lead firm for collusion to occur, without which the situation reverts back to one of firms attempting to differentiate themselves. An implication of these results is that the lead firms were in fact *not* earning superior rents compared to the other firms in the industry. Support for this claim is found in Chart 5 which shows the distribution for the most concentrated industries (Herfindahl index >1000) of the deviations in firm size and rate of return from industry average. As one can see, those firms which earn the highest rates of return tend to be the smaller, not larger, players. This issue, however, is still somewhat of a puzzle and a good area for future research.

**Chart 5 - Firm Size vs. ROR Deviation from Industry Average for Concentrated Industries** (Herfindahl>1000)




With respect to the control variables, all three had the expected sign on the coefficients, but it was the R&D ratio which appeared to have the strongest and most significant impact on the dependent variable, implying that high R&D expenditures, which are characteristic of attempts at differentiation, do in fact cause rates of return to diverge. In contrast to the R&D ratio, the advertising variable was highly insignificant. What this implies is that while these two factors may both be means for differentiating oneself from one's competitors, they may have different levels of effectiveness and impact on the competitive dynamics. One way to approach this is to analyze what effect each has on the "lumpiness" of strategic actions. This is done by looking at the length of time needed by competitors to respond to a rival's actions. In the case of product or process innovations, the lag time associated with having to invest in R&D can allow the first mover to earn rents for a given period of time and thus increase the variability of intra-industry rates of return. By contrast, advertising expenditures are much more easily matched by competitors in a shorter period of time, thus reducing the length of time during which the first mover can potentially earn rents. By adopting such an approach, one would expect R&D to be more effective at differentiating that advertising and thus more pronounced in its impact on return variability.

As for the IM control variable, while its sign was in the direction predicted, it was significant only at the 89% level, potentially reflective of the crudeness of the measure.

The complete results for the regression are given in Equation (1) below with standard errors in parentheses (See Table 4 for further detail).

$$V = -1.089 + .004C - .000001C^2 + .946S - .002SC + 3.331IM + 5.330AD + 24.4RD \qquad (1)$$

(1.001) (.002) (.0000007) (.710) (.001) (2.034) (6.071) (7.510)

In addition to the larger sample of 61 industries, regressions were also run on the sub-sample of "purer" industries. For the most part, the results stayed the same, with the primary concentration variables actually increasing in significance, thus implying an even stronger relationship when "cleaner" data is used. Furthermore, the adjusted $R^2$ increases from .17 to .63. (See Equation (2) as well as Table 5 for more detail)

$$V = -2.116 + .008C - .000002C^2 + .705S - .003SC + 4.614IM - 13.861AD + 54.127RD \qquad (2)$$

(1.689) (.003) (.000001) (1.225) (.001) (5.467) (23.498) (12.833)

As was hypothesized in Section 4, the age of the market structure may have an impact on the relationship described in Proposition 1, in the sense that historically concentrated industries would find it easier to collude than newly concentrated ones. While it was not possible to obtain comparable Herfindahl indices for years prior to 1982, a regression was run of the industry variability in rates of return in 1987 on the average Herfindahl index for 1982/87. As one might expect, there were no drastic changes from the original regression, but the strength of the results was improved, indicating that incorporating historical concentration levels does improve the model. Partial support for this claim as well as the one that stable equilibria foster collusion amongst firms in concentrated industries is the fact that the two industries with the lowest variability in ROR among those with Herfindahl indices >1000 are also the two which witnessed the smallest change in concentration levels from 1982 to 1987.

**Table 4 - Regression Statistics From Main Sample**
Using Herfindahl Index of Concentration

*Regression Statistics*

| | | | |
|---|---|---|---|
| Multiple R | 0.515 | Adjust. R Square | 0.168 |
| R Square | 0.265 | Standard Error | 1.688 |
| Observations | 61 | | |

*Analysis of Variance*

| | *df* | *Sum of Squares* | *Mean Square* | *F* |
|---|---|---|---|---|
| Regression | 7 | 54.5237 | 7.7891 | 2.7333 |
| Residual | 53 | 151.0324 | 2.8497 | |
| Total | 60 | 205.5562 | | |

| | *Coefficients* | *Standard Error* | *t Statistic* | *P-value* |
|---|---|---|---|---|
| Intercept | -1.0885 | 1.0014 | -1.0870 | 0.2820 |
| C | 0.0044 | 0.0019 | 2.2512 | 0.0285 |
| C Squared | -9.7904E-07 | 7.1552E-07 | -1.3683 | 0.1770 |
| S | 0.9458 | 0.7104 | 1.3313 | 0.1888 |
| S*C | -0.0021 | 0.0010 | -2.1185 | 0.0388 |
| IM | 3.3306 | 2.0342 | 1.6373 | 0.1075 |
| AD | 5.3302 | 6.0713 | 0.8779 | 0.3839 |
| RD | 24.4757 | 7.5106 | 3.2588 | 0.0020 |

**Table 5 - Regression Statistics From Subsample**
Using Herfindahl Index of Concentration

*Regression Statistics*

| | | | |
|---|---|---|---|
| Multiple R | 0.870 | Adjust. R Square | 0.626 |
| R Square | 0.757 | Standard Error | 1.340 |
| Observations | 21 | | |

*Analysis of Variance*

| | *df* | *Sum of Squares* | *Mean Square* | *F* |
|---|---|---|---|---|
| Regression | 7 | 72.718 | 10.388 | 5.785 |
| Residual | 13 | 23.345 | 1.796 | |
| Total | 20 | 96.063 | | |

| | *Coefficients* | *Standard Error* | *t Statistic* | *P-value* |
|---|---|---|---|---|
| Intercept | -2.1159 | 1.6890 | -1.2527 | 0.2324 |
| C | 0.0084 | 0.0031 | 2.6962 | 0.0183 |
| C Squared | -2.3500E-06 | 1.1770E-06 | -1.9967 | 0.0672 |
| S | 0.7054 | 1.2255 | 0.5756 | 0.5747 |
| S*C | -0.0030 | 0.0014 | -2.1694 | 0.0492 |
| IM | 4.6142 | 5.4674 | 0.8440 | 0.4140 |
| AD | -13.8611 | 23.4983 | -0.5899 | 0.5654 |
| RD | 54.1269 | 12.8335 | 4.2176 | 0.0010 |

## *7. Conclusions*

As was mentioned in the introduction, this paper was meant to accomplish two objectives, one nested inside the other. On a more specific level of analysis, this paper has addressed the relationship between seller concentration and intra-industry variability in rates of return. By having first reviewed the literature, it was shown that although much work has been done on trying to understand the concentration-profitability relationship, the majority of it has focused on absolute levels of profitability. Even those studies which have looked at variances have, for the most part, conducted their analysis only at the industry or firm level, rarely combining the two.

Furthermore, most of the literature assumes and attempts to model linear relationships between these variables. Justifications have been given and empirical evidence presented as to why this may not be an accurate depiction. It was shown that both high and low concentration industries are likely to have low variances in rates of return, either as a result of collusion or high levels of competition. By contrast, those industries in the middle, in which firms compete through differentiation, tend to show higher levels of variability. Attempting to model this relationship in a linear fashion would produce a null result.

In addition, the paper focused on refining Proposition 1 by highlighting those entry barriers and industry/ firm attributes which interact with high levels of concentration to result in low variability in rates of return within an industry. While it was not possible to empirically test all the variables at this level due to current data limitations, several testable hypotheses were put forth for future research.

In addition to those described in the paper, there are several other avenues by which this line of research could be pushed forward. The most obvious route for further research would be to test the same hypotheses on a larger (both in terms of number of industries and years) and potentially purer data set such a the FTC Line of Business database. In addition, further work is needed on adjusting the concentration measures for the effect of globalization. In some industries simply accounting for imports does not accurately reflect the international competitive dynamics and it may be necessary to use international concentration measures, though on average it has been shown that the differences do not tend to be large. The area, though, which is in need of the most work is that of exploring in more

detail differences in firm resources. While the issue was touched upon in the second part of the paper, a further elaboration of potential firm heterogeneity in resources and its impact on the propositions made here is needed.

Though the question addressed here is embedded in one of the oldest fields in business strategy, it has received relatively little direct attention, and as was just shown there are still many avenues with which to push this line of research. This question promises to be not only a challenging academic issue but also one which could have strong implications for practitioners, both in terms of investment and risk management as well as more general corporate strategy.

The second objective of this paper was to show that by combining the levels of analysis of the "classical" and "revisionist" schools and incorporating both firm and industry characteristics, one can improve the explanatory power of structural aspects such as concentration. Such an approach is also ripe for being applied to other aspects of industry structure.

## APPENDIX 1: MAIN SAMPLE DATA (N=61)

| "SIC" Code | Coeff. of Variation (V) | Herf50 (C) | Sales Symmetry (S) | Imports/ Shipments (IM) | Advert./ Sales (AD) | R&D/ Sales (RD) |
|---|---|---|---|---|---|---|
| 2011 | 0.26 | 403 | 0.86 | 0.059 | 0.006 | 0.001 |
| 2013 | 0.22 | 222 | 1.94 | 0.007 | 0.006 | 0.001 |
| 2015 | 1.39 | 305 | 1.03 | 0.037 | 0.008 | 0.001 |
| 2024 | 1.91 | 276 | 1.01 | 0.000 | 0.015 | 0.003 |
| 2211 | 0.76 | 640 | 0.87 | 0.188 | 0.081 | 0.006 |
| 2621 | 0.35 | 432 | 0.91 | 0.167 | 0.003 | 0.005 |
| 2631 | 0.13 | 431 | 0.80 | 0.009 | 0.000 | 0.003 |
| 2731 | 0.28 | 259 | 1.14 | 0.057 | 0.063 | 0.007 |
| 2761 | 0.41 | 448 | 1.14 | 0.000 | 0.001 | 0.008 |
| 2821 | 0.66 | 248 | 0.67 | 0.034 | 0.003 | 0.027 |
| 2834 | 4.16 | 273 | 1.60 | 0.047 | 0.042 | 0.100 |
| 2835 | 2.12 | 624 | 3.65 | 0.066 | 0.191 | 0.024 |
| 2836 | 3.08 | 676 | 1.20 | 0.066 | 0.191 | 0.024 |
| 2842 | 1.87 | 609 | 0.99 | 0.006 | 0.080 | 0.018 |
| 2844 | 1.85 | 397 | 2.00 | 0.035 | 0.143 | 0.023 |
| 2851 | 0.35 | 258 | 1.44 | 0.014 | 0.019 | 0.031 |
| 2911 | 1.20 | 435 | 1.37 | 0.103 | 0.002 | 0.002 |
| 3011 | 0.59 | 1897 | 1.20 | 0.176 | 0.019 | 0.019 |
| 3081 | 0.67 | 226 | 1.22 | 0.054 | 0.009 | 0.016 |
| 3241 | 0.70 | 398 | 0.88 | 0.102 | 0.001 | 0.001 |
| 3312 | 0.75 | 607 | 1.42 | 0.179 | 0.001 | 0.005 |
| 3334 | 4.62 | 1934 | 0.61 | 0.270 | 0.002 | 0.011 |
| 3443 | 1.37 | 81 | 1.20 | 0.025 | 0.002 | 0.036 |
| 3448 | 1.85 | 286 | 0.39 | 0.043 | 0.015 | 0.003 |
| 3452 | 0.70 | 120 | 0.86 | 0.166 | 0.006 | 0.008 |
| 3523 | 1.36 | 802 | 1.16 | 0.205 | 0.006 | 0.023 |
| 3531 | 5.05 | 903 | 1.95 | 0.198 | 0.004 | 0.033 |
| 3537 | 0.64 | 366 | 0.53 | 0.230 | 0.005 | 0.028 |
| 3541 | 3.21 | 350 | 0.79 | 0.361 | 0.008 | 0.023 |
| 3555 | 0.44 | 729 | 1.55 | 0.037 | 0.008 | 0.028 |
| 3561 | 1.20 | 192 | 1.60 | 0.126 | 0.004 | 0.022 |
| 3562 | 1.28 | 966 | 1.16 | 0.165 | 0.004 | 0.012 |
| 3564 | 2.01 | 123 | 1.05 | 0.276 | 0.006 | 0.009 |
| 3567 | 2.99 | 135 | 0.43 | 0.099 | 0.004 | 0.012 |
| 3571 | 7.97 | 693 | 1.26 | 0.222 | 0.004 | 0.085 |
| 3572 | 5.92 | 901 | 1.18 | 0.222 | 0.004 | 0.085 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 3575 | 1.02 | 588 | 1.02 | 0.222 | 0.004 | 0.085 |
| 3577 | 1.52 | 2066 | 1.40 | 0.222 | 0.004 | 0.085 |
| 3578 | 0.97 | 856 | 1.19 | 0.222 | 0.025 | 0.070 |
| 3585 | 0.63 | 368 | 0.98 | 0.071 | 0.011 | 0.017 |
| 3612 | 0.73 | 706 | 1.23 | 0.081 | 0.002 | 0.015 |
| 3621 | 1.44 | 436 | 1.49 | 0.175 | 0.002 | 0.013 |
| 3634 | 0.51 | 565 | 1.00 | 0.161 | 0.044 | 0.016 |
| 3651 | 2.14 | 559 | 1.54 | 0.675 | 0.031 | 0.017 |
| 3672 | 1.45 | 108 | 0.63 | 0.237 | 0.000 | 0.043 |
| 3678 | 0.94 | 1011 | 1.30 | 0.086 | 0.007 | 0.022 |
| 3714 | 0.68 | 1558 | 1.48 | 0.208 | 0.007 | 0.009 |
| 3721 | 8.81 | 1686 | 0.77 | 0.050 | 0.001 | 0.101 |
| 3724 | 0.63 | 2201 | 1.31 | 0.063 | 0.001 | 0.162 |
| 3728 | 2.85 | 652 | 1.19 | 0.116 | 0.001 | 0.101 |
| 3812 | 0.81 | 401 | 2.15 | 0.007 | 0.004 | 0.049 |
| 3821 | 0.71 | 571 | 0.44 | 0.099 | 0.001 | 0.057 |
| 3823 | 0.64 | 215 | 2.45 | 0.099 | 0.001 | 0.057 |
| 3825 | 5.70 | 446 | 2.06 | 0.045 | 0.001 | 0.057 |
| 3826 | 1.54 | 293 | 1.43 | 0.099 | 0.001 | 0.057 |
| 3827 | 0.62 | 469 | 0.51 | 0.099 | 0.001 | 0.057 |
| 3842 | 1.60 | 339 | 1.06 | 0.032 | 0.017 | 0.039 |
| 3844 | 2.44 | 2003 | 0.46 | 0.033 | 0.017 | 0.039 |
| 3845 | 3.38 | 434 | 1.80 | 0.033 | 0.017 | 0.039 |
| 3861 | 0.52 | 2241 | 1.33 | 0.182 | 0.028 | 0.072 |
| 3949 | 4.53 | 94 | 0.71 | 0.250 | 0.037 | 0.008 |
| Average | 1.82 | 648 | 1.21 | 0.125 | 0.020 | 0.033 |

## APPENDIX 2: SUBSAMPLE DATA (N=21)

| "SIC" Code | Coeff. of Variation (V) | Herf50 (C) | Sales Symmetry (S) | Imports/ Shipments (IM) | Advert./ Sales (AD) | R&D/ Sales (RD) |
|---|---|---|---|---|---|---|
| 2011 | 0.26 | 403 | 0.86 | 0.059 | 0.006 | 0.001 |
| 2013 | 0.22 | 222 | 1.94 | 0.007 | 0.006 | 0.001 |
| 2015 | 1.39 | 305 | 1.03 | 0.037 | 0.008 | 0.001 |
| 2621 | 0.35 | 432 | 0.91 | 0.167 | 0.003 | 0.005 |
| 2731 | 0.28 | 259 | 1.14 | 0.057 | 0.063 | 0.007 |
| 2761 | 0.41 | 448 | 1.14 | 0.000 | 0.001 | 0.008 |
| 2834 | 4.16 | 273 | 1.60 | 0.047 | 0.042 | 0.100 |
| 2851 | 0.35 | 258 | 1.44 | 0.014 | 0.019 | 0.031 |
| 2911 | 1.20 | 435 | 1.37 | 0.103 | 0.002 | 0.002 |
| 3011 | 0.59 | 1897 | 1.20 | 0.176 | 0.019 | 0.019 |
| 3241 | 0.70 | 398 | 0.88 | 0.102 | 0.001 | 0.001 |
| 3312 | 0.75 | 607 | 1.42 | 0.179 | 0.001 | 0.005 |
| 3334 | 4.62 | 1934 | 0.61 | 0.270 | 0.002 | 0.011 |
| 3448 | 1.85 | 286 | 0.39 | 0.043 | 0.015 | 0.003 |
| 3452 | 0.70 | 120 | 0.86 | 0.166 | 0.006 | 0.008 |
| 3531 | 5.05 | 903 | 1.95 | 0.198 | 0.004 | 0.033 |
| 3562 | 1.28 | 966 | 1.16 | 0.165 | 0.004 | 0.012 |
| 3585 | 0.63 | 368 | 0.98 | 0.071 | 0.011 | 0.017 |
| 3612 | 0.73 | 706 | 1.23 | 0.081 | 0.002 | 0.015 |
| 3721 | 8.81 | 1686 | 0.77 | 0.050 | 0.001 | 0.101 |
| 3861 | 0.52 | 2241 | 1.33 | 0.182 | 0.028 | 0.072 |
| Average | 1.66 | 721 | 1.15 | 0.104 | 0.012 | 0.022 |

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## *Notes*

[1] A meta-analysis of the studies reviewed by Weiss was attempted for the empirical section of this paper. However, none of the studies report the needed standard errors of profitability by concentration level, reflective of the lack of attention to this issue.

[2] McEnally's results for concentrated industries are opposite those expected here but he bases his results on a sample of only five industries and does not differentiate between levels of concentration within this sample.

[3] Wernerfelt and Montgomery (1988) discourage the use of COMPUSTAT firm data for advertising and R&D measures as they are often inaccurate or missing.

[4] In addition, SIC codes for industries not elsewhere classified (n.e.c.) were excluded as were six outlying industries for which there were reasons to believe the data was not accurate.