

# The Two Faces of Competition: Dynamic Resourcefulness and the Hypercompetitive Shift

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## Abstract

Competition in the American economy has fundamentally changed over the last few decades, from static to dynamic. This study labels this important change the *hypercompetitive shift*, and documents it across 200 industries of the US manufacturing sector during 1958 to 1991. For industries that undergo a hypercompetitive shift, there is an increase in the cross-firm variance in performance and a rotation in the value-rivalry relationship from a negative association to an inverted-U. As a consequence of these competitive changes, the strategic focus of firms shifts from careful exploitation of given, highly durable strategic assets to the steady creation of many new, rapidly depreciable ones.

The key driver of hypercompetitive shift is the *dynamic resourcefulness* of an industry, or the ease with which new strategic assets can be created. Determinants of dynamic resourcefulness include the dynamism of related transactors (notably consumers and suppliers), the knowledge base of the industry, and structural conditions that promote easy entry. (*Hypercompetitive Shift; Dynamic Competition; Schumpeterian Competition; Dynamic Resourcefulness*)

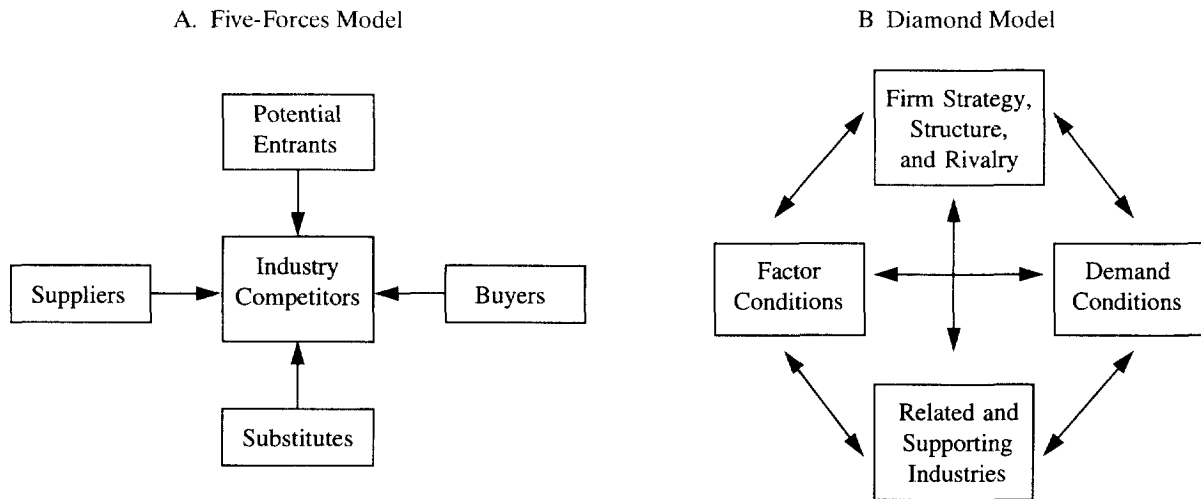
## Introduction

Competition has two faces, or two distinct impacts on firms. On one side, *static competition* takes technology as given, thereby forcing firms to compete on price and costs. Static competition reduces the value of the firm by denying it cashflows. Greater competition lowers prices and/or raises costs of providing services, thus reducing profits and depreciating strategic assets. On the other side, *dynamic (or Schumpeterian) competition* changes technology at various points of the value chain, challenging firms to compete in completely new ways. As firms in an industry transform their technologies, they create different strategic assets that bring them new streams of cashflows. Thus competition can be a benefit or a detriment to a firm depending on whether it is primarily static or dynamic.

Which face does competition really show? This study examines this question for industries of the U.S. manufacturing sector during 1958 to 1991. The principal finding is that the overall nature of competition in the U.S. economy has dramatically changed during these three and one-half decades. In the early years of the study, static competition dominated. But by the final, most recent years, dynamic competition clearly dominates. This change from static to dynamic competition, a trend ignored by most strategy models, is called the *hypercompetitive shift*, a term adapted from D'Aveni (1994). In addition to this trend over time, the study finds that whether competition is static or dynamic varies with the instruments of rivalry among firms and with the structural propensity of an industry to produce new strategic assets. The latter propensity is described as the *dynamic resourcefulness* of an industry.

The plan of this paper is as follows. The next two sections provide theoretical context. The distinction between static and dynamic competition is examined in more detail, and the concept of dynamic resourcefulness of an industry is defined and explored. Three conditions are identified under which competition in an industry is likely to be dynamic: (1) hypercompetitive industries, having structural features that promote dynamic competition, (2) the hypercompetitive shift, as competition becomes more dynamic with a secular trend on average across all industries, and (3) hypercompetitive behaviors, instruments of rivalry that are likely to trigger dynamic competition. Then the methodology of the study is outlined in terms of measurement, data sources, and estimation issues. After the empirical findings are reported, the conclusion summarizes the findings on the hypercompetitive shift and notes their strategic implications. Appendix A presents in detail the estimation technique (maximum pseudo-likelihood) and Appendix B examines various limitations and extensions of the empirical findings.

Figure 1 Two Models of the Determinants of Corporate Success



**Theory: The Two Faces of Competition**

What makes a firm successful relative to others in an economy? Few issues are more hotly debated in strategic management and industrial economics (for reviews of this debate, see Grant (1991a), Winter (1995), and Porter (1991)). To place this in the context of that debate, two well-known models of corporate success are contrasted, though of course other versions of these models and even other models could be comparably used.<sup>1</sup>

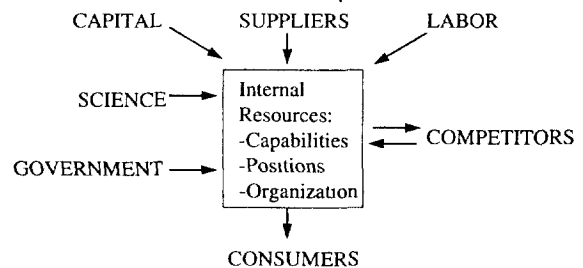
On the left in Figure 1 is the Five Forces restatement of the Structure-Conduct-Performance model by Porter (1979a, 1980), and on the right is the Diamond model by the same author (1990, 1990b). At first glance, they are the same "model," in that both are nothing more than an iteration of participants in an industry, with a few quirks. Consumers of a firm's products and services are listed twice in each model, as "substitutes" and "buyer power" in the Five Forces model and as "demand conditions" and "related industries" in the Diamond model. (This last point is also made by Grant (1991b).) Further, these models offer very Anglo-Saxon iterations in which government, capital markets, and the institutions of science are excluded and invisible. A more comprehensive listing of industry participants is given in Figure 2.

Clearly, the important differences between the Five Forces and Diamond models cannot lie in the particularities of how the more comprehensive iteration of industry participants in Figure 2 is reduced to specific listings in Figure 1. Rather, the difference between the two models is in the assumed underlying nature of competition itself. In the Five Forces model, we are in

a world of static or non-Schumpeterian competition, with given strategic assets. The focus is on cashflows from higher prices and restrained costs, achieved by low rivalry among a given and clearly identifiable set of competitors. Competition is damaging to success in the world represented by this model. Such turbulence reduces the ability of firms to tacitly collude for higher prices and restrained costs, and it interferes with the ability of current competitors to successfully exclude new entrants despite the high profits of existing firms. In this world of static technology, rivalry unambiguously reduces the value of the firm to its owners. Additionally, strong buyers, strong suppliers, activist government, and strong labor organizations undermine success for firms by reducing their ability to collude/exclude and by creating countervailing bilateral monopolies.

Porter's own words leave no doubt as to the static nature of competition in the Five-Forces model. "Competition in an industry continually works to drive down the rate of return on invested capital toward the com-

Figure 2 The Network Model: The Firm as Resources in a Network of Relationships



petitive floor rate of return" (1980, p. 5; also 1979a, p. 137). It is not just direct rivalry that threatens profits in this world of static technology. "Suppliers can exert bargaining power on participants in an industry by raising prices or reducing quality. Powerful suppliers can thereby squeeze profitably out of an industry." And "customers likewise can force down prices, demand higher quality or more service, and play competitors off against each other—all at the expense of industry profits" (both Porter 1979a, p. 140; also 1980, pp. 24, 27). The bottom line under such circumstances is that "the corporate strategist's goal is to find a position in the industry where his or her company can best defend itself against these forces" (Porter 1979a, pp. 137, 145; also 1980, pp. 4, 29). The completely static nature of the underlying technology in this world is transparent. Especially note Porter's summary injunction to find *a position* (clearly static) on which to found corporate strategy.

The non-Schumpeterian nature of the Five Forces model is sometimes obscured by confusion over use of the term "dynamic." The actual mechanics of competition in the Five Forces model, of course, occur over time. Collusion, exclusion, and bargaining with powerful related transactors such as key suppliers thus acquire "dynamic" aspects such as reputation, signaling, promises/threats, and so on. Nonetheless, for rivalry, entry, and related transactors to unambiguously damage the value of the firm requires a world of static technology and non-Schumpeterian competition. Note the semantic ambiguity of the term "dynamic competition" as meaning either competition over time or competition through innovation, with only the latter constituting dynamic competition in the sense of Schumpeter (1934).<sup>2</sup>

In the Diamond model, however, we are in a world of truly dynamic, Schumpeterian competition. The focus of the model is on the creation of new strategic assets at various points of the value chain, driven by rivalry among a shifting set of powerful firms. Rivalry is essential to corporate success in this brave new world. Competitive challenge is what compels firms to break down old ways of business and what enables them to create new ways of doing business. Further, powerful related transactors such as strong buyers, strong suppliers, activist government, and strong labor organizations are critical to success in dynamic competition. Their strength and dynamism add to the challenge facing firms, and these strong external transactors offer their own new technologies and new approaches.

Again, Porter's own words leave no doubt as to the dynamic or Schumpeterian nature of competition in

the Diamond model. "Companies achieve competitive advantage through acts of innovation" (1990b, p. 74). "Innovation and change are inextricably tied together. But change is an unnatural act, particularly in successful companies; powerful forces are at work to avoid and defeat it" (1990b, p. 75). Innovation is seen as powered by intense rivalry and by strong related transactors. "Rivalry creates pressure on companies to innovate and improve. Local rivals push each other to lower costs, improve quality and service, and create new products and processes" (1990b, p. 82; also 1990a, p. 118). And "demanding buyers provide a window into advanced customer needs, they pressure companies to meet high standards; they prod them to improve, to innovate, and to upgrade into more advanced segments" (1990b, p. 79; also 1990a, p. 89). By 1990, Porter's ultimate strategic commandment of 1979/1980, that firms should find "a position" to shield themselves from competitive forces is now seen as one of the "all-too-easy escape routes that appear to offer a path to competitive advantage, but are actually short-cuts to failure" (1990b, p. 89). Instead, the new strategic injunction is for managers to provide "leadership that harnesses and amplifies competitive forces to promote innovation and upgrading" (1990b, p. 89).

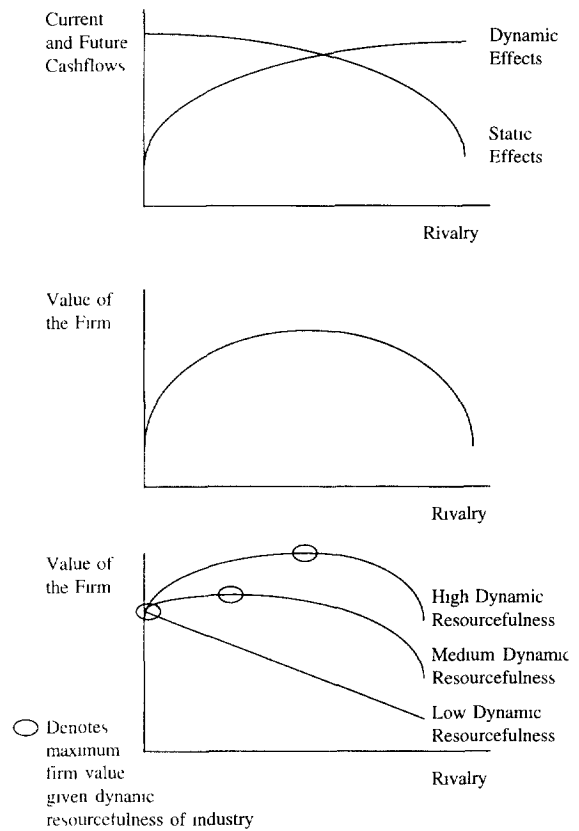
How do we reconcile these two very different views of competition? Let us begin with the pronounced irony that Schumpeter (1942) himself argued that innovation is best advanced by reduced rivalry, contrary to the Diamond model. Indeed, for decades of empirical research in industrial economics, the "Schumpeterian hypotheses" meant precisely the argument that large firms in highly concentrated industries are more innovative than other firms. Schumpeter posed his hypotheses out of concern about the very basic question of how firms raise the necessary cashflows to fund creation of new strategic assets. His concerns appear to be a mix of the cashflow issues of the Five Forces model and the challenge issues of the Diamond model. And indeed, Schumpeter's concerns would seem to have significant validity. For example, Chrysler's development of minivans and purchase of the Jeep division of American Motors saved and transformed the firm. The near bankruptcy of Chrysler in 1979 certainly challenged the firm to develop these new competitive niches, but a U.S. government bailout was a necessary antecedent (Reich 1985). Similarly, Airbus has developed significant capabilities and market positions in the commercial aviation market. The price for development of those resources was some \$20 billion in loans from various European governments (Tyson 1992). As a third example, low domestic prices for ethical drugs set

through government regulations have certainly challenged French pharmaceutical firms—right into competitive oblivion—by denying them adequate resources to perform R & D for major innovations (Thomas, 1994). Clearly, the cashflow issues that are the focus of static competition do not suddenly evaporate simply because dynamic competition occurs.

Thus we see that Schumpeterian rivalry really shows both faces of competition. Dynamic effects from rivalry challenge firms to develop new strategic assets generating future cashflows, but static effects remain, reducing current cashflows. An important reconciliation of those two effects of rivalry was provided by Scherer (1967b, 1980), whose argument is adapted in Figure 3.<sup>3</sup> At low levels of rivalry, the dynamic effects of rivalry dominate (see the top panel of Figure 3). Increases in rivalry from zero would do little to change the cashflows from present strategic assets (minimal static effects), but would importantly spur firms to create new strategic assets that would generate future cashflows (large dynamic effects). Thus at low levels of rivalry, rivalry and innovative effort (hence the value of the firm) would be positively correlated. At very high levels of rivalry, however, static effects dominate. The dynamic benefits from greater rivalry plateau, while the static costs mount. Thus at high levels of rivalry, rivalry and innovative effort (hence firm value) are negatively associated. Overall, the rivalry-innovation relationship would be “inverted-U,” with some optimal level of rivalry (see the middle panel of Figure 3).<sup>4</sup> Thus both faces of competition are incorporated in the model. Scherer (1967a) provided empirical support for his inverted-U hypothesis, subsequent theory development was offered by Kamien and Schwartz (1976), and further empirical confirmation was provided by several researchers, including Scott (1984) and Levin, Cohen, and Mowery (1985). For excellent surveys of these issues, see Cohen and Levin (1989) and Cohen (1995).

The first postulated main effect of the theory is the inverted-U relationship. The second postulated main effect arises from recognition of the high variance in performance across firms in dynamic competition, so that not all firms benefit. Dynamic competition involves the introduction of new products, new processes, and new organizations that will become new strategic assets for the firm—if the firm is lucky. Many if not most of such innovative efforts by firms in fact fail. As a consequence, some firms gain in competitive position and their immediate competitors lose. The analysis to this point has considered only the average impact of rivalry. Here we see that though rivalry may well increase the average value for firms in an industry (the

**Figure 3 Rivalry, Cashflows, and Value**



left arm of the inverted-U), it will increase the variance as well. As the experiences of firms diverge, corporate success will depend less and less on the “shared assets” (to use Porter’s 1979b term) of the industry such as the general price level and the intensity of demand. Instead, as an industry undergoes a hypercompetitive shift, the source of corporate success moves internal to the firm, toward its ability to create new strategic assets as old ones depreciate ever more rapidly.

The two main effects in this study thus concern changes in firm stock market values due to escalating industry rivalry. The dependent variables for analysis are industry means and intra-industry variances for *changes in stock market value* of firms in the industry. Those values can be readily measured, and indeed several alternate measures are examined in Appendix B. The independent variables for analysis are *escalations in rivalry*, for which measurement is more difficult. The most common approach historically has been to proxy the level of rivalry at a given point of time, not changes in rivalry over time. That traditional approach has proved highly controversial and ultimately unimpressive. The early investigations of the “Schum-

petarian hypotheses" in industrial economics, for example, used concentration as a crude inverse proxy for rivalry. A series of studies have cast severe doubt on the validity of that proxy, including those by Demsetz (1973) documenting the diversity of returns among firms in concentrated industries, by Peltzman (1977) and Salinger (1990) documenting that increased concentration reduces industry prices, and by Porter (1979b), Ravenscraft (1983), and Schmalensee (1985) documenting that concentration reduces industry profitability. These newer studies all challenge the traditional interpretation that concentration is associated negatively with rivalry, and strongly suggest that concentration is instead a result of efficiency differences across firms.

Fortunately, for this study we are not directly interested in measuring rivalry *per se*. Instead we are concerned with measuring the challenge that rivalry exerts for firms in an industry. The static effects of challenge are reduced current cashflows and the dynamic effects are the future benefits of innovations. For both static and dynamic effects, then, we do not measure rivalry directly, but rather measure the impact of rivalry on cashflows. For example, the most obvious measure of challenge arises when prices fall while industry output and unit costs are constant (in formal terms, prices fall *ceteris paribus*). By far the most likely cause of declining prices *ceteris paribus* is indeed increased rivalry among firms in the industry. As a consequence, the core independent variables of this study are changes in unit sales, prices, and costs—all of which drive industry cashflows.<sup>5</sup> A reduction of industry prices *ceteris paribus* implies escalating industry challenge and signals greater competition, as do increases of unit costs *ceteris paribus*.

The two core empirical issues examined in this study are the mean value-rivalry relationship for firms in an industry and the within-industry variance around that mean. If competition is primarily static, escalating rivalry (reduced cashflows) will lower the average value of firms in an industry and the intra-industry variance in performance will be small. Essentially, current cash-flow effects shared by all firms in the industry will dominate any effects of changes in technology that are heterogeneous across firms. Conversely, if competition is primarily dynamic, the value-rivalry relationship will be an inverted-U, so that rivalry will increase average firm value at least initially, and the intra-industry variance in performance will become larger. Firms will be forced by escalating rivalry to innovate and to create new strategic assets, and those dynamic effects will augment value for firms on average, though with higher variance.

**Figure 4 Two Main Effects**

Mean Performance Denoted by Heavy Line  
Range of One Standard Deviation Denoted by Shaded Area

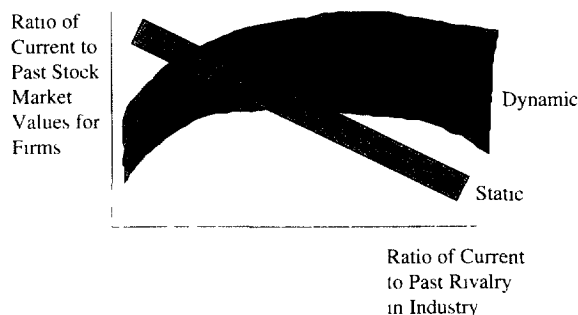


Figure 4 summarizes the two main effects that are the core expectations of the study. Under static competition, increased rivalry will monotonically decrease the stock market value of firms on average, and the realized effects on individual firms will not deviate much from the industry average effect. The mean effect on firms in the industry is denoted by the heavy declining line: one standard deviation around the mean effect is denoted by the shaded area around the line. Under dynamic competition, increased rivalry will have a non-linear impact on the average stock market value for firms, but with much greater variance in impact.

### Theory: Dynamic Resourcefulness and Hypercompetition

The argument thus far is that under static competition, expected firm value monotonically declines with rivalry and has little variance, whereas under dynamic competition, expected changes in firm value are related to escalating rivalry with an inverted-U shape and the interfirm variance is high. These two discrete models can be linked by positing a contingency factor: the innate propensity of an industry to create new strategic assets, here called the *dynamic resourcefulness* of the industry. Dynamic resourcefulness varies widely across industries. In an industry where it is low, the creation of new strategic assets is very difficult. For such industries, competition is essentially static as there are few or no dynamic benefits from rivalry. Rivalry and firm value are then unambiguously negatively related (see the bottom panel of Figure 3). In industries of medium dynamic resourcefulness, rivalry will generate some dynamic effects, though the value-rivalry curve will be rather flat. In industries of high dynamic resourcefulness, here called *hypercompetitive industries*, we observe

the true inverted-U (again, see the bottom panel of Figure 3).

It is useful to contrast the concept of dynamic resourcefulness with two other concepts in strategic management. First, the *resource-based view of the firm* presents corporate success as derived from firm-specific efficiency rents as opposed to industry-wide monopoly rents. The latter (monopoly) approach is of course the basis of the Five Forces model. In contrast, hypercompetition is driven by the rapid creation of new firm-specific resources, and thus represents a dynamic application of the resource-based view of the firm—hence the term “dynamic resourcefulness.” But note that hypercompetitive industries also involve the rapid depreciation of strategic assets, be they based in efficiency or in monopoly. Hence, though hypercompetition is consistent with the resource-based view of the firm, the reverse need not be true—a completely static industry with no monopoly but stable, large efficiency rents would not in fact be hypercompetitive. Such an industry (one of static efficiency) seems to be the type described by Demsetz (1973). Note then that this study cannot be construed as providing evidence for the historical validity of the Five Forces model, but merely evidence that whatever validity it may once have had has depreciated with time. The study findings indicate a shift away from static competition, be it monopoly based or efficiency based.

The second related concept in strategic management is *resource munificence*. An industry is munificent in resources if firms have large cashflows from either efficiency or monopoly sources. Essentially, resource munificence is *static resourcefulness*, or the static equivalent of dynamic resourcefulness. Resource munificence refers to the presence of strategic assets. Dynamic resourcefulness refers to the ability to generate new strategic assets that will generate future cashflows. A dynamically resourceful industry has a balance between resource munificence (static resourcefulness) and challenge, as discussed previously.

### Hypercompetitive Industries

What attributes of an industry are likely to make it more dynamically resourceful than most other industries, and thus more likely to be hypercompetitive? Several recent studies can be adapted to answer this question. In the strategic management literature, D’Aveni (1994) identified four industry factors as drivers of hypercompetition: (1) consumer demand, (2) the knowledge base of firms and associated workers, (3) the declining height of entry barriers, and (4) the increasing frequency of alliances among firms—one

driver for each of his “arenas.” In the industrial economics literature, numerous “post-Schumpeterian” studies (for surveys, see Cohen and Levin (1989) and Cohen (1995)) have identified three sets of industry factors associated with high levels of innovative activity: appropriability conditions, consumer demand, and technological opportunity. Those three factors are in addition to firm size and industry concentration that were the focus of “traditional Schumpeterian” industrial economics.

The intersection of these sets of studies suggests three industry factors that make some industries more dynamically resourceful than others.

1. *Transactor dynamism*, or features of demand and supply that both push and nurture innovation in an industry. An example of how related transactors forced innovation is provided by how the dynamism of demand forced a hypercompetitive shift in the U.S. petroleum industry in the 1930s (Comanor and Scherer 1995).<sup>6</sup> Among the many factors used in the neo-Schumpeterian literature as empirical proxies for the dynamism of related transactors are (1) the growth rate of demand, which facilitates new technologies and firms and rewards innovation, (2) the inelasticity of demand, which makes possible higher prices and greater rewards for innovation, and is proxied by the percentage of final demand due to consumers (versus industry and government), and (3) the technical sophistication of suppliers, which both challenges and aids firms in the industry to innovate, and which is inversely proxied by the percentage of supply due to raw materials.

2. *Knowledge base*, or the dynamism and depth of the knowledge base of an industry. Proxies for this driver of hypercompetition include (1) the percentage of the workforce that is professional, indicating the capacity of workers in the industry to innovate, and (2) the productivity growth rate for the industry, a rather direct measure of innovative activity.

3. *Entry conditions*, or the dynamism of market structure. An important example of how entry triggers industry innovation and competitive renewal is provided by the wave of imports and minimills that beset the American steel industry in the 1970s (Comanor and Scherer 1995). Proxies for this driver of hypercompetition include (1) growth in the industry concentration ratio, an inverse proxy for ease of entry, and (2) growth in industry imports, a direct proxy for ease of entry.

These variables are expected to be reasonable measures of dynamic resourcefulness with the exception of imports for which minimal effect is expected. Imports reduce cashflows and challenge firms (static effects) without readily enabling innovative response (dynamic

effects). Imports are discussed further below in the subsection on hypercompetitive behaviors. Formal hypotheses, one for each main effect, follow.

H1. *More dynamically resourceful industries have a more pronounced inverted-U in the relationship between mean growth in stock market value and escalating rivalry; less dynamically resourceful industries have a traditional monotonically declining performance-rivalry relationship. Dynamic resourcefulness is associated with seven variables that encourage innovativeness: three for transactor dynamism, two for knowledge base, and two for entry conditions.*

H2. *More dynamically resourceful industries have higher intra-industry variance across firms in the growth of firm stock market values.*

The two hypotheses are summarized in Table 1.

**Hypercompetitive Shift**

From the preceding arguments, dynamic resourcefulness is expected to increase generically over time. The

study sample covers the years 1958 to 1991. At the beginning of the sample, technology evolved rather slowly and creating new strategic assets was difficult (D'Aveni 1994). Transportation costs were high, and the U.S. economy was essentially closed to foreign competition. Communication and data processing costs were high, and information moved slowly. Under those circumstances, strategic assets were very durable. Consider some examples. In the soft drink industry, the five major firms each purveyed only one brand, which had been introduced decades earlier. In the telecommunications industry, AT&T maintained a vertical and horizontal monopoly, established by 1909, for much of the United States. In the automobile industry, General Motors dominated the American market with the twin strategies of vertical differentiation (from Chevrolet up to Cadillac) and vertical integration of production. Both GM strategies were established in the 1920s. The internal organization of such firms as Coca-Cola, AT&T, and General Motors was rigidly focused on intensive exploitation of their historic strategic assets.

**Table 1 Hypotheses, Method of Testing, and Findings**

#	Hypothesis	Method	Finding
<b>Hypercompetitive Industries</b>			
H1	More resourceful industries have an inverted-U for the value-rivalry relationship, less resourceful industries have a monotonically negative relationship	Six industry factors have appropriate signs in Table 7 sales growth (+) consume (+) raw materials (-), professional (+) productivity (-), concentration (-)	Correct sign, significant in 4 of 6 cases
H2	More dynamically resourceful industries have higher intra-industry variance in firm performance	Five industry factors have appropriate signs in Table 6 consume (+), raw materials (-), professional (+) productivity (-), concentration (-)	Correct sign significant in 5 of 10 cases
<b>Hypercompetitive Shift</b>			
H3	The value-rivalry relationship moves from monotonically negative in early years to an inverted-U relationship in more recent years	Estimated minimum of value-SGA relationship $(-\alpha_3 / \gamma_3)$ falls above most observations in early years, estimated maximum $\{-[\alpha_3 - \beta_3^*(t - 68)] / [\gamma_3 + \delta_3^*(t - 68)]\}$ lies near median of observations in later years	Confirmed, see Figure 8
H4	The intra-industry variance of firm performance increases over time	Coefficient on year term is positive in Table 6	Positive and significant
<b>Hypercompetitive Behaviors</b>			
H5	Growth in industry shipments and industry prices has smaller impacts on firm values over time	Coefficients on time-interaction terms for growth in shipments and prices are negative in Tables 4 and 5	Negative and significant
H6	Rivalry in unit-SGA costs is more likely to have an inverted-U relationship with firm values in recent years than are other forms of rivalry in the same time period	Estimated maximum $\{-[\alpha_3 - \beta_3^*(t - 68)] / [\gamma_3 + \delta_3^*(t - 68)]\}$ for SGA-growth lies near median of observations in later years, comparable estimated minimum or maximum lies outside range of most observations for CGS and prices	Confirmed compare Figures 7, 8, and 9
H7	Growth in industry shipments and prices reduces the intra-industry variance in firm performance	Coefficients on terms for growth in shipments and prices are negative in Table 6	Negative and significant in 3 of 4 cases
H8	Growth in unit-CGS and unit-SGA increases the intra-industry variance in performance	Coefficients on terms for growth in unit-CGS and unit-SGA are positive in Table 6	Positive significant in 3 of 4 cases

By 1991, that calm and stable economic environment had quite disappeared for most American firms (D'Aveni 1994). Falling transportation, telecommunication, and data processing costs had globalized many markets. The top panel of Figure 5 demonstrates the steady rise over time of trade as a share of GDP for the United States. This globalization simultaneously depreciated historic, national strategic assets and fostered the creation of new, global strategic assets. The rapid change of technology facilitated the proliferation of new products and new competitors, again depreciating old strategic assets. The bottom panel of Figure 5 traces the steady, slow deterioration of competitive position for firms in the U.S. manufacturing sector after 1950. From a postwar high of 40 percent, ROA (return on total capital) slowly declined until the 1980s where it plateaued. A recent paper (Thomas and Waring 1995) documents that the stabilization and turnaround of ROA for U.S. manufacturing firms was due to the rise of firm-specific innovations that mark

dynamic competition. The steady trend in increasing competitive intensity for American manufacturers was driven by underlying changes in technology that precipitated entry by new competitors and new modes of competition among current competitors—that is, an increase in the general dynamic resourcefulness of U.S. manufacturing industries.

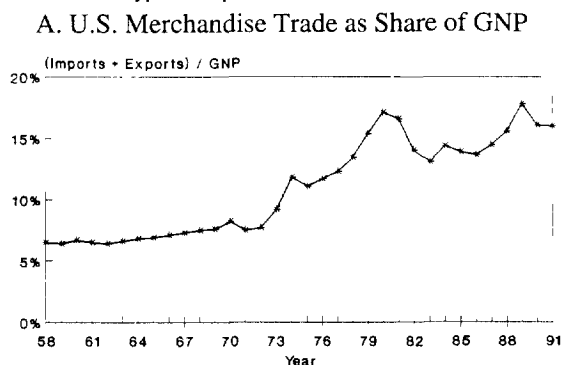
The preceding argument suggests a steady, almost linear increase in the dynamic resourcefulness of many U.S. industries during the 1958 to 1991 span of the study, a linear trend that was itself driven by the effectively linear increase in the underlying determinants of dynamic resourcefulness: transactor dynamism, knowledge base, and entry conditions. The exogenously generated increase in dynamic resourcefulness caused a hypercompetitive shift from static to dynamic competition over the time period. Hence, a simple linear time trend interacted with key variables is used as a proxy for the general intertemporal increase. Over the time period of the study, shared factors for all firms in the industry (such as prices) would have steadily smaller impact on firm performance. At the same time, the rivalry-value relationship would flatten and in the extreme become an inverted-U. Finally, the intra-industry variance for performance would increase over time. Formal hypotheses for each main effect follow.

H3. *The relationship between the average growth in firm stock market value and escalating rivalry is monotonically negative for the early years of the sample, but over time shifts to an inverted-U in later time periods.*

H4. *The intra-industry variance of stock market growth for firms in an industry increases over time.*

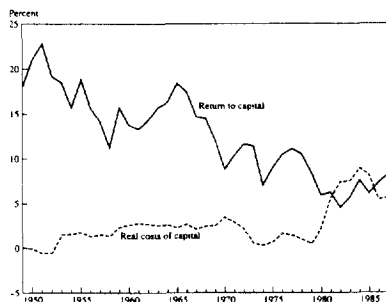
These hypotheses are summarized in Table 1.

**Figure 5** Examples of Underlying Secular Trend Generating a Hypercompetitive Shift



Source: U.S. Statistical Abstract (1994)

B. Returns and Costs of Capital, U.S. Manufacturing Sector



Source: Blair and Litan (1990)

cashflows (static effects) and challenge firms. Yet new product development by its very nature is much more likely to generate new strategic assets that will help firms cope with the challenge over the long term. Similarly, contrast the consequences of a competitive invasion by foreign firms through imports and an invasion by the same firms through local transplants established by direct investment. Again, both developments challenge established local firms and produce negative static effects for them. Yet studies by Porter (1990a) for a variety of industries and Thomas (1994) for the global pharmaceutical industry demonstrate that firms learn far more rapidly from localized rivalry. Nearby rivals, competing under the same general conditions, learn readily from each other. Imports come from rivals obscured by geography, culture, language, and other profound differences of the competitive environment that impede learning and other dynamic responses.

Both the intertemporal and cross-sectional effects discussed previously vary by the instrument of rivalry. Some instruments are a common experience of all firms in the industry (such as price levels). Those shared instruments will have a steadily smaller effect on firm values over time because of the hypercompetitive shift, will be unlikely to have an inverted-U relationship with value, and will be associated with lower intra-industry variance in firm stock market performance. Other instruments are by their nature much more firm specific (such as new product launches) and will have opposite effects. The most important firm-specific instruments are the marketing and R & D expenses that are aggregated in SGA (selling, general, and administrative expenses). Hence:

H5. *The impact of changes in industry shipments and industry prices on changes in average firm stock market values declines over time.*

H6. *Increased rivalry in unit-SGA expenses is likely to have an inverted-U relationship with average increases in firm stock market performance, whereas increased rivalry in prices or in unit-CGS (cost of goods sold) is more likely to retain a monotonically negative relationship.*

H7. *The impact of growth in industry shipments and industry prices on the intra-industry variance in stock market performance across firms is negative.*

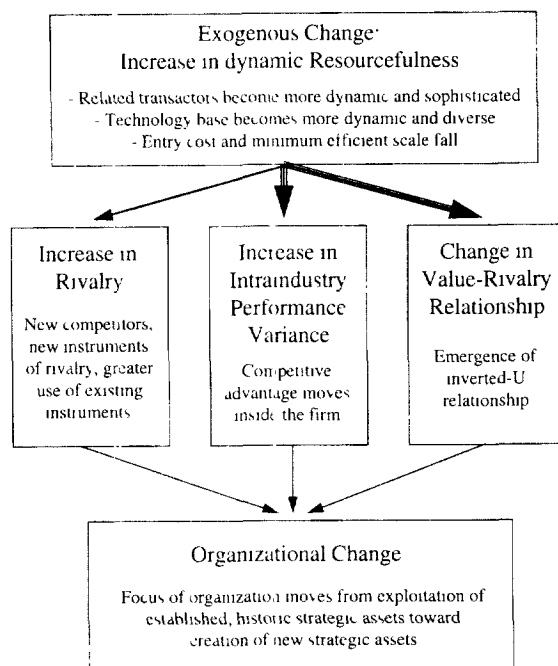
H8. *The impact of growth in unit-CGS and unit-SGA on the intra-industry variance in stock market performance across firms is positive.*

Again, these hypotheses are summarized in Table 1.

### Summary

The theory for this study is restated and extended in Figure 6. An industry undergoes a hypercompetitive shift when exogenous changes in technology make the industry more dynamically resourceful, by making the creation of new strategic assets easier. The more rapid creation of new strategic assets is accompanied by the more rapid depreciation of older ones. These exogenous changes in technology are expected to have three impacts, as indicated in Figure 4. Only the last two are examined formally in this study (denoted by double arrows). First, there will be an increase in rivalry—through emergence of new competitors, the development and deployment of new instruments (or arenas) of rivalry, and increased use of old instruments. Second, there will be an increase in the variance of performance across firms in an industry. Third, the effect of rivalry on the expected value of firms will change from an unambiguous negative association to an inverted-U. As a final effect, these changes in the industry will force changes inside the firm itself, as it reorganizes to adapt to its new competitive environment. Reorganization refocuses the firm from intense exploitation of old, given strategic assets toward a new goal of ever more rapid creation of new strategic assets. Internal reorganization is perhaps the most critical step in the realization of dynamic benefits from rivalry.

Figure 6 Summary of Theory



**Method**

**Sample and Data Sources**

Data for this study are pooled cross-section time-series. Individual observations are single 4-digit SIC manufacturing industries in single years during 1958 to 1991. Table 2 provides an overview of the data with descriptive statistics and variable correlations. Variable definitions and sources are summarized in Table 3. Data were drawn from four sources. First, industry changes in sales, prices (wholesale price indices), and sales per worker (productivity) were taken from the excellent NBER (National Bureau of Economic Research, Cambridge, MA) dataset maintained by Wayne Gray, of NBER and Clark University. The importance of the

NBER data is that they are consistent over the various changes in SIC definitions during the three decades. The NBER dataset spans the years 1958 to 1991 and thus provided the time limits for the study. Second, average industry changes in stock market values, in unit cost of goods sold (CGS), and in unit selling, general, and administrative expenses (SGA) were drawn from two versions of Standard & Poor's Compustat. Firms are linked across the two Compustat datasets by cusip-code (a six-digit numerical identifier). Third, changes in concentration ratios and import/sales ratios were taken from Salinger (1990). Finally, unlike all other data which vary by both industry and year, data for industry features used as proxies for industry dy-

**Table 2 Data Overview: Sample Attributes, Descriptive Statistics, and Variable Correlations**

Sample Attributes	1-Year Growth Rates		10-Year Growth Rates	
Number of raw data points (firm / year)	60,960		26,386	
Number of observations (industry / year)	6,682		4,648	
Total number of years	33		24	
Average number of firms per industry	9.1		5.7	
Average number of industries per year	202		194	

Descriptive Statistics (Mean at left, standard deviation at right)	1-Year		10-Year	
1 In(grow(Stock Market Value))	124	370	.986	902
2 In(grow(Industry Shipments))	026	103	253	369
3 In(grow(Unit Cost of Goods Sold))	003	043	010	114
4 In(grow(Unit Selling & Administrative Costs))	020	095	116	245
5 In(grow(Wholesale Price Index))	040	054	472	281
6 In(grow(Shipments per Worker))	023	065	227	217
7 In(grow(4-Firm Concentration))	011	032	- 040	505
8 Percentage Final Demand to Consumers			141	204
9 Percentage Inputs from Raw Materials			030	107
10 Percentage Workforce Professional			076	056

(Variable numbers immediately above, one-year correlations at bottom left of matrix, 10-year correlations at top right of matrix)

Variable Correlations										
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1.		.04**	- .23**	.05**	.02	.09**	.00	.07**	.06**	.07**
2	- .02		- .00	- .12**	- .38**	.39**	.08**	- .02	- .07**	.18**
3	- .15**	- .02		- .25**	- .00	.02	.02	- .01	- .02	.04**
4	- .04*	- .12**	.00		.02	- .07**	- .12**	- .02	.01	.00
5	.02	- .25**	.00	.03*		- .55**	.03*	- .10**	- .01	- .05**
6	.04**	.62**	- .06**	- .09**	- .32**		.05*	.19**	.07*	.18**
7	.01	.01	- .01	.00	.01	.01		- .04*	- .03	- .04**
8	.01	- .01	- .01	- .00	- .03*	.05**	.02		.08**	- .32**
9	- .00	- .02	- .00	.02	- .02	.02	.05	.08**		- .20**
10	.03*	.06**	- .00	- .00	- .02	.06**	.03*	- .23**	- .20**	

**Table 3** Variable Glossary

Functional Forms	
grow( $X_t$ )	Ratio of variable $X$ in year $t$ to either $X$ in year $(t - 1)$ for one-year changes or to $X$ in year $(t - 10)$ for 10-year changes
$\ln(\text{grow}(X_t))$	Natural logarithm of $\text{grow}(X_t)$
Computation and Sources	
Stock Market Value	For each firm, stock market value of common equity is computed as shares of common equity outstanding times calendar year-end closing price. Data for this variable are derived from Compustat Values for 1974–1991 are taken from Compustat PC Plus, including research (defunct) firms. Values for 1958–1975 are taken from the Back Compustat tapes, including the full coverage, PST, and research files. Firms are matched across the two files by the 6-digit cusip code. One-year and 10-year growth ratios are computed for each firm, and the average is taken over all firms in the 4-digit SIC industry.
Shipments	Value of shipments in an industry, deflated by the industry-specific wholesale price index, taken from the NBER database based on original Census data.
Prices (PPI)	Industry producer price deflator (PPI) from the NBER database based on Census data.
Unit-CGS	Unit cost of goods sold is the ratio of cost of goods sold to sales for each firm. This variable has the same computation method and source as stock market value.
Unit-SGA	Unit selling, general, and administration expense is the ratio of SGA expense to sales for each firm. This variable has the same computation and source as unit-CGS.
Productivity	Constant dollar shipments divided by number of workers in the industry, from the NBER database based on Census data.
Concentration	Four-firm concentration ratio, taken from Salinger (1990).
Imports	Ratio of imports to industry shipments, taken from Salinger (1990).
Consumer	Ratio of consumer demand to total demand, taken from the Annual Input-Output Tables of the United States for 1987 only.
Raw Material	Ratio of inputs from agriculture and mining to total inputs, taken from the Annual Input-Output Tables of the United States for 1987 only.
Professional	Percentage of workers in an industry that are professional, taken from the Current Population Survey for 1989 only.

dynamic resourcefulness were taken for a single year, 1987. From the Annual Input-Output Tables for the United States, for each 4-digit SIC, data were taken for the proportion of final demand due to consumers (as opposed to business or government demand) and for the proportion of inputs that are raw materials (from agriculture and mining). From the Current Population Survey, data for each 3-digit SIC were taken for the proportion of workers in an industry that are professional. The variable glossary in Table 3 gives further details of variable definition.

### Operationalization

Most variables are of the form of one-year and ten-year growth rates:  $\ln(X_t/X_{t-1})$  for one-year growth and  $\ln(X_t/X_{t-10})$  for 10-year growth. For the one-year changes data run from 1959 to 1991, as the first year of data is lost in computing the growth ratios. For the 10-year changes data run from 1968 to 1991, as the first ten years of data are lost. For the one-year changes, static competition is expected to prevail; too little time

elapses in a single year to allow the benefits of challenge and of technical evolution that would offset the current cashflow impacts of greater competition. For the 10-year changes, whether static or dynamic competition prevails is an empirical equation.

To allow for the hypothesized secular trend, key variables are interacted with (year-59) for the one-year changes and (year-68) for the 10-year changes. All estimation includes fixed effects for years (binary variables included for each year). The coefficients for the year binary variables are not of interest and are not reported.

To allow for nonlinearity that creates an inverted-U, the regressions are specified in the following form:

$$\ln(Y) = \alpha + \beta^* \ln(X) - \gamma^* X.$$

That functional form implies that as  $X$  increases,  $Y$  initially increases and reaches a maximum when  $X = (-\beta/\gamma)$ . If the signs for  $\beta$  and  $\gamma$  are reversed, then  $Y$  is a minimum at  $X = (-\beta/\gamma)$ .

**Estimation**

The two key regression specifications follow.

$$\begin{aligned}
 & \ln(\text{SMV}_t/\text{SMV}_{t-1}) \\
 &= \alpha_0 + \alpha_1 \ln(\text{Ship}_t/\text{Ship}_{t-1}) \\
 & \quad + \alpha_2 \ln(\text{Unit\_CGS}_t/\text{Unit\_CGS}_{t-1}) \\
 & \quad + \alpha_3 \ln(\text{Unit\_SGA}_t/\text{Unit\_SGA}_{t-1}) \\
 & \quad + \alpha_4 \ln(\text{PPI}_t/\text{PPI}_{t-1}) \\
 & \quad + \beta_1 \ln(\text{Ship}_t/\text{Ship}_{t-1}) * (t - 59) \\
 & \quad + \beta_2 \ln(\text{Unit\_CGS}_t/\text{Unit\_CGS}_{t-1}) * (t - 59) \\
 & \quad + \beta_3 \ln(\text{Unit\_SGA}_t/\text{Unit\_SGA}_{t-1}) * (t - 59) \\
 & \quad + \beta_4 \ln(\text{PPI}_t/\text{PPI}_{t-1}) * (t - 59) \\
 & \quad + \gamma_1(\text{Ship}_t/\text{Ship}_{t-1}) \\
 & \quad + \gamma_2(\text{Unit\_CGS}_t/\text{Unit\_CGS}_{t-1}) \\
 & \quad + \gamma_3(\text{Unit\_SGA}_t/\text{Unit\_SGA}_{t-1}) \\
 & \quad + \gamma_4(\text{PPI}_t/\text{PPI}_{t-1}) \\
 & \quad + \delta_1(\text{Ship}_t/\text{Ship}_{t-1}) * (t - 59) \\
 & \quad + \delta_2(\text{Unit\_CGS}_t/\text{Unit\_CGS}_{t-1}) * (t - 59) \\
 & \quad + \delta_3(\text{Unit\_SGA}_t/\text{Unit\_SGA}_{t-1}) * (t - 59) \\
 & \quad + \delta_4(\text{PPI}_t/\text{PPI}_{t-1}) * (t - 59). \tag{1}
 \end{aligned}$$

$$\begin{aligned}
 & \ln(\text{SMV}_t/\text{SMV}_{t-10}) \\
 &= \alpha_0 + \alpha_1 \ln(\text{Ship}_t/\text{Ship}_{t-10}) \\
 & \quad + \alpha_2 \ln(\text{Unit\_CGS}_t/\text{Unit\_CGS}_{t-10}) \\
 & \quad + \alpha_3 \ln(\text{Unit\_SGA}_t/\text{Unit\_SGA}_{t-10}) \\
 & \quad + \alpha_4 \ln(\text{PPI}_t/\text{PPI}_{t-10}) \\
 & \quad + \beta_1 \ln(\text{Ship}_t/\text{Ship}_{t-10}) * (t - 68) \\
 & \quad + \beta_2 \ln(\text{Unit\_CGS}_t/\text{Unit\_CGS}_{t-10}) * (t - 68) \\
 & \quad + \beta_3 \ln(\text{Unit\_SGA}_t/\text{Unit\_SGA}_{t-10}) * (t - 68)
 \end{aligned}$$

$$\begin{aligned}
 & + \beta_4 \ln(\text{PPI}_t/\text{PPI}_{t-10}) * (t - 68) \\
 & + \gamma_1(\text{Ship}_t/\text{Ship}_{t-10}) \\
 & + \gamma_2(\text{Unit\_CGS}_t/\text{Unit\_CGS}_{t-10}) \\
 & + \gamma_3(\text{Unit\_SGA}_t/\text{Unit\_SGA}_{t-10}) \\
 & + \gamma_4(\text{PPI}_t/\text{PPI}_{t-10}) \\
 & + \delta_1(\text{Ship}_t/\text{Ship}_{t-10}) * (t - 68) \\
 & + \delta_2(\text{Unit\_CGS}_t/\text{Unit\_CGS}_{t-10}) * (t - 68) \\
 & + \delta_3(\text{Unit\_SGA}_t/\text{Unit\_SGA}_{t-10}) * (t - 68) \\
 & + \delta_4(\text{PPI}_t/\text{PPI}_{t-10}) * (t - 68). \tag{2}
 \end{aligned}$$

Estimates for Eqs. 1 and 2 are reported in Tables 4 and 5, respectively. If there is no inverted-U (H1, H3, and H6), then the  $\gamma$  and  $\delta$  sets of coefficients will all be zero. If there is no time trend (H5), then the  $\beta$  and  $\delta$  sets of coefficients will all be zero. Note how the relationships between value and the four instruments of rivalry vary over time. For example, from regression Eq. 2, in 1968 at the start of the sample, the relationship between stock market value (SMV) and rivalry in unit SGA (selling, general, and administrative costs) is:

$$\begin{aligned}
 & \ln(\text{SMV}_t/\text{SMV}_{t-10}) \\
 &= \alpha_3 \ln(\text{Unit\_SGA}_t/\text{Unit\_SGA}_{t-10}) \\
 & \quad + \gamma_3(\text{Unit\_SGA}_t/\text{Unit\_SGA}_{t-10}). \tag{3}
 \end{aligned}$$

By the end of the sample period in 1991, the relationship is:

$$\begin{aligned}
 & \ln(\text{SMV}_t/\text{SMV}_{t-10}) \\
 &= (\alpha_3 + \beta_3 * 23) \ln(\text{Unit\_SGA}_t/\text{Unit\_SGA}_{t-10}) \\
 & \quad + (\gamma_3 + \delta_3 * 23) (\text{Unit\_SGA}_t/\text{Unit\_SGA}_{t-10}), \tag{4}
 \end{aligned}$$

as 23 years have elapsed since 1968. Because of the proliferation of coefficients in the specification, we interpret the appropriate relationships by plotting them at the start (1968) and end (1991) of the sample. In other words, we plot the curves given by Eq. 3 and 4.

The estimation for the study is complicated by the hypothesized changes in variances (H2, H4, H6, and

**Table 4 Mean Regressions, Basic Variables, One-Year Growth Rates, 1959-1991**

	Without Nonlinearity		With Nonlinearity	
	Basic Variable	Variable Interacted with Time	Basic Variable	Variable Interacted with Time
	Intercept	18** (4.50)		-.06 (-.07)
ln(grow(Shipments))	66** (7.02)	-.014** (-.4.23)	81** (3.56)	-.021 (-.1.71)
grow(Shipments)			-.23 (-.91)	.002 (.45)
ln(grow(Unit-CGS))	-1.37** (-.9.49)	.001 (.51)	-2.51 (-.91)	-.0.51 (-.1.11)
grow(Unit-CGS)			.94 (.47)	.014 (.1.03)
ln(grow(Unit-SGA))	-.55** (-.5.66)	-.002 (-.52)	-1.33** (-2.80)	.004 (.67)
grow(Unit-SGA)			.55 (.92)	-.004 (-.75)
ln(grow(Price))	93** (5.56)	-.021** (-.3.77)	1.03** (9.48)	-.033 (-.1.73)
grow(Price)			-.07 (-.44)	-.04 (-.76)
F-Tests	9.20** null hypothesis coefficients for 4 time interaction terms = 0		1.57 null hypothesis coefficients for 8 nonlinear terms = 0	
Pseudo-R <sup>2</sup>	.56		.56	
Observations	5364		5364	

Notes: Dependent variable is ln(grow(SMV)), SMV denotes stock market value. *T*-statistics are given parenthetically. Regressions include a full set of binary variables for years, though these binary coefficients are not reported. Estimation technique is pseudo-maximum likelihood. Estimates of the variance relation are in Table 6. Significance levels: \*\* at 1-percent, \* at 5-percent.

**Table 5 Mean Regressions, Basic Variables, Ten-Year Growth Rates, 1968-1991**

	Without Nonlinearity		With Nonlinearity	
	Basic Variable	Variable Interacted with Time	Basic Variable	Variable Interacted with Time
	Intercept	86** (17.46)		-4.06** (-5.98)
ln(grow(Shipments))	72** (12.55)	-.011** (-5.38)	57** (7.60)	-.012 (-.1.17)
grow(Shipments)			.02 (.66)	-.002 (.91)
ln(grow(Unit-CGS))	-1.22** (-8.49)	-.027** (-3.51)	-10.51** (-6.91)	.217** (4.17)
grow(Unit-CGS)			6.94** (4.96)	-.151** (-7.94)
ln(grow(Unit-SGA))	-.35** (-3.66)	-.012 (-.52)	-2.11** (-9.19)	.239** (8.12)
grow(Unit-SGA)			1.35** (5.00)	-.186** (-9.58)
ln(grow(Price))	93** (6.84)	-.059** (-5.06)	.64* (2.06)	-.105** (-5.63)
grow(Price)			.63** (4.15)	-.014 (-.97)
F-Tests	7.65** null hypothesis coefficients for 4 time interaction terms = 0		17.61** null hypothesis coefficients for 8 nonlinear terms = 0	
Pseudo-R <sup>2</sup>	.35		.41	
Observations	3520		3520	

Notes: Dependent variable is ln(grow(SMV)), SMV denotes stock market value. *T*-statistics are given parenthetically. Regressions include a full set of binary variables for years, though these binary coefficients are not reported. Estimation technique is pseudo-maximum likelihood. Estimates of the variance relation are in Table 6. Significance levels: \*\* at 1-percent, \* at 5-percent.

H8). Ordinary least squares analysis assumes that variances across observations are uniform. Yet four of the hypotheses are precisely that variances differ over time (an increasing secular trend), across industries (being higher in more resourceful industries), and across instruments of rivalry (being lower for shared instruments such as prices and higher for heterogeneous instruments such as SGA expense). At the minimum we have a rich heteroscedasticity problem. Even more fundamentally, however, we expect the mean and variance of performance across industries to be positively correlated, as both increase with a hypercompetitive shift. Thus the dependent variables cannot be normally

distributed, as variances do not depend on the mean for normally distributed variables.

Appendix A gives the estimation procedure in full detail. It is sufficient here to say that the mean and the variance regressions are estimated together, so that the estimated variances can be used to correct for the non-uniform and non-normal nature of the dependent variable. The estimated variance regressions are reported in Table 6.

A final estimation issue is how to allow industry dynamic resourcefulness variables to alter the functional shape of the value-rivalry relationship. By this point, with time trends, nonlinearity, and non-normal

**Table 6 Variance Regressions**

	One-Year Growth Rates 1959-1991		Ten-Year Growth Rates 1968-1991	
	Without Non- linearity	With Non- linearity	Without Non- linearity	With Non- linearity
Intercept	-5.31 (-23.60)	-5.33 (-23.51)	-2.30 (-4.24)	-2.44 (-5.45)
Predicted Value of Industry Mean	1.50 (5.23)	1.33 (4.79)	.25 (2.77)	.27 (2.47)
Number of Firms in Industry	-.05 (-.910)	-.05 (-.977)	-.04 (-.803)	-.04 (-.728)
Year	.014 (.422)	.014 (.409)	.021 (.362)	.023 (.393)
ln(grow(Shipments))	-.84 (-2.63)	-.95 (-2.97)	.12 (.95)	.13 (1.07)
ln(grow(Unit-CGS))	5.07 (3.55)	5.56 (4.56)	3.20 (7.60)	2.17 (3.29)
ln(grow(Unit-SGA))	.60 (.99)	.43 (.73)	.56 (3.11)	.79 (4.44)
ln(grow(Price))	-2.19 (-3.80)	-1.78 (-3.31)	-.91 (-6.27)	-.86 (-5.51)
Percent Final Demand Consumer	.03 (.45)	.03 (.61)	.09 (1.08)	.05 (.76)
Percent Supply Raw Materials	-.20 (-1.99)	-.13 (-1.26)	.12 (1.13)	.31 (2.14)
Percent Workforce Professional	.82 (3.67)	.81 (3.72)	.67 (2.91)	.67 (2.78)
ln(Grow(Shipments per Worker))	.25 (.92)	.17 (.59)	.76 (5.45)	.68 (5.75)
ln(Grow(4-Firm Concentration))	-.01 (-.47)	-.03 (-.67)	-.12 (-2.81)	-.14 (-1.98)
Observations	5344		3506	
Source of Coefficients Used for Estimation	Table 4		Table 5	

Notes: For estimation procedure, see statistical appendix. *T*-statistics in parentheses. Dependent variable is  $\ln(\text{residual}^{**2})$  residuals taken from the indicated table.

errors, the estimation verges on being overly complex. Rather than proliferate additional coefficients for industry variables, we can apply the following more straightforward procedure. Because greater dynamic competition and industry dynamic resourcefulness are expected to be present mostly in recent years, we will examine only the 10-year growth rates for the last one-half of the sample, growth rates ending in 1980 to 1991. The expected most likely source of nonlinearity is

the value-SGA rivalry relationship. We therefore estimate the following regression equation for the mean 10-year growth rates during those last 11 years.

$$\begin{aligned} \ln(\text{SMV}_t/\text{SMV}_{t-10}) &= \alpha_0^* \text{SHIFT} + \alpha_1 \ln(\text{Ship}_t/\text{Ship}_{t-10}) \\ &+ \alpha_2 \ln(\text{Unit\_CGS}_t/\text{Unit\_CGS}_{t-10}) \\ &+ \alpha_3 \ln(\text{Unit\_SGA}_t/\text{Unit\_SGA}_{t-10})^* \text{SHIFT} \\ &+ \alpha_4 \ln(\text{PPI}_t/\text{PPI}_{t-10}) \\ &+ \gamma_2(\text{Unit\_CGS}_t/\text{Unit\_CGS}_{t-10}) \\ &+ \gamma_3(\text{Unit\_SGA}_t/\text{Unit\_SGA}_{t-10})^* \text{SHIFT} \\ &+ \gamma_4(\text{PPI}_t/\text{PPI}_{t-10}) \end{aligned} \quad (5)$$

$$\begin{aligned} \text{SHIFT} &= \theta_1^* \ln(\text{grow}(\text{Shipment})) + \theta_2^* \text{Consume} \\ &+ \theta_3^* \text{Raw\_Material} + \theta_4^* \text{Professional} \\ &+ \theta_5^* \ln(\text{grow}(\text{Shipment per Worker})) \\ &+ \theta_6^* \ln(\text{grow}(4\text{-Firm Concentration})). \end{aligned}$$

That specification allows for greater or less estimated nonlinearity in the impact of SGA rivalry on value, per Figure 3. The results are reported in Table 7. The shift term estimation included a variable for growth of the import-sales ratio for the industry. Unfortunately, because of the limitations of U.S. government data collection, import values are missing for some 30 percent of sample observations. The import variable proved insignificant in every specification tried, and was therefore ultimately excluded from estimation. Because we do not expect any effect of imports (as discussed in the preceding subsection on hypercompetitive behaviors), and because so many observations lack import data, the results with the import variable are not reported.

The estimation approaches used to test each of the eight hypotheses are summarized in Table 1. Estimation results are reported in the next section.

## Findings

The empirical findings are summarized in Table 1 and reported for the one-year growth rates in Tables 4 and 6 and for the 10-year growth rates in Tables 5 and 6. Recall that regressions for the mean and variance of growth in stock market value for firms in an industry are estimated together. The dependent variable is

**Table 7** Regression Results, Industry Factors Shift Value-Rivalry Relationship

Ten-Year Growth Ratios, 1980–1991			
Basic Relationship		Shift Parameters	
ln(grow(Shipment))	51** (8 22)	ln(grow(Shipment))	53 (1 36)
ln(grow(Unit-CGS))	-1 38** (-6 11)	Percent Final Demand Consumer	45** (2 77)
grow(Unit-CGS)	78** (2 84)	Percent Supply Raw Materials	-13 (-64)
ln(grow(Unit-SGA))	55** (3 75)	Percent Workforce Professional	1 25** (3 37)
grow(Unit-SGA)	-77** (-5 50)	ln(grow(Shipments per Worker))	34** (4 02)
ln(grow(Price))	-1.05** (-3 51)	ln(grow(4-Firm Concentration Ratio))	-13* (-2 04)
grow(Price)	71** (5 45)		
Pseudo-R <sup>2</sup>	44		
Observations	1560		

Notes: the dependent variable is ln(grow(SMV)), where SMV indicates stock market value, regressions include a full set of binary variables for years, coefficients for these binaries are not reported. Estimation technique is pseudo-maximum likelihood, estimates of the variance regression are not reported. Significance levels: \*\* at 1 percent, \* at 5 percent.

ln(grow(SMV)) in regressions for Tables 4 and 5, where SMV stands for stock market value and ln(grow(·)) gives the natural logarithm of the one-year or 10-year growth rate. The dependent variable for Table 6 is the natural logarithm of the squared residuals from the associated mean regression of Table 4 or 5. Again, for details of the statistical procedure, see Appendix A.

### Hypercompetitive Industries

The cross-sectional differences across industries in the nature of competition are largely as expected. Under H1, seven industry factors were examined for their impact on the value-SGA rivalry relationship, the relationship most expected to trigger hypercompetition. Results are reported in Table 7. One of those factors, imports, was not expected to effect the relationship, and in fact did not. Results with the import variable are not reported. Of the six remaining factors, four performed well: the percentage of final demand from consumers (a proxy for the inelasticity of demand), the percentage of the workforce that is professional and the 10-year productivity growth (both proxies for the

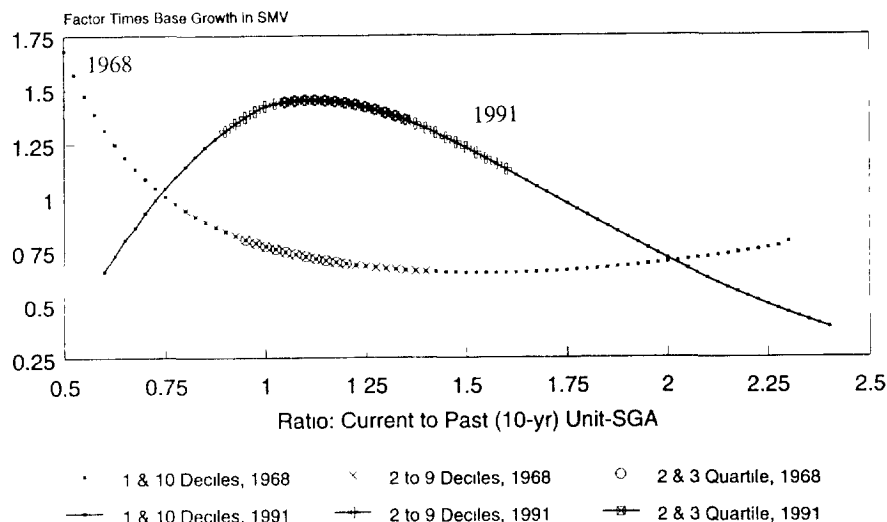
technological base), and the 10-year growth in concentration (an inverse proxy for ease of entry). A fifth variable, 10-year growth in industry shipments (a proxy for dynamism of demand) was correctly signed but insignificant. That outcome may be due to the fact that ln(grow(Shipment)) already appears in the basic relationship, as well as in the shift term; further, the 10-year growth in shipments and 10-year growth in productivity are correlated at the .50 level—not highly, but perhaps enough to mask the true effect of growth in sales. The raw materials variable (an inverse proxy for sophistication of supply) did not perform well.

Under H2, six industry factors were examined for their impact on the intra-industry variance of stock market growth. Results are reported in Table 6. By far the best-performing measures are those for the knowledge base of the industry: percentage of the workforce that is professional and the growth rate of labor productivity. The market structure variables are mixed. Increases in concentration are associated with decreased variance, as expected. As import data were missing for almost 30 percent of the sample and the import variable was not statistically significant when used, the specifications including imports are not reported. The demand/supply variables contribute little to explanation of differences across industries in internal variance of performance.

### Hypercompetitive Shift

The intertemporal shifts between 1958 and 1991 in the nature of competition are largely as expected. Under H3, the value/SGA-rivalry relationship was expected to be monotonically negative for the one-year growth rates and to shift from monotonically negative to an inverted-U for the 10-year growth rates. Results are reported in Table 4 for the one-year growth rates and Table 5 for the 10-year growth rates. The findings in Table 5 are plotted in Figure 7. First, there is no relevant nonlinearity in the findings in Table 4 for the one-year growth rates. Specifically, if we formally test the null hypothesis that all eight nonlinear coefficients (the  $\gamma$  and  $\delta$  sets of coefficients in Eq. 1) are all equal to zero, we can not reject this hypothesis at the 5 percent level. That result is expected, as a single year is arguably too short a period for the dynamic effects that cause nonlinearity to be realized.

Turning to the 10-year growth rates and the nonlinear relationship reported on the right of Table 5, we find that most of the coefficients allowing for nonlinearity are highly significant. Interpretation of the nonlinear findings is difficult by simply looking at Table 5.

**Figure 7** Effect of Rivalry in Unit-SGA on Mean Growth in Firm Value (SMV)

Finding an inverted-U relationship requires not only an appropriate pairing of coefficient signs, but also an appropriate distribution of the independent variable around the maximum. For example, if all observations are on the left of the estimated inverted-U maximum, we have merely found a concave, positively sloped relationship. To assist in interpretation of the findings, the estimated value-rivalry relationships for unit-SGA costs are plotted in Figure 7, which gives the estimated relationship in 1968 and the subsequent relationship in 1991. In 1968, the value-SGA-rivalry relationship is monotonically negative for more than 95 percent of the sample, consistent with static competition. In 1991, however, we have a true inverted-U as expected for dynamic competition. Note that industries with no change in unit-SGA have a value of 1.0 for the 10-year growth rate in unit-SGA. As shown in Figure 7, those median industries perform significantly better than ones with much lower or much higher SGA growth.

For H4, the hypothesized positive secular trend for intraindustry variance in performance is strongly documented in Table 6. As reported, the coefficient on the linear-time variable has a positive significant estimate.

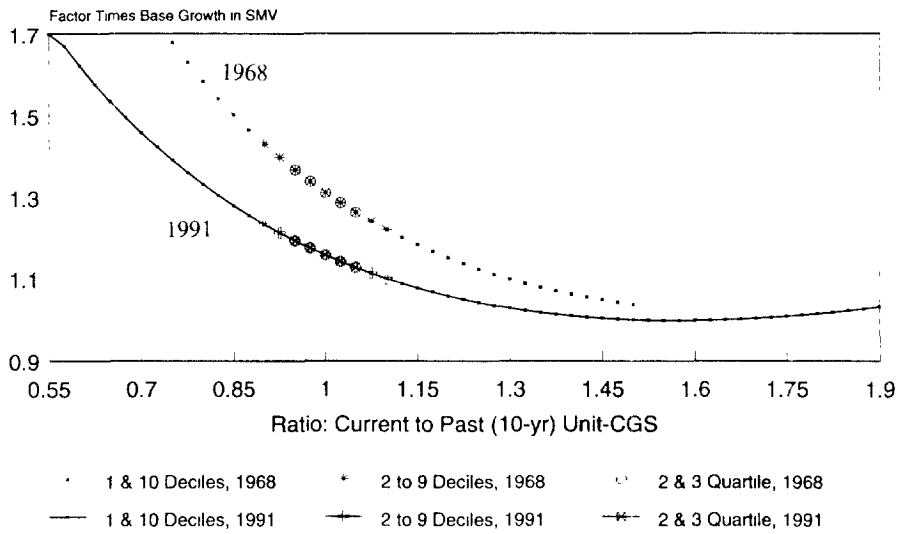
#### Hypercompetitive Behaviors

As hypothesized, different competitive behaviors differ sharply in impact. Under H5, the impact of escalations in shipments and in prices becomes steadily lower over the sample period. In Table 4 for the one-year growth rates, the time-trend coefficients (the  $\beta$ s of Eq. 1) are highly significant and negative for shipments and output prices. By 1991, the effect of those two variables on the mean industry valuation growth, though still posi-

tive, is markedly lower. Clearly, the “shared assets” of industry sales and industry price have much less impact today than in 1950s, even on a one-year growth basis. Note that there is no significant change over time in the impact of unit cost of goods sold (CGS) or unit selling, general, and administrative costs (SGA). The comparable coefficients for the 10-year growth rates are reported in Table 5 and show similar results, with one important difference. This difference arises from the estimated value-price rivalry relationship in 1991, at the end of the sample period. In Table 4, the estimated effect of price changes is positive and significant in 1991; in Table 5, the estimated effect of price changes becomes negative after 1983, and is negative and significant by 1991.<sup>8</sup> Given that a positive value-price rivalry relationship is at the core of the Five Forces model, which is one of the most prominent in strategic management, this result is unexpected and perhaps even startling.

Under H6, escalations in SGA expense are much more likely to trigger dynamic competition than other competitive behaviors. To assist in interpretation of the findings, the estimated value-rivalry relationships for unit-SGA, unit-CGS, and the producer price index are plotted in Figures 7, 8, and 9 respectively. Each figure shows the estimated relationship in 1968 and the subsequent relationship in 1991. For rivalry in unit-CGS as plotted in Figure 8, the estimated relationship is monotonically declining for virtually all sample observations, both in 1968 and in 1991. However, for rivalry in unit-SGA, the findings are quite different. By 1991, we have a true inverted-U as expected for dynamic competition. Finally, the value-price rivalry relationship is

**Figure 8** Effect of Rivalry in Unit-CGS on Mean Growth in Firm Value (SMV)



plotted in Figure 9. Here we see a shift from a monotonically increasing relationship in 1968 to one that is monotonically declining in 1991 for more than 95 percent of sample observations. The “nonlinear” results for prices on the right of Table 5 are thus really not so different from the “linear” results on the left.

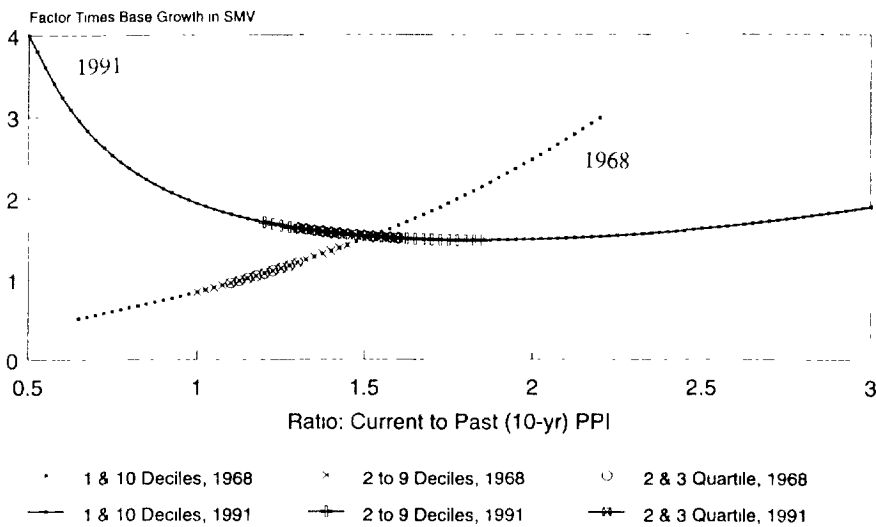
Under H7 and H8, we expect asymmetries in the impacts of various instruments of rivalry on the intraindustry variance in stock market growth. The results are reported in Table 6. Industries with rapid growth in

firm-specific instruments such as rivalry in CGS and SGA are associated with higher intraindustry variance. Industries with rapid growth in shared instruments such as prices and shipments have lower variances (though shipments have no effect for the 10-year growth rates).

### Conclusion

This study has pulled together arguments from a variety of sources to assert that a hypercompetitive shift

**Figure 9** Effect of Rivalry in Price on Mean Growth in Firm Value (SMV)



has occurred for the American economy. The study theory is drawn from the structure-conduct-performance paradigm (Bain (1959) through Porter (1979, 1980)), from the literature on firm networks and dynamic competition (Marshall (1920) through Freeman (1993), Porter (1990), and Thomas (1994)), from the traditional Schumpeterian studies of industrial economics (notably Scherer (1967)), from the recent stream of neo-Schumpeterian research (including Levin, Cohen and Mowery (1985), and Levin, et al. (1987)), and from D'Aveni's (1994) important monograph on hypercompetition. While D'Aveni initially identified the hypercompetitive shift, the present study spelled out theoretically what the shift entails, ties the theory to underlying literatures, and empirically verifies that the shift is generally present among some 200 industries of the U.S. manufacturing sector.

The study theory is summarized in Figure 6. The dynamic resourcefulness of the average industry in the U.S. manufacturing sector has steadily increased. Fundamental exogenous changes in the underlying technologies for commerce have made the creation of new strategic assets significantly easier. The inescapable flip-side of more rapid creation of new strategic assets is the more rapid depreciation of older, established strategic assets. Thus, the increase in dynamic resourcefulness triggers a hypercompetitive shift, from static to dynamic competition. That shift entails greater competitive rivalry (not examined here), greater variance in competitive outcomes, and the rise of an inverted-U for the value-rivalry relationship.

The empirical findings document the existence of the hypercompetitive shift in multiple and consistent ways.

- Shared aspects of competition in an industry, such as industry prices and industry demand growth, are shown to be much less important for firm performance today than in the 1960s, only 30 years ago. Despite the academic prominence accorded by certain models to the role of high prices as a source of corporate success, by 1991 industry prices had an estimated minimal and in some cases even negative relationship to long-term firm performance.

- For rivalry in SGA-costs, the value rivalry relationship is shown to have shifted from a monotonic decline expected under static competition to an inverted-U expected under dynamic competition. SGA expense, encompassing marketing and research activities, is the instrument of rivalry most likely to be associated with the creation of new strategic assets.

- Industries with a stronger knowledge base, more dynamic related transactors, and easier conditions of

entry are more associated with hypercompetitive shift. The strongest evidence is for the technology base of an industry.

- The within-industry variance of firm performance is increased by dynamic competition: over time, across rivalry instruments, and across the industry factors.

The second and third sets of findings suggest the particular importance of knowledge base in triggering the hypercompetitive shift. They suggest that of D'Aveni's four arenas of competition, his knowledge arena is by far most likely to be associated with dynamic competition. Again, comparison of Figures 7, 8, and 9 shows the unique importance of the knowledge arena.

The strategic implications of the findings are that the basis of competitive advantage for contemporary firms has moved steadily away from in the "shared assets" of common features in an industry toward unique firm-specific aspects of innovation. Correspondingly, the focus of internal organization for firms has shifted from thorough exploitation of given strategic assets toward new organizational forms that facilitate the creation of new strategic assets. With the rise of the resource-based view of the firm, the strategic management profession seems to have intuitively sensed and anticipated that fundamental shift, though it has not yet fully recognized the implications of constant resource competition, erosion, and recreation.

The study is only a small start toward the necessary empirical studies of hypercompetition. In a period when American firms have radically altered their strategies and organizations to shift from static to dynamic competition, much of American academe remains mired in models that are valid only under static competition. It is time for researchers who study strategic management to join American firms with our own hypercompetitive shift.

#### Appendix A. Statistical Method

The growth rate of stock market value for firms in an industry (denoted  $Grow(SMV)$ ) is a random variable with a highly nonnormal distribution. First, the growth rates are skewed, with most firms achieving moderate growth and small number of firms achieving truly enormous growth. Second, the variance of the random variable is heteroscedastic. And third, the means and variances of realizations are positively related. An industry in which firms undergo moderate growth will have low variance in  $Grow(SMV)$ , whereas industries in which firms undergo spectacular growth will have great volatility. Therefore, the relationship between  $Grow(SMV)$  and rivalry cannot be estimated by ordinary least square techniques, as OLS presumes a uniform normal distribution. Further, were the relationship to be

investigated by maximum likelihood techniques, a potentially complex density function would be specified

Not only are maximum likelihood techniques cumbersome, but the need to choose an explicit density function poses risks of misspecification. For example, Grow(SMV) might initially be regarded as distributed gamma, where variance is proportionally related to the square of the mean. Yet the gamma density function cannot be expressed in closed form, and thus maximum likelihood estimation would require cumbersome numerical integration. Further, the gamma distribution requires that the variance of Grow(SMV) be exactly proportional to the square of the mean of Grow(SMV), a strong assumption. The variance of Grow(SMV) might instead be regarded as proportional only to the mean, rather than its square. Yet the classified distribution reflecting such linear proportionality is the Poisson, whose density is for discrete distributions, not continuous random variables such as Grow(SMV). Hence, there is a trade-off. On the one hand we might specify simpler densities (such as the unmodified exponential, a closed-form member of the gamma family) with associated likelihood functions, but simpler density functions pose risks of misspecification, and the resulting maximum likelihood estimates will be inconsistent. On the other hand, we might specify modified classical densities for Grow(SMV) with associated likelihood functions that are extremely complex and cumbersome to estimate.

The use of quasi-likelihood and pseudo-likelihood techniques vastly reduces the force of this tradeoff. With those methods, we do not specify the density function for Grow(SMV), but only the relationship between the means and variances of the dependent variable. If that specification is valid, the resulting estimates are consistent and asymptotically normal (Carroll and Rupert 1988). The estimates are conveniently obtained through iteratively weighted nonlinear least squares, using standard routines. When the exact relationship between the mean and variance of the dependent variable is known and weighted least squares are iterated to convergence, the resulting estimates are called maximum quasi-likelihood estimates (McCullagh and Nelder 1983, Carroll and Rupert 1988). When the exact mean-variance relationship is unknown, with parameters of some functional mean-variance relationship to be estimated, the fully iterated weighted least squares estimates are called maximum pseudo-likelihood estimates (Carroll and Rupert 1988). Thus, surprisingly enough, these techniques are at once less restrictive and less prone to misspecification and at the same time significantly easier to implement than maximum likelihood estimation.

Because the exact mean-variance relationship is not known, and indeed is a focus of study, we must use pseudo-likelihood techniques. The mechanics of the pseudo-likelihood method are as follows. For a given number  $k$  of independently distributed random variables  $Y$  with a vector of realizations  $\mathbf{y}$  (and components  $y$ ), we specify given scalar functions  $M$  and  $V$  such that the expected value and variance of each  $y$  is

$$EV(y) = M(\mathbf{b}) \tag{A1}$$

$$\text{Var}(y) = \sigma^2 V(M(\mathbf{b}), \mathbf{a}) \tag{A2}$$

where  $\sigma^2$  is an unknown scalar dispersion parameter, where  $\mathbf{b}$  is a vector of  $p$  unknown parameters to be estimated, and  $\mathbf{a}$  is a vector of

$q$  unknown parameters. If we knew the parameter vector  $\mathbf{a}$  exactly, we could directly use quasi-likelihood estimation. Here we must not only estimate the parameter vector  $\mathbf{b}$  for the mean relationship in A1 but also the parameter vector  $\mathbf{a}$  for the variance relationship in A2. For purposes of this study, we further specify  $M$  and  $V$  such that

$$\ln(EI(y)) = \ln(M(\mathbf{b})) = \mathbf{b}\mathbf{x} \tag{A3}$$

$$\ln(\text{Var}(y)) = a_0 + a_1 \ln(M(\mathbf{b})) + a_2^* N_{\text{firm}} + a_3^* \text{Year} + \mathbf{c}\mathbf{z} \tag{A4}$$

where  $\mathbf{x}$  is a vector of  $p$  known independent covariates (including instruments of rivalry),  $\mathbf{z}$  is a vector of  $r < q$  known independent covariates (including instruments of rivalry and industry resourcefulness proxies), and  $\mathbf{c}$  is a subvector of  $\mathbf{a}$  with  $r$  parameters to be estimated. When  $a_0 = 0$ , then  $a_1 = 0$  is consistent with a unit normal distribution for  $y$ ,  $a_1 = 1$  is consistent with the Poisson distribution, and  $a_2 = 2$  is consistent with the exponential distribution (again, a closed-form member of the gamma family).

To estimate the parameters  $\mathbf{b}$  and  $\mathbf{a}$  we must first obtain start-values. OLS regression of equation 1 in the text produces initial start-values for the  $\mathbf{b}$  vector. Saving the residuals from this OLS regression, squaring them, and using them as the dependent variables in OLS estimation of Eq. 2 in the text produces initial start-values for the  $\mathbf{a}$  vector. Second, using those start-values, we form the variance function as in A3 and perform iteratively weighted nonlinear least squares as follows:

dependent variable	$y$	
regression function	$M(\mathbf{b})$	(A5)
weights	$1/V(M(\mathbf{b}), \mathbf{a}^*)$	

Third, saving parameter estimates  $\mathbf{b}^k$ , or equivalently saving the results and predicted values  $M(\mathbf{b}^k)$ , pseudo-likelihood estimation executes a second round of iteratively weighted least squares to obtain new estimates of the variance function parameter vector  $\mathbf{a}^k$  as follows:

dependent variable	$\ln[(y - M(\mathbf{b}^k))^2]$	
regression function	$a_0 + a_1 \ln(M(\mathbf{b}^k)) + a_2^* N_{\text{firm}} + a_3^* \text{Year} + \mathbf{c}\mathbf{z}$	(A6)
weights	1.0	

Because of the specification of the variance function, ordinary (un-weighted, linear) least squares can be used here. The sole problem with that approach arises from extremely good fits, whereby the "dependent variable" in A6 becomes the logarithm of nearly zero. Such so-called "inliers" are clearly visible on a diagnostic plot of logarithm of the squared residuals against logarithm of the predicted means. In the study, roughly 15 (of more than 5000) observations were clear inliers, with the logarithm of squared residuals having value less than -15. Those few observations have been deleted in variance function estimations (only) reported in Table 6. Finally, the last two steps are repeated in their entirety, with updated estimates of  $\mathbf{b}$  and  $\mathbf{a}$ , until convergence is achieved.

Inference about the parameter vector  $\mathbf{b}$  can be based on the asymptotic coefficient standard errors and asymptotic  $t$ -statistics reported in weighted least squares outputs of statistical packages. Carroll and Ruppert (1988) label that tactic "Wald inference." Inference about the parameter vector  $\mathbf{a}$  is usually more complicated, because of the dependence of the distribution of  $\mathbf{a}$  on estimates of  $\mathbf{b}$ . In the case where the intercept variance term  $a_0$  is small, as it is here, the complications are eased and the asymptotic  $t$ -statistics reported from the OLS regressions employed in A6 may be used for approximate Wald inference. Inference in the variance regression, however, is not well established.

#### Appendix B. Limitations and Extensions of Empirical Findings

Several additional analyses were executed to test the limitations of the study. The full results of the analyses are not reported, but the approach and findings are described here.

**DIVERSIFICATION.** To examine the impact of rivalry on individual firms, and hence stock market values, we must match firms to industries. For an undiversified firm, the matching is straightforward. A diversified firm, however, operates in multiple industries, and matching its performance with industry characteristics becomes problematic. As the degree of diversification for American firms steadily and markedly increased over the study period, some of the study findings may be due less to a hypercompetitive shift than to a downward secular trend in data quality.

To discern the extent of the problem posed by diversification, data from the Compustat *Industrial Segment File* were examined for 1989. Of the more than 6000 firms listed there, almost 75 percent operated in only a single 4-digit SIC. For only 2 percent of those firms (roughly 300) did the largest 4-digit business segment (SBU) account for less than 50 percent of total corporate sales; for only 80 firms (1.3 percent) did the largest SBU account for less than 40 percent; and for only 15 firms did the largest SBU account for less than 30 percent. Those very highly diversified firms are of course among the very largest in the U.S. economy, so their economic impact is much greater than that indicated by this simple "headcount." Nonetheless, the study employed unweighted averages of firms in an industry, which precisely reflect the headcount. Hence, diversification, which on a corporate-sales-weighted basis has a large impact on the U.S. economy, had a small impact on the study.

As a check on the reported empirical findings, the Compustat data (covering the variables stock market value, unit-CGS, and unit-SGA) were recomputed after deletion of any firm that in 1989 had more than 20 percent of corporate sales outside its largest SBU. From the preceding discussion, it is no surprise that the empirical findings are virtually unchanged when even moderately diversified firms are excluded from the analysis. This approach is hardly definitive, as the roster of firms in 1989 is not a complete roster of all firms in the 1958 to 1991 period. Further, the diversification level for many firms changed over time. Unfortunately, a complete SBU breakout for all firms over the 33 years of the study is not available.

**VALUE RATIOS VERSUS VALUE LEVELS.** The study examined the growth in the levels of stock market values. This approach was taken

because dynamic competition may well involve a tradeoff of lower margins for higher growth that increases firm value. Nonetheless, it is useful to check whether the findings are still valid when different formulations of the dependent variable are used. Two new variables were computed for each firm: SMV/S or the ratio of stock market value to sales and SMV/B or the ratio of stock market value to book value of common equity. Industry means and variances for these two new variables were computed and the reported analyses were replicated. The reported findings were not materially changed.

**FIRM VERSUS INDUSTRY UNIT OF ANALYSIS.** The study used industry averages as dependent variables, because the rivalry phenomenon of interest occurs at an industry level. The analysis was replicated with individual firms as observations. The results differed marginally, and in expected ways. The pseudo- $R^2$  statistic was much lower (.15 versus .40), but because there were 10 times as many observations with individual firms, the  $t$ -statistics were higher. In the variance regressions, the effect of number of firms in the industry was lower and the effect of the mean on the variance was higher (indicating greater non-normality). Key findings were unchanged.

**CORPORATE LEVERAGE.** The debt-equity ratio for nonfinancial U.S. firms measured in book value terms rose slowly from 50 percent in 1960 to 65 percent in 1974. It then fell sharply back to 50 percent where it remained until 1984. After 1984, corporate America aggressively retired equity and issued new debt so that the debt-equity ratio rose to 75 percent by 1989 (for these data, see Blair and Litan 1990). That is hardly a smooth secular trend, but it is an upward trend that may account for some of the reported findings. As a check on the empirical work of the study, a new variable  $\ln(\text{grow}(\text{Debt}))$  was computed, where Debt refers to the book value of outstanding long-term debt for firms in an industry. The new independent variable was linearly added to the analysis. The estimated coefficient for the debt variable was insignificant. Perhaps the aggregate financial restructurings, like diversification, were heavily skewed to a few large firms. The size-weighted impact on the economy is large, but the unweighted average effect on most firms is much smaller.

#### Acknowledgements

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#### Endnotes

<sup>1</sup>The Five Forces model is a restatement of the Structure-Conduct-Performance model that dates at least back to Bain (1959), though Scherer (1980) cites Mason (1939) as the fountainhead for this enormous stream of research. The Diamond model restates an old argument that firms locally cluster together and thus share performance attributes. That argument dates back to Marshall (1920, Chapter X, Section 3), who cited three rules governing the process: "good choice of workers" (factor supply), "subsidiary trades" (related industries), and shared "mysteries of the trade" (technology base).

Had Marshall been more of a popularizer, he would perhaps have called his model the "Marshallian triangle."

<sup>2</sup>A third meaning of the phrase "dynamic competition" is provided by D'Aveni (1994). In his discussion of four different arenas (or instruments) of rivalry, he characterizes a slow pace of competition as static and a more rapid pace as dynamic. Some of his arenas/instruments are non-Schumpeterian and others are clearly Schumpeterian. There is little point in trying here to reconcile the three different meanings of "dynamic competition," as each is sensible in its own realm. In this article, the term "dynamic" refers exclusively to the Schumpeterian sense of competition.

<sup>3</sup>Scherer's 1967 paper examines the relationship between market structure and the average research intensity of firms in an industry, a key concern of the traditional industrial economics studies of the "Schumpeterian hypotheses." The reasoning of Scherer's important work is adapted and applied to the broader issues raised here.

<sup>4</sup>There is no expectation whatsoever that firms in industry will somehow attain this optimal level of rivalry. The careful collusion among firms that would be necessary to adjust industry rivalry toward the optimum is highly unlikely, particularly given the uncertainty and heterogeneity that inherently characterize innovation. The actual determinants of any given level of industry rivalry are an issue well beyond the scope of this article.

<sup>5</sup>The actual levels of profitability would be very poor proxies for rivalry and challenge. First, profitability is arguably a much closer proxy to the dependent variable, stock market value, than to the independent variable, rivalry. Second, some of the core hypotheses are that the value-rivalry relationship is an inverted-U under dynamic competition, and that the nature of competition shifts from static to dynamic across industries and across time. Hence, it would be nearly impossible to map a given level of profits to a given level of rivalry in advance, prior to the empirical analysis, so that the mapping could be used as an independent variable. Instead, cashflows were disaggregated into their key components, revenues (prices and inflation-adjusted sales) and costs (for manufacturing and for selling/innovation). Once we execute this disaggregation, we are forced to use change measures, as it is difficult to tell in advance whether a given price level is "high" or "low" or whether a given level of SGA expense indicates mild or intense rivalry. The empirical analysis relates changes in rivalry to changes in stock market value.

<sup>6</sup>Comanor and Scherer (1995) contrast the evolution since 1911 of U.S. Steel, which survived an antitrust challenge intact, and the trust-busted fragments of Standard Oil Company. From a Five Forces perspective, the petroleum industry in the U.S. "lost" the antitrust case and suffered greater rivalry. Yet Comanor and Scherer demonstrate that in the long-run, Standard Oil "won" its antitrust battle. In the 1930s, driven by an exogenous shift in demand from kerosene to gasoline, smaller firms grew and competition sharply intensified, forcing the Standard Oil spinoffs to adapt. With their innovations of manufacturing technology and organization, the spinoffs stopped the aggregate loss of market share that had set in for Standard Oil even before the divestiture order drove many smaller and weaker firms from the industry, and attained a level of competitive excellence that remains preeminent in the world today. In contrast, the dominant U.S. Steel maintained a price umbrella over its competitors, encouraging minimal competition, and suffered

continuous loss of market share until the 1990s. By the 1970s, the U.S. Steel industry had lost its leadership position to the Japanese. Ultimately, hammered by imports and by new minimills using recycled steel, the large and established U.S. steel firms were forced to become more adaptive and competitive. This example suggests that a hypercompetitive shift comes eventually to all industries, but arrives sooner in some industries than in others. Indeed, in the U.S. petroleum industry, the hypercompetitive shift appears to have occurred in the 1930s.

<sup>7</sup>The dynamic resourcefulness of an industry is thus a product of the year in history, industry factors, and the instruments of rivalry. All three factors matter in combination. For example, Porter (1990) argued that the challenge provided by high wages in Germany has added value and success for German firms. This may well be true. But the domestic institutions of German labor markets are quite distinct from those of the United States (Freeman 1993). Because of extensive worker training programs (including government technical schools and corporate apprenticeship programs), strong worker organizations (including pervasive work councils and, in larger firms, union codetermination) and stringent regulation of layoffs and separations, it is plausible that higher German wages may indeed lead to new strategic assets based on high productivity uses of labor. Wright (1987) argued that such upgrading occurred in the American South with the advent of the 1930s New Deal labor regulations. In contrast, the United States in the 1990s maintains minimal worker training, extremely high job mobility across firms, decimated unions, and (in states such as Georgia) laws that still allow workers to be fired without cause (Freeman 1993). It is implausible under these circumstances that higher U.S. wages will accomplish much beyond reduction of corporate wealth. Thus, even in the same year and with the same instrument of rivalry, the degree of dynamic resourcefulness of an industry may vary dramatically.

<sup>8</sup>Note for the one-year growth rates that  $.93 - 32^*.021 = .26$ , as there are 32 years separating 1959 and 1991, and a test for the null hypothesis that  $\alpha_1 + 32^*\beta_1 = 0$  can not be rejected at the 5 percent level. Note for the 10-year growth rates that  $.93 - 23^*.059 = -.43$ , as there are 23 years separating 1968 and 1991, and a test for the comparable null hypothesis of zero is rejected at the 1 percent level.

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