

The Transfer of Experience in Groups of Organizations: Implications for Performance and Competition

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Groups of organizations are pervasive, although there is little systematic knowledge about how they affect their members. We examine one dimension of the operation of organization groups, the transfer of experience. Our core argument is that organization groups may create benefits for their members, but problems for those outside the group. Within the group they can facilitate the transfer of experience among their members by creating mechanisms for communication, incentives for helping, and by promoting understanding. The predicted pattern of experience transfer should improve performance of those within the group, but also has implications for those outside it. Experience accumulated in one organization group strengthens the competitiveness of its organizations, and thereby harms competitors outside the group. Thus, organization groups are fundamental both for the functioning of their members and the competitive dynamics of their industries. Our longitudinal analysis of the profitability of kibbutz agriculture supports both these claims. Between 1954 and 1965 (the years of this study), almost all kibbutzim were part of organization groups. Kibbutzim became more profitable as a function of the experience of others in their group. Their profitability was reduced, however, as a function of experience of others outside their group.

(Learning Curve; Knowledge Sharing; Profitability; Agriculture; Kibbutz; Groups)

Introduction

The image that interaction between organizations occurs at arms' length, across clear and meaningful organizational boundaries, is fading. It is being replaced by a recognition that organizations form groups which affect their conduct and performance. Granovetter (1994, p. 453) captures the phenomenon forcefully when he observes that "in every known capitalist economy, firms do not conduct business as isolated units, but rather form cooperative relations with other firms, with legal and social boundaries of variable clarity around such relations." He goes on to argue that questions of the existence and operation of

organization groups are as important as similar questions about firms, but have been neglected.

In this paper, we partially redress this neglect by analyzing kibbutz profitability in agriculture as it is affected by kibbutzim's (plural of kibbutz) groups. Kibbutzim are cooperative agricultural settlements and their groups are political federations. We focus on how the federation affects the transfer of experience among its members, and on the competitive impact of that transfer. To be sure, this is only one of many ways that groups can affect organizations. Recent reviews include among organization groups' benefits the increased access to inputs such as entrepreneurial talent, capital, and technology, as

well as the creation of political power, and tacit collusion among multipoint competitors (Ghemawat and Khanna 1998, Khanna and Rivkin 2001). The research from which those benefits have been derived, however, is based mainly on diversified groups—agglomerations of businesses in different industries, such as the Japanese keiretsu, or the broad-ranging family organization groups in India, Chile, and other countries. By contrast, the kibbutz federations are nondiversified, made up of similar organizations that participate in the same industry, agriculture. Nondiversified groups suggest particular effects which are the basis of our theory and analysis. Specifically, nondiversified groups have extra opportunities for knowledge transfer because they are engaged in the same activities, and the knowledge of one organization is typically most valuable to others that are similar. At the same time, the similarity among nondiversified organizations makes them competitors, which raises new issues for their internal operation and their interdependence with other groups. These distinct features of nondiversified organization groups lead us to examine the transfer of experience in those groups, and the competitive implications of that transfer.

A number of recent arguments point to experience (or more broadly, knowledge) transfer as a primary benefit of organizational interconnectedness. Indeed, some accounts emphasize experience transfer as the foundation for a rapidly developing network form of organization (Powell et al. 1996, Baker 1993). Building on the literature on interorganizational learning and networks, we argue that experience is more likely to be transferred and understood between organizations that are co-members in an organization group than between organizations that are not. The reasons are that group co-membership improves the opportunities and motivations for transferring experience and the capacity for organizations to successfully apply the experience of others. Opportunities for transfer within a group arise when the structure of the group puts participants of organizations together, and when personal relationships develop between those participants. The motivation to transfer is provided by sympathy between participants, which may be based on similarity and enhanced by comparisons to outgroups. The capacity for one organization to successfully apply the experience of another is enhanced by

the shared language and empathy that organization groups may create as well as by an awareness of what people know at other organizations in the group.

This pattern of experience transfer should create a within-group benefit, where organizations enjoy performance improvements as a function of the experience of others in their group. The first contribution of this paper is to test this claim. Such a test is not easy because it requires experience data from a whole industry, as comparisons must be made between the effect of group and nongroup experience (Granovetter 1994). There are some past-experience-curve studies that have satisfied that condition (Darr et al. 1995, Baum and Ingram 1998, Darr and Kurtzburg 2000). None of those studies, however, used profitability as the dependent variable. Our data allow us to examine profitability, which is a particularly appealing measure of performance. Further, the ties in those studies were a function of having the same owner, and may represent hierarchical integration rather than the middle-range association that Granovetter (1994) uses to define organization groups. By examining within-group transfer of experience in groups without co-ownership, we expand the evidence to ties based on elective affiliation as opposed to hierarchical integration. Without taking anything away from the significance of co-ownership as the basis for grouping, there are many other types of groups which cohere around ethnic, religious, political, geographic, or friendship ties that are significant to the performance of organizations and industries.

The second contribution of this paper is to highlight the implications of the transfer of experience for competitive dynamics. As organizations gain experience they become stronger, which harms their competitors (Barnett and Hansen 1996, Henderson and Cockburn 1996). This suggests that as some organizations benefit from the transfer of experience within a group, organizations outside of the group are harmed through the mechanism of competition. Thus, the significance of the organization group is not only for the functioning of its members, but also as a fundamental element of the competitive environment. Ours is the first paper to simultaneously recognize the dual effect of experience among organization groups—to benefit

within the group through transfer, but to cause harm outside it through competition.

These arguments are supported by our analysis of the profitability of kibbutz agriculture from 1954 to 1965. A given kibbutz became more profitable as other kibbutzim in its federation accrued experience. It became less profitable as other kibbutzim outside its federation accrued experience. Thus, a picture emerges of the kibbutz federations as primary units of experiential advance, and of competition.

Kibbutzim and Their Federations

Kibbutzim have played a central role in the political economy of Israel, and they are arguably the most successful utopian organizations in history (Kanter 1972, Near 1992, 1997). The political, economic, and organizational importance of kibbutzim, however, is a necessary but insufficient justification for studying them here. Therefore, we now provide the background for understanding the performance of kibbutzim, the operation of their federations, and the generalizability to other organization groups of our arguments and findings.

All kibbutzim are permanent settlements, existing on land leased from the Jewish National Fund. During the period we analyzed they were characterized by: economies based predominantly on agriculture, common ownership and democratic management of financial affairs, communal consumption and child care, and a centralized labor allocation system, which emphasized job rotation and the reliance on member (as opposed to hired) labor.¹ The number of kibbutzim was almost constant over this period, ranging from 215 to 220 (with seven foundings and two failures). Given that we study economic performance, it is notable that kibbutzim had the same profitability goals as for-profit organizations in Western economies: More product for internal consumption

and profit from external exchange were always preferred to less (Leviatan 1980, Kibbutz Ha'Artzi 1980). It is also notable that experience was an important determinant of performance for kibbutz agriculture. Indeed, one of the first experience-curve studies relating organizational experience to performance was conducted in kibbutz agriculture (Barkai and Levhari 1973), those authors focused on the influence of the kibbutz's own experience whereas we focus on the influence of others' experience.

Kibbutzim have always had significant organization groups in the guise of political federations. During the 1954 to 1965 period, the three major federations were Ha'Kibbutz Ha'Meuchad (from now on, Meuchad, accounting for 26% of the kibbutzim during the period we studied), Ha'Kibbutz Ha'Artzi (Artzi, 32%), and Ichud Hakvutzot Vehakibbutzim (Ichud, 34%). These three major federations all represent variants of Zionist and utopian ideology. Two smaller federations, Kibbutz Dati (Dati, 5%), and Poalei Agudat Israel (Pagi, 1%) included Judaism in their ideology. A few other kibbutzim (2%) were not affiliated with political federations, and we treat them as independent in our analysis.

These federations represented their members politically, but they did much more. Co-membership in a federation was a decidedly "thick" tie between kibbutzim, implying shared ideology and numerous mechanisms of contact between individuals in co-member kibbutzim. Interkibbutz transfer of experience was explicitly identified as a result of federation co-membership (Near 1997, p. 236), and was encouraged by the federations through reports and seminars (Hashavuah Bakibbutz Ha'Artzi 1960, issue 524, pp. 6-7).

It is also important to emphasize something that the federations did not do, which was to limit competition among their members. The federations did not coordinate the production of their member kibbutzim, and they did not grant exclusive marketing territories to their members, which are the two most likely ways to limit within-federation competition. Niv and Bar-On (1992, p. 172) note that while the federations were designed to facilitate helping behavior such as the transfer of experience, "the autonomy (and possible competitiveness) of communities was to be maintained." Daniel (1976, p. 180) asserts that any claim

¹ In the period since 1965, some of these features have changed. Kibbutzim are now much more likely to have mixed economies of agriculture and industry, and to employ hired labor. Communal child care has disappeared completely, while common ownership, democratic management, and communal consumption persist in various forms (Simons and Ingram 2000).

that kibbutzim did not compete freely "is unjustified and has no empirical evidence." He explains that the federations were inhibited from implementing collusion by their cooperative ideology, which dictated open membership and democratic decision making, precluding the centralized coordination of production and restriction of output that are typically necessary for collusion.

By encouraging the transfer of experience, but discouraging the restriction of competition, the kibbutz federations provided a kind of natural experiment for studying one likely effect of nondiversified organization groups while holding another constant. The kibbutz federations allow a purer assessment of experience transfer because that influence of the organization group can be seen without worrying about a confounding influence from restricted competition. While the context of this study provided a rare opportunity to empirically isolate the experience transfer of one type of organization group, its results will be useful for unpacking the effects of other organization groups which combine experience transfer with restricted competition.

Transfer of Experience in an Organization Group

Our arguments rest on the large literature that relates some measure of an organization's experience to some measure of its performance (Yelle 1979, Argote 1999). Studies of this type are typically referred to as "learning-curve," "progress-curve," or "experience-curve" research, depending on whether they focus on an individual worker, organization, or industry level of analysis (Dutton and Thomas 1984). Although there is variance in effect sizes, studies of this type almost always show that performance improves as a function of experience. Such findings have been made in a range of industries, and by applying a variety of definitions of performance. For example, Argote's (1999) review of this literature describes studies in discrete product manufacturing, continuous-flow manufacturing, agriculture, and services. Performance improvements in those studies are most often measured by reductions in time or cost of production, but have

occasionally been measured as reductions in organizational failure rates (Baum and Ingram 1998) and by increases in profitability (Foster and Rosenzweig 1995).

The mechanism behind these robust results is argued to be learning from experience. In the many studies that use performance measures that represent internal efficiency, such as cost of production, learning is conceptualized as the incremental learning by doing that comes from repeating a production process (Argote 1999). And while the typical study does not directly evidence learning, many studies are able to control for likely alternatives, such as economies of scale, leaving learning as the best explanation for improvements in internal efficiency as experience increases. Organizations' experience may also generate learning about output markets, for example, what products are desired by consumers (Cyert et al. 1993). Studies that use more comprehensive measures of organizational performance, such as failure rates or profitability, may examine the implications of both learning to produce more efficiently and learning about output markets. This is advantageous for providing a fuller picture of the impact of experience on performance.

A small subset of experience-curve studies examines the effect of the experience of other organizations on the focal organization's performance. A number of empirical results in this literature suggest that closer (as opposed to arms' length) ties between organizations are better for the transfer of experience. To begin with, there is a general emphasis on various forms of strategic alliances as mechanisms of knowledge transfer (e.g., Hamel 1991, Powell et al. 1996). Further, Mowery et al. (1996) found more knowledge transfer in alliances that represented closer ties between the organizations (e.g., joint equity investments), as opposed to alliances that were more arms' length (e.g., technological licensing). Three studies that have categorized other organizations' experience as to whether or not those others were tied to the focal organization all found performance improvements from the experience of tied, but not untied, others (Darr et al. 1995, Baum and Ingram 1998, Darr and Kurtzberg 2000). Another study that directly measured organizational knowledge found that knowledge was greater for organizations whose managers

tried to learn from other organizations they were formally tied to, but not for organizations whose managers tried to learn from arms' length sources (Rulke et al. 2000).

These results indicate the significance of interorganizational ties for experience transfer and other forms of interorganizational learning, and as such are key to understanding the role of organization groups in this regard. We argue below that organization groups facilitate the transfer of experience among members through three specific mechanisms: by increasing the *opportunity* for transfer, by increasing the *motivation* for transfer, and by increasing the *capability* of organizations to successfully apply the experience of others. We provide illustrations for each mechanism from kibbutz agriculture.

Opportunity to Transfer Experience

Organization groups create opportunities for transfer of experience by bringing the members of organizations together for both task-oriented and social purposes (Darr et al. 1995, Grindley et al. 1994). Contact between members of one organization with problems, and members of another with solutions to those problems, is the first step in matching solutions to problems. The importance of interpersonal contact is shown in Almeida and Kogut's (1999) study of the regional variation of innovation in the U.S. semiconductor industry. They find that major patents are higher in regions like Silicon Valley, where engineers are relatively more likely to move from one firm to another. The key implication of that result is that taking an individual with knowledge from one organization, and putting him or her in another organization, greatly enhances the knowledge transfer between the two organizations. The kibbutz federations illustrate that organization groups can create similar contact opportunities without actually requiring that individuals give up jobs with one organization and move to another.

Among kibbutzim in the same federation, the opportunities for task-oriented contact were great. The newsletters of the federations report of committees of experts that would visit member kibbutzim to consult on various agricultural topics (BaKibbutz 1954, issue 232, p. 14, issue 247, p. 22). Experience

could also be transferred by members of a kibbutz who visited other kibbutzim in their federation to help with the work (BaKibbutz 1954, issue 253, p. 4, Igeret 1964, issue 656, p. 5). Some contact opportunities were created explicitly to generate interkibbutz experience sharing, such as the kibbutz management seminar entitled "Transfer of Experience" (Hashavuah Bakibbutz Ha'Artzi 1960, issue 524, pp. 6-7).

Co-membership in a federation also contributes to the formation of social ties between individuals, creating an informal channel for the transfer of experience. For example, kibbutzim in the same federation often share schools, creating from an early age the opportunity for interkibbutz friendships (Rayman 1981). More evidence that federation co-membership contributed to social ties comes from Talmon's (1972) demonstration that interkibbutz marriages are more likely to be within the federation than would be expected by chance. She argues that interkibbutz marriage ties have practical implications for the kibbutzim: "Parents and relatives [of those] who have gone over to new kibbutzim maintain frequent and close ties with them and eventually come into contact with other members as well" (p. 147). It is easy to see how close ties between members of different kibbutzim can lead to the transfer of experience, either in casual conversation or in a concerted effort to help.

Motivation to Transfer Experience

The motivation to transfer experience, or to otherwise help another organization, is an issue because transferring experience involves time and effort and may impose a competitive cost. The competitive cost may be less significant in groups based on co-ownership, where the owners benefit regardless of which organization succeeds, but are clearly important for the kibbutzim which, regardless of federations, competed in the market for their agricultural output and benefited from their own success in that market. Uzzi (1997) documents instances of altruism and reciprocity between organizations in the New York garment industry, and speculates that the social character of close ties creates an interest in the other that goes beyond a rational calculus. For ties which create organization groups, there are good arguments for a psychological basis for prosocial behavior. Experimental

evidence shows that conflict between groups, which enhances cohesion within the groups, has the effect of causing group members to forego self-interest and contribute to collective goods (Erev et al. 1991).

Altruism between kibbutzim that are co-members in a federation may emerge from the conflict between federations, from the shared world view which causes kibbutzim to join the same federation in the first place, or from the interpersonal relations that develop from federation-induced contact. This altruism (braced by reciprocity) is illustrated in Talmon's account of the federations' system of "adoption," whereby an established kibbutz "adopts a newly founded kibbutz and pledges to assist it until it is able to manage on its own" (Talmon 1972, p. 147). Talmon further explains that the adoption system is reinforced by interpersonal ties between kibbutzim, such as those created by interkibbutz marriage: "Since the assistance scheme affects the well-being of their close kin, members...become personally committed to it and press for a strong alliance between the two communities."

Creating the Capacity to Successfully Use Transferred Experience

Finally, organization groups may improve the capacity of one organization to successfully apply the experience of another. Kogut and Zander (1992) argue that organizational knowledge consists of two parts, information and know-how. Information is more accessible to outsiders than know-how, because communicating know-how requires a language which may depend on a high level of common knowledge, both technical and organizational, between the firms. Yet, information without the associated know-how can be next to useless for organizations trying to apply experience because of the complex relationship between organizational actions and outcomes (Levinthal and March 1993). Organization groups, however, facilitate the communication of know-how through richer communication channels braced by empathy. According to Uzzi (1997, p. 45), the information communicated through close interorganizational ties "is not only more detailed and tacit but has a holistic rather than a divisible structure that is difficult to communicate through market ties." In other

words, when organizations are closely tied, as when they are co-members in a group, they can communicate the tacit know-how derived from experience that leads to performance improvement.

Organizations in a group may also have higher levels of mutual awareness, which will also smooth the effective transfer of experience. Cohen and Levinthal (1990) argued that organizations require a level of preparedness, which they called absorptive capacity, to successfully absorb knowledge from other organizations. Part of absorptive capacity is technological preparedness, but another part is understanding the other organizations sufficiently to know where to look for useful experience. This "network awareness" component of absorptive capacity is illustrated by Powell et al. (1996), who found that the diversity and amount of network experience of biotechnology firms drove their subsequent network development, and their growth. Those authors argued that organizations learn what people know through their history of ties to other organizations.

In the kibbutz federations there was ample opportunity to develop both rich communication channels, and an awareness of what people know at other kibbutzim. For example, participation in the same schools and training programs gave the members of kibbutzim in the same federation a shared language to use to communicate subtle and technical experience. Also, the seminars and publications that promoted the exchange of agricultural experience would help federation members to develop their own maps of the location of key capabilities within the federation. Indeed, the federations directly contributed to the development of those maps by publicizing agricultural best practices among their members (e.g., Igeret 1964, issue 655, p. 8).

These three mechanisms, although theoretically distinct, will typically occur together. Certainly that is true in the kibbutz case, where one structural feature, for example a shared school, may create opportunities and motivations to share experience, and a capacity for understanding between kibbutzim. Combined, the mechanisms lead us to make this prediction:

HYPOTHESIS. The effect of the experience of another kibbutz on a kibbutz's profitability will be more positive if they are in the same federation.

Competitive Implications of Within-Group Experience Transfer

Transfer is not the only way that the experience of another organization can affect the performance of the focal organization. Others' experience also allows those others to improve their own performance, and therefore become more potent competitors, producing a negative effect on the performance of the focal organization. Van Valen (1973) labeled the phenomenon the "Red-Queen effect" after the Red Queen's advice to Alice that in a world that moves very fast "it takes all the running you can do, to keep in the same place. If you want to get somewhere else you must run at least twice as fast as that!" Barnett and Hansen (1996) demonstrated the Red-Queen effect by showing that competitors' experience increased the failure rates of Illinois banks. Henderson and Cockburn (1996) demonstrated a related negative effect of competitors' knowledge progress in their study of innovation in the pharmaceutical industry.

The overall effect of the experience of others could therefore be positive, neutral, or negative depending on the relative magnitudes of the Red-Queen effect and the effect of transferred experience. It could even be that the Red-Queen effect offsets the transferred experience effect within the kibbutz federations (recall that the federations did not restrict competition among their members), although the apparent extent of experience transfer within the federations makes that less likely. It seems much more likely, however, that the Red-Queen effect will offset the experience transfer effect for kibbutzim outside of the focal kibbutz's federation, making their experience an overall negative. Those other kibbutzim will benefit from their own experience and from the experience of others in their federations, creating a substantial Red-Queen effect for the focal kibbutz. At the same time, their arms' length relationship to the focal kibbutz suggests a meager transferred experience effect. We are therefore prepared for the possibility that the experience of kibbutzim outside of the focal kibbutz's federation will actually decrease the focal kibbutz's profitability.

Data and Method

The data we use contain an observation for every kibbutz for each year from 1954 to 1965 (Barkai 1977b). These years were chosen because of data availability, but they are appropriate for our purposes because they are after the formation of the Israeli state but before federation influence was undermined by other kibbutz groups, which formed subsequently around specific industries and geographic regions. The primary sources for these data were the audited annual statements prepared by each kibbutz. In addition to detailed financial information, the data include information on inputs and outputs of the productive activities of the kibbutz (agriculture and industry), federation affiliation, kibbutz demographics, and physical size.

The experience curve literature provides a strong methodological paradigm for estimating the effect of experience on organizational outcomes (Yelle 1979, Argote and Epple 1990). While our hypothesis deals with the effect of others' experience, a complete model must include the kibbutz's own experience, so we start with the conventional form of the experience curve:

$$y = ax^b, \quad (1)$$

where y is the profitability of the kibbutz from agriculture, a is the profitability when experience was one, x is the cumulative experience of the kibbutz in agriculture, and b is a parameter capturing the change in profitability as cumulative experience increases.

A log-linear transformation can be used on Equation (1) for estimation purposes:

$$\log y = \log a + b \log x. \quad (2)$$

Effects of others' experience can be introduced by including terms for the experience of other organizations that are in the focal organization's federation (fx) or not (nx):

$$\log y = \log a + b_1 \log x + b_2 \log fx + b_3 \log nx. \quad (3)$$

Our hypothesis implies that $b_2 > b_3$. As explained below, we also included appropriate control variables in our models to capture the other likely influences on profitability.

We estimated fixed-effects regressions, which included a constant for each kibbutz. The fixed-effects specification captures kibbutz-level differences which are not captured by our control variables, and is also a response to serial correlation, which in these data would most likely result from persistent but unmodelled differences at the kibbutz level. Durbin-Watson tests indicated that significant serial correlation was not present in our models when fixed-effects were included. Allowing for differing constants for each kibbutz also addresses the possibility that we may be missing some of the relevant experience each kibbutz has accumulated. While an argument can be made that 1954 represents a fresh start for the productive efforts of kibbutzim (the two years immediately prior to 1954 represented major political, economic, and social disruptions, as the kibbutz movement struggled to define its relationship to the new Israeli state), some benefit of pre-1954 experience was likely to have persisted for some kibbutzim. Different starting points for experience would be captured by the fixed effect for each kibbutz.

We also considered the problem of simultaneity that results in biased coefficients when some measure of output is specified as a function of inputs which are not completely exogenous. According to Barkai and Levhari (1973, p. 58), the data we use do not have this problem because of the external constraints on capital, land, and labor that kibbutzim face. The most important constraint on labor is the principle of self-labor, which held that the kibbutz should use only the labor of members, and not hired outsiders. The supply of land was also externally constrained as all kibbutz land was bought by and leased from the Jewish National Fund (Near 1992). Reflecting these constraints, agricultural labor and total land did not vary greatly (relative to other variables) within a kibbutz during the period we study. Agricultural capital and irrigated land are the inputs that are most likely to depend on agricultural profitability, but even here interdependence is not certain because kibbutzim had numerous sources and uses of money, blurring the relationship between agricultural profit and agricultural mechanization. We used the two-stage least-squares procedure to investigate the risk of simultaneity for these variables. Our analysis

did not indicate simultaneity for capital, but it did for irrigated land. Apparently, kibbutzim increased irrigated land when they were profitable in agriculture. So, in the analysis below, we used the instrumental variables approach to create a substitute for the irrigated-land variable that was not correlated with the error term in our regression (Greene 1990).²

Operationalizations

Profitability. The dependent variable is a measure, for each kibbutz in each year, of profitability (in thousands of 1958 Israeli Lira) per labor unit: (market value of agricultural output-direct expenses for agriculture)/units of labor used for agriculture (in thousands of days). Another option for the profitability measure was to use total profit rather than profit per labor unit. We employed the latter option because experience-curve analyses traditionally use a measure of organizational performance standardized by the unit of experience, because profitability per labor unit is regarded as the best measure of the economic performance of cooperative organizations (Abell and Mahoney 1981, cited by Rothschild and Whitt 1986), and because many of our explanatory variables, such as capital and experience, are likely to improve the performance of each labor unit. We used total profit as a dependent variable in preliminary analysis, and it yielded results consistent with those reported below.

Experience. Experience-curve studies most often operationalize experience as a measure of cumulative production, for example, total ships produced in the history of a given shipyard (Argote and Eppler 1990). In kibbutz agriculture, however, there is no standardized measure of production. Often, in industries where outputs are nonstandardized, experience is conceived of in terms of the labor inputs of organizational participants, as in a law office that claims 70 years of experience because its lawyers have been in practice for a total of 70 years. Therefore, we measure experience in agriculture as cumulative labor inputs.

² We used lagged variables from our best model of profitability (see Table 2, model 4) as instruments to create the substitute of irrigated land.

OWN EXPERIENCE for kibbutz i in year T is the cumulative labor units used by the kibbutz in its history since 1954 to the year preceding the observation:

$$= \sum_{1954}^{T-1} \text{Labor Units}_{it}. \quad (4)$$

March (1991) has argued that organizations can fall into "competency traps" when their own experience is so large as to overwhelm their capacity to change. Following Baum and Ingram (1998), we included (OWN EXPERIENCE)² in the models in case competency traps caused profitability to decrease at high levels of a kibbutz's own experience.

The variable FEDERATION EXPERIENCE, for kibbutz i in year T , is an accumulation over the life of kibbutz i of the labor units employed by the F other kibbutzim that were members of its federation (the experience of kibbutz i is not included):

$$= \sum_{1954}^{T-1} \sum_{1}^F \text{Labor Units}_{ft}. \quad (5)$$

Because federation affiliation may affect agricultural profits through ways other than transferred experience (e.g., the federations had different work philosophies), our analyses included dummy variables for affiliation to each of the three largest federations (the 8% of kibbutzim that were not part of one of these federations form the omitted category). NONFEDERATION EXPERIENCE, for kibbutz i in year T , is an accumulation over the life of kibbutz i of the labor units employed by the U other kibbutzim that were not members of its federation:³

$$= \sum_{1954}^{T-1} \sum_{1}^U \text{Labor Units}_{ut}. \quad (6)$$

³ Although our measures capture all of the experience of kibbutzim, there may be other sources of experience that the kibbutzim could have benefitted from. There were other organizations and independent farmers engaged in agriculture during the period we study. Kibbutzim were, however, a very important part of the agricultural sector in Israel during the years we studied, accounting for more than 50% of cultivated land (*Statistical Abstract of Israel*, various years), and dominating the agricultural markets they participated in (Near 1997).

Control Variables. Our models include labor in agriculture in the current period because profitability per labor unit probably decreases as more labor units are employed. The total value of capital employed by the kibbutz in agriculture is also included because it probably increases profitability per labor unit. Irrigated land and dry land are two other important inputs for kibbutz agriculture (measured in hundreds of dunams [a dunam is 1,000 square meters]). To capture possible differences in the market power of kibbutzim and of economies of scale and scope in their productive efforts, we measure nonagricultural labor as the labor units the kibbutz applied in industry, crafts, and work outside the kibbutz. This variable combines with the agricultural labor variable to ensure that our models represent the full productive activities of the kibbutz. To capture possible differences in the market power of the federations we include federation prominence, which is the proportion of all kibbutzim that are part of the focal kibbutz's federation. During the period we study there was rapid population growth and corresponding market development in Israel, so our models also included the Israeli population. Exports from Israel also increased, so we include the total value of agricultural exports for each year. We also control for the calendar year to capture changes over time.

Table 1 presents basic statistics for the variables. Overall, the correlations were surprisingly low given that we use time-series data. Year and Israeli population were very highly correlated. That is to be expected given the pattern of population growth in Israel, but the correlation does not have substantive implications for our analysis because those two variables do not test our hypotheses. Note also the high correlations among year, Israeli population, and the experience variables, which suggest multicollinearity. To investigate multicollinearity, we estimated hierarchically nested regression models (Kmenta 1971, p. 371). The nested models show that the coefficients of the highly correlated variables are robust to various model specifications. F-tests (shown in Table 2), which provide a measure of the joint significance of added variables, are consistent with the tests of the individual significance of the coefficients of added variables, indicating that the standard errors of those

Table 1 Basic Statistics

Variable	Raw data			Logged data [†]																	
	Min	Max	Mean	Mean	S.D.	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
(1) Profitability	0	1,001	35.32	3.41	0.59	0.58	0.58	0.68	0.71	0.10	0.28	0.47	-0.06	0.16	0.10	0.78	0.73	0.78	0.07	0.00	-0.04
(2) Federation experience	0	17,171	6,553	7.74	3.36		0.89	0.84	0.72	0.18	0.26	0.39	-0.01	0.18	0.39	0.64	0.63	0.65	0.07	0.00	0.10
(3) Nonfederation experience	0	46,309	15,810	8.73	3.36			0.90	0.76	0.16	0.27	0.40	-0.08	0.16	-0.02	0.69	0.67	0.69	-0.01	0.02	-0.02
(4) Own experience	0	574	102.6	4.02	2.10				0.95	0.41	0.37	0.60	-0.03	0.41	0.03	0.78	0.77	0.79	-0.02	-0.01	0.02
(5) (Own experience) ²		square of logged-variable		18.42	8.27				0.46	0.37	0.63	-0.05	0.47	0.04	0.84	0.82	0.84	-0.02	-0.02	0.04	0.02
(6) Agricultural labor	1	87.1	19.24	2.83	0.62						0.57	0.74	0.32	0.92	0.07	0.11	0.12	0.11	-0.05	-0.02	0.07
(7) Capital	0.2	1,090	149.25	4.78	0.86							0.53	0.17	0.57	0.27	0.25	0.27	0.00	0.04	-0.03	0.04
(8) Irrigated land (instrumented)	0.01	57.36	15.69	2.56	0.76								0.17	0.72	0.04	0.42	0.40	0.42	-0.08	0.04	0.04
(9) Dry land	0	384.1	50.32	3.52	1.12									0.29	0.11	-0.17	-0.15	-0.17	0.08	0.02	-0.08
(10) Nonagricultural labor	0	388.1	37.37	3.43	0.71										0.06	0.14	0.14	0.14	-0.02	-0.00	0.03
(11) Federation prominence	0	0.34	0.29	-1.41	0.98											0.01	0.01	0.01	0.21	0.02	0.24
(12) Israeli population	1,483	2,239	1,839	7.51	0.13																
(13) Agricultural exports	722	1,886	1,260	7.10	0.30												0.94	0.99	-0.00	-0.00	0.01
(14) Year	54	65	59.52	4.10	0.06													0.94	-0.00	-0.00	0.01
(15) Artzi federation	0	1	0.33	0.33	0.47														-0.00	-0.00	-0.51
(16) Meuchad federation	0	1	0.26	0.26	0.44															-0.41	-0.51
(17) Ichud federation	0	1	0.34	0.34	0.48															-0.42	-0.42

[†] All variables are logged in the estimation of an experience curve.

Table 2 Regressions of Kibbutz Profitability in Agriculture[†]

Variable	(1)	(2)	(3)	(4)
Fixed effects (kibbutz-specific constants) included in all models				
Constant	-13.67** (1.89)	-13.59** (1.89)	-22.00** (2.37)	-17.99** (2.32)
Federation experience				0.026* (0.015)
Nonfederation experience				-.067* (0.017)
Own experience		0.026** (0.009)	0.157** (0.022)	0.299** (0.047)
(Own experience) ²			-0.039** (0.006)	-0.050** (0.006)
Agricultural labor	-0.628** (0.047)	-0.615** (0.047)	-0.614** (0.047)	-0.628** (0.047)
Capital	0.029** (0.011)	0.028* (0.011)	0.022** (0.011)	0.025** (0.011)
Irrigated land (instrumented variable)	0.507** (0.048)	0.434** (0.053)	0.336** (0.056)	0.349** (0.057)
Dry land	-0.069** (0.016)	-0.051** (0.017)	-0.033+ (0.017)	0.041** (0.018)
Nonagricultural labor	0.053 (0.048)	0.056 (0.048)	0.085* (0.048)	0.092* (0.048)
Federation prominence	-0.016 (0.037)	-0.018 (0.037)	-0.025 (0.036)	-0.032 (0.037)
Israeli population	2.237** (0.700)	2.606** (0.700)	3.206** (0.700)	2.944** (0.702)
Agricultural exports	0.114* (0.061)	0.074 (0.062)	0.213** (0.065)	0.175** (0.066)
Year	-0.545 (1.64)	-0.628 (1.64)	-0.415 (1.63)	1.053 (1.64)
Artzi federation	0.059 (0.213)	0.074 (0.213)	0.077 (0.212)	0.081 (0.211)
Meuchad federation	0.009 (0.209)	0.039 (0.209)	0.031 (0.207)	0.036 (0.207)
Ichud federation	0.075 (0.212)	0.083 (0.212)	0.110 (0.210)	0.114 (0.210)
R ² statistic	0.7570	0.7578	0.7620	0.7636
F-test comparison to preceding model	530.61**	7.88**	42.08**	8.06**

** $p < 0.01$, * $p < 0.05$, + $p < 0.10$

[†]Standard errors shown in parentheses; 2,620 observations in each model; fixed effects account for 219 d.f.

coefficients are not inflated. Additionally, we estimated our models on random subsamples of the data (Greene 1990). The parameter estimates were not substantially affected by such changes in the data. Finally, we estimated models using year and Israeli population variables that were made orthogonal to the experience variables, and obtained results similar to those reported below. Thus, there is no evidence that multicollinearity compromised the estimation.

Results

Table 2 presents the results of nested fixed-effects regressions. To test the significance of each subsequent model, we performed an F-test of the significance of the variables added to the preceding model, with model 1 being compared to a model with only the fixed effects. According to these tests, each subsequent model represents a significant improvement over the previous model, indicating that the added

variables improved the model's ability to predict profitability. These F-tests are the appropriate indicators of the significance of added variables, rather than the relatively small increases in the R^2 statistic between models, which result because of the predictive power (high R^2) of model 1. Because the F-tests indicate that model 4 is the best model of kibbutz profitability, we interpret the coefficients from that model.

Federation experience increases profitability, and nonfederation experience decreases profitability. An F-test clearly supports the hypothesis that the effect of federation experience is more positive than the effect of nonfederation experience (F-Value = 9.60, $p < 0.01$). Because we estimated a log-linear transformation of a multiplicative model, the effect of any variable can be seen in terms of a multiplier of the profit rate as determined by the other variables. Federation experience, at the mean of 6,553 units, generates a multiplier of the profit rate of 1.26, indicating that the profit for a kibbutz with mean federation experience is 1.26 times that of a kibbutz with no federation experience (such as one of the independent kibbutzim). Nonfederation experience, at the mean of 15,810 units, generates a multiplier of the rate of 0.52, indicating that the experiential advance of non-group others causes substantial downward pressure on profits. We also estimated our models on data that excluded the few independent kibbutzim, who had no federation experience. Those results were comparable to those shown in Table 2.

Results for the control variables generate further insight into the agricultural profitability of kibbutzim. Own experience increased, and (own experience)² decreased profitability. Profitability increases with own experience, but only up to a point. Then, subsequent experience begins to reduce profitability. This result was obtained in other studies that included a nonmonotonic effect of own experience, and is attributed to a competency trap, where organizations become beholden to their own histories (March 1991, Baum and Ingram 1998).

Agricultural labor decreased profitability as would be expected if the kibbutz assigned labor to the most profitable uses first. Again as expected, the more capital invested in agriculture and the more irrigated land owned by the kibbutz, the higher the profitability per

labor unit. Dry land decreased profitability, probably because Zionist ideology encouraged kibbutzim to use all of their available land, even when that land was problematic for agriculture. Kibbutzim with more nonagricultural labor were more profitable, perhaps because of market power, or synergies between agriculture and other economic activities. The Israeli population had a strong effect of increasing profitability, consistent with accounts of economic growth in Israel during this period (Barkai 1977a). Similarly, kibbutz agriculture was more profitable as agricultural exports increased. Notable among the nonsignificant coefficients are federation prominence and the dummy variables for the three major federations. While an organization group's market power, strategy, or work philosophy may affect members' profitability in other circumstances, this was not the case for the kibbutz federations in the period we studied, where the only discernable influence of the federations on kibbutz profit was through experience.

As a final check on these results, we investigated the possibility that the effect of kibbutz experience decays due to "forgetting" (Argote et al. 1990). We estimated four models, with experience not decaying at all, or decaying as a linear, logarithmic, or power function of time. The model with no decay of experience fit our data better than the other three models. To further investigate experiential decay, we used nonlinear regression to fit a model that estimated the decay of experience as a parameter (Darr et al. 1995). That model also indicated a zero-decay rate. This is an interesting result in light of previous studies indicating organizational forgetting. Perhaps kibbutzim forget less than other organizations because of the relatively high stability and motivation of their members.

Discussion

Kibbutzim were made more profitable by the experience of others when those others were in their federation, and less profitable by the experience of others that were not in their federation. Our explanation is that the federations facilitated the transfer of experience by creating the opportunity and motivation for transfer, and enhanced the capacity of their members to benefit from transferred experience. A small

number of past studies have shown that the experience of tied others is more beneficial to organizational performance than the experience of nontied others (Darr et al. 1995, Baum and Ingram 1998, Darr and Kurtzburg 2000). Our study, however, is the first to explore the significance of group vs. nongroup experience in a complete industry of organizations that are not joined by shared ownership (as in a restaurant or hotel chain). This is significant because joint ownership may represent the opportunity to transfer experience via bureaucratic fiat, whereas the kibbutz federations, lacking the authority to employee fiat, relied on more relational, voluntary mechanisms to promote transfer. Recognizing that experience transfer occurs among these less formal ties expands the set of groups which may be understood to facilitate experience transfer.

Our study is also rare in that it demonstrates the effect of experience on profitability, rather than the more typical experience-curve-dependent variables of time or cost to produce. Profitability is a more comprehensive performance measure, better representative of the goals of an organization's stakeholders, than is internal efficiency. Therefore, our study may be particularly interesting to scholars who focus on organizational performance. More important, however, is that the use of profitability, which reflects the relative performance of organizations in an industry, allows us to examine the competitive implications of transferred experience. As an organization advances through experience, the relative position of its competitors worsens. This was demonstrated in our results by the negative impact of nonfederation experience on the profitability of a given kibbutz. If our dependent variable had been internal efficiency, we could not have discovered this Red Queen effect—while kibbutz profitability is negatively affected by competitors' experiential advance, it is unlikely that kibbutz internal efficiency is similarly affected. In fact, it is completely possible that internal efficiency improves with nonfederation experience, even as profitability declines.

We conducted supplementary analysis to investigate this possibility. Table 3 presents the results of regressions with all of the covariates from model 4, but with the dependent variables being the expense

Table 3 Effects of Others' Experience on Expense per Labor Unit[†]

Variable	(5) Expense	(6) Revenue
Fixed effects (kibbutz-specific constants) and all variables from Model 4 included in all models		
Federation experience	−0.013** (0.003)	−0.006 (0.008)
Nonfederation experience	−0.008* (0.003)	−0.024** (0.009)
Own experience	0.032** (0.005)	0.055** (0.012)
R ² statistic	0.960	0.885

** $p < 0.01$, * $p < 0.05$.

[†]Standard errors shown in parentheses; 2,620 observations in each model; fixed effects and control variables account for 232 d.f.

(model 5) or revenue (model 6) per labor unit, rather than the profit. Model 5 is aimed at identifying the effects of others' experience on the internal efficiency of the focal kibbutz. Both federation and nonfederation experience have a negative effect on expense, suggesting that there are transfer benefits from both tied and untied experience. The benefit from tied experience appears to be greater, however, as indicated by the larger (negative) coefficient on the federation experience variable compared to that of nonfederation experience. It is necessary to be cautious when interpreting this result because we cannot standardize for the product mix of the kibbutz, and therefore cannot be completely certain that lower expenses are a function of increased internal efficiency.⁴ However, given the data available, this result is wholly consistent with (a) our claim that transfer benefit is greater in the presence of a tie between kibbutzim and (b) the idea that nontied others' experience harms the overall performance of the

⁴ An anomaly in model 5, that own experience increases expense, appears to be due to a shift in the mix of agricultural activities. The one segment of activity that we have specific data on is orchards, which were significantly less expensive per labor unit than other activities. Supplementary analysis indicates that kibbutzim deemphasized orchards in their mix of agricultural activities as own experience accumulated. Their own experience affected a move away from this cheap segment (contributing to the increase in expense shown in model 5) to others that were more profitable (the even bigger increase in revenue shown in model 6).

focal kibbutz even as the focal kibbutz learns something from that experience.

Model 6, examining revenue, indicates no significant effect of federation experience, but a negative effect of nonfederation experience.⁵ This later result is direct evidence of the Red Queen—the focal kibbutz is suffering reduced revenues as its competitors gain experience. The breakdown of the drivers of profitability in models 5 and 6 reinforce the theoretical promise of studying the effect of experience on comprehensive measures of performance. Traditional learning-curve studies run the risk of mischaracterizing the influence of others' experience by missing the Red Queen effect. At the same time, studies that examine the influence of others' experience only on revenue (or growth, or market share) might miss differential efficiency benefits of experience. Overall, the field would benefit from increased analysis of comprehensive measures of performance, *as well as* attention to the integration between studies that examine the influence of experience on only cost (as research in economics and operations traditionally does) or only revenue (as is the recent trend in organizational ecology).

Combining our two main results of in-group experience sharing and an out-group Red Queen effect suggests an experiential race between rival federations. The kibbutzim in a given federation had a common fate, rising and falling together as a function of the magnitude of their shared experience relative to that of the other federations. The biggest losers in this race were independent kibbutzim and the members of the smaller federations. They received little or no benefit via experience transferred from others, yet suffered from the increased competition created by the experience-driven progress of those others.

Consideration of the independent kibbutzim highlights another important question: Given the benefits of being within an organizational group, why

wouldn't every organization join one? The independent kibbutzim were independent because they found the political ideologies of the various federations to be unpalatable. As we have described, many of the benefits of an organizational group spring from the cohesion that shared ideology (ethnicity, geography, friendship) creates among members. Without some sincere basis of cohesion, there is no reason to expect the benefits of within-group ties. Moreover, participation in an organizational group also imposes constraints on its members. The kibbutz federations expected their members to uphold a set of ideological principles. Like groups of all types, they enforced adherence to these principles by punishing deviation. Indeed, we have found that the benefits kibbutzim get from federation membership, including the transfer of experience, are partly dependent on adhering to the political norms of those groups (Simons and Ingram 2000). Adherence to group norms is often expensive or difficult, but it would be doubly so for organizations that do not share core values with others in the group. It is for these reasons that some kibbutzim maintained their independence, foregoing some material benefit.

So far, we have talked generally about what organization groups do to smooth experience transfer among their members, but it is likely that some groups are better at this than others. With this in mind, we conducted supplementary analysis by adding interactions between the federation affiliation dummy variables and the experience variables to model 4. The only federation for which we found different effects of experience was Artzi. It had a greater increase in profit from federation experience and a greater decrease in profit from nonfederation experience. It is not hard to construct a post hoc explanation for these effects. Artzi was the most ideologically distinct federation (Near 1992), resulting in cohesion within the federation and separation from the other federations. Artzi was also the most centralized of the federations, which may have resulted in more formal and heavy-handed efforts to encourage experience transfer among its members.

The evidence of Artzi's differential experience transfer suggests opportunities to further investigate

⁵ These results do not necessarily invalidate our belief that the federations did not restrict competition. The nonsignificant result of federation experience on revenue could be the result of some revenue-enhancing benefit that flows to the focal kibbutz from the experience of those in its federation, offset by the indirect competition created as its federation others gain experience and become more competitive themselves.

how specific features of organizational groups influence the experience transfer of their members. To distill one such opportunity, it seems that one of the most important things the kibbutz federations did was bring members of different kibbutzim together. The interpersonal relationships that emerge from such contact contribute to all dimensions of the experience-transfer process. An intriguing feature of the federations' facilitation of interpersonal relationships was that it was often rooted in contact that had nothing to do with agriculture or economic performance. For example, interkibbutz marriage appears to have led to organizational awareness between members of different kibbutzim and to have increased motivation to provide economic help to other organizations. Therefore, researchers who want to understand experience transfer between organizations, or managers who want to promote such transfer, might now give some attention to a wider set of mechanisms that promote contact between members of different organizations.

Other than the transfer of experience, there is no evidence of other influences of the federations on kibbutz profitability. There were no main effects for membership in any of the three main federations. And, apart from transferred experience, there was no advantage of being part of a larger federation, as would be expected if the federations exercised market power or produced economies of scale. It would be wrong, however, to generalize from our results to conclude that the transfer of experience is the most important influence of all organization groups on the performance of their members. Rather, it must be remembered that features of the kibbutz federations make the transfer of experience particularly important to them. Most importantly, the kibbutz federations did not restrict competition among their members. This appears to be rare among organization groups, so other groups would likely produce significant benefits from market power or multipoint collusion. It is also notable that the kibbutz federations were made up of similar organizations. This makes the transfer of operating experience particularly valuable, although knowledge transfer of other types has been shown to yield benefits to differentiated organizations (e.g.,

Lincoln et al. 1998, Mowery et al. 1996, Dyer and Singh 1998).

As a final consideration of the significance of experience transfer in this context, compare the positive influence of federation to that of the focal kibbutz's own experience. As described, own experience has the nonmonotonic pattern of influence that is consistent with a competency trap. The maximum benefit of own experience, however, comes early for kibbutzim. Using coefficients from model 4, most kibbutzim obtain the optimal level of log (own experience), 2.99, in the second year of our time series. After that, additional own experience does not increase profitability (in fact, decreases it slowly). This is consistent with research that indicates that the biggest productivity gains from experience in new manufacturing plants come in the very early period after start-up (Bahk and Gort 1993). Contrast this pattern with that of federation experience, where the benefit increases throughout the life of the kibbutz (we tested for and found no nonmonotonic effect of federation experience). Although the initial learning from own experience is much greater than that of federation experience, federation experience may continue to benefit the kibbutz over time, and may eventually come to represent an even greater benefit than own experience. Indeed, by the end of our observation period, 155—or approximately 75%—of the kibbutzim were enjoying a greater benefit from their federation's experience than from their own. This suggests that the process of learning from tied others' experience may be different from that of own experience, and even that it may have more long-run potential to improve organizational performance. This difference is a very promising topic for future research.

To close, we describe two surface-level idiosyncracies of the kibbutzim and their federations that *do not* detract substantially from the generalizability of our results. First, there is nothing really unusual about the fact that the kibbutz federations are held together by a shared political purpose. Organization groups typically cohere around some noneconomic similarity between their members, be it kinship, geography, ethnicity, religion or political ideology (Leff 1978, Granovetter 1994). Many other organization groups, then, will have some basis for cohesion that may form

a foundation for the type of close, interpersonal relationships which seem important for knowledge transfer among the kibbutzim. Second, agriculture is an old industry which some perceive as slow to change. Previous accounts of experience transfer in an organization group have focused on complex industries where innovation is an obvious source of competitive advantage (e.g., biotechnology and semiconductors). That focus has served the laudable purpose of linking the phenomenon to some of the most interesting and important organizations in the current economy. However, it may also obscure the fact that experience is fundamental for all organizations, regardless of the salience of innovation in their industries.

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