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Autonomy in a Social Topology¹

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My purpose here is to define and illustrate a concept of “structural autonomy” based on recent developments in network analysis. The concept is stated in terms of the pattern of relations defining a network position, and it incorporates aspects of oligopoly from economics and group-affiliation from sociology. Eight hypotheses are derived from the proposed concept. These hypotheses concern the effects on autonomy of aspects of the pattern of relations defining a network position, the places in social structure where cooptive relations should appear (as well as places where they should not), and the increase in autonomy that can be expected from effective cooptation. Numerical illustration is provided. As a useful research site, firms in manufacturing industries of the 1967 American economy are treated as structurally equivalent actors, and total profits in an industry are taken to be a result of the relative autonomy of firms in separate industries. The autonomy hypotheses are used to explain relative industry profits and strategies for coopting other firms. Those industries with high structural autonomy tend to have high profits. Firms in an industry tend to purchase other firms in mergers patterned to coopt constraints on the industry’s structural autonomy.

As members of society, you and I can be considered to occupy positions defined by a complex pattern of relations with other actors in society. Our patterns of relations serve to bind each of us to society via its other members through a division of labor reflecting an interdependency of one actor on another. Beyond the mere increase in the density of exchanges among members of society, division of labor ensures that patterns of relations develop such that as societal members we are stratified across jointly occupied statuses defined by interlocking role-sets. Recent developments in network analysis focusing on actors’ positions in systems give algebraic meaning to this well-known metaphor. We can describe, in a fairly rigorous manner, the social structure of a multiple network system in terms of

¹ As part of the ongoing work under the Project in Structural Analysis at the Survey Research Center, University of California, Berkeley, the preparation of this article was made possible by a grant from the National Science Foundation (SOC77-22938). I appreciate the facilities made available to me during the formulation and initial writing of this discussion at the National Opinion Research Center, University of Chicago, by J. S. Coleman through a grant from the National Science Foundation (SOC73-05504). Portions of the numerical work and preparation of a final draft were accomplished during a leave of absence I spent in the Department of Sociology, State Uni-

existing static patterns of relations between statuses in the system. Still problematic, however, is the manner in which freedom from societal constraint operates in terms of the static structure of a system so captured. How does occupying a particular status in society determine freedom from constraint? More specifically (in a network sense), how does the pattern of relations defining an actor's "position" in a system determine his autonomy, that is, his ability to pursue and realize interests without constraint from other actors in the system.² My purpose here is to propose a concept of structural autonomy.

AUTONOMY AS A STRUCTURAL CONCEPT

The Social Topology of Relational Structure

I assume that the social structure of a system of actors is cast as a "social topology." Three ideas are central to such a representation: position, distance, and equivalence (see Burt 1976, 1977*b*, 1977*d*, 1978, for details). A "position" is defined as a pattern of relations to and from an actor within a system of actors. Two actors are separated by zero "distance" if they have identical relations with every actor in their system. They are separated by high distance to the extent that they have very different relations with each actor. Actors separated by zero or negligible distance are "structurally equivalent" within their system and can be discussed as jointly occupying a single position as a system status/role-set. For our purposes, let distance be reduced to a nominal level of measurement such

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² The phrase "without constraint from other actors in the system" is to be emphasized here. It explicitly excludes from the domain of autonomy those interests that involve deliberate opposition from other actors. In order to realize interests despite "constraint from other actors in the system," an actor needs to have high power within the system. A discussion of power in terms of an actor's position in a system of actors is given elsewhere (Burt 1977*d*). While a hermit can have high autonomy, few would consider him powerful. Also, autonomy as it is discussed here does not consider behaviors that are performed after the original impetus for performance has disappeared. Such a view of autonomy is elaborated, e.g., by Simmel ([1917] 1950, pp. 41-43) as "the autonomization of contents," by Allport (1937; 1961, chap. 10) as "functional autonomy," and by Kelman (1961) as "internalization." Piaget's ([1932] 1965, chap. 3) discussion of "moral autonomy" in terms of the internalization of rules and the subsequent demand for justice in the establishment of rules mixes the treatment given here with the above-cited discussions of behavior without impetus.

that the distance between any two actors is zero if they are structurally equivalent and one otherwise. A multiple network system composed of N actors can be reduced to $M + 1$ groups of actors— M groups of actors corresponding to M unique statuses each jointly occupied by multiple, structurally equivalent actors and a residual set composed of actors non-equivalent to the M statuses in the system and no more than two of whom are equivalent to one another. The social structure of this system can be described in terms of aggregate relations between actors in each of the $M + 1$ sets, as presented in figure 1. If there are no actors falling into a residual group, figure 1 could define a “blockmodel” of the system’s social structure (cf. White, Boorman, and Breiger 1976). Aggregating relations is plausible here since relations between structurally equivalent actors are being aggregated and these relations are merely variations on a single average relation between two sets of structurally equivalent actors. The position J is defined by a pattern of relations in row and column J of figure 1; an average relation to the occupants of position 1 (z_{j1}), an average relation to the occupants of position 2 (z_{j2}), an average relation from the occupants of position 1 (z_{1j}), and so on.

Let me rephrase the original question in the light of figure 1: What is it about the pattern of relations defining position J in figure 1 that could yield its occupants high autonomy relative to occupants of other positions in the

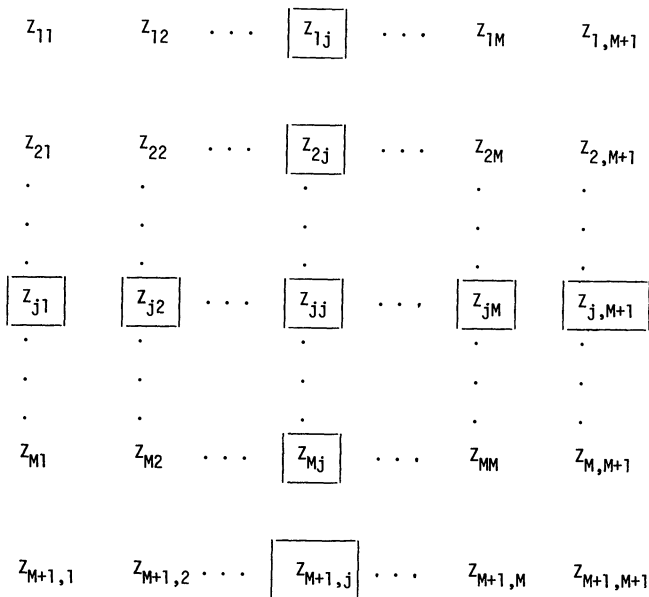


FIG. 1.—A system of actors cast as a social typology of relations among $M + 1$ structurally nonequivalent groups of actors (relations in boxes define position J).

system? Note that the question is concerned with the autonomy of occupying a position, not with the autonomy of particular actors per se, and is concerned with the relative autonomy of occupying structurally nonequivalent statuses, not with an absolute level of autonomy per se.

Aspects of Autonomy

There seem to be two basic aspects to the idea of being autonomous within a system of actors, either of which can be treated as embodying the overall concept of autonomy.

Developing Adam Smith's discussion in *The Wealth of Nations* ([1776] 1937), political economy treats the concept of autonomy in terms of collusion. As a consequence of competition among actors in a market system, "market prices" for any type of commodity (the prices for which the commodity is "sold") gravitate toward the "natural price" for the commodity (the price for which the commodity can be brought to market). Actors are equally constrained by the balancing of supply and demand through competition. The division of labor ensures that types of positions develop where each position is jointly occupied by actors who produce similar commodities, drawing supplies from the same types of other actors and making their sales to the same types of other actors. This means that interactor competition is sharpest between actors jointly occupying a status; each actor occupying the status is the structural equivalent of, and therefore substitutable for, other actors occupying the status.³ To the extent that decision making is centralized among structurally equivalent actors, the actors define an oligopoly to eliminate competition within their position and, accordingly, to escape the constraints of supply and demand. The autonomy of actors in an oligopoly, with regard to the constraint of supply and demand, is illustrated by their ability to raise the market price for their "commodity" far above the natural price (cf. Stigler 1964; Shepherd 1970, pp. 11–47).⁴

Thus, one aspect of autonomy concerns the relations among actors jointly occupying a status in a system. This is element (J, J) in figure 1. The actors jointly occupying position J will be able to escape the constraints of supply and demand imposed by actors in other positions and, accordingly, will be "autonomous" within their system, to the extent that among

³ The concept of structurally equivalent actors being substitutable goods and having substitutable perceptions is elaborated in detail elsewhere (Burt 1977*d*, pp. 25–36; 1979*b*; 1980).

⁴ Weber ([1925] 1947, p. 192) mentions a similar perspective but does not develop it systematically as "market freedom": ". . . the degree of autonomy enjoyed by the parties to market relationships in price determination and in competition."

persons,⁵ or corporate actors,⁶ occupying the position there exists an oligopoly (few competitive decision makers) or, in the extreme of centralization, a monopoly (a single decision maker). Let y_{j1} be a measure of the centralization of decision making within position J such that $0 < y_{j1} < 1$. Measures of Y_1 will vary by research problem. In sectors of an economy, for example, centralization is usually measured as the ratio of total sales by some number of the largest firms in a sector over the total sales by all firms in the sector. To the extent that there are few competitive firms in a sector, this ratio will approach one, as discussed below. In a traditional sociometric study, Y_1 could be measured by any of several centralization measures. For example, Freeman (1977) suggests measures that capture the extent to which communication among a set of persons must pass through a single "central" person.

What if collusion develops between actors in separate sectors of the market so that the entire market becomes what sociologists term an undifferentiated, cohesive system? Then, actors in each sector are constrained by their lack of differentiated relations to other actors in the system. Durkheim's *The Division of Labor in Society* ([1893] 1933) at a macro level and Simmel's "Web of Group-Affiliations" ([1922] 1955) at a more micro level contain discussions emphasizing the constraining effects of an absence of differentiation within a system of actors. For both Durkheim and Simmel, differential freedom from constraint by society occurs as a result of differential complexity in an actor's relations to other actors.⁷ Durkheim

⁵ In his discussion of the determinants of wages and the advantages of employers over laborers given by the greater ease with which the former are capable of organizing collectively to oppose the interests of the latter, Smith ([1776] 1937, p. 66) states: "It is not, however, difficult to foresee which of the two parties must, upon all ordinary occasions, have the advantage in the dispute, and force the other into a compliance with their terms. The masters, being fewer in number, can combine much more easily; and the law, besides, authorises, or at least does not prohibit their combinations, while it prohibits those of the workmen." Locke ([1689] 1955, chap. 5) develops a similar theme in which individuals forced to sell their labor in order to survive are less able to compete in society than are individuals whose accumulated capital goods enable them to purchase the labor of others (cf. Macpherson's [1962, pp. 221–38] discussion of how Locke generalizes this argument from an exchange of property to a loss of natural rights).

⁶ After making general remarks concerning the monopolistic purpose of corporations (Smith [1776] 1937, pp. 123–29), Smith considers some corporate actors in detail (e.g., the wool industry [pp. 612–19] and the trading companies with exclusive franchises in the colonies [pp. 557–606]) as supporting evidence. Examples more meaningful in current industrial society are discussed by Bain (1959) and Kaysen and Turner (1959). Shepherd (1970, pp. 39–42) reviews characteristics of the presence of few independent firms within a sector of the economy as "internal market structure."

⁷ I have deliberately replaced the term "autonomy" with "freedom" in this sentence because Durkheim and Simmel use the term "autonomy" differently, even though they both emphasize what has been discussed here as a group-affiliation hypothesis. Simmel uses autonomy to refer to the content of relations that continue to be performed after the original impetus for them is gone ("autonomization of contents")

focuses on the balancing of forces between occupational groups as statuses created by a division of labor⁸ and by moral authority of government.⁹ Simmel focuses on the competition among groups linked to an actor for his attention and conformity.¹⁰ He ([1908] 1950, p. 121) emphasizes the po-

[1917] 1950, pp. 41–43). Durkheim uses the term “moral individualism” to refer to what is discussed here as autonomy. His ([1925] 1961, pp. 95–126) discussion of autonomy is a mixture of our use of autonomy and Piaget’s ([1932] 1965) discussion of autonomy as morality based on an understanding of the rules by which action is guided as being “fair” or “just” rules.

⁸To say that the division of labor creates a stratification of statuses at some point in time does not in itself add to the oligopoly hypothesis. Indeed, the assumption of fixed requirements in input-output analysis corresponds to just such a condition. Instead of freely choosing transactions for the exchange of property, actors freely choose to occupy positions (i.e., sectors) within the system, and the capacity of actors occupying a position to restrict free entry to their position can be treated under the oligopoly hypothesis (cf. Bain 1956). It is by a consideration of the form and content of the pattern of relations defining a position that the group-affiliation hypothesis as represented in Durkheim’s discussion differs from the oligopoly hypothesis.

⁹Actors are occupants of professions, and these professions are constrained by the authority of the government. Durkheim ([1893] 1933, p. 131) views this liberation of the actor from the direct authority of either profession or government favorably: “Even in the exercise of our occupation, we conform to usages, to practices which are common to our whole professional brotherhood. But, even in this instance, the yoke that we submit to is much less heavy than when society completely controls us, and it leaves much more place open for the free play of our initiative. Here, then, the individuality of all grows at the same time as that of its parts. Society becomes more capable of collective movement, at the same time that each of its elements has more freedom of movement.” He ([1906] 1974, p. 76) is more general at a later date in his response to a critic who claimed that “civilization” is the continuing liberation of man from the material structure of society: “These rights and liberties are not things inherent in man as such. If you analyze man’s constitution you will find no trace of this sacredness with which he is invested and which confers upon him these rights. This character has been added to him by society. Society has consecrated the individual and made him pre-eminently worthy of respect. His progressive emancipation does not imply a weakening but a transformation of the social bonds. The individual does not tear himself from society but is joined to it in a new manner, this is because society sees him in a new manner and wishes this change to take place. The individual submits to society and this submission is the condition of his liberation.”

¹⁰In attending to the pattern of multiple ties between an individual and multiple disparate groups in society, Simmel ([1922] 1955, pp. 140–41) points out a cycle of causation between the individual’s position as a set of ties to groups and actions undertaken by the individual: “The groups with which the individual is affiliated constitute a system of coordinates, as it were, such that each new group with which he becomes affiliated circumscribes him more exactly and more unambiguously. . . . As the person becomes affiliated with a social group, he surrenders himself to it. A synthesis of such subjective affiliations creates a group in an objective sense. But the person also regains his individuality, because his pattern of participation is unique; hence the fact of multiple group-participation creates in turn a new subjective element. *Causal determination of, and purposive actions by, the individual appear as two sides of the same coin*” (emphasis added). He ([1922] 1955, p. 163) concludes after reviewing issues in multiple group affiliation: “Thus one can say that society arises from the individual and that the individual arises out of association.”

tential oppression of relations with groups left unchecked by competition from other relations:

Almost all relations—of the state, the party, the family, of friendship or love—quite naturally, as it were, seem to be on an inclined plane: if they were left to themselves, they would extend their claims over the whole of man. . . . But it is not only through the extensity of claims that the egoism of every sociation threatens the freedom of the individuals engaged in it. It does so also through the relentlessness of the claim itself, which is one-tracked and monopolistic. Usually, each claim presses its rights in complete and pitiless indifference to other interests and duties, no matter whether they be in harmony or in utter incompatibility with it.

In other words, competitive claims by groups of actors can be balanced against one another to limit constraint from others. This principle works for those occupying positions of authority as well as for those occupying positions of subordination.¹¹ Autonomy is high for actors occupying a position with many conflicting group-affiliations and low for those occupying a position affiliated with only one other position.

It is important to recall that the concern here is with describing the autonomy of a jointly occupied position rather than of an actor per se. Under the idea of group-affiliation, actors jointly occupying a position that forms an oligopoly are subject to the constraints of the oligopoly. These constraints, in contrast to autonomy via oligopoly relative to other positions, serve to limit the autonomy of the individual wishing to deviate from other actors occupying his position. Substantively, the constraint on individual actors of being too strongly integrated into a group of similar others is documented in a range of studies, such as Festinger, Schachter, and Back's (1950) description of the formation of social norms within cohesive groups of students at M.I.T.; Riesman's (1950, chap. 14) description of "enforced privatization" as the constraints one's peers enforce concerning appropriate behaviors for someone occupying their position in society; Bott's (1957) description of the formation of conjugal roles as a function of husband and wife being absorbed into separate cohesive groups; and Gans's (1962) description of the maintenance of social norms among Italian-Americans in Boston's West End through cohesive peer groups. In

¹¹ Simmel (1896) emphasizes the symbiotic constraints imposed on actors occupying positions of authority by actors occupying the positions over which authority is exercised and vice versa. Riesman (1950, chaps. 13, 14) provides illustrations relevant to our day-to-day experience in his elaboration of two impediments to an individual having high autonomy: "false personalization" and "enforced privatization." The former refers to autonomy that is lowered because of an individual's absorption in artificial social relations arising from occupancy of a position rather than from relations defining the position (e.g., the need of a secretary, whose life outside the office is dull, for personalistic rather than universalistic relations with the employers [Riesman 1950, pp. 264–66]), and the latter refers to autonomy that is lowered as a result of other occupants of the position placing constraints on what is proper behavior for someone occupying their position.

contrast to these studies, I am concerned with the relative autonomy of separate positions. My use of the term “group-affiliations” accordingly refers to affiliations to actors in other positions rather than to structurally equivalent actors.

Thus, a second aspect of autonomy concerns the manner in which actors jointly occupying a status are related to actors occupying other statuses in their system. These are the elements of row and column J in figure 1, excluding element (J, J) . Actors jointly occupying position J will be able to balance demands from other actors and, accordingly, will be “autonomous” within their system, to the extent that the pattern of relations defining position J ensures high competition among those actors who interact with the occupants of position J . Autonomy via group-affiliation emphasizes two characteristics of the pattern of relations defining a position. First, actors occupying position J will have high autonomy to the extent that they have relations to many other statuses rather than with only one other. Second, actors occupying position J will have high autonomy to the extent that the statuses with whose occupants they do have relations are not oligopolies. In other words, a measure of autonomy via group-affiliation must consider two things: the extent to which actors occupying a status have diversified relations with other statuses, and the extent to which they have relations only with statuses that are too poorly organized to make collective demands.

Simply stated, the absence of these two characteristics in the pattern of relations defining position J is captured by the following group-affiliation index:

$$y_{j2} = \sum_i^{M+1} x_{ji} = \sum_i^{M+1} y_{i1} [(z_{ij}/\Sigma_i^{M+1} z_{ij})^2 + (z_{ji}/\Sigma_i^{M+1} z_{ji})^2], \quad j \neq i,$$

where z_{ij} is the average relation from actors occupying status I to actors occupying status J , y_{i1} is the above-mentioned measure of oligopoly among actors occupying status I , and $M + 1$ is the number of separate sets of actors being considered as groups in the topological representation of social structure. For each position I , other than position J , the component x_{ji} captures the extent to which position I is an oligopoly and all of the relations to and from occupants of position J are with occupants of position I . The index, then, is a sum of the x_{ji} across the M other sets of actors in the system. The index will equal its maximum of two when actors occupying position J initiate interaction only with actors occupying a single other position and are themselves the object of interaction from actors occupying a single other position and these position(s) are perfectly centralized ($Y_1 = 1$). The index will approach zero as the occupants of position J have relations only with actors jointly occupying very decentralized positions

($Y_1 = 0$) and have no relations with actors whose positions are perfectly centralized ($Y_1 = 1$).

Structural Autonomy

Autonomy via oligopoly and autonomy via group-affiliation seem to be complementary aspects of autonomy rather than alternative concepts. The separation of these two aspects in the literature can be attributed, it seems to me, to disciplinary history rather than to substantive necessity. It seems reasonable, therefore, to propose a network concept of autonomy that is a simple combination of these well-known aspects: oligopoly focusing on the relations among structurally equivalent actors occupying a status, and group-affiliation focusing on relations linking those actors to other statuses.

As a simple first approximation, actors jointly occupying position J can be said to have high structural autonomy to the extent that their pattern of relations has three characteristics: (1) There is high centralization among occupants of the position such that they form an oligopoly; (2) their relations to other statuses are diversified and exist only with statuses that do not themselves form oligopolies; and (3) the first two conditions occur simultaneously as an interaction effect. These three conditions determine the structural autonomy of position J 's occupants, \mathbf{a}_j , in the following equation, where β_o , β_g , and β_x , respectively, weight the above three features:¹²

$$\mathbf{a}_j = \beta_o y_{j1} + \beta_g y_{j2} + \beta_x (y_{j1} - \bar{y}_1)(\bar{y}_2 - y_{j2}) . \quad (1)$$

The weights in equation (1) have expected signs. Oligopoly should lead to autonomy, so a first hypothesis is that Y_1 has a positive effect on the autonomy of position J 's occupants:

$$H_1: \beta_o > 0 .$$

As captured in Y_2 , the lack of conflicting group-affiliations should constrain autonomy, so a second hypothesis is that β_g is negative:

$$H_2: \beta_g < 0 .$$

Finally, a third hypothesis is that β_x is positive to the extent that simultaneously forming an oligopoly and having conflicting group-affiliations leads to autonomy above and beyond the direct additive effects of either aspect of autonomy:

$$H_3: \beta_x > 0 .$$

¹² The interaction term is expressed in terms of deviations from mean scores so as to eliminate spurious correlations between it and the two measures of aspects of autonomy, Y_1 and Y_2 (cf. Althausser 1971).

In words, hypotheses 1, 2, and 3 say that actors jointly occupying position J will have high structural autonomy to the extent that their relations ensure low competition among occupants of position J and high competition among the nonoccupant actors who interact with the occupants of position J .

Beyond measuring the relative autonomy of occupants of separate positions in a system, equation (1) contains information on where cooptive relations should occur. As described by Selznick (1949, p. 13) in his analysis of the Tennessee Valley Authority, “. . . cooptation is the process of absorbing new elements into the leadership or policy-determining structure of an organization as a means of averting threats to its stability or existence.” Without doing violence to Selznick’s analysis of corporate actors, let me extend this idea to actors in general and refer to a “cooptive” relation, w_{ji} , as an informal relation giving the actor(s) occupying position J some effect on the decisions made by actor(s) occupying position I . By an informal relation, I refer to a relation that is relatively dependent on, or at the discretion of, the individuals performing it. This is in contrast to a formal relation such as a role or technical requirement that is imposed on the individuals performing the relation.¹³ Within a corporate bureaucracy, for example, lines of authority would be formal relations between actors as employees, while friendships would be informal relations between actors as individuals. Authority relations are formal in the sense that the people to whom one gives direction and from whom one takes direction are defined by one’s “job.” Friendship relations in this context are informal in the sense that they can be created and destroyed at the discretion of the individuals engaged in them. If a friendship in this context is used to affect another person’s decisions, the friendship is a “cooptive” relation in the sense used here. Persons with a “friend” in the purchasing department, for example, seem to get their requests filled more quickly than do persons without such a “friend.”

Assuming that cooptive relations are used to eliminate constraints on autonomy, a cooptive relation, w_{ji} , should appear whenever such a relation will increase the autonomy of occupants of position J .

The partial derivative of the autonomy of position J ’s occupants with respect to the level of oligopoly within the position is given as $\partial \mathbf{a}_j / \partial y_{j1} = \beta_o + \beta_x(\bar{y}_2 - y_{j2})$, assuming that infinitesimal change in y_{j1} leaves the mean of Y_1 unchanged. Since β_o is positive under hypothesis 1 and β_x is positive

¹³ This formal-informal contrast is not to be confused with Granovetter’s (1973) strong-weak contrast. Strong relations differ from weak relations in terms of the form of a relation, strong relations being far more intense than weak relations. In the formal-informal contrast, I wish merely to highlight two extremes in the content of relations, formal relations being far more subject to social sanctions or technical requirements beyond the control of the individuals performing them than is the case with informal relations.

under hypothesis 3, an increase in oligopoly, y_{j1} , will lead to an increase in autonomy, \mathbf{a}_j , as long as the occupants of position J are not strongly constrained by actors in other positions.¹⁴ To specifically state a fourth hypothesis, there should be a significant level of cooptation among the occupants of a network position as long as they are not more constrained by actors in the system than are the average occupants of positions in the system:

$$H_4: w_{jj} > 0, \quad \text{given } \partial \mathbf{a}_j / \partial y_{j1} > 0.$$

In other words, structurally equivalent actors will always have cooptive relations with one another as long as they are not subject to high constraint from actors outside their position.

In order to predict cooptive relations with actors in other positions, equation (1) must be disaggregated. Stating the group-affiliation index in terms of its component x_{ji} , an approximation to equation (1) can be stated in terms of the contribution each status makes to the structural autonomy of position J 's occupants:¹⁵

$$\begin{aligned} \mathbf{a}_j &\simeq \beta_o y_{j1} + \sum_i^{M+1} \beta_o x_{ji} + \sum_i^{M+1} \beta_x (y_{j1} - \bar{y}_1) [y_{j2} / (M + 1) - x_{ji}], \quad j \neq i \\ &\simeq \beta_o y_{j1} + \sum_i^{M+1} \{ \beta_o x_{ji} + \beta_x (y_{j1} - \bar{y}_1) [y_{j2} / (M + 1) - x_{ji}] \}, \quad j \neq i \\ &\simeq \sum_i^{M+1} x_{ji}^*, \end{aligned}$$

where x_{ji}^* is $\beta_o y_{j1}$ so that the extent to which the occupants of position I contribute to the autonomy of position J 's occupants is given as the ratio:

$$\mathbf{a}_{ji} = x_{ji}^* / |\mathbf{a}_j|. \quad (2)$$

Equation (2) has x_{ji}^* divided by the absolute value of \mathbf{a}_j merely for the convenience of comparing structural constraints across separate positions. If \mathbf{a}_{ji} is significantly positive, the autonomy of position J 's occupants is

¹⁴ When occupants of position J suffer above-average constraint from actors occupying other positions, the term $\beta_x (\bar{y}_2 - y_{j2})$ will be negative. If the constraint is so high that this term exceeds β_o , then $\partial \mathbf{a}_j / \partial y_{j1}$ will be negative so that occupants of position J would not perceive an increase in their autonomy as a result of a small increase in their centralization. In order to increase their autonomy, either a large increase in centralization is needed so that y_{j1} increases considerably, or, more important, a change is needed in their relations with other statuses so that y_{j2} decreases.

¹⁵ This is an approximation because of the manner in which the interaction term in eq. (1) is disaggregated. The strict disaggregation of the interaction term in (1) is: $\beta_x (y_{j1} - \bar{y}_1) [\sum_j^{M+1} (\sum_i^{M+1} x_{ji}) / (M + 1) - (\sum_i^{M+1} x_{ji})]$. The term I have used to disaggregate \mathbf{a}_j replaces the mean group-affiliation index across all positions (\bar{y}_2), with the mean contribution each position makes to the group-affiliation index for position J , $\bar{x}_{j1} = \sum_i^{M+1} x_{ji} / (M + 1) = y_{j2} / (M + 1)$. My concern in disaggregating autonomy is to capture the relative contribution of each status to the autonomy of occupants of position J rather than to capture the relative contribution of each status to autonomy in general. For position J , the term $[y_{j2} / (M + 1) - x_{ji}]$ is negative to the extent that relations between positions I and J constrain the occupants of position J more than the average constraint they suffer from any one other position.

increased by their relations with the occupants of position I . On the other hand, if \mathbf{a}_{ji} is significantly negative, relations with the occupants of position I decrease the autonomy of actors occupying position J .

The extent to which change in the relations with position I would affect the autonomy of position J 's occupants is given by the partial derivative of autonomy with respect to x_{ji} (the component of the group-affiliation index for position J which measures the extent to which position I is an oligopoly and is the only other position with which position J 's occupants have relations), which is $\partial \mathbf{a}_j / \partial x_{ji} = \beta_y + \beta_x(\bar{y}_1 - y_{j1})$, assuming that infinitesimal change in x_{ji} leaves the mean of Y_2 unchanged. Since β_y is negative under hypothesis 2 and β_x is positive under hypothesis 3, this derivative will be negative as long as the level of oligopoly among occupants of position J is no more than a fraction below the mean level for all $M + 1$ groups of actors.¹⁶

Given the above negative derivative, actors occupying position J can lower the extent to which they are constrained by the occupants of position I by establishing a cooptive relation to position I . Assuming that the cooptive relation w_{ji} does decrease x_{ji} as the constraint on position J from position I , and assuming that actors are interested in eliminating significant constraints on their autonomy, then a fifth hypothesis can be stated. Unless the actors occupying position J are poorly organized such that the above partial derivative is positive, there should be a significant level of cooptation by position J 's occupants of the occupants of each other position I which places a significant constraint on the autonomy of position J (i.e., each position I for which eq. [2] is significantly negative):

$$H_5: w_{ji} > 0, \quad \text{given } \mathbf{a}_{ji} < 0 \text{ and } \partial \mathbf{a}_j / \partial x_{ji} < 0.$$

If the occupants of position I do not constrain the autonomy of actors occupying position J , there is no need for actors occupying position J to establish cooptive relations with position I 's occupants. For negligible and positive \mathbf{a}_{ji} , therefore, w_{ji} should be negligible:

$$H_6: w_{ji} = 0, \quad \text{given } \mathbf{a}_{ji} = 0$$

and

$$H_7: w_{ji} = 0, \quad \text{given } \mathbf{a}_{ji} > 0 \text{ and } j \neq i.$$

Suppose that in observing the social topology of a system, only formal relations were considered. The autonomy of employees in a corporate bu-

¹⁶ When the occupants of position J are particularly disorganized in comparison with the other M groups in their system, the term $\beta_x(\bar{y}_1 - y_{j1})$ will be positive. If y_{j1} falls below the mean (\bar{y}_1) by more than the fraction β_y/β_x , $\partial \mathbf{a}_j / \partial x_{ji}$ will be positive, so that occupants of position J would not perceive an increase in their autonomy as a result of a small decrease in the constraints they suffer at the hands of occupants of other positions. In order to increase their autonomy, the occupants of position J must radically alter their relations with other statuses or organize themselves to increase the centralization of decision making for their position.

reaucracy, for example, could be computed using equation (1) from the network(s) of formal authority relations in the bureaucracy without considering the network of informal friendship relations. This is illustrated below. Hypotheses 4–7 concern the likelihood of actors establishing informal, potentially cooptive relations with groups of actors threatening their autonomy. Not all actors, however, need to be equally successful in coopting such threats. Some will be able to eliminate all threats to their autonomy while others might not be able to eliminate any. This variability in successful cooptation means that autonomy estimated from formal relations alone will be erroneous in a predictable manner. Those actors who have successfully coopted the occupants of positions detracting from their autonomy (i.e., those positions I for which eq. [2] is negative) should have higher than expected autonomy. Those actors who have failed to coopt threats to their autonomy should have lower than expected autonomy. The extent to which the autonomy of position J 's occupants is increased through their strategies for coopting occupants of other positions is given as the product of the partial derivative of their autonomy with respect to constraints from other actors ($\partial \mathbf{a}_j / \partial x_{ji}$) and the level of constraint they have managed to coopt. The latter quantity can be measured as the sum of the negative x_{ji} that have been successfully coopted. This yields an index of the expected increase in the autonomy of position J 's occupants:

$$d(\mathbf{a}_j) = (\partial \mathbf{a}_j / \partial x_{ji})(\sum_i^{M+1} w_{ji} x_{ji}), \quad \text{for all } x_{ji} < 0. \quad (3)$$

This index will be high when the occupants of position J are constrained by many other positions and have successfully coopted all of the constraints. As an eighth hypothesis, the extent to which true autonomy (\mathbf{a}_j) exceeds the level of autonomy erroneously estimated when cooptive relations were ignored (call it $\hat{\mathbf{a}}_j$) should have a positive slope (β_c) when regressed over the extent to which occupants of position J have successfully coopted threats to their autonomy ($d[\mathbf{a}_j]$):

$$H_8: \beta_c > 0, \quad \text{in the equation } (\mathbf{a}_j - \hat{\mathbf{a}}_j) = \beta_c d(\mathbf{a}_j).$$

In answer to the question of how the pattern of relations defining an actor's position determines his autonomy, then, equation (1) proposes the concept of structural autonomy. Hypotheses 1–8 make explicit some of the concept's implications. Before assessing the adequacy of these implications in a strategic research site, I wish to provide a more traditional numerical illustration of the concept itself.

Numerical Illustration

Figure 2 presents a sociogram of choices among 12 persons in an organization obtained from their responses to the sociometric question, "To

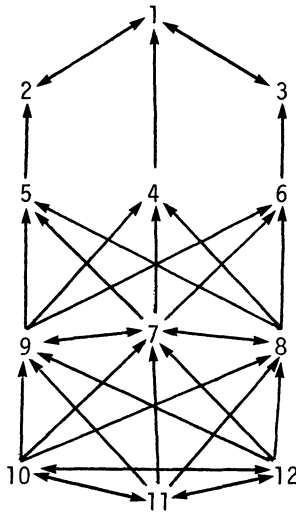


FIG. 2.—A sociogram of a hypothetical system of actors responding to the question, “To whom do you go for information on your work?”

whom do you go for information on your work?” Table 1 presents the adjacency matrix described by figure 2 and blockmodel densities for the one-network system. Four jointly occupied positions were located, each composed of three structurally unique persons. There are no residual persons; each person occupies a jointly occupied position. Since the system is composed of only one network, the four jointly occupied positions define the system’s statuses. The system-network model in table 1 presents average relations between occupants of the four statuses as densities computed from the sociometric choices. Computational details are given in the note to table 1. Persons 1, 2, and 3 jointly occupy status S_1 . They interact only with one another. Persons 4, 5, and 6 jointly occupy status S_2 . They have no interaction with one another, but they do seek information from the occupants of status S_1 and are the object of information seeking from the occupants of status S_3 . Persons 7, 8, and 9 jointly occupy status S_3 , while persons 10, 11, and 12 jointly occupy S_4 . Occupants of these statuses seek information on their work from persons with whom they are structurally equivalent, and the occupants of S_4 go to the occupants of S_3 for job-related information. Given the patterns of relations defining each of the four statuses in table 1, how is structural autonomy distributed across the statuses, and where are the structural constraints upon which cooptive relations should be patterned?

Table 2 presents the relative structural autonomy of the four statuses. Statuses S_1 and S_3 have high centralization, S_4 has lower centralization, and S_2 is completely decentralized. Note in figure 2 that the occupants of

TABLE 1
 SOCIOMETRIC CHOICES AND DENSITIES AMONG OCCUPANTS OF
 FOUR STATUSES IN THE HYPOTHETICAL SYSTEM IN FIGURE 2

	STATUSES			
	S ₁	S ₂	S ₃	S ₄
Binary choices:				
1.....	0 1 1	0 0 0	0 0 0	0 0 0
2.....	1 0 0	0 0 0	0 0 0	0 0 0
3.....	1 0 0	0 0 0	0 0 0	0 0 0
4.....	1 0 0	0 0 0	0 0 0	0 0 0
5.....	0 1 0	0 0 0	0 0 0	0 0 0
6.....	0 0 1	0 0 0	0 0 0	0 0 0
7.....	0 0 0	1 1 1	0 1 1	0 0 0
8.....	0 0 0	1 1 1	1 0 0	0 0 0
9.....	0 0 0	1 1 1	1 0 0	0 0 0
10.....	0 0 0	0 0 0	1 1 1	0 1 1
11.....	0 0 0	0 0 0	1 1 1	1 0 1
12.....	0 0 0	0 0 0	1 1 1	1 1 0
Densities:				
S ₁.....	.7	.0	.0	.0
S ₂.....	.3	.0	.0	.0
S ₃.....	.0	1.0	.7	.0
S ₄.....	.0	.0	1.0	1.0

NOTE.—Densities have been computed from the binary choices as the ratio of observed choices over possible choices. The four statuses were located by inputting the binary choices into the computer package STRUCTURE (Project in Structural Analysis 1977) which separated four clusters of persons. As a check on the cluster analysis, there is a single dimension of distance to each status (see Burt 1977b, p. 113; 1977c, p. 557). The ratio of predicted to observed variance in distance to actors using a single principal component for each status is .87, .57, .85, and .97, respectively.

TABLE 2
 CENTRALIZATION, GROUP-AFFILIATION, AND STRUCTURAL
 AUTONOMY OF THE FOUR STATUSES IN FIGURE 2

	STATUSES			
	S ₁	S ₂	S ₃	S ₄
Centralization (Y_1)*.....	1.00	.00	1.00	.50
Group-affiliation (Y_2)†.....	.00	2.00	.17	.25
$(y_{j1}-\bar{y}_1)(y_{j2}-\bar{y}_2)$.....	.23	-.88	.16	-.04
Structural autonomy (\mathbf{a}_j)‡.....	1.09	-2.44	.89	.24

* Centralization is measured as the maximum centrality of any one occupant of a status. Modified from Freeman (1977, p. 37), person K is central to the extent that $b_{ij}(p_k) = g_{ij}(p_k)/g_{ij}$ is close to one, where $g_{ij}(p_k)$ is the number of connections linking persons I and J through person K and g_{ij} is the total number of connections linking persons I and J .

† Computed from the densities in table 1 and the centralization scores according to the equation for group-affiliation index given in the text.

‡ Arbitrary values have been used for β_o , β_g , and β_x in eq. (1). In keeping with hypotheses 1 and 3, β_o and β_x are positive; in keeping with hypothesis 2, β_g is negative. The t -tests for the four-digit manufacturing industries (see table 4) suggest that β_o and β_g are equal and larger than β_x by about five to two so the following values have been used as weights in this example: $\beta_o = 1.0$, $\beta_g = -1.0$, and $\beta_x = .4$.

S_2 have no relations with one another. The occupants of S_4 have relations with one another, but there is no centralization of communication. In contrast, the occupants of S_1 and S_3 are centralized since a single person coordinates communication among all three persons occupying either status: persons 2 and 3 communicate through person 1, persons 8 and 9 communicate through person 7. Based on the densities in table 1, the group-affiliation index shows that the occupants of S_1 suffer no constraint from the other statuses (Y_2 is 0), the occupants of status S_2 suffer a maximum constraint from the other statuses (Y_2 is 2), and statuses S_3 and S_4 are subject to low constraint. The patterns of relations in table 1 explain these scores. The occupants of S_1 are free from constraint because their only relations with persons outside their own status are relations with status S_2 , a status that is completely decentralized so that its occupants cannot collectively impose demands on the occupants of S_1 . The unfortunate occupants of S_2 , in contrast, have all their relations with statuses S_1 and S_3 , both of which are completely centralized statuses. Finally, the computed values of Y_1 and Y_2 have been used to generate relative levels of structural autonomy for each status, a_j , using weights in keeping with hypotheses 1, 2, and 3 and suggested by the analysis given below.

Owing to their high centralization and the low constraint they confront from other statuses, the occupants of status S_1 have the highest autonomy in the system ($a_1 = 1.09$). The occupants of status S_3 are equally centralized; however, the constraint imposed on them by status S_4 means that they have lower autonomy ($a_3 = .89$) than the occupants of S_1 do. Completely decentralized and facing maximum constraint from outside their status, the occupants of status S_2 have the lowest autonomy of all ($a_2 = -2.44$). Even though the occupants of status S_2 serve as brokers between the prestigious status S_1 and the less "influential" statuses S_3 and S_4 , and even though the role of broker is traditionally thought of as an autonomous role optimum for the profit-seeking entrepreneur, the fact that the occupants of S_2 must deal with two oligopolistic statuses (S_1 and S_3) reduces their autonomy to a minimum in the system.

Table 3 presents information on constraint and cooptation in the hypothetical system. The only positive contributions to autonomy come from collusion among occupants of each status (a_{11} , a_{33} , and $a_{44} > 0$). The exception here is status S_2 , in which there is no centralization ($a_{22} = 0$). Since the relevant partial derivatives are all positive, there should be cooptive relations among occupants of each status. In addition, there should be cooptive relations wherever there is a significant constraint relation since the relevant partial derivatives here are all negative. The four highly negative contributions to autonomy in the system are not surprising in light of the above discussion of the group-affiliation index. The occupants of status S_2 confront high constraint from statuses S_1 and S_3 , so cooptive

TABLE 3
STRUCTURAL CONSTRAINTS, PARTIAL DERIVATIVES, AND
PREDICTED COOPTIVE RELATIONS FOR THE
HYPOTHETICAL SYSTEM IN FIGURE 2

	STATUSES			
	S ₁	S ₂	S ₃	S ₄
Structural constraints (a_{ji}):				
S ₁.....	.92	.00	.00	.00
S ₂	-.36	.00	-.36	-.05
S ₃.....	.00	.00	1.12	-.22
S ₄.....	.00	.00	-1.00	2.08
$\partial a_j / \partial y_{j1}$	1.24	.44	1.18	1.14
$\partial a_j / \partial x_{ji}$	-1.15	-.75	-1.15	-.95
Cooptive relations (w_{ji}):				
S ₁	Yes	No	No	No
S ₂	Yes	Yes	Yes	Yes
S ₃	No	No	Yes	Yes
S ₄	No	No	Yes	Yes

NOTE.—Structural constraints have been computed from eq. (2), the partial derivatives have been computed from equations in the text, and a cooptive relation w_{ji} appears where predicted by hypothesis 4, 5, or 6.

relations linking occupants of S₂ with those of S₁ and S₃ are expected ($a_{21} = a_{23} = -.36$). Similarly, occupants of statuses S₃ and S₄ constrain one another ($a_{34} = -.22$; $a_{43} = -1.0$), so cooptive relations would be expected between the occupants of these statuses. As a result of the lack of constraint imposed on their status, persons occupying status S₁ would be expected to establish no cooptive relations with persons occupying other statuses.

A STRATEGIC OPERATIONALIZATION

Having sketched what appears to be a plausible concept of autonomy and having illustrated how such a concept might be used in a routine network analysis, I turn now to the substantive adequacy of the concept's implications. In order to test the constraint and cooptation hypotheses, I propose to analyze manufacturing industries in the American economy as structurally equivalent firms whose pattern of transactions with other firms acting as suppliers and consumers has inherent in it some level of structural autonomy reflected as the relative level of profits obtained by firms in the industry. Manufacturing industries in the American economy provide a research site optimally suited to hypothesis testing for three reasons: (1) Perhaps most important, data are readily available on industry profits as a reflection of autonomy. (2) Data are readily available on the

economic transactions defining each manufacturing industry as a network position in the economy. (3) Economic transactions as formal relations are clearly distinct from a variety of informal—and potentially cooptive—relations involving industries in other sectors of the economy.

Industry Profits as a Reflection of Industry Autonomy

Values of V_1 and V_2 can be computed for any system of actors cast as a social topology, and, as illustrated for figure 2, possession of these values together with the original network relations is sufficient to compute the structural autonomy of positions in the system and the constraint on each position from every other. The constraint hypotheses, however, cannot be tested without some criterion variable that can be regressed over V_1 and V_2 . Thus, not all systems are equally suited to hypothesis testing.

There is no clear empirical criterion variable reflecting actor autonomy for all systems. Adopting an innovative idea or mode of dress, for example, would be a reflection of autonomy in some circumstances. The adoption demonstrates freedom from constraint by the traditional ideas or modes of dress endorsed by social norms. Where most actors are a priori favorably disposed toward the innovation, however, adoption could instead reflect constraint by social norms rather than freedom from such norms. In general, autonomy is not a prediction of behavior; it is a prediction of freedom of choice of behavior.¹⁷

It is only when an actor's interests and behaviors are known to an observer that the two can be compared to determine whether observed behaviors are a result of the actor's own interests rather than the interests of others. As a practical research problem, unfortunately, determining all the interests of all actors in a system is a formidable task, certainly a task beyond the capabilities of easily available research methodologies.

Another strategy is to look for a system composed of actors pursuing one nonzero-sum interest. In such a system, each actor's manifest behavior is oriented toward realizing a single interest for himself. Given the actors' common interest, manifest behavior can be analyzed for discrepancy in realizing that interest; discrepancy indicates the extent to which each actor is subject to constraint from other actors in the system. Those actors subject to the least constraint would evidence behaviors most directly realizing for themselves the common interest.

Of the general class of corporate actors, consider business firms engaged

¹⁷ This point is emphasized by Riesman (1961, pp. xv ff.) in his complaint that readers have tended to equate the concept of autonomy with his idea of "inner-directed" man, an equivalence that reduces autonomy to a type of behavior instead of keeping it as an ability to choose behaviors freely.

in manufacturing goods for sale to the highest bidder. These firms can be assumed to have a common motivating interest. Over time, they can be expected to seek maximum profits (in addition, of course, to a range of goals specific to more narrowly defined classes of firms). In seeking profits, a business firm does not commit the whole economy to some course of action (a type of interest the realization of which would require corporate power).¹⁸ The level of profits obtained by a firm within an economy thus provides a clue to the lack of market constraint confronting that firm. Those firms obtaining the highest profits should be the firms with the highest structural autonomy in the market.

Fortunately, data on profits need not be obtained for individual firms or obtained on an absolute scale. Since the hypotheses are concerned with relative levels of autonomy of structurally nonequivalent positions, profits need to be measured so as to capture the relative ability of groups of firms to make profits. Inferential measures of profits are available for whole manufacturing industries as groups of firms producing the same type of good.

As introduced by Collins and Preston (1968, pp. 13–17, 54–57; 1969), the relative level of profit obtained by firms in separate manufacturing industries can be compared in terms of the “price-cost margins” for the industries: $PCM_j = (VA_j - L_j)/VS_j$, where PCM_j is the price-cost margin for industry J computed as the ratio of dollars of sales in excess of direct costs over the total dollars of sales by firms in the industry; VS_j is the total dollars of sales by firms in industry J (value of shipments); L_j is the gross annual earnings of employees on the payroll of firms in industry J ; and VA_j is the value added by industry J as the difference between VS_j and direct costs (including materials, supplies, fuel, electric energy, cost of resales, and contract work done by others). Since the difference between VA and L does not consider the cost to different industries of

¹⁸ Again, the close linkage between power and autonomy should be emphasized. Powerful corporate actors will be able to derive high profits for their investors. There can be corporate actors that are autonomous yet not powerful, however, and these corporate actors will also be able to derive high profits according to hypotheses 1–3. It can be said that a powerful corporate actor would be a firm that controls highly valuable resources and has exchange relations with other corporate actors controlling resources (e.g., labor unions, government agencies, other business firms, etc.). This concept of structural power is elaborated elsewhere (Burt 1977*d*, pp. 25–36). According to the concept of structural autonomy, however, all a corporate actor needs in order to derive high profits is to have low competition with other firms in its industry and extensive transactions with firms in sectors of the economy within which there is high competition. Of course, this is not to say that power in combination with autonomy would not result in increased profits over time. As pointed out by an anonymous reviewer for this *Journal*, autonomy could be a sufficient condition for obtaining profits in the short run, but power is required in order to ensure the continued ability to obtain high profits in the long run. Unfortunately, the issues arising from a consideration of time series on profits and structural autonomy are beyond the scope of this discussion.

purchasing capital for production, price-cost margins have been corrected for interindustry differences in capital requirements (CR) in order to estimate relative industry profit margins as

$$y_{j0} = PCM_j - b(CR_j - \overline{CR}). \quad (4)$$

Relative industry profits as of 1967 have been computed for 335 four-digit Standard Industrial Classification (SIC) categories as well as for the 20 highly aggregated two-digit SIC categories.¹⁹ If y_{j0} is high relative to other industries, firms in industry J are able to obtain profits further in excess of direct costs than would be expected as a result of the industry's capital requirements.

Manufacturing Industries as Jointly Occupied Network Positions

The economy within a system of actors can be discussed as a network of exchange relations among corporate actors and persons. Division of labor ensures considerable redundancy in such a network. Those actors engaged in the production of similar goods will have similar relations from other actors (i.e., will require similar proportions of goods as inputs from suppliers) and to other actors (i.e., will offer similar types of goods as outputs to consumers). Those firms producing similar types of goods would be expected to occupy positions defined by similar patterns of relations with other actors as suppliers and consumers. Such firms are structurally equivalent, as given in the social topology in figure 1. The M jointly occupied positions in figure 1 correspond to "sectors" of the economy in an input-output table representation (cf. Leontief 1966). Such a representation of the network of economic relations among firms in the American economy is readily available at different levels of aggregation from the Department of Commerce such that z_{ji} in figure 1 would be the total dollars of sales by firms in sector J to firms in sector I .

Dollar flow transactions have been taken from the 1967 Input-Output Study of 83 sectors. Manufacturing sectors have been aggregated to corre-

¹⁹ Data used to compute price cost margins are taken from table 8 of the *1967 Census of Manufactures* (U.S. Department of Commerce 1971a). Industry capital requirements (CR_j) are computed as the gross book value of depreciable assets for industry J divided by the value of shipments for the industry (both taken from the *1970 Annual Survey of Manufactures*, chap. 7, table 1 [U.S. Department of Commerce 1973]). For the 335 input-output sectors corresponding to unique four-digit SIC categories, the regression coefficient in eq. (4) was .077. For the 20 two-digit SIC categories, the coefficient was .064. The regression results in table 4 were also computed for raw price-cost margins. While the coefficients were modified somewhat, the same inferences resulted. The results reported here are conservative in supporting the hypotheses since I have completely removed the effect on price-cost margins of interindustry differences in capital requirements.

spond to two-digit SIC categories.²⁰ The resulting table has 51 sectors. The pattern of relations defining the position occupied by firms in the food industry, for example, is given in row and column 14 of the aggregated input-output table. Firms in this industry sell \$3,694 million worth of goods to the "Livestock" sector ($z_{14, 1}$), nothing to the "Other Agriculture" sector ($z_{14, 2}$), and \$24 million worth to the "Forestry/Fishery" sector ($z_{14, 3}$). Firms in the food industry purchase \$19,777 million worth of goods from the "Livestock" sector ($z_{1, 14}$), \$6,882 million worth from the "Other Agriculture" sector ($z_{2, 14}$), and \$423 million worth from the "Forestry/Fishery" sector ($z_{3, 14}$). Each manufacturing industry is defined, therefore, by a pattern of relations consisting of 51 relations as sales to consumers and 51 relations as purchases from suppliers.

Following the lead of economic research on oligopoly within manufacturing industries (Weiss 1963; Collins and Preston 1968, 1969; Lustgarten 1975), the level of oligopoly within a manufacturing industry has been measured in terms of four-firm concentration ratios: the ratio of the combined sales of the four largest firms in the industry over the combined sales of all firms in the industry. To the extent that there are only four competitors, the four-firm concentration ratio will equal one. Concentration ratios for four-digit SIC categories are given in the *1967 Census of Manufactures* (U.S. Department of Commerce 1971a). Average concentration ratios based on the four-digit data have been computed for the two-digit categories.²¹ These concentration ratios provide a measure of Y_1 that varies between zero and one.

Given the relations defining each industry as a network position and concentration ratios as a measure of Y_1 , values of the group-affiliation index (Y_2) and constraint coefficients (\mathbf{a}_{ji}) have been computed.²² Computing the variance in the 51 \mathbf{a}_{ji} for industry J , I have used a t -statistic for placing a confidence interval around the mean in order to place an interval around zero. While not statistically accurate since the mean \mathbf{a}_{ji} is not zero for each

²⁰ The original 83 industries are given in the 1967 Input-Output Study (U.S. Department of Commerce 1974). The SIC category 23, "Apparel," includes some portions of SIC category 22, "Textiles." In the Input-Output Study, four-digit industries 2251, 2252, 2253, 2254, 2256, and 2259 are classified as apparel rather than as textile sectors. I have therefore corrected the price-cost margins and concentration ratios to take into account the changes in these two industries.

²¹ These concentration ratios have been computed as the weighted sum of four-digit concentration ratios subsumed by each two-digit industry: $y_{j1} = \sum_k \mathbf{a}(VS_k y_{k1}) / VS_j$, where k is a four-digit SIC category within two-digit category j . The value of shipments and concentration for four-digit industries are taken from the *1967 Census of Manufactures*, table 8 (U.S. Department of Commerce 1971a) of the special report series. Concentration ratios for nonmanufacturing sectors are approximations based on a variety of census data as presented for the 484 sector input-output table in Burt (1977a, table C.1).

²² The unstandardized estimates of β_o , β_g , and β_x for the two-digit level of aggregation in table 4 have been used to compute the \mathbf{a}_{ji} .

industry, the following classification of the \mathbf{a}_{ji} into three categories is adequate for the purposes here:

$$\mathbf{a}_{ji} = \begin{cases} \text{significantly positive if } \mathbf{a}_{ji} - CI > 0 \\ \text{negligible if } \mathbf{a}_{ji} + CI \geq 0 \text{ or } \mathbf{a}_{ji} - CI \leq 0 \\ \text{significantly negative if } \mathbf{a}_{ji} + CI < 0 \end{cases} \quad (5)$$

where CI is the .95 confidence interval around the mean ($CI = .28s_j$, where s_j is the standard deviation of the 51 \mathbf{a}_{ji} in industry J). This is a fairly conservative criterion for locating constraints. If the same rule is applied to the hypothetical data in table 3, the only significantly negative constraints in the system are those on status S_2 (\mathbf{a}_{21} and \mathbf{a}_{23}). This rule yields 20 positive contributions to autonomy (all intra-industry),²³ 106 constraints on autonomy (of which 70 are between manufacturing industries), and 894 negligible contributions (of which 330 are between manufacturing industries.²⁴

Cooptive Relations Involving Firms in Manufacturing Industries

Relations in the input-output table constitute “formal” relations in the sense that a firm choosing to manufacture a type of good must adopt the pattern of relations with other sectors as suppliers and consumers that characterizes the good. A firm in the food industry, for example, can expect to purchase the bulk of its supplies from firms in the “Livestock” and “Other Agriculture” sectors as well as from other firms in the food industry itself.

A second network of relations among firms is superimposed upon this

²³ Since y_{j1} and β_o will always be positive, the \mathbf{a}_{jj} will always be nonnegative. For J not equal to I , however, the only condition under which the \mathbf{a}_{ji} in eq. (5) will be positive when computed from (1) is when the term $(y_{j1} - \bar{y}_1)[y_{j2}/(M + 1)]\beta_o$ is greater in absolute value than $x_{ji}(\beta_p - \beta_x)$. Thus, when industry J is highly concentrated and/or highly constrained by other sectors, other industries can make a positive contribution to the autonomy of firms in the industry. For example, firms in the “transportation equipment” industry have the most frequently positive \mathbf{a}_{ji} . This industry is highly concentrated ($y_{j1} - \bar{y}_1 = .350$) and has an about-average level of constraint from other sectors ($y_{j2} - \bar{y}_2 = -.008$). Since positive \mathbf{a}_{ji} occur as a result of the interaction term in eq. (1), the more components into which Y_2 is disaggregated, and accordingly the more interaction terms in eq. (1), the more likely are positive \mathbf{a}_{ji} . A disaggregation of eq. (1) is required for an analysis of the four-digit industries and is given elsewhere (Burt 1979a, 1979c). Since the absolute value of \mathbf{a}_{ji} is noticeably affected by the specification of structural autonomy, the most important feature of constraints on a specific industry are the relative values of \mathbf{a}_{ji} for the industry. Cooptive relations are expected with those sectors I for which \mathbf{a}_{ji} is significantly more negative than the other \mathbf{a}_{ji} in industry J . For this reason, eq. (5) identifies significant constraints for each industry separately rather than for all industries simultaneously.

²⁴ The specific sectors constraining each of the 20 two-digit manufacturing industries, the estimated \mathbf{a}_{ji} , price-cost margins, concentration ratios, group-affiliation indices, and the aggregated (51, 51) input-output table are given in Burt, Christman, and Bittner (1979).

network of formal economic relations. Firms have the option of creating and destroying informal social relations with one another. Perhaps the best known of these relations is the interlocking directorate: two firms are interlocked to the extent that the same individuals sit on their respective boards of directors (e.g., Allen 1974). For this analysis, I have operationalized informal, potentially cooptive relations between firms in terms of diversification through mergers. When constrained by firms in sector I , a firm in industry J can coopt that constraint by purchasing a representative firm in sector I . In one sense, purchasing a firm constraining an industry is a very formal method for strengthening oligopoly. However, it is important to distinguish the relative formality of an industry's economic transactions as the z_{ji} from its potentially cooptive merger relations as the w_{ji} . To what extent is a relation at the discretion of the actor initiating it? Under current technology, a firm in the food industry must purchase the bulk of its supplies from the "Livestock," "Other Agriculture," and "Food" sectors. There is no discretion here. General Foods can select between alternative suppliers, but in order to output food product it must purchase inputs from these three sectors. In contrast, there are no sectors into which a firm in the food industry must diversify. To be sure, when a firm in one industry purchases a firm in another, the resulting interindustry connection is less fragile than a friendship tie between two erstwhile colleagues. Nevertheless, the interindustry connection has been created at the discretion of the two parties to the merger; it is perhaps related to, but definitely not a technical requirement of, each firm's production of output. As such, the merger is an informal relation in comparison with economic transactions that are formal relations.

Given the frequency with which firms in industry J have purchased firms in sector I , f_{ji} , a significant merger relation from the industry to the sector is coded if the number of mergers is not less than a standard error below the mean tendency for firms in the industry to merge with other firms in manufacturing:

$$w_{ji} = \begin{cases} \text{negligible if } f_{ji} \leq (\bar{f}_j - .22s_j) \\ \text{significant otherwise} \end{cases} \quad (6)$$

where \bar{f}_j is the mean frequency with which firms in industry J merge with firms in other manufacturing industries and s_j is the standard deviation of the 21 f_{ji} for industry J . Two types of merger data have been used to locate significant merger relations according to equation (6): (1) data from the Federal Trade Commission (1970) on mergers between 1948 and 1969 of corporations with assets over \$10 million²⁵ (I refer to these w_{ji} as cor-

²⁵ These data were kindly provided by J. Pfeffer. For manufacturing industries, Pfeffer (1972) correlates the number of mergers in industry J that were with industry I ($f_{j,i}$ in eq. [6]) and the percentage of total merger assets acquired in I by J with various

porate mergers), and (2) data from the U.S. Department of Commerce (1971*b*) on the purchase of establishments with 250 or more employees between 1963 and 1967²⁶ (I refer to these w_{ji} as establishment mergers).

The operationalization of potentially coercive interindustry relations here is clearly less than perfect. Merger relations are reduced to a dichotomy: present versus absent. I have not selected this operationalization because network data are often based on binary sociometric citations. I could find no guidance from the available literature on how cooptation might vary by the number of mergers between two sectors. Does the occurrence of three mergers between two sectors reflect three times as intense a coercive effort as the occurrence of one merger between the sectors? This seems to be a naive interpretation, but I could find no systematic research on alternatives. Equation (6) has been adopted for two reasons. First, it corresponds to the operationalization of constraint. In the same manner that constraints are assessed separately for each industry, equation (6) locates as “significant” a merger relation where firms in industry J have at least a no less than average tendency to merge with firms in industry I . Second, a large number of mergers are considered. The corporate merger relations are aggregated from a total of 854 transactions, and the establishment merger relations are aggregated from a total of 1,098 transactions. Since most of the interindustry merger relations are null, a large number of observed mergers are being used to locate a small number of significant merger relations. Therefore, it seems reasonable here to use statistical inference to identify significant merger relations. This would not be the case where a small number of interorganizational relations were used to estimate a large number of interindustry relations (e.g., Burt, Christman, and Kilburn 1979).

measures of the extent to which firms in industry J have transactions with those in industry I . Since Pfeffer finds nearly identical results using the two measures of merger relations, I have used the simple count data in eq. (6).

²⁶ Purchases by firms in the manufacturing industries of firms in nonmanufacturing are not given for these data (U.S. Department of Commerce 1971*b*, table 3). Mergers are traced by identification numbers assigned to each establishment in the 1963 census. Mergers are recorded when an establishment changes owners between the 1963 and the 1967 census. Of the 496 nonzero entries relevant to this analysis from the report, only 51 referred to mergers of more than one firm across sectors. Of these, 44 were intra-industry mergers, and all 51 fall within a significant merger relation, w_{ji} . The problem with these multiple mergers is that there is no method for determining exactly how many mergers occurred. As a simple assumption, multiple mergers were coded as two mergers. Most certainly, some of these multiple mergers involved more than two establishments changing hands since the total sales for the transferred establishments varied considerably across multiple mergers. Fortunately, all of the multiple mergers occurred in what were identified as significant merger relations. For the dichotomous level of measurement used here, the exact number of mergers represented by a multiple merger is unimportant.

ANALYSIS

Presented in table 4 are least-squares estimates of the coefficients in equation (1) at both the 20- and 335-industry levels of aggregation. The effects are weaker for the 20-industry level than they are for the 335-industry level; however, all coefficients are in the expected directions, and the results for the 335-industry level strongly support hypotheses 1, 2, and 3. As expected under hypothesis 1, oligopoly has a positive effect on profits. The unstandardized value of β_o is .1, which is identical with the estimated regression of price-cost margins over concentration found by economists for earlier time periods (e.g., Collins and Preston 1969; Lustgarten 1975).²⁷ At both levels of aggregation, the strongest effect on profits is from the group-affiliation index. High values of Y_2 are associated with low profits, as expected under hypothesis 2 (the unstandardized estimate of β_g is $-.224$ for the 335 industries and $-.582$ for the 20 industries). Hypothesis 3 receives the weakest—albeit statistically significant—support. At the 335-industry level of aggregation, concentration and group-affiliation are nearly independent ($r = .073$). Even so, there is a significant interaction effect from the two variables at less than the .05 level of confidence (unstandardized β_x is .792). At the 20-industry level, in contrast, concentration and group-affiliation are highly correlated ($r = -.333$), and their interaction effect on profits is negligible.

Figure 3 presents data on the patterning of potentially coercive merger relations by structural market constraints. For the 420 relations among

TABLE 4
CORRELATION AND REGRESSION COEFFICIENTS FOR EQUATION (1)

	VARIABLES					β 's	
	Y_0	Y_1	Y_2	X	s_e		($R = .40$)
Y_0.....		.243***	-.291***	.130**	.081		
Y_1.....	.324*		.073	-.088	.217	β_o	.272 (5.38)***
Y_2	-.390**	-.333		-.288	.105	β_g	-.291 (5.62)***
X.....	.029	.203	.496		.027	β_x	.264 (1.70)**
s_e.....	.066	.156	.053	.009			
β 's ($R = .47$)		β_o .369 (.46)	β_g -.467 (1.59)*	β_x .230 (.83)			

NOTE.—Coefficients above the diagonal are based on the 335 industries corresponding to unique four-digit SIC categories and those below the diagonal are based on the 20 two-digit industries. Variables are defined in the text; Y_0 is the industry price-cost margin corrected for capital requirements; Y_1 is an industry concentration ratio; Y_2 is the industry group-affiliation index; X is the interaction term in eq. (1); and t -tests are given in parentheses.

- * Significant at less than the .10 level of confidence.
- ** Significant at less than the .05 level of confidence.
- *** Significant at less than the .001 level of confidence

²⁷ A more detailed discussion of the findings in table 1 connecting the analysis by economists with a network approach to industry profits is given elsewhere (Burt 1979a).

Autonomy in a Social Topology

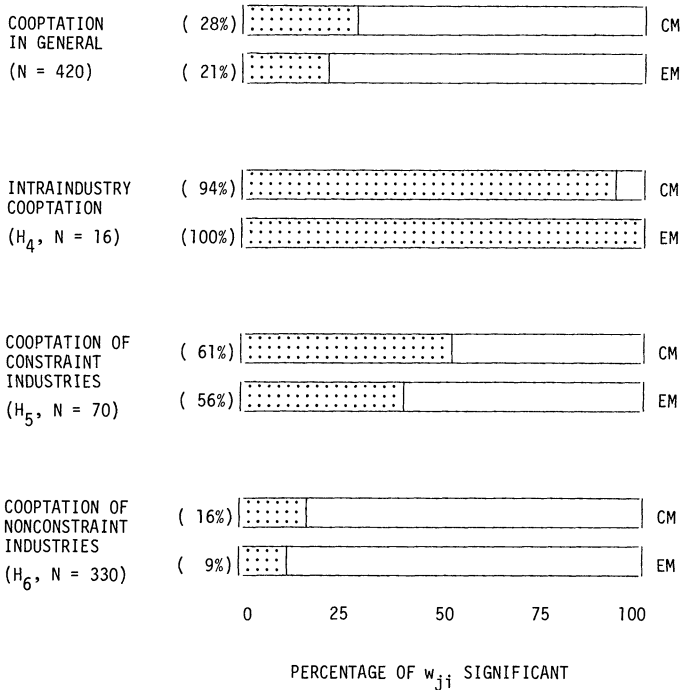


FIG. 3.—Cooptive relations are patterned by market constraints (*CM* refers to corporate mergers, *EM* refers to establishment mergers). For example, the 100% for hypothesis 4 means that all of the 16 w_{ji} under the hypothesis were significant establishment merger relations.

manufacturing industries, the top of figure 3 shows that there are 116 significant corporate merger relations (28%) and 90 significant establishment merger relations (21%). If the merger relations are randomly distributed across sectors under each hypothesis, approximately 25% of the merger relations falling under each hypothesis should be significant. Statistical inference can be used to assess the extent to which mergers occur under each hypothesis more or less than would be expected by random chance since the merger relations have been computed from data on a large number of interorganizational transactions. The frequency with which merger relations are significant under hypothesis K , call this frequency f_k , can be expressed in terms of four parameters (cf. Goodman 1970, p. 228; 1972, p. 1042): $f_k = \gamma \gamma^c \gamma_k^h \gamma_k^{ch}$, where γ is a constant similar to the overall mean in an analysis of variance; γ^c and γ_k^h describe the marginal tendencies, respectively, for mergers to be significant and for relations to fall under hypothesis K ; and γ_k^{ch} describes the tendency for mergers to be significant under hypothesis K . The interaction terms (the γ_k^{ch}) are the central concern here. A parameter is greater than one when

it describes a condition that occurs more often than would be expected on the average. Table 5 presents estimates of the above parameters based on the data in figure 3.²⁸

Hypothesis 4 says that firms in an industry will establish cooptive relations with one another as long as they are not too constrained by firms in other sectors. This hypothesis receives strong support. As given in figure 3, firms in each of the 16 industries have significant merger relations with other firms in the industry.²⁹ The higher than average occurrence of intra-industry merger relations is reflected in the greater than one estimates of γ_1^{ch} in table 5 (for corporate and establishment mergers, re-

TABLE 5
PREDICTING COOPTIVE RELATIONS IN FIGURE 3

PARAMETERS	COOPTIVE RELATIONS	
	Corporate Mergers	Establishment Mergers
Marginal terms:		
γ	27.36	21.43
γ^c	1.22	.25
γ_1^h.....	.18	.13
γ_2^h	1.26	1.65
γ_3^h	4.49	4.53
Interaction terms:		
γ_1^{ch}	2.65 (3.37)*	4.50 (3.12)*
γ_2^{ch}	1.04 (.21)	.88 (.52)
γ_3^{ch}.....	.37 (6.45)*	.25 (5.48)*
$\chi^2(\gamma_1^{ch} = \gamma_2^{ch} = \gamma_3^{ch} = 1) \dots$	88.45*	119.27*

NOTE —Unit normal tests of significance for the interaction terms are in parentheses and the χ^2 statistic has two degrees of freedom.
* Significant at less than the .001 level of confidence.

²⁸ Frequencies for each type of merger relation can be computed directly from fig. 3. Let n_k refer to the number of relations falling under each hypothesis ($n_1 = 16$, $n_2 = 70$, and $n_3 = 330$). The f_k can then be computed from the percentages in fig. 3. For example, 61% of the relations falling under hypothesis 2 are significant corporate mergers, so f_2 for corporate mergers is .61(70), or 43. The relations under hypothesis 2 that are not significant, then, are $n_2 - f_2$, or 27. As described by Goodman (1972, p. 1046), the effects in table 6 are computed as geometric means:

$$\gamma = [\Pi_k^3(n_k - f_k)f_k]^{1/6}, \quad \gamma^c = \{[\Pi_k^3(n_k - f_k)f_k]^{1/3}\} / \gamma,$$

$$\gamma_k^{ch} = f_k / (\gamma \gamma^c \gamma_k^h), \quad \text{and} \quad \gamma_k^h = \{[f_k(n_k - f_k)]^{1/2}\} / \gamma.$$

²⁹ Although not present in the analysis, firms in all four industries severely constrained by other sectors, i.e., industries for which the partial derivative $\partial \mathbf{a}_j / \partial y_{j1}$ is negative, also have significant intra-industry establishment, as well as corporate merger, relations. These industries are the "Textiles," "Apparel," "Rubber," and "Fabricated Metals" industries.

spectively, $\hat{\gamma}_1^{ch}$ is 2.65 and 4.50). The tendency for intra-industry mergers to occur is significant at well beyond the .001 level of confidence.

Hypothesis 5 says that firms in a sector having a negative effect on the structural autonomy of firms in an industry will be the object of cooptive relations, as long as firms in the industry are not too disorganized. All the industries are organized sufficiently well to engage in cooptive relations since the partial derivative $\partial a_j / \partial x_j$ is negative for all industries. Figure 3 shows that the firms in industry J have an increased tendency to merge with firms in industry I when I constrains the structural autonomy of J . On the average, the odds are one out of four that firms in an industry will have a significant merger relation with other firms in an industry. If firms in industry J suffer a constraint to their structural autonomy from firms in industry I , however, the odds of a significant merger relation from J to I more than double (from .28 to .61 for corporate mergers and from .21 to .56 for establishment mergers). Table 5 shows, however, that this increased tendency for merger is not statistically significant even at the .10 level of confidence.³⁰ In accordance with hypothesis 5, the odds of firms merging into those other industries constraining their structural autonomy are double the odds of their merging on average, but this increase is not statistically significant.³¹

Hypotheses 6 and 7 say that firms in a sector which does not constrain the structural autonomy of firms in an industry will be ignored in the industry's cooptive strategies. There are no significant positive contributions to the structural autonomy of industries aside from intra-industry

³⁰ Is it the case, then, that firms are capitalizing on their ability to constrain other industries in order to purchase, at below market price, firms in those industries constrained? Instead of firms in industry J merging into industry I when I constrains J , perhaps the reverse is happening. Since the merger relations are asymmetric, this possibility was assessed by transposing the matrix of merger relations, so that w_{ji} became w_{ij} , and recomputing the parameters in table 5. This transposition greatly lowers the interaction between constraint (the a_{ji}) and cooptation (the w_{ji}). The χ^2 statistic drops to about two-thirds its value in table 5: from 88 to 65 for corporate mergers and from 119 to 73 for establishment mergers. The pattern of effects for the three hypotheses, however, is consistent with table 5. As would be expected, since the w_{ji} are not affected by transposing W , the intra-industry mergers are still high and significant. Mergers into constraint industries are still insignificant, and the absence of mergers into nonconstraint industries is still significant, although less so than is the case in table 5. For corporate and establishment mergers, respectively, the unit-normal test statistics for γ_s^{ch} drop from 6.5 to 5.6 and from 5.5 to 4.6. In short, the merger data demonstrate a slight, but hardly overwhelming, asymmetry corroborating the cooptation hypotheses as stated in the text.

³¹ Subsequent research on the cooptive uses of corporate boards of directors has extended the domain of potential cooptees to include nonmanufacturing sectors (Burt, Christman, and Kilburn 1979). The results are encouraging. Ownership ties, direct interlock ties, indirect interlock ties through financial institutions, and multiplex cooptive ties between corporations all have a statistically significant tendency to occur in the presence of market constraint, as predicted by hypothesis 5.

collusion (see n. 23). There is a very strong tendency, however, for firms not to merge with firms in industries having no effect on their structural autonomy. If firms in industry J suffer negligible constraint from firms in industry I , the odds are nine to one that there will be no significant merger relation from J to I (.84 for corporate mergers and .91 for establishment mergers). This tendency for mergers not to occur is reflected in the relevant parameter estimates being less than one in table 5 at well beyond the .001 level of confidence (for corporate and establishment mergers, respectively, $\hat{\gamma}_3^{ch}$ is .37 and .25).

In computing the structural autonomy of firms in separate industries based on the economic, or formal, relations defining each industry as a network position, no consideration was given to the merger relations as potentially cooptive "informal" relations. Since most market constraint confronting the manufacturing industries comes from firms in other manufacturing industries, the interindustry merger relations could be eliminating the bulk of market constraints in manufacturing. Hypothesis 8 says that the errors made in predicting profits in table 4 have a specific meaning. Industries with coopted constraints should have higher profits than expected from the regression results in table 4. Assuming that the presence of a significant merger relation from industry J to industry I is sufficient to eliminate any structural constraint by I on J , values of the differential in equation (3) have been computed for each two-digit manufacturing industry.³² When the differential $d(\mathbf{a}_j)$ is high, it means that firms in industry J have coopted a high level of the structural constraint they confront. The values of $d(\mathbf{a}_j)$, multiplied by 1,000 are presented in figure 4, where industry J is located in the graph according to its observed profit margin (y_{j0}) versus the profit margin it is predicted to have (\hat{y}_{j0}) as a result of the industry's structural autonomy defined by its pattern of economic transactions with suppliers and consumers.

The results on hypothesis 8 are not encouraging. The mean expected increase in structural autonomy for the industries as a consequence of their merger activities is .099, with a standard error of .024. In contrast to hypothesis 8, the correlation between expected increase ($d[\mathbf{a}_j]$) and the difference between observed and predicted profit margin ($y_{j0} - \hat{y}_{j0}$) is negligible ($r = -.01$). Note in figure 4 that the chemical industry has a much higher profit margin than would be expected from the industry's structural autonomy based on economic transactions. At the bottom of the graph, the petroleum industry has a much lower profit margin than would be expected. Yet the two industries have similarly low expected increases in autonomy as a result of their merger activities ($d[\mathbf{a}_j]$ is .050 and .021,

³² A significantly negative \mathbf{a}_{jt} is considered eliminated whenever w_{jt} is either a significant corporate or establishment merger. In 91% of the cases where w_{jt} is a significant merger, it represents both a significant corporate as well as establishment merger.

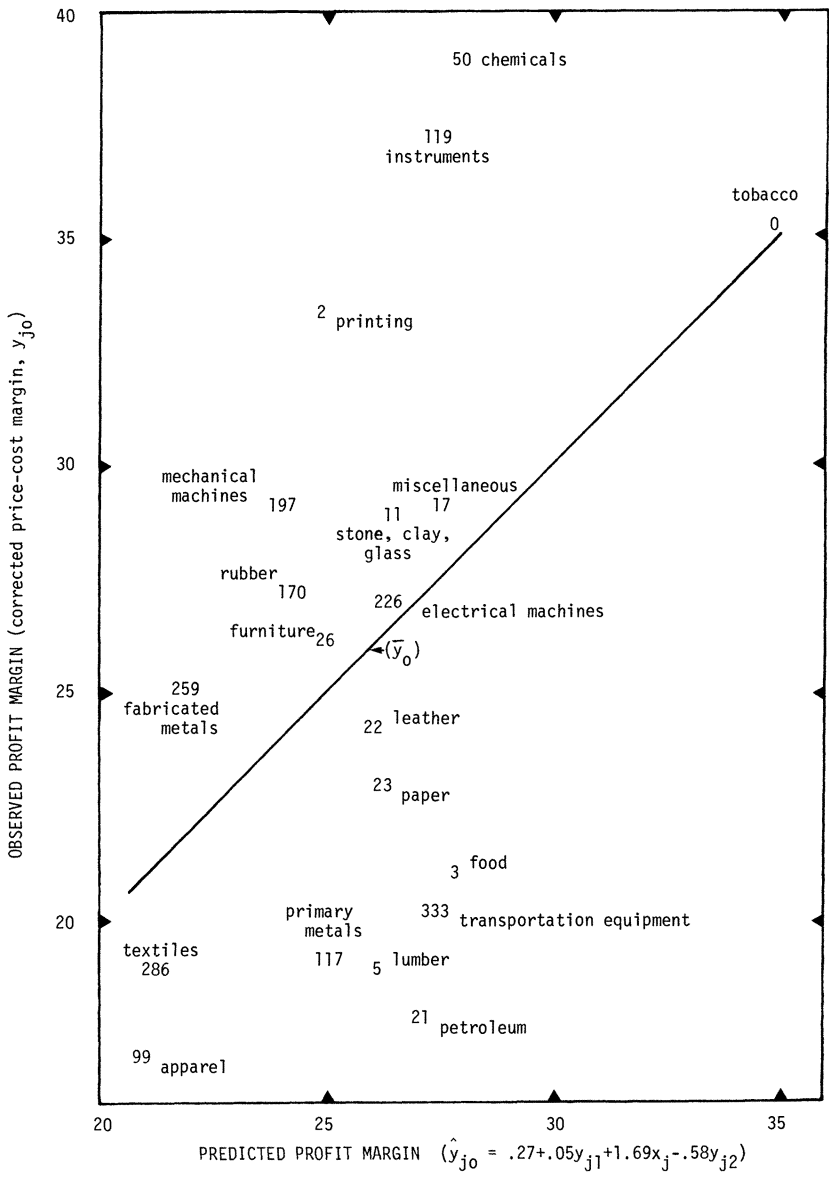


FIG. 4.—Observed versus predicted profit margin, with success of cooptive mergers as $d(\mathbf{a}_j)$.

respectively). Across all manufacturing industries, firms in the transportation equipment industry have eliminated the greatest level of constraint on their structural autonomy ($d[\mathbf{a}_i]$ is .333). Instead of the profit margin in this industry being grossly underestimated by the industry's structural autonomy based on its economic transactions, the observed profit margin is nearly the most overestimated of all.

The lack of support for hypothesis 8 is, to some extent, a result of support for the other hypotheses. While significant merger relations do not occur whenever there is a significant market constraint (as evidenced by the statistically negligible support of hypothesis 5), virtually all the largest market constraints confronting each industry are covered by a significant merger relation.³³ This observation is strengthened and extended to non-manufacturing sectors when other types of cooptive ties are considered (Burt, Christman, and Kilburn 1979). There is little variation across industries in terms of cooptive success, as success is measured here. Those industries subject to massive structural constraint from other sectors do indeed make lower profits, as expected under hypothesis 2; however, firms in each industry have cooptive ties with firms in those sectors most severely constraining their structural autonomy, as expected under hypothesis 5. Thus, and in opposition to hypothesis 8, successfully coopting market constraints appears to be an attribute of all industries rather than a variable distinguishing industries in terms of their ability to obtain profits in excess of the profits to be expected from their relative levels of structural autonomy.

CONCLUSION

In an effort to capture the manner in which the pattern of relations defining a network position "frees" occupants of the position from constraint by others, a concept of structural autonomy has been proposed. The concept is based on two well-known ideas: oligopoly in economics and group-affiliation in sociology. While the many nuances of these two ideas are by no means captured in the proposed concept, the central features of oligopoly and group-affiliation are captured for the context of a system stratified across structurally nonequivalent statuses/role-sets. Beginning with the

³³ A measure of the extent to which firms in an industry have failed to coopt market constraints imposed on the industry by other manufacturing industries can be generated by computing the differential in eq. (3), where x_{jt} refers to uncoopted constraints. This computed differential, an expected increase in structural autonomy that would result from more successful cooptive efforts than were observed in the merger data, is close to zero for most of the industries. It has a mean across industries of .042 with a .086 standard deviation. Three industries have one \mathbf{a}_{jt} each that is high, relative to the other \mathbf{a}_{jt} in the industry, and is not coopted by a significant merger relation: textiles, apparel, and printing.

simple statement of structural autonomy in equation (1), eight hypotheses have been derived that provide a constellation of expectations concerning the location of cooptive relations in a system of actors and the relative freedom of actors in each system status from constraint by others in the system.

The most promising application of the concept, I believe, is in systems where there is a clear separation of formal from informal, potentially cooperative relations. In such systems, the hypotheses make the least ambiguous predictions. In a corporate bureaucracy, structural autonomy predicts the relative discretion allowed to executives occupying positions in the corporation and predicts informal friendships to develop where constraint on each position is high. Between corporate bureaucracies, as in the substantive application here, structural autonomy predicts the relative freedom of corporations in sectors of the economy to set prices independent of other sectors and predicts diversification, joint ventures, interlocking directorates, etc., to develop where constraint on each sector is high. Beyond describing observed groups of interconnected corporations, the proposed concept of structural autonomy predicts how groups should be interconnected and why, in terms of the constraints corporations place on one another as a result of their network of transactions.

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