TRADEOFFS IN THE ORGANIZATION OF PRODUCTION: MULTIUNIT FIRMS, GEOGRAPHIC DISPERSION AND ORGANIZATIONAL LEARNING

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ABSTRACT

Firms face a choice in the organization of production. By concentrating production at one site, they can enjoy economies of scale. Or, by dispersing production across multiple facilities, firms can benefit from product-specific efficiencies and enhanced organizational learning. When choosing to organize in multiple units, firms must also decide where to locate these units. Concentrating production geographically can enhance economies of scale and facilitate organizational learning. On the other hand, dispersing facilities might allow the firm to lower transportation costs, reduce risks, and forbear competition. To examine these tradeoffs, we compare exit rates of single-unit organizations to multiunit organizations and their constituent plants in the U.S. footwear industry between 1940 and 1989. Our results suggest that, multiunit organizations benefit primarily from enhanced organizational learning, competitive forbearance and the diversification of risk. Nevertheless, these benefits appear to come at the expense of organizational adaptability.

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INTRODUCTION

In the last two centuries, the organization of production has shifted from small, single-unit firms toward large, multiunit organizations. Much debate surrounds the interpretation of this profound shift. Some view the rise of the multiunit organization as an inevitable stage in the natural progression of economic evolution (Chandler, 1977; Galbraith, 1956). In sharp contrast, others, calling attention to the failure of many large corporations and the persistence of small firms in most industries, suggest that the prevalence of the multiunit organization stems from a recent, yet ephemeral, configuration of economic and social conditions (Acs & Audretsch, 1990; Piore & Sabel, 1984).

Both economists and organization theorists offer explanations for the rise of the multiunit form. Economists and business historians tout the superiority of multiunit firms by pointing to their ability to reach higher efficiency levels, (Chandler, 1977; Sherer et al., 1975). They argue that multiunit firms can realize product-specific economies not available to single-unit organizations through the efficient allocation of production across their multiple units. Meanwhile, organization theorists contend that multiunit firms benefit from more effective incremental learning through the accumulation and transfer of knowledge across establishments (Argote, Beckman & Epple, 1990; Greve, 1999; Ingram & Baum, 1997a).

When firms do choose to organize production into multiple production units, managers face the additional task of deciding where to locate these facilities. Concentrating establishments geographically can facilitate organizational learning both by improving information transfer across units and by increasing the likelihood that knowledge generated at one plant applies to another (Ingram & Baum, 1997b). On the other hand, dispersing operations can allow multiunit firms to reduce transportation costs (Greenhut, 1956) and to diversify the economic risks associated with operating in a particular location (Ingram & Baum, 1997a, 1997b). Managers might also wish to consider the degree to which they avoid or seek contact with rivals in their choice of locations, as research shows that meeting competitors in multiple markets improves the firm's ability to forbear competition (Bernheim & Whinston, 1990; Edwards, 1955; Simmel, 1950).

Although the multiunit form offers many benefits, these advantages may come at a cost. To coordinate the operations of multiple units and maintain consistency across establishments, multiunit organizations add layers of managerial staff for coordination and control (Chandler, 1977). These complex bureaucratic structures allow multiunit firms to operate effectively, but they can also inhibit the organization's ability to adapt to shifts in environmental conditions (Hannan & Freeman, 1984).

We investigate these tradeoffs in the U.S. footwear industry from 1940 to 1989. Since these issues ultimately weigh on the success of the firm, we analyze the effects of these strategic choices on firm performance (organization survival). However, because previous studies on multiunit organizations often examine the outcomes of the constituent units (e.g. Ingram & Baum, 1997a), we also analyze this issue at the plant level. Our results suggest that multiunit organizations benefit primarily from organizational learning. Nevertheless, the bureaucracy necessary to maintain this structure impedes the organization's response to rapid environmental change. Multiunit firms also appear to face a tradeoff between dispersing to benefit from multi-local organization and concentrating to enable organizational learning. From a methodological point of view, our study suggests that plant level analyses may not translate well to organization level outcomes. Let us begin by reviewing the tradeoffs inherent in the organization of production.

THEORY AND HYPOTHESES

Multiunit Advantages: Product-Specific Economies

Production systems can benefit from both technology-specific and product-specific economies of scale. Efficiencies that accrue when the increased size of a single operating unit reduces the unit cost of production fall into the first category. Both single-unit and multiunit organizations can realize these economies depending on the size of their plants. In contrast, product-specific economies arise from the efficient use of multiple productive units. Thus, these economies of production represent a unique source of advantage for multiunit organizations.

Multiunit firms achieve these efficiencies through product specialization. According to Sherer et al. (1975: p. 295) "Product specialization exists when plants belonging to the same organization produce for a broad geographic market some narrow segment of the product line normally encompassed within an industry's definition." Product specialization allows longer production runs that facilitate worker productivity, increase product quality and simplify production planning. For example, according to Pratten and Dean (1965), shoe manufacturers can reduce labor and overhead costs by roughly 10 to 15% by increasing average production run lengths from 200 pairs to between 1,000 and 6,000 pairs. A second benefit of product specialization arises from centralizing inventories. By concentrating special raw material stocks and finished good inventories in one place, firms can reduce inventories as a percentage of production because random variations in consumption tend to offset each other (Kekre, 1987).

Can single-unit firms benefit from these product-specific economies? In principle, single-unit firms can achieve production economies by focusing on specialty lines such as work shoes or high-quality men's shoes. Nonetheless, they operate at a disadvantage even then because, not offering a broad product line, they cannot provide frequent replacement of stock without incurring exorbitant shipping costs. Hansen's (1959) study reports that single-plant firms that specialized their production to a single type of shoe felt considerable pressure from retailers to offer a broader product line and to replace stock more frequently. Though inefficient in terms of production costs,[1] broad product lines allow single-unit firms to meet retailer demands and to reduce risk by adjusting their production mix to frequent fluctuations in the demand for specific products (Sorenson, 2000). Thus, it should not surprise us that research on the shoe industry reports that single-unit firms typically offer a wide array of products (Hansen, 1959; Szenberg, Lombardi & Lee, 1977). This leads us to our first expectation: To the extent that product-specific economies exist, firms that distribute their production across several specialized plants should outperform those that manufacture all of their products within a single facility.

Hypothesis 1. Dividing operations among a larger number of plants increases organizational performance.

Multiunit Geography: Multi-local Production

When a firm organizes into multiple units, the geographic distribution of its facilities can importantly affect the firm's performance. Multi-local firms – those operating in many dispersed locations – can realize competitive advantages from several sources (Greenhut, 1956). First, multi-local firms can minimize transportation costs by locating plants in close proximity to important markets and by adapting production to local tastes. Theoretical models of spatial competition show that firms should space themselves maximally when transportation costs affect the price of providing goods to customers (Lösch, 1954; Smithies, 1941). Although most consider the footwear industry to operate at a national (OECD, 1976), rather than local or regional level, manufacturers supplying multiple distribution channels might reduce the transportation costs associated with delivering goods to distributors by maintaining geographically dispersed production.

A type of statistical economy of scale offers a more likely source of multi-local advantage. At a general level, units that belong to larger collectives can often avoid selection pressures (Barnett, 1997). Ingram and Baum (1997a, 1997b) extend this argument to cover multiple geographically distinct units that tie their fates together through common ownership. They argue that the operation of multiple units allows the firm to weather idiosyncratic risks associated with particular locations. For example, if the labor market tightens in one location, a multiunit firm can shift some portion of production to plants operating in areas where wages remain low. Similarly, the operation of multiple plants probably gives the firm leverage against union activity because employees may find it difficult to engage in collective action across geographically dispersed facilities. Regardless of whether they actually do, firms clearly *could* engage in this redistribution of labor, as plants in this industry typically operate substantially below capacity.[2] Together these factors suggest that firms might benefit from spreading production geographically.

> *Hypothesis 2*. Dispersing operations geographically increases organizational performance.

Additionally, operating in multiple geographic markets might allow firms to forbear competition with their rivals. Two rationales suggest that competing with rivals across multiple markets might increase the likelihood of cooperative behavior (Baum & Korn, 1999). Economists focus on the ability to retaliate credibly should a rival decide to compete too vigorously in the focal firm's primary market (Bernheim & Whinston, 1990; Edwards, 1955). Meanwhile, sociologists highlight the notion that firms might understand the benefits of tacit cooperative behavior, allowing a rival to dominate one market in exchange for acquiescence in another (Simmel, 1950). These complementary views both suggest that firms might benefit from multi-point competition. Indeed, a growing body of research finds evidence of this benefit in the form of increasing margins (Evans & Kessides, 1994; Gimeno & Woo, 1996; Scott, 1982, 1991) and decreasing market exit rates (Barnett, 1993; Baum & Korn, 1996; Boeker et al., 1997) when firms engage in multi-point competition.

> *Hypothesis 3*. Meeting rivals in multiple geographic markets increases organizational performance.

Multiunit Advantages: Organizational Learning

Organization theorists point instead to the ability to learn incrementally and transfer that knowledge across units as a chief advantage of the multiunit form (Argote, Beckman & Epple, 1990; Greve, 1999; Ingram & Baum, 1997a). To benefit from the transfer of knowledge across units, constituent plants must perform similar tasks, as one sees in the footwear industry. Unlike vertically organized firms in which constituent plants produce different components that other facilities assemble, plants belonging to multiunit organizations in the footwear industry typically make similar products and tend to employ the same production processes.[3]

Under parallel production conditions, even random variation across sites allows multiple plant organizations to garner comparative information regarding the best means of production (Teece, 1977). Savvy managers can take further advantage by engaging in systematic strategic experimentation and the implementation of best practices. Organizations with only one site can also experiment strategically, but multi-plant organizations enjoy an advantage when engaging in experimentation: While single plant organizations must experiment sequentially, organizations with multiple sites can participate in several experiments at once.

Parallel experimentation offers at least two advantages over sequential experimentation. First, parallel experimentation allows learning to occur at a faster pace. Experiments take place in chronological time. Parallel processing allows the firm to reduce substantially the time required to investigate the potential benefits of a change in operating procedures. When experiments reveal opportunities to improve performance, firms benefit by adopting these changes sooner. Second, parallel experimentation increases the internal validity of the conclusions garnered from the experiment. Sequential experimentation suffers from an inability to control for several threats to internal validity that parallel experimentation, presumably with a control group, covers (Cook & Campbell, 1979). For example, maturation can bias sequential tests. In the U.S. footwear industry, both employee-level learning and equipment wear could impact the perceived results of a strategic experiment. One experimental condition might appear to outperform another simply due to the order of testing the conditions. When run sequentially, managers cannot decompose the effects of these maturation factors from the effect of the experimental condition. Essentially, this confounding of factors introduces noise into the learning process. Thus, sequential experimentation increases the risk that the organization learns superstitiously (March, 1988).

Empirical research suggests that organizational learning benefits multiunit firms (for a review, see Argote, 1999). For instance, Ingram and Baum (1997a) find that chains with greater operating experience offer stronger survival advantages to their component hotels. Moreover, knowledge transfer appears to offer additional improvements in firm performance. For example, Darr, Argote and Epple (1995) find that organizations operating multiple fast food restaurants lower production costs by transferring best practices. And Banaszack-Holl et al. (2000) find that chains that acquire poorly performing nursing homes appear able to raise the performance of these acquisitions toward the level of the other units in the chain.

Unlike economies of scale that result from the contemporaneous organization of production, learning accrues through the accumulation of experience over time. Thus, the literature on learning curves in manufacturing and services focuses on cumulative output as a measure of economies of experience (Argote, 1999). Alternatively, one might consider the cumulative years of operating experience embodied in an organization as an indicator of learning (e.g. Greve, 1999; Ingram & Baum, 1997a). These studies often incorporate some discounting factor to account for the fact that old experience, forgotten or irrelevant, might no longer improve firm performance (e.g. Argote, Beckman & Epple, 1990; Ingram & Baum, 1997a). Regardless, we expect learning to enhance the viability of multiunit organizations and their constituent plants. Moreover, more plants provide more points at which strategic experiments can occur.

Hypothesis 4. Greater cumulative operating experience increases organizational performance.

Multiunit Geography: Dispersion and Learning

Though largely absent from the research on organizational learning, the geographic dispersion of the organization likely influences the efficiency of knowledge transfer (Argote, 1999). The transfer of tacit knowledge can prove difficult even with face-to-face contact – without it, nearly impossible. Thus, knowledge tends to diffuse slowly through space (Jaffe, Trajtenberg & Henderson, 1993). Though organizations provide conduits for the transfer of this knowledge (Argote, Beckman & Epple, 1990; Greve, 1996), even within these institutions face-to-face contact seems less likely when employees must travel long distances to learn from their colleagues. Indeed, Jaffe and Adams (1996) find that spillovers within an organization decline rapidly with distance and several other studies suggest that organizations learn best within tight geographic boundaries (Argote, Beckman & Epple, 1990; Epple, Argote & Murphy, 1996; Greve, 1999). Thus, we expect geographic dispersion to reduce the efficiency of knowledge transfer in the organization, thereby limiting the returns to learning across units.

A second issue regarding geographic dispersion and organizational learning relates to the usefulness of the knowledge being transferred. As the similarity of two components declines, it becomes increasingly likely that routines learned at one unit would not improve the performance of the other unit. For example, Banaszak-Holl et al. (2000) find that chains acquiring nursing homes unlike their existing units encounter more difficulties improving performance at these newly acquired sites. Units that reside in geographically distant locations often face different factor markets, product markets and distribution channels. These differences can limit the usefulness of (or perhaps even make harmful) transferring routines from one constituent unit to another. Both Ingram and Baum (1997b and this volume) and Greve (1999) find evidence that geographically distant experience benefits chain components less than local experience. Thus, we expect dispersed organizations to generate knowledge with less applicability on average to all of their constituent units.

> *Hypothesis 5*. Geographically dispersed firms benefit less from cumulative operating experience than geographically concentrated organizations.

Multiunit Disadvantage: Bureaucratization

Although organizing into multiple units might improve the organization's ability to realize product-specific economies and to improve efficiency through incremental learning, the multiunit form also has its drawbacks. Chandler (1977, 1990) persuasively argues that the number of operating units, rather than the total assets or the size of the workforce, determines the number of middle and top managers, the nature of their tasks, and the complexity of the institution they manage. Based on his historical analysis, Chandler observes that:

> Each unit has its own administrative office, its own managers and staff, its own set of books, as well as its own physical facilities and personnel. The activities of the managers of these units (lower level managers) are monitored and coordinated by a full-time top-level executive, or a team of such executives, who plan and allocate resources for the operating units and the enterprise as a whole (1990: p. 15).

Although these administrative structures critically allow multiunit organizations to achieve product-specific economies and to generate and transfer knowledge across units through their coordinating activities, this bureaucratization also constrains organizations' ability to adapt to changing environments (Hannan & Freeman, 1984). Decisions become farther removed from the locus of execution, which can lead to frequent delays and mistakes as the complexity of the decision-making process increases. Operating procedures that ensure individuals perform tasks in an efficient manner across establishments can generate additional inflexibility because adaptation requires managers to overrule well-established control systems. When change does occur, it often fails to account adequately for shifts in environmental conditions because long-term planning and time consuming compromises between conflicting departments introduce political interests into the decision-making process (March & Olsen, 1976). Lending support to this account, Sherer et al. (1975) in their study of multiunit firms report virtual unanimity among the people they interviewed that decision making slows in large multi-plant firms and that top executives became more isolated from operational problems, potentially degrading the quality of managerial decisions. This organizational rigidity becomes most pronounced when changes in environmental conditions invalidate the old way of doing things.

> *Hypothesis 6*. Dividing production across a larger number of facilities decreases performance when the environment shifts.

DATA AND METHODS

To test these hypotheses, we analyzed the evolution of the U.S. footwear industry from 1940 to 1989. Some historical background on the industry may prove useful.

History of the Shoe Manufacturing

In his study of shoemaking from 1649 to 1895, Commons (1909) provides a fascinating and detailed account of the evolution of production arrangements in the industry. At first, itinerant shoemakers traveled with their tools from house to house making shoes to customers' specifications. Craftsmen, who worked in their own shops, began to replace these itinerant shoemakers at the end of the 17th century. Then, during the 18th century, the increased concentration of people in space created markets for standard shoe sizes and shapes, spurring additional changes in the organization of shoe production. Although the technology of shoe production remained largely unchanged, this movement away from bespoke shoe manufacturing generated economies of scale that led craftsmen to specialize in their production activities (Commons, 1909).

The McKay sole-sewing machine, introduced in 1862, dramatically changed the business of making shoes. By reducing eighty hours of work, using traditional production methods, to just one hour, using the McKay machine, it justified the centralization of production, facilitating the transition from a craft system to a mass production system (Commons, 1909; Hansen, 1959). Nevertheless, until the 1920s, single plant firms accounted for nearly all production. Two factors aided the dominance of small single-unit organizations: First, the production process allowed efficient manufacturing in plants of varying size (Hoover, 1937; Szenberg, Lombardi & Lee, 1977). Second, the widespread practice of leasing machinery minimized the need for startup capital (Davis, 1940; OECD, 1976).

Beginning in the 1920s, single-unit firms began to face a new type of competitor: the multiunit firm.[4] Two features distinguished this form: it comprised a number of distinct units and a hierarchy of full-time salaried executives managed it (Chandler, 1977). Despite the low barriers to entry that characterized the industry, multiunit firms grew rapidly to become important players. In 1957, the four largest firms, Endicott Johnson, Brown Shoe, General Shoe, and International Shoe, respectively operated 25, 27, 31, and 45 plants, and together accounted for 23% of domestic production (Hansen, 1959).

The U.S. footwear industry remained relatively stable from the advent of mass production until the 1960s. Starting in the sixties, several external changes began altering the competitive landscape. Synthetics, which required new production technology, started to replace leather (OECD, 1976) and auxiliary industries introduced several new procedures for manufacturing leather shoes (Boon, 1980). Moreover, markets became more and more fashion oriented – increasingly requiring manufacturers to monitor and adapt to fickle consumer preferences instead of producing classic styles for years on end (OECD, 1976). Footwear manufacturers in the United States found it difficult to adapt to these radical changes (Duchesneau, Cohn & Dutton, 1979; OECD, 1976; USITC, 1984).

A flood of imports swamped the U.S. footwear industry, growing from 26.6 million pairs in 1960 to 241.6 million in 1970 (Footwear Industries of America, various years). Easy access to raw material, cheap labor, and low barriers to entry allowed countries such as South Korea and Taiwan to develop export capabilities quickly (OECD, 1976). Strong political pressure led the U.S. to establish import quotas for South Korea and Taiwan in 1977, but the government terminated all import relief following the expiration of these quotas; President Reagan vetoed a Senate Commission's proposal to extend them. In the 1980s, imports exploded – led this time by Brazil and China – peaking at 940.8 million pairs, 82% of the U.S. market (Footwear Industries of America, various years).

This radical change in the competitive landscape prompted a variety of strategic responses by American manufacturers in the 1980s. Many of the larger firms adopted automation to compete on time, capitalizing on growing retail channel demand for just-in-time delivery (Freeman & Kleiner, 1998; Hazeldine, 1986; Warrock, 1985). Lacking the scale to justify and the resources to implement these improvements, many smaller manufacturers retreated to high quality niches (Bahls, 1989; Freeman & Kleiner, 1998). Some companies acted as middlemen, selling imported shoes through their distribution channels, but few manufacturers moved their own production abroad (Warrock, 1985). Although these changes improved the competitiveness of American shoe manufacturers, for many firms, it proved too little, too late; between 1968 and 1989, the number of plants operating in the U.S. fell from 1330 to 632.

Sample and Data Sources

The data incorporated the histories of all American shoes manufacturing plants from 1940 to 1989. The *Annual Shoemaking Directory of Shoe Manufacturers*, a comprehensive listing of footwear manufacturers published by the Shoe Traders Publishing Company, provided most of the data. For each plant, this publication contains a rich array of information including the year of its founding, the year of its closure, daily output, and the plant's owner. Annual data from *Moody's* and *Footwear News* supplemented the information in the *Shoemaking Directory*. Data on international trade tracing the imports of footwear came from publications of the Footwear Industries of America.

The data included information on 5119 distinct shoe manufacturing plants. During the study period, 4116 new plants opened, while 1003 plants opened prior to 1940. Using editions of the *Shoemaking Directory* that date back to 1921, we determined the founding dates for 758 of these left-censored plants. The remaining 245 plants with unknown founding dates received a founding year of 1921 and a dummy variable marking them as left-censored observations. Of the plants in the data set, 4395 ceased operations by the end of 1989. The cessation of plant operations defined a failure event at the plant level. Changes in name or ownership did not indicate plant failure because the plant continues to produce shoes. Nevertheless, this information did allow us to track changes in multiunit organizations. Often a change in ownership implied shrinkage or expansion of a multiunit organization. For single-unit organizations, plant founding and failure coincided with organization founding and failure. For multiunit organizations, founding occurred with entry of its first plant; failure occurred when the last plant closed. Figure 1 depicts the density of the population, average plant output and imports over time.

Model

To test our propositions, we estimated organization and plant exit rates as a function of industry, plant and organization level characteristics. Although one could use other measures of performance, exit provided a particularly useful

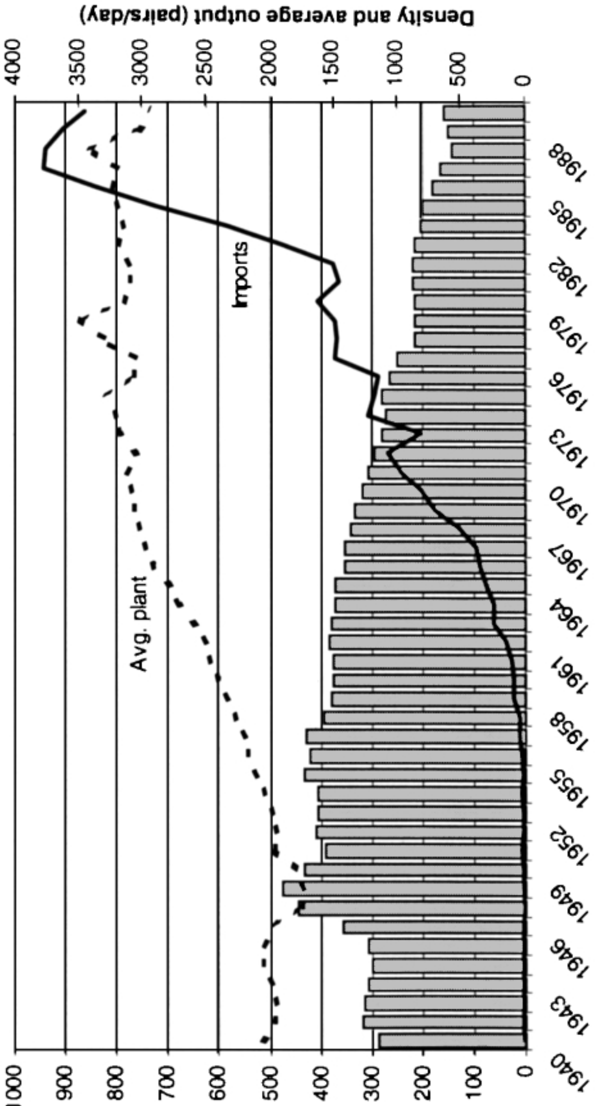

Fig.1. Shoe Manufacturer Population, 1940–1989.

measure in these data for two reasons. First, the preponderance of private firms (>90% of firm-years) precludes the use of profit information. Exit provided an observable outcome for every firm in the industry. Second, relatively few organizations exited through acquisition. Therefore, exit likely represented an unsatisfactory outcome for both the managers and investors involved. We estimated all models as instantaneous hazard rates of market exit:

$$\mu_i(t) \lim_{\Delta t \to 0} \frac{\Pr(t < T \leq t + \Delta t \mid T > t)}{\Delta t}$$

where T is a random variable for the time of firm exit, t is the time that organization i has spent in the shoe industry, Pr(.) is the probability of firm exit over the interval $[t,\ t + \Delta t$ given that the organization belonged to the risk set at the beginning of the interval, and the rate can vary as a function of organization age. We implemented these models using TDA (Rohwer, 1995).

Use of the instantaneous hazard rate allowed us to estimate the risk of market failure while explicitly controlling for age dependence (Tuma & Hannan, 1984). Researchers have found a variety of relationships between age and failure rates. Early research typically found that failure rates declined as organizations aged (e.g. Carroll, 1983). However, subsequent studies find nearly every conceivable relationship between age and mortality rates (for a review, see Baum, 1996). To control for age dependence and avoid the possibility of misspecification, we employed the piece-wise exponential model, which does not require one to assume a functional form for time dependence. The piece-wise exponential splits time into pieces (dummy variables) according to the age of the organization. The base failure rate remains constant within each piece, but base rates vary freely across age pieces. We selected age intervals of 0–3 years, 3–10 years, 11–20 years, and over 20 years. As an additional benefit, left censoring, which exists in these data, does not bias estimation of the piece-wise exponential (Guo, 1993). Nonetheless, we included a dummy variable to account for any systematic differences across the left-censored cases introduced by the downward bias in our age measures for these cases.

Measures

Plant count indicated the number of plants, in excess of one, commonly owned by the same company.[5] We expected the number of plants to reduce both organization and plant failure rates (Hypothesis 1). To test the effect of multiple plants under changing environmental conditions (Hypothesis 6), we interacted this variable with imports and expected the interacted term to increase plant and organization failure rates.

Geographic dispersion captured the average distance between manufacturing facilities in hundreds of miles. To generate this variable, we located each plant in space using the longitude and latitude of the town in which the plant resided. Then, we calculated the distance between each dyad (i.e. pair of plants) using spherical geometry, logged these dyadic distances, and averaged them across all possible dyads within the firm (an analogue to the weighted density term in Sorenson & Audia, 2000).[6] Larger values on this variable indicate greater degrees of dispersion. For the plant-level analyses, we constructed this variable individually for each plant. We anticipated decreasing failure rates with dispersion due to the benefits of multi-local production (Hypothesis 2).

Multi-market contact allowed us to estimate the potential benefits of meeting competitors in multiple markets. To create this measure, we simply counted, for each multiunit firm, the number of geographic markets (defined as towns) in which they met each other multiunit firm. We then averaged this count across all multiunit organizations that the focal firm met in local markets. For example, if firm A met firm B in 3 markets and firm C in 4 markets, then it would receive a multi-market contact score of 3.5 [= (3 + 4)/2]. High levels of this measure indicated a higher degree of multi-market contract.[7] Therefore, we expected multi-market contact to decrease failure rates (Hypothesis 3).

Experience provided our measure for the effects of organizational learning. Following Ingram and Baum (1997a, 1997b) and Greve (1999), we cumulated years of operating experience to form an indicator of organizational learning.[8] We logged the experience measure to account for decreasing returns. In the plant-level models, we separated out experience in the focal plant from experience at other plants that belong to the same owner. We expected experience to decrease both organization and plant exit rates (Hypothesis 4).

To test the limits that dispersion placed on organizational learning, we created two interaction terms between operating experience and dispersion. For the organization models, we multiplied the average distance between plants by the number of plants in operation before cumulating these experience figures over time. Thus, a positive effect for this interaction suggests that dispersed firms learn more slowly than concentrated firms (Hypothesis 5). The plant-level models used a slightly different measure. Here, we weighted the experience associated with all plants other than the focal plant by the inverse of their distance from the focal plant. The two measures differed because the plant-level models had an obvious reference point – the focal plant – while the organization-level models did not.

Imports in billions of pairs of shoes in a given year provided an indicator of environmental change in the shoe industry. Although the rise of imports marked a clear change in the competitive landscape for the industry, we remained agnostic as to whether the rise of imports itself changed the industry or whether imports arose from several interrelated changes in production technology, materials and consumer preferences. Regardless, we expected firms with multiple plants to adjust more slowly to these changes, and therefore to suffer declining performance (Hypothesis 6).

Control Variables

Plant size controlled for plant-level economies of scale. The technology of production might require that organizations operate at multiples of some discrete size to minimize per unit costs – often referred to as the minimal efficient scale, or MES (e.g. Scherer & Ross, 1990). Various studies of shoe manufacturing estimate that plants producing more than 2500 shoes per day generate 15% to 28% higher gross profits than smaller facilities[9] (Bain, 1956; Szenberg, Lombardi & Lee, 1977). Plant size measured the number of pairs of shoes manufactured each day. Unfortunately, roughly 70% of cases did not report output information in any given year. To increase the number of usable cases, we used straight-line interpolation to estimate production information for plants with gaps in their reported size information. Interpolation increased the percentage of usable cases in the plant level models from 30% to 92% and in the organization level models from 26% to 91%.[10] Since we considered size an important control variable, only those cases with size information available entered the analyses. In the organization-level exit models, we included only organization size because this variable together with the number of plants already captures the impact of plant-level (technology-specific) economies of scale.

Organization size captured many types of production economies stemming from the ability to amortize certain costs (e.g. administrative) over a large number of units. Since scale economies operate as a function of size, these effects could spuriously affect the plant count measure without a control for organization size. This variable also accounted for the fact that large organizations might experience advantages beyond those captured by plant size and the number of facilities as a result of their power relative to buyers and suppliers (Pfeffer & Salancik, 1978) or their stock of slack resources (Cyert & March, 1963). Organizational size summed the shoes manufactured per day by all plants in a common ownership group.

We also controlled for the effects of fundamental variables influencing the carrying capacity of the industry, such as density and population. A large body of research in organizational ecology demonstrates that the number of firms in an industry crucially affects the mortality rates of organizations (for a review, see Baum, 1996). This theory posits a U-shaped relationship between the number of organizations and mortality rates (Hannan & Freeman, 1989; Hannan & Carroll, 1992) for populations of organizations observed since their birth. Nevertheless, our left-censored sample cannot actually test density-dependence because late low density – when legitimacy might not decline – rather than low density at the population's emergence drives the linear term (Baum & Powell, 1995). Regardless, we included organization and plant density as control variables. **Density** counted the number of firms in the industry. **Plant density** tallied the number of plants operating in a given year. Although ecology studies typically use organization density, those studies that analyze site-level data commonly use site density (e.g. Baum & Mezias, 1992). **Population**, a proxy for domestic demand, counted the number of people in millions living in the United States in a given year. **Year**, which tracked the number of calendar years since the beginning of our observation period, captured other factors that vary systematically with the passage of time. Table 1 displays the descriptive statistics for these variables. Table 2 reports estimates for Models 1 through 5.

Table 1. Descriptive statistics for organization-level characteristics (4,341 firms for 51,581 firm-years).

Variable	Mean	Std. Dev.	Minimum	Maximum
Organization age	11.83	11.13	0	49
Density	1,134.47	301.53	438	1,656
Plant density	1,358.75	321.82	566	1,893
Imports	1.42	2.28	0.002	9.41
Population	1,770.44	395.37	1321	2,504
Organization size	3,903.03	16,922.69	1	1,897,500
Plant count	0.21	1.77	0	52
Dispersion	0.34	0.77	0	3.30
Multi-market contact	0.24	1.23	0	8
Experience	18.94	45.89	0	1,179
Avg. plant size	2,689.06	4,170.69	1	110,000
Left-censoring	0.00	0.06	0	1

Table 2. Organization level exit models.†

	Model 1	Model 2	Model 3	Model 4	Model 5
Age 0–3 years	0.899	0.908	0.890	1.516	1.779•
	(0.791)	(0.790)	(0.790)	(0.790)	(0.788)
Age 3–10 years	1.308	1.318	1.299	2.575••	2.844••
	(0.792)	(0.791)	(0.791	(0.792)	(0.790)
Age 11–20 years	0.836	0.845	0.836	2.537••	2.816••
	(0.791)	(0.790)	(0.790)	(0.794)	(0.792)
Age 20+ years	0.879	0.902	0.900	2.905••	3.129••
	(0.794)	(0.794)	(0.794)	(0.798)	(0.796)
Year	0.040••	0.040••	0.040••	0.031••	0.033••
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Density/100	1.865••	1.859••	1.845••	1.624••	1.683••
	(0.240)	(0.240)	(0.240)	(0.240)	(0.241)
$Density^2$/10,000	–0.070••	–0.070••	–0.069••	–0.056••	–0.056••
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)
Plant density	–2.102••	–2.100••	–2.087••	–1.905••	–1.962••
	(0.269)	(0.269)	(0.269)	(0.269)	(0.269)
Plant $density^2$/1000	0.072••	0.072••	0.071••	0.061••	0.061••
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)
Imports	0.446	0.443	0.430	0.449	–0.284
	(0.318)	(0.318)	(0.318)	(0.318)	(0.331)
Population	–0.005••	–0.005••	–0.005••	–0.005••	–0.005••
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Ln (organization size)	–0.094••	–0.089••	–0.085••	–0.080••	–0.115••
	(0.006)	(0.006)	(0.006)	(0.006)	(0.007)
Plant count		–0.181••	–0.029	–0.027	–0.037
		(0.040)	(0.032)	(0.033)	(0.075)
Geographic dispersion			–0.501•	–1.028•	–1.581•
			(0.195)	(0.559)	(0.791)
Multi-market contact			–0.159••	–0.136••	–0.122••
			(0.037)	(0.037)	(0.037)
Ln (experience)				–0.487••	–0.489••
				(0.025)	(0.025)
Ln (experience) X				0.241•	0.384•
geographic dispersion				(0.121)	(0.200)
Imports X plant count					0.240•
					(0.986)
Imports X ln (org. size)					0.119••
					(0.015)
Left censored	–1.776	–1.761	–1.751	–0.811	–0.767
	(1.003)	(1.003)	(1.003)	(1.004)	(1.005)
Log-liklihood	–14,292.11	–14,272.12	–14,252.29	–14,080.46	–14,042.85
χ^2 (d.f.)		40.0 (1)	39.7 (2)	343.7 (2)	75.2 (2)

† 4,341 firms; 3,836 exit events.

RESULTS

Model 1 provided a baseline for our hypothesis tests. The control variables behave sensibly in the baseline. Population increases, which expand the potential domestic market and presumably ease competition, decrease failure rates. Moreover, the declining failure rates with size correspond to our notions of the advantages that these firms hold in terms of economies of scale, power and buffering mechanisms.

Model 2 included the plant count to test Hypothesis 1. The addition of this variable significantly improved the model ($\chi^2 = 40.0$, 1 d.f.). Multi-plant firms appear to enjoy an advantage relative to single-unit organizations even after controlling for scale.

In Model 3, we added measures of geographic dispersion and multi-market contacts to test Hypotheses 2 and 3. Firms that locate their plants such that they meet other multiunit firms in several markets appear able to obtain a reduction in competition. As the degree of multi-market contact increases, the likelihood of firm exit declines, supporting Hypothesis 3. This competitive forbearance apparently offers substantial benefits to the firm as organizations exhibiting the maximum degree of multi-market contact enjoy a 42% reduction in exit rates relative to their single market rivals. However, mutual forbearance alone does not explain the multi-local advantage. Even after explicitly accounting for multi-market contact, results indicate that firms with geographically dispersed production outperform those that concentrate production, in support of Hypothesis 2. The inclusion of these spatial configuration measures not only improved the model ($\chi^2 = 39.7$, 2 d.f.), but also appears to explain much of the multi-plant advantage, as the number of plants has no independent effect following the inclusion of these variables. We interpret this pattern as suggesting that multiunit firms benefit from their spatial configurations rather than from the reduction of line setup costs and inventories through plant specialization, leading us to reject Hypothesis 1.

Model 4 included the experience terms to account for organizational learning and test Hypotheses 4 and 5. Model 4 dramatically improves the model ($\chi^2 = 343.7$, 2 d.f.) and provides substantial evidence that multiunit firms benefit from enhanced organizational learning. As organizations accumulate operating experience, their failure rates decline, supporting Hypothesis 4. The interplay between experience and dispersion lends further credence to this interpretation. As expected in Hypothesis 5, firms that disperse their units geographically benefit less from the accumulation of operating experience.

Model 5 added interaction terms between imports and plant count and organizational size to test Hypothesis 6. These additions built significantly on Model

4 (χ^2 = 75.2, 2 d.f.) revealing strong evidence for the rigidity of multiunit firms. Although multiunit firms generally enjoy performance advantages relative to their single-unit rivals, this advantage erodes when the environment shifts substantially (in this case, in the form of rising imports). Thus, dividing production into multiple facilities does impose a cost on the organization, in the form of lost adaptability. By controlling for the interaction between organizational size and imports, Model 5 rules out the possibility that this disadvantage captures some type of resource partitioning that large organizations might experience by competing in market segments more vulnerable to international competition (Carroll, 1985).

Though these results appear robust, the experience measure reported in Models 1 through 5 does not incorporate discounting. Nevertheless, previous studies typically find that discounted measures of experience provide better estimates of learning because these measures account for the fact that old routines likely benefit the firm's operations less than more recently acquired knowledge (Argote, 1999; Greve, 1999; Ingram & Baum, 1997a). Therefore, we re-estimated model 5 using the various discount factors suggested by Ingram and Baum (1997a). Specifically, we generated three measures that weight prior learning according to the age of that learning in years. One measure divides previous learning by the square root of the number of years since the learning occurred; another divides it by the simple age of the experience; the final one divides experience by the square of its age. Because the models do not nest, we use the change in the Bayesian Information Criterion (BIC) to compare the models (Raftery, 1995). Model 5 provides the baseline for ΔBIC. Therefore, positive values for the difference indicate that model 5 provides a better fit to the data, while negative values signify the inferiority of model 5 to the model being compared to it. When the magnitude of ΔBIC exceeds 10, Raftery (1995) suggests that we should strongly prefer the model with the lower BIC. Table 3 shows the results of these estimates.

Unlike previous research, the model without discounting provides the best fit to our data. Model fit actually declines with the sharpness of the discounting of prior experience. This pattern points to a problem with using discounting on multiunit experience measures. For example, note that discounting according to the square of knowledge age weights recent experience so heavily that it nearly collapses to a count of the number of plants (r = 0.98). Thus, independent of the plant count, this discounted measure primarily picks up changes in the number of plants. As such, it captures the impact of opening and closing plants, rather than cumulated experience. Regardless, the models do illustrate the robustness of our other findings with respect to alternative specifications.

Table 3. Estimates of learning decay parameters.[†]

	Model 5	Model 6	Model 7	Model 8
Ln (organization size)	–0.115••	–0.115••	–0.117••	–0.120••
	(0.007)	(0.007)	(0.007)	(0.007)
Plant count	–0.037	–0.063	–0.111	–0.354••
	(0.075)	(0.092)	(0.099)	(0.110)
Geographic dispersion	–1.581•	–1.610•	–0.060	–1.191•
	(0.791)	(0.742)	(0.552)	(0.562)
Multi-market contact	–0.122••	–0.115••	–0.119••	–0.136••
	(0.037)	(0.037)	(0.037)	(0.038)
Ln (experience)	–0.489••			
	(0.025)			
Ln (experience) X	0.384•			
geographic dispersion	(0.200)			
Ln (experience)/$\sqrt{\text{age}}$		–0.919••		
		(0.058)		
Ln (experience)/$\sqrt{\text{age}}$ X		0.807•		
geographic dispersion		(0.397)		
Ln (experience)/age			–0.480••	
			(0.074)	
Ln (experience)/age X			–0.089	
geographic dispersion			(0.231)	
Ln (experience)/age^2				0.769••
				(0.100)
Ln (experience)/age^2 X				0.224
geographic dispersion				(0.295)
Imports X plant count	0.240•	1.891•	2.519•	2.965••
	(0.986)	(0.912)	(1.050)	(1.147)
Imports X ln (org. size)	0.119••	0.132••	0.122••	0.115••
	(0.015)	(0.015)	(0.015)	(0.015)
Left censored	–0.767	–1.989	–1.883	–1.379
	(1.005)	(1.003)	(1.003)	(1.004)
Log-liklihood	–14,042.85	–14,094.53	–14,194.15	–14,182.53
Δ BIC (vs. model 5)		103.4	305.6	279.4

[†]4,341 firms; 3,836 exit events, estimates of control variables not shown

The data also allowed us to verify whether organization level results hold at the plant level of analysis – an interesting test since most studies of multiunit organizations have analyzed data on productive units rather than organizations. Table 4 presents the results of these investigations. Model 9 essentially replicates Model 5 using plant exit, rather than organization exit, as the dependent variable. To create a model consistent with much of the existing research on constituent

Table 4. Plant level exit models.

	Model 9 Plant Exit	Model 10 Plant Exit Single plants	Model 11 Plant Exit Mult-plants
Age 0–3 years	–3.773••	–4.319••	–3.362
	(1.153)	(1.253)	(3.173)
Age 3–10 years	–2.660••	–3.222•	–1.850
	(1.158)	(1.259)	(3.175)
Age 11–20 years	–2.978••	–3.545•	–2.066
	(1.161)	(1.263)	(3.185)
Age 20+ years	–2.964••	–3.534••	–2.080
	(1.163)	(1.264)	(3.187)
Year	0.031	0.017	0.114
	(0.025)	(0.027)	(0.069)
Plant density/10	0.009	0.008	0.023
	(0.008)	(0.009)	(0.020)
Plant density^2/1000	0.002	0.002	–0.003
	(0.003)	(0.003)	(0.007)
Imports	1.229••	1.428••	–0.291
	(0.293)	(0.324)	(1.083)
Population	–0.003••	0.002	0.002
	(0.001)	(0.010)	(0.003)
Plant count	–0.063••		–0.038••
	(0.011)		(0.012)
Ln (plant size)	–0.100••	–0.101••	–0.121••
	(0.006)	(0.006)	(0.016)
Ln (other organization size)	–0.067••		–0.091•
	(0.012)		(0.037)
Weighted distance	0.0032		0.003
	(0.003)		(0.002)
Multi-market contact	–0.007••		0.012••
	(0.003)		(0.005)
Ln (plant experience)	–0.369••	–0.373••	–0.323••
	(0.035)	(0.038)	(0.111)
Other organization experience	0.006••		0.005••
	(0.001)		(0.001)
Other organization experience/ distance	–0.006••		–0.006••
	(0.001)		(0.001)
Imports X plant count	–0.104••		–0.085••
	(0.025)		(0.029)
Imports X ln (organization size)	0.108••	–0.170	0.218••
	(0.023)	(0.149)	(0.094)
Left censored	–1.143	–1.070	–0.988•
	(9.146)	(6.577)	(17.84)
Log-liklihood	–15181.0	–13130.9	–2034.9
Plants	5127	4410	717
Exits	4609	4018	591

units (e.g. Ingram & Baum, 1997a), we included plant density and calculated organizational measures, such as experience, with respect to the focal plant. We also split the population into two groups[11] – independent plants and plants that belong to multiunit organizations. Model 10 reports the results for plants that operate independently, while Model 11 provides the estimates for plants that belong to a larger collective. Although these models differ significantly in a statistical sense (($\chi^2 = 30.4$, 13 d.f.), the two models bear remarkable similarity to each other, though notably while imports primarily hurt the larger multi-plant manufacturers, they appear to affect all single-plant organizations equally.

Comparing the plant level models to the organization level analyses reveals interesting disjunctions. First, the interaction between imports and plant count suggests that whereas multi-plant firms experience higher failure rates when imports rise their constituent units appear less likely to close with the influx of imports. Second, the weighted distance variable indicates that, although geographic dispersion improves firm performance, plants located distant from the company's other operations do not enjoy lower exit rates. Third, despite the beneficial effects of multi-market contact, plants that substantially expand the firm's exposure to multi-market contact appear most likely to close.

DISCUSSION

This study demonstrates that – holding constant organizational size – different configurations of production activities influence the effectiveness of the entire organization and of its components. More precisely, our study demonstrates that having multiple sites offers both benefits and liabilities to the firm. During the relatively stable environment of the U.S. footwear industry prior to the 1960s, operating multiple establishments increased the viability of multiunit organizations and their plants through enhanced organizational learning and advantageous spatial configurations. This competitive advantage, however, depended crucially on the environment. To operate effectively, multiunit firms developed complex bureaucratic structures that stifled their ability to adapt to radical external changes (Chandler, 1977; Hannan & Freeman, 1984). Thus, when the environment changed, beginning in the 1960s, multiunit organizations became disadvantaged relative to independent plants.

Our results contribute interesting data to the study of organizational learning. Consistent with evidence on service and retail chains (Argote, 1999), we find that operating experience lowers the failure rate of multiunit producers and their units. The diffusion of incremental process improvements across the firm's facilities appears to increase its productive efficiency over time. However, the fact that the number of plant-years of experience, our measure of organizational learning, generates strong effects on organization performance raises interesting theoretical and measurement issues for research on organizational learning. Our analyses suggest that organizing production into a larger number of smaller plants increases the organization's capacity for learning. Nevertheless, studies that measure experience in terms of cumulative output – the typical metric used to capture organizational learning effects (e.g. Darr, Argote & Epple 1995) – miss the impact of the structure of production on learning because producing the same number of units in one plant or ten yields the same measure of experience. That approach overlooks the fact that managers may find it difficult to evaluate information derived from a single site. Multiunit firms may also benefit from the ability to observe and learn from a larger number of rivals (Loree & Cassidy, this volume). Thus, even holding constant aggregate output, firms might learn more when production occurs across several facilities. Elaborating this relationship between organizational structure and learning strikes us as a rich topic for future research.

This study also presents strong evidence that multiunit producers enjoy an advantage relative to single-unit firms as a result of their spatial configurations. Geographic dispersion lowers organizational failure rates. Holding other factors constant, a one standard deviation increase in the degree of geographic dispersion in plant locations (an increase in the average distance between plants of 77 miles) predicts a 70% decline in the likelihood of firm exit. Theories of location suggest that these dispersion effects might stem either from a reduction in the transportation costs required to ship products to buyers or from the diversification of location specific risks. In this particular case, diversification of risk may play a stronger role since studies reveal that shipping accounts for only a small percentage of total production costs in the footwear industry (Hoover, 1939; Raehse & Sharpley, 1991). Thus, one might expect even stronger advantages to geographic dispersion in industries with high costs for transporting goods to the consumer. Firms with a higher degree of multi-market contact also exhibited lower failure rates, presumably because multi-faceted interaction with competitors allows these firms to avoid competitive escalation.

Though spatial configuration can benefit the multiunit firm, managers of these organizations face tradeoffs in their decisions. The multiunit firm's learning advantage depends critically on geographic dispersion, with concentrated firms benefiting the most from the accumulation of operating experience. Learning in the multiunit organization involves both the generation of new knowledge and the diffusion of knowledge across units. Not only does the difficulty of transferring knowledge across facilities increase with distance, but also the likely usefulness of that knowledge declines across space. In our study, when the average distance between facilities exceeds 127 miles (roughly one quarter of the multiunit firms), additional operating experience actually *increases* the likelihood of organizational failure, a result that matches Ingram and Baum's (1997a, 1997b, this volume) finding that non-local operating experience degrades unit performance. Only recently have researchers begun to explore how organizational processes unfold in space, for example with studies of interlocking directorates (Kono et al., 1998) and ecological work on the spatial range of competition and legitimacy (Carroll and Wade, 1991; Hannan et al., 1995). This research proves further evidence of the need for continued investigation of this issue.

Managers should note: The benefits of the multiunit firm do not come free. In the face of changing environmental conditions, multiunit firms appear unable to adapt. Though we attribute this rigidity to bureaucratization, inertia might also arise from investments in inflexible production technologies. The volume-driven pursuit of efficiency leads managers of multiunit organizations to favor incremental improvements in the production process over the introduction of radical innovations and/or the launch of new products (Utterback & Abernathy, 1975). This narrow focus on efficiency can result in the development of rigid technologies that impair the ability of multiunit organizations to adjust their product mix to environmental changes. In contrast, lacking the expertise and the resources to invest in sophisticated production techniques, single-unit firms may focus their efforts on finding the right market segment. By doing so, they develop the ability to switch from niche to niche in response to fluctuations in demand. Regardless, the expectations associated with the adoption of rigid technologies differ little from those generated by bureaucratic rigidity.

The discrepancies between the organization-level and plant-level analyses strike us as interesting for two reasons. First, they clearly demonstrate that analyzing the results at the level of the constituent unit can miss important factors in organizational performance. For example, using only the plant-level analyses, one would likely conclude that geographic dispersion does not impact firm performance and might think that multi-market contact actually produces detrimental outcomes, though the organization-level analyses reveal the fallacy of these conclusions. The problem stems from the fact that plant-level exit models confound internal managerial decisions with environmental selection (i.e. performance). This confound brings us to the interesting theoretical implications of these discrepancies: They show that managers fail to reconfigure their organizations in a manner that maximizes firm performance (regardless of their intentions). For example, though closing the most distant plants reduces the dispersion of the organization as a whole and closing the plants with the highest exposure to multi-market contact reduces the opportunities for mutual forbearance – both actions that hurt organizational performance – managers show no propensity to avoid these actions.

Our results contribute to the organizational research in several ways. First, by linking organizational learning to the literature on experimental design, we provide a strong argument and evidence for why multiunit firms might enjoy accelerated organizational learning. Second, the presence of multiunit advantage in the shoe industry extends the evidence for the advantages of this organizational structure beyond industries with local markets, such as hotels and banks, to an industry with a national market. Third, our paper considers explicitly the role of geographic dispersion in the multiunit firm, a factor particularly relevant to these national markets. Fourth, we argue and demonstrate that the multiunit advantage might only exist during periods of environmental stability. Fifth, our results demonstrate that the results of analyses carried out at the organization- versus the plant-level may yield very different accounts and managerial prescriptions.

This study also suggests interesting new directions for future research on multiunit organizations. Future studies might delve more deeply into those factors that make certain multiunit firms more effective than others. For example, some multiunit firms might reduce the negative impact of dispersion on learning by adopting new technologies that widen and accelerate communication channels (e.g. intranets), or limit bureaucratic inertia by outsourcing less critical stages of their production activities. The direct examination of the factors underlying the multiunit effect – for example, knowledge transfer across units and bureaucratization – strikes us as another interesting line of investigation. Although an in-depth understanding of how multiunit firms function offers clear benefits, the difficulty of this approach lies in obtaining direct measures of these underlying processes. Unlike our study, which covers an entire industry for a period of fifty years, the need for such data would probably confine the investigation to a shorter period of time and a much smaller sample.

For managers, the results call attention to two important tradeoffs faced when designing the organization of production. The first tradeoff concerns the tension between maximizing efficiency and optimizing flexibility. Although splitting the firm's operations into a large number of units can generate efficiency gains through accelerated organizational learning, the bureaucracy necessary to manage these operations introduces substantial inertia that can hurt the firm in the face of radical environmental change. Moreover, growth through the opening of new facilities rather than the expansion of existing plants limits the firm's ability to realize plant-level economies of scale.

A less obvious tradeoff faces the managers of multiunit firms: Where should they locate these facilities? Geographic concentration facilitates the transfer of knowledge, but this centralization conflicts with the need to reduce transportation costs and diversify risk. The ideal balance between these two contrasting needs probably depends on the specifics of the industry. For example, in industries where proximity to customers seems key, like the dairy industry, managers might opt for dispersion to minimize transportation costs and diversify risk. By dedicating resources to the transfer of knowledge across sites, perhaps they can avoid the detrimental learning consequences of this configuration. In industries less affected by transportation costs – for example, computer hardware – managers may prefer geographic concentration hoping that the advantages to learning outweigh those of dispersion.

We introduced this paper asking whether the multiunit organization offered a new dominant mode of organization or whether it simply arose as a response to transient environmental conditions. Our study shed new light on the understanding of these two fundamental organizational forms by drawing on both economics and organization theory. From our analyses of the footwear industry, we can say that neither multiunit organizations nor single-unit organizations hold a position of absolute superiority. Rather, the optimal form shifts over time with changes in the underlying economics of production and in the dynamics of competition.

NOTES

1. Although automated production techniques introduced in the 1980s somewhat reduced the inefficiency of producing in small batches (Hazeldine, 1986), only the largest single plant firms could afford these new technologies (Freeman & Kleiner, 1998).

2. The Federal Reserve Board's statistical information on capacity utilization (available at http://www.bog.frb.fed.us/releases/) indicates that from 1967 to 1989, plants operated at roughly 80% of capacity, on average. Davis reports similar utilization rates before World War II (1940).

3. Unfortunately the data do not provide complete information about the production methods used in multiunit organizations. Nonetheless, 8% of our organization–years include production process information. The mean Herfindal index for production technologies in multiunit firms of 0.85 (SD = 0.22) indicates an extremely high degree of parallel production, as 1 corresponds to all plants using the same technology. Even firms with a large number of plants rarely use more than two production technologies.

4. Caves (1982) identifies three kinds of multiunit organizations: (1) those in which plants make similar goods (horizontal multiunit organizations); (2) those in which the products of some plants serve as inputs to other plants (vertical multiunit organizations); and, (3) those in which plants' outputs have no relation (diversified multiunit organization). We use 'multiunit' to refer to the first of these: horizontal multiunit organizations.

5. We also tested dichotomous (i.e. single-unit vs. multiunit) and non-linear specifications, but the linear count of productive units provided the best functional form for multiunit effects.

6. Logging the distance accounted for the fact that substitution between modes of transportation and communication typically prevents distance from relating to either the time or the expense of these activities in a linear fashion (Sorenson & Stuart, 2001).

7. Though Gimeno and Jeong (this volume) note that count measure of multi-market contact sometimes correlate highly with size, these data exhibit only a weak relationship between this measure and firm size (r = 0.27).

8. Some researchers suggest that cumulative output provides a better proxy for learning (Darr, Argote & Epple, 1995; Lieberman, 1984; Rapping, 1965). Using cumulative output yields did not change our models qualitatively, however, we feel more comfortable reporting the models using operating experience as our size measure relies heavily on interpolation.

9. Some of these studies (Bain, 1956; Simon & Bonini, 1958; Szenberg, Lombardi & Lee, 1977) find diseconomies of scale at production levels above 6000 pairs of shoes per day. Our data showed decreasing returns to plant scale; however we did not see evidence for actual diseconomies of scale. We simply logged plant size to account for the decreasing returns.

10. In unreported models, we included a dummy variable to denote cases with interpolated size measures. These models did not indicate any significant difference between the cases using interpolated data and the cases with observed size data.

11. Splitting the groups equates mathematically to interacting all terms in Model 6 with a dummy variable indicating membership in a larger organization.

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