Evaluating Small Firm Performance in Local Context: A Case Study of Manufacturers in Columbus, Ohio*

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ABSTRACT. This research approaches corporate restructuring from a place-based perspective, departing from firm or industry-specific analysis and focusing instead on the performance and problems of a local economy. The study systematizes data from a survey of small manufacturing firms in Columbus, Ohio, offering a methodology that can be used for comparative analyses of sectors within or among communities.

We link the performance of firms and local context using a sampling strategy that represents local industry mix. We recognize the multidimensional character of performance and employ several indicators, stated in both static and dynamic terms. We use these indicators to identify patterns of firm performance, relative to both national and local standards. Discriminant analyses reveal variables that account for differences among groups of firms, identified by level of performance, industry, and mode of labor-management relations.

Results indicate that small manufacturers in Columbus are relatively uncompetitive. The few high performing firms are investing more in labor than in capital, but most firms are investing more in capital than labor. These findings are consistent with American corporate tradition that deemphasizes workers. Effective restructuring entails more than technical change, which enables competitiveness but does not itself engender it.

Introduction

Birch's landmark study (1979, see also 1987) indicated that small firms had become the most significant employer of Americans and, indeed, the engine of U.S. economic growth. This finding, at the end of the 1970s, was especially provocative in the context of research foci on large, multilocational and transnational corporate enterprises, which underpinned American economic hegemony in the global economy after World War II (e.g., Hakanson, 1979). Questions about the shifting significance of large and small firms prompted a wide variety of research in business, economics, and economic geography, and included questions about problems or conditions specific to firm size, the corporate locus of innovation, and analytical problems of research related to data accuracy (e.g., Acs and Audretsch, 1990; Armington and Odle, 1982; Gertler, 1984; Hansen, 1992; Piore and Sabel, 1984; Storey and Johnson, 1987). Skeptics argue that large corporations remain preeminent and the role of small firms in the economy has been seriously overestimated (Harrison, 1994).

We concur that large firms remain important in the national and global economy and, moreover, that large firms are significant as markets for small suppliers in locales dominated by small firms. However, we contend that the persistence and importance of large firms do not in any way negate small firms' significance to local economic development. As local employment increasingly occurs as a function of the small firm sector, these firms are vital to the health of the local economy, irrespective of market linkages. Thus, analysis of small firms and the determinants of high-level performance logically have remained strong research foci (Acs and Audretsch, 1990; Best, 1990; Sengenberger et al., 1990; Storey et al., 1987).

Less studied, however, are the local economic development implications of small firms. When

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small firms are studied within a local economy, the general presumption is that conclusions about the firms reflect general conditions of the local economy. However, such inferences often are tenuous because firms typically are sampled from a particular industry (or possibly a few), in keeping with research questions that address the dynamics of small firms in the industry; the *representativeness* of those firms/industries with respect to the local economy is rarely addressed. Moreover, in the case that representativeness (of a local economy) is assumed, inexplicit reasoning begs the question as to what is being represented. For example, if the majority of small firms in a local economy are classified as low or medium-technology firms and the research focuses on high-tech production, conclusions are unlikely to characterize the local environment. Furthermore, samples of firms frequently are drawn in regard to questions about strategy, and thus questions pertain to types of technology, external alliances, innovativeness, and so forth; whether the sample represents firms that employ the bulk of a locale's work force often remains unaddressed.

The relative success in recent years of manufacturing sectors in western Europe (notably Germany) and East Asia (notably Japan and the "four tigers") and corresponding relative decline in American productivity and employment clearly suggest that local manufacturing economies warrant attention (Dertouzos et al., 1989; Howes and Markusen, 1993). Fundamentally at issue is the *performance* of firms and local economies. Are firms restructuring? If so, are firms changing at the expense of the local work force? *How* is change unfolding? What are the prospects of industries that have experienced decline? Will they rejuvenate or are they likely to experience further decline? What, then, are the implications for local economic performance and, concomitantly, work forces in different local economies? Finally, the overarching question at this point is how to best *evaluate* the performance of small firms and local economies so that we can assess variation in the status of firms, industries, and work forces in different local economies.

This study connects small firm analysis to local context. The intent is to identify and explain patterns of performance, specifically among small manufacturers in one local economy, metropolitan

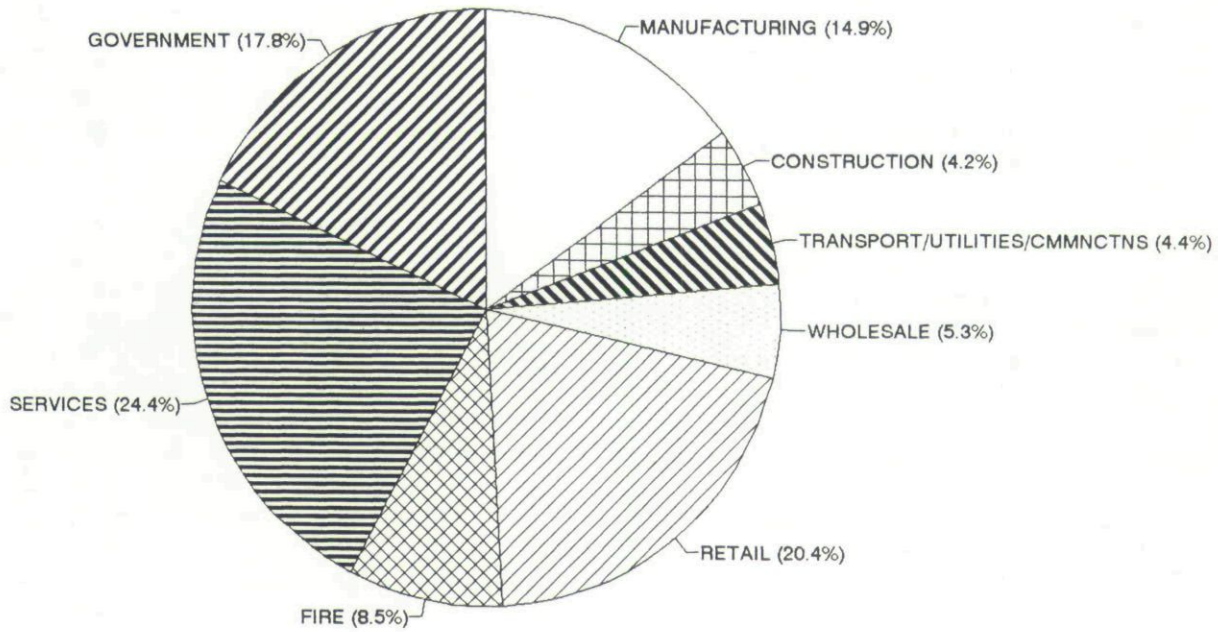

Fig. 1. Percent share of total employment (Columbus, 1989).

Columbus (Franklin County, Ohio). Specific questions include: are small manufacturing firms relatively homogenous or differentiated regarding performance? How can we best capture "performance"? What types of variables best explain different levels of performance? From a labor market perspective, do firms performing at different levels offer more positive or negative conditions for workers? What do the findings of firm performance and organization suggest regarding the relative status of the local economy, and what are the implications for constructive policy?

Towards answering these questions, we avoided an open-ended interview approach that typically involves highly subjective interpretations. Our fundamental purpose in this study is to develop a methodology that permits replicable procedures for comparative analysis. We also were interested in developing an approach that goes beyond reporting CEOs' responses to particular questions. Our intent is to systematize data to allow for the identification and interpretation of local economic performance. We employ measures for firm performance that enables assessment both of intra-community differences and the overall performance of a local manufacturing sector. This latter and more general assessment may be especially useful for comparative, inter-community analysis. Thus, although our case study is situated in a particular local economy, the research questions and design are intended to be applicable elsewhere, as well as to other sectors of the economy, such as services. We link our concern with firm performance to *local context* by using a sampling strategy that represents a local industrial mix. This strategy permits responsible discussion of a local manufacturing economy and scrutiny of connections (between firms and local context) that typically are assumed without clear empirical support. From this perspective, empirical findings are context-specific and should vary across localities, or at least across *types* of local economies.

The study area

Despite its location in the Rustbelt, metropolitan Columbus (Franklin County) differs substantially from branch plant towns such as Youngstown, or from higher order manufacturing centers such as Cleveland. As shown in Figure 1, Columbus is an economically diversified city, with a substantial service sector, including a large FIRE (finance, insurance, real estate) component. Furthermore, as the state capitol and home to the largest public institution of higher education in the state – the student body at Ohio State totals upwards of 60,000 – Columbus has a strong public sector, providing employment as well as local demand for goods and services.

In many respects, Columbus is a quintessential "post-industrial" city. From the perspective developed and popularized by Noyelle and Stanback (1983), those cities that are diversified and develop quaternary sector activities (producer or corporate services) will grow, while those that are specialized, especially outside the quaternary sector, are most likely to decline. Consistent with the Noyelle and Stanback thesis, Columbus weathered quite well the recessions of the 1970s as well as those of the 1980s. Although during the 1970s (1973–1979) Columbus' employment growth (13.1%) fell behind that of the nation (17%), Columbus had the highest growth rate in the state; excluding Columbus, Ohio's growth rate during this period was 8.5% (City of Columbus Development Department, 1990, Table E-3, p. 58). During the 1980s (1979–1989), Columbus' employment growth accelerated (25.7%), surpassing the employment growth for the nation (19.5%), and diverging substantially from the rest of the state (4.8%, excluding Columbus) (City of Columbus Development Department, 1990, Table E-3, p. 58).

Figure 2 shows that the overall health of the Columbus economy owes itself mostly to the relative vitality of the wholesale, retail, FIRE, and services sectors. In contrast, the manufacturing sector overall struggled during the 1970s and during the 1980s. Indeed, percentage change in employment in Columbus during the 1970s and 1980s was negative only with respect to the durable goods sector; although the non-durable goods sector grew, its rate of growth was negligible in comparison to the rest of the economy. Note that although the rate of public sector employment growth slowed during the 1970s and 1980s, this sector nevertheless has provided considerable employment in absolute terms (around 18% of total employment in 1989) (City of

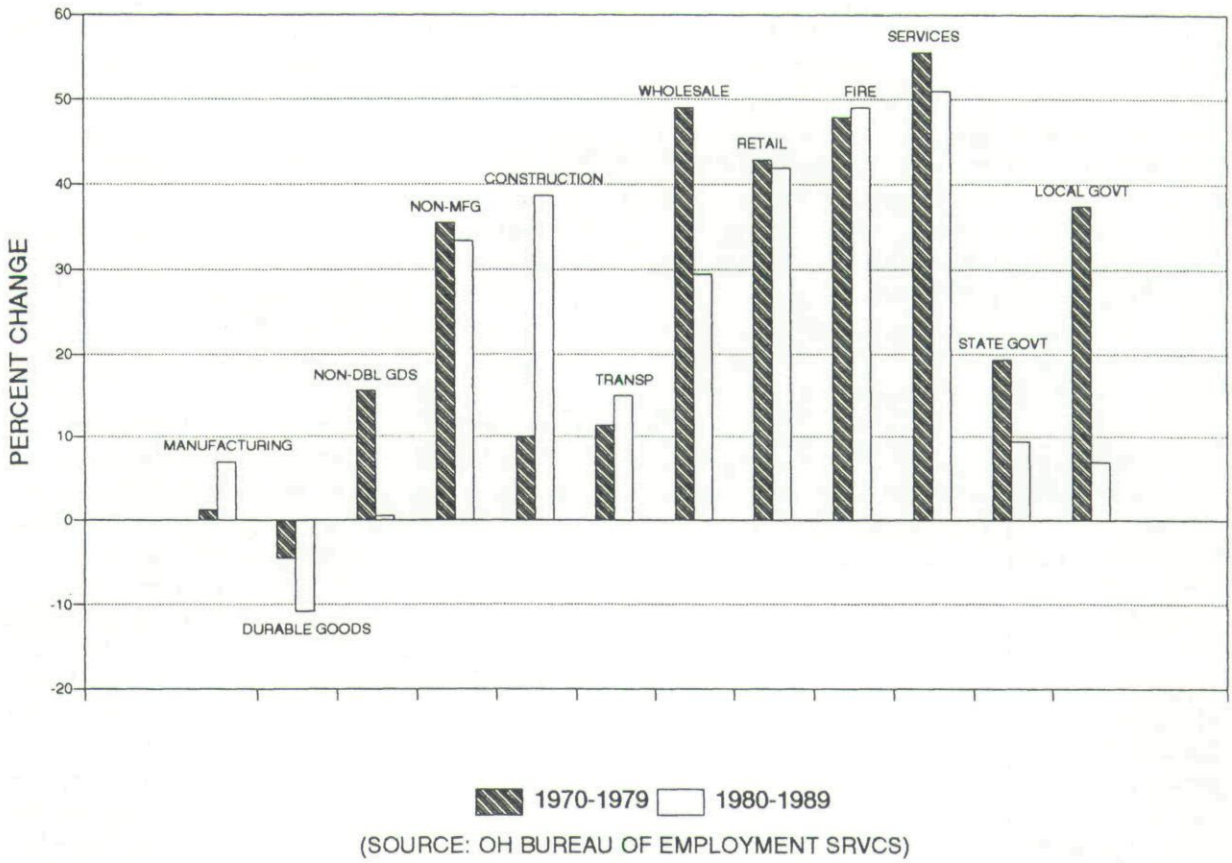

Fig. 2. Changes in employment by sector (Columbus, 1970–1979 and 1980–1989).

Columbus Development Department, 1990, Table E-1, p. 57).

Our focus on manufacturing involves an exploration of activities that have not experienced the employment growth characteristic of other sectors. In this regard, Columbus is to some extent a microcosm of the United States economy, which overall has fared well in corporate services and FIRE activity yet declined in relative terms in manufacturing. At issue is why. Specifically in the case of Columbus, how are individual manufacturers performing? Is performance differentiated among types of firms? If so, by industry? by organizational attributes? by age or size? If we know the principal determinants of lowest and highest performance, we can better position ourselves to recommend solutions and possibly develop appropriate policy to assist lagging sectors of a local economy. Questions both answered and raised by this research provide a baseline for future research regarding comparisons among sectors among different localities, as well as within a local economy – for example, how does performance vary among firms in growing (e.g., corporate services) versus declining (manufacturing) sectors, and how might intersectoral differences in performance vary from one local economy to another?

Sampling strategy and data

As indicated, our study focuses on small manufacturing firms in Columbus. Although firm size can be defined using a variety of variables (e.g. employment, sales volume, assets, or qualitative categories such as independent ownership or management), we use employment as an indicator of size because it is reliable, accessible, and can be used readily for comparative purposes. Specifically, we define small firms as those employing under 100 workers. Using the Ohio Harris Industrial Data (Harris Publishing Co.,

1991), we tabulated the number and percent of small manufacturing firms (under 100 employees) in Columbus, by Standard Industrial Code (SIC) at the two-digit level. From this universe of small manufacturers, we selected the dominant set of SICs, which comprised substantially more firms (a total of 967) than other manufacturing industries. Table I shows the sample of 967 firms, by SIC, number, and percent. Given time and financial constraints, 400 firms were selected to contact for interviews. Selection was guided by the distribution of firms across SICs in the universe to maintain a similar distribution in the sample; within SICs, firms were selected randomly. Letters were sent to chief executive officers (CEOs) and owners of the 400 firms, followed by telephone calls to arrange interviews. Ideally, the distribution of our final sample of firms – those with which interviews were arranged – would parallel the distribution as shown in Table I. Our final sample for analysis (63 firms) also is shown in Table I. Note that although SIC 20, food and kindred products, represents a dominant industry in the universe, it is not represented in the sample. This is because the response rate was zero for firms in this industry. Excepting the absence of SIC 20, the distribution reasonably approximates the distribution of the dominant set of SICs.

Data from firms for 1991 and 1992 (and limited data for 1987 to assess change in performance) were collected through interviews.[1] We include in the foregoing analysis variables that pertain directly to local performance and avoid redundancy. In addition, our mode of analysis involves parametric procedures, and thus we focus principally on interval-scale data.

Types of information encompassed by the variables (Table II) include basic *descriptive* information, such as SIC, age, and employment. Our intent was to include as much information as possible that might reflect organizational attributes of firms. Thus, with respect to employment, we included information on total employment as well as salaried employees as a percent of total employment to reflect conditions of full or less than full-time work.

Performance-related information (i.e. measures of productivity) include indicators that are commonly available and thus permit replicable analysis. Specifically, we used sales and value-added per employee[2]; these data were recorded for 1991 as well as for 1987 to permit analysis of performance both in static terms and, dynamically, as a function of change. We selected a relatively brief time frame so as to incorporate all firms, including those under five years of age. From a dynamic perspective on performance, a firm may perform at a high level in terms of value-added or sales per employee at a particular point in time, yet may register as a low performer in the absence of improvement. Especially in light of new emphases in the United States on adopting and adapting Japanese-inspired strategies such as continuous improvement, dynamic indicators of performance are critical (Best, 1990). To avoid an arbitrary judgement by selecting one indicator

TABLE I
Distribution of dominant firms in Columbus and case study sample, by product line

Product Line	Dominant firms in Columbus		Case study sample	
	Number	Percent	Number	Percent
SIC 20 (food and kindred products)	68	7.03	0	0.00
SIC 24/25 (lumber/furniture	87	9.00	5	7.94
SIC 27 (printing/publishing)	278	28.75	18	28.56
SIC 30 (rubber and misc. plastic products)	63	6.51	4	6.35
SIC 32 (stone, clay and glass products)	61	6.31	4	6.35
SIC 34 (fabricated metal products)	150	15.51	12	19.05
SIC 35 (non-electrical machinery and equipment)	178	18.41	15	23.81
SIC 39 (misc. manufacturing industries)	82	8.84	5	7.94
Total	967	100.00	63	100.00

Source: Ohio Harris Industrial Directory, 1991.

TABLE II
Types of information encompassed by variables in the analysis

Type of information	Variable
Descriptive	SIC
	Age of firm
	Employment
	Total
	% Salaried
Performance	Value-added per employee
	Sales per employee
Investment Foci	
Capital	Replacement Value of Production Equipment (RVPE)
	% RVPE Less Than 5 Years Old
	% RVPE Accounted for by Computer-Aided Manufacturing (CAM) Equipment
Labor	% Employees Participating in Continuing Education Programs
	% Employees with College Degree
Labor-Management Relations	Characterization of Production Workers as Specialized or Multi-skilled
Geographical Linkages	
Market	% Sales Exported to Location in U.S. Outside of Ohio
	% Sales Exported to Other Nations
Technical Services	% Technical Requirements Purchased Locally
	% Technical Requirements Purchased State-wide
	% Technical Requirements Purchased Nationally

over another, be it sales or value-added per employee or static or dynamic data, our approach recognizes that performance is multidimensional and thus involves a variety of indicators. Specifically, we employ four indicators: static (1991) and dynamic (1987–1991) sales and value-added per employee. The inductive exercise provides interesting results because firms' performance vary across indicators. From this perspective, at issue are the variables that best discriminate among levels of performance relative to the different indicators. As elaborated in the next section on methods, data on national averages for sales and value-added per employee for each SIC in the sample were collected from published sources to arrive at a relative measure of firms' performance with respect to national standards.

Another set of variables encompassed information on *investment foci*, regarding both capital and labor. Capital investment is relatively straightforward and includes variables such as replacement value of production equipment, percent replacement value of production equipment less than five years old, and percent dollar replacement value of production equipment accounted for by computer aided manufacturing (CAM) equipment. In contrast, measuring investment in human resources is uncharted territory, in part because the American corporate tradition, Taylorism, has deemphasized the value of workers' skills (Ettlinger, 1994). Although concerns about the "soft" side of modernization – human relations – increasingly have been voiced (e.g., Dankbaar, 1990; *The Economist*, 1994; Giordano, 1992; Lorenz, 1992), formal operationalization is relatively undeveloped. To reflect firms' investment in their workers and interest in developing or maintaining a skilled work force we used percent employees with a college degree and percent employees engaged in continuing education.

Building on the concern with *human* resources, our intent was to try to capture organizational aspects of firms with regard to *labor-management relations* and the organization of the work force. Here we settled on categorical information that would indicate tendencies toward traditional Taylorism or devolution of power and responsibilities, specifically the characterization of pro-

duction workers as specialized in a particular task or as assuming multiple responsibilities (i.e., multi-skilled).

A final set of variables pertain to *geographical linkages*, which have been recognized as important factors in the development of small firms, notably in high tech sectors (Oakey, 1985). At issue here is whether there are patterns of geographical linkages relative to the local industrial mix, suggesting local dependence or independence with regard to forward and/or backward linkages. Are small manufacturers dependent on local expertise regarding technical input linkages or do such linkages prevail over longer distances? Do small manufacturers cater mostly to local or non-local markets? Variables to address questions about non-material backward or input linkages include percent of local, statewide, and national technical input linkages (referring to a wide range of facilities or services from universities/colleges, research organizations, and technology centers as well as external services related to data bases/software, management/marketing, advertising, industrial design, production engineering, laboratory testing and R&D). Variables to address forward or market linkages include percent international sales and national sales outside Ohio.

In sum, categorical data on industry (SIC) and labor-management relations and interval-scale data on basic firm description and indicators of performance, investment foci, and geographical linkages were compiled (Table II) and systematized, as indicated below.

Measuring local performance: Methods and analysis

To reiterate, our purpose is to measure firms' performance, identify patterns of performance in the local economy, and finally, to explain these patterns. The performance variables indicated above serve the first and second of these tasks; the other variables (descriptive information, investment foci, labor-management relations, and geographical linkages) serve the third task.

Identifying and explaining patterns of performance among firms in Columbus involved several steps. First, we identified patterns of performance among firms using the variables that capture both the static and dynamic measures of relative performance, value-added and sales per employee. We developed initial indices for the static and dynamic value-added and sales per employee measures, respectively, that captured the performance of firms relative to national standards; a second and final set of indices incorporated firms' performance relative to others in the local economy. Thus, our analytical approach to performance involves a set (4) of relative measures that position firms' performance both in the local and national economy. The distribution of firms by index values permitted specification of groups of firms by level of performance for each index. We then used discriminant analysis to discern the variables that best discriminate groups (by level of performance) and thus help to explain performance for each measure. We also used categorical information (SICs and labor-management relations) as the basis for groups in two additional discriminant analyses to determine which variables, including performance-related variables, best differentiate firms. Below we elaborate on the research strategy.

Patterns of firm performance

We calculated initial performance indices for Columbus firms relative to national standards[3] for the industry group of which each firm was a part (determined by two-digit SIC), as indicated by Equations (1) through (4).

Relative Value-Added per Employee (V_{1f}):

$$V_{1f} = \frac{V_f}{V_n} \tag{1}$$

where V = value-added per employee, 1991; f = firm; n = national standard of industry of which firm is a part.

Change in Value-added per Employee (V_{2f}):

$$V_{2f} = \frac{\frac{V_{f91}}{V_{n91}}}{\frac{V_{f87}}{V_{n87}}} \tag{2}$$

where V = value-added per employee, 1987 and 1991; f = firm; n = national standard of industry of which firm is a part.

Relative Sales per Employee (S_{1f}):

$$S_{1f} = \frac{S_f}{S_n} \tag{3}$$

where S = sales per employee, 1991; f = firm; n = national standard of industry of which firm is part.

Change in Sales per Employee (S_{2f}):

$$S_{2f} = \frac{\frac{S_{f91}}{S_{n91}}}{\frac{S_{f87}}{S_{n87}}} \quad (4)$$

where S = sales per employee, 1987 and 1991; f = firm; n = national standard of industry of which firm is part.

We used the distribution of index values for each of the four indices to delineate *patterns* of performance relative to national standards. In each case, four clear categories or "groups" (very low, low, medium, high) were evident (Figures 3–6). Consistent with the overall negative indications for manufacturing in Columbus, the distribution of index values for all four indices were skewed to very low and low performance levels, with relatively few firms indicated as high performers. Delineating groups allowed us to discern how firms were faring (with respect to the performance measures employed in this analysis) relative to others in the local economy. Accordingly, we assigned each group a weight: very low (1), low (2), medium (3), high (4).

We then recalculated each index by multiplying the initial index values by the assigned weights to position firms' relative performance (to national standards) in the local economy. This procedure permits sensitivity to the following situation: a firm might perform relatively poorly in relation to the national standard, but may perform substantially better than other firms in the local economy; conversely, a firm may perform well relative to national standards, but other firms in the local economy may perform at an even higher level. The final indices, indicated by Equations (5)

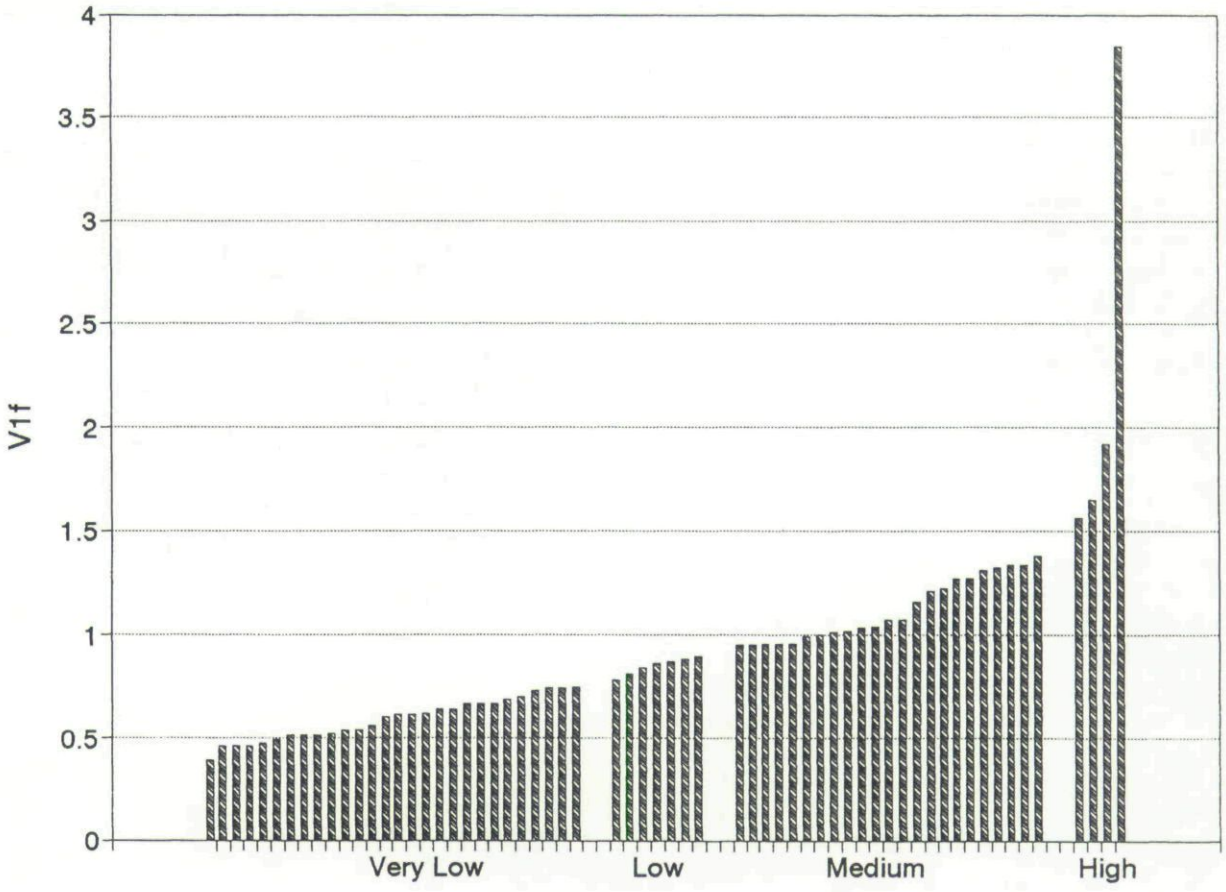

Fig. 3. Relative value-added per employee.

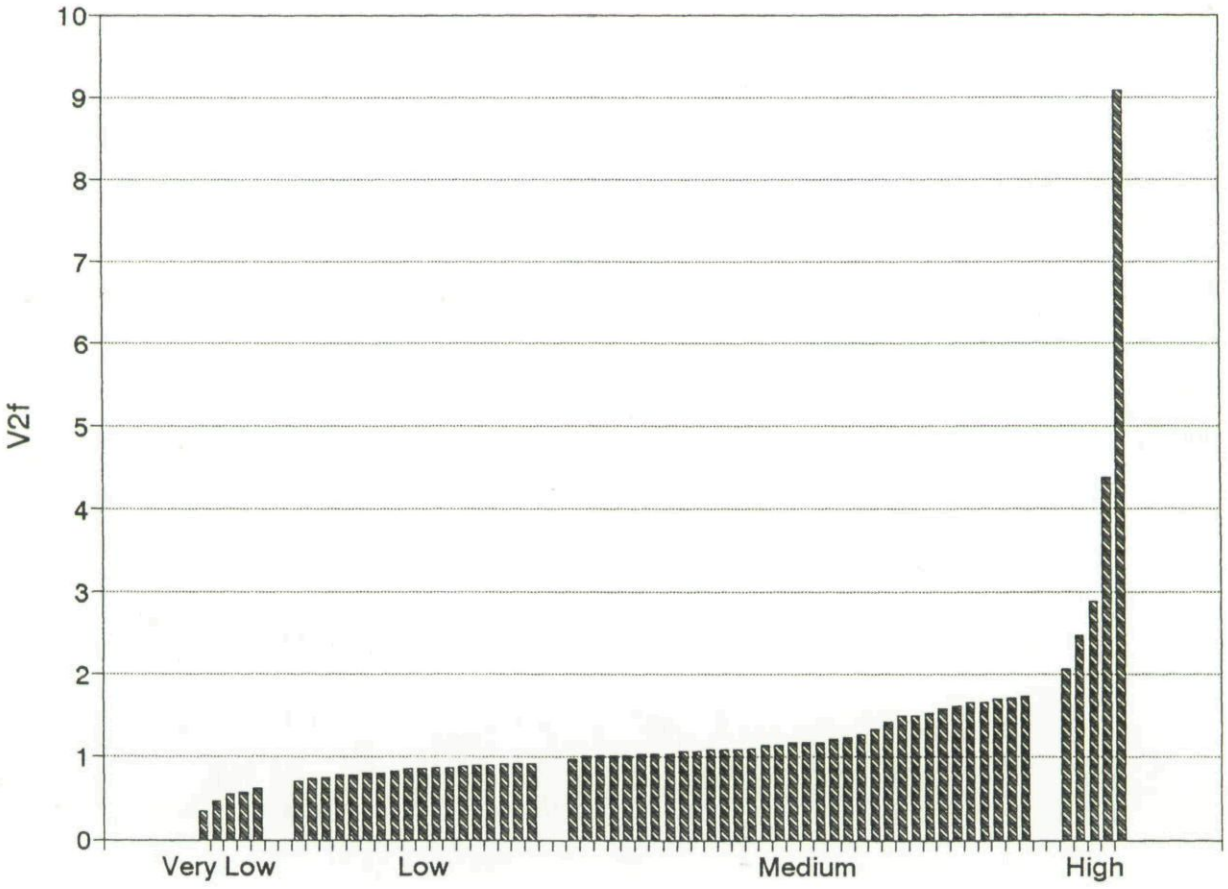

Fig. 4. Change in value-added per employee.

through (8) below, were then used to assign firms to groups for discriminant analysis of performance.

Static Value-Added per Employee (V_{3f}):

$$V_{3f} = V_{1f} * r \tag{5}$$

where V_{1f} = relative Value-Added per Employee; r = weight of relative performance.

Dynamic Value-Added per Employee (V_{4f}):

$$V_{4f} = V_{2f} * r \tag{6}$$

where V_{2f} = change in Value-added per Employee; r = weight of relative performance.

Static Sales per Employee (S_{3f}):

$$S_{3f} = S_{1f} * r \tag{7}$$

where S_{1f} = relative Sales per Employee; r = weight of relative performance.

Dynamic Sales per employee (S_{4f}):

$$S_{4f} = S_{2f} * r \tag{8}$$

where S_{2f} = change in Sales per Employee; r = weight of relative performance.

Interestingly, group membership varies when different measures are employed *except* in the case of highest performers indicated by both dynamic measures, given by Equations (6) and (8). Thus, whereas measurement of the same phenomena in static and dynamic terms show different patterns of performance, measurement of *change* for *different* phenomena show similar patterns, specifically among the highest performing firms. The former case, which applies to most of the firms in the sample, signifies that both ranking and bases for group differentiation vary across the measures, underscoring the multidimensional character of performance; the latter case, applying to just a few firms specific to one group (highest performers) suggests that aggressive decision-making regard-

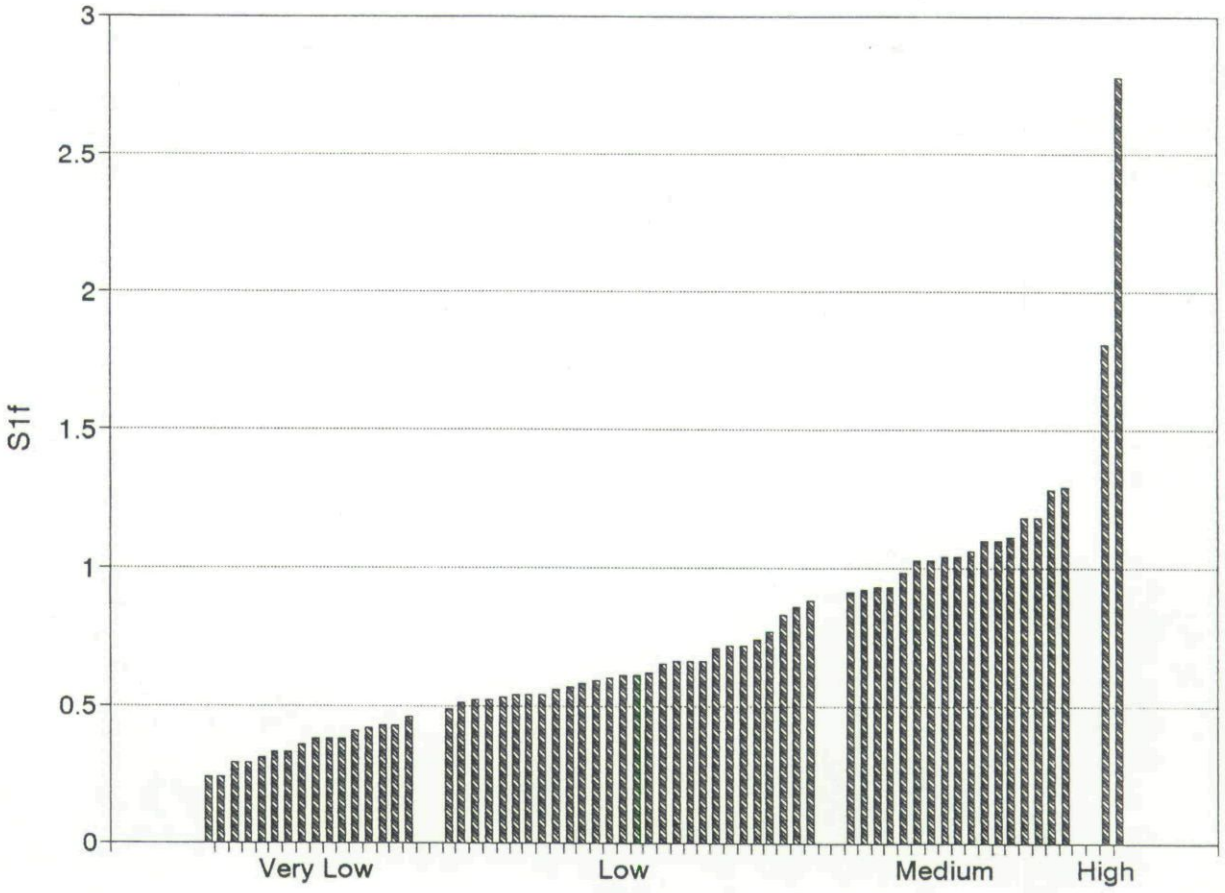

Fig. 5. Relative sales per employee.

ing change tends to be consistently applied to different aspects of firm strategy among highest performers.

More general indications from patterns of performance (i.e., pertaining to more than just the highest performing firms) is that about 39% of the firms rank higher on the dynamic than on the static indices; patterns for the remaining firms are random. The one clear pattern, whereby a relatively large number of firms rank higher on dynamic than static indices, reinforces indications of overall low firm performance yet suggests that many firms are changing. The critical question is whether the most appropriate changes are being made. This question can be addressed if we know which variables best discriminate highest (and lowest) performers.[4]

Differentiating groups of firms: Discriminant analysis

At the outset it is worth recalling that the strength of the sampling strategy oriented toward local industry mix also presents an analytical limitation, specifically heterogeneity in the sample within SICs and statistically insignificant subsamples relative to SICs. Accordingly, we used basic descriptive statistics to analyze the data conservatively, assessing the degree of variation exhibited by variables that showed up as significant variables in the discriminant analysis. If, for example, a standard deviation exceeded the mean, we chose to drop the variable rather than impose what we considered an arbitrary interpretation. We also used descriptive data to check the distribution of firms in performance groups (very low, low, medium, high) across SIC categories to find out if particular levels of performance by different

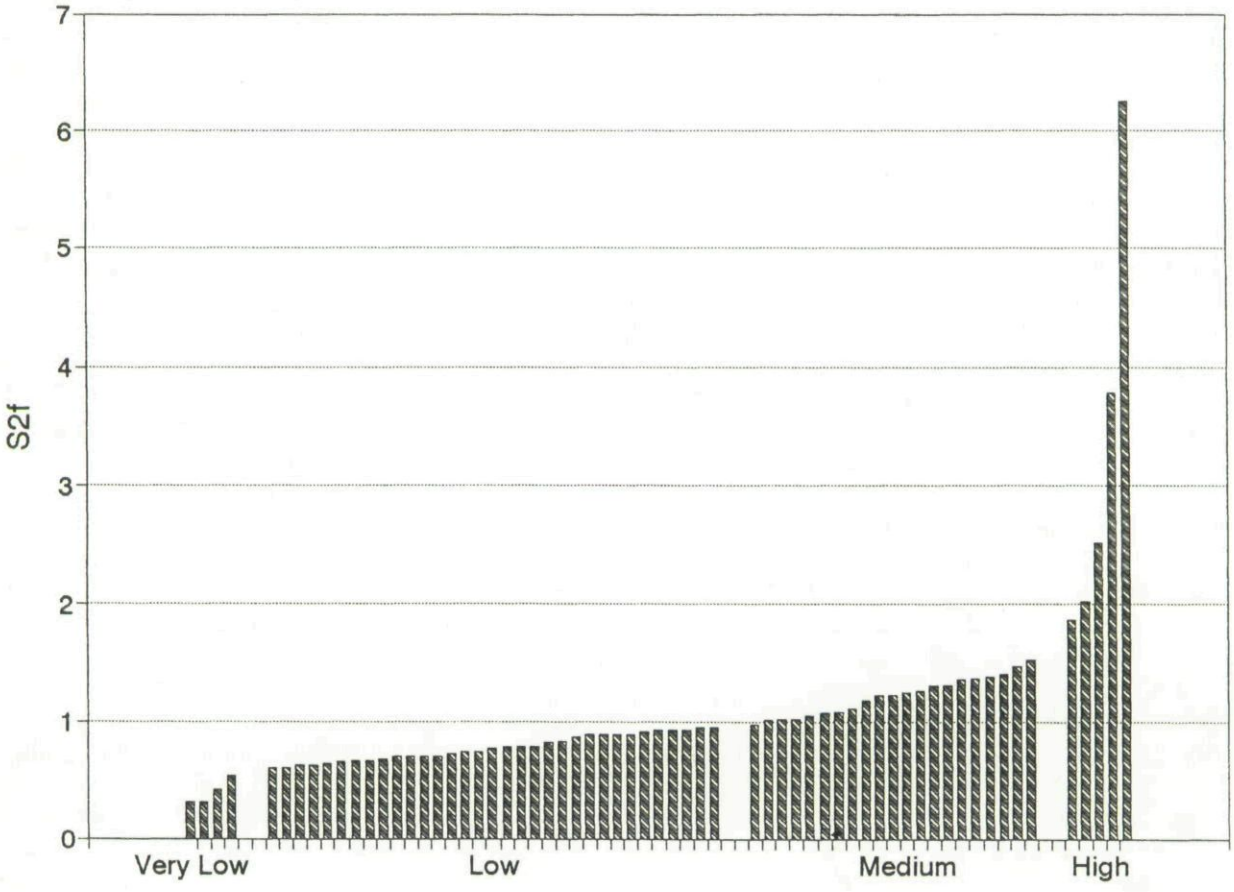

Fig. 6. Change in sales per employee.

measures are specific to particular industries. We found some SIC concentration among firms differentiated by the dynamic analysis of sales per employee, slight SIC concentration among firms differentiated by the dynamic value-added analysis, yet no concentration in the static analyses, an important finding in itself. For the static indicators, the wide distribution of firms across SICs within performance groups suggests that the variables selected for analysis are appropriate for the sampling strategy; decision-making regarding *change* apparently requires analytical sensitivity to industry groups. Overall, we found that the explanation of performance is far from obvious, and requires investigation beyond conventional descriptive indicators.

Discriminant analysis is well-suited to the task of uncovering variables that best differentiate levels of performance, indicated here by groups of firms determined inductively as described in the previous section. Appendix A includes 6 tables that show results of the discriminant analyses.[5] Information in the tables include: variables that are highly significant by virtue of high discriminant function coefficients; the discriminant functions with high eigenvalues (indicating high relative importance of functions); and indications from high group centroids relative to the significant functions (showing the relative importance of firm groups to each function).[6] Below we report and discuss salient findings for discriminant analyses of firms by levels (groups) of performance given by Equations (5) through (8) as well as categorical information (SICs, labor-management relations).

Discriminating groups of firms by the Static *Value-Added per Employee Measure,* V_{3f}

Results from this analysis indicate that the proportion of salaried workers is the salient variable differentiating the very lowest and highest performing firms. The highest performing firms have the greatest proportion of salaried workers among all of the groups and the very lowest performers have a much smaller proportion of salaried workers. This suggests that the highest performers may have a greater commitment to their labor as they are investing in a permanent labor force (salaried employees) rather than in hourly or less than full-time workers. This finding is especially relevant from a labor market perspective in light of the recent surge of less than full-time employment that has served firms' short-term cost-cutting interests but has simultaneously placed labor in a precarious situation regarding wages, benefits, as well as chances for skill enhancement or upward mobility (Ansberry, 1993; Tilly, 1991). The fact that highest performers have invested in a permanent work force, whereas lowest performers have not, shows that worker and corporate welfare can coincide. Although we might predict this result given the measure of performance used in this analysis, value-added per employee, the analytical capability to discern more and less important dimensions by the relative signigicance of the different functions helps clarify the relative contributions of variables to firm performance. The real insight to be gained from the analysis is that the variable "percent salaried employed" showed up on the most significant function, rather than variables reflecting capital investment that frequently are assumed as principal determinants of high value-added performance.[7]

Distribution of SICs varies within each group, an important finding suggesting that performance indicated by the static value-added per employee measure is not dependent upon industry.

Discriminating groups of firms by the Dynamic *Value-Added per Employee Measure,* V_{4f}

Although age clearly differentiates the groups,[8] both the very lowest and highest performers are young. This indicates that age is an *in*sufficient determinant of performance. Longer-term dynamic analysis should reveal whether rates of change are high among new firms as a matter of immediate survival, or whether managers of new firms recognize continuous improvement as a long-run strategy to achieve competitiveness in the new international economy. From a planning perspective, the low performing status of older firms (on average about forty-five years old, see endnote 8) prompts questions about whether older, stable firms may experience competitive pressure in the future from newer, high-performing firms that sustain high rates of change.

This particular analysis yielded interesting results by industry. Several of the very lowest performing firms in Columbus are in SIC 34 (fabricated metals) and several of the highest performing firms are in SIC 35 (non-electrical machinery). We interpret these results cautiously because only a small percentage of SIC 34 and SIC 35 are represented in the lowest and highest groups, respectively; nevertheless these SICs represent over half of each of these groups of performers. These data are at a minimum suggestive of industry-specific patterns of managerial decision-making, specifically with respect to efforts to improve (or not improve) value-added performance.

As we might expect, the second function separates the very lowest performers from the others according to replacement values of production equipment, which, as indicated by the descriptive data, are lowest among all other firms in the sample.

Overall, analysis of both static and dynamic measures of performance based on value-added per employee yield interesting results. Analysis using the *dynamic* indicator portrays highest performing firms as young and focused on improved performance by capital investment. Analysis using the *static* measure indicates a substantial focus on labor investment, specifically regarding the development of a permanent, full-time and salaried workforce. Importantly, membership to the highest performing group differs between the dynamic and static analyses; thus, it should not necessarily be surprising that highest performers in the static analysis were not typically young.

Discriminating groups of firms by the Static *Sales per Employee Measure,* S_{3f}

Although we expected to find market-related variables to be the most significant discriminators

for a sales per employee measure,[9] in fact results are consistent with those from the *static* analysis of value added per employee on the most significant function. Again, we find that percent salaried employed is a significant discriminating variable; total number of employees is significant as well. This labor-related function for the *static* sales per employee indicator distinguishes medium-performing firms (group 3), which on average have a greater proportion of salaried workers than firms in other groups as well as a mid-sized workforce for "small" firms as defined in this analysis (on average about 52 workers). The principal difference between the two static indicators – not insignificant – is that firm size appears significant on the sales per employee indicator yet not on the value-added indicator. Comparative analyses in the future should help clarify whether the significance of firm size (mid-size) for the sales per employee measure is a context-specific phenomenon or more generally a reflection of the labor dimension associated with aggressive marketing. Note also that the salient function on the sales per employee indicator distinguished the medium-level performers only, suggesting that the determinants of highest or lowest level performance is not readily discernable.

Discriminating groups of firms by the Dynamic *Sales per Employee Measure, S_{4f}*

As with the *static* sales per employee indicator, discriminant analysis distinguishes medium-level performers but neither the lowest nor highest performers. The first function principally differentiates medium-level performers by total employment, which have on average about 26 employees.[10] As with the *dynamic* analysis of value-added per employee, but to a much greater extent, SIC concentration among firms distinguished by the first function is relevant. Specifically, medium performers indicated by the *dynamic* sales per employee measure show concentration in the non-durable goods sector, SIC 27 (printing and publishing).

The second function distinguishes lowest performers by employment growth, which is especially high among firms in this group.[11] Apparently, firms that are substantially increasing the size of their workforce are doing so at the expense of market-related efforts. Note that the discriminating variable for the lowest performers is employment growth overall, irrespective of type of employment. This is possibly significant in light of our findings that high-level performers tend to invest in *salaried* employees in particular.

Discriminating groups of firms by categorical variables (SICs, labor-management relations)

SICs. Porter's (1985) study highlighted the industry-specific character of corporate strategy and production. Our concern for analytical problems associated with firm heterogeneity in the sample suggested that discriminant analysis with groups determined by SICs would be useful. Using SICs as groups, we incorporated in the analysis as variables the performance measures V_{3f} (*static* value-added), V_{4f} (*dynamic* value-added), S_{3f} (*static* sales per employee), and S_{4f} (*dynamic* sales per employee). We considered that if each function clearly distinguishes an SIC group, then we might infer industry-specific features, which would render an analysis of local industry mix somewhat tenuous. Our results, however, did not overall show discrete groups, reaffirming our findings that patterns of performance are not necessarily dependent on industry differences. A variety of SICs (SIC 27, printing and publishing; SIC 30, rubber and miscellaneous plastic products; SIC 32, stone, clay, and glass; and SIC 35, non-electrical machinery and equipment) were differentiated on the most significant function by several variables, although only percent sales outside Ohio in the United States (i.e., national market) showed reasonable variability.[12] Information regarding national markets is helpful since linkage-related variables in particular were difficult to interpret for the previous discriminant analyses (see endnotes 9, 11).

Indications of the group centroids from the discriminant analysis reveal significant differences between SIC 27 on the one hand, and SICs 30, 32, and 35, on the other.[13] Whereas firms in the durable goods sectors plus rubber and plastics (SIC 30, non-durable goods) cater more to national markets, firms in printing/publishing (SIC 27) cater principally to the local market. This result makes sense for these industries, and is especially interesting when we recall that it was the non-durable goods sector in Columbus that kept

manufacturing employment afloat when all industries in the durable goods sector declined precipitously (Figure 2). From this perspective, the export base in Columbus manufacturing was maintained by only one growth industry, SIC 30 (rubber and plastics)[14]; the other major non-durable goods industry, printing and publishing (SIC 27) is locally oriented and, moreover, is not characterized by high performance by any measure. Although findings from this study positively identify an industry with a relative competitive advantage, SIC 30, they also suggest a precarious situation for Columbus manufacturing, in general, from the perspective of increased emphasis on exports under increasingly competitive conditions in the global economy (Howes and Markusen, 1993; Nothdurft, 1992; Porter, 1990). This is not to suggest that production for local consumption is necessarily negative (Erickson, 1989), but rather that a local manufacturing economy with marginal export performance *overall* is likely to remain uncompetitive and experience declining employment.

Labor-management relations

We used categorical information to reflect labor-management relations, specifically the characterization of production workers as specialized or multi-skilled. We considered that a system of labor-management relations based on divisions of labor and specialization in tasks is consistent with traditional American management, Taylorism; in contrast, a system oriented toward multiple-responsibility jobs and multi-skilled workers reflects a newer, more progressive form of labor-management relations that devolves power and responsibility (Ettlinger, 1990; Marshall, 1992; Norton, 1993).

Discriminant analysis using binary groups (specialized, multi-skilled) produced one function, which distinguishes firms that classified workers as "specialized" (about 30% of the sample) by total employment and V_{4f} (the dynamic value-added measure). On average these firms employed a larger number of workers and were among the lower performers regarding change in value-added per employee. Interestingly, checking back to descriptive data, we noted only one industry that exhibited clear concentration of firms in the "specialized" category: SIC 27. The implications: in addition to the fact that Columbus manufacturing has only a few high performing firms, the growth sector with respect to employment neither contributes to the export economy nor to new forms of human relations.

Conclusion

This study employs an approach to evaluating small firms that involves reasonably accessible types of data to insure replicability for comparative analysis, assuming, however, that surveys or interviews are possible. By recognizing the local context of small firm performance and using a sampling strategy oriented to local industrial mix, we link the performance of small firms with the local economy. Our case study is modest and addresses only one sector of the Columbus economy, manufacturing. At issue for future research is the comparison of firms and industries across sectors (manufacturing, corporate services) and the more general anatomy of the Columbus economy at large. Our concern overall is for sub-national spatial variation. Thus, also pressing is a comparison of firm performance across communities, cities, states, and multi-state regions to responsibly arrive at comparative statements of the performance *and needs* of different local economies. In this regard, this study speaks to both basic and applied research and, fundamentally, to connecting these two dimensions of research that typically are considered discretely.

Despite the limited scope of our analysis, the case study – Columbus manufacturing – is meaningful in the context of national economic trends, specifically the relative growth of corporate services and the decline of manufacturing. Columbus manufacturing has overall been dwarfed by growth in employment in corporate as well as public services and has experienced significant decline, with the exception of the non-durable goods sector, which nevertheless remains a small part of the economy. Although Columbus is often considered a "Sunbelt" city because of the strong services component, the relative weaknesses of its manufacturing sector place this city firmly in the American heartland from the perspective of the manufacturing economy. Especially in light of the general health of the local economy, one might imagine some attempt to counteract recent

setbacks of manufacturing and develop competitiveness on an economy-wide basis. At issue for academicians, policy-makers, and the business community is whether restructuring is underway, and if so, to what degree?

The answer as to whether the Columbus manufacturing economy is restructuring is a qualified "no". The first step of our analysis involved identifying patterns of performance using a double relative measure to capture firms' performance relative to national standards as well as to other firms in the local economy. By several measures, including static and dynamic indicators, we conclude that small manufacturers in Columbus are skewed toward very low and low performance. A few firms stand out as high performers, but membership in this group of high performers is inconstant across the static indicators. On the other hand, the dynamic indicators reveal both relatively constant group membership as well as at least some SIC concentration. It remains somewhat disconcerting, however, that these firms ranked substantially lower by the static measures. This prompts the following questions: What kinds of changes are being made in these firms? Are these changes likely to positively affect performance by static indicators in the future? What are the relevant characteristics of firms that exhibit high performance by the static indicators? To answer these questions we systematized the data using discriminant analysis to help search for variables across a range of dimensions that differentiate groups of firms by performance levels, SICs, and type of labor-management system.

Overall, results from the discriminant analyses revealed that highest performance by static measures is best explained by investment in human relations – developing a permanent salaried workforce. However, this type of investment characterizes only a few firms, without any clear industry concentration; i.e., the pattern is random. In addition, negative findings from the analysis of labor-management systems suggest that human relations predicated on Taylorist principles remains a strong component of Columbus' most stable industry (SIC 27, printing and publishing) in terms of employment and employment growth; moreover, market linkages for this industry typically are localized, signifying that the local manufacturing economy is ill-equipped to contribute significantly to Columbus' export base. Export industries generally are concentrated in the durable goods sectors, which continue to decline.

Are small manufacturers in Columbus changing? Yes, however we conclude that efforts to change – presumably, to improve performance – are not focused on investment in human relations or market development, either in the durable or non-durable goods sectors. Analysis using the dynamic sales per employee measure indicated investment in employment, but not necessarily in *salaried* employees; in sum, the investment in employment typically is quantitative, not qualitative. The dynamic value-added per employee indicator revealed that the greatest change is occurring among younger firms that are investing in *capital*. Indeed, this is consistent with the "technology first" approach of American firms that appear to cling to Taylorist traditions. Examples abound regarding the American convention of investing heavily, yet without clear necessity, in new, sophisticated technology (e.g., Flamm, 1988). This tendency frequently results in inefficient use of technology (Jaikumar, 1986), often in light of inadequate attention to progressive human relations that are required to effectively utilize new technologies (Dankbaar, 1990; Ettlinger, 1994; Gold, 1989). This is not to suggest that capital investment is inherently flawed; rather, that the immediate and tangible benefits of new technology may be relatively ineffective in the long-run without prerequisite investment in *people*. This implies that new programs and local initiatives oriented toward the development of new technologies – flexible manufacturing technologies or advanced telecommunications systems (electronic data interchange) – may be less appropriate although more glamorous than long-term investment in the intangible realm of human relations.

Appendix

TABLE A1
Results from the discriminant analysis for V_{3f}

Discriminant function	Variable	Standardized discriminant function coefficient	Eigenvalue	Percent variance	Highest group centroids*
1	% salaried employees	0.67495	0.58	53.75	Very low/high

* "/" separates groups that are inversely related.

TABLE A2
Results from the discriminant analysis for V_{4f}

Discriminant function	Variable	Standardized discriminant function coefficient	Eigenvalue	Percent variance	Highest group centroids*
1	Age of firm	–0.83499	0.41	49.56	Very low, high/low
2	Replacement value of production equipment	1.00855	0.29	34.59	Very low

* "/" separates groups that are inversely related.

TABLE A3
Results from the discriminant analysis for S_{3f}

Discriminant function	Variable	Standardized discriminant function coefficient	Eigenvalue	Percent variance	Highest group centroids
1	Total employment	0.59326	0.73	58.27	Medium
	% salaried employees	0.53865			
2	% Employees with college degrees	–0.67820	0.38	30.20	High

TABLE A4
Results of discriminant analysis for S_{4f}

Discriminant function	Variable	Standardized discriminant function coefficient	Eigenvalue	Percent variance	Highest group centroids
1	Total employment	–0.88110	0.44	51.37	Medium
2	Employment growth	0.51784	0.27	31.43	Very low

TABLE A5
Results of the discriminant analysis for SICs

Discriminant function	Variable	Standardized discriminant function coefficient	Eigenvalue	Percent variance	Highest group centroids*
1	% sales exported to location in U.S. outside of Ohio	1.29031	2.147	43.87	Printing-publishing/rubber and misc. plastics, stone, clay and glass, non-electrical machinery and equipment

* "/" separates groups that are inversely related.

TABLE A5
Results of the discriminant analysis for SICs

Discriminant function	Variable	Standardized discriminant function coefficient	Eigenvalue	Percent variance	Highest group centroids*
1	Total employment	–0.98345	0.601	100.00	Workers specialized

Notes

[1] Interview data were collected by Martin Hynes.

[2] Financial data as well as output per employee were unavailable.

[3] Data for national standards for value-added and sales per employee in 1987 and 1991 were obtained from the U.S. Bureau of the Census (1991) and Gale Research Inc. (1988, 1992), respectively.

[4] Note that one firm ranked highest across all four measures. Some salient characteristics of this firm are: youth (10 years old), small size (13 employees), salaried and degreed employees accounting for about 30% of the work force, relatively substantial export markets (national and international), low replacement value of production equipment, and presence in the durable goods sector (SIC 35, non-electrical machinery and equipment). Although these attributes may provide clues to high performance, generalizing from one case is precarious. For example, results of the discriminant analysis indicate that many of the attributes of the above-mentioned firm (e.g., age, size) do not necessarily characterize all high performers, whereas other attributes (e.g., apparent deemphasis on capital investment) do apply. Thus, we use procedures that permit systematization of data across the sample, specifically discriminant analysis to avoid problems associated with generalizing from one or a few cases.

[5] The discriminant analyses were performed using the direct method, SPSS (Statiscal Package for the Social Sciences).

[6] Analysis of classification coefficients was not germane to our research question; these data are available from the authors on request. These results generally are acceptable: the percent of correctly classified grouped cases ranged from 56.45% to 82.26%.

[7] Capital investment did show up on the second and third discriminant functions, distinguishing the highest performing by proportion of production equipment accounted for by computer-aided manufacturing equipment (CAM) on the second function and replacement value of production equipment on the third function; however, the relatively low eigenvalue on these functions and the extremely high variability of the salient variables suggest that high capital investment need not always account for high value-added performance.

[8] The first function differentiates groups by age, which appears significant for three of the four groups – the very lowest and highest, which are young (on average about 7 and 10 years old, respectively), and the low performers, which are substantially older (on average about 45 years old).

[9] Although market-related variables were not significant on the first function, this type of information *as well as* labor-related investment are most significant on the second discriminant function. Specifically, percent of sales to other nations and proportion of employees with college degrees differentiate highest performing firms, which exhibited higher than average values for these variables. We refrain from attributing too much emphasis here because of the extremely high variability exhibited by these variables and the low eigenvalue of the function.

[10] Replacement value of production equipment also is significant on the first function, although variability is high among medium performers with respect to this variable, relative to this measure. Consistent with the *dynamic* value-added indicator, this suggests that firms that are changing are doing so more through capital than labor investment. Again, however, high variability here limits this interpretation.

[11] As with the *static* analysis of sales per employee, linkage-related information showed up significantly on the second function, although extreme variability limits our interpretation. Specifically, this function distinguishes lowest performers by market-related variables (percent sales to other nations, percent technical requirements purchased locally,

percent sales to locations in the United States outside Ohio) as well as one variable related to technical inputs (percent technical requirements purchased nationally).

[12] Variables that also are significant on this function but exhibit extreme variability include the static value-added and sales per employee measures (V_{3f} and S_{3f}, respectively) and total employment. The finding regarding the static performance measures specifically reaffirms our conclusions based on the initial grouping of firms by levels of performance, revealing industry-specific concentration among highest performers relative to the dynamic measures but no clear industry-specific concentration relative to the static measures.

[13] The sign (positive, negative) differs for the group centroid for SIC 27 (printing and publishing) from the sign for group centroids for the other SICs (30, 32, 35), reflecting substantial differences in values of the significant variable, percent sales outside Ohio.

[14] Although SICs 32 and 35 (stone, clay, and glass and non-electrical machinery and equipment, respectively) are export-oriented, these industries have experienced substantial decline in employment along with all other durable goods industries in Columbus (Figure 2).

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