



“Summary of article by Casey Ichniowski, Kathryn Shaw, and Giovanna Prennushi: The Effects of Human Resource Management Practices on Productivity: A Study of Steel Finishing Lines” in Frontier Issues in Economic Thought, Volume 4: The Changing Nature of Work. Island Press: Washington DC, 1998. pp.140-143

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## **“Summary of article by Casey Ichniowski, Kathryn Shaw, and Giovanna Prennushi: The Effects of Human Resource Management Practices on Productivity: A Study of Steel Finishing Lines”**

Innovative work practices such as incentive pay, teamwork, and flexible job assignments are often said to increase the productivity of labor. However, there is continuing debate about both the nature of the effects on productivity in theory, and the extent of the effects in practice. This study analyzes the effects of human resource management (HRM) practices on 36 steel finishing lines owned by 17 companies. It finds that HRM innovations are generally introduced in particular clusters, and that these clusters of employment practices have a greater effect on productivity than the individual practices alone. Thus it is consistent with theories which stress the importance of complementarities among work practices.

### **SAMPLE AND DATA**

The sample consists of several years of monthly data on each of 36 steel finishing lines of one particular type (out of roughly 60 lines of this type in the U.S.), together with detailed information on technology, equipment, management and employment practices on each line. Measurement of productivity is straightforward, since each line produces a fixed amount of steel per hour whenever it is running; given the specific engineering specifications of that line. A finishing line can operate continuously around the clock, with only occasional scheduled downtime for maintenance. Productivity is therefore measured as the percentage of "uptime," i.e., the percentage of scheduled operating time that the line actually runs. For the more than 2,000 "line-month" observations in the sample, the mean uptime is 91.9%, with a standard deviation of 4.4%.

The heart of the study is a statistical analysis of the effects of HRM innovations on productivity, or uptime. The productivity equations include as many as 25 controls for other features of the lines that may affect uptime, including the age of the line, many technical specifications, the temporary disruption experienced when new equipment is added, and the extent of scheduled maintenance. "Fixed effect" productivity models are also estimated which measure any gains in productivity within those lines that adopt HRM innovations.

### **WORK PRACTICES AND HRM SYSTEMS**

Fifteen new work practices, or HRM innovations, were examined in the study, including one or more measures in each of the following areas: incentive pay plans, selectivity in recruitment,

teamwork, employment security, flexibility in job assignments, skills training, and improved communication between management and workers. In addition, the traditional labor relations variables of unionization (33 of the 36 lines were unionized) and rate of grievance filings were also considered.

Several recent theorists have suggested that there are complementarities among new employment practices. Problem-solving teams, for example, may be more effective when adopted in combination with incentive pay, allowing workers to share the benefits of improvements they propose, and employment security, guaranteeing that no one will be laid off if productivity increases. The primary question under investigation here is: do *groups* of innovative HRM practices increase productivity?

## **IDENTIFYING HRM SYSTEMS AND THEIR EFFECTS**

The 15 individual HRM practices are highly correlated with each other; that is, lines that adopt one are more likely to adopt others as well. The patterns of implementation of these practices can be grouped into four HRM systems. Starting with the most traditional, System 4 contains no innovative HRM practices; System 3 adds worker involvement in teams (though usually at a low level of involvement) and enhanced labor-management communications. System 2 includes System 3, and adds extensive skills training and high levels of worker involvement in teams; occasionally one or two other innovations are also present in System 2. Finally, System 1 incorporates innovative HRM practices in all areas, including incentive pay systems, flexible and sometimes rotating job assignments, very selective recruiting practices, and an implicit employment security pledge, as well as all the practices included in System 2. All of the lines employed one of these four systems; some lines changed systems -- always in the direction of greater innovation -- during the study period.

How large is the effect of differing HRM systems on productivity? Average uptime was 89.9% in System 4 and 94.0% in System 1, with intermediate values for Systems 2 and 3. However, many other factors that affect productivity varied between plants, so simple averages may be misleading. One of the study's several regression analyses estimates that, compared to System 4, the increase in uptime is 2.5 percentage points for System 3, 4.1 percentage points for System 2, and 7.8 percentage points for System 1. Productivity increases of this magnitude are of great value; cost data from one small line show the value of each percentage point of uptime to be \$28,000 per month. The more innovative HRM systems also increase the average quality of output, making them even more valuable.

## **ALTERNATIVE EXPLANATIONS**

Several other explanations could be suggested for the changes in productivity. The gains associated with innovative HRM systems might be due to better management, or individual variation in managerial style and behavior; or to threats of layoffs and plant shutdowns, pressuring workers to work harder; or to worker responses to increases in pay under incentive systems. Controlling for these factors leaves the estimated effects of the four HRM systems roughly unchanged. Including fixed effects for specific plants and lines, or for specific years within the study period, strengthens the effects of the HRM systems.

A final statistical analysis provides the clearest demonstration of the importance of the HRM systems. When variables for individual HRM innovations are added to equations that already include the four systems, there is virtually no additional effect on estimated productivity: the HRM systems appear to incorporate all the available information about the effects of innovative practices. The reverse, however, is not true. Beginning with equations that include the 15 individual HRM practices, there is a significant increase in explanatory power when variables for the 4 HRM systems are added.

The evidence shows that *systems of HRM practices determine productivity and quality, while marginal changes in individual work practices have little effect...* [I]nnovative employment practices tend to be complements, as is proposed in the recent theoretical work on optimal incentive structures. That is, workers' performance is substantially better under incentive pay plans that are coupled with supporting innovative work practices -- such as flexible job design, employee participation in problem-solving teams, training to provide workers with multiple skills, extensive screening and communication, and employment security -- than it is under more traditional work practices. (311-12, emphasis in original.)

If the new systems are so clearly productive and profitable, why do any lines fail to implement them? In fact, all new or reopened lines that started up during the study period did adopt innovative HRM systems. Some (not all) older lines stuck with older practices, due to lack of knowledge, institutional inertia, and investment -- by both management and labor -- in skills and work relationships tailored to the traditional style of HRM.