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**The Economic Analysis of Teams: An
Interdisciplinary Perspective**

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Abstract

Economic research on organizations traditionally focuses on three different levels of aggregation: (a) the business unit or establishment, (b) sub-units that have easily-identified output metrics, such as manufacturing lines within a plant, and (c) individual workers. Yet there is another level of aggregation that is important for understanding productivity at the different levels, and which has been under-studied by economists: groups or teams of workers. Groups are the organizing logic behind many complex production processes, and thus must be studied to fully understand productivity at higher levels of aggregation. This paper provides an interdisciplinary look at the issues surrounding group-level processes and productivity, comparing the economic and behavioral science literatures and providing suggestions for ways that economists can learn from advances in the behavioral science literature.

1. Introduction

What is a team? The economics literature often has used “team” and “organization” synonymously. For example, Marschak and Radner’s *Economic Theory of Teams* (1972) defines team to be “an organization the members of which have only common interests” (p. 9). Holmstrom (1982) defines it as “rather loosely a group of individuals who are organized so that their productive inputs are related” (pp. 324-325). Kandel and Lazear (1992) refer to incentives in organization-wide partnerships as a “team incentive problem” (p. 802). Prendergast’s (1999) review uses the term mostly to indicate entire organizations: “Most of the work on team compensation concerns profit-sharing schemes ... carried out on large firms, where the wages (or often pensions) of employees are based on the profits of the entire firm,” (p. 41).

If the “team” and “organization” really are synonymous, then teams empirically would not differentiate phenomena within organizations. Yet a separate strand of research in the behavioral science and industrial relations fields has identified and established the economic importance of teams as subunits within organizations, focusing particularly on the use of teams as one of a number of complementary HR practices designed to boost productivity. Contributions from economics and industrial relations include Appelbaum and Batt (1994), Cooke (1994), MacDuffie (1995), Ichniowski, Shaw and Prennushi (1997), Cappelli and Neumark (2001), Bresnahan, Brynjolfsson, and Hitt (2002), Hamilton, Nickerson and Owan (2003), Janod and Saint-Martin (2004), Black, Lynch and Krivelyova (2004), Zwick (2004), Blasi and Kruse (2006) and Devaro (2008). These authors typically focus on self-directed work teams, which Appelbaum and Batt (1994) define as “groups of workers who have substantial discretion over the work process, make changes in production methods as needed, and take on many of the tasks traditionally carried out by front-line supervisors, such as allocating and coordinating work ...

and scheduling” (p. 253). Aside from noting that teams are complementary with HR practices such as cross-training and group-based rewards, however, these contributions largely focus on productivity without a deeper look at the factors that differentiate teams in both form and function.

While the economics research cited above on teams and HR practices was built in part on a foundation provided by the behavioral literature, labor economists have tapped only a small part of that literature for insights into measuring the nature and potential impacts of teams. The models that behavioral researchers have applied to the study of teams contain many variables and causal relationships that focus on the conditions under which teams can best operate. The behavioral science literature on teams is very extensive, covering issues of effectiveness ranging from performance outcomes (quality, productivity, etc.) to behavioral outcomes (turnover, absenteeism, etc.) and attitudinal outcomes (job satisfaction, trust, organizational commitment, etc.) (Cohen and Bailey, 1997). The range of intermediate measures that are modeled as both outcomes of team design features and precursors of effectiveness include internal and external processes (conflict, communication, etc.) and group psychosocial traits (norms, shared mental models, etc.) (Cohen and Bailey, 1997).

This paper reviews the behavioral literature on teams for an economics audience. Given the wide range of issues addressed by that literature, the emphasis here is on structural elements of teams that are most likely to mirror issues of interest to economists. Advances in the measurement of team-related phenomena are used to illustrate ways that economists could expand how they approach team level measurement issues. The conclusion reached is that many team dimensions are under-studied by economists, despite the most recent contributions on the productivity impacts of self-directed work teams. Analyzing these dimensions has the potential

to increase our understanding of both those productivity impacts as well as other issues of interest to labor economists, including the design and impact of incentive systems.

2. Evidence on the importance and role of teams

Teams are fairly prevalent, covering at least half of core employees in approximately forty percent of all private sector establishments with fifty or more employees (Osterman, 1994, 2000); if the measure is more broadly defined as using teams at all, the number rises to fifty-five percent (Osterman, 1994).¹ There is essentially no long-run nationally representative trend data on the prevalence of teams, so it is hard to say definitively whether the usage of teams has been increasing, though the evidence that exists suggests they are more prevalent than in the past (Appelbaum and Batt, 1994; Cohen and Bailey, 1997). It appears, however, that “teams are probably the most difficult work innovation to implement and the one that is most likely to be disrupted by turnover and restructuring” (Osterman, 2000, p. 186), which concurs with behavioral scientists’ views of team complexity (Mohrman, et al., 1995; Gibson and Cohen, 2003). Organizations may be in a continual state of flux with respect to teams, sometimes expanding their use and sometimes contracting as they struggle to implement them effectively.

Teams have played a definite role in the transformation of work, as evidenced by research on a myriad of industries, including airlines, automobiles, steel, aerospace, telecommunications, mining, health care, energy, financial services, and electronics (Appelbaum and Batt, 1994; MacDuffie, 1995; Cohen and Bailey, 1997; Ichniowski, et al., 1997; Knez and Simester, 2001). Teams are not, however, typically introduced by themselves. Rather, they often

¹ Osterman (2000) notes that the percentages of employees working in teams in his survey is higher than in other surveys, which in large part is likely due to his focus on “core” employees – the largest group of non-supervisory, non-managerial workers directly involved in making the product or providing the service. Because these are the employees at the heart of any complex process, whose actions are most important to closely coordinate, they are the most likely candidates to be on teams. In contrast, one would expect the janitors at an establishment to be more peripheral, their tasks less critical to close coordination with other tasks, and thus less likely to be on teams.

are introduced along with other HR changes, such as (increased) group-based rewards and cross-training (see previous citations). They also are typically introduced as part of a work redesign process, which can include the introduction of new technology (Black and Lynch, 2001; Bresnahan, Brynjolfsson, and Hitt, 2002; Bartel, Ichiniowski, and Shaw, 2005),² reconfiguration of the work flow (Hamilton, et al., 2003), or shift in strategy toward an emphasis on speed, efficiency, quality, innovation, or customer responsiveness (Appelbaum and Batt, 1994; Mohrman, et al., 1995).

There appears to be a fairly strong link, both conceptually and empirically, between team effectiveness – including productivity – and the use of group-based rewards. Wageman (1995) and Boning, Ichiniowski, and Shaw (2001) found that group-based rewards are more effective when used with team-based work, versus using group-based rewards only. Wageman (1995) showed that, for service technicians at Xerox Corporation, adopting a hybrid approach of either team work and individual rewards or individual work and group rewards led to inferior performance compared to the two “pure” options of both individual work and rewards, or both group work and rewards. These results are consistent with Itoh’s (1991) and Arya, Fellingham and Glover’s (1997) models of work design and reward tradeoffs, and Milgrom and Roberts’ (1995) model of complementarities in organizations’ design. Cooke (1994) provides evidence that team-based work and group-based incentive programs have differential impacts in unionized versus nonunionized work settings.

The literature on teams and “high performance” processes also strongly indicates the need for using complementary practices, such as training, job rotation, and group-based rewards, in order to realize maximum team benefits (Appelbaum and Batt, 1994; Mohrman, et al., 1995).

² Hemmer (1995) shows that the optimality of team production versus traditional assembly line production may depend on the level of technological development.

Thus the marginal impact of introducing teams alone often is lower than when used with other practices (Ichniowski, et al., 1997; MacDuffie, 1995; Wageman, 1995). Because of team and other workplace change simultaneity, analyses focused only on teams may erroneously find no productivity or wage impact, particularly if drawn from samples lacking details for analyses such as those conducted by Boning, et al. (2001), Osterman (2006) and Wageman (1995).³

Despite the considerable insights cited above regarding how teams can best be used to improve productivity, a number of fundamental issues regarding why teams exist and how to approach the measurement of them are addressed elsewhere in the behavioral literature.

3. Behavioral and economic views of teams

Our inquiry starts with job and organization design, areas that behavioral researchers have studied extensively. While the economics literature often has not used a group lens when framing the issues, in organizational economics there have been a number of conceptual contributions that have direct implications for the optimal design of groups. These typically address the boundaries of the firm, and proper location for decision making within the firm.

The empirical work measuring group versus team characteristics and team success determinants has been done almost exclusively outside of economics. The recent empirical literature in economics has focused largely on “treatment – control” analyses that try to measure the productivity impacts of using self-managing teams. The empirical behavioral literature on teams addresses a wide variety of topics. To make the exposition tractable, we focus the discussion of that literature on a sample of aspects that should appeal to the largest economics audience. We also limit the scope to work teams, meaning teams that “are continuing work units

³ This is a potential issue for Black and Lynch (2004), Black, Lynch and Krivelyova (2004), and Cappelli and Neumark (2001). Even though these studies address the simultaneity issue, the only measure of group-based rewards is the presence of establishment-wide profit sharing, which may be too removed from the work of individual teams to have a strong enough incentive effect. Thus these studies may suffer from omitted variables bias, to the extent that they are trying to test for the impact of teams and team-related HR practices.

responsible for producing goods or providing services [whose] membership is typically stable, usually full-time, and well-defined” (Cohen and Bailey, 1997, p. 242). These contrast with more transitory teams, such as task forces and project teams, and with management teams, all of which have interesting characteristics in their own right, but which are too complex to adequately address here; for more details on such teams, see Cohen and Bailey (1997).

Our framework for organizing the discussion of teams focuses on the tradeoffs firms face regarding the use of teams versus individual job design. We first discuss job enrichment and the assignment of decision rights in the hierarchy of an organization. The insights from that discussion are then used to illustrate the tradeoffs firms face in using highly specialized jobs that require greater communication and collaboration across workers versus less highly specialized jobs that decrease communications costs at the expense of less specialization. Implications for the optimal design of teams follow, with highlights of specific measurement examples from the behavioral literature that should appeal to economists interested in better understanding the nature of teams and how they can contribute to, or detract from, increased productivity.

A. Job enrichment and the assignment of decision rights

Aside from basic insights into the powerful benefits of specialization originally identified by Smith (1776), and more recently explored further by Rosen (1983) and Becker and Murphy (1992), economics has had very little to say about job design (Gibbs and Levenson, 2002). Most notably, the economics literature is essentially silent on the benefits of moving away from narrow specialization and toward broader jobs that combine tasks that could be done by separate workers.⁴ The behavioral literature, in contrast, addresses this issue head on, including important early contributions by Hackman and Lawler (1971) and Hackman and Oldham (1980). This

⁴ One notable recent exception is Lindbeck and Snower (2000), who model the factors that might lead organizations to move from narrowly defined, unitary task jobs to more broadly defined, multitask jobs.

literature essentially starts with narrow jobs and analyzes the potential benefits of making those jobs broader. This is called the “enrichment” approach to looking at job design.⁵ Hackman and others subsequently extended that framework to the design of work within groups of jobs; see Hackman (1987) for a review and the discussion in the next section.

A key insight from the enrichment approach is that “adjacent” tasks in the production process may be performed more effectively if they are executed by one person. Some of the conditions for this to hold include that the skill requirements for the two tasks are sufficiently similar, and that task bundling increases the worker’s understanding and ownership of how her actions impact the firm’s objectives in terms of cost, speed, quality, etc., without detracting from the total productivity of the combined tasks. Another benefit can be relieving monotony for jobs that are extremely narrow – such as assembly line work that entails performing only a single, extremely repetitive task. For a detailed discussion, see Hackman and Oldham (1980).⁶

For example, the tasks of starting and monitoring an assembly line machine are usually bundled together for one person, the operator, to perform. In many cases, the responsibility for maintenance of the machine is separated out and assigned to another person, the mechanic, who has a set of specialized skills that are different from the operator. For some routine maintenance tasks, however, such as checking fluid levels and adding oil, the task may be equally well performed by either the operator or the mechanic. Yet the operator may have a comparative advantage of being close to the machine more frequently, and thus in a better position to take responsibility for maintaining the appropriate fluid levels. Thus “expanding” the operator job to

⁵ Gibbs, Levenson and Zoghi (2010) find systematic evidence that firms design jobs to be either enriched or not enriched along a number of complementary job dimensions, and that, within the same firm, enriched jobs and nonenriched jobs tend to be segregated in different locations from each other.

⁶ Gibbs and Levenson’s (2002) discussion interprets Hackman and Oldham’s framework from an economist’s perspective.

include monitoring of the machine's vital signs may increase the optimal use of the machines, thereby increasing both the efficiency of capital spending and profits.

Another issue addressed by the job design literature is that expanding jobs to include multiple tasks often means providing a certain amount of autonomy for deciding how to do the work. This enables the workers to make efficient tradeoffs of how to allocate their time without having to constantly check with their supervisor about how or in what sequence to perform each task. There are limits to the efficient amount of autonomy, however, to the extent that there are established standards or routines that have been shown to produce high productivity. Autonomy is one core element of Hackman and Oldham's (1980) job design model.

There are limits, of course, to how far the operator's job can be expanded. Given the returns to learning about both machine operation and maintenance, it likely is the case that there would be too great a loss in efficiency if all the operator's tasks and the mechanic's tasks were combined together in one job, except perhaps in very small plants with only one production line. In more typically sized plants with multiple production lines, companies segment the tasks and take advantage of the returns to specialization across the two broad categories of tasks (machine operation and maintenance).⁷ Even in the smallest plants, however, one would never expect to see bundled together all the tasks of (a) machine operation, (b) machine maintenance, and (c) driving the finished product to a warehouse, because the coordination and switching costs of having the same worker perform all tasks would introduce unnecessary bottlenecks into the production process; for example, finished product piling up while the person monitors the machinery, or inability to perform proper routine maintenance at night when the line is down after working for 10 hours during the day operating the machinery and stocking the warehouse.

⁷ These conclusions are based in part on personal observations that the author has made on numerous plant visits and interviews with production personnel.

One important job design principle Hackman and Oldham (1980) label “task identity”:
“[t]he degree to which a job requires completion of a ‘whole’ and identifiable piece of work, that is, doing a job from beginning to end with a visible outcome” (p. 78). They elaborate as follows:

“When workers have an intact task ... they tend to see that task as more meaningful than ... when they are responsible for only a small part of the job. A social worker in a public welfare department who is responsible for dealing with all the needs and problems of his or her clients will find the work more meaningful than a colleague who deals only with issues relating to income maintenance or homemaker assistance ... [I]t is more meaningful to assemble a complete toaster than to solder electrical connections on toaster after toaster – even if the skill levels required for the two jobs are about the same.” (p. 78)

While these examples emphasize the psychological benefits of executing a “complete” task, there are direct information transmission benefits as well, which Hackman and Oldham call “Job feedback: The degree to which carrying out the work activities required by the job provides the individual with direct and clear information about the effectiveness of his or her performance” (p. 80). Thus, if the outcome that the public welfare department wants is total quality of care for its clients, giving individual social workers the responsibility for deciding over and administering the complete range of benefits for a set of clients can motivate them to focus on interventions with the greatest marginal return in part because they observe directly the link between their actions and the outcomes of interest for the organization, thereby economizing on communication costs across the hierarchy or “garbling” (Geanakoplos and Milgrom, 1991).

B. Choosing teams versus groups

In order for a team to be an efficient choice for organizing a set of tasks, it must be the case that productivity is no lower than if the tasks are assigned to individual workers who are managed independently. For some types of product or task, teams are the only option. These include the Alchian and Demsetz (1972) example of two people lifting heavy cargo into trucks: the cargo is too heavy for only one person, so a two-person team must be used. Other examples include performing a string quartet (or symphony orchestra) and carrying out multiparty negotiations (Hackman, 1988). For each of these cases, multiple people are needed to perform the task, and all jobs are completely interdependent, meaning that the people have to cooperate closely to accomplish their individual objectives (which can be executed successfully only if everyone does what they are supposed to do). These are the extreme examples, however, that fall outside the domain in which organizations can choose between organizing people into teams or a more loose collection of individually managed jobs.

In cases like manufacturing production processes (Appelbaum and Batt, 1994), repair technicians (Wageman, 1995), and call center workers (Batt, 1999), teams often are not a requirement but a choice. In these cases, one argument for why teams might be more than the sum of their parts (i.e. yield greater productivity organized as a team versus as individual workers) is the joint learning that can take place, leading to quicker and/or better solutions to production problems than the individuals could collectively produce working on their own (Hackman, 1992). What constitutes the difference between a “real” team and a loose collection of jobs or workers is a topic that has received a great deal of attention in the behavioral literature. According to Wageman, Hackman and Lehman (2005, p. 377), “real” teams (a) “have clear boundaries that reliably distinguish members from nonmembers,” (b) “are interdependent for some common purpose, producing a potentially assessable outcome for which members bear

collective responsibility,” and (c) “have at least moderate stability of membership, which gives members time and opportunity to learn how to work together.” Thus team production in the manufacturing environment often has meant taking a group of workers who previously performed very narrow tasks and reorganizing them so that they are jointly responsible for finishing a complete, visible set of work, such as assembling an entire engine.

Returning to the example of the social work office above, the organization faces a tradeoff at the level of individual job design. Assigning a social worker to handle all issues regarding a client provides greater task identity but with a potential loss of efficiency for the client: if the social worker is sick or on vacation at a critical moment when the client needs immediate service, a model that assigns one social worker per client would not be able to deliver good service at all times when the client might need it. Organizing the social workers into a team where they are jointly responsible for a pooled set of clients can provide improved client service if the team dynamics work correctly.

Decreeing that a group of workers will be jointly responsible for a set of tasks and using collective rewards to align the workers’ incentives with the outcomes is one way to help ensure that the workers are motivated to provide the right effort. Communication inefficiencies and the size of the team (number of members) serve as natural barriers to team effectiveness: if a group is too large then the benefits of teaming should be dissipated as the costs of coordination among the team members increase beyond the ability of the members to overcome those costs. Larger teams also should be more susceptible to free rider problems. Supporting this view, the early literature often found an inverted U shape relationship between team size and effectiveness, suggesting that teams should be staffed with enough members to get the work done, but no more than is absolutely necessary (Hackman, 1987, 1998). Countering this, however, Cohen and

Bailey (1997) cite three more recent studies that did not show a negative relationship between large group size and effectiveness. This suggests there may be settings in which having a larger team is not necessarily counterproductive.

More generally, joint responsibility and group-based rewards alone are not sufficient to ensure that a team will be more productive than a loose collection of individuals. Extending the job design model to the group level, Hackman (1987, p. 324) identifies five core elements of group design that can increase motivation and team effectiveness:

1. **Skill Variety:** The group task requires members to use a variety of high-level skills. Workers who collectively are challenged to perform a variety of tasks should find the work more inherently interesting than a set of only routine tasks.
2. **Task Identity:** The group task is a whole and meaningful piece of work, with a visible outcome. The argument here is the same at the individual job level.
3. **Task Significance:** The outcomes of the group's work on the task have significant consequences for other people (e.g. other organization members or external clients). Even if a set of tasks is relatively routine (low Skill Variety) or narrow (low Task Identity), it may still be motivating to perform the tasks if they are critical to the success of the product.
4. **Autonomy:** The task provides group members with substantial autonomy for deciding about how they do the work – in effect the group “owns” the task and is responsible for the work outcomes.
5. **Feedback:** Work on the task generates regular, trustworthy feedback about how well the group is performing.

The main point is that designing teams with varying amounts of any of the above, including interdependence (Thomas, 1957) and the extent of group rewards, can lead to differences in motivation and team effectiveness.⁸

How important are these as potential barriers for teams to work effectively? Based on years of field research, Hackman (1998) identified a number of ways that teams have lower productivity than the group would if organized, rewarded and managed as individuals, including:

- Calling the performing unit a team but managing the members as individuals. Organizations often set up groups that are teams in name only, but which do not have the design features a “real” team needs to be successful.
- Using teams for work that inherently is best performed by individuals. While this at one level is a tautology, the point is that there can be a good deal of uncertainty regarding whether it is possible to create a group with the sufficient level of interdependence to foster the productivity necessary to overcome the inefficiencies inherent in group processes.
- Giving the team too much or too little autonomy. Striking the right balance between autonomy and hierarchical decision making is difficult, particularly for managers who are being held accountable for a team’s performance. Thus Hackman (1998) emphasizes the importance of managers exercising their authority with respect to the overall objectives of the team, but leaving to the team as much as possible the discretion to decide the means by which the objectives are to be accomplished.

⁸ One caveat that comes from the job design literature (Hackman and Oldham, 1980) is that doing work that is designed to provide high levels of skill variety, task identity, task significance, autonomy and feedback may be motivating only for employees who have high “growth needs,” i.e. for whom being challenged is intrinsically motivating. For other employees, these factors may not necessarily lead to greater motivation and better performance. In the teams setting, the composition of the team in terms of the members’ growth needs may be an important factor in the relationship between team design features and productivity.

- Not providing enough organizational support for the team to succeed. This can take the form of insufficient training, inadequate resources (equipment, tools, space, money, etc.), or inadequate information for the team to accomplish its objectives.

Thus collecting data on and controlling for measures such as these may be critical to understanding the true relationship between teams and productivity.

4. Applications to research on teams in economics

While teams have taken on a more prominent role in economic research in recent years, the review of the behavioral literature above indicates that there are potentially fruitful areas where additional theoretical and empirical research in economics could add greatly to our insights about the roles that teams play in organization.

A. Suggestions for future theoretical research

Extending the Hackman and Oldham (1980) job design model to teams as discussed above (Hackman, 1987) has a good amount of intuitive appeal, but what are the assumptions necessary to do so? The factors that make work motivating for an individual may not so simply aggregate up to a group level. More formal modeling of the link between team design features and both individual and group motivation could yield interesting insights.

For example, teams may be needed to provide Task Identity at the group level if a set of tasks is too much for an individual person to handle. The factors leading to this could include too many tasks or skills for one person (loss of specialization), too much equipment (not able to realize economies of scale), and/or too much stress (taking individual job enrichment too far, to the point where the job is more taxing than motivating).

Comparing across teams, the behavioral literature tends to analyze separately teams that do different sets of tasks such as production (work teams) versus R&D (innovation/new product

development teams) (Cohen and Bailey, 1997). There are empirical reasons to do so if one suspects that omitted variables might lead to different dynamics across the different type of teams. But what might those omitted variables be? Work teams in manufacturing, call centers, etc. tend to be staffed by people who may specialize in certain tasks but who typically are capable of doing each others' jobs – hence the prevalence of job rotation and cross-training. Innovation teams, in contrast, are staffed by deep functional experts who bring to the group their unique set of skills in engineering, manufacturing, design, marketing, etc. For these teams job rotation and cross-training are neither feasible nor warranted: what makes each person's contribution so important to the team is the fact that they embody unique sets of knowledge that can only be mastered through years of schooling and specific on-the-job learning, each of which is critical for the innovation effort to succeed.

Consider now what collaboration and feedback mean in these two different types of teams. In the work team staffed by people from similar functional backgrounds, the responsibility for different tasks may be divided among the team members leading to each person having a unique piece of information that must be shared efficiently with the other team members. Yet because of the team members' functional background similarity, communication should be relatively easy and free riding harder. In the innovation team staffed by people from highly dissimilar functional backgrounds, communication about critical issues may be much more inefficient. Even in the absence of free riding risk, if a given member's contribution to the team's work processes is less-than-ideal, the other members may have no ability to discern the difference between a second-best versus first-best contribution. Applying more formal modeling techniques here could indicate ways in which certain team design factors (incentives, information systems, etc.) might play very different roles in these different types of teams.

Finally, how might we model how factors such as these (Task Identity; collaboration/feedback) should vary with firm or product characteristics? Both types of team compared above (work vs. innovation) often co-exist within the same firm. But each firm is characterized by unique product characteristics and market trends. How should we expect the optimal design and implementation of teams to vary based on the type of product the firm produces, including complexity, predictability, etc.? How might they vary with differences in industry characteristics such as the levels of competition, innovation, etc.? These types of issues have not been systematically addressed in the behavioral literature using models that can be applied economy-wide. Formal economic modeling could do so in ways that should greatly increase our understanding of what teams are and how they can contribute to firm productivity.

B. Suggestions for future empirical research

A disproportionate amount of the research on the impact of teams, particularly in economics, has been conducted using data from work teams in manufacturing settings only. A number of the stylized facts about the complementarity of teams and certain HR practices like job rotation and cross-training most likely are more unique to work teams than to innovation teams (see discussion of specialization above). Future empirical work should first specify and then carefully measure these kinds of differences to see if the findings from work teams in manufacturing can be generalized to other types of teams in other work settings.

Further, just as we need more theoretical modeling of the relationship between product characteristics, industry characteristics, and team characteristics, we also need more systematic analysis of teams across these different dimensions. Conducting large scale data analysis of teams is hard because standard nationally-representative data sets that sample firms or workers do not collect data on teams. Consequently, most of what we know empirically about teams

comes from comparing results across a very large number of case studies. Yet our ability to understand how teams vary systematically is hampered considerably by lack of comparability of data collection and analysis approaches across case studies. While it would take considerable effort to build nationally representative data sets of teams either as part of or in addition to current national surveys of workers and firms, doing so could yield very deep insights into teams' roles in organizations and productivity. This could do much to at least partially open up the "black box" of internal firm processes that has eluded economic researchers for generations.

In the absence of readily available nationally representative data sets, an alternative for empirical economic researchers is to use the kind of smaller scale data collection efforts that are standard in the behavioral sciences. These typically require conducting field research using methodologies that are not part of many empirical economists' repertoire. While this presents a challenge, it is not an insurmountable one. In the short term, there is a legion of empirical researchers in the behavioral fields who already are familiar with many economic models and incorporate parts of them into their research frameworks. Teaming up with these researchers could provide a relative quick entry point for empirical economists to get access to data on teams, as well as producing interesting interdisciplinary research. Examples of specific types of empirical research areas that are likely to prove interesting to economists were discussed above and include measuring constructs like group rewards, interdependence, task identity, clear boundaries between team members and nonmembers, stability of membership, autonomy, collective accountability for outcomes, etc. and relating those to impacts of teams on productivity and profitability.

For specific guidance on how to measure these constructs in practice, the Wageman, et al. (2005) paper may be a good place to start. A source of much debate in the behavioral fields is the

tradeoff between scientific rigor and ease of data collection. When collecting attitudinal data, in order to have statistically valid constructs, multiple questions about the same construct are asked in slightly different ways; typically, the more questions asked, the higher the reliability of the construct that ultimately is constructed from the individual questions. Yet devoting more survey items to one construct reduces the amount of items available to apply to other constructs, given a high correlation between survey length and response rates (very long surveys have lower response rates). An advantage of the Wageman, et al. (2005) article is that it attempts to directly address this tradeoff in a way that maximizes the number of constructs measured in a single survey while meeting minimum criteria for statistical reliability of each construct. Their explicit purpose is to develop and disseminate a survey instrument (the Team Diagnostic Survey, or TDS) that can be used by researchers to look at a variety of team issues using a survey that also meets the criteria of brevity, thereby maximizing response rates. The end result is a set of questions on over 20 different constructs that are empirically tractable to administer.

Specific examples from the TDS that relate to our discussion above include constructs measuring (with an example in each case of one of the questions that comprises the construct):

- Bounded team membership (e.g. “Team membership is quite clear – everybody knows who is and isn’t on this team”)
- Stable team membership (e.g. “This team is quite stable, with few changes in membership”)
- Interdependence (e.g. “Generating the outcome or product of this team requires a great deal of communication and coordination among members”)
- Knowledge of results/feedback (e.g. “Carrying out our team’s task automatically generates trustworthy indicators of how well we are doing”)

- Information (e.g. “Teams in this organization can get whatever information they need to plan their work”)

For each of these constructs and the others discussed above, whether it is the Wageman, et al. (2005) approach or any of a host of alternatives provided by the behavioral literature, there are ample opportunities for empirical economists to incorporate findings from that literature into interdisciplinary frameworks that are guaranteed to provide deep insights into the role teams play in the economy.

5. Conclusion

Collecting team-level data is not easy, but doing so could help economic analysis of the firm, productivity, and human capital. Focusing more directly on teams provides an avenue for considering the role of interdependence in economic models of the firm that emphasize the importance of the assignment of decision rights. Incorporating teams should increase the ability of economic analyses of firms to explain growth and productivity at the job, product, business unit, and firm levels. Understanding teams and the time and spatial division of work could further improve the ability of economic models of outsourcing and offshoring to capture the full range of costs and benefits of such distributed work. These and other new lines of inquiry that can be derived from the behavioral sciences literatures on job and organization design offer the promise of interesting insights if properly incorporated into future economic research.

Given the prevalence of team-based work and difficulties in managing teams, there are many areas where better understanding of teams could shed additional light onto labor market outcomes for workers. For example, even though group-based incentives and team-based work are complements, typical economic analyses of the impacts of incentive pay focus only on variation in the form of pay. Additional data on the structure of work added to such analyses

likely should increase model fit and deepen our understanding of how organizational characteristics impact worker outcomes. Similarly, the ability to manage teams may be important in the career dynamics for professional and managerial workers. If this ability is scarce and facing increased demand, the role of teams in organizations could help explain recent labor market trends for these workers. These and related topics are fruitful areas for future research.

7. References

- Alchian, Armen A. and Harold Demsetz. 1972. "Production, Information Costs, and Economic Organization," *American Economic Review*, 62:5, 777-795.
- Applebaum, Eileen and Rosemary Batt. 1994. *The New American Workplace: Transforming Work Systems in the United States*. Ithaca, NY: ILR Press.
- Arya, Anil, John Fellingham, and Jonathan Glover. 1997. "Teams, Repeated Tasks, and Implicit Incentives," *Journal of Accounting and Economics*, 23, 7-30.
- Bartel, Ann, Casey Ichniowski, and Kathryn Shaw. 2005. "How Does Information Technology Really Affect Productivity?" NBER Working Paper number 11773.
- Batt, Rosemary. 1999. "Work Organization, Technology, and Performance in Customer Service and Sales," *Industrial and Labor Relations Review*, 52:4, 539-564.
- Becker, Gary S. and Kevin M. Murphy. 1992. "The Division of Labor, Coordination Costs, and Knowledge," *Quarterly Journal of Economics*, 107:4, 1137-1160.
- Black, Sandra and Lisa Lynch. 2001. "How to Compete: The Impact of Workplace Practices and Information Technology on Productivity," *Review of Economics and Statistics*, 83, 434-445.
- Black, Sandra, Lisa Lynch and Anya Krivelyova. 2004. "How Workers Fare When Employers Innovate," *Industrial Relations*, 43:1, 44-66.

Blasi, Joseph and Douglas Kruse. 2006. "U.S. High-Performance Work Practices at Century's End," *Industrial Relations*, 45:4, 547-578.

Boning, Brent, Casey Ichniowski, and Kathryn Shaw. 2001. "Opportunity Counts: Teams and the Effectiveness of Production Incentives," NBER Working Paper 8306.

Bresnahan, Timothy, Erik Brynjolfsson, and Lorin Hitt. 2002. "Information Technology, Workplace Organization, and the Demand for Skilled Labor," *QJE*, 117:1, 339-376.

Cappelli, Peter and David Neumark. 2001. "Do High-Performance Work Practices Improve Establishment-Level Outcomes?" *Industrial and Labor Relations Review*, 54, 737-775.

Cohen, S.G. & Bailey, D. 1997. "What makes teams work: Group effectiveness research from the shop floor to the executive suite," *Journal of Management*, 23(3), 239-290.

Cooke, William. 1994. "Employee Participation Programs, Group-Based Incentives, and Company Performance," *Industrial and Labor Relations Review*, 47:4, 594-609.

Devaro, Jed. 2008. "The Effects of Self-Managed and Closely Managed Teams on Labor Productivity and Product Quality: An Empirical Analysis of a Cross-Section of Establishments," *Industrial Relations*, 47:4, 659-697.

Geanakoplos, John and Paul Milgrom, 1991. "A Theory of Hierarchies Based on Limited Management Attention," *Journal of the Japanese and International Economies*, 5, 205-225.

Gibbs, Michael and Alec Levenson. 2002, "The Economic Approach to Personnel Research," in Shoshana Grossbard-Shechtman and Christopher Clague, eds., *Expansion of Economics: Towards a More Inclusive Social Science*, New York: M.E. Sharpe.

Gibbs, Michael, Alec Levenson and Cindy Zoghi. 2010. "Why Are Jobs Designed the Way They Are?" in Solomon W. Polachek and Konstantinos Tatsiramos, eds., *Jobs, Training*

and Worker Well-being: Research in Labor Economics Volume 30, Emerald Group Publishing Limited, 107-154.

Gibson, Cristina and Susan Cohen. 2003. *Virtual Teams That Work*. San Francisco, CA: Jossey-Bass.

Hackman, J. Richard. 1987. "The Design of Work Teams," in J. Lorsch, ed., *Handbook of Organizational Behavior*, Englewood Cliffs, NJ: Prentice-Hall, 315-342.

Hackman, J. Richard. 1992. "Group Influences on Individuals in Organizations," in M.D. Dunnette and L.M. Hough, eds., *Handbook of Industrial and Organizational Psychology*, Vol. 3, Palo Alto, CA: Consulting Psychologists Press, Inc., 199-267.

Hackman, J. Richard. 1998. "Why Teams Don't Work," in R.S. Tindale, ed., *Theory and Research on Small Groups*. New York: Plenum, 245-267.

Hackman, J. Richard and Edward E. Lawler, III. 1971. "Employee Reactions to Job Characteristics," *Journal of Applied Psychology Monograph*, 55, 259-286.

Hackman, Richard and Greg Oldham. 1980. *Work Redesign*. Reading, MA: Addison-Wesley.

Hamilton, Barton H., Jack A. Nickerson, and Hideo Owan. 2003. "Team Incentives and Worker Heterogeneity: An Empirical Analysis of the Impact of Teams on Productivity and Participation," *Journal of Political Economy*, 111:3, 465-497.

Hemmer, Thomas. 1995. "On the Interrelation between Production Technology, Job Design, and Incentives," *Journal of Accounting and Economics*, 19, 209-245.

Holmstrom, Bengt. 1982. "Moral Hazard in Teams," *Bell Journal of Economics*, 13:2, 324-340.

Ichniowski, Casey, Kathryn Shaw, & Giovanna Prennushi. 1997. "The Effects of Human Resource Management Practices on Productivity," *American Economic Review*, 87, 291-313.

Itoh, Hideshi. 1991. "Incentives to Help in Multi-Agent Situations," *Econometrica*, 59:3, 611-636.

Janod, Veronique and Anne Saint-Martin. 2004. "Measuring the Impact of Work Reorganization on Firm Performance: Evidence from French Manufacturing, 1995-1999," *Labour Economics*, 11:6, 785-798.

Kandel, Eugene and Edward P. Lazear. 1992. "Peer Pressure and Partnerships," *Journal of Political Economy*, 100:4, 801-817.

Knez, Marc and Duncan Simester. 2001. "Firm-Wide Incentives and Mutual Monitoring at Continental Airlines," *Journal of Labor Economics*, 19:4, 743-772.

Lindbeck, Assar, and Dennis Snower. 2000. "Multitask Learning and the Reorganization of Work," *Journal of Labor Economics*, 18:3, 353-376.

MacDuffie, John Paul. 1995. "Human Resource Bundles and Manufacturing Performance: Organizational Logic and Flexible Production Systems in the World Auto Industry," *Industrial and Labor Relations Review*, 48:2, 197-221.

Marschak, Jacob and Roy Radner. 1972. *Economic Theory of Teams*. New Haven: Yale University Press.

Milgrom, Paul and John Roberts. 1995. "Complementarities and Fit: Strategy, Structure, and Organizational Change in Manufacturing," *Journal of Accounting and Economics*, 19, 179-208.

Mohrman, Susan A., Susan G. Cohen, and Allan M. Mohrman, Jr. 1995. *Designing Team-Based Organizations: New Forms for Knowledge Work*. San Francisco, CA: Jossey-Bass.

Osterman, Paul. 1994. "How Common Is Workplace Transformation and Who Adopts It?" *Industrial and Labor Relations Review*, 47:2, 173-188.

Osterman, Paul. 2000. "Work Reorganization in an Era of Restructuring," *Industrial and Labor Relations Review*, 53:2, 179-196.

Osterman, Paul. 2006. "The Wage Effects of High Performance Work Organization in Manufacturing," *Industrial and Labor Relations Review*, 59:2, 187-204.

Prendergast, Canice. 1999. "The Provision of Incentives in Firms," *Journal of Economic Literature*, 37:1, 7-63.

Thomas, Edwin J. 1957. "Effects of Facilitative Role Interdependence on Group Functioning," *Human Relations*, 10:4, 347-366.

Wageman, Ruth. 1995. "Interdependence and Group Effectiveness," *Administrative Science Quarterly*, 40:1, 145-180.

Zwick, Thomas. 2004. "Employee Participation and Productivity," *Labour Economics*, 11:6, 715-740.