COMPETITION, CONTINGENCY,

AND THE EXTERNAL STRUCTURE OF MARKETS

Ronald S. Burt, Miguel Guilarte, Holly J. Raider, and Yuki Yasuda

Running Head: use chapter title (62 characters with spaces)

Correspondence to:

Ronald S. Burt
Graduate School ofBusiness
University of Chicago
Chicago, IL 60637
773-792-0848 or 972-998-7817 or 312-946-1711
ron.burt@gsb.uchicago.edu

Pre-print of a chapter to appear in Advances in Strategic Management (2002, Volume 19)
Edited by Paul Ingram and Brian Silverman, New York: Elsevier

ABSTRACT

This paper is in three parts about the market factor in contingency theory: (1) We focus on the dual structure of markets; the internal structure of relations among producers versus the external structure of buying and selling with other markets. We use a network model to describe the association between performance and the dual structure of American markets from 1963 to 1992. (2) We reverse-engineer the network model to infer the "effective" level of competition among producers in each market. Effective competition, a measure of competitive intensity, is inferred from observed market profits predicted by the market network of dependence on other sectors of the economy. Producers with profit margins higher than expected from observed market structure must face an "effective" level of competition lower than the level implied by the observed structure. Instead of predicting performance from internal and external market structure, we use data on performance and external structure (the more reliable and detailed data) to infer internal structure. (3) We demonstrate the research value of the effective competition variable for its reliability (illustrated by automatic adjustment for the exogenous shock of imports in 1982), its accuracy (illustrated by revealing the contingent value of a strong corporate culture in Kotter and Heskett's, 1992, study), and as a market factor integrating case with comparative research. We close discussing the market conditions measured by effective competition, which, as an unobserved variable, is more subject than observed variables to misinterpretation.

INTRODUCTION

Consider an example piece of organization research; an example to which we return later, an example about economic performance linked to corporate culture. Corporate culture is to a corporation what it is to any other social system, a set of beliefs, myths, and practices shared by people such that they feel invested in, and part of, one another. There is a rich literature describing how the cultures of organizations differ and the concept of culture developed in organization studies (e.g., Barley, Meyer and Gash, 1988; Ott, 1989; Martin, 1992; Schein, 1996; Pfeffer, 1997:120-126; Scott, 1998:133-136, 311-313; Hirsch and Levin, 1999:209), but it is sufficient for the purposes here to put aside the specific beliefs that employees share and focus on culture strength. The culture of an organization is strong when employees share beliefs, myths, and practices so as to feel invested in, and part of, one another. Culture is weak when employees hold widely different, even contradictory, beliefs so as to feel distinct from one another (where the individual, as Durkheim, 1897:157, so nicely put it in his analysis of social integration created by shared beliefs, is "far more the author of his faith").

In theory, a strong corporate culture can enhance corporate economic performance by reducing costs. One factor is lower monitoring costs. The shared beliefs, myths, and practices that define a corporate culture are an informal control mechanism that coordinates employee effort (e.g., O'Reilly, 1989; Kotter and Heskett, 1992: Chap. 2; Barker, 1993). Employees deviating from accepted practice can be detected and admonished faster and less visibly by friends than by the boss. The firm's goals and practices are more clear, which lessens employee uncertainty about the risk of taking inappropriate action so they can respond more quickly to events. New employees are more effectively brought into coordination with established employees because they are less likely to hear conflicting accounts of the firm's goals and practices. Moreover, the control of corporate culture is less imposed on employees than it is socially constructed by them, so employee motivation and morale should be higher than when control is exercised by a superior through formal lines of authority. In addition, there are labor savings. For reasons of social pressure from peers, the attraction of pursuing a transcendental goal that makes one's job signficant beyond pay, or the exclusion of employees who do not fit the corporate culture, employees work harder and for longer hours in an organization with a strong corporate culture (e.g., Kotter and Heskett, 1992: Chap. 2). The savings from lower monitoring costs and free, quality labor mean that firms with stronger corporate cultures can be expected to enjoy higher levels of economic performance. Whatever the magnitude of the economic enhancement, call it the "culture effect."

There is evidence of the culture effect, but the evidence also shows that the effect is contingent on market environment as illustrated in Figure 1. The graphs in Figure 1 are adapted from Burt, Gabbay, Holt, and Moran's (1994) analysis of Kotter and Heskett's (1992) data on corporate culture and economic performance. We take a closer look at these data later in the paper. For the moment, allow that we have — from Kotter and Heskett for 180 firms in 19 markets — a measure of the strength of a firm's corporate culture, and a measure of the firm's economic performance based on a decade of returns to invested capital. To make comparisons across markets, subtract from each firm's score the average in its market (Burt et al., 1994: 348-350). As evidence of the culture effect, economic performance has a significant positive association with culture strength across the 180 firms (.51 correlation, 7.4 t-test with 18 dummy variables adjusting for market means; Burt et al., 1994: Figure 2).

The results in Figure 1 show how the culture effect varies between markets (cf. Burt et al., 1994: Figures 3 and 5). The graph in the bottom-right corner of Figure 1 shows the culture effect for 36 sample firms in the four most "effectively" competitive markets in Kotter and Heskett's study (airlines, apparel, motor vehicles, textiles; "effective" defined below). The culture-performance correlation (CPr) is .72 with a 5.8 t-test, showing that firms with stronger cultures have significantly higher returns to invested capital. At the other extreme, the graph in the bottom-left corner of Figure 1 shows a very different culture effect for the 30 sample firms in the four least effectively competitive markets (beverages, communications, personal care, pharmaceuticals). There is no association in these markets between culture strength and economic performance (.06 CPr, 0.3 t-test).

——— Figure 1 About Here ———

Each dot in the graph at the top of Figure 1 is a market in Kotter and Heskett's study, positioned vertically by the strength of culture effect within the market (CPr), and horizontally by the effective level of competition within the market. Causality could run either or neither way in the association between culture strength and performance (see Burt et al., 1994: 365ff.), but either way it is clear that the association increases in proportion to competitive pressure in a market. For the purposes of this paper, we assume the causal order of the culture effect and infer from Figure 1 that strong cultures are more valuable to firms in more competitive markets.

The horizontal axis — effective competition — is key to the observed contingency and we have not yet defined what it means for a market to be "effectively" competitive. Nor did Burt et al. (1994) define it. Readers were referred for explanation to an early draft of the paper you are now reading. More specifically, for example, it seems odd to say that the beverages market to the left in Figure 1 is not effectively competitive given rivalry such as between Pepsi and Coke. The communications market is among the least effectively competitive of markets in the graph, but the many alternative communication producers surely create a healthy level of competition within the market (though these data describe the late 1970s and early 1980s, when there was less rivalry in communications than there is today). Common-sense questions notwithstanding, whatever it is that the measure of effective competition captures, it reveals the contingent value of strong corporate culture in Figure 1, and it will be shown to be productive in other ways as well. In fact, we will show that more familiar measures of market competition do not as clearly reveal the contingency so obvious in Figure 1.

Effective competition is the central concept in this paper. We derive the concept from the dual network structure of markets, internal and external. The tradition is to discuss and measure competition in terms of internal structure. Competition is between producers within a market, so producers are a natural frame of reference for thinking about competition (e.g., Swedberg, 1994; Lie, 1997, on the sociology of markets). Markets are sorted in terms of internal structure such that competition in one can be said to be some degree more intense than in another. Examples are competition in terms of the number of producers (e.g., Hannan and Freeman, 1989), their relative share of the market (e.g., Caves, 1982:8-16; Burt, 1983: Chap. 2; Weiss, 1989; Schmalensee, 1989: 966-967), their recognition of one another as a frame of reference (e.g., White, 1981; DiMaggio and Powell, 1983; Burt, 1992: 197-208; Han, 1994), or their network of relations with one another (e.g., Baker, 1984; Podolny, 1993; Podolny, Stuart and Hannan, 1996; Powell, Koput and Smith-Doerr, 1996).

Markets also have an external structure defined by the network of producer buying and selling in other markets. External structure is familiar from contingency theories of optimum organization (Lawrence and Lorsch, 1967), resource dependence theories of organization ties across markets (Pfeffer and Salancik, 1978; Burt, 1983; 1992; Finkelstein, 1997; even law suits across markets, Gersen, 1999; see Pfeffer, 1997, for review), institutional accounts in which producer legitimacy in a market depends on recognized affiliation with symbolic forms beyond the market (e.g., Meyer and Rowan, 1977; DiMaggio and Powell, 1983; 1991; Zuckerman, 1999; see Scott, 1998, for review), and strategy frameworks such as the five-forces ideograph so widely used in business schools to discuss market competition (Porter, 1980). In a sense, strategic thinking has moved beyond market structure to re-emphasize the resources created down an experience curve (Stern and Stalk, 1998), and consider resources more broadly in terms of corporate deployment of assets and processes (e.g., Foss, 1997), but the value of a resource continues to be a function of the advantage it confers on an organization in a specific market. The value of a strategy for deploying resources remains contingent on the market in which the strategy is applied.

Our goal is to get another handle on the market factor in contingency theory, to produce graphs like Figure 1 describing the contingent value of specific organizational resources. Our handle on the market factor comes from using the external structure of a market, combined with observed market profits, to infer the internal condition of the market; much as an entomologist uses the exoskeleton of a bug to determine phylum and genus. Effective competition, a measure of competitive intensity, is inferred from observed market profits predicted by the market network of dependence on other sectors of the economy. Producers with profit margins higher than expected from observed market structure must face an "effective" level of competition lower than the level implied by the observed structure. Effective competition as a concept involves its own debatable assumptions, which we discuss at the end of the paper, but it also introduces an alternative and demonstrably productive perspective on the market factor in contingency theory.

We proceed in three sections. We establish the functional form of the empirical association between performance and the network structure of aggregate American markets. We then reverse-engineer the network model to infer effective levels of competition within the markets, and demonstrate the research value of effective competition for contingency theory.

THE DUAL STRUCTURE OF MARKET COMPETITION

We use network theory to juxtaposition the performance effects of internal and external market structure (a "stylized fact" following Schmalensee's, 1989, review of market structure research). Relying on review elsewhere (Burt, 1992), we can be brief. Structural autonomy, A, measures the extent to which producers in a market are free from the pressures of competitive pricing. A multiplier function defines structural autonomy in terms of constraint implicit in the internal and external structure of a market:

$$A = \alpha\,(k\text{-}O)^{\beta}\,C^{\gamma}, \qquad (1)$$

where O measures producer coordination, k is a constant equal to maximum coordination, (k-O) measures the internal constraint of producer competition, and C measures the external constraint of dependence on coordinated suppliers and customers (defined below). Ceteris paribus, performance should decrease with the internal constraint of competitive producers (β negative), and decrease with the external constraint of dependence on coordinated suppliers and customers (γ negative).

Aggregate American Markets

Every five years, the Department of Commerce publishes benchmark input-output tables of the American economy reporting the dollar value of goods exchanged between sectors of the economy. The benchmark tables are computed from a census of buying and selling in the economy. The data collection and processing involved result in benchmark tables appearing several years after the benchmark year. We use the most recent thirty years of benchmark tables; 1963, 1967, 1972, 1977, 1982, 1987, and 1992. The first four were described in Burt (1988). The later three have been available on diskette from the U. S. Department of Commerce, Bureau of Economic Analysis.

The tables contain sales and cost data with which performance can be compared across markets. We use price-cost margins, a profit measure of net income to sales introduced by Collins and Preston (1969) and widely used in market structure research: P equals dollars of value added minus labor costs, quantity divided by sales (see Burt, 1988:371ff., on price-cost margins computed from input-output tables versus the Census of Manufactures). For example, apparel producers had sales in 1987 of $64,184 million, of which $27,003 million was value added beyond the cost of supplies, of which $17,503 million was employee compensation — leaving apparel producers with a profit margin of 15¢ on a dollar of sales (.148 price-cost margin). Communications producers did bigger and better; $161,127 million in 1987 sales, of which $94,949 million was value added beyond the cost of supplies, of which $36,761 million was employee compensation, leaving a 36¢ profit margin (.361 price-cost margin).

The tables distinguish manufacturing and nonmanufacturing markets ("sectors" in input-output terminology) defined at a detailed level roughly corresponding to four-digit Standard Industrial Classification (SIC) categories. For example, there are 528 producer sectors in the 1982 table, from "poultry and eggs" within the aggregate "livestock" market, to "motion pictures" within the "amusements" market. The detailed categories combine to define 77 aggregate markets that are the units of analysis in this paper.

We use aggregate markets for two reasons: First, the aggregate markets are more likely to encompass the operations of the medium and large firms so often studied in organization research. Some of the aggregate markets are too broad for organization research (e.g., beverages and food processing are combined in the aggregate food market), but many are defined at a level appropriate for organization research (e.g., tobacco, metal containers, household appliances, motor vehicles). Where aggregate markets are too broad for a research project they can be disaggregated to an appropriate level with the data on detailed categories (as we did to match input-output data to Kotter and Heskitt's, 1992, market categories, see footnote 7). Second, we can compare aggregate markets over the thirty years for which we have data. Detailed categories can change substantially between benchmark tables, but the aggregate categories are comparable in the sense that changes occur within, rather than between, aggregate categories. We have a total of 537 market observations in seven panels, a panel for each benchmark input-output table.[1]

Internal Market Constraint (β effect)

Internal market constraint refers to the competition between producers in the same market seeking the same business. Competition is inversely related to the level of coordination among producers. This is the traditional axis of market competition, varying from the lack of competition in monopoly markets (maximum producer coordination) to the intense competition of commodity markets where opportunistic undercutting of one another's prices drives market price to the minimum possible and prevents any one producer from rising above market price (minimum producer coordination). A fitting summary is Stigler's (1957: 262) conclusion to his review of market competition in economic analysis; "If we were free to redefine competition at this late date, a persuasive case could be made that it should be restricted to meaning the absence of monopoly power in a market." The empirical task is to sort markets in terms of internal structure such that competition in one can be said to be some degree more intense than competition in the other. Of alternatives, market share measures discussed as concentration ratios are the most widely used.

Per standard practice, we use four-firm concentration ratios (market share of the four largest firms). Each aggregate market corresponds to a set of four-digit SIC categories (categories assigned to each input-output sector are published with each benchmark table). We measure producer coordination (O) in an aggregate market by the average concentration within market segments: $O = (\Sigma_q S_q CR_q)/(\Sigma S_q)$, where S_q is the dollars of sales by establishments in SIC category q, and CR_q is the four-firm concentration ratio for SIC category q. Concentration ratios for manufacturing markets are taken from the Census of Manufactures and ratios in nonmanufacturing are approximated with sales data in other census publications from the U.S. Department of Commerce (Burt, 1988:370; 1992:89-91). Varying from 0 to 1, concentration (O) indicates the extent to which a small number of producers hold a large share of their market.

The presumption is that more concentration indicates more coordination among producers, which means less intense competition, so producers can obtain higher profit margins. For example, apparel is less concentrated than communications (respective concentration ratios of .262 and .447) with the corresponding, above-mentioned difference in profit margins (15¢ on the dollar in apparel, 36¢ in communications), and the communications margin decreases over time with decreasing producer coordination (52¢ on a dollar of sales in 1963 when AT&T held a virtual monopoly on the market, to 45¢ in 1977, to 39¢ in 1982, and down to 36¢ in 1987 with regional companies and independent producers growing over the years). The correlation between concentration and profit margin is statistically significant across markets more generally, but weak in magnitude (Schmalensee, 1989:973-976). For example, concentration and price-cost margin have a .31 correlation across our 364 observations in manufacturing (6.3 t-test).

External Market Constraint (γ effect)

Weak performance-concentration correlations are to be expected, according to Eq. (1), if the correlations are computed without controls for variation in the external structure of markets (e.g., see Raider, 1998, on corporate innovation). Markets are not independent production sites. The mix of goods purchased from supplier sectors is determined by production technology, which ensures a network of variable dependence among production markets. Car producers, for example, can purchase steel from one or another company, but they must purchase steel somewhere. External market constraint is the competitive disadvantage associated with being dependent on coordinated suppliers and customers. Analogous to the metaphor of countervailing power (Galbraith, 1952, for the metaphor; Lustgarten, 1975, for an illustrative effort to operationalize the metaphor), the network concept of external constraint is grounded in the sociology of Simmel (1922) and Merton (1957) describing the autonomy created by conflicting affiliations (see Burt, 1983, 1992, for application to product markets).

Measures of external market constraint begin with resource dependence. Producers in a market are dependent on another market to the extent that a large portion of producer buying and selling directly or indirectly involves the other market. There is a network of asymmetric dependence weights implicit in the input-output table of buying and selling: $w_{ij} = (p_{ij} + \sum_q p_{iq}p_{qj})^2$, $i \neq q \neq j$, where p_{ij} is the proportion of producer i business that directly involves market j and the sum is the proportion of producer business that indirectly involves market j. Proportion p_{ij} is dollars of buying and selling between markets i and j, $(z_{ij}+z_{ji})$, divided by the sum of all producer buying and selling in other markets; $\sum_j(z_{ij}+z_{ji})$, $i \neq j$, where z_{ij} is dollars of sales from market i to j in the input-output table. Dependence weight w_{ij} varies from 0 to 1 with the extent to which producer buying and selling is directly (p_{ij}) or indirectly ($\sum_q p_{iq}p_{qj}$) with establishments in market j (see Burt, 1992: 54-62, for other specifications and connections with laboratory results on exchange networks).

Dependence is constraint when a buyer or supplier market contains few independent competitors. Transaction-specific constraint score c_{ij} measures the extent to which producers in market i are constrained in their transactions with market j, and the sum of transaction-specific scores measures the aggregate buyer-supplier constraint on producers in market i: $C = \sum_j c_{ij} = \sum_j w_{ij}O_j$, $i \neq j$, where O_j is the coordination of producers in sector j, which we measure with concentration in sector j (as described above).

——— Figure 2 About Here ———

Figure 2 is a simplified market network (useful in the next section to illustrate effective competition and link it to the descriptive results in this section). Each dot in Figure 2 represents a producer. Lines indicate coordinating ties within markets as well as aggregate buying and selling between markets. Relations are on or off for this illustration. Markets are distinguished by circles around substitutable producers. The sociogram is a fragment of the trade network around the four producers in the gray circle buying supplies (in markets A, E, and F), and selling their output (in markets B, C, and D).

The table at the bottom of Figure 2 shows the constraint on gray-circle producer transactions with each other sector. In this simplified network, the p_{ij} are one over the number of a market's ties. Producer coordination (O) is high to the extent that a few disconnected producers are responsible for a large proportion of market output. Let the producers in Figure 2 be the same size, so each producer in the gray circle has a 25% market share, the coordinated producers in market A together hold a 100% market share, and each producer in disorganized market C has a 12.5% market share. Transaction-specific constraint score c_{ij} (bottom row of table) is the product of producer dependence on market j (weights w_{ij} in first row) times producer coordination in market j (O_j in second row). Producer transactions with market C are least constrained because C is disorganized and does no business in the other markets in this network. Producer transactions with market A are most constrained. Market A producers are tied to one another to operate as a single organization and do business in three of the other supplier-customer markets. Aggregate buyer-supplier constraint on the gray-circle producers is the sum of the six transaction-specific constraints (C = .26). We have a buyer-supplier constraint score for each market in each benchmark input-output table.

Association with Performance

Now to the empirical regularity captured by Eq. (1). Results in Table 1 connect our measures with prior work, extend the work into the 1990s, and explain our choice of functional form for a baseline model.

The four models at the top of the table are alternative functional forms linking performance with internal and external market constraint. We have several hundred observations, but they are repeated observations of the same 77 markets, and market structure at this aggregate level is quite stable over the thirty years (Table 3). Therefore, we estimated each model twice. At the extreme of maximum autocorrelation, our data on each market are one observation repeated over time, which yields the estimates in the "a" column for each model (computed from data averaged over time so there is one observation per market, N = 77). At the other extreme of minimum autocorrelation, the five years between benchmark tables could be sufficient interval to treat each observation as independent, which yields the estimates in the "b" column for each model (computed from seven observations on 76 markets and five on the restaurant market, N = 537). The "b" column includes a control for trend and the 1982 drop in margins (discussed below in Table 4). Between the extremes of assuming maximum and minimum autocorrelation are various statistical methods for dealing with autocorrelation (e.g., Burt, 1988, presents similar results estimated with pooled cross-section controls for autocorrelation). We present estimates at the two extremes of autocorrelation because we reach the same substantive conclusions either way, and so ignore autocorrelation for the purposes of this paper. The summary point is that estimates of β and γ are significantly negative for the respective effects of internal and external market constraint (least clearly in linear Model I and most clearly in nonlinear Model IV, which is the model in Eq. 1).

——— Table 1 and Figure 3 About Here ———

Model I defines a linear form for the prediction. Burt (1983) described this association for 1967 with profits in American manufacturing markets defined at broad and detailed levels of aggregation, and extended the results into nonmanufacturing through the 1960s and 1970s (Burt, 1988). The results are replicated in Table 1 for aggregate American markets into the 1990s; margins decline linearly with internal and external market constraint. The control for nonmanufacturing adjusts for higher margins in nonmanufacturing. Producer competition (k-O) is measured with constant k set to 1 (maximum concentration possible and slightly higher than the highest observed score of .963 for iron ore mining in 1977). Burt (1988) separates out the effect of constrained business with government sectors, which we have combined for the purposes of this paper with other producer buying and selling in the external constraint measure C. Similar results have been observed in other countries; Germany during the 1970s and 1980s

(Ziegler, 1982; Burt and Freeman, 1994), Israel during the 1970s (Talmud, 1994), Japan in the 1980s (Yasuda, 1996), and Korea in the 1980s (Jang, 1997).

The other models in Table 1 have the nonlinear form in Eq. (1) needed to capture the steeper effects of market conditions approaching monopoly. Model II replicates the results in Burt (1992:92-100) over our broader time period. Model III is the same as II but the nonmanufacturing dummy is replaced with a land-market dummy. Margins are not uniformly higher outside manufacturing so much as they are high in five nonmanufacturing markets concerned with political control over land. The five “land” markets return much higher profits than expected from their market structure: farming (sector 2, which excludes livestock and dairy products), forestry and fishery (sector 3), coal mining (sector 7), crude petroleum and natural gas (sector 8, not to be confused with petroleum refining), and real estate (input-output sector 71). We are not concerned in this paper with the specifics of these markets, so we control for their difference from other markets and see the predicted market structure effects more clearly in the sense of stronger t-tests in Model III. Finally, trial and error with alternative forms led us to Model IV for the clearest association with market structure. Estimates come from regressing price-cost margins over ln(A) rather than regressing ln(P) over ln(A) as in Models III and II. Model IV is our baseline model for the remainder of the paper.[2]

Figure 3 summarizes the Model IV market structure effects in a visual display. The two dimensions of market structure define the floor of the three-dimensional graph. The front corner of the floor is maximum internal and external constraint (O = 0, C = 1). The back corner of the floor is maximum structural autonomy (O = 1, C = 0). The wire-mesh performance surface is based on 509 observations (all markets excluding the four distinguished by the land dummy in Table 1). The surface is high over combinations of internal and external market constraint where price-cost margins are high (using a distance-weighted least-squares smoothing to average adjacent price-cost margins).

Four points are illustrated in Figure 3. First, the surface slopes down from maximum structural autonomy at the back of the graph to maximum constraint at the front of the graph (i.e., more competitive markets yield lower profit margins). Second, the surface slopes downward more steeply at the back of the graph showing the stronger effect of market structure on performance for more autonomous producers. Third, the back edge of the surface slopes down more steeply to the left than to the right showing the stronger effect of internal market constraint. Fourth, the smooth surface implies continuous performance effect across mixtures of internal and external market constraint.

EFFECTIVE COMPETITION

Producers with profit margins lower than expected from observed market structure must face an "effective" level of competition higher than the level implied by the observed structure.

Given a functional form in Model IV, Table 1, for the association between performance and market structure, we can reverse-engineer the model to infer the effective level of producer coordination from observed performance and producer dependence on other markets. Begin with the logarithm of Model IV:

(2) $$\widehat{P}_i = \ln(A_i) = \ln(\alpha) + \beta[\ln(k - O_i)] + \gamma[\ln(\textstyle\sum_j w_{ij} O_j)], \; i \neq j$$

where the equation is written for producers in market i doing business with supplier and customer markets j, buyer-supplier constraint C is replaced with its definition, and $\widehat{P}$ is the price-cost margin predicted by market structure (observed margin minus a residual not predicted by market structure). The residual includes effects of the control variables in Table 1 plus unknown other effects presumed random. This is an equation for testing hypotheses about the effects. We know, from past work and the results in Table 1, that performance varies across market structures as illustrated in Figure 3 and that β and γ are significantly negative.

Re-write Eq. (2) to infer the effective level of producer coordination from observed performance and producer dependence on other markets:

(3a) $$P_i = \ln(A_i) = \ln(\alpha) + \beta[\ln(k - \widehat{O}_i)] + \gamma[\ln(\sum_j w_{ij} \widehat{O}_j)], \quad i \neq j$$

which is the regression model for the following network model obtained by taking the antilog of Eq. (3a):

(3b) $$A_i = \alpha \left[\left(k\text{-}\widehat{O}_i\right)^r \left(\sum_j w_{ij}\widehat{O}_j\right)\right]^\gamma, \quad i \neq j$$

where r is the effect ratio of internal versus external market constraint (β/γ, discussed below), and the concentration measure of producer coordination (O) in Eq. (2) has been replaced by an unobservable "true" level of coordination $\widehat{O}$.

Error is the key difference between Eqs. (2) and (3). Errors in Eq. (2) occur in the performance variable (thus the predicted level of performance, $\widehat{P}$). There is no error in the Eq. (3) performance variable. Profit is the log of structural autonomy, P = ln(A), and structural autonomy is the exponential of profit, $A = e^P$. Errors in Eq. (3) occur in the producer-coordination variable (thus the predicted level of producer coordination, $\widehat{O}$). Instead of asking what value of outcome Y can be expected from known causal variable X, we ask in Eq. (3) what value of X would be necessary to generate the known outcome Y. To obtain their known profit margin, operating from their known network position in the economy, how well coordinated must producers be?

<u>Variable</u> $\widehat{O}$ <u>measures the "effective" coordination of producers in the sense that coordination is inferred from the market structure effect on performance</u>. Effective often means "good," but it should be clear that such is not our use of the word. <u>Effective coordination is the level of producer coordination implicit in the observed level of</u>

producer performance (P) and the observed network of producer dependence relations with other markets (w_{ij}). Given $\widehat{O}$ as the effective level of coordination among producers, (k-$\widehat{O}$) is the effective level of competition within their market — which we propose to use as the market context factor in contingency theory.[3]

Identification and Computation

Equation (3) defines for N markets a system of N equations containing N+2 unknowns (intercept α, slope γ, and an effective level of coordination within each of N markets). To define a unique solution, we gain a degree of freedom by normalizing scores to the maximum in any market ($\widehat{O} = \widehat{O}/\widehat{O}max$), and gain one or more by fixing scores in one or more markets to equal observed concentration ratios, or fixing the minimum score at zero ($\widehat{O} = (\widehat{O}-\widehat{O}min)/(\widehat{O}max - \widehat{O}min)$).

We use a Newton-Raphson algorithm to solve for the unknowns (see Appendix for details and analogy to network eigenvector models). The algorithm adjusts observed levels of producer coordination to improve the match between observed and expected performance. Where observed performance is higher than expected from market structure, increase the effective coordination of producers and decrease the effective coordination within key supplier or customer markets. The process is illustrated in Table 2 below. Constant k is set to a value slightly higher than the maximum possible coordination score of 1 to ensure that producer competition is always a positive fraction so variation in buyer-supplier constraint can affect performance in even the most organized markets (we set k to 1.001). Replacing β with ratio r allows us to preserve the effect balance between internal and external constraint when inferring $\widehat{O}$ ($r = \beta/\gamma = .071/.049 = 1.45$ for the aggregate American markets in Table 1, cf. Table 4).

Residual Coordination

The difference between concentration and effective coordination measures the extent to which concentration understates the level of coordination within a market: $\widehat{O} = \mu + O + \phi$, so;

$$\phi = \widehat{O} - O - \mu, \quad (4)$$

where μ is an intercept (mean $\widehat{O}$ - mean O), $\widehat{O}$ is the effective coordination of producers, O is the level of coordination indicated by concentration, and ϕ is an error term measuring residual coordination. Residual coordination varies from positive to negative scores. A positive score indicates producers better coordinated than they appear to be. Zero indicates producers effectively as coordinated as they appear to be. A negative score indicates producers effectively less coordinated than they appear to be.

Numerical Illustration

Table 2 contains effective coordination scores for the network fragment in Figure 2. Three panels of data are displayed. The first contains concentration and dependence weights as already discussed for the illustrative network.

The second describes coordination when performance is determined by observed market structure. Performance differences between the markets follow from the earlier discussion of Figure 2. Performance is high in market D, for example, because producers are completely coordinated facing minimum constraint from other markets. Markets E and F face strong external constraint, but F is better organized to handle it and so shows the higher performance. Residual coordination is zero in every market. Effective coordination ($\widehat{O}$) equals observed coordination (O) when performance is determined by observed market structure.

——— Table 2 About Here ———

The bottom panel describes what happens when performance is not predicted by observed market structure. Performance is the same as in the first panel — except in market A. Instead of the 86¢ profit expected on a dollar of sales, we lowered the observed margin to 9¢. Market performance in the second panel is therefore not determined by market structure. Now effective coordination differs from concentration. For example, observed concentration of 1.0 in market A is adjusted down to .148 effective coordination. If market A is under-performing, then producers must be less coordinated than they appear to be. Also, key supplier or customer markets must be better coordinated than they appear to be. Market A is most dependent on the gray-circle market (w_{17} = .340) and the observed .25 concentration in the gray-circle market is adjusted up to .351 effective coordination. If market A producers are less coordinated than they appear to be, then the constraint on their customer markets is less. Since performance in those markets has not changed, producers in the customer markets must be less coordinated than they appear to be. The low observed concentration in E is adjusted down to minimum effective coordination. Changing coordination within the gray-circle market changes the external constraint on every other market because every other market depends on it (seventh column of w_{ij} in Table 2 are all substantially over zero). The most affected is market C. Market C is exclusively and entirely dependent on the gray-circle market (w_{37} is the maximum possible, 1.0). Since market C performance is unchanged and it now faces more severe supplier constraint, producers in market C must be better coordinated than they appear to be. The concentration of .125 in market C is adjusted up to .661 effective coordination.

This story can be told various ways to make the point: Effective coordination traces inconsistencies between performance and producer coordination through the network of market dependencies to find levels of effective coordination consistent with the observed performance differences between markets.

WHY EFFECTIVE COMPETITION?

Effective competition can be a productive market variable for contingency theory. In this final section, we demonstrate the point in three ways: more reliable measurement robust to ad hoc adjustments and exogenous shocks to markets, more accurate measurement revealing contingency, and a market factor integrating case with comparative research.

Reliable Measurement

The presumption in predicting performance from market structure is that prediction errors are due to error in measuring the dependent variable, performance.

But which of the three elements in the baseline model — performance, internal structure, and external structure — is most subject to measurement error? Price-cost margins (P) and the network of market dependencies (the w_{ij} used to define buyer-supplier constraint C) are observable with census precision down to the detailed level of about 500 production markets in the American economy and they measure what they are presumed to measure. Price-cost margins measure the extent to which producers receive income above production costs. Market dependency w_{ij} measures the extent to which buying and selling by producers in market i directly or indirectly involves producers in some other market j.

In contrast, producer coordination (O) measured by concentration data involves substantial assumption and guesswork. The assumption is that intensity of competition among producers decreases with the market share of the largest firms. Economists have long been troubled by the ambiguous connection in theory between concentration and competition (e.g., Schmalensee, 1989:966). No competition is clear at the extreme of monopoly — one company controlling all producers means no alternative offers except as the company allows them. It is not clear in theory how competition increases with the introduction of additional companies, though there are empirical results on profits decreasing most with the presence of third and subsequent large competitors (Kwoka, 1979; Burt, 1983:16-32), and there are abundant empirical results on mortality correlates of the number of companies in a market (e.g., Hannan and Freeman, 1989). Causal direction is also ambiguous. Concentration is assumed to measure a lack of competition, which allows producers to increase profit margins. An alternative is to argue that superior firms earn high profits and large market share, which means that correlation between concentration and profit is spurious (Peltzman, 1977; Ravenscraft, 1983; Weiss, 1989:7-10).

There would be problems with concentration measures of coordination even if there were a linear connection between competition and concentration. Weiss (1989:1-10) offers a succinct review of issues. Local competition is an issue we find especially troubling since concentration ratios are computed for the national economy. Some services, such as hotels, restaurants, and government-sanctioned utilities, are typically sold locally rather than nationally (e.g., Baum and Mezias, 1992, on local crowding among hotels; Ingram and Roberts, 2000, on hotel performance and competitor friendship networks). The cost of shipping can also protect local producers from distant producers. Stone, concrete, and the like are obvious examples, but in the history of almost all industries there is an element of local competition due to transportation barriers (e.g., Bigelow, Carroll, Seidel and Tsai, 1997, on regional competition in the automobile industry). Even in national markets, however, there can be a preference for personal ties between supplier and customer such that competition is more local than national. Romo and Schwartz (1995) describe companies in inter-dependent markets moving to the geographical area around a core firm to facilitate flexible, personal ties (see Romo and Schwartz, 1993, on the growth of regional service economies; cf. Sorenson and Stuart, 2001, on geographic concentration and social networks). Whether for reasons of transportation costs, government regulation, or the importance of personal ties, competition in certain markets is more local than national. The largest firms in a locally competitive market can have a small share of the national market, even if each dominates their local market. In such a market, concentration at the national level understates the level of competition, so the profit margin determined by competition will be higher than expected from the national level of concentration. And concentration ratios in manufacturing are the better data! Concentration in nonmanufacturing is more obviously affected by measurement error since ratios are approximated from sales at the level of whole firms that span multiple markets (Burt, 1988: 370; 1992: 89-91).

The problems with concentration measures of producer coordination are acceptable in the sense that they have precedent in published empirical research and continue to generate expected market structure effects.

However, the ambiguous measurement they represent is troubling, and unnecessary if error is more accurately handled in the network model of effective competition. The presumption in effective competition is that performance can be observed and measured more accurately than producer coordination. Coordination is treated as an unobserved market condition to be inferred from performance and the constraint implicit in a market's external structure of transactions with supplier and customer markets. An attractive consequence is that effective competition adjusts automatically for exogenous shocks to market competition that affect producer performance. We can illustrate this point is with the effect of imports on American markets in 1982.

<u>Market Structure Stability</u>

Internal and external market constraint are dramatically stable across the thirty years on which we have data. Table 3 lists correlations for the repeated measures; producer concentration (O) in the upper diagonal, buyer-supplier constraint (C) in the lower diagonal. There are ups and downs in individual markets (e.g., concentration and price-cost margin increase from 1972 to 1977 within oil and gas drilling, then drop back down in 1982 to their level before the energy crisis), and trend in some markets (e.g., the decreasing concentration and margins in communications mentioned earlier), but the primary feature of the table is stability (see Burt, 1988, for detailed results on stability through the 1960s and 1970s). Average scores do not change over time ($F_{6,530}$ is 0.07 for concentration and 0.13 for buyer-supplier constraint, giving the constant-mean hypothesis a .99 probability of being true). A single principal component accounts for 96% of the concentration variance in the seven panels, and 89% of the buyer-supplier constraint variance in the seven panels (and going beyond Table 3, 93% of the variance in the seven vectors of dependence weights w_{ij} used to compute buyer-supplier constraint).

——— Table 3 About Here ———

We estimated two covariance models to better understand stability at this aggregate level. A single-factor model presumes complete stability: market structure has a true value Y that is constant over time but observed with error in panel t ($y_t = d_t Y + e_t$). A simplex model says that stability is more short term than long-term: the structure observed in panel t is an incremental change from structure in the preceding panel ($y_t = d_t y_{t-1} + e_t$). The strong correlations in Table 3 and extensive variance described by a single principal component suggests a single-factor model, but there is also evidence of simplex structure in which panels further apart in time are less correlated. Buyer-supplier constraint in adjacent panels is correlated .94 on average (.94 = [.961+.933+.926+.870+.972+.965]/6), which decreases to .90 between panels two time periods apart, .85 for panels three time periods apart, .80 for panels four time periods apart, .78 for panels five time periods apart, and .70 between the first and last panels which are six time periods apart. Neither model, however, describes the data.[4] We also get rejections beyond a .001 level of confidence with log scores, and models fit to the more comparable five panels after 1970. Aggregate market structure is clearly stable across the seven panels, but there is more than a single-factor or simplex process responsible for the stability.

Disconnect from Market Performance in 1982

The association between performance and market structure, however, is not stable. Table 4 shows what happens when our baseline Model IV in Table 1 is estimated for each panel separately. Through the 1960s and 1970s, then again in 1987 and 1992, the association is as depicted in Figure 3 — price-cost margins decrease with the internal market constraint of disorganized producers (t-tests of -2.9 to -5.4) and the external market constraint of dependence on coordinated suppliers and customers (t-tests of -3.2 to -4.8).

In 1982, however, margins are independent of producer concentration (-1.7 t-test). There is evidence of buyer-supplier constraint lowering performance (-3.2 t-test), but the evidence is hardly reassuring. If negotiating with coordinated suppliers and customers erodes performance, why doesn't producer coordination enhance performance?

Imports an Exogenous Shock in 1982

The market model's failure to predict performance in 1982 can be traced to an exogenous shock. Except for their significant drop in 1982 (-2.9 t-test, $P < .01$), margins are stable across the panels preceding 1982 ($F_{3,302} = 0.30$, .82 probability of no difference) and again after 1982 ($F_{5,454} = 0.82$, .53 probability of no difference before and after 1982). The 1982 exogenous shock cannot be traced to the market structure variables. The results in Table 3 show that market structure continued through the 1980s as it was during the 1960s and 1970s, and the 1982 failure remains if we exclude the four markets showing unusual change in the preceding decade (-0.8 t-test for concentration association with performance in 73 markets excluding oil and gas drilling, ferrous ores mining, nonferrous ores mining, and chemical mining). Further, the exogenous shock in 1982 was a shock to certain markets more than a shock to the whole economy. Figure 4 shows how average price-cost margins in the 1960s and 1970s are associated with later margins. Negative margins in 1982 are the most apparent difference between the graphs. No aggregate market at any other time has a negative margin; only in 1982, when eight markets are in the red. Margins in the other 69 markets are similar in 1982 to their averages across the preceding panels (.93 correlation). Also, the association lost in 1982 between performance and market structure is regained if we put aside the eight markets with negative profit margins (-2.5 t-test for the β effect of internal market constraint in the remaining 69 markets, and -2.7 t-test for the γ effect of external market constraint).

——— Table 4 and Figure 4 About Here ———

Further study (not reported here) of the markets with negative margins led us to imports as the exogenous shock responsible for the 1982 failure. The search is an interesting story in its own right, but it is sufficient for the purposes of this paper to show the result. The last five columns in Table 4 contain estimates of our baseline model with a control added for the market share held by imports in each market.[5] Imports have a negative effect on profit margins (see Schmalensee, 1989:976, for similar results in other countries). The point is that the baseline association between performance and market structure is again apparent when imports are held constant. In the third to the last column in Table 4, 1982 margins decrease significantly with the internal market constraint of disorganized producers (-2.5 t-test) and the external constraint of dependence on coordinated suppliers and customers (-3.1 t-test). Imports continue to increase their share of American markets after 1982 (the average market share of imports is 6%, 7%, 8%, 12%, and 13% in 1972, 1977, 1982, 1987, and 1992 respectively), but they do not have in 1987 or 1992 the disruptive effect that they had in 1982.

<u>Effective Competition Adjusts for Exogenous Shock</u>

Thus, the market model failed in 1982 because we measured producer coordination in terms of domestic producers. The market share of the four largest domestic producers overstated the effective level of producer coordination when there are foreign competitors in the market.

The significant point with respect to effective competition is that the exogenous shock of imports in 1982 is captured by effective competition without us having to know about the shock. When 1982 margins were less than expected in certain markets, the network model adjusted down the effective coordination of producers in the markets and so adjusted up the effective level of competition within the markets. Negative residual coordination (ϕ in Eq. 4) identifies markets in which the effective coordination of producers is less than implied by concentration.

It is not surprising to learn that the residual coordination of producers in 1982 is correlated with imports. A quarter of the variance in residual-coordination adjustments to concentration in 1982 can be predicted from imports (-.56 correlation with log imports, -5.8 t-test). The negative association shows that as the market share of foreign-made goods increased, domestic producers were effectively less coordinated than concentration implied. With its automatic adjustment for exogenous change, effective competition is more reliable than observed market structure as the context variable in contingency theory.

Moreover, effective competition makes its adjustments simultaneously in supplier and customer markets up and down the production chain that runs through the market directly affected by an exogenous variable such as imports. For example, the price-cost margin in iron ore mining decreased from 21¢ in 1972, to 18¢ in 1977, and -6¢ in 1982. Organization within the market is part of the story. Concentration was above 90% through the 1970s, then dropped to 69% in 1982. Direct imports are part of the story. Imported iron ore held about a third of the market through the 1970s, which increased slightly to 37% in 1982. But a systematic change that mirrors the lost profit margin is downstream of the producers. Iron mining depends on sales to steel companies; 87% of their sales in 1982, and imports take an increasing share of the steel market in the preceding years (9% in 1972, 11% in 1977, 16% in 1982). By the end of 1983, iron ore mining had virtually ceased in the western half of the country, and federal legislation had been introduced in both houses of the Congress to limit imports to a proportion of domestic production (Klinger, 1983).

Leather shows a more complex production-chain effect. The price-cost margin for leather tanning and preparation decreased from 8¢ during the 1970s to -3¢ in 1982. Downstrean imports help explain leather's poor performance in 1982. Shoe manufactures accounted for 72% of domestic leather sales in 1982, and domestic shoe production was down. The market share of imported shoes increased dramatically to record levels in 1982, primarily because of the removal of the Orderly Marketing Agreements with Korea and Taiwan, and the strength of the US dollar against foreign currencies. The 19% market share of imports in 1972 grew to 38% in 1982. Leather producers were simultaneously oppressed by exogenous change upstream. Supplier exports increased the price of hides. In the early 1980s, some countries such as Argentina, Brazil and India used embargoes and export taxes to restrict hide exports to encourage the growth of their own leather markets. World demand shifted to American hide suppliers, raising the price of hides, and so increasing the cost of supplies for American leather producers. In addition, domestic customers were buying more imported leather. Imported leather increased from 13% of the market in the 1970s to 19% in 1982. As the Department of Commerce report summarized the situation (Byron, 1983:4); "The five-year outlook for the US leather tanning and finishing industry remains poor."

Contingency Revealed

Our second point on the value of effective competition is its ability to make contingency more apparent. Return to the “culture effect” discussed at the beginning of the paper — a strong corporate culture can improve the economic performance of a firm. Kotter and Heskett (1992) offer a rare opportunity to test the culture effect with data on performance and strength of corporate culture for a selection of firms in a variety of broad markets analogous to the market categories in *Fortune* magazine. We use the 180 firms in 19 markets summarized in Figure 1.

To measure the relative strength of culture, Kotter and Heskett mailed questionnaires to the top six officers in each sample company, asking them to rate the strength of corporate culture in the other firm selected for study in their market. Respondents were given three indicators of a "strong" culture (Kotter and Heskett, 1992:159-162): (1) managers in the firm commonly speak of their company's "style" or way of doing things, (2) the firm has made its values known through a creed or credo and has made a serious attempt to encourage managers to follow them, and (3) the firm has been managed according to long-standing policies and practices other than those of just the incumbent CEO. Responses were averaged to define the strength of a firm’s corporate culture, and we remove negligible market differences in culture strength by subtracting from each firm’s score the average for all sample firms in the market (Burt et al., 1994: 347; horizontal axis of the graphs at the bottom of Figure 1).

Kotter and Heskett (1992:166-174) list three measures of economic performance: net income growth from 1977 to 1988, average return on invested capital from 1977 to 1988, and average yearly increases in stock prices from 1977 to 1988. The three performance measures are reported to have correlations of .46, .31, and .26 respectively with culture strength (Kotter and Heskett, 1992:189). We use average return on invested capital to measure performance because it is most similar to the price-cost margins we have from the input-output tables, and its reported .31 correlation with culture strength is intermediate between the alternative performance measures. Almost half of the performance variance between firms can be predicted from the market in which a firm operates.[6] To study performance net of market differences, we subtract from each firm’s performance score the average score for all sample firms in the market (vertical axis of the graphs at the bottom of Figure 1).

Figure 1 shows that the culture effect — strong on average across firms — varies from dramatic in some markets to nothing in others. The .85 correlation in the graph at the top of Figure 1 shows how closely the culture effect varies with market competition (analysis with effective competition computed for more detailed market categories yields the same contingency function, Burt et al., 1994:368).[7] The nonlinear regression line in the graph is a contingency function in the sense of describing how the culture effect is a function of market competition. For any specific level of market competition, the contingency function defines an expected strength of correlation between culture strength and producer performance.[8]

<u>The significant point with respect to effective competition is that the contingency visible in Figure 1 is less visible, in fact, virtually invisible, if markets are ordered on the horizontal axis of Figure 1 by their observed structure</u>. Note the regression equation in the corner of the graph at the top of Figure 1 — the contingent value of a strong corporate culture (measured by the correlation between culture and performance in a market, CPr) increases with the effective level of competition in the market ($k-\widehat{O}$). The .85 correlation across markets is .46 for producer concentration (1 - O), or .20 if we replace effective competition with buyer-supplier constraint (C). If we predict CPr with all three market measures, only effective competition is associated with the contingent value of a strong corporate culture; 5.0 t-test for ($k-\widehat{O}$), 0.4 t-test for (1-O), 1.5 t-test for C.

Results in Table 5 make the point at the organization level. Firm performance is predicted from culture strength and a contingency function keyed to market competition. The positive association between performance and culture strength increases significantly with the effective level of competition in a firm's market (4.3 t-test in the second column of Table 5). There is no association with either of the two measures of observed market structure (-0.2 and 1.1 t-tests for internal and external constraint).

——— Table 5 About Here ———

A reviewer suggested that we add other concentration measures to the table, measures adjusted for the problems discussed in the preceding section; localized competition, government regulation, imports, and so on. The suggestion takes us back to the preceding section. The problem with such tests is the lack of a definitive adjustment against which effective competition can be tested. Reasonable adjustments to concentration are a list of variably ad hoc alternatives, with the significance of any one more a function of data than theory (e.g., adjusting concentration for imports is in theory reasonable at any time, but the results in Table 4 show that the adjustment is only in 1982 critical to seeing the expected association between performance and producer concentration).

Moreover, if one managed to capture all relevant adjustments, adjusted concentration would equal the effective coordination of producers ($\widehat{O}$), and so duplicate our results in Figure 1 and Table 5 with effective competition. The effective competition model saves us the labor that would otherwise be spent on learning what adjustments are needed in any one year. Concentration is adjusted automatically to balance producer performance with the constraint implicit in producer buying and selling in other sectors of the economy.

Our results do not reject producer concentration or buyer-supplier constraint as useful measures. Effective competition might or might not work as well at revealing the contingent value of other aspects of organizational form. That is a task for future research. What we do know from the above results is that for at least one often-discussed aspect of organizational form — the value of having a strong corporate culture — unobserved effective competition reveals contingency better than familiar, observable conditions of producer concentration or buyer-supplier constraint.

Integrating Case and Comparative Research

Our third point on the research value of effective competition is the bridge it provides for integrating case and comparative research. To generalize the culture effect to firms not in

Kotter and Heskett's study, we have to know how their firms constitute a sample of organizations. Such knowledge rarely exists in organization research because firms are almost never selected for study by probability criteria (e.g., Kotter and Heskett's, 1992:19, sampling frame is defined in the book by its goal to; "get a large and diverse sample of companies."), and even the best efforts are based on quota-sampling frames that do not compare across studies (size in sales or assets, market categories, geographical regions, etc.). Standard operating procedure is to publish case studies as if they represented organizations more generally, and convenience samples as if they were probability samples, whereupon routine statistical inference can be used to guide generalizations. Given the general acceptance of contingency theory, and the sophisticated sampling frames possible with current technology, it is surprising to see so little attention given to sampling organizations from which population inferences can be made (for an exception, see Kalleberg, Marsden, Aldrich and Cassell, 1990; Kalleberg, Knoke, Marsden and Spaeth, 1996, esp. Chap. 2, on strategies for sampling organizations).

Effective competition is a bridge for inferring population parameters from sample statistics. Given a contingency function (as in Figure 1), and census network data available on the population of markets (input-output tables), apply the contingency function to the census data to make inferences about the economy as a population of organizations. For example, the expected culture effect E(CPr) in Kotter and Heskett's sample of firms equals the sum across markets i of the proportion P(i) of sample firms drawn from market i times the culture-performance correlation F(i) predicted by the contingency function for the market; $E[CPr] = \sum_i P(i) F(i) = .49$. The .49 correlation expected between culture strength and performance in the Kotter and Heskett data from the contingency function and the proportion of sample firms drawn from each study market is close to the .51 correlation observed across the sample firms. This is the methodology that Burt et al. (1994: 359-365) use to draw inferences about the probable strength of the culture effect for American firms throughout the economy.

Here we focus on selecting organizations and markets for generalizeable case study. The strength of the culture effect in a research design can be predicted from two things a priori to conducting research: the contingency function, and the relative number of firms selected for study from markets at known points on the contingency function. To study the processes by which a strong corporate culture (or similar coordination-enhancing forms of organization) enhance performance, select firms for study from effectively competitive markets (e.g., airlines, apparel, motor vehicles, or textiles at the right in Figure 1), where a strong corporate culture is known to be a competitive advantage. It won't be surprising to find the culture effect, but the goal of the research is to describe the social processes responsible for the effect. At the other extreme, to study processes that substitute for the culture effect on performance, study firms in the markets where producers are effectively coordinated (e.g., communications, beverages, or pharmaceuticals at the left in Figure 1). There will be no evidence of the culture effect, but the goal of the research is to describe how other social mechanisms such as interpersonal networks coordinate employees in lieu of culture to enhance performance.

Consider a hypothetical case of two students designing research on the performance effects of a strong corporate culture. One selects 10 beverage firms for in-depth case analysis because he worked in the industry and so has good personal contacts there. The other student selects 10 apparel firms for the same reason. Two reasonable and interesting projects with a relatively large number of firms for case analysis.

There is no need to do the research. The first student has selected a market in which producers are effectively coordinated ($\widehat{O}$ score of .916 for beverages in 1982), so effective competition is low (beverages are to the far left in Figure 1), and a strong corporate culture offers no competitive advantage. This student will find no evidence of higher performance in strong-culture firms, will generalize his results to conclude that there is no culture effect, and later advise client firms against wasting resources on institutionalizing a strong corporate culture. The second student has selected markets at the other extreme of the contingency function. Effective coordination is low within apparel ($\widehat{O}$ score of .396), so effective competition is high (apparel is to the far right in Figure 1), and a strong corporate culture is a competitive advantage. This student will find evidence of higher performance in strong-culture firms, will generalize her results to conclude that performance depends on developing a strong corporate culture, and later advise client firms to concentrate on institutionalizing a strong corporate culture. Meta-analysts will later average the significant-results project with the negligible-results project to conclude that evidence is mixed on whether or not a culture effect exists. Within the scope of the individual studies, all three conclusions are reasonable. Nevertheless, all three are wrong; simplistic in their ignorance of the culture effect's contingency function.

——— Table 6 About Here ———

How essential is effective competition to this integration? We are merely using census data on markets to integrate case and comparative research. The same method has been used in organization research for decades with other census measures of market structure such as concentration. Effective competition is noteworthy here because it is more reliable (Table 4) and accurate (Table 5) than familiar measures of observed market structure, such as producer concentration, in revealing the contingency function integrating case and comparative research.

More, the contrast between effective competition and observed market structure indicates residual coordination unseen in a market, which is a further guide to siting case analyses. Effective coordination is in some part explicit, observable from market concentration, and in some other part implicit, seen only in the ability of producers to obtain higher profit margins than one would expect from the observed structure of their market. Residual coordination defined in Eq. (4) measures the extent to which producers in a market are more effectively coordinated than they appear to be. Table 6 contains average scores across 1982, 1987, and 1992, ranking markets by residual coordination (detailed transaction data are available on diskette for 1982, 1987 and 1992, so they are the most likely to be analyzed for structure within the aggregate markets).

The 15 markets with the most positive residual-coordination scores are listed at the top of Table 6. These markets are strategic research sites for studying forms of organization in which producers with small shares of their market are organized so as to lower the effective level of competition in their market. Margins tend to be above average (e.g., 77¢ on the dollar in real estate and rentals, 39¢ in forestry and fish), but there are also markets in which margins are below average (e.g., 12¢ in livestock, and 6¢ in agriculture, forestry and fishery services). The common feature is that the margins, high or low, are higher than one would expect from the observed structure of these markets.

Real estate is an ideal-type at the top of the list. The largest real estate firms account for only a small proportion of all American real estate transactions. Concentration is close to zero. To obtain the high profits observed in real estate, producers must be coordinated in ways not apparent from concentration. In fact, real estate markets are organized locally by interpersonal referrals and dominant local brokerages, with city and state regulations an important factor in who gets to sell what (Case, 1965:2, 141; Fine, 1989:10).

Business services are close to the top of the list. The business services market is a hodge-podge of services; 21% advertising, 13% architects and engineers, 12% lawyers, 9% management consulting. These are services provided to firms in large part by internal suppliers (staff lawyers, engineers, managers) and local suppliers. Personal ties with clients are critical to success, and such ties are invisible to concentration data. Of course, social order in the market could have other origins (Mizruchi, 1992: Chap. 3). For example, status differentiation seems a likely source of residual coordination since socially accepted distinctions between high- and low-status producers could help explain profits higher than expected from observed concentration and buyer-supplier constraint (Podolny, 1993; Podolny, Stuart, and Hannan, 1996; Stuart, 1998; also note the markets at the top of

Table 6 in which status distinctions more familiarly order the market; hotels, personal services, amusements, restaurants, medicine, education, and publishing).

Coal and stone mining are a different kind of example. Transportation costs are substantial and margins are thin. Producers rely on local customers (Rogers, 1986:40, on coal mining; Ampian, 1989:303, and Tepordei, 1989:1007, on clay and crushed stone). Government is another factor in residual coordination. Farming and fisheries are at the top of the list in Table 6. There are no dominant large firms in these markets (concentration is only two to five percent). But 26% of forestry and fish products are imported, and 20% of farming is exported. Both transactions are intimately linked with national policy; for example, fishing treaties on the one hand, grain sales on the other. There is also a complicated history of farm subsidies to consider when measuring coordination within American farming (see Browne, 1988, and Cunningham et al., 1985, pp. 238-248, respectively on government's role in American farming and fishing).

The 15 markets with the most negative residual-coordination scores are listed at the bottom of Table 6. These markets are strategic research sites for studying how large organizations fail to coordinate. Again, margins tend to be below average (e.g., 7¢ on a dollar of motor-vehicle sales and 5¢ in steel), but there are also markets in which margins are above average (e.g., 34¢ in utilities and 49¢ in tobacco). The common feature is that the margins are lower than expected from observed market structure.

For example, tobacco producers enjoyed a high profit margin, but it is lower than one would expect from a market in which the largest producers so dominate the market. This is a rare instance of government and public opinion eroding producer coordination. Legal action against the tobacco industry weakened the informal arrangements through which competition was managed for so long in the industry (Miles, 1982).

Utilities are a different kind of example in that concentration is such an obviously poor measure of producer coordination. Utilities are usually local monopolies subject to government regulation, so in the absence of concentration data, we set concentration at a high, but not maximum, level of .9. The negative residual coordination for utilities in Table 6 shows that the effective level of coordination is lower, even in these years before energy deregulation.

Third, concentration is computed from the market shares of domestic producers, but imports hold a large share in many of these markets — making the effective level of competition higher than would be expected from concentration data. Among the markets at the bottom of Table 6, auto imports are a familiar mass media story, as are stories about imported household appliances, electrical equipment, steel, and aluminum.

CONCLUSION AND DISCUSSION

It is difficult to overstate the influence of Lawrence and Lorsch's (1967) insight into the contingency of organization (see Scott, 1998: Chap. 4, for historical perspective). The work was a stark rejection of the idea that an optimum organizational form can be determined without understanding the market in which the organization is to operate. Focusing on coordination ties among research, production, and sales functions within their study firms, Lawrence and Lorsch showed that loose-coupling was a competitive advantage in plastics (a market of widely diverse customer demands so the firm that can quickly adapt to new customer needs has a competitive advantage) while tight-coupling was a competitive advantage in metal containers (a market dominated by strong customers able to insist on reliable quality at low price).

Beyond the question of whether different forms of organization are an advantage in different markets is the question of how their advantage varies across markets. A contingency hypothesis says that the association between two variables X and Y is contingent on the value of a context variable Z. Markets vary in many ways, any of which could be the context variable for a contingency hypothesis in organization theory, but market competition is a critical context variable for any study predicting the performance advantages of alternative organization forms.

Conclusion

This paper has been in three parts about competition as the market context factor in contingency theory. We began with an introduction to the dual structure of markets; the internal structure of producer coordination, versus the external structure of producer buying and selling with other markets. We used a network model to describe the association between performance and the dual structure of American markets from 1963 through 1992. Summary results in Table 1 and Figure 3 show how profit margins decrease with the internal market constraint of disorganized producers and the external market constraint of dependence on coordinated suppliers and customers.

Second, we reverse-engineered the model to infer the "effective" coordination of producers, and so the "effective" level of competition in a market. We asked how coordinated producers must be in order to earn their observed level of profit from their observed pattern of dependence on specific other sectors of the economy. Instead of predicting producer performance from market structure, we used the network model with data on producer performance and external structure (the more reliable and detailed data) to infer internal structure. Producers have an effective level (as opposed to an observed level) of coordination, and so an effective level of competition, defined by the association between their observed performance and levels of coordination within the markets where they do business.

Third, we discussed the research value of effective competition as the market factor in contingency theory. We demonstrated its value as a reliable market factor (illustrated by its automatic adjustment for the exogenous shock of imports in 1982), its value as an accurate market factor (illustrated by it revealing the contingent value of a strong corporate culture in Kotter and Heskett's, 1992, study), and its value as a market factor integrating case with comparative research.

Our conclusion across the results presented is that the concept of effective competition opens an interesting and demonstrably productive perspective on the market factor in contingency theory.

Assumptions

The assumptions required to measure effective levels of competition seem to us less troubling than the assumptions required to measure competition with concentration data, but the cost of the new assumptions remains uncertain and so warrants brief discussion before we close.

Measurement Error

Market structure-performance models predict performance from market structure, allowing for measurement error in the performance variable. Effective competition assumes instead that producer coordination is measured with error. Of the three structure-performance variables — performance, producer coordination, buyer-supplier constraint — producer coordination is least accurately measured (by concentration ratios with or without ad hoc adjustments). This measurement error in the predictor can be expected to suppress market structure effects on performance and make effect estimates inconsistent. For reasons discussed in the text, it seems safe to assume that producer performance is better measured with input-output table price-cost margins, than producer coordination is measured by concentration data. Thus, effective competition puts the measurement error where measurement is most problematic. This is the point of our demonstration that effective competition is a more reliable market factor for contingency theory. However, the assumption is more than performance being better measured; it is that performance is measured without any error at all. Error in the performance measure used to compute effective competition will be added to the effective level of coordination among producers. For example, if performance is measured erroneously high for a market, then the effective level of coordination within the market will be erroneously high — which can affect measures of effective coordination in other markets since the coordination reported for any one market depends on the effective level of coordination in its supplier and customer markets.

Complete System

Effective competition scores are computed under the assumption that all significant supplier and customer markets are in the analysis. Effective competition is inferred from producer dependence on buying and selling in specific other sectors of the economy, so it will be measured inaccurately if significant supplier or customer markets for any producers are excluded from the analysis. Concentration ratios do not require this assumption because they are computed from producer market shares without taking into account producer dependence on other sectors of the economy. The assumption of a complete system does not trouble us because the Department of Commerce benchmark input-output tables are a census of business establishments throughout the economy, but it is important to include all sectors in the analysis. Levels of aggregation can be an issue here as well, but selecting a proper level of aggregation is as much an issue for concentration measures of producer coordination (if not the same issue).

Producer Homogeneity

We compute effective competition scores for whole markets, without distinguishing individual producers for their relative exposure or contribution to the competition. The effective aggregate level of competition in a market mixes with aggregate buyer-supplier constraint to determine producer performance in the aggregate. How individual producers combine to define the aggregate is unknown. This is typical of market-level variables in organization research, but the next step in predicting organization performance is to add the market-level competition score to organization-level performance equations as in Table 5. That is where we see the contingent value of a strong corporate culture for individual firms.

[NOTE TO TYPESETTER -- The maxtrix symbol O with a hat over it should be level with the line of type, not subscripted as it appears in some of the lines here. The problem is limited to O-hat in the text. It doesn't happen in the equations I pasted into the text from an equation editor.]

APPENDIX

We use a Newton-Raphson alogithm to compute effective competition. For the first iteration, we set effective coordination equal to the concentration scores used in Table 1 to predict performance. It is convenient to work with natural logarithms of the variables in Eq. (3) with the r ratio taken from Table 4: 1.45 in 1963, 1.35 in 1967, 1.17 in 1972, 1.07 in 1977, 1.00 in 1982 (we use the ratio obtained with imports held constant since the baseline model is so obviously misspecified in 1982), 1.78 in 1987, and 1.02 in 1992. Given values of r, P, O, and the input-output network of market dependencies w_{ij}, the regression intercept α and market structure effect γ can be estimated to define vector **A**.

Compute adjustments in producer coordination to improve the match between expected and observed performance. Where performance is higher than expected, increase the effective coordination of producers and decrease effective coordination within key supplier and customer markets. The match is perfect for the final scores: $\mathbf{P} = \ln\mathbf{A} - \Delta\ln\mathbf{A}$, where **P** is a vector of N price-cost margins. Vector $\Delta\ln\mathbf{A}$ of adjustments to **A** comes from adjustments to the effective coordination of producers: $\Delta\ln\mathbf{A} = (\partial\ln\mathbf{A}/\partial\hat{\mathbf{O}})\Delta\hat{\mathbf{O}} = \mathbf{J}(\Delta\hat{\mathbf{O}})$, so:

$$(5) \qquad \Delta\hat{\mathbf{O}} = \mathbf{J}^{-1}(\ln\mathbf{A} - \mathbf{P}),$$

where **J** is the N by N Jacobian matrix of partial derivatives. Diagonal elements in the Jacobian are ratios of the internal market constraint effect over the effective level of producer competition $(k-\hat{O}_i)$. In diagonal element (i,i), the partial derivative of $\ln A_i$ in Eq. (3) with respect to producer coordination $\hat{O}_i$ is: $r\,\gamma\,[\partial\ln(k-\hat{O}_i)/\partial\hat{O}_i]$, which equals:

$$r\,\gamma\left[\frac{1}{\left(k-\hat{O}_i\right)}\left(\frac{\partial\left(k-\hat{O}_i\right)}{\partial\hat{O}_i}\right)\right],$$

which is:

$$(6) \qquad (-r\,\gamma) / (k-\hat{O}_i),$$

where the product $r\gamma$ equals β, the effect of producer competition. Eq. (6) is positive reflecting the fact that producer performance increases as producers become better coordinated. Off-diagonals in the Jacobian are ratios of the external market constraint effect over the current level of supplier-customer constraint on producers. The partial derivative of $\ln A_i$ in Eq. (3) with respect to coordination $\hat{O}_j$ in supplier-customer market j is: $\gamma\ [\partial \ln(\sum_j w_{ij}\ \hat{O}_j)/\partial\ \hat{O}_j]$, which equals:

$$\gamma \left[\frac{1}{\left(\sum_j w_{ij}\hat{O}_j\right)} \left(\frac{\partial\left(\sum_j w_{ij}\hat{O}_j\right)}{\partial\hat{O}_j} \right) \right],$$

which is:

(7) $$(\gamma\ w_{ij}) / (\sum_j w_{ij}\ \hat{O}_j),$$

where $i \neq j$. Eq. (9) is negative reflecting the fact that producer performance decreases as key supplier or customer markets become better organized.

Third, adjust and evaluate. At each iteration, there is a new 77 by 77 matrix **J** to be computed, inverted, and inserted in Eq. (5) to define adjustments. Continue until the adjustment $\Delta\hat{O}$ in every market is less than a criterion. We use a criterion of .001 to secure three decimal places in each score. If any adjustment is larger than the criterion, go back to step one with adjusted score $\hat{O}_{i+1}$, equal to $\hat{O}_i$ minus $\Delta\hat{O}_i$. Adjusted scores are positive fractions relative to the maximum score ($\hat{O} = \hat{O}/\hat{O}_{max}$). If any adjusted score is less than zero, the distribution is shifted up so scores remain positive fractions ($\hat{O} = (\hat{O}-\hat{O}_{min})/(\hat{O}_{max} - \hat{O}_{min})$). Adjusted scores are inserted in Eq. (3) to compute an expected price-cost margin for the next iteration. The iterations involve extensive computation, but few are required to reach convergence (38 to 94 iterations, depending on the year and start values).

Issues

Iterations were run under various conditions to check solution stability. Four issues are noted. (1) The first issue is convergence. The iterations are Newton-Raphson. As Press et al. (1992:380) state, “This method gives you a very efficient means of converging to a root, if you have a sufficiently good initial guess. It can also spectacularly fail to converge.” The problem is that $\Delta\hat{O}$ correctly indicates the direction in which coordination should be adjusted to improve the match between expected and observed performance, but it can overstate the magnitude of adjustment such that scores adjusted from one iteration to the next can weaken the match between expected and observed performance. The algorithm works well for our initial iterations, but over-adjusts as iterations converge on the final solution. Since the direction of Newton adjustment is correct, Press et al. (1992:383-385) recommend fractional adjustments. We scale adjustments to the multiple correlation at each iteration. Correlation R between **P** and **A** is the multiple correlation between observed price-cost margins and the margins expected from market structure. The correlation increases across iterations to a value of one at convergence. At iteration i, compute R_i and adjustments for the next iteration $\Delta \hat{\mathbf{O}}_i$. If R_{i+1} computed with the adjusted scores $\hat{\mathbf{O}}_i - \Delta\hat{\mathbf{O}}_i$, is less than R_i, make a fraction λ of each adjustment and re-compute $\hat{\mathbf{O}}_i - \lambda\Delta \hat{\mathbf{O}}_i$. We use successive fractions of λ equal to 1, (1-R), $(1\text{-R})^2$, $(1\text{-R})^3$, and so on as needed until R_{i+1} is larger than R_i, or a .01 minimum for λ is reached (which guarantees some change in each iteration). The multiple correlation is close to one within a dozen iterations.

(2) The second issue also involves convergence. The algorithm is sensitive to low levels of producer coordination. Figure 5 displays the association between ln(A) and producer coordination in 1972. The lines are evaluated at the mean level of external market constraint (C). The lines are higher (lower) for lower (higher) levels of external constraint. The dashed line describes the observed market structure effect — producer coordination is measured by the concentration data. Ordinary least squares estimates predicting performance are 1.020 for α and -.037 for γ, with a .313 multiple correlation. The solid line in Figure 5 describes the effective market structure effect — producer coordination is measured by effective coordination scores at convergence. Ordinary least squares estimates predicting performance are .860 for α and -.066 for γ, with a 1.00 multiple correlation.

The slopes of these lines are the diagonal elements of the Jacobian matrix **J** (given in Eq. 6). The dashed line in Figure 5 describes Eq. (6) in the first iteration. The solid line describes Eq. (6) in the final iteration. The points at which change in ln(A) is linear with change in producer coordination are marked by the 45 degree slope lines in the graph. Notice that the slope is near zero to the left of the graph, at low levels of producer coordination. At low levels of producer coordination, Eq. (6) is a small fraction ($-r\gamma$ is 1.51 times .037 for the initial iteration in 1972) divided by a fraction $k-\hat{O}$ that is close to one (at the left of the graph in Figure 5). Near-zero diagonal elements in the Jacobian often make the matrix singular (zero determinant) so we can't compute the inverse for Eq. (5). Our solution was to impose a threshold of 1.0 on the diagonal elements in the Jacobian, which means that rates of change are as great or greater than the two 45-degree slope lines in Figure 5. The exact value of the threshold is arbitrary. We tried lower values down to .75 before encountering problems, but obtained the same final scores. In different populations, other values could be appropriate. We also tried imposing the threshold until the iterations were in the neighborhood of the solution (multiple correlation greater than .9, or .99), then allowing the partial to vary over the whole range of its values. This cured the singularity problem, but the algorithm wouldn't converge. The near-zero diagonal elements in the Jacobian create large elements in the inverse of the Jacobian (on the order of 80 to 100), which, ceteris paribus, define large adjustments in Eq. (5) for the next iteration. Iterations cycle across the low coordination markets with a large adjustment in one market triggering a large adjustment in another, then back again. So, we imposed the threshold on the diagonal elements in every iteration. The effect is that the final scores are not exact. The 1977, 1982, and 1987 scores are not affected to three decimal places, but the 1972 data are. The multiple correlation should be 1.000, but it is instead .9976, and there are small differences between scores obtained with alternative start values (.003 maximum, .0001 mean, discussed below). This is adequate precision for analyzing the 77 aggregate markets, but the potential effect of imposing a threshold should be noted for applications in other study populations. For example, we get less precise results if the diagonals are all forced to equal one (.993 multiple correlation). The point is that the algorithm is sensitive to low levels of producer concentration in the sense that the Jacobian can be singular or the iterations can fail to converge. Our solution was to impose a threshold on the diagonal elements of the Jacobian, but results should be obtained with alternative thresholds to be sure that the threshold is not interfering with a desired level of precision.

(3) Given convergence, outliers are a third issue. Our effective coordination scores are sensitive to outliers because we give them a fixed range. Performance is especially poor for two markets in 1982: wood containers and nonferrous mining (-.21 and -.22 price-cost margins in Figure 4). The two markets are outliers. The next lowest margin is -.09, and there are several markets at that level. The two outliers are at the bottom of the effective coordination distribution, but their scores are so low that all other markets are compressed into the interval between .5 and one. Differences between markets are obscured. We ran the iterations for 1982 with negative profit treated as no profit (negative margins set to zero). Effective coordination in nonferrous mining and wood containers remains at the bottom of the distribution, but the other markets are free to vary more widely over the full range of values (.83 mean and .15 standard deviation in effective coordination scores before; .68 mean and .22 standard deviation after).

(4) The fourth issue is where to start. We use concentration data as initial estimates of effective coordination, but such data are not always available. We tried four alternative start values corresponding to different guesses about producer coordination within markets. We put random error into the observed concentration ratios (random increase or decrease of up to fifty percent of concentration, where errors are from a normal distribution centered on the observed concentration ratio), and we homogenized concentration ratios into a high-low dichotomy (markets above average concentration have a .8 start value, others have a .2 start value). We also tried random fractions drawn from a uniform distribution (to exaggerate the tails of the concentration distribution), and random fractions drawn from a normal distribution. The alternative start values affect the number of iterations required to reach to convergence, but have little effect on the final scores. Scores obtained with the

four alternative start values are correlated 1.0000, with a maximum difference of .003 and average difference of .001 between scores.

Connection with Eigenvector Network Model

Model I in Table 1 can be written as: A = a + bO - gC. Replace C with its definition to get: $A_i = a + bO_i - g\sum_j w_{ij}O_j$ where $i \neq j$. With three markets, there would be three equations:

$$A_1 = a + bO_1 - gw_{12}O_2 - gw_{13}O_3,$$
$$A_2 = a - gw_{21}O_1 + bO_2 - gw_{23}O_3,$$
$$A_3 = a - gw_{31}O_1 - gw_{32}O_2 + bO_3,$$

which is matrix equation:

$$\begin{bmatrix} A_1 - a \\ A_2 - a \\ A_3 - a \end{bmatrix} = \begin{bmatrix} b & -gw_{12} & -gw_{13} \\ -gw_{21} & b & -gw_{23} \\ -gw_{31} & -gw_{32} & b \end{bmatrix} \begin{bmatrix} O_1 \\ O_2 \\ O_3 \end{bmatrix},$$

or for N markets more generally: **A** = **WO**, where **A** is a vector of N structural autonomy scores measuring the relative performance expected in each market (**A** = {A - a}), **O** is a vector of N concentration ratios measuring coordination within markets, and **W** is an N by N nonsymmetric matrix of market dependencies. Expected performance is defined by the coordination of producers within markets filtered through the network of market dependencies.

With the **WO** form of the model explicit, take the market constraint effect out of **W** so the matrix equation for the three markets is:

$$\mathbf{A} = g\mathbf{WO} = g\begin{bmatrix} b/g & -w_{12} & -w_{13} \\ -w_{21} & b/g & -w_{23} \\ -w_{31} & -w_{32} & b/g \end{bmatrix} \begin{bmatrix} O_1 \\ O_2 \\ O_3 \end{bmatrix}.$$

Assume that A and O converge at an equilibrium in which producers are autonomous to the extent that they are not dependent on autonomous suppliers and customers. The equation becomes; **A** = g**WA**, which is the characteristic equation of the weight matrix **W**; 0 = **WA** - (1/g)**A**, which can be written in a more familiar form; 0 = (**W** - μ**I**)**A**, where **I** is an identity matrix. Diagonal elements in the W matrix are the r ratio in Eq. (3). Assume equal effects of internal and external market constraint so ratio r equals 1. Matrix **W** is now defined (w_{ii} = b/g = r = 1), μ is the dominant eigenvalue, and autonomy **A** is the corresponding right eigenvector.

Eigenvalue μ and eigenvector **A** are available with canned computer routines for solving the characteristic equation of square, nonsymmetric matrices. Market i has autonomy at equilibrium to the extent that it doesn't depend on autonomous supplier and customer markets; $a_i = g(a_i - \sum_j w_{ij} a_j)$, where $i \neq j$. The eigenvalue is an adjustment for the level of dependence between markets. Higher w_{ij} generate higher μ. For the network fragment in Figure 2 and Table 2, the eigenvalue is 1.32 (so g equals .76), and the eigenvector elements scaled with respect to the most positive element are; -1.1, 0.2, -3.1, -1.6, -0.1, -0.1, and 1.0. Market C is expected to reach the lowest level of autonomy at equilibrium (it is exclusively and completely dependent on the gray-dot market, row three in Table 2), and the gray-circle market is expected to reach the highest level (it has the lowest dependence on other markets, row seven in Table 2).

This model is a variation on the familiar eigenvector models of network centrality (also discussed as power, prestige or status; Hubbell, 1965; Coleman, 1972, 1990; Bonacich, 1972, 1987; Marsden, 1981, 1983; Burt, 1982:35-37; Mizruchi et al., 1986; Podolny, 1993; see Richards and Seary, 2000, for review). The variation is two-fold: dependence has a negative value (negative w_{ij} in the **W** matrix), and equilibrium autonomy is the right rather than the left eigenvector (row vector rather than column). Analogy to the familiar eigenvector model helps link effective coordination to the familiar concept of network centrality, but substantive study of the market networks is better served by the effective coordination model. A nonlinear network model better describes performance differences between markets (Table 1), and reliable performance data are available so there is no need to assume that relative performance evolves to equal relative producer coordination to get the characteristic equation, **A** = g**WA**.

ACKNOWLEDGEMENTS

Portions of this paper were presented in James Coleman's "Mathematical Sociology" workshop at the University of Chicago (1993), an INSEAD conference on "Organizations in Markets" in Fontainebleu, France (1996), and a "Sociology of Strategy" workshop at the University of Chicago (1997). While graduate students at Columbia University, Martin Garguilo assembled the 1982 transaction data and the concentration data on manufacturing, and Shin-Kap Han assembled the 1982 concentration data on nonmanufacturing. While a graduate student at the University of Chicago, Ezra Zuckerman assembled the 1987 concentration data. We are grateful to colleagues for comments improving the text; William Barnett, James Coleman, Michael Hannan, Donald Palmer, Joel Podolny, Jesper Sørensen, Toby Stuart, and Brian Uzzi.

NOTES

[1]For example, photoengraving and electrotyping are combined in 1982 (detailed sectors 260804 and 260805 in 1977 are sector 260804 in 1982), all three of which are in the aggregate printing and publishing market (sector 26). There are two caveats to our statement about stable market boundaries: (a) The 1967 to 1972 transition involved a change to the computation of dollar flows between markets (secondary products completely excluded), and numerous SIC category revisions that moved commodities from one market into another, though the network pattern of buying and selling for even the most changed markets is similar between 1967 and 1972 (Burt, 1988, describes stability through the 1960s and 1970s). The one exception is that later tables contain a restaurant sector (sector 74) missing in the 1963 and 1967 tables. (b) The 1977 and 1982 tables follow 1972 with little change, but the transition to 1987 and 1992 involved a switch to the 1987 SIC categories, more efficient data processing that distinguished fewer detailed categories (528 detailed production markets in 1982 decrease to 469 in 1987, though most of the lost detail is within construction; 54 detailed construction categories in 1982, 5 in 1987), and more distinctions between aggregate markets. The 77 aggregate production markets in prior tables are 88 in the 1987 and 1992 tables (14 of the aggregate markets in prior tables are combined into 7, and 12 of the 77 are disaggregated into 30 — for an increase to 88, Lawson and Teske, 1994:76). The goal was to combine small, declining markets and disaggregate large, growing markets (e.g., footwear and leather were combined into a single market and business services were divided into four markets each for a specific kind of service). To compare markets over time, we aggregated the 1987 and 1992 detailed data into the 77 aggregate market categories in preceding tables. Thus, we have six observations on each of 76 aggregate markets over time, plus observations on the restaurant market after 1967, for a total of 537 market observations.

[2]The eight negative price-cost margins in 1982 (first graph in Figure 4) are a problem because the log of a negative margin is undefined and effects are estimated by

regressing ln(P) over ln(1-O), ln(C), and the controls. We tried truncating the P distribution and adding a constant to move the distribution above zero. Truncating better preserves relative performance over time for the markets with positive margins in 1982 (discussed under Table 4 below) so the eight negative margins in 1982 are re-coded to the .02 minimum in the preceding tables. Negative profit is deemed no profit for the purposes of estimating Models II and III.

[3]Equation (3) also defines effective constraint at the level of transactions between markets (a predictor in resource dependence theories of organization, see Burt, 1992:236-252, for review). Re-write Eq. (3) with producer organization brought into the sum of constraint coefficients;

$$A_i = \alpha \left[\sum_j (k-\widehat{O}_i)^r w_{ij} \widehat{O}_j \right]^\gamma = \alpha \left[\sum_j \hat{c}_{ij} \right]^\gamma, \; i \neq j$$

where the expression being summed, $\hat{c}_{ij}$, is the effective constraint on producers in their transactions with supplier-customer market j. This is an attractive form. The effective constraint coefficient $\hat{c}_{ij}$ is producer dependence on market j (w_{ij}) times relative organization in the two markets (disorganized producers $k-\widehat{O}_i$ versus organized suppliers-customers $\widehat{O}_j$). Definition in terms of effective coordination means that the coefficients are adjusted for foreign competitors and the measurement issues that plague concentration data. Further, effective constraint coefficients have the practical advantage of not requiring concentration data.

[4]There are seven variances and 21 covariances in Table 3 from which we estimated for the single-factor model seven error variances, the variance of the market factor, and six factor loadings (d_{72} is set to 1.0 making 1972 structure the reference indicator). The 14 parameters estimated from 28 data in the variance-covariance matrix leave 14 degrees of freedom. Lack of fit generates chi-square statistics of 614.53, 275.03, and 205.27 for concentration, buyer-supplier constraint, and the w_{ij} dependence weights respectively, all of which reject the single-factor model beyond a .001 level of confidence. There are six

panel-to-panel effects and seven error variances in the simplex model, which leaves 15 degrees of freedom. Lack of fit generates chi-square statistics of 731.43, 104.99, and 65.11 for concentration, buyer-supplier constraint, and the dependence weights respectively, all of which reject the simplex model beyond a .001 level of confidence.

[5]Market share of imports, F, is dollars of imports divided by the sum of four variables; total commodity output (row sum in the input-output tables), plus sales from inventory, minus exports, plus imports. For example, domestic consumption of motor vehicles in 1982 was $131,289 million, which was $110,259 million of production, plus $1,337 million of sales from inventory, minus $12,305 million sold in foreign markets, plus $31,998 million of buses, cars, trucks, and parts imported from foreign markets. Imports held a 24% share of the motor vehicle market in 1982 (F = .244 = 31.998/131.289 = 31.998/[110.259+1.337-12.305+31.998]). We do not know whether an American firm or a foreign firm produced an imported commodity. An automobile that Honda manufactures in the United States is a domestically produced commodity. A car that Ford manufactures in Europe and sells in the US is an import. Our imports variable is the market share of foreign-made goods, not the market share of foreign firms. Regardless, the results in Table 4 show that imports erode the association between producer profit and concentration.

[6]We are reassured by the fact that the 44% performance variance predicted by the 19 market distinctions is similar to the 45% estimated by others with return to assets over time for more detailed market categories (McGahan and Porter, 1997:23, report the 45% in three components; 18.7% associated with four-digit SIC categories plus 31.7% associated with business segments within the categories, minus a 5.5% firm-industry covariance adjustment). However, there is little meaning to the 44% except as motivation for our decision to hold market performance differences constant. Claims regarding the exact portion of performance variance associated with market distinctions have little meaning since markets have no agreed-upon boundaries so the performance variance associated

with them can be anything from none and all depending on research design (none - assign all sample firms to one market; all — define markets so narrowly that each sample firm operates in its own market). Ceteris paribus, more narrowly defined market categories mean a higher portion of corporate performance variance associated with market distinctions.

[7]To compute effective competition scores for Figure 1, we aggregated detailed input-output categories for 1982 to match the Kotter and Heskett market categories. The result was an aggregate input-output table distinguishing 82 rather than the Department of Commerce's 77 sectors: the food sector was divided into beverages versus food processing, transportation was divided into airlines versus other transport, trade was divided into wholesale versus retail, and finance was divided into three subsectors (banking, credit agencies, brokers and insurance).

[8]We adjusted the position of publishing in Figure 1, as described in Burt et al. (1994: Appendix), for McGraw-Hill's outlier effect on the association between performance and strong culture. The .33 correlation for publishing on the vertical axis in Figure 1 is -.04 before the adjustment. We have only done this in Figure 1 to simplify the illustration. All results we report apart from Figure 1 are based on the raw data, and the same conclusions about Figure 1 would be reached in this and the next paragraph with the data adjusted for McGraw-Hill or the raw data. The .85 correlation in the graph at the top of Figure 1 is .81 for the raw data. The t-tests of 5.0, 0.4, and 1.5 in the next paragraph for effective competition, producer concentration, and buyer-seller constraint respectively are 4.2, 0.0, and 0.8 when based on the raw data.

REFERENCES

Ampain, Sarkis G. (1989) "Clays." Pp. 271-303 in Minerals Yearbook 1989, Bureau of Mines, US Department of the Interior. Washington, DC: Government Printing Office.

Baker, Wayne E. (1984) "The social structure of a national securities market." American Journal of Sociology, 89:775-811.

Barker, James R. (1993) "Tightening the iron cage: concertive control in self-managing teams." Administrative Science Quarterly, 38: 408-437.

Barley, Stephen R., Gordon W. Meyer and Debra C. Gash (1988) "Cultures of culture: academics, practitioners, and the pragmatics of normative control." Administrative Science Quarterly, 33: 24-60.

Baum, Joel A. C. and Stephen J. Mezias (1992) "Localized competition and organizational failure in the Manhattan hotel industry, 1898-1990." Administrative Science Quarterly, 37:580-604.

Bigelow, Lyda S., Glenn R. Carroll, Marc-David L. Seidel and Lucia Tsai (1997) "Legitimation, geographical scale, and organizational density: regional patterns of foundings of American automobile producers, 1885-1981." Social Science Research 26:377-398.

Bonacich, Philip (1972) "Factoring and weighting approaches to status scores and clique identification." Journal of Mathematical Sociology, 2:113-120.

———. (1987) "Power and centrality: a family of measures." American Journal of Sociology, 92: 1170-1182.

Browne, William P. (1988) Private Interests, Public Policy, and American Agriculture. Lawrence, KA: University Press of Kansas.

Burt, Ronald S. (1982) Toward a Structural Theory of Action. New York: Academic Press.

———. (1983) Corporate Profits and Cooptation. New York: Academic Press.

———. (1988) "The stability of American markets." American Journal of Sociology, 94:356-395.

———. (1992) Structural Holes: The Social Structure of Competition. Cambridge: Harvard University Press.

Burt, Ronald S., and John H. Freeman (1994) "Market structure constraint in Germany." Graduate School of Business, University of Chicago.

Burt, Ronald S., Shaul M. Gabbay, Gerhard Holt and Peter Moran. (1994) "Contingent organization as a network theory: the culture-performance contingency function." Acta Sociologica, 37: 345-370.

Byron, James E. (1983) "Leather and leather products." Pp. 41.1-11 in 1983 US Industrial Outlook, Bureau of Industrial Economics, US Department of Commerce. Washington, DC: Government Printing Office.

Case, Frederick E. (1965) Real Estate Brokerage. Englewood Cliffs, NJ: Prentice-Hall.

Caves, Richard (1992) American Industry: Structure, Conduct, Performance. Englewood Cliffs, NJ: Prentice-Hall.

Coleman, James S. (1972) "Systems of social exchange." Journal of Mathematical Sociology, 2: 145-163.

———. (1990) Foundations of Social Theory. Cambridge: Harvard University Press.

Collins, Norman R. and Lee E. Preston (1969) "Price-cost margins and industry structure." Review of Economics and Statistics, 51: 271-286.

Cunningham, Stephen, Michael R. Dunn and David Whitmarsh (1985) Fisheries Economics. New York: St. Martin's Press.

DiMaggio, Paul J. and Walter W. Powell (1983) "The iron cage revisited: institutional isomorphism and collective rationality in organizational fields," American Sociological Review, 48: 147-160.

———. (1991) "Introduction." Pp. 1-38 in The New Institutionalism in Organizational Analysis, edited by Walter W. Powell and Paul J. DiMaggio. Chicago: Chicago University Press.

Durkheim, Emile ([1897] 1951) Suicide, translated by John A. Spaulding and George Simpson. New York: Free Press.

Fine, Tina Karen (1989) Innovation, Concentration and the Residential Real Estate Brokerage Industry. Unpublished Ph.D. Dissertation, Department of Economics, Columbia University.

Finkelstein, Sydney (1997) "Interindustry merger patterns and resource dependence: a replication and extension of Pfeffer (1972)." Strategic Management Journal, 18:787-810.

Foss, Nicolai J. (1997) Resources, Firms, and Strategies. New York: Oxford University Press.

Galbraith, John K. (1952) American Capitalism. New York: Houghton Mifflin.

Gersen, Jacob E. (1999) "Markets and corporate conflict: a substitution-cost approach to business litigation." Law & Social Inquiry, 24:589-609.

Han, Shin-Kap (1994) "Mimetic isomorphism and its effect on the audit services market." Social Forces, 73: 637-664.

Hannan, Michael T. and John H. Freeman (1989) Organizational Ecology. Cambridge: Harvard University Press.

Hirsch, Paul M. and Daniel Z. Levin (1999) "Umbrella advocates versus validity police: a life-cycle model." Organization Science, 10: 199-212.

Hubbell, Charles H. (1965) "An input-output approach to clique identification." Sociometry, 28: 377-399.

Ingram, Paul and Peter W. Roberts (2000) "Friendships among competitors in the Sydney hotel industry." American Journal of Sociology, 106:387-423.

Jang, Ho (1997) Market Structure, Performance, and Putting-Out in the Korean Economy. Unpublished Ph.D. Dissertation, Department of Sociology, University of Chicago.

Kalleberg, Arne L, Peter V. Marsden, Howard E. Aldrich, and J. W. Cassell (1990) "Comparing organization sampling frames." Administrative Science Quarterly, 35:658-688.

Kalleberg, Arne L., David Knoke, Peter V. Marsden, and Joe L. Spaeth (Eds., 1996) Organizations in America. Thousand Oaks, CA: Sage Publications.

Klinger, F. L. (1983) “Iron ore.” Pp. 447-465 in Minerals Yearbook 1983, Bureau of Mines, US Department of the Interior. Washington, DC: Government Printing Office.

Kotter, John P. and James L. Heskett (1992) Corporate Culture and Performance. New York: Free Press.

Kwoka, John E., Jr. (1979) “The effect of market share distribution on industry performance.” Review of Economics and Statistics, 61: 101-109.

Lawrence, Paul R. and Jay W. Lorsch ([1967] 1986) Organization and Environment. Boston: Harvard Business School Press.

Lawson, Ann M. and D. A. Teske (1994) “Benchmark input-output accounts for the U. S. economy, 1987.” Survey of Current Business, 74: 73-115.

Lie, John (1997) “Sociology of markets.” Annual Review of Sociology, 23: 341-360.

Lustgarten, S. H. (1975) “The impact of buyer concentration in manufacturing industries.” Review of Economics and Statistics, 57: 125-132.

Marsden, Peter V. (1981) “Introducing influence processes into a system of collective decisions.” American Journal of Sociology, 86:1203-1235.

———. (1983) “Restricted access in networks and models of power.” American Journal of Sociology, 88: 686-717.

Martin, Joanne (1992) Cultures in Organizations: Three Perspectives. New York: Oxford University Press.

McGahan, Anita M. and Michael E. Porter (1997) “How much does industry matter, really?” Strategic Management Journal, 18:15-30.

Merton, Robert K. ([1957] 1968) “Continuities in the theory of reference group behavior.” Pp. 335-440 in Social Theory and Social Structure, edited by Robert K. Merton. New York: Free Press.

Meyer, John W. and Brian Rowan (1977) "Institutionalized organizations: formal structures as myth and ceremony." American Journal of Sociology, 83:340-363.

Miles, Robert H. (1982) Coffin Nails and Corporate Strategies. Englewood Cliffs, NJ: Prentice-Hall.

Mizruchi, Mark S. (1992) The Structure of Corporate Political Action. Cambridge, MA: Harvard University Press.

Mizruchi, Mark S., Peter Mariolis, Michael Schwartz and Beth Mintz (1986) "Techniques for disaggregating centrality scores in social networks." Pp. 26-48 in Sociological Methodology, edited by Nancy Tuma. San Francisco, CA: Jossey Bass.

O'Reilly, Charles A. III (1989) "Corporations, culture, and commitment: motivation and social control in organizations." California Management Review, 31: 9-25.

Ott, J. Steven (1989) The Organizational Culture Perspective. Chicago, IL: Dorsey.

Peltzman, Sam (1977) "The gains and losses from industrial concentration." Journal of Law and Economic Review, 2: 105-140.

Pfeffer, Jeffrey (1997) New Directions for Organization Theory. New York: Oxford University Press.

Pfeffer, Jeffrey and Gerald R. Salancik (1978) The External Control of Organizations. New York: Harper & Row.

Podolny, Joel M. (1993) "A status-based model of market competition." American Journal of Sociology, 98: 829-872.

Podolny, Joel M., Toby E. Stuart and Michael T. Hannan (1996) "Networks, knowledge, and niches: competition in the worldwide semiconductor industry, 1984-1991." American Journal of Sociology, 102: 659-689.

Porter, Michael E. (1980) Competitive Strategy. New York: Free Press.

Powell, Walter W., Kenneth W. Koput and Laurel Smith-Doer (1996) "Interorganizational collaboration and the locus of innovation: networks of learning in biotechnology." Administrative Science Quarterly, 41:116-145.

Press, William H., Saul A. Teukolsky, William T. Vetterling, and Brian P. Flannery (1992) Numerical Recipes in C. Cambridge: Cambridge University Press.

Raider, Holly J. (1998) “Market structure and innovation.” Social Science Research, 27:1-21.

Ravenscraft, David (1983) “Structure-profit relationships at the line of business and industry level.” Review of Economics and Statistics, 65:22-31.

Richards, William and Andrew Seary (2000) "Eigen analysis of networks." Journal of Social Structure 1:1-15.

Rogers, Kathryn S. (1986) US Coal Goes Abroad. New York: Praeger.

Romo, Frank P. and Michael Schwartz (1993) “The coming of post-industrial society revisited: manufacturing and the prospects for a service-based economy.” Pp. 335-373 in Explorations in Economic Sociology, edited by Richard Swedberg. New York: Russell Sage Foundation.

———. (1995) “The structural embeddedness of business decisions: the migration of manufacturing plants in New York State, 1960-1985.” American Sociological Review, 60: 874-907.

Schein, Edgar H. (1996) "Culture: the missing concept in organization studies." Administrative Science Quarterly, 41:229-240.

Schmalensee, Richard (1989) “Inter-industry studies of structure and performance.” Pp. 951-1009 in Handbook of Industrial Organization, edited by Richard Schmalensee and Robert Willig. New York: North-Holland.

Scott, W. Richard (1998) Organizations: Rational, Natural, and Open Systems. Englewood Cliffs, NJ: Prentice-Hall.

Simmel, Georg ([1922] 1955) Conflict and the Web of Group Affiliations. Trans. by Kurt H. Wolff and Reinhard Bendix. New York: Free Press.

Sorenson, Olav and Toby E. Stuart (2001) "Syndication networks and the spatial distribution of venture capital investments." American Journal of Sociology, 106: 1546-1588.

Stern, Carl W. and George Stalk (eds., 1998) Perspectives on Strategy. New York: John Wiley & Sons.

Stigler, George J. ([1957] 1965) “Perfect competition, historically contemplated.” Pp. 234-267 in Essays in the History of Economics, edited by George J. Stigler. Chicago: Chicago University Press.

Stuart, Toby E. (1998) "Network positions and propensities to collaborate: an investigation of strategic alliance formation in a high-technology industry." Administrative Science Quarterly, 43:668-698.

Swedberg, Richard (1994) “Markets as social structures.” Pp. 255-282 in The Handbook of Economic Sociology, edited by Neil J. Smelser and Richard Swedberg. Princeton: Princeton University Press.

Talmud, Ilan (1994) “Relations and profits: the social organization of Israeli industrial competition.” Social Science Research, 23: 109-135.

Tepordei, Valentin V. (1989) “Crushed stone.” Pp. 981-1008 in Minerals Yearbook 1989, Bureau of Mines, US Department of the Interior. Washington, DC: Government Printing Office.

Weiss, Leonard W. (ed., 1989) Concentration and Price. Cambridge: MIT Press.

White, Harrison C. (1981) “Where do markets come from?” American Journal of Sociology, 87: 517-547.

Yasuda, Yuki (1996) Network Analysis of Japanese and American Markets. Tokyo: Bokutaku-sha.

Ziegler, Rolf (1982) “Market structure and cooptation.” Institut für Soziologie, Universität München.

Zuckerman, Ezra W. (1999) "The categorical imperative: securities analysts and the illegitimacy discount." American Journal of Sociology, 104: 1398-1438.

TABLE 1. PERFORMANCE AND MARKET STRUCTURE ACROSS THREE DECADES

	Linear Model $A = \alpha + \beta(k\text{-}O) + \gamma C + \delta X$		Nonlinear Model $A = \alpha(k\text{-}O)^{\beta} C^{\gamma} X^{\delta}$					
	Ia	Ib	IIa	IIb	IIIa	IIIb	IVa	IVb
Criterion Variable	P		P		P		e^P	
R^2	.337	.306	.409	.322	.456	.344	.649	.538
Intercept (α)	.110	.100	.052	.053	.041	.045	.898	.943
Internal Market Constraint (one minus producer concentration; β effect)	-.110 [-.216] (-2.1)	-.101 [-.186] (-4.8)	-.268 [-.230] (-2.5)	-.223 [-.175] (-4.8)	-.366 [-.315] (-3.5)	-.310 [-.244] (-6.7)	-.082 [-.331] (-4.6)	-.071 [-.302] (-9.9)
External Market Constraint (buyer-supplier constraint index C; γ effect)	-.497 [-.202] (-2.0)	-.354 [-.158] (-4.1)	-.211 [-.249] (-2.7)	-.169 [-.183] (-5.0)	-.309 [-.363] (-4.0)	-.247 [-.267] (-7.3)	-.068 [-.375] (-5.1)	-.049 [-.286] (-9.3)
Controls (δ adjustments): Nonmanufacturing	.156 (6.1)	.154 (14.8)	.705 (6.5)	.707 (13.2)	——	——	——	——
Land	——	——	——	——	1.578 (7.3)	1.459 (14.1)	.397 (11.3)	.371 (23.2)
1982	——	-.049 (-3.6)	——	-.437 (-6.0)	——	-.426 (-5.9)	——	-.041 (-3.7)
Year	——	.003 (1.4)	——	.032 (2.5)	——	.036 (2.9)	——	.005 (2.5)

NOTE. — These are ordinary least-squares estimates predicting market price-cost margins. Standardized coefficients are in [brackets] and routine t-tests are in (parentheses). The (a) column for each model contains estimates from data averaged over time (N = 77). The (b) column contains estimates from each observation of each market (N = 537).

Table 2

Effective Coordination in the Figure 2 Network Fragment

	A	B	C	D	E	F	Gray Circle
Observed Market Structure (Figure 2)	——	.085	.000	.000	.085	.085	.340
	.151	——	.000	.151	.000	.000	.340
Interdependence	.000	.000	——	.000	.000	.000	1.000
Weights (w_{ij})	.000	.340	.000	——	.000	.000	.444
	.340	.000	.000	.000	——	.000	.391
	.340	.000	.000	.000	.000	——	.391
	.151	.085	.028	.049	.043	.043	——
Concentration (O)	1.00	.125	.125	1.00	.125	1.00	.250
Network Constraint (C)	.191	.388	.250	.154	.438	.438	.264
P Determined by Observed Structure							
Performance (P)	.856	.108	.152	.878	.096	.773	.162
Effective Coordination ($\hat{O}$)	1.00	.125	.125	1.00	.125	1.00	.250
Residual Coordination (ϕ)	0.00	0.00	0.00	—	0.00	0.00	0.00
P Not Determined by Observed Structure							
Performance (P)	.086	.108	.152	.878	.096	.773	.162
Effective Coordination ($\hat{O}$)	.148	.414	.661	1.00	.000	.997	.351
Residual Coordination (ϕ)	-.844	.297	.543	—	-.117	.005	.109

NOTE. — Performance in the first solution is determined by the observed market structure; $e^{P} = [(k\text{-}O)C]^{-.1}$, with constant k set to 1.001. Effective coordination in market D is fixed to its observed value (1.0). Parameters for the first solution are $\alpha = 1.000$ and $\gamma = -.100$ with a 1.000 multiple correlation. For the second solution, $\alpha = .899$ and $\gamma = -.121$ with a 1.000 multiple correlation.

Table 3.
Observed Market Structure Across Three Decades

	1963	1967	1972	1977	1982	1987	1992	Mean	S.D.
1963	——	.992	.964	.934	.922	.907	.952	.348	.245
1967	.961	——	.977	.943	.933	.920	.964	.350	.242
1972	.871	.933	——	.959	.934	.951	.987	.357	.254
1977	.825	.888	.926	——	.932	.940	.984	.354	.249
1982	.724	.796	.843	.870	——	.934	.949	.335	.212
1987	.792	.850	.899	.910	.972	——	.978	.342	.223
1992	.696	.770	.835	.881	.972	.965	——	.351	.238
Mean	.062	.058	.060	.062	.057	.059	.057		
S.D.	.049	.045	.050	.053	.046	.052	.053		

Note. — These are correlations, means, and standard deviations for the aggregate markets, producer concentration (O) in the upper diagonal and buyer-supplier constraint (C) in the lower diagonal. With pairwise deletion, there are 76 markets during the 1960s and 77 markets thereafter.

Table 4. Performance, Market Structure, and Imports

	1963	1967	1972	1977	1982	1987	1992	1972	1977	1982	1987	1992
R^2	.495	.505	.629	.646	.520	.577	.445	.657	.689	.583	.590	.535
Effect Ratio of Internal to External Constraint ($r = \beta/\gamma$)	1.45	1.35	1.17	1.07	0.62	1.78	1.02	1.45	1.42	1.00	1.99	1.49
Intercept (α)	.919	.937	.881	.938	.850	.957	.955	.830	.882	.779	.931	.890
Internal Market Constraint (one minus producer concentration; β effect)	-.084	-.077	-.083	-.065	-.048	-.098	-.058	-.094	-.075	-.069	-.106	-.076
	[-.349]	[-.323]	[-.417]	[-.360]	[-.138]	[-.398]	[-.257]	[-.472]	[-.419]	[-.199]	[-.431]	[-.339]
	(-4.0)	(-3.8)	(-5.4)	(-4.9)	(-1.7)	(-5.0)	(-2.9)	(-6.0)	(-5.8)	(-2.5)	(-5.3)	(-4.0)
External Market Constraint (buyer-supplier constraint index C; γ effect)	-.058	-.057	-.071	-.061	-.078	-.055	-.057	-.065	-.053	-.070	-.053	-.051
	[-.308]	[-.301]	[-.374]	[-.308]	[-.284]	[-.280]	[-.293]	[-.342]	[-.266]	[-.254]	[-.270]	[-.265]
	(-3.6)	(-3.5)	(-4.8)	(-4.0)	(-3.2)	(-3.4)	(-3.2)	(-4.4)	(-3.6)	(-3.1)	(-3.3)	(-3.1)
Land (δ adjustment)	.329	.338	.410	.387	.490	.375	.344	.411	.383	.483	.371	.351
	(7.8)	(8.1)	(10.6)	(10.6)	(8.9)	(9.5)	(7.2)	(11.0)	(11.1)	(9.3)	(9.4)	(8.0)
Market Share of Imports	—	—	—	—	—	—	—	-.020	-.026	-.036	-.012	-.030
								[-.181]	[-.222]	[-.262]	[-.117]	[-.313]
								(-2.4)	(-3.1)	(-3.3)	(-1.5)	(-3.7)

Note. — These are ordinary least-squares estimates for Model IV in Table 1 predicting price-cost margins computed from input-output data on the 77 markets. Standardized coefficients are in [brackets] and routine t-tests are in (parentheses). Market share of imports is added to the estimation equation as ln(.01+F), where F is the ratio of imported goods sold over total goods sold. Import data are not available in the 1963 or 1967 input-output tables.

TABLE 5.

CONTINGENT CULTURE EFFECT AT THE LEVEL OF INDIVIDUAL FIRMS

Squared Multiple Correlation	.255	.334	.255	.260
Intercept	0.000	0.000	0.000	0.000
Corporate Culture, Relative Strength (firm score-market average)	3.053 (7.4)	9.451 (6.2)	2.937 (3.9)	2.369 (3.1)
Interaction between Corporate Culture and Market Competition:				
Effective Competition ($k - \hat{O}$)	—	9.365 (4.3)	—	—
Observed Internal Market Constraint (one minus producer concentration, 1-O)	—	—	-.348 (-0.2)	—
Observed External Market Constraint (buyer-supplier constraint index, C)	—	—	—	22.42 (1.1)

NOTE — These are ordinary least-squares estimates predicting a firm's relative performance within its market (vertical axes in graphs as the bottom of Figure 1) from the relative strength of its corporate culture (horizontal axes in graphs at the bottom of Figure 1), with an adjustment for stronger culture-performance association in more competitive markets. Effects were estimated with market performance differences held constant using 18 dummy variables to distinguish the 19 markets. Slope adjustments with log market structure variables are similar; 4.3, 0.5, and 1.5 t-tests respectively for the three interaction terms in the table.

Table 6. Extremes of Residual Producer Coordination (ϕ)

O	ϕ	P	Imports	
0.34	0.00	0.17	11%	mean scores (N = 77)
				Effective Producer Coordination Much Higher than Concentration Implies:
0.01	0.69	0.77	0%	Real Estate & Rental (71)
0.04	0.63	0.47	4%	Other Agriculture (farming, 2)
0.03	0.60	0.39	26%	Forestry & Fish (3)
0.03	0.52	0.12	1%	Livestock (1)
0.09	0.44	0.24	0%	Hotels, Personal & Repair Services (not auto, 72)
0.04	0.44	0.24	0%	Business Services (73)
0.08	0.44	0.26	0%	Automobile Repair & Services (75)
0.20	0.42	0.26	0%	Coal Mining (7)
0.06	0.39	0.13	0%	Eating & Drinking Establishments (74)
0.12	0.39	0.21	0%	Amusements (76)
0.13	0.38	0.27	2%	Wholesale & Retail Trade (69)
0.21	0.38	0.28	4%	Stone and Clay Mining & Quarrying (9)
0.03	0.34	0.11	0%	Medical & Educational Services (77)
0.21	0.31	0.20	2%	Printing & Publishing (26)
0.07	0.26	0.06	0%	Agriculture, Forestry & Fishery Services (4)
				Effective Producer Coordination Much Lower than Concentration Implies:
0.85	-0.21	0.49	5%	Tobacco (15)
0.64	-0.28	0.17	2%	Ordnance & Accessories (13)
0.42	-0.30	0.12	13%	Electrical Industrial Equipment (53)
0.90	-0.31	0.34	1%	Electric, Gas, Water & Sanitary Services (68)
0.41	-0.32	0.10	10%	Transportation Equipment (not cars/planes/trucks, 61)
0.51	-0.38	0.07	23%	Miscellaneous Electrical Machinery & Supplies (58)
0.35	-0.41	0.06	6%	Screw Machine Products & Stampings (41)
0.67	-0.44	0.14	16%	Household Appliances (54)
0.38	-0.49	0.05	15%	Iron & Steel (37)
0.59	-0.50	0.12	15%	Engines & Turbines (43)
0.64	-0.51	0.10	11%	Aircraft & Parts (60)
0.73	-0.67	0.07	23%	Nonferrous Metal Ores Mining (6)
0.43	-0.67	0.03	13%	Nonferrous Metals (38)
0.82	-0.71	0.06	33%	Iron & Ferroalloy Ores Mining (5)
0.80	-0.76	0.07	28%	Motor Vehicles & Equipment (cars and trucks, 59)

NOTE — Columns are concentration (O), residual coordination (ϕ, computed from Eq. 4, μ = .31), price-cost margin (P), market share of imports (footnote 5), and market name (input-output sector in parentheses). Markets are listed in descending order of residual coordination, the fifteen highest and the fifteen lowest.

FIGURE 1.
VALUE OF A STRONG CORPORATE CULTURE IS CONTINGENT ON MARKET COMPETITION

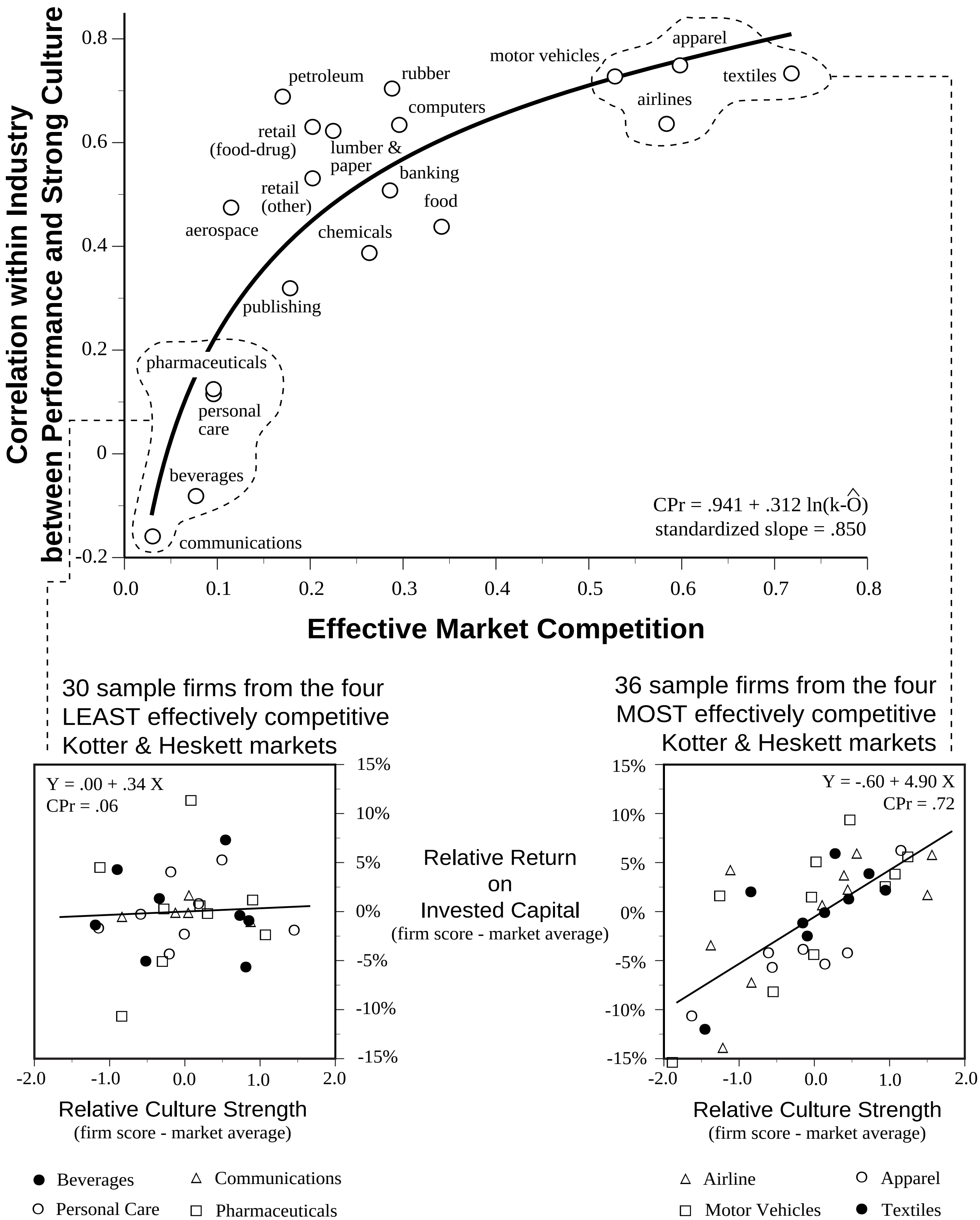
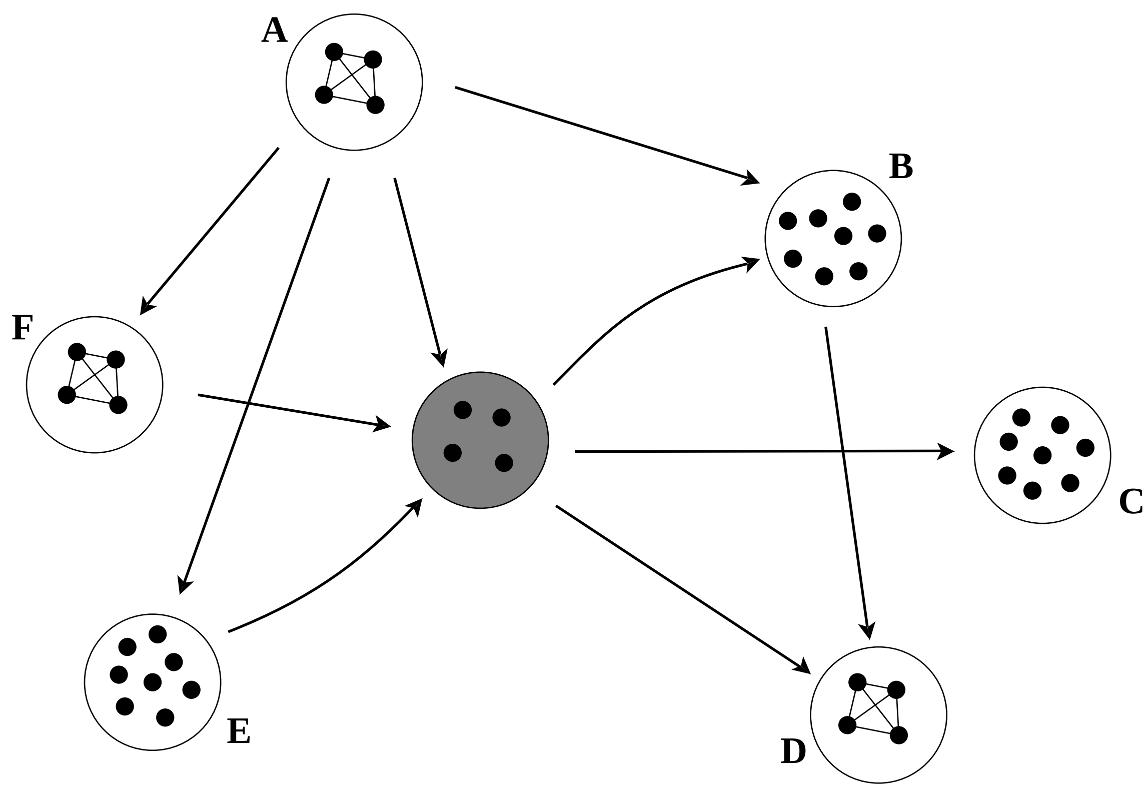


FIGURE 2.
ILLUSTRATIVE NETWORK FRAGMENT



$$w_{ij} = (p_{ij} + \Sigma_q \, p_{iq} p_{qj})^2 \quad q \neq i,j$$

		A	B	C	D	E	F
i dependence on j	$= w_{ij} =$	0.1512	0.0851	0.0278	0.0494	0.0434	0.0434
producer organization in j	$= O_j =$	1.0000	0.1250	0.1250	1.0000	0.1250	1.0000
constraint on i in i-j relation	$= c_{ij} =$	0.1512	0.0106	0.0035	0.0494	0.0054	0.0434

external market constraint
on producers in i $= C = \Sigma_j \, c_{ij} = \Sigma_j \, w_{ij} O_j = 0.2635$

FIGURE 3. PRODUCER PERFORMANCE BY INTERNAL AND EXTERNAL MARKET CONSTRAINT

(509 observations of aggregate American markets between 1963 and 1992)

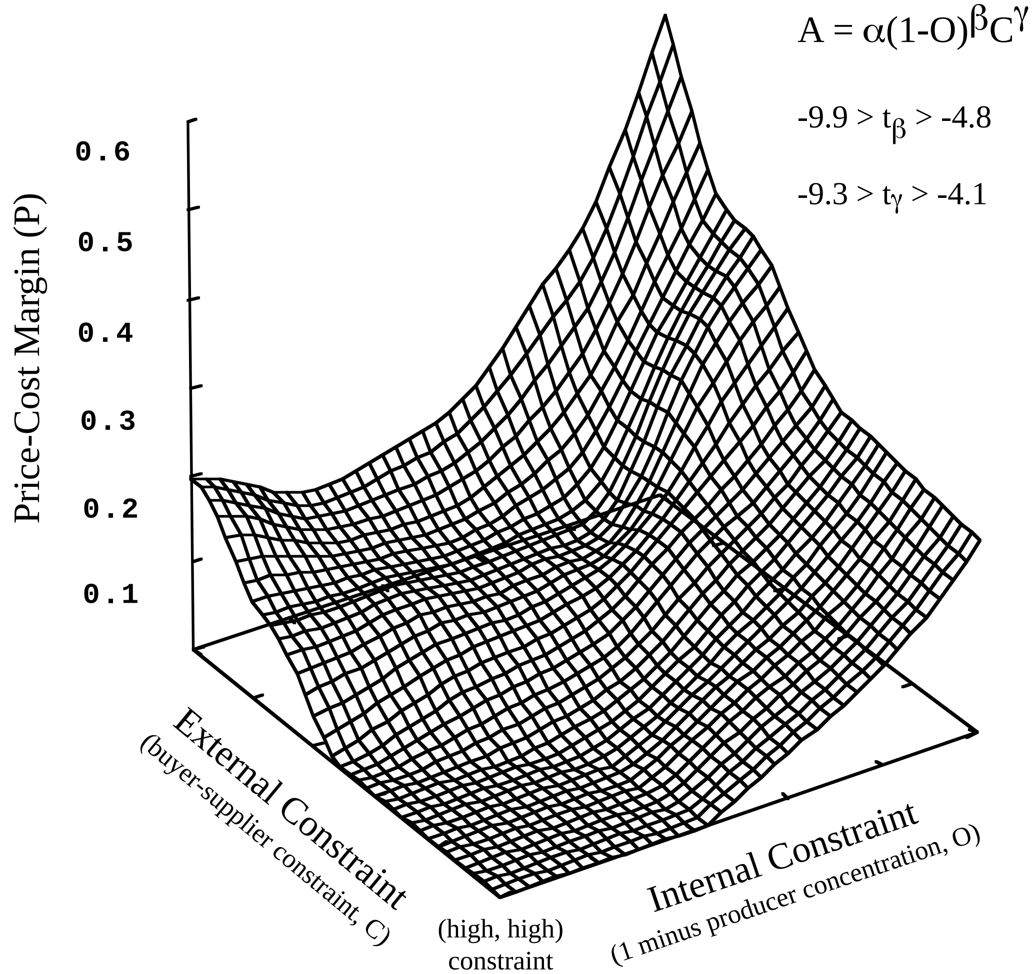


Figure 4. Price-Cost Margins Over Time.

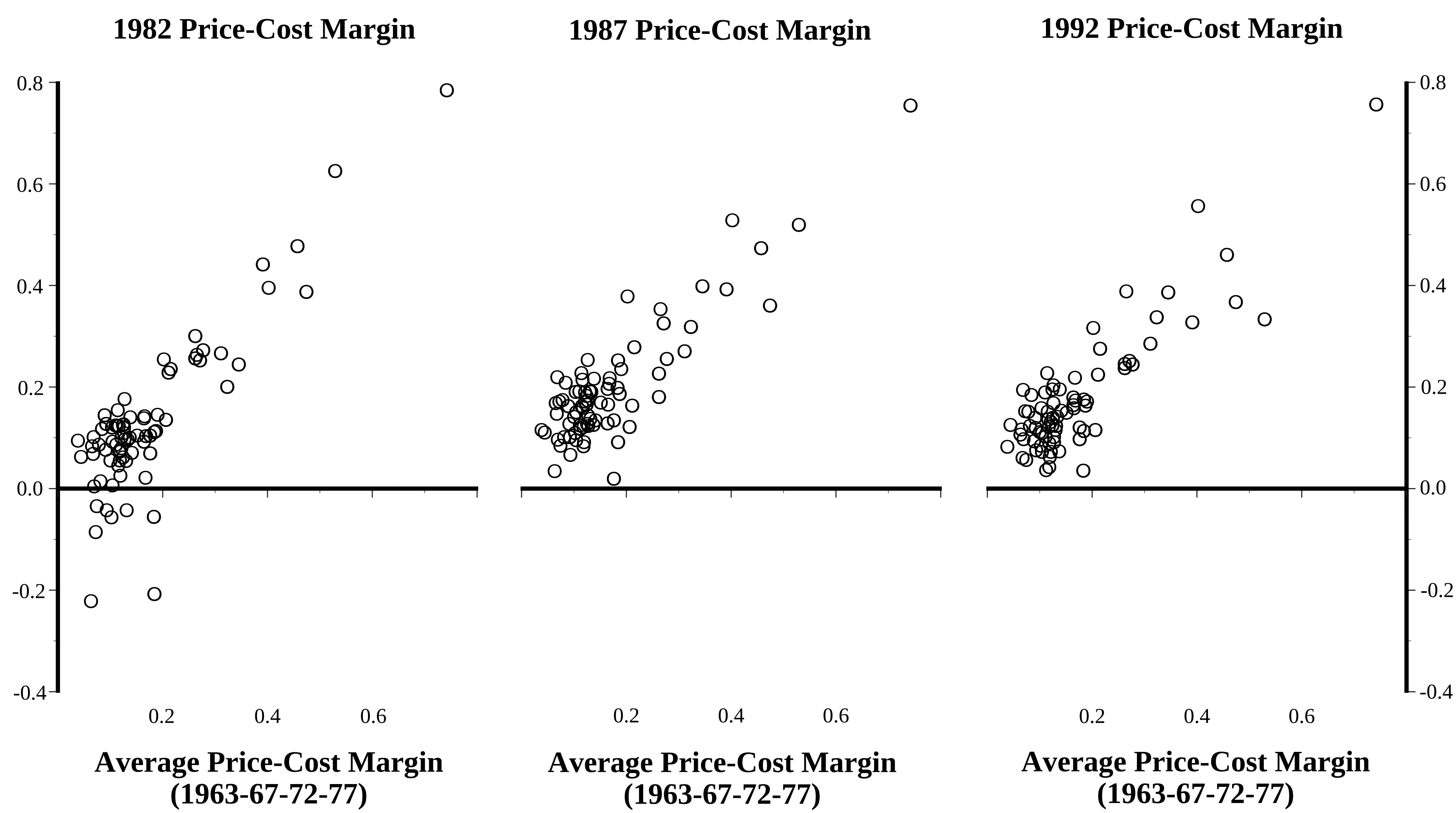


FIGURE 5.
DIAGONAL ELEMENTS IN THE JACOBIAN