Assessing the Effects of Mergers and Acquisitions on Firm Performance, Plant Productivity, and Workers: New Evidence from Matched Employer-Employee Data

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Abstract

Empirical studies of mergers and acquisitions typically focus on firm-level financial performance. In contrast, we use human capital theory to model these events as transactions that simultaneously have cross-level, real effects on workers, plants, and firms. Our empirical analysis is based on longitudinal, linked employer-employee data for virtually all Swedish manufacturing firms and employees. We find that mergers and acquisitions enhance plant productivity, although they also result in the downsizing of establishments and firms. Firm performance does not decline in aftermath of these ownership changes. We conclude that such transactions constitute a mechanism for improving the sorting and matching of plants and workers to more efficient uses.

Keywords: Mergers and Acquisitions, Total Factor Productivity, Compensation, Matched Employer-Employee Data

I. INTRODUCTION

The resurgence in mergers, acquisitions, and divestitures has focused greater attention on assessing the impact of these transactions on organizations and workers. Empirical studies of the effects of mergers and acquisitions typically examine a single unit of analysis: firms, plants, or workers. Firm-level analyses evaluate the impact of changes in corporate control on short-run stock prices ("event studies"), long-run stock prices, or accounting profits of companies whose shares are publicly-traded (e.g., Harrison, Hitt, Hoskisson, and Ireland, 1991; Hoskisson, Johnson, and Moesel, 1994; Jensen, 1988, 1993; Ravenscraft and Scherer, 1987; McWilliams and Siegel, 1997).

A recent meta analysis by King, Dalton, Daily, and Covin (2004) reviewed 93 empirical studies of the antecedents and consequences of mergers and acquisitions. The authors concluded that acquiring firms do not experience an increase in post-acquisition accounting profitability, even though share prices rise (for both acquired and acquiring firms) soon after such events are announced when the event window is very short. That is, even though the stock market anticipates that synergies will arise from acquisitions, these gains do not appear to be realized (Agrawal and Jaffe, 2000).

Although share prices and accounting profits are useful performance indicators, they may be imperfect measures of organizational efficiency or productivity. Inferences regarding the ability of the stock market to accurately reflect changes in firm efficiency are problematic when the assumptions of efficient markets are violated (Shleifer, 2001). Accounting measures of profit have also been criticized by researchers in economics and finance because they are also not necessarily perfectly correlated with real performance and can be subject to manipulation by managers (Benston, 1982).

Moreover, many mergers and acquisitions involve privately-held companies or occur below the firm level (e.g., divisions of large, publicly-traded firms), which makes it virtually impossible to assess stock price or accounting profitability effects, except for transactions involving large, publicly-traded firms. Of course, these large deals constitute only a small percentage of overall merger and acquisition activity. Most transactions involve the sale of small, single-plant firms or the sale of a single plant or division by a larger firm (Siegel, Simons, and Lindstrom, 2008).

The end result is that analyses of mergers and acquisitions based solely on information from large, public companies could yield misleading estimates of the impact of such transactions on performance. As a result, several authors (e.g., Lichtenberg and Siegel 1987, 1990a, 1990b; McGuckin and Nguyen, 2001; Maksimovic and Phillips, 2001; Harris, Siegel, and Wright, 2005) have asserted that a more desirable methodology is to eschew share price and profit measures and, instead, assess the productivity of plants before and after ownership changes.

Similar measurement concerns plague empirical research on the effects of mergers and acquisitions on workers. In the management literature, there have been numerous studies of turnover involving top-level managers ("top management teams") in the aftermath of mergers and acquisitions (Walsh, 1988, 1989; Hambrick and Canella, 1993; Krug and Hegarty, 1997, 2001). However, these transactions could affect employment, compensation, and career paths, not just for top managers, but for all workers.

There have been several empirical studies of the employment and wage effects of mergers and acquisitions at the plant and firm levels (Brown and Medoff, 1988; Lichtenberg and Siegel, 1987, 1990a, 1990b; McGuckin et al., 1998; McGuckin and Nguyen, 2001; Conyon et al., 2002a, 2002b, 2004; Gugler and Yurtoglu, 2004). While these studies enable us to make

inferences about what happens to the average worker at an establishment or company in the immediate aftermath of these transactions, they do not allow assessment of the effects on individual employees, nor on long-run careers. That is because detailed data on employees involved in these transactions are unavailable to most researchers in publicly-available files (e.g., Compustat) or even proprietary, confidential datasets (e.g., the U.S. Census Bureau's Annual Survey of Manufacturing). Thus, there is no direct, systematic, large-scale empirical evidence regarding the effects of a merger or acquisition on individual workers.

Some scholars have asserted that corporate takeovers have deleterious effects on workers. For example, Shleifer and Summers (1987) conjecture that the new owners of a firm in the aftermath of a hostile takeover are more likely to abrogate implicit contracts with employees, with respect to wages, benefits, and pension contributions. More specifically, they assert that shareholder wealth creation arising from corporate takeovers need not reflect improvements in economic welfare or efficiency. Instead, the increase in economic performance may reflect a transfer of wealth from employees and other non-financial stakeholders to shareholders. Others have alleged that mergers and acquisitions lead to substantial downsizing or even mass layoffs, usually basing their conclusions on small samples of "event studies" of large corporations. Such layoffs have been alleged to have a traumatic, lasting negative impact on workers who are fired and also on "survivors," or those who remain with the firm in the aftermath of the layoff (Brockner et al. (1987), Brockner (1988)).

In contrast, we assert that takeovers constitute a mechanism for improving the sorting and matching of workers and managers to firms and industries that best suit their skills. This can potentially enhance careers, particularly when the transactions result in the implementation of

new technologies, by stimulating additional firm investment in human capital and promoting "skill upgrading" of the workforce.

Our empirical analysis is based on longitudinal, linked employer-employee data for virtually the entire population of Swedish manufacturing firms and employees for the period 1985-1998. These data allow us to simultaneously assess the effects of mergers and acquisitions on firm performance, plant productivity, levels of employment, and compensation.

II. THEORY AND HYPOTHESES

We draw on human capital theory to generate a set of hypotheses regarding cross-level effects of mergers and acquisitions on workers, plants, and firms. Coff (1999, 2000, 2002) analyzed human capital factors in the market for corporate control. His research focuses on how human capital affects information asymmetry between buyers and sellers regarding the market value of the firm. In contrast, we develop hypotheses regarding the relationship between human capital and compensation, worker quality, and various indicators of plant performance.

The first relevant concept from the theory of human capital is the notion of a "fit" or "match" between plants and firms and their owners. This idea was first applied in the theory of labor turnover or job separation proposed by Jovanovic (1979), who asserted that some workers are particularly well-suited to a given job or establishment. According to Jovanovic (1979), if a worker is employed in the right job or organization, a good match will result and he or she will experience higher wage growth than a similar worker. On the other hand, a worker may instead be a bad match for a given task or a particular organization, with negative consequences for both the organization and the employee's career.

Building on this idea, Lichtenberg and Siegel (1987) outlined a "matching" theory of ownership change, in which the quality of the "fit" between heterogeneous plants and owners is

reflected in the productivity of the organization. Sub-par plant productivity constitutes a signal of a bad match involving an owner and a plant, which will be the major determinant of the firm-level decision to maintain or relinquish ownership of a given plant. Holmes and Schmitz (1990) modified this framework to include an additional human capital dimension that they call "business quality," which is directly related to the quality of the manager. In their model, high quality managers buy companies that implement high quality projects based on new ideas.

Jovanovic and Rousseau (2002) also conjectured that there is a positive association between high quality projects and high quality employees. In their theoretical framework, mergers and takeovers allow for the diffusion of new technologies and the reallocation of capital to more efficient uses and to better managers. Thus, according to the authors, these transactions play a role similar to the efficiency-enhancing, dynamic adjustment associated with entry and exit.

Matching theory, which is based on a human capital perspective, is also consistent with a vast literature in industrial/organization psychology, based on the "attraction-selection-attrition" (ASA) model (see Schneider (1987); Schneider, Goldstein, and Smith (1995)). The ASA model also considers the quality of the fit between the worker and the job, as well as the fit between the worker and the organization. This perspective nicely complements the "matching theory" we have advanced in this paper, since it is also based on assessment of worker compensation and performance, as well as organizational performance.[1]

Hypotheses Relating to Workers and the Plant's Use of Labor

We now synthesize and extend these ideas to generate a set of testable empirical propositions regarding cross-level effects of mergers and acquisitions. Let us begin at the lowest

[1] We are indebted to an anonymous reviewer for raising this point.

level of aggregation, the micro or employee level. Mergers and acquisitions can be expected to have differential effects on employees. First, we consider employees at a given plant or establishment that is sold to another firm. The new owners of these facilities recognize that the merger or acquisition creates a window of opportunity for improving the sorting and matching of workers across plants. They use the transaction as a mechanism to discard unproductive workers, upgrade the skills of existing workers, and hire new employees whose skills better suit the "new" organization.

On the managerial side, another signal of a bad match between an employee and a given plant occurs when workers are "over-compensated," relative to employees with similar characteristics in the same industry. If matching is working well and workers are well-sorted, they should be paid on the basis of their productivity. When there is a bad match, a worker may be paid the prevailing wage, even when he or she is not productive enough to warrant this level of compensation. Thus, we have our first hypothesis pertaining to workers:

Hypothesis 1: Workers employed at plants that are destined to be sold earn higher levels of compensation than comparable employees.

An implication of this view is that these transactions should result in a decline in employment at facilities that are sold, since a change in corporate ownership can be used as a mechanism for shedding unproductive workers ("bad matches") and reducing costs. Thus, for representative plants that are involved in a merger or acquisition, we should observe a downsizing of the workforce:

Hypothesis 2: Plants that are sold experience a decline in employment, relative to comparable plants that are not sold.

It is also likely that mergers and acquisitions stimulate organizational change, which suggests that "skill upgrading" of the workforce will result. A merger or acquisition can be

thought of as a type of technological change, which often involves the transfer of new knowledge and the implementation of new production processes. Under this scenario, the firm's demand for educated workers should increase. That is because highly-educated workers are likely to have a comparative advantage in helping the firm implement technological and organizational change, which arises from their ability to solve problems and adapt to change in the work environment.[2]

It also follows from human capital theory that the average "quality" of the workforce, as proxied by levels of education, increases after an establishment is sold to a new owner. This occurs for two reasons. First, new owners tend to dismiss lower-quality workers. Another cause of the increase in average labor quality is that the new owners of the plant will tend to hire workers with higher levels of education and skill.

Workers may have skills and traits that are well suited to other jobs and or/firms, but not to their present job or employer. A merger or acquisition provides an impetus for employees whose matches are poor to seek out (by their own volition or after being laid off) appropriate work elsewhere. The opportunity to find a better match leads to a rise in the average quality of the match among departing employees. In a competitive labor market, the quality of the match is reflected in the worker's earnings. This suggests that departing employees will experience (on average) higher earnings growth, leading to our third hypothesis:

Hypothesis 3: Employees who change jobs in the aftermath of a merger and acquisition experience higher earnings growth than employees who do not change jobs

It is also plausible to conjecture that a change in ownership provides an opportunity to implement key organizational changes. That is, the acquisition may be a catalyst that enables managers to undertake tough business decisions, such as firing unproductive workers or hiring

[2] There is considerable evidence in the literature on "skill-biased technological change" (see Siegel (1999) and Siegel, Waldman, and Youngdahl (1997) for comprehensive reviews of this literature) that technological change is associated with downsizing and skill-upgrading of the workforce.

better ones. Managers may have held off making such decisions, yet are compelled to implement workforce reduction programs due to financially-induced stress associated with the new ownership regime (i.e., a mandate to cut costs and increase performance). These pressures should also result in an improvement in the average quality of the workforce.

Thus, we have our fourth hypothesis:

Hypothesis 4: Plants that are sold experience an increase in average worker quality, relative to comparable plants that are not sold.

Hypotheses Relating to Plant Performance

Matching of plants and owners has two implications for plant and firm performance. The first is that the lower the productivity of a plant, relative to average productivity in its industry, the higher is the probability that the plant will be sold. That is because the quality of the match is the primary determinant of the corporate-level decision to relinquish or maintain ownership of the facility. Lower relative productivity is a signal of a bad match. A second implication of the model is that when a merger or acquisition occurs, even an average match can be expected to lead to above average productivity growth because a better match will result. Thus, we have the following hypotheses relating to the performance of plants before and after a sale:

Hypothesis 5: Plants have low performance before a sale, relative to comparable plants.

Hypothesis 6: Plants experience an increase in performance after a sale.

It is also likely that matching works more effectively for partial acquisitions than for full acquisitions. That is, when a firm purchases one or several plants from another company, it can better assess the quality of the match than when it purchases a firm consisting of multiple divisions and numerous establishments. The role of information asymmetry is also useful to

consider in this context, since this could have a negative influence on the quality of matching. That is, it is conceivable that the buyer may have poor information about the true quality of the assets being purchased. These information asymmetry problems are likely to be less severe in a partial acquisition, relative to a full acquisition.

If one ignores the information asymmetry problem, it also follows from human capital theory that partial acquisitions should lead to better performance, relative to full acquisitions. Recall that the matching model that we test is based on the notion that the quality of the "fit" between heterogeneous plants and owners is reflected in the productivity of the organization. Sub-par plant productivity constitutes a signal of a bad match involving an owner and a plant, which will be the major determinant of the firm-level decision to maintain or relinquish ownership of a given plant. Holmes and Schmitz (1990) modified this framework to include an additional human capital dimension relating to the quality of the manager. That is, when a firm purchases one or several plants from another company, it can better assess the quality of the match than when it purchases a firm consisting of multiple divisions and numerous establishments.

The bottom line is that we expect that matching works more effectively with fewer facilities, which allow the new owners to "cherry pick." Thus, we expect improvements in performance to be more pronounced for partial acquisitions, as opposed to full acquisitions. This leads to our last hypothesis:

Hypothesis 7: A partial acquisition leads to more substantial improvement in performance than a full acquisition.

In the following section, we outline our methods and discuss other empirical issues.

III. METHODS

To test these hypotheses, we estimate several productivity, profit, market share, output, employment, and earnings equations at the firm, plant, and individual levels. Productivity analysis begins with the notion of a production function, which is a graphical or algebraic representation of the relationship between the inputs or resources an organization uses and the output it produces. A common approach to productivity measurement is to specify a functional form for the production function and then apply regression analysis to estimate the parameters of this function.[3] In a seminal article, Cobb and Douglas (1928) proposed a functional form for estimating the relationship between the inputs of labor (L) and capital (K) and output (Q) in U.S. manufacturing industries. Assuming constant returns to scale, their production function (in log-log form) was represented as:

$$(1) \quad \ln Q = \ln A + \alpha \ln K + \beta \ln L$$

where Q represents the quantity of output, A represents a constant term, K represents the quantity of capital input, and L represents the quantity (hours) of labor input.

Another input should be included in this equation: intermediate goods and materials (M), in order to estimate total factor productivity, which is considered to be the best indicator of plant performance. Total factor productivity is preferred to a partial productivity measure, such as labor productivity, because it takes account of all resources, such as capital (physical capital, plant, and equipment) and materials (intermediate goods), as well as labor. We also need to control for a variety of factors which might explain why some plants generate more output than others (e.g., the age of the plant). Most importantly, we wish to assess how relative (i.e., relative

[3] See Majumdar and Marcus (2001) and McWilliams, Siegel, and Van Fleet (2005) for a more comprehensive discussion of non-parametric methods of productivity measurement.

to other plants in the same industry) output, productivity, employment, and human capital variables behave before and after a merger or acquisition.

The productivity equation and other equations we estimate are:

Total Factor Productivity

$$\ln(Q_{ijt}) = \alpha_{jt} + \beta_{1j}\ln(L_{ijt}) + \beta_{2j}\ln(K_{ijt}) + \beta_{3j}\ln(M_{ijt}) + \sum_{\ell=-13}^{12}\gamma_\ell MA_{ijt-\ell} + \sum_{\ell=-13}^{12}\delta_\ell ND_{ijt-\ell} + \text{Age Dummies} + \text{Industry Dummies} + \text{Time Dummies} + \varepsilon_{ijt} \quad (2)$$

Profit, Market Share, Output, Employment, Earnings, Experience, and Education

$$y_{ijt} = \alpha_{jt} + \sum_{\ell=-13}^{12}\gamma_\ell MA_{ijt-\ell} + \sum_{\ell=-13}^{12}\delta_\ell ND_{ijt-\ell} + \text{Age Dummies} + \text{Industry Dummies} + \text{Time Dummies} + \varepsilon_{ijt} \quad (3)$$

where L_{ijt}, K_{ijt}, and M_{ijt} are labor, capital, and materials for plant or firm i in industry j at year t, $MA_{ijt-\ell}$ are the year-specific merger or acquisition dummy variables, and $ND_{ijt-\ell}$ are "no-data" dummy variables that allow us to control for measurement error and sample selection biases (see Siegel, Simons, and Lindstrom (2008) for further clarification), and y_{ijt} is profit, market share, output, employment, average worker experience, and average worker education for plant or firm i in industry j at year t.

We follow the convention in the productivity literature (e.g., Lichtenberg and Siegel (1991)) by measuring output (Q) as deflated sales (price deflators are available at 4-digit SIC level), materials (M) as deflated purchased intermediate goods and materials, and labor input (L) as the total number of employees. Capital is bit trickier to estimate, since we need to account for depreciation. Following Siegel, Simons, and Lindstrom (2008), we use standard procedures to estimate this variable. We first computed an initial estimate of the stock of physical capital (as

of 1989) and then calculate the flow of capital services based on the "perpetual inventory" algorithm, $K_{it}^{c} = (1-\delta^{c})K_{it-1}^{c} + \rho_{t} I_{it}^{c}$, where i denotes an establishment, t denotes a year, c is either machinery or buildings and land, K represents capital, I denotes investment, δ is the depreciation rate, and ρ is an investment deflator. We then computed the sum of our estimates for machinery, buildings, and land to calculate the overall capital stock measure, K_{it}.

It is important to note that each regression includes industry level (4-digit SIC) fixed effects. The coefficients on the production function inputs, labor, capital, and materials, likewise are allowed to differ by industry, and we report weighted means of industry-specific estimated coefficients. The equations do not include plant fixed effects, only industry fixed effects, because including plant fixed effects would make it impossible to observe whether plants that experience a merger or acquisition tend to have persistently low or high productivity or indeed to know how these plants compare to their industry (and age and time) averages at all – all patterns crucial to the hypotheses advanced herein.

Earnings Equation

At the individual level, we estimate the following earnings equation:

$$(4) \qquad \text{EARN}_{\text{ieft}} = \alpha + \sum_{\ell=-13}^{12} \gamma_{\ell} \text{MA}_{\text{it}-\ell} + \boldsymbol{\delta}'\text{INDIV}_{\text{it}} + \boldsymbol{\phi}'\text{ESTABLISHMENT}_{\text{et}} + \boldsymbol{\psi}'\text{FIRM}_{\text{ft}} + \lambda_{\text{t}} + \varepsilon_{\text{it}}$$

where $\text{EARN}_{\text{ieft}}$ denotes the natural logarithm of annual earnings of individual i working in establishment e of firm f in year t, α is an intercept term, and $\sum_{\ell=-13}^{12} \gamma_{\ell} \text{MA}_{\text{it}-\ell}$ parameterizes the relationship to a merger or acquisition using coefficients γ_{ℓ} as discussed below. INDIV_{it} refers to a set of *individual-specific* factors: gender, national origin, age, categories of educational attainment, field of education, and location, along with a continuous measure of employee

experience. $ESTABLISHMENT_{et}$ is a set of *establishment-specific* characteristics: plant age, size (as measured by the logarithm of employment), average wage, relative productivity (i.e., relative to other plants in the same industry), and five-digit SIC industry dummies. $FIRM_{ft}$ refers to *firm-specific* characteristics: total employment, R&D intensity (commonly thought to reflect investment in the development of new technology), average wage, number of plants, and a dummy variable denoting whether the firm operates in diverse industries. λ_t is a year-specific fixed effect, and ε_{it} is the remaining classical disturbance term (random noise). We also include dummies for self-employment (and self-employment simultaneously with organizational employment), in order to assess the extent to which changes in compensation can be attributed to shifts between organizational and self employment.

The following describes our calculation of the dummy variables denoting whether an establishment experienced a merger or acquisition, which is of key interest in our econometric analysis. The approach we take is the same as in Siegel, Simons, and Lindstrom (2008). In equations (2)-(4), ℓ represents the year relative to the year of the merger or acquisition. Thus, negative values of ℓ refer to years before an ownership change, where $\ell = 0$ is the year during which an ownership change involving an employee's plant transpired, while positive values of ℓ refer to the years after a merger or acquisition. The matching from employee to plant is done in the year preceding the merger or acquisition. That is, the analyses carried out here address the performance of workers who were in establishment e in November of the year preceding the year during which the establishment changed owners. We constrict a dummy variable, $MA_{it-\ell}$, which is equal to 1 if individual i was in a plant, in November of the preceding year, that changed owner (with certainty) ℓ years preceding the current year t for $\ell \geq 0$, or $|\ell|$ years following the current year for $\ell < 0$, or 0 otherwise. The data enable us to determine the owner of each

manufacturing establishment, during the period 1985-1998. Therefore, if a sale occurs, we are able to identify the new owner for each year beginning in 1986. For an individual observed in 1985, we can identify (for 13 years) whether they have experienced a merger or acquisition. We can also measure, with precision, their "pre-merger or acquisition" behavior (up to 12 years before such an event).

The relationship between earnings and employment status and past or future merger or acquisition events can then be assessed, at each value of ℓ, by including in the model the terms $\sum_{\ell=-13}^{12} \gamma_\ell \mathrm{MA}_{\mathrm{it}-\ell}$, where γ_ℓ parameterizes the relation to merger or acquisition at lead/lag ℓ. As noted in Siegel, Simons, and Lindstrom (2008), we avoid model specification bias by allowing each γ_ℓ to be unconstrained. Thus, we estimate parameters over the full range of ℓ from –13 to +12 and then we use the fitted terms of γ_ℓ to generate estimates of the relationship of merger or acquisition events to earnings and employment status.

IV. DATA

Our empirical analysis is based on linked, longitudinal employer-employee data on Swedish workers and plants and firms that employ them. The file covers every employee in Sweden in every year from 1985 to 1998. The full database contains 36,398,617 records across the 14 years of data, for an average of 2.6 million workers per year, consistent with the Swedish population of close to 9 million. Establishment level data are available for the majority of employees if and when they were employed in the manufacturing sector (for at least one year), so that 9,251,962 records have matching information available about the employee's plant (and usually firm) workplace.

The database facilitates our investigation of employment status and earnings. Employment is recorded each year in November, and given that the database covers all employees, we infer that a worker whose record is missing in a given year was not employed in Sweden during that year. Annual earnings are recorded from employees' official tax filings, and are divided into earnings paid by an organization versus self-employment and other earnings. Unfortunately, we do not have data on hours worked or hourly wages, only annual total income. Self-employment income serves as a proxy for whether the employee was self-employed, and we use the two sources of income to divide each working employee into one of three categories in each year: organizationally employed, self-employed, or both.

For individual employees, we have data on gender, national origin, age, geographic location, year of last educational exam, categorical variables for educational attainment and field of education, and 5-digit SIC industry classification of employment. The national origin information is based on an employee's birthplace, divided between Sweden, other Nordic countries, the remainder of Europe, and five other world regions (Asia, Africa, North America, South America, and other nations). The employee's location is mapped into 338 local government districts. Educational attainment and broad field of education are likewise recorded categorically. Attainment is categorized as 0-8 years, 9-10 years (obligatory in Sweden), 11-12 years, 13-14 years (equivalent to a normal high school education similar to U.S. grade twelve), college or university education for one to two years (including extended high school engineering programs), college or university education for three or more years but not PhD education, or PhD education. Field of education is categorized as basic (general) education; esthetics, language, and religion; pedagogy; trade, office, economic, social, and behavioral degrees; industry-relevant education including handcrafts, engineering, mathematics, physics, chemistry, and biology;

transportation and communication; caring including nursing, child care, and geriatric care; farming, gardening, forestry, and fishing; general service skills including private guards and military service; or other areas of education.

The data record the year of an employee's last educational examination in 45% of records, and a proxy for employee work experience is constructed in these cases as the logarithm of the number of years (including the last educational year) since finishing education. This proxy for experience is likely to be an adequate control despite the paucity of information on educational examination year, because examination year information is mainly lacking among older employees, for whom age dummies (also included as control variables) provide a good proxy for experience. The employee's current industry classification of activity divides employees into one of 1,092 categories based on either 1969 or 1992 Standard Industrial Classification (SIC) codes. Categorical variables for gender, national origin, geographic locations, educational attainment, field of education, and industry are represented in our analyses using 0-1 dummy variables.

Although employee, plant, or firm data are missing for some observations, we do not exclude records from the sample on the basis of missing data, to avoid potential sample selection bias. Instead, we set the values of missing variables equal to the population mean or zero, and add dummy variables that equal one when the relevant type of data is unavailable or zero otherwise. Hence all these variables are used as controls to the full extent possible, while records with missing observations are allowed to differ on average from records with available information.

The data on individual manufacturing employees were linked to data at the plant level. Although plant-level data are available only for manufacturing plants, they provide a means to

control for potentially important effects of plant-related characteristics on earnings. Moreover, the measures of merger or acquisition used here depend upon the plant-level data. We also require plant-level data to test our theoretical proposition regarding the effects of mergers and acquisitions on productivity, output, employment, and human capital.

Following conventional international standards, the plant or establishment is defined as a physically independent unit within a firm. Each plant is assumed to produce for a single industry. Firms that are involved in multiple activities at the same physical address may report separate figures for each activity, which are then recorded as separate facilities. Plants that were considered to be "non-active" and "help plants," such as sales offices, were excluded from the data.

Next, we address whether our sample of manufacturing plants is representative of the population of establishments. As noted in Siegel, Simons, and Lindstrom (2008), Swedish establishment must report information on their operations on an annual basis. As of 1990, plants with more than 10 employees are sampled with certainty by the statistical agency, while a stratified sampling procedure is applied to smaller plants.

To assess the quality of our sample coverage, we compared the size distribution of our sample of plants to corresponding values for the population of Swedish manufacturing plants in 1986 and 1995. We found that our sample contains an overwhelming majority of plants with more than 20 employees. Sample coverage of plants with more than 20 employees increased from 86% in 1986 to 95% in 1995.

We also analyzed the incidence of mergers and acquisitions involving the plants in our sample. Over the entire sample period (1985-1998), 5.1% of our establishments experienced at

least one merger or acquisition. These rates of ownership turnover are slightly higher when they are weighted by value-added and employment.

Finally, to construct our two indicators for firm performance (of the acquiring firm), profit and market share, we rely on a separate company-level file which contains numerous variables. A proxy for profit is value-added per employee, which we consider to be superior to conventional accounting measures of profitability. Our second indicator of firm performance is market share, which is computed as a weighted (by sales) average of the firm's share of industry output at the industry (basically 4-digit SIC) level.

V. EMPIRICAL RESULTS

Table 1 contains correlations, means, and standard deviations for key variables used in the regression analysis. Note that these variables are measured at three levels of aggregation: individual (employee), plant, and firm. Not surprisingly, we observe strong positive correlations between experience and earnings (.41), age and experience (.67), and the various inputs or resources used to produce output (capital, labor, and materials).

Employee Earnings

We begin our regression analysis of the effects of mergers and acquisitions at the employee level. As a first cut, in Table 2, we report OLS estimates of earning equations, based on the specification outlined in equation (4). To conserve space, we only report coefficients on the mergers and acquisitions dummy variables in the seven years preceding and following a merger or acquisition. Not surprisingly, we find that more experienced workers earn higher compensation, while women employees earn significantly less than comparable male employees.

We now focus our attention on the coefficients of the merger or acquisition dummy variables in Table 2. These estimates indicate that workers whose plants are destined to experience a merger or acquisition earned 1-2% more than observationally equivalent employees in years shortly before a merger or acquisition, with wages falling back to comparable amounts over the next few years.[4]

Figure 1 plots this relationship in the estimates, showing the estimated coefficients (multiplied by 100 to convert to percentages) in the seven years preceding and following a merger or acquisition. Note that in each graph, we have a 15-year period, extending from seven years before a merger or acquisition to 7 years after a merger or acquisition. Values of the estimated coefficients are presented on the vertical axis, providing an estimate of the average effect of a merger or acquisition on compensation at a given time relative to the year of a merger or acquisition. The curve drawn across the diagram indicated the value of compensation relative to the norm for similar individuals (i.e., with similar control variable values), which changes on an annual basis. A 95% confidence bound is provided for each of the estimated coefficients. Our results strongly support Hypothesis 1, in which we conjectured that workers employed at plants that experience a merger or acquisition earn higher levels of compensation than observationally equivalent workers.

In Table 3, we present averages of the coefficients of the merger or acquisition dummies in the earnings equations for 5 years before and 5 years after the transaction (we exclude year 0, which is the year of the acquisition). We also formally test whether the post vs. pre merger or acquisition effects are statistically significant. The findings also clearly indicate that ownership

[4] If values of a coefficient in fact differ across individuals in the sample, then its coefficient estimate is correctly interpreted as the estimated mean of the values of the coefficient across all individuals in the sample.

change reduces the extent of "overcompensation." This can be viewed as an indicator of an improvement in management quality resulting from a new match.

Table 4 assesses worker mobility and compensation growth for two types of employees: (a) those employees whose plants were involved in a merger or acquisition during the previous year and (b) those employees whose establishments were not involved in such a transaction. Specifically, we examine employee destinations and earnings growth for each set of workers. Employees are tracked from a year before the merger or acquisition to a year after (T-1) the ownership change T-1 to T+1, for mergers or acquisitions that occurred (or failed to occur) during year T.[5] Of employees present in the year before a merger or acquisition, 37.3% left their establishment, including 15.2% who ceased employment. This compares to 27.1% of workers who left establishments that did not experience a merger or acquisition, including 12.6% who ceased employment. Although 2.6% more employees than usual ceased employment in the event of a merger or acquisition, at least the departing employees who found jobs seem to have benefited from the new match. Their earnings growth – like the earnings growth of employees in general who found new job matches – was typically several times higher than for employees who remained in the same establishment. This suggests that, consistent with Hypothesis 3, employees who left plants that merged or were acquired actually benefited (after the transition year T) from an improved match in their new roles.[6]

Establishment Productivity, Output, Employment, and Worker Characteristics

We now shift our focus to empirical tests of the establishment and firm-level hypotheses.

[5] Employee data were collected in November of each year, whereas merger or acquisition could occur at any point during the year, necessitating the use of data from years preceding and following the year of sale.

[6] The behavior of employees may be endogenous with respect to plant productivity and other characteristics in advance of merger or acquisition. In employee-level logistic regressions using all employees matched to the establishment data, even after controlling for plant productivity (and its nonlinearities and lags) and year effects, the probability of an employee departing the plant was not substantially affected 3 or more years before a merger or acquisition, but rose by 5.5% two years before and by 8.4% in the year preceding a merger or acquisition.

The first set of results is presented in Table 5. The coefficients on labor, capital, and materials in the output/productivity equation are consistent with previous plant-level studies (see Siegel, Simons, and Lindstrom, 2008). Note that the number of observations is smaller for the productivity equation because capital measures are available only from 1989 onward.

As before, when we considered earnings, the key coefficients in Table 5 are those on the merger and acquisitions dummies. For example, the value -.056 for the estimated coefficient of MA_{-1} in the productivity equation signifies that plants experiencing a merger or acquisition one year hence were 5.6 percent less productive, on average, than comparable establishments that did not change owners. Note that while the relative performance of plants involved in a merger or acquisition was significantly worse before the transaction, relative efficiency appears to have improved after the ownership change, as these establishments converged to the average level of industry performance. The results indicate productivity steadily deteriorating to a low of nearly 6 percent below average at the time of ownership change followed by a steady return to average and higher productivity after the ownership change.

In Figure 2, we plot the estimated coefficients on the merger and acquisition dummies in the productivity equations in the seven years preceding and following a merger or acquisition. These values can be interpreted as measures of the difference in productivity between plants that are involved in a merger or acquisition and those establishments within the same industry that do not experience such an event. This graph is similar to one we presented in a previous study (Siegel, Simons, and Lindstrom (2008), even though the econometric model is somewhat different, since we have additional control variables and a more sophisticated algorithm in this study.

The graph suggests a "V-shaped" productivity effect, which is consistent with our proposed matching theory in the sense that productivity is declining before a corporate control change and increasing in the aftermath of these events. The end result is that our findings appear to confirm Hypotheses 5 and 6, which asserted that plants that are sold are less productive before the transaction and experience an improvement in relative performance after they are sold.

The output and employment results, which are presented in the last two columns of Table 5, help explain the productivity increase. Plants that changed owners apparently had higher output and employment than comparable plants both before and after a merger or acquisition. Output and employment are both reduced after an ownership change. This finding is consistent with Hypothesis 2, which states that mergers and acquisitions are associated with a downsizing of the workforce. Note that employment declined at a faster rate than output, which resulted in a productivity increase.

Although the change in output could result either from a decision on the part of the new owners or a firm-specific shock that triggers ownership change, there is some evidence that the output reductions may in fact result from the decisions of the new management. First, similar declines in output do not coincide with the gradual reduction in productivity that precedes ownership change. Second, the same declines in output and employment are apparent after we add industry-year interactions to the model using 4-digit SIC codes, thereby controlling for possible industry-specific demand shocks. This type of strong empirical test (made possible by the availability of rich data) lends further credence to the notion that the improvements in real performance can be attributed to the change in ownership.

In the top panel of Table 6, we present averages of the coefficients on the ownership change dummies in the productivity, output, and employment equations for 5 years before and 5

years after the transaction (we exclude year 0, which is the year of the acquisition). In the next two panels, our findings are also presented separately for full and partial acquisitions. The "post-pre" results in the first panel of Table 6 confirm our earlier finding that plants involved in a merger or an ownership change became more productive after the transaction. From the 5 years before to the 5 years after a merger or acquisition, productivity is estimated to have increased by 1.7% ($p<.01$). We also find that output and employment were reduced after ownership change, with employment declining more than output. Output is estimated to have declined by 8.6% ($p<.001$) from the pre- to post-ownership change 5-year periods, and employment is estimated to have decreased by 12.0% ($p<.001$). Consistent with Hypothesis 7, plants that were acquired in a partial acquisition are estimated to have experienced slightly higher (2.6%) productivity growth than establishments that were purchased as part of a full acquisition (1.4%).

Table 7 presents similar aggregated (five years before and five years after a merger or acquisition) regression results for the additional plant-level variables relating to human capital: average experience, percentage of college-educated workers, and earnings. The findings in Table 7 imply that plants involved in ownership change experienced estimated increases in experience by 0.17 year ($p<.01$), and in the percentage of employees with a college education by (an absolute amount of) 0.18% ($p<.05$). We also find that ownership change resulted in an increase in employees' mean earnings (as always, relative to the industry and plant age and year norm) by 1.3% ($p<.001$). These results appear to confirm our Hypothesis 4 that mergers and acquisitions result in an increase in average worker quality.

It is natural to ask whether other determinants of mergers and acquisitions are at play and whether controlling for these determinants might affect the results obtained above. First, recall that all the regressions control for the detailed 4-digit SIC industry, as well as other

characteristics such as plant age and location and year, that are associated with many theories of merger and acquisitions. Second, when industry and year dummies are interacted as controls, the plant-level estimates change very little, indicating that industry-specific linear or nonlinear time trends do not drive the results. Third, the merger and acquisition coefficients can be interacted with covariates associated with possible motivations for mergers and acquisitions, including relatedness at the 2- and 4-digit SIC levels and measures of physical and human capital intensity. When these interactions are used, the same V-shaped productivity trends are estimated for each subtype of acquisitions: related and unrelated, low and high physical capital, and low and high human capital.

In Table 8, we present these estimated interactions between ownership change and physical or human capital. Plots of the estimates relative to year of ownership change appear as Figure 3, with separate panels for the physical versus human capital models. The phrase "*Cap. Int.*" in the leftmost column of Table 8 refers to a capital intensity 0-1 variable, equal to one for low or high physical or human capital plants or zero otherwise. Plants with above-median physical capital intensity had estimated productivity fall from 2.5% to 9.5% below the norm for comparable plants over the five years leading up to the merger or acquisition, then rise to 3.4% above the norm by three years after acquisition. In contrast, plants with below-median physical capital experienced more limited and rapid productivity improvements. Plants with high human capital, defined as over 5% of employees having a college education, experienced substantially greater productivity improvements then low human capital plants.

The fact that an increase in productivity occurs regardless of capital intensity is consistent with our matching theory of mergers and acquisitions. Moreover, the evidence suggests that the greatest gains occur in just the kinds of businesses for which the need for high physical or human

capital makes possible large improvements from a good match: well-matched new owners can benefit such plants with appropriate and up-to-date equipment, personnel, and techniques.

Acquirer Plant and Firm Performance

In assessing the overall effects of a merger and acquisition, it is also useful to examine the impact of such transactions on an acquirer's existing establishments (or the establishments it owned before it purchased additional plants), which can be thought of as "incumbent" plants. Column (1) of Table 9 presents parameter estimates for the plant productivity equation, similar to those reported in Table 5.

In contrast to plants that were acquired, existing plants of the acquiring firm experienced a slight increase in productivity in the years before the acquisition, rising to 1.7% above the norm for comparable plants in the year of acquisition. However, there are statistically insignificant changes in the productivity of "incumbent" establishments, in the aftermath of a merger or acquisition. Thus, the merger or acquisition does not appear to reduce or enhance the productivity of incumbent plants, even though acquired plants experience significant productivity gains.

Firm-level regression results are presented in models 2 and 3 of Table 9, for our two proxies for firm performance: profit (net profit per employee) and market share (a sales-weighted average of the firm's market share in each industry). Following the convention in the literature (McWilliams and Siegel, 2000), these regressions include controls for firm size (total firm employment), risk (the debt/asset ratio of the firm), and R&D investment.

Once again, we focus on the coefficients of the merger and acquisition dummy variables and also provide a graphical presentation of these values in Figures 4 and 5, for profit and market share, respectively. In the profit regressions (column 1), all but one of the coefficients of the

dummy variables is statistically insignificant and there does not appear to be a shift in performance patterns after a merger or acquisition. Although acquirers have higher market shares than comparable firms before an ownership change, they do not appear to experience a decline in market share (controlling for other factors) after a merger or acquisition. These patterns are more clearly revealed on the graphs. The end result is that mergers and acquisitions do not appear to result in an improvement in firm performance.

These findings are consistent with the evidence presented in the recent meta analysis of post-acquisition profitability by King, Dalton, Daily, and Covin (2004). However, it is important to note that our findings are based on virtually the entire population of manufacturing firms, not just strictly large, publicly-traded firms. There are many costs associated with acquisitions, including those that are unrelated to the production function, including overhead and transactions costs. Thus, although we observe an increase in plant productivity, it is not surprising to find that overall firm performance (proxied by net profit per employee or market share) does not improve in the aftermath of an ownership change. Nonetheless, it is important to explore how these transactions affect individual establishments and employees, as well as the entire organization.

VI. CONCLUSIONS

Existing studies of the impact of mergers and acquisitions on performance suffer from several key theoretical and empirical limitations. From a theoretical standpoint, they typically ignore the relationship between human capital and real performance and also do not consider cross-level real effects. Due to data restrictions, empirical analysis has focused almost exclusively on the effects of these transactions on share prices or accounting profits of publicly

traded firms. These studies also typically ignore the consequences of such ownership changes for representative employees.

As noted in Shleifer and Summers (1987), an exclusive focus on the impact of these transactions on financial stakeholders could be problematic if mergers and acquisitions are a "zero-sum" game that benefits shareholders at the expense of non-financial stakeholders. It is also well known that acquisition activity occurs below the firm level. In contrast, this study addresses these limitations based on human capital theory and a rich new dataset that matches comprehensive longitudinal information on hundreds of thousands of plants and firms and millions of workers. These matched employer-employee data allow us to simultaneously assess the antecedents and consequences of mergers and acquisitions for firms, plants, and workers.

Using the theory of human capital, we generate a set of hypotheses regarding the antecedents and consequences of firm, plant, and worker turnover. These predictions are based on the role of "matching" in the labor market and the market for corporate control. Our empirical analysis is based on longitudinal, linked employer-employee data for virtually the entire population of Swedish manufacturing firms and employees for the period 1985-1998. These data allow us to assess the effects of mergers and acquisitions on firm performance, plant productivity, employment, compensation, and the career development of workers.

Consistent with human capital theory, we find that mergers and acquisitions lead to an improvement in plant productivity with no perceptible change in firm performance, although they also result in the downsizing of establishments and firms. Specifically, we find that plants are less productive than comparable plants before a merger or acquisition. Our results also show that plants involved in a merger or acquisition had higher output and employment than comparable establishments before the transaction. The increase in productivity after the transfer

of ownership appears to be the result of a decline in output, combined with an even larger reduction in employment. Finally, our findings indicate that the improvement in productivity is greater for partial acquisitions of firms than for acquisitions of an entire company.

These transactions actually seem to enhance the careers of workers, judging from earnings, presumably by providing a mechanism for improving the sorting and matching or workers and managers to firms and industries that best suit their skills. Our findings are consistent with recent theoretical and empirical evidence (see Jovanovic and Rousseau, 2002; Maksimovic and Phillips, 2001, 2002) suggesting that takeovers and asset sales result in the reallocation of a firm's resources to more efficient uses and to better managers.

We also find that plants involved in a merger or acquisition experienced an upgrading in the "quality" of human capital. That is, we observe increases in average employee experience and education. Ownership change also led to an increase in earnings for those who remain employed at the establishment. Finally, it appears as though workers in plants that experience a merger or acquisition receive higher compensation than comparable workers. This relative compensation gap is reduced to the norm in the aftermath of the transaction.

In future, we hope to provide additional evidence on the impact of mergers and acquisitions on careers, by making full use of each employee's complete work history. These data can be used to assess worker transitions across and within firms and industries. It would also be interesting to determine whether workers are more likely to become self-employed in the aftermath of an ownership change, and how this affects their subsequent compensation.

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Table 1

Correlations, Means, and Standard Deviations of Worker, Plant, and Firm Characteristics

	Unit of Analysis	Mean	Std. Dev.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Log Earnings	Worker	11.71	0.82	----														
2. Log Experience	Worker	2.09	0.85	.41**	----													
3. Age	Worker	38.46	12.51	.20*	.67**	-----												
4. Female	Worker	0.29	0.46	-.25*	-.06	-.02	----											
5. Log Gross Output	Plant	9.49	1.71	.09	-.00	-.03	-.04	----										
6. Dummy for Merger or Acquisition (in the following year)	Plant	0.04	0.20	.07	.04	.07	-.09	.03	----									
7. Log Capital	Plant	9.14	1.59	.12	.02	-.01	-.04	.90**	.04	----								
8. Log Employment	Plant	3.32	1.21	.06	-.01	-.01	-.02	.79**	.05	.71**	----							
9. Log Materials	Plant	8.67	2.08	.09	.01	-.02	-.07	.84**	.03	.77**	.71**	----						
10. Average Age of Employees	Plant	39.6	5.42	.18+	.26**	.30**	-.04	-.11	.01	-.04	-.07	-.09	----					
11. Percentage of Female Employee	Plant	25.7	21.68	-.15	-.06	-.03	.39	-.05	.00	-.05	.04	-.08	.02	----				
12. Percentage of Non-Swedish Employee	Plant	9.23	11.61	-.06	-.05	-.01	.03	.10	.01	.09	.15	.08	.02	.06	----			
13. Percentage of Employees With At Least A College Education	Plant	2.80	7.12	.21*	.06	.03	.03	.02	-.01	.04	.09	-.02	.06	.10	.02	----		
14. Profit Per Worker	Firm	32.82	518.33	.01	.01	.01	-.01	.00	.04	.01	.00	.00	.02	.00	-.01	.02	----	
15. Market Share	Firm	0.011	0.051	.03	-.01	-.01	.00	.25	.01	.30	.28	.21	.02	.02	.03	.07	.02	----

Notes: +p < .10; *p < .05; **p < .01

Figures shown are computed at the highest level of aggregation possible. Employee figures are based on all individuals who ever worked in manufacturing during the sample period. Sample sizes are reduced for selected variables

Table 2

Worker Level Regressions: Estimates of the Effects of Mergers and Acquisitions on Earnings

Dependent Variable: Log Earnings	Coefficient on:
Experience	.095*** (.002)
Female	-.377*** (.001)
MA_{t-7}	-.001 (.001)
MA_{t-6}	.005*** (.001)
MA_{t-5}	.004*** (.001)
MA_{t-4}	.004*** (.001)
MA_{t-3}	.006*** (.001)
MA_{t-2}	.010*** (.001)
MA_{t-1}	.014*** (.001)
MA_{t+0}	.020*** (.001)
MA_{t+1}	.004*** (.001)
MA_{t+2}	.005*** (.001)
MA_{t+3}	.000 (.001)
MA_{t+4}	.000 (.001)
MA_{t+5}	.004*** (.001)
MA_{t+6}	.007*** (.001)
MA_{t+7}	.003*** (.001)
R^2	0.477
Number of Plants	15946
Number of Workers	2096580
Number of Observations	18337355

Notes: 18,337,355 observations on 2,096,580 workers. Regression also includes dummy variables for national origin, level of education, type of education, "no-data," industry, year, location, and plant age. Robust standard errors are presented in parentheses. To save space, we only report coefficients on the mergers and acquisitions dummy variables in the seven years preceding and following a merger or acquisition.

† p<.10, * p<.05, ** p<.01, *** p<.001. These are two-tailed significance levels using robust standard errors.

Table 3
Worker Level Regressions: Averages of Coefficients on Merger or Acquisition Dummy Variables in Compensation Equation Five Years Before and After a Merger or Acquisition

Coefficient on:	Merger or Acquisition Dummy Variables
MEAN OF MA_{t-5} TO MA_{t-1}	.0075*** (.0004)
MEAN OF MA_{t+1} TO MA_{t+5}	.0025*** (.0005)
INCREASE PRE TO POST MERGER OR ACQUISITION	-.0050*** (.0006)

Notes: Robust standard errors in parentheses
† p<.10, * p<.05, ** p<.01, *** p<.001. These are two-tailed significance levels using robust standard errors.

Table 4

Percent of Employees Experiencing Employment Status Change, and Mean Earnings Growth, of Employees from Time T-1 to Time T+1

	% of Employees		Two-Year Real Earnings Growth	
Employment Location at Time T+1	Employees Whose Plant Experienced A Merger or Acquisition at Time T	Employees Whose Plant Did Not Experience A Merger or Acquisition at Time T	Employees Whose Plant Experienced A Merger or Acquisition at Time T	Employees Whose Plant Did Not Experience A Merger or Acquisition at Time T
Same Plant	62.7%	72.9%	10.6%	12.6%
Another Plant Belonging to the Same Firm	2.3%	2.2%	6.6%	16.8%
Another Plant Belonging to the Acquiring Firm Or Merged Entity	2.4%	n.a.	20.3%	n.a.
Another Firm In The Same Industry	2.8%	1.8%	17.6%	25.6%
Another Firm in Another Manufacturing Industry	6.2%	4.1%	41.0%	62.8%
Another Firm Outside Manufacturing	5.9%	4.9%	36.9%	51.9%
Not Employed in Sweden	15.2%	12.6%	-100.0%	-100.0%
Uncertain	2.5%	1.4%	4.6%	13.9%

Table 5

Plant-Level Regressions: Estimated Effects of a Merger or Acquisition on Acquired Plant Productivity, Output, and Employment or Acquirer's Plant Productivity (Standard Errors in Parentheses)

Coefficient on:	Model 1: Productivity	Model 2: Output	Model 3: Employment
Labor ‡	.328 *** (.005)	-------	-------
Capital ‡	.321 *** (.007)	-------	-------
Materials ‡	.360 *** (.005)	-------	-------
MA_{-5}	-.031 *** (.008)	.203 *** (.021)	.228 *** (.019)
MA_{-4}	-.027 *** (.006)	.180 *** (.020)	.206 *** (.017)
MA_{-3}	-.037 *** (.006)	.179 *** (.019)	.206 *** (.016)
MA_{-2}	-.034 *** (.005)	.177 *** (.018)	.199 *** (.015)
MA_{-1}	-.055 *** (.006)	.147 *** (.018)	.188 *** (.015)
MA_0	-.065 *** (.006)	-.004 (.017)	.018 (.015)
MA_{t+1}	-.030 *** (.005)	.077 *** (.018)	.079 *** (.015)
MA_{t+2}	-.023 *** (.005)	.087 *** (.019)	.081 *** (.016)
MA_{t+3}	-.012 * (.006)	.096 *** (.021)	.086 *** (.018)
MA_{t+4}	-.019 ** (.006)	.090 *** (.023)	.085 *** (.019)
MA_{t+5}	-.014 * (.007)	.090 *** (.024)	.084 *** (.021)
R^2	0.961	0.379	0.322
Number of Plants	15,946	18,513	18,962
Number of Observations	82,307	124,441	125,416

Notes: † p<.10, * p<.05, ** p<.01, *** p<.001. These are two-tailed significance levels using robust standard errors, allowing for correlated ("clustered") errors within plants. ‡ Weighted means of industry-specific coefficients at the detailed (4-digit SIC) industry level. Regressions include "no-data," industry, plant location, plant age, and year dummies.

Table 6
Plant Level Regressions: Estimated Effects of a Merger or Acquisition on Plant Productivity, Output, and Employment for Various Types of Ownership Changes

All Mergers and Acquisitions

Period	Productivity	Output	Employment
Pre-Ownership Change (Average-5 years Before)	-0.037 ***	0.177 ***	0.205 ***
Post-Ownership Change (Average-5 years After)	-0.020 ***	0.088 ***	0.083 ***
Post-Pre	0.017 **	-0.089 ***	-0.122 ***

Full Acquisitions

Period	Productivity	Output	Employment
Pre-Ownership Change (Average-5 years Before)	-0.037 ***	0.060 **	0.109 ***
Post-Ownership Change (Average-5 years After)	-0.023 ***	-0.055 **	-0.046 **
Post-Pre	0.014 *	-0.116 ***	-0.155 ***

Partial Acquisitions

Period	Productivity	Output	Employment
Pre-Ownership Change (Average-5 years Before)	-0.036 *	0.631 ***	0.578 ***
Post-Ownership Change (Average-5 years After)	-0.009	0.546 ***	0.498 ***
Post-Pre	0.026	-0.085 **	-0.080 **

† p<.10, * p<.05, ** p<.01, *** p<.001.

Table 7
Plant Level Regressions: Estimated Effects of Mergers and Acquisitions on Experience, % College-Educated, and Earnings

Period	Experience	% College-Educated	Earnings
Pre-Merger or Acquisition (Average-5 years Before)	0.037 (0.036)	0.002 (0.061)	-0.008** (0.002)
Post- Merger or Acquisition (Average-5 years After)	0.184*** (0.047)	0.155† (0.081)	0.005* (0.002)
Post-Pre	0.148** (0.051)	0.153* (0.073)	0.013*** (0.003)

† p<.10, * p<.05, ** p<.01, *** p<.001.

Table 8

Plant-Level Regressions: Estimated Effects of a Merger or Acquisition on Acquired Plant Productivity, for High- versus Low (Just Before Acquisition) Physical or Human Capital Plants (Standard Errors in Parentheses)

Coefficient on:	Model 1: Productivity		Model 2: Productivity	
	Physical Capital Intensity Below Median	*Physical Capital Intensity Above Median*	*Human Capital ≤ 5% College Educ.*	*Human Capital > 5% College Educ.*
Cap.Int. × MA_{-5}	-.043*** (.012)	-0.025* (0.010)	-0.026** (0.008)	-0.053* (0.021)
Cap.Int. × MA_{-4}	-.028** (.010)	-0.029*** (0.008)	-0.030*** (0.007)	-0.011 (0.017)
Cap.Int. × MA_{-3}	-.042*** (.009)	-0.036*** (0.008)	-0.042*** (0.006)	-0.002 (0.019)
Cap.Int. × MA_{-2}	-.024** (.008)	-0.045*** (0.008)	-0.036*** (0.006)	-0.021 (0.016)
Cap.Int. × MA_{-1}	-.052*** (.009)	-0.060*** (0.009)	-0.057*** (0.006)	-0.054* (0.022)
Cap.Int. × MA_{0}	-.063*** (.009)	-0.094*** (0.009)	-0.072*** (0.006)	-0.041* (0.019)
Cap.Int. × MA_{t+1}	-.019* (.009)	-0.067*** (0.009)	-0.031*** (0.006)	-0.046** (0.017)
Cap.Int. × MA_{t+2}	-.021* (.009)	-0.048*** (0.010)	-0.026*** (0.005)	-0.010 (0.017)
Cap.Int. × MA_{t+3}	-.015 (.010)	-0.034** (0.011)	-0.019*** (0.006)	0.032 (0.021)
Cap.Int. × MA_{t+4}	-.029* (.011)	-0.033** (0.012)	-0.025*** (0.006)	0.016 (0.022)
Cap.Int. × MA_{t+5}	-.027* (.011)	-0.033* (0.014)	-0.019** (0.007)	0.021 (0.023)
R^2	0.961		0.961	
Number of Plants	15,946		15,946	
Number of Observations	82,307		82,307	

Notes: † p<.10, * p<.05, ** p<.01, *** p<.001. These are two-tailed significance levels using robust standard errors, allowing for correlated ("clustered") errors within plants. Regressions include "no-data," industry, plant location, plant age, and year dummies. Physical capital intensity is capital per employee, except in the few cases where plant employment is unknown or zero, in which case the measures are based on capital per unit of output. Human capital intensity is based on the percentage of a plant's employees with at least three years of college education, for which the median is zero and the 83.9^{th} percentile is 5%.

Table 9
Plant and Firm Level Regressions: Estimated Effects of a Merger or Acquisition on the Performance of the Acquirer

Coefficient on:	Model 1: Productivity of the Acquirer's Existing Plants	Model 2: Firm Net Profit Per Employee	Model 3: Firm Market Share
MA_{-5}	-.026 * (.013)	-11.3 (11.7)	.010 (.006)
MA_{-4}	-.020 (.015)	0.5 (11.3)	.012 * (.005)
MA_{-3}	-.012 (.010)	-13.6 (10.3)	.010 * (.005)
MA_{-2}	.009 (.010)	-18.4 † (9.9)	.010 * (.004)
MA_{-1}	.010 (.009)	-19.0 (15.9)	.003 (.004)
MA_0	.017 * (.009)	14.6 (25.5)	.005 (.004)
MA_{t+1}	.011 (.009)	-13.6 (15.4)	.008 * (.004)
MA_{t+2}	.002 (.011)	-34.6 * (15.0)	.008 * (.004)
MA_{t+3}	.021 † (.012)	-15.5 (12.6)	.010 * (.004)
MA_{t+4}	-.005 (.011)	49.8 (51.2)	.009 * (.004)
MA_{t+5}	-.004 (.012)	204.3 (207.1)	.009 † (.005)
R^2	0.961	0.017	0.522
Number of Plants or Firms	15,946 plants	9,387 firms	9,416 firms
Number of Observations	82,307	31,461	31,544

Notes: † p<.10, * p<.05, ** p<.01, *** p<.001. These are two-tailed significance levels using robust standard errors, allowing for correlated ("clustered") errors within firms. Plant-level regression includes "no data," industry, plant location, plant age, and year dummies. Firm-level regressions include "no-data," industry, location, and year dummies, plus firm employment, risk, and R&D intensity.

Figure 1
Worker-Level Regressions: Percentage Mean Earnings above Norm,
Relative to Year of Merger or Acquisition

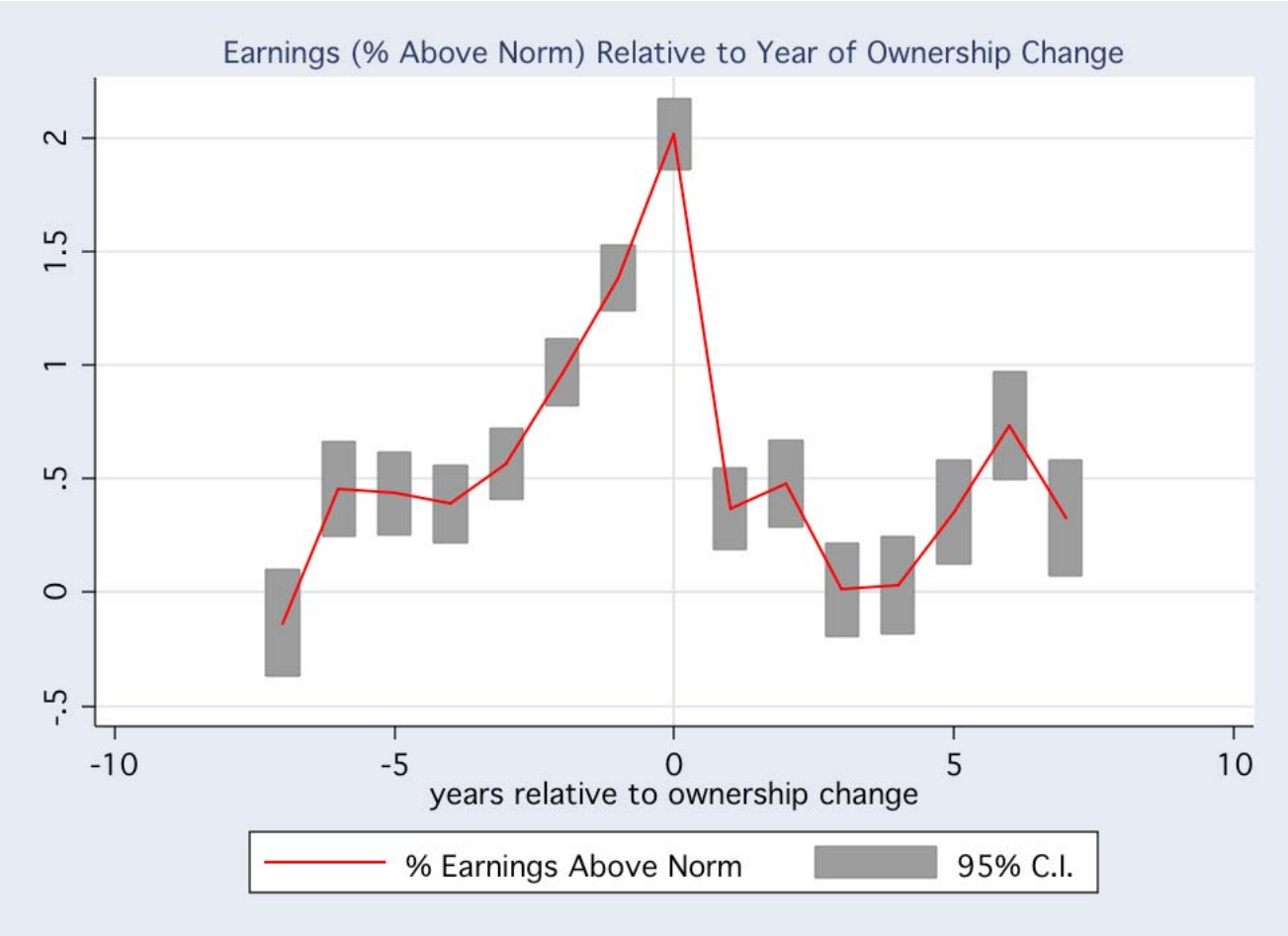

Figure 2

Plant-Level Regressions: Graphs of the Coefficients on the Mergers and Acquisitions Dummy Variables in the Productivity Equation

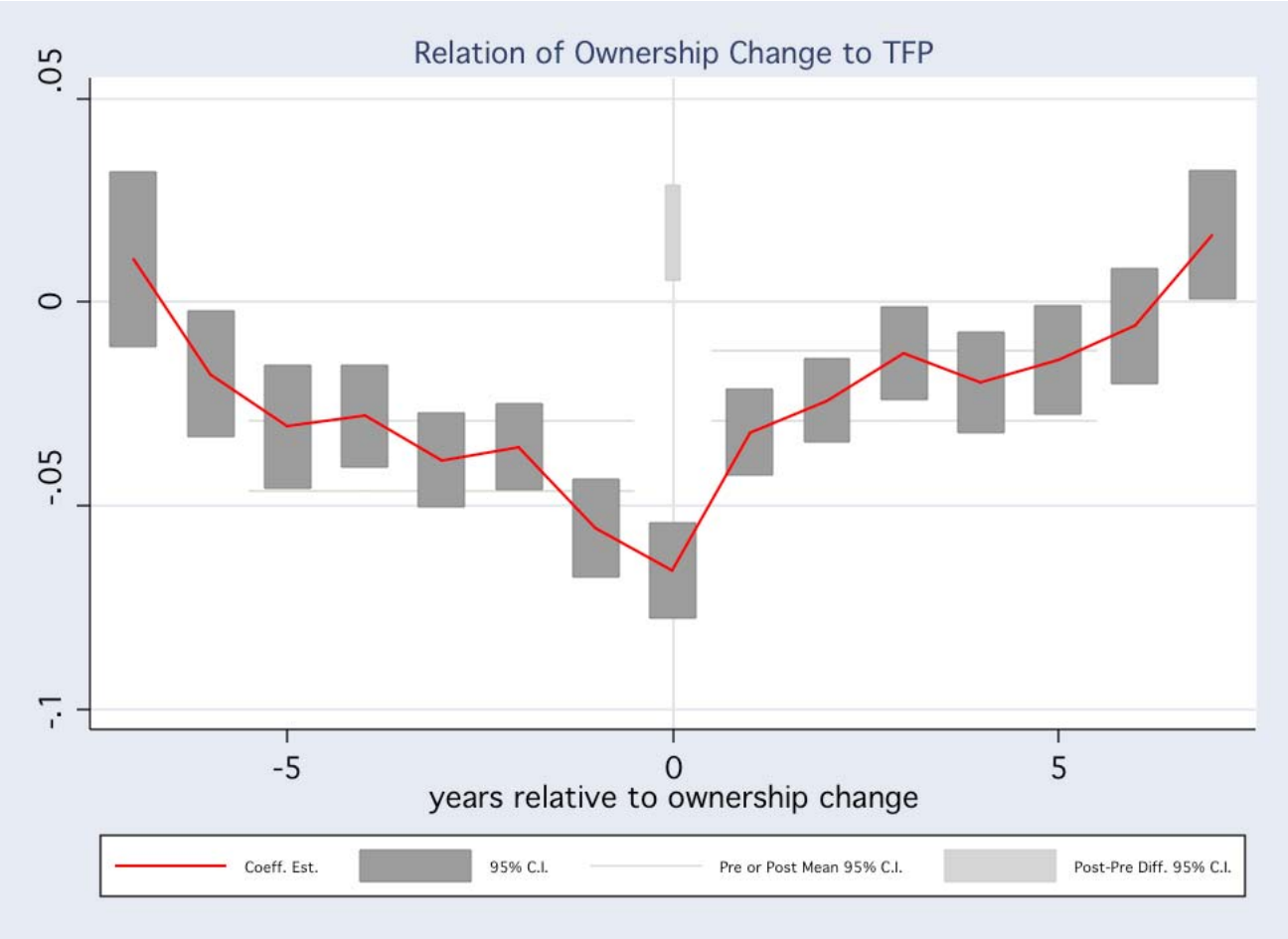

Figure 3

Plant-Level Regressions: Graphs of the Coefficients on the Mergers and Acquisitions Dummy Variables in the Productivity Equations for Low versus High Physical and Human Capital

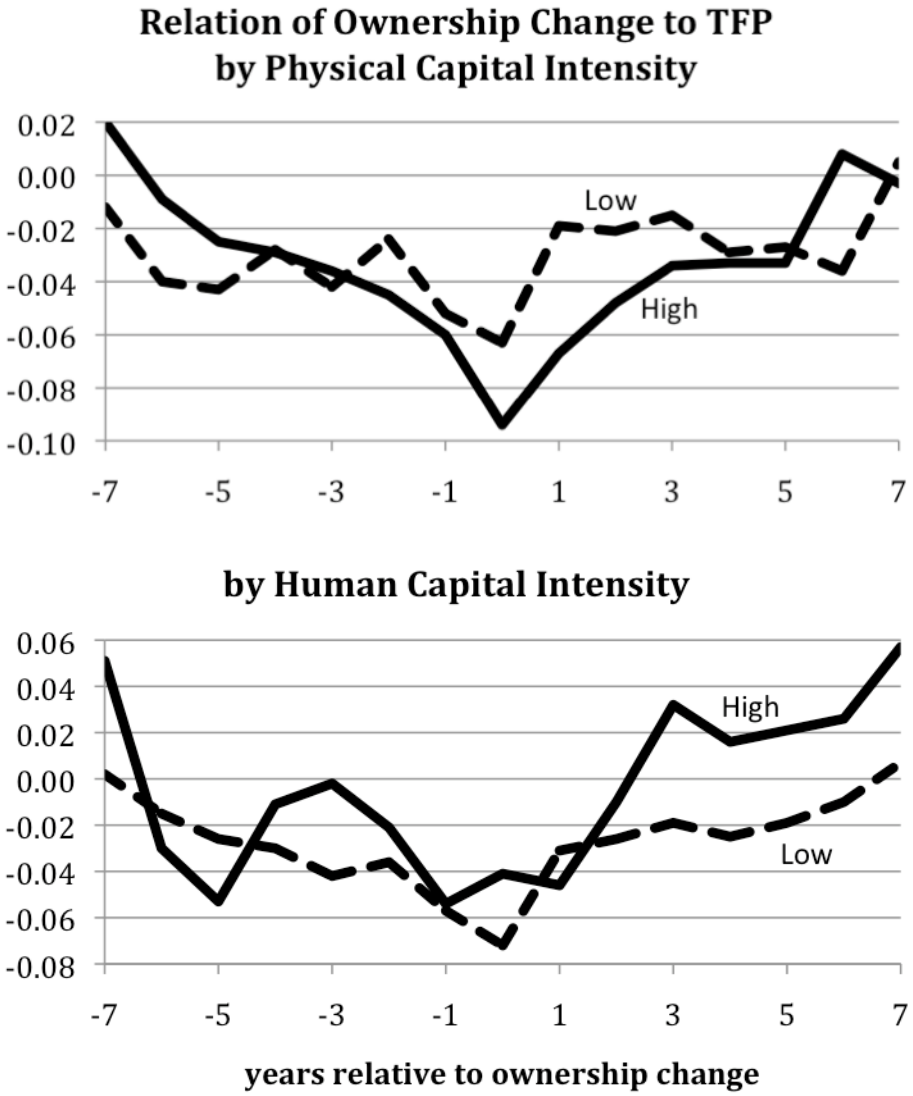

Figure 4

Firm-Level Regressions: Graphs of the Coefficients on the Mergers and Acquisitions Dummy Variables in the Profit Equation

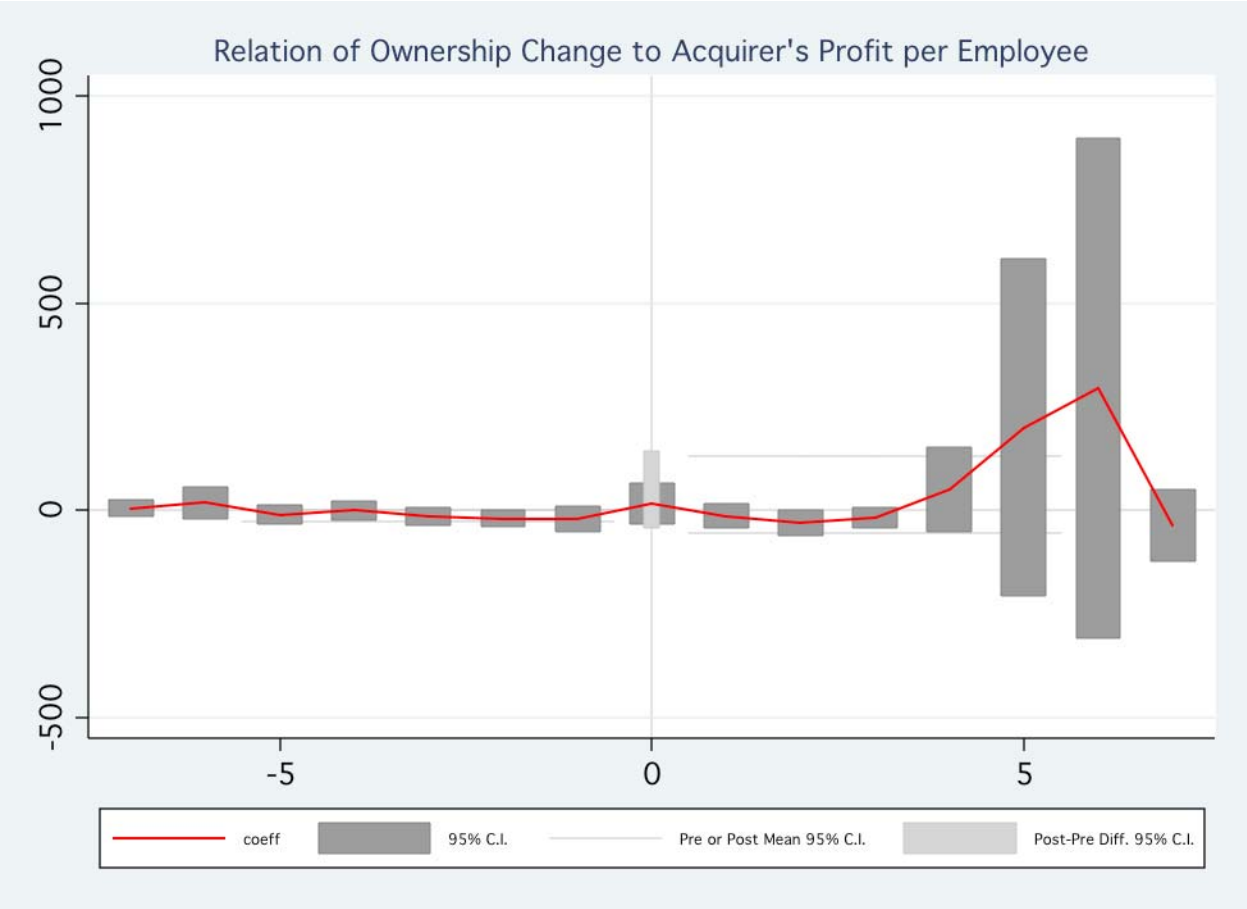

Figure 5

Firm-Level Regressions: Graphs of the Coefficients on the Mergers and Acquisitions Dummy Variables in the Market Share Equation