

AN EMPIRICAL ANALYSIS OF POST-MERGER ORGANIZATIONAL INTEGRATION

Valerie Smeets
Department of Economics and Business, Aarhus University

Kathryn Ierulli
University of Chicago

Michael Gibbs
University of Chicago Booth School of Business & IZA

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We study organizational integration after merger. Integration is implemented primarily by reassigning high-skilled workers, especially in R&D or managers, rather than large-scale mixing of workforces. Mixing is biased towards establishments set up after merger, rather than existing establishments. Turnover is high for both Acquiring and Target workers, but new hiring yields stable total employment. Target employees have higher turnover and reassignment; these are mitigated if the Target firm is larger in comparison to the Acquiring firm. These patterns indicate the importance of human capital and knowledge sharing, are consistent with the brokerage view of networks, and suggest substantial integration costs.

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I. INTRODUCTION

A merger is a dramatic event for firms and employees, for it requires integration of two organizations. There is a large economics literature on mergers, but it offers little evidence on how integration is accomplished (e.g., see the surveys by Andrade, Mitchell and Stafford 2001; Pautler 2001, 2003). In this paper we present evidence on this question, using Danish matched employer-employee data to construct a sample of mergers during the 1980s and 1990s. The specific aspect of integration that we focus on is physical collocation of the workforces of both firms involved in a merger. The data are particularly well suited to study of this aspect of integration, because they identify the physical location where each employee works. Thus it is possible to observe when workers are reassigned following a merger, including when employees of both firms mix in the same workplaces.

Outside of economics, the importance of integration to the success of mergers is well known, which highlights the need to better understand how such integration is accomplished. The business press and management literature often argue that a high percentage of mergers fail to meet strategic or financial expectations, and that a primary reason for this is the difficulty of integration. For example, consulting firm Pricewaterhouse Coopers publishes an annual survey of post-merger integration. The latest (PWC 2010) argues that emphasis on careful integration improves the odds of success in a merger. They find that careful pre-deal planning on how to implement integration makes it more likely that a merger will achieve cost synergies or other goals. PWC argues that “speed is critical to successful integration” and “the key integration challenges ... are motivation of employees, alignment of cultures, organization and processes as well as IT systems.” A recent McKinsey study (Cogman and Tan 2010) finds that many Asian firms use a “lighter touch” for mergers to avoid integration costs. They describe this as

a focus on economies from common procurement, minimizing integration and organizational disruption of the firm that is being acquired, and allowing incumbent management to stay in place with oversight by the acquiring firm.

An interesting example of how important integration can be to mergers is Cisco (O'Reilly 1998). For years Cisco has pursued a strategy of innovation and growth via acquisition of small companies that are technology leaders. This gives the company substantial experience with post-merger integration, and it has developed methods to make the process more effective. Cisco explicitly has historically avoided “mergers of equals” – firms with similar size – preferring to absorb small firms. The company includes human resource staff on the due-diligence team that evaluates whether a company is a good acquisition candidate. They screen targets for “shared vision” and the “right chemistry or cultural compatibility.” Deals are rejected if the cultural fit is not strong enough.

Once an acquisition is executed Cisco is very direct in handling integration. Integration teams immediately descend on the Target company to implement changes as quickly as possible. The implementation plan includes two parts: structural (organization chart, rationalization of policies, etc.) and cultural. Newly acquired employees are each assigned a “Cisco Buddy” from the company’s workforce to help them assimilate, and are given training in Cisco’s culture. Cisco executives recognize the potential for resistance by new employees, and for formation of factions on both sides in the workplace. They note that the high number of prior acquisitions mean that many Cisco employees were acquired in the past, which reduces such tendencies. The director of HR due diligence bluntly tells new employees, “this was an acquisition, not a merger of equals” and “The more flexible and positive you are, the better it will be for you” (O'Reilly 1998). These policies are not unique to Cisco. Emerson Electric has acquired over 200 companies since 1973, and reports that most of these have been profitable. The company’s methods for integration are quite similar to Cisco’s (Knight and Dyer 2005).

According to the Wall Street Journal, Cisco has recently experimented with a different approach for a small number of acquisitions of larger companies such as LinkSys (White and Vara 2008). In those limited cases, instead of quick and close integration, Cisco is experimenting with allowing the acquisition to operate as a standalone division, with its own brand name, management, product design staff, and organization. According to the article, “The slow pacing for some of the ‘platform’ integrations suggests they're not as easy. Cisco decided to take a year and a half learning Scientific-Atlanta's business before sitting down with its executives to discuss detailed sales synergies,” and that “some ‘us versus them’ dynamics have lingered.” This different approach for larger acquisitions is consistent with the argument that larger mergers (even if not quite of equals) are more difficult to implement, and take more time.

Our analysis provides new stylized facts on post-merger integration, using a representative sample of mergers. There is surprisingly little overall integration, defined here as the reassignment of employees to work with new colleagues from the other firm. Three years after a merger, only about 8% of surviving employees from the Acquiring firm, and 15% from the Target firm, have moved to a workplace that was in the other firm before merger, or that was set up after the merger. The rest remain in workplaces that existed in their firm prior to merger, where most of their colleagues are from their pre-merger firm. The merged firm chooses certain types of employees to mix with employees from the other firm – particularly those who are highly skilled, managers, or in R&D, presumably to share knowledge and coordinate between organizations. Strikingly, we find high turnover from both firms, but on average the combined firm does not decline in total employment. Instead lost workers are replaced by new hires. Finally, the results depend on the relative size of the merging workforces. The larger the Target workforce relative to the Acquiring workforce (i.e., the more the merger is between equals), the greater the extent to which Target workers are shielded from

the merger's effects: their turnover is lower and they are less likely to be reassigned to Acquiring firm establishments.

One interpretation of these findings is that, consistent with practitioner observations and examples such as Cisco, organizational integration is difficult and costly, so that mergers are implemented in ways that mitigate those costs. That would explain why most employees are not reassigned to collocate with colleagues from the other firm. It might also explain high turnover combined with hiring, as it may be easier to integrate new hires than to combine two existing workforces. The evidence that the relative size of the two workforces affects outcomes suggests potential for conflict between more equal groups, as emphasized by practitioners (Pautler 2003). This paper contributes to the literature by highlighting the importance of integration costs for research on mergers, providing new evidence on how firms integrate after mergers, and suggesting an approach for further empirical research on these questions. Finally, the findings have broader relevance for the literature on the economics of organization (e.g., Garicano 2000, Crémer, Garicano and Prat 2007, Ichniowski and Shaw 2009) because post-merger integration is one example of the broader issue of coordination within firms.

II. ECONOMICS OF ORGANIZATIONAL INTEGRATION

In this section we present a brief literature review followed by a discussion of the costs and benefits of post-merger integration, setting the stage for the empirical questions studied. First, a clarification on what we mean by “merger” is called for. Mergers are sometimes distinguished from acquisitions. The former refers to a combination of two firms that are relatively equal (in size, market share, or value). The latter term is used more when a larger firm such as Cisco buys a smaller and less powerful firm. Usually the Acquiring firm is larger, though this is not always the case. In the finance research on mergers this distinction is common, since it is

usually easy to identify which firm made a bid for the other firm's stock. However, most of the research outside of finance does not distinguish between Acquiring and Target firms, or between mergers and acquisitions.

In this paper we use the terms Acquiring and Target to refer to two firms that merge together, because our data provides a natural definition of which firm is legally buying the other – the Acquiring firm is the firm whose identification code is used by the combined firm after the merger. However, we are relatively agnostic about the relative power or size of the two firms (though we use a possible measure for this, Dominance, below). We do not distinguish acquisitions from mergers, but view all of the transactions that we study as mergers of two firms into one. Furthermore, Denmark had almost no hostile takeover attempts during our sample period, so we ignore the distinction between friendly and hostile transactions.

Prior Literature

There is a large literature on mergers in economics, accounting and finance (see the surveys by Andrade, Mitchell and Stafford 2001; Pautler 2001, 2003). Topics studied include returns to shareholders of both firms, and the effects of mergers on profit, product quality, R&D intensity, market share, and productivity. Returns to shareholders tend to be positive, with most of the gains accruing to Target shareholders. Many potential motives for merging have been proposed, but empirical evidence is inconclusive on which are most common or create the most value. Mergers tend to occur in waves and to cluster within industries, suggesting they are often driven by exogenous shocks such as technological or regulatory change.

Target workers tend to fare worse than Acquiring workers in wages and employment (Brown and Medoff 1988; Margolis 2006). However, Ouimet and Zarutskie (2010) find that Target employees have higher wage growth than Acquiring employees, especially when the Target workforce is the more skilled of

the two. Kubo and Saito (2011) study Japanese mergers and find that total employment decreases while wages increase. Gugler and Yurtoglu (2004) find that European mergers lead to reductions in employment, compared to little effect in the US. They attribute this to relatively rigid labor markets in Europe. However, their sample includes only 5 Danish mergers in a sample of 646, and Denmark's labor market is quite flexible, as discussed below.

A recent literature exploits matched employer-employee datasets, similar to ours, to study the effects of mergers. Benedetto (2006) finds increased turnover. Pesola (2007) and Lehto and Böckerman (2008) find high turnover of workers acquired by a foreign company. Kwon and Meyersson-Milgrom (2009) find higher turnover for workers losing occupational status after a merger, and conclude that workers may prefer status over wages. Davis et al (2008) study private-equity transactions, and find that Target firms had declining growth both before and after acquisition, but after a few years employment grew more rapidly than firms in a control group. Siegel and Simons (2010) analyze effects on establishment-level productivity. They find that establishments tend to downsize but increase productivity, so mergers appear to sort workers to more efficient use. Maksimovic, Phillips and Prabhala (forthcoming) find substantial restructuring after mergers of manufacturing firms, including selling and closing of establishments. Target establishments increase productivity, especially when the Acquiring firm has higher productivity itself.

Put together, these results suggest the importance of key human capital and knowledge sharing in mergers (see also Matsusaka 1993; Ouimet and Zarutskie 2010). However, these studies do not identify whether the benefits arise through extensive integration, or by using a few key employees to share knowledge between workforces.

Despite the substantial body of research on mergers summarized above, there is almost no discussion or evidence concerning post-merger integration. The

only survey on integration that we are aware of is Pautler (2003), which primarily discusses reports by consulting firms. He references academic studies only to provide evidence consistent with or related to practitioner conclusions. It is interesting to note that the economics literature focuses almost exclusively on the benefits of mergers, whereas Pautler finds that practitioners emphasize the costs – particularly of organizational integration. He summarizes recurring themes in the consulting literature under the heading “What Makes Some Mergers Work Well?” Related mergers are more likely to have successful integration than are unrelated mergers. Integration of equal-sized firms is more likely to fail than of unequal-sized firms. Early planning and fast execution improve the odds of successful integration. Managers are important to successful integration, and should be “cognizant of cultural differences between organizations and avoid conflicts.” Finally, retention of key employees is important, especially in technology or human-capital intensive industries, including managers, and those in R&D or Sales. Of course, these observations are consistent with the Cisco example and Pricewaterhouse Coopers report described above. Our analysis provides evidence on each of these ideas. Our focus in the next subsection is primarily on the costs of mergers, given that they have been less explored in the economics literature.

Benefits and Costs of Integration

There are many potential benefits of mergers, only some of which require integration. There may be efficiencies from reduced headcount or wages – as mentioned above, empirical evidence is mixed concerning such effects. To the extent that such efficiencies are the motive, a merger may be a negative experience for many employees. There may also be gains from knowledge sharing across the firms. These can arise in several ways, including economies of scope in product design, cross-selling to customers from the other firm, sharing technology, and improving production methods. One firm might learn from the other, or both might learn

from each other. If knowledge sharing is important, certain employees may benefit by playing a key role in a merger; e.g., possessing knowledge the merged firm wants to share, working in a position that can benefit from new knowledge, or facilitating the exchange of ideas.

Practitioners consistently emphasize the costs of implementing mergers, and firms with extensive merger experience go to some length to attempt smooth integration. Organizational integration is likely to create three types of costs: the difficulty of changing formal and informal policies; negative effects of those changes on productivity; and the possibility of factions and favoritism between the two workforces.

First, an important integration cost is likely to be the changing of structures and policies, for at least one side and possibly for both. Organizational structures must be reconciled, including business units, geographical locations, hierarchies, functions, reporting relationships, and job titles. Compensation systems and human resource policies must be made consistent. Implicit policies and intangible assets must also be reconciled. The two firms will differ in their hiring criteria, extent and type of firm-specific human capital, and corporate culture. Crémer, Garicano and Prat (2007) view culture as a specialized code (language or jargon) between employees that facilitates coordination. They argue that a firm's ability to broaden its scope to create synergies (e.g., through unrelated merger) is limited by the need for common code across the two workforces. That code can be developed, but it will take time and possibly turnover and training of a new workforce. Finally, employees have implicit contracts with their original firm, on the basis of which they provide effort, invest in skills, and have expectations about career prospects. All of these formal and informal systems may need to be changed following a merger. The greater the extent of integration, the more change will be required for the merger to succeed. For example, Weber and Menipaz (2003) sur-

veyed employees in merging firms to assess cultural fit, and found that mergers with better fit had stronger financial performance.

A second cost of integration is that it may lower productivity for some employees. Productivity arises in part from firm-specific human capital, including social networks with colleagues to aid problem solving and learning (Garicano 2000, Ichniowski and Shaw 2009). When the merged firm changes policies and mixes the two workforces together, some of that human capital will depreciate in value or be lost entirely, and new investments may be required. For example, if the Acquiring firm imposes its production methods, Target workers who are forced to change lose the value of their knowledge of old methods. Similarly, as organizations mix, an employee's network of colleagues becomes less useful, and he or she must invest in new contacts and relationships in order to work effectively.

A third potential cost of integration is conflict between the two workforces. The merged firm must choose how much weight to give each side's policies in structuring the new organization. The side whose policies are more favored can be expected to lose less than the other side, because its human capital, authority, and networks are likely to remain intact. Each workforce has an incentive to use its power to implement its own policies, rather than those of the other workforce, to resist attempts by the other side to impose its own policies, and to act with favoritism towards its own members (Prendergast and Topel 1996).

Empirical Questions

We now state our empirical research questions, which are derived from practitioner observations, prior research, and the preceding discussion of the benefits and costs of mergers. Not surprisingly, previous studies have found that Acquiring employees tend to fare better than Target employees in wages and employment. By definition the Acquiring firm takes legal control of the Target. It typically con-

trols the board and appoints its CEO to run the combined firm. It seems likely that it will impose more of its policies on the Target. Favoritism would only magnify any disadvantage for Target workers. All of our empirical analyses will distinguish Acquiring from Target workers.

Prior studies tended to find that mergers lead to a decline in the size of the total workforce, though the evidence is mixed. The theoretical effect of a merger on workforce size is ambiguous. If the firm is merging to obtain economies of scale, it may be able to eliminate workers. However, if the more efficient merged firm grows, the workforce might grow. The merged firm faces the choice of retaining (and integrating) existing workers, or replacing them with new hires that lack firm-specific human capital, productive social networks, etc. A potential advantage of new hires is that they may be easier to integrate into the new firm than Target workers. The merged firm can choose its recruitment criteria and training, and new hires do not belong to an existing workforce and so are less likely to affiliate with one side or the other, or engage in favoritism. New workers can be selected that fit best with the new and emerging organizational culture. We will analyze the composition of the merged workforce in terms of Acquiring, Target and newly-hires.

Integration costs suggest several new research questions that we now describe: whether mergers of equal or unequal sized firms differ; the extent and methods used for workforce integration; and the role of employees with key human capital in implementing the merger.

Mergers of Equals and Unequals

Is a merger of equally-sized firms more difficult, as practitioners consistently argue (O'Reilly 1998, Pautler 2003)? If so, why? A potential explanation is suggested by the literature on ethnic conflict and assimilation (e.g., Montalvo and Reynal-Querol 2005; Caselli and Coleman 2010). Conflict is more likely when

two groups are of similar size. When one group is relatively small, resisting integration with the larger group is less likely to succeed, and the smaller group is more likely to assimilate. Similar logic may apply inside a merging firm. If one firm is relatively small, it is likely that the policies of the larger firm will be adopted or imposed. The smaller firm may resist, but is less likely than the larger firm to win political battles. The smaller workforce may be more cooperative, or its workers might exit. To study these questions we define the variable *Dominance*: the fraction of the workforce that worked in the employee's firm at the time of merger. This is calculated for both workforces; Dominance of the Target workforce equals one minus Dominance of the Acquiring workforce. We examine whether Dominance affects how the merger plays out for Acquiring or Target workers.

Extent and Method of Workforce Integration

To what extent do the merging workforces actually integrate, and how is integration accomplished? If integration is costly the firm may try to realize the benefits of a merger through methods that avoid integration. We observe the extent to which the merged firm mixes the two sets of employees: reassigning them to locations with employees from the other firm. A large amount of mixing of either kind suggests substantial integration. By contrast, a small amount suggests two possibilities. One would be that merging firms use low levels of integration, to avoid integration costs. An alternative would be that integration does not require collocation, but can be reasonably achieved by common policies, communication, and mixing only a few key employees.

We define two types of mixing. *Hard Mixing* refers to reassignment of an employee to an establishment that was in the other firm before the merger. *Soft Mixing* refers to reassignment to a new establishment created after the merger. These terms are designed to reflect the presumption that Soft Mixing may be less

difficult for an employee than Hard Mixing. All colleagues in a new establishment will also be Soft Mixing, whereas an employee who Hard Mixes is a minority in an existing establishment consisting of employees from the other firm, who already work together. Relatively more Hard than Soft Mixing would be consistent with one firm imposing its organization on the other, and focusing on the integration of employees from the other firm who possess key human capital. Soft Mixing might result if the merged firm grows and moves into new locations or opens new factories.¹ An alternative use of Soft Mixing is to “reboot” the organization, starting a new establishment from scratch with employees from both firms. That might reduce conflict, and may make it easier to change policies, reducing integration costs.

Importance of Key Human Capital

Do employees with certain types of human capital play a disproportionate role in mergers? A motive for many mergers is to share knowledge. A small literature in economics analyzes social networks inside firms (Jackson 2008). Ichniowski and Shaw (2009) view a firm as a collection of “experts developing connective capital.” They emphasize a case where skills are dispersed throughout the workforce, so many employees develop networks. That view would suggest that high rates of mixing are needed to get the benefits of integration. An alternative view comes from organizational sociology (Burt 2005) and models of knowledge hierarchies (Garicano 2000): a small number of workers become brokers or experts at solving problems and sharing knowledge. According to this view, integration may be possible by mixing a small number of workers who possess knowledge to share, or are good at communication or coordination. What kinds of skills or knowledge are most valuable for integration? Pautler (2003) concludes

¹ However, Denmark is a small country, with most of the economy is located in a small area surrounding Copenhagen, so that is less likely in our data.

that high-skilled employees, managers, and those in R&D or Sales, are key to integration (especially in technological or human-capital intensive industries). Managers have experience coordinating across functions and business units. R&D engineers possess knowledge about product design necessary to achieve economies of scope or share improvements in production methods. Salespeople may have relationships (a form of intangible capital) with important customers. High-skilled employees might act as brokers or experts, since they are likely to possess intangible knowledge that can benefit the other firm.

III. DATA AND SUMMARY STATISTICS

We employ a unique dataset that includes information on post-merger organizational integration, in a representative sample of mergers representing the entire economy of Denmark over 20 years. The Danish regulatory environment for mergers is similar to the US, with no significant unusual provisions (Jensen and Reinholdt 2011). The Target firm's board must present the terms of the offer, and an analysis of its impact on employees, to employee representatives such as unions. However, employees have no formal role in approving or rejecting mergers. Europe as a whole has experienced merger waves similar to those seen in the US (Gugler, Mueller and Weichselbaumer 2011), though merger sample is evenly divided over time.

We constructed the sample using matched employer-employee data from the central registers of the Danish government statistical agency Statistics Denmark, covering all individuals and firms in that country from 1980 to 2001.² We know each worker's employer in November, so the data are annual snapshots at that date. These data have several useful features. They allow accurate identifica-

² Many papers use these data. See for example Christensen et al (2005), Bennedsen et al (2007) and Lentz and Mortensen (2008).

tion of mergers and physical workplaces. Workers can be followed as they stay, exit, or are transferred within the firm after the merger. Gender, age, education, and compensation are included; labor market experience and firm tenure are easily calculated. Occupations are coded using International Standard Classification of Occupation (ISCO) codes that are standard in several European datasets of this kind. However, occupation data are only available from 1993 onward, and are most complete from 1995-1999, so occupation analyses use a more limited sample.

Unlike many datasets of this type, establishments are unique physical work locations, such as an office, store, or factory. They therefore provide a good measure of which employees work in close proximity. Statistics Denmark provides the primary industry of each establishment. We define the industry of the firm as the modal industry, measured by total employment across establishments.

We construct a sample of mergers between privately owned, private sector firms with 5 or more employees (there are a few publicly owned firms in the private sector in Denmark, which we exclude). Mergers are easily and accurately identified when establishments from different firms become part of the same firm in a given year (see the Appendix for sample construction). Most cases (around 75%) are single acquisitions where firm A acquires firm B. The remaining cases are multiple acquisitions where firm A acquires firms B, C, D ..., or joint mergers where firms A and B merge to create a new firm C. We discard multiple acquisitions because integration is more complex in such cases. Joint mergers are discarded because the Acquiring and Target firms cannot be identified. Partial mergers, in which firm A acquires some but not all establishments of firm B, are included. We require data from at least two years before to three years after the merger. Cases where a firm went through more than one merger during that window of time are excluded. These restrictions result in a final sample of 595 mergers.

We do not study merger motives as there are few relevant proxies, but do control for several merger characteristics. One is whether the merger is related (primary industry of the two firms is the same) or unrelated. An unrelated merger is more likely than an unrelated merger to be motivated by desire for economies of scope. Both can benefit from knowledge sharing, but it is of interest to see if there are differences in integration. We also control for partial mergers, in which part of a firm merges with another firm, but part is spun off. These might involve cherry-picking to maximize benefits or minimize costs of implementing the merger. Finally, we control for workforce size in case integration costs are non-linear with respect to size.

Characteristics of the 595 mergers are summarized in Table 1. Denmark has a large service sector, so nearly half of firms are in retail, hotels or restaurants. Manufacturing comprises about a third of the sample. About 10% are partial mergers, (typically, the Acquiring firm merged with some establishments from the Target firm, with the other establishments remaining independent of the merged firm). About 81% are related mergers (both firms have the same modal 4-digit industry), and 19% unrelated.

Acquiring firms have on average 4-5 times as many establishments as Target firms. Acquiring workforces are on average about 6 times larger than Target workforces. Our measure of the relative size of each workforce is Dominance, the fraction of the merged workforce that came from that employee's firm at the time of merger. The average Dominance of Acquiring workers, about 70%, implies that the average for Target workers is about 30%. Not surprisingly, Acquiring firms tend to dominate Target firms. There is, however, substantial variation in this measure. The data even include a small number of mergers with more Target workers than Acquiring workers.

Finally, Table 1 shows turnover in the 2 years prior to merger. Turnover is generally high in Denmark due to Danish "flexicurity" labor market institutions

that reduce turnover costs for both workers and firms (Westergaard-Nielsen 2002). In our sample 25.5% of Acquiring workers and 31.4% of Target workers leave during the first year after merger (and even more from $t = -1$ to $t = 0$). By contrast, firms with similar size and industry but not involved in a merger have lower turnover, respectively 24.3% and 26.5% for firms similar to Acquiring and Target firms. Target firms have more turnover than Acquiring firms. Both have higher turnover in the year before we define the merger. This reflects that mergers occur throughout the calendar year, but our data are fiscal-year-end snapshots. Thus mergers actually occurred sometime in the 12 months preceding what we call merger date $t = 0$, so our data understates organizational change to that extent. Of course, this is a limitation of most merger studies, which typically use annual data. Turnover 2 years before merger is not very different from that of non-merging firms.

Table 2 examines characteristics of Target and Acquiring workers in our 595 merging firms one year before the merger, compared to employees of control groups for each type. Control groups were created by propensity-score matching by 5-digit industry, firm size, and year. In the top panel of the table we see that Acquiring workers are better paid than Target workers by a small amount (about \$2 per hour). Both Target and Acquiring employees are about 35% female, have average age of 35, average schooling of 11 years, and tenure of a bit more than 4 years. There are few differences between our sample and the control groups. There are some small differences between the sample and column 5, which shows characteristics of employees of all non-merging firms of five or more employees for the period 1980-2001. The differences in column 5 – slightly lower pay, age, tenure, and experience – seem attributable to the larger percentage of small firms in the non-merging data.

The second half of Table 2 is occupational distributions (see the Appendix for occupation definitions). As we lack occupation information for the entire peri-

od, our sample here is smaller with 195 mergers. Workers are classified as Managers, R&D, Sales, Support, and Other. While only one occupation is significantly different between Target and Acquiring firms, the patterns are suggestive. Acquiring firms have more managers, 6.1% compared to 5%, and the difference is significant. There are also more managers in Acquiring firms than in the control groups. There are more R&D workers in Target than Acquiring firms, 8% to 7% (although the difference is insignificant), and both have more R&D workers than their control groups. Sales and Support are also found more in Acquiring and Target firms than in non-merging firms, but differences between Target and Acquiring firms are smaller.

IV. RESULTS

Firm Size and Workforce Composition

We now turn to analysis of post-merger job moves. If the purpose of the merger is to enjoy economies of scale, we might expect turnover, unless the merged firm grows enough to maintain the current workforce. Whether it grows or not, we expect the firm to have a preference for its current workforce over new hires, to retain firm-specific human capital (from both firms), and avoid turnover and hiring costs. For these reasons, overall employment, and rates of exit and new hiring, are of interest. Figure 1a plots the average number of establishments, while 1b-d plot the average number of employees, for the combined firm from 2 years before to 3 years after merger. These are divided into those from Acquiring and Target firms, plus establishments or employees added after the merger. Firm size stayed roughly constant over the 6-year merger window: the average number of establishments declined slightly while the average number of employees remained at about 230. Mergers are often characterized as being motivated by downsizing, but the sample period was not a period of dramatic restructuring in Denmark. The fact that the

size of the merged firm's workforce does not decline will be of interest for interpreting some findings below.

While the number of establishments stayed roughly constant, there was some shutting down of both Acquiring and Target establishments. These were replaced by creation of 1 new establishment in the average merger. A similar story holds for employment, but the creative destruction is more pronounced. We see high turnover of Acquiring and Target workers in the 3 years after merger. Roughly 45% of Acquiring workers and 55% of Target workers had gone after 3 years. However, these were replaced with new hires, so that half the workforce was new by the end of year 3. This reflects the high turnover in Denmark's labor market, but presumably also indicates some restructuring during implementation of the merger.

These patterns may obscure heterogeneity in types of mergers. As a quick check, Figures 1c-d provide plots similar to 1b for large and small mergers.³ The basic story remains the same. Both large and small mergers have approximately constant total employment over time, high turnover of Acquiring and Target workers, and end up with new hires comprising roughly half of the workforce 3 years after merger. Similar conclusions apply to the number of establishments, or if we divide the sample into related and unrelated mergers (neither comparison is shown). It is remarkable that in this sample merging firms tend to have stable overall size, and that there appear to be few differences in post-merger restructuring across mergers of varying size, or that are related or unrelated.

Worker Transitions and Reallocations

If the purpose of the merger is to share knowledge, the firms need some method of organizational integration. As discussed above there are two issues to consider.

³ We use median employment size at merger (73 workers) as the cut-off point.

The first is the method used – the choice between mixing employees by reassignment to an establishment in the other firm (Hard Mixing) or by reassigning workers from both to a new establishment (Soft Mixing). The second issue is the extent of collaboration between the workforces after merger. If integration costs are high, the firm might elect for less dramatic ways to achieve knowledge sharing, avoiding mixing (especially Hard Mixing) and strategically assigning a small fraction of workers to the task of achieving integration.

Table 3 sheds light on these issues by summarizing the extent of different types of job moves after the merger. Employees who do not exit are classified into Non Mixing (remain employed in an establishment that was in their firm at the time of merger) or mixing (Hard or Soft). The majority of day-to-day colleagues of Non Mixers are from their original firm, so disruption to those employees is likely to be relatively slight. Mixers are likely to have a high fraction of colleagues who are not from their original firm, especially if they Hard Mix.

We present actual and predicted values for these job moves, for Acquiring and Target employees. Predicted values provide a baseline of comparison, because Acquiring and Target firms have different structures. Acquiring firms tend to have more and larger establishments, so an Acquiring worker reassigned at random would be less likely to mix than a Target worker. Predicted values account for this by assuming that employees are randomly reassigned based on the number and size of other establishments.⁴

Perhaps the most striking observation in Table 3 is that mixing rates are not very high. Of those who remain in the firm after 3 years, roughly 92% of Ac-

⁴ That is, predicted values assume employees are reassigned to other establishments randomly, with odds equal to the fraction of employees in those other establishments – they are more likely to be reassigned to larger rather than smaller establishments. We calculate these predicted values over all possible establishment changes, both types of mixing plus changing within the employee's original firm, to account for the fact that Acquiring firms tend to have more establishments, so that conditional on changing location a Target employee is more likely to mix.

quiring workers and 85% of Target workers have not mixed in any way. This is an important observation because it implies that gains from integration are achieved not by creating one seamless organization out of the two workforces, but instead by reassigning only some employees to work with colleagues from the other firm.⁵ In this sense, the merger may have little day-to-day effect on the jobs of most workers. Below we examine what types of workers are given those reassignments.

We start to see some differences between the workforces when we examine those who do change establishments. First, Target workers are more likely to mix than are Acquiring workers. Total mixing after 3 years is over 15% for Target workers, compared to about 8% for Acquiring. Much of this appears to be driven by the fact that Target firms have fewer establishments, but some of the difference could reflect differential treatment of the workforces. We will come back to this point in the next subsection. Second, there is less Hard Mixing, and more Soft Mixing, than expected. For example, Acquiring workers have 6.5% odds of Soft Mixing after 3 years, compared to 2.6% expected, and 1.2% Hard Mixing. This is an interesting observation, telling us something about how merging firms implement integration. It may be that setting up new organizational units instead of combining existing ones increases the gains or decreases the costs of integration. Hard Mixing sends an employee “across enemy lines” into an existing group that might resist change. That mixing employee will probably have to adopt most of the policies and procedures of the existing group, and may face pressure to fit in rather than push for changes. The firm may find it easier to make changes by Soft

⁵ Alternatively this finding could imply that integration is largely possible via communication and coordination without collocation. Certainly there must be some truth to this. However, most organizations go to some lengths to locate employees together unless there is a compelling business reason for different locations, suggesting that physical proximity improves collaboration and coordination. Urban economics finds a similar effect, in which more densely populated cities tend to have higher rates of innovation, suggesting that even collaboration across firms is enhanced by physical proximity (Carlino 2001).

Mixing, since it has a chance to start the organizational unit from scratch. No employees are incumbents and none are minorities trying to assimilate into an existing group.

Finally, Table 3 suggests that a merger is likely to be experienced differently by Target and Acquiring workers. As discussed above, there are good reasons to expect Hard Mixing to be more challenging for an employee than Soft Mixing. Hard Mixing may be a job move with high variance in outcomes. Such moves are likely to be important ways for the firm to transfer knowledge and implement gains from merger. Success at such a move may lead to prestige, promotions and higher compensation. However, the difficulty of the situation may also lead to high rates of failure and turnover. A typical Acquiring worker has only about 7.7% (1.2 + 6.5) odds of mixing, and only 1.2% odds of Hard Mixing. A typical Target worker has 15.4% odds of mixing, and 12% odds of Hard Mixing. If we are correct that Soft and Hard Mixing are different, Target workers seem far more likely to be affected strongly (and adversely) by the post-merger reorganization. That may help explain why Target turnover rates are higher, in this and most other studies of mergers.

The bottom panel presents statistics on moves between establishments for related and unrelated mergers. Since our focus is on integration, we concentrate on the numbers for Hard and Soft Mixing. The patterns are similar to what we found before: Acquiring workers do not mix much, and when they do, they mostly rely on Soft Mixing. Target workers mix much more often, and are especially likely to Hard Mix. There is, however, a different pattern between related and unrelated mergers. Unrelated mergers have higher rates of mixing for Target workers (a noteworthy 17.7% Hard Mix), and slightly lower rates for Acquiring workers. Such mergers are more likely to be motivated by the Acquiring firm's desire to buy technology, customers or other valuable knowledge from the Target. Whether or not this is so, it is still the case that overall mixing rates are lower than would

be implied by extensive physical integration of the two workforces. In all cases, Hard Mixing is less than predicted and Soft Mixing is more than predicted.

Characteristics of Mixers, Non Mixers, Exits and New Hires

Table 4 describes the characteristics of employees by their status three years after merger. Compared to Non Mixers, Hard Mixers are more likely to be male, have less tenure though ages are about the same, are slightly better educated, and in a higher wage percentile (especially Target workers). Soft Mixers look similar to Hard Mixers but exhibit smaller differences in term of tenure, gender and education with respect to Non Mixers. Workers who exit are younger, less educated, have less experience and tenure, and lower pay. Firms appear to retain skilled workers, mixing the most skilled of that group, and replace those less skilled with new hires (who are younger, less experienced, and less paid). These findings are interesting because they are consistent with the view that an important motive for mergers is to share knowledge (Matusaka 1993; Ouimet and Zarutskie 2010).

In the lower half of Table 4, we examine occupation distributions and mixing status three years after merger. Among Acquiring workers, 12.6% of Hard Mixers are managers, compared to 4.1% of Non Mixers. On the other side, the share of Acquiring managers who Soft Mix (3.4%) is marginally different from Non Mixers. If we look at Target workers, we find the opposite: more Target managers Soft Mix. Thus Acquiring managers are redeployed to Target workplaces, suggesting that some supervision from the Acquiring company may be required there. The firm may send Target managers to newly created establishments to share specific capital or knowledge, or to redeploy more talented Target managers.

A large fraction of R&D workers Hard Mix. For Acquiring workers, R&D workers comprise 21.7% of Hard Mixers, while they only account for 10.7% of Non Mixers. The effect is even stronger for Target workers, where R&D accounts

for 31.3% of Hard Mixers. This may indicate that physical integration is particularly important for R&D workers to create synergies, and share knowledge.

For other occupation groups patterns are less suggestive. Acquiring workers in Sales and Support occupations represent a lower share of mixers than Non Mixers. Target Sales workers are subject to more reallocation. It is also interesting that Support occupations comprise the highest share of exits. Low mixing combined with high exit rates for those workers could mean that those occupations are more likely to be redundant post-merger, or most easily replaced by new hires.

Competing Risks

In Tables 5a-c we use competing risk models to estimate the effect of worker and firm characteristics on the probability that the worker experiences one of the following transitions: Hard Mixing, Soft Mixing, or exit.⁶ The baseline in our estimations is remaining in an establishment from one's pre-merger firm. We rely on multinomial probits for the competing risk models (Jenkins 2008).⁷ To capture the fact that the time workers are at risk plays a role, we use a non-parametric baseline by creating duration-interval-specific dummy variables, one for each spell at risk. All specifications include industry and year fixed effects. Tables report marginal effects instead of coefficients for ease of interpretation. To quantify the economic significance of those marginal effects, for variables of interest we discuss the implied effect of a change in that variable (by one standard deviation, and from the 25th to 75th percentile) on the odds of a risk in absolute and percentage terms.

⁶ We only estimate competing risks for first transitions for each worker. For example, a worker might mix in year 2, then move back to his original establishment in year 3. Including multiple moves would create too many competing risks for feasible estimation or meaningful interpretation. Fortunately only a small fraction of workers make multiple moves, even when we use a 10 year period.

⁷ We also estimated multinomial logits for the competing risk models. Multinomial logits assume independence of irrelevant alternatives (Greene 2002). We use multinomial probits because our data do not satisfy the IIA assumption. Note, however, that our results were similar when using multinomial logits.

The first result in Table 5a is the “protective” effect of Dominance on the worker’s probability of transition, particularly for Target workers. A more dominant (relatively larger) Target workforce at the time of merger implies less reallocation (to Acquiring or new establishments) and fewer exits for Target workers. This effect is found after controlling for firm size and the number of establishments each pre-merger firm owns. The marginal effect on Hard Mixing for Target workers is 8.1% percent (-0.081 in the first row, column 4). The standard deviation of Dominance is 0.241, so a one standard deviation increase in Dominance for Target workers decreases the probability of Hard Mixing by $0.081 \cdot 0.241 = 2\%$. The predicted rate of Hard Mixing for Target workers is 3.7%, so a 2% fall in probability amounts to a 54% relative decline in the rate of Hard Mixing, a very large relative effect. A change in Dominance from the 25th to 75th percentile ($0.542 - 0.205$) yields a 74% fall in the predicted value of Hard Mixing. Similarly, a one standard deviation increase in Target Dominance yields a 0.87 percentage point, or 67% decrease, in predicted Soft Mixing, and a 2.2 percentage point or 9.8% reduction in predicted exits. Since we think of post-merger transitions as risky and difficult from the worker’s point of view, and probably from the point of view of the firm as well, it is notable that Dominance reduces the probability of these events for Target workers.

Dominance is not as strongly related to post-merger transitions for Acquiring workers. There is a significant reduction in Hard Mixing, but no effect on Soft Mixing or exits. Since Dominance of the Acquiring firm is on average about 70%, we might not expect large marginal effects of Dominance for Acquiring workers. The fact that we see strong effects for Target workers, in contrast, suggests that small increases in power from a relatively small base translate into large effects in outcomes for those workers.

Looking at other firm characteristics, there are few significant variables. Related Merger is a dummy variable indicating whether the firms are in the same

4-digit industry.⁸ Our expectation was that post-merger transitions might vary by whether or not the firms are in the same industry, since such firms might experience economies of scale by merging, while those in different industries might have economies of scope. However, there are no significant differences between related and unrelated mergers in transitions. Both types of mergers seem to require similar levels of mixing and turnover. Similarly, the dummy variable for partial mergers (which might indicate that the Acquiring firm cherry-picked establishments of particular value or ease of integration) is positive and significant for Acquiring workers who Soft Mix, but insignificant in all other cases.

Pre-merger turnover, which may in part proxy for the extent of firm turbulence before the merger, has positive and significant effects for both Acquiring and Target workers on Soft Mixing and exit rates, but not on Hard Mixing.⁹ Having more pre-merger establishments decreases the probability of exit and increases the probability of Soft Mixing for Target workers. Since a small change in number of establishments is more significant in proportional terms for Target firms, it seems reasonable that the effect is larger than for Acquiring workers. Merger size (total number of employees) only affects Acquiring workers, and the effect is small.

Effects of worker characteristics are estimated in the lower part of Table 5a. Older, more experienced, and more tenured workers are less likely to exit the firm, with all exhibiting statistical significance. This is consistent with previous findings that as workers age, their rate of turnover slows down (Topel and Ward 1992). Women in Target firms are less likely to Hard Mix, consistent with Table 4.

⁸ We use modal industry for each pre-merger firm, defined with respect to the number of workers. We experimented with using 2-digit and 3-digit industry classifications. We also computed the share of workers active in the same major industry to capture related mergers in a continuous way. None of our results were affected by the type of variable chosen.

⁹ As noted above, some of pre-merger turnover may in fact be measurement error, since we observe mergers as a snapshot at the end of October.

We saw in Table 4 that workers who mix, particularly from the Target firm, tend to be in higher wage percentiles and slightly more educated. However, wages are correlated with educational attainment. For this reason in Table 5a we use wage residuals as an estimate of unobserved ability, computed from OLS estimation of individual wages controlling for years of education, gender, merger size, industry fixed effects, years, and quadratics for age, experience, and tenure. Workers with high wage residuals are more likely to exit the firm. Additionally, Target workers with high wage residuals are more likely to engage in Hard Mixing. It appears that the effect of unmeasured ability on transition probabilities is bimodal – some workers with high unmeasured ability will be more likely to experience transitions in the newly merged firm, while some will have better outside options and leave the firm to pursue them.

Taken as a whole, the results in Table 5a imply that firm structure and merger characteristic variables do not matter much. The notable exception is Dominance, which protects Target workers from workplace transitions; and pre-merger turnover, which indicates that firms experiencing volatility see it continue after merger. As far as worker characteristics, the interesting result is that turnover is lower for workers with more observable ability (education, tenure and experience), but higher for those with more unobservable ability (wage residual). These findings provide mixed evidence on the role of high human capital workers in implementing a merger. We explore this question more below.

Table 5b repeats the analyses of Table 5a, but for up to ten years post-merger, to see whether long-term effects are different from the three-year effects.¹⁰ Again, Dominance matters for Target workers, with significant protective

¹⁰ The sample criterion required data availability for a minimum of 3 years after merger (more years would have reduced the sample size). Therefore in Table 5b data are truncated for some mergers – those that occurred less than 10 years before the last year in the sample, or where the firm disappeared from the sample for some other reason (shut down, was itself acquired) in years 4-10 after the merger.

effects on Hard Mixing, Soft Mixing, and exit. The magnitudes and significance of the coefficients are not much different than the three-year estimates in Table 5a. Acquiring workers again experience a protective effect of Dominance on Hard Mixing, and the marginal effect is similar to the three-year estimate. Pre-merger turnover is positive and significant for Soft Mixing and exit in both groups, as before.

The effects of worker characteristics are also comparable in the three- and ten-year estimates, for both Acquiring and Target workers: age, experience, and tenure all are negatively related to the probability of exit; schooling reduces exit for Acquiring but not Target workers; females are less likely to Hard Mix when they come from Target firms. Again, wage residuals increase the probability of exit for Acquiring and Target workers, and increase Hard Mixing for Targets, and the magnitudes of the marginal effects are similar to the three-year estimates.

Overall, the effects of firm and worker characteristics are durable and persist up to ten years after merger. As in the three-year estimates in Table 5a, Dominance and pre-merger turnover, as well as age-related variables and unmeasured ability, have significant effects on workers' post-merger transitions. The persistent impact of these variables on transitions over a ten-year period argues that these are not fleeting effects which appear at merger and dissipate quickly. Rather, they are fundamentals that influence the long-term fate of workers in merged firms. Moreover, the fact that the effects are similar in magnitude at three and ten years suggests that most restructuring occurs quickly.

Tables 5a and 5b provide mixed evidence on the role that skilled workers play in mergers. In Table 5c we conduct similar estimations, adding dummy variables to see if certain occupations are more or less likely to mix. We chose occupations that seemed especially relevant for mergers (e.g., Pautler 2003), either because they might play a role in coordination (Managers, R&D), possess

knowledge and skills that are important for the merged firm (R&D, Sales), or be a source of efficiencies by eliminating redundancies (Support).

Recall that occupation data are only available for 1993 on, and is most complete from 1995-1999. As the panel is shorter and the sample size smaller, it is striking that the marginal effects are quite comparable between Tables 5a and 5c. For example, the effect of Dominance on Hard and Soft Mixing is approximately the same, for both Acquiring and Target workers. Although the marginal effect on Hard Mixing for Targets is a bit smaller, a one standard deviation increase is $-0.066 \cdot 0.242 = -0.016$, or a reduction of 42% of the predicted value, nearly the same as the effect in Table 5a. The other marginal effects of Dominance are about the same as in Table 5a, save exits for Targets. Other marginal effects on firm variables are not significant, except pre-merger turnover increasing post-merger transitions for Target workers, and exits for Acquiring workers. Similar observations apply to the effects of worker characteristics, compared to Table 5a. We regard the stability of marginal effects in the face of occupational controls and smaller sample sizes as evidence that employee skills play an important role in post-merger organizational integration.

Now consider the effects of occupational classifications (Other occupations are the omitted group). The occupations denoted by dummy variables turn out to have significantly higher Hard Mixing rates than other occupations. The marginal effects for Target employees are almost ten times larger than the effects for Acquiring employees. This implies that mergers are at least partially motivated by a desire to acquire key skills and knowledge from Target employees, and to enjoy cost efficiencies by eliminating staff. In addition, the effects for high-human capital occupations – Managers and R&D – are substantially larger than those for Support or Sales. High human capital occupations are more likely to be involved in integration (Hard Mix), and the effect is more pronounced for Target workers than Acquiring workers. In fact, if a Target worker is a manager or in R&D, the

marginal effect of occupation – ignoring the impact of the other variables – is large enough that the predicted probability of Hard Mixing is nearly fully accounted for. Similarly for Acquiring workers, the effect of occupation accounts for half to two-thirds of the predicted probability.

These large occupation effects reinforce our hypothesis that post-merger transitions are deliberate on the part of the firm, consequential for careers, and explainable by the structure of the merging firms and the types of workers that management inherits. Many papers have documented that Target workforces are disadvantaged when mergers take place; we link the Target's population outcomes to Dominance and its protective effect on shielding workers from post-merger transitions. Similarly, some studies have examined the role of human capital in mergers; we find that this is concentrated in certain occupations.

Wages and Exit Rates by Type of Transitions

As mentioned above, mixing (especially Hard Mixing) may lead to high variance in outcomes, but potentially high rewards if the employee is successful in the new role. To investigate this further, Table 6 presents the mean and variance of wage level, wage growth, and exits for three types of job moves: Not Mixing, Hard Mixing, and Soft Mixing. 3 years post-merger, mixing is associated with higher wage levels than Not Mixing. In most of the cases, the variance of wages is also higher for mixing. This is true for both Acquiring and Target workers.

Turning to wage growth, the mean and variance are also higher for mixing. Acquiring and Target groups here exhibit some different patterns. For Acquiring workers, Hard Mixing leads to higher mean and variance of wage growth than does Soft Mixing or Not Mixing. Acquiring workers who Soft Mix do not seem to differ much from those who do not mix, except that they have lower variance. This may indicate that Acquiring firms send their employees with high management human capital or skills to Target establishments in order to foster better or-

ganizational integration, and that this difficult task corresponds to higher rises in pay (with slightly more risk).

In contrast, in Target firms the ones who enjoy the largest wage growth are Soft Mixers, while the group with the highest variance is Hard Mixers. Hard Mixing leads to slightly higher wage growth than not mixing, but what is notable is the huge variance in wage growth, implying that Hard Mixing is risky for Target workers. On the other side, Soft Mixing leads to the highest gains in wage growth, with the lowest variance, making it a safe move for Target workers. This indicates that only a share of the Target workers who are sent to Acquiring establishments will succeed. One interpretation is that the firm tries to learn about Target workers' ability and only allocate the best to highly-paid positions. It may also be that selection is made with respect to how easily Target workers can integrate. Target workers who Soft Mix may end up in a managerial position and see their wage increased, as we saw in Table 4. This could be due to the fact that the firm finds it easier to integrate Target workers into newly created establishments.

Finally, exit patterns in Table 6 are consistent with the view that mixing is risky, particularly for Target workers. Exit rates are not very different for non mixers and mixers from the Acquiring firm. By contrast, among Target workers, exit rates are substantially higher for mixers than for non mixers.

It is not surprising that Acquiring and Target employees have different consequences from Hard versus Soft Mixing. Organizational integration is one of the most difficult tasks after a merger. It seems reasonable that Acquiring firms reward those who can spread their culture and methods, and that Target workers who "cross enemy lines" have to prove themselves (in skills, integration or both) in order to be given more responsibility. Finally, new establishments may especially benefit from receiving Target managers since changing the culture and expectations is not necessary in a new plant.

Robustness Checks

A variety of robustness checks were performed at various stages in this project. In earlier drafts we used a broader definition of mergers. We included “joint” mergers in which firms A and B merged to form a company with a new identifier C. In those cases the Acquiring firm is not clearly defined, but we assumed that it was the larger of the two firms. The initial sample also included publicly owned firms, and mergers in public sector industries. Finally, we did some analyses extending the sample to 2005 – for which the data are only partially complete.¹¹ None of these changes in sample altered our general conclusions.

Different econometric methods were used in earlier drafts. Our initial analyses of exits used simple probits for turnover at 1 and 3 years after merger. We also fit duration models (complementary log-log form) for turnover and mixing. Those models used a set of covariates similar to those used in the multinomial probits presented. The general conclusions were essentially the same as described above.

Analyses similar to Tables 5a-c were conducted with several variations to check for consistency of conclusions, available on request. For example, we split the sample into firms with sizes above and below median firm size. We find no evidence that large and small firms vary systematically in post-merger outcomes for Acquiring and Target workers. We ran similar analyses dividing the sample into related and unrelated mergers (not shown). Once more, results were similar to Tables 5a-c, with no important substantive differences between the two samples.

¹¹ While this extended the length of our sample, it proved to be somehow problematic as the data after 2001 present issues with respect to the way occupational information is reported, as many more workers have a missing occupation code. We therefore decided to stick to our current sample, which runs until 2001.

V. DISCUSSION & CONCLUSIONS

A merger is a very interesting topic for study in organizational economics, because two organizations suddenly become one. The methods, timing, and extent of integration provide important clues to more general questions about organizational design, since they reflect various tradeoffs between the benefits from merger, and the costs of integration. The business press and management literature often argue that integration is the most difficult hurdle to successfully completing a merger (Schmidt 2002; Pautler 2003; Cogman and Tan 2010). The topic has been largely ignored in economic research on mergers. In this paper we discussed reasons why integration may be costly, and used that to guide an empirical analysis of post-merger integration. We provided new evidence on the extent and methods of integration, which we hope will stimulate other researchers to analyze this topic theoretically and empirically.

As in prior research, we find substantial restructuring as a result of merger. Most of the changes occur within 3 years but persist for the first 10 years after the merger. Turnover rises for workers from both firms, but especially those of the Target firm. A very large fraction of employees leave the merged firm within the first few years. Interestingly, in our sample those workers are replaced by new hires, so that the average size of the firm stays stable after the merger.

We provide new evidence on the extent and methods of integration, measured by collocation of workers from the merging firms. Our results indicate that post-merger integration does not require large scale collocation of the two workforces. Approximately 5-15% of surviving Acquiring and Target employees are reassigned to mix with workers from the other firm. Mixing rates are higher for Target workers. Integration is apparently achieved by coordination, communication, and changes in policies in addition to collocation.

We find more Soft Mixing (a Target or Acquiring worker is reassigned to a new establishment set up after the merger), and less Hard Mixing (an employee is

reassigned to an establishment that existed in the other firm) than predicted. When Hard Mixing is used, it is much more likely that Target employees are reassigned to Acquiring establishments than vice versa.

The limited mixing is strategic, and provides strong evidence that knowledge sharing among high human capital workers is important for post-merger integration. Certain types of employees are more likely to be reassigned than others. In particular, R&D workers from both firms are much more likely to be mixed with workers from the other firm. Managers are also more likely to mix. Moreover, while Hard Mixing is rare for Acquiring workers, it is more likely for Acquiring managers than for other types of employees. It appears that managers play the role of coordinating and implementing the merger – acting as brokers in the language of the social networking literature – while R&D workers play the role of sharing technology and methods. Meanwhile, some Sales and Support workers are mixed, but Support workers also experience relatively high turnover, suggesting efficiencies from economies of scale in support functions.

Taken together the findings suggest that integration costs may be an important concern in implementing mergers. A striking observation is that the merged firm has high turnover of Acquiring and (especially) Target workers, but replaces them with new hires. It would seem at first glance to be more efficient to retain existing workers, who possess firm-specific human capital. However, if integrating two existing workforces is difficult because of conflict and favoritism, it may be easier to integrate new hires and limit integration to key employees (particularly in R&D). The bias towards Soft Mixing instead of Hard Mixing is consistent with that view, as integration may be easier if a new establishment is set up in which no employees are incumbents and there is no pre-existing structure and culture. The apparently protective effect of Dominance (relative workforce size) for Target workers is also consistent with this view. The variable Dominance was inspired by the literature on ethnic conflict, to proxy for the potential for conflict

between the two workforces. There may be other interpretations of this variable, but an intriguing possibility is that it indicates that there is less conflict from integration in a merger of unequals than in a merger of equals – precisely what practitioners argue.¹² Finally, the patterns of wage growth, variance in wage growth, and exit rates for mixers compared to non mixers are consistent with the idea that mixing is a risky job change (especially from the Target firm), with high wage growth if successful, but also the chance of failure and greater risk of turnover.

We believe that our findings about post-merger integration strongly suggest that integration costs are important. However, other interpretations are possible and more research needs to be done to reach firm conclusions. The approach taken here to analyze integration (e.g., Hard and Soft Mixing) may be fruitful for studying integration and organizational design with other datasets. We conclude with a brief discussion of further research questions suggested by our findings.

Certainly it would be of interest to document the extent and methods of mixing in other merger samples, the extent to which that varies by occupation, etc. One interesting conclusion is what we did not find – integration patterns seem to vary little with merger characteristics. The only major difference between different types of mergers (measured by total employment, partial v. full merger, and unrelated v. related merger) is that unrelated mergers use more Hard Mixing of Target workers (suggesting synergies in product design). It would be interesting to see whether that general lack of pattern is found in other merger samples. More importantly, we hope that researchers with different data are able to analyze whether integration patterns vary with merger characteristics that we were unable to measure, such as whether the merger is horizontal or vertical, diversifying or focusing, or motivated by economies of scale or scope.

¹² Note that virtually all of the mergers in our sample are between unequal-sized firms.

An important question is the effect of integration (extent and method) on productivity and financial gains from merger. We are unable to assess such questions as we lack financial data. Other datasets do have establishment or firm level financial data, so it may be possible to analyze interactions between integration and performance of the merged firm.

We tentatively conclude that integration is costly, but more research could be done exploring this issue. For example, is it in fact the case that mergers of unequals are more likely to succeed, and if so is that because integration is easier? Does relative workforce size (Dominance) affect outcomes for Target and Acquiring workers in other merger samples? Do merging firms tend to replace incumbent workers with new hires, and bias mixing towards new establishments, to avoid conflict?

Our findings provide some evidence of interest to the organizational economics and social network literatures, and therefore some relevance beyond mergers. The limited extent of mixing, achieved primarily by a small set of occupations, strongly suggests that knowledge sharing does not require extensive networks among all employees (except perhaps in R&D). Instead, it is more consistent with the idea that the benefits of knowledge sharing may be realized by having a small group of experts or coordinating managers act as brokers across the organization, as suggested by organizational sociologists who study networking (Burt 2005). Crémer, Garicano and Prat's (2007) argue that hierarchy is an alternative to common codes as a coordination mechanism. In their model a manager can serve as translator across functions. Our evidence is quite consistent with their view. In particular, employees who Hard Mix, especially those in managerial occupations, are likely to be translating and coordinating between the Acquiring and Target workforces. An extension of our analysis about the role of managers would be to see if employees with broad human capital (e.g., from earning an MBA, or a career history of movement between occupations or hierarchical func-

tions) are more likely to Mix. Such a finding would also be consistent with Lazear's (2005) argument that managers are generalists who coordinate specialists.

Finally, our measure of integration is limited to physical collocation, and how that varies with worker characteristics. It would be interesting to collect systematic evidence on how the organizational designs of Target and Acquiring establishments change as a result of merger. Which policies (explicit and implicit) are changed, and which are not? Does the Acquiring firm largely impose its own policies on Target employees, or does it adopt some Target policies? Are Target establishments allowed to maintain some of their own policies, thereby having somewhat different organizational design than Acquiring establishments? Much remains to be studied about post-merger integration, but the topic seems quite important to a full understanding of mergers.

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Table 1: Merger Characteristics

	%
Modal 1-digit industry at merger	
Retail, hotels & restaurants	45.0
Manufacturing	32.3
Construction & transport	11.6
Finance, real estate & R&D	9.9
Agriculture	1.2
Partial merger	10.4
Related merger	
1-digit	90.4
2-digit	85.0
3-digit	81.7
4-digit	81.2
	Mean std. dev.
# of Establishments	6.7 (22.3)
Acquiring	5.5 (22.3)
Target	1.2 (0.7)
# of Employees	221.5 (642.9)
Acquiring	189.7 (630.5)
Target	31.8 (61.7)
% Dominance of Acquiring workforce	70.6 (22.1)
Pre-merger turnover	
Acquiring t = -1 to t = 0	27.5 (15.5)
t = -2 to t = -1	24.0 (18.5)
Target t = -1 to t = 0	37.9 (17.9)
t = -2 to t = -1	29.3 (20.5)
N	595

Table 2 - Workforce Characteristics of Acquiring and Target Firms Pre-Merger

	Acquiring Firms	Target Firms	Control Group		All Firms
			Acquiring	Target	
Hourly wage (kroner)	159.2 (43.9)	149.0* (39.7)	155.1 (40.4)	154.2 (87.1)	142.5 (55.9)
% Female	35.5 (24.4)	35.1 (27.6)	34.3 (24.2)	35.4 (26.2)	34.9 (29.6)
Age	35.0 (5.7)	34.7 (6.7)	35.0 (5.6)	34.5 (6.7)	32.9 (7.0)
Experience	11.2 (4.3)	10.9 (4.6)	11.0 (4.1)	10.5 (4.5)	9.4 (4.6)
Tenure	4.3 (2.6)	4.1 (2.9)	4.2 (2.5)	4.1 (2.8)	3.3 (2.7)
Years of schooling	11.1 (1.0)	11.1 (1.0)	11.0 (0.9)	10.9 (1.0)	10.9 (1.0)
N	595	595	595	595	644,425
Occupation					
Manager	6.1 (6.0)	5.0* (7.2)	4.6 (4.4)	5.3 (7.1)	4.1 (7.2)
R&D	7.0 (14.0)	8.0 (17.8)	6.4 (12.3)	6.1 (13.0)	4.1 (11.6)
Sales	13.8 (16.6)	12.8 (18.8)	12.0 (15.2)	8.2 (12.3)	7.7 (13.8)
Support	23.5 (18.9)	22.1 (20.1)	19.5 (14.3)	20.3 (17.8)	20.4 (20.8)
Other	33.7 (28.7)	35.7 (30.9)	38.3 (27.8)	39.8 (29.4)	37.5 (31.7)
Missing	15.7 (20.5)	16.3 (21.9)	19.2 (21.8)	20.3 (22.7)	26.2 (25.2)
N	195	195	195	195	186,786

Means and standard deviations. Wages in 2001 prices. Columns 3-4 report summary statistics for control group firms, identified with propensity score matching using 3-digit industry and firm size to determine the closest match. Column 5 reports summary statistics for all private firms with a minimum of 5 workers and active in the same years as firms in our merger sample. Note that no control group (Columns 3-5) includes firms involved in any type of merger during 1980-2001. *Significantly different at 5% between acquiring and target workers.

Figure 1: Size of Merged Firm Over Time



Figure 1a plots the number of establishments. Figures 1b-d plot the number of employees; b is for all mergers, while c-d divide the sample into large and small mergers (total number of employees at merger above or below 73). In all plots, the horizontal axis is the time period relative to the year of merger ($t = 0$). Shaded bars represent Acquiring firms, white bars Target firms, and cross-hatched bars new hires or establishments opened after the merger.

Table 3: Cumulative Post-Merger Transitions

			Acquiring		Target	
			Actual	Predicted	Actual	Predicted
Among those who do not exit:						
From t=0 to t=1	Not Mixing	% staying in same establishment	91.3		89.9	
		% changing establishment w/in pre-merger firm	6.2	6.0*	0.8	0.6*
	Mixing	% Hard Mixing - to estab. in other firm	0.8	2.0*	6.8	8.7*
		% Soft Mixing - to estab. created post-merger	1.7	0.7*	2.5	0.6*
% who exit			20.8		26.7	
Among those who do not exit:						
From t=0 to t=3	Not Mixing	% staying in same establishment	80.3		83.1	
		% changing establishment w/in pre-merger firm	12.0	13.0*	1.5	1.2*
	Mixing	% Hard Mixing - to estab. in other firm	1.2	3.3*	12.0	14.0*
		% Soft Mixing - to estab. created post-merger	6.5	2.6*	3.4	1.3*
% who exit			40.4		52.0	
N			112,877		18,918	
Related Mergers						
From t=0 to t=1	% changing establishment w/in pre-merger firm		10.1	11.9*	1.1	0.8*
	% Hard Mixing - to estab. in other firm		1.2	3.5*	10.0	12.1*
	% Soft Mixing - to estab. created post-merger		7.9	3.0*	3.0	1.0*
N			80,244		14,318	
Unrelated Mergers						
From t=0 to t=3	% changing establishment w/in pre-merger firm		16.5	15.9*	2.7	2.7
	% Hard Mixing - to estab. in other firm		1.0	2.9*	17.7	19.4*
	% Soft Mixing - to estab. created post-merger		3.3	1.6*	4.6	2.2*
N			32,633		4,600	

*Actual and predicted transitions are different with 5% significance. Predicted values assume that, conditional on switching establishment, employees are reassigned to other establishments randomly, with odds equal to the fraction of employees in those other establishments.

Table 4: Employee Demographics by Type of Transition - 3 Years Post Merger

	Acquiring				Target				New Hires
	Not Mixing	Mixing		Exit	Not Mixing	Mixing		Exit	
		Hard	Soft			Hard	Soft		
Female	36.3 (48.1)	29.6 (45.7)	40.0 (49.1)	36.4 (48.1)	31.3 (46.4)	20.0 (39.7)	28.6 (45.2)	33.9 (47.4)	35.7 (47.9)
Age	38.6 (10.6)	38.8 (11.4)	38.5 (10.3)	34.6 (13.6)	38.7 (10.7)	38.4 (10.6)	38.0 (11.0)	33.8 (13.3)	31.7 (11.3)
Years of schooling	11.7 (2.0)	12.0 (2.3)	12.1 (2.4)	11.3 (2.1)	11.2 (1.9)	12.0 (2.2)	12.2 (2.3)	10.9 (2.0)	11.5 (2.2)
Experience	15.1 (8.0)	13.4 (7.9)	14.5 (7.5)	10.4 (8.6)	15.1 (8.0)	15.6 (8.6)	14.0 (8.3)	10.4 (8.7)	9.0 (8.0)
Tenure	7.7 (7.1)	4.6 (5.7)	6.3 (6.5)	4.1 (5.8)	6.0 (6.5)	4.6 (5.4)	4.8 (6.0)	3.3 (5.2)	0.9 (1.7)
Wage percentile	53.2 (27.8)	54.5 (29.0)	52.1 (27.7)	45.6 (30.0)	51.6 (27.2)	56.4 (28.0)	57.1 (28.0)	43.4 (28.9)	42.3 (29.6)
N	62,140	788	4,384	45,565	7,690	1,089	311	9,828	61,448
Occupation									
Manager	4.1 (19.8)	12.6 (33.2)	3.4 (18.1)	3.5 (18.3)	4.1 (19.7)	4.6 (21.0)	9.8 (29.9)	3.7 (18.9)	2.6 (15.9)
R&D	10.7 (30.9)	21.7 (41.3)	7.3 (26.1)	8.6 (28.1)	8.2 (27.5)	31.3 (46.4)	4.9 (21.7)	9.2 (28.9)	11.7 (32.2)
Sales	13.5 (34.2)	10.2 (30.5)	10.5 (30.7)	14.1 (34.8)	6.7 (25.0)	10.8 (31.0)	15.7 (36.5)	7.5 (26.4)	11.8 (32.2)
Support	38.6 (48.7)	22.3 (41.7)	25.3 (43.5)	29.4 (45.6)	15.0 (35.7)	17.2 (37.8)	15.7 (36.5)	17.4 (37.9)	22.6 (41.8)
Other	26.8 (44.3)	26.3 (44.1)	42.5 (49.5)	29.3 (45.5)	56.7 (49.6)	26.8 (44.3)	37.3 (48.6)	44.7 (49.7)	35.1 (47.7)
Missing	6.3 (24.2)	4.0 (19.7)	11.0 (31.2)	15.1 (35.8)	9.4 (29.2)	9.3 (29.0)	16.7 (37.5)	17.4 (37.9)	16.2 (36.8)
N	21,352	175	683	14,400	3,975	604	102	4,136	35,295

Means and standard deviations. Columns in the bottom half sum to 100%.

Table 5a: Multinomial Probit Estimation of Post-Merger Movements - Up to 3 years Post-Merger

Baseline: stay in establishments in pre-merger firm	Acquiring						Target					
	Mixing				Exit		Mixing				Exit	
	Hard		Soft		dy/dx	s.e.	Hard		Soft		dy/dx	s.e.
	dy/dx	s.e.	dy/dx	s.e.			dy/dx	s.e.	dy/dx	s.e.		
Dominance, employee's workforce	-0.013***	(0.003)	0.018	(0.013)	0.026	(0.040)	-0.081***	(0.015)	-0.036***	(0.010)	-0.091***	(0.031)
Related merger	0.000	(0.001)	0.007	(0.005)	-0.002	(0.013)	0.009	(0.008)	-0.008	(0.005)	-0.024	(0.017)
Partial merger	0.001	(0.002)	0.015***	(0.006)	-0.019	(0.018)	0.001	(0.010)	0.011	(0.009)	-0.023	(0.025)
Pre-merger turnover	0.008	(0.007)	0.077***	(0.019)	0.206***	(0.038)	-0.020	(0.019)	0.031***	(0.009)	0.086*	(0.047)
# establishments, employee's firm	-0.000	(0.000)	-0.000***	(0.000)	0.001**	(0.000)	0.004	(0.003)	0.003***	(0.001)	-0.011*	(0.006)
Merger size/100	-0.000	(0.001)	0.001***	(0.000)	-0.002**	(0.001)	0.000	(0.001)	-0.000	(0.001)	-0.002	(0.002)
Age	-0.000	(0.001)	0.000	(0.001)	-0.019***	0.002	-0.000	(0.001)	-0.000	(0.001)	-0.017***	(0.002)
Age ²	0.000	(0.001)	-0.000	(0.001)	0.000***	(0.000)	-0.000	(0.001)	0.000	(0.001)	0.000***	(0.000)
Experience	0.000	(0.001)	0.001*	(0.000)	-0.004***	(0.001)	0.000	(0.001)	0.000	(0.001)	-0.012***	(0.002)
Experience ²	-0.000	(0.001)	-0.000	(0.001)	0.000	(0.001)	0.000	(0.001)	0.000	(0.001)	0.000***	(0.000)
Tenure	-0.000	(0.001)	-0.001**	(0.000)	-0.015***	0.001	-0.001	(0.001)	-0.001***	(0.000)	-0.018***	(0.002)
Tenure ²	0.000	(0.001)	0.000	(0.000)	0.000	(0.001)	0.000	(0.001)	0.000*	(0.000)	0.001***	(0.000)
Years of schooling	0.001	(0.001)	0.006**	(0.003)	-0.029***	(0.009)	-0.005	(0.005)	-0.005	(0.005)	-0.005	(0.014)
Years of schooling ²	-0.000	(0.001)	-0.000**	(0.000)	0.001***	(0.000)	0.000**	(0.000)	0.000	(0.001)	0.000	(0.001)
Female	-0.000	(0.001)	0.000	(0.001)	-0.006	(0.006)	-0.012***	(0.004)	0.004**	(0.002)	-0.001	(0.008)
Wage residual	0.002	(0.004)	-0.003	(0.017)	0.278***	(0.054)	0.190***	(0.040)	0.004	(0.030)	0.394***	(0.111)
Predicted probability	0.004		0.020		0.162		0.037		0.013		0.225	
Log Pseudo Likelihood			-129,849						-26,582			
N			267,825						40,076			

All specifications include industry and year fixed effects. We use a non-parametric baseline by creating duration-interval-specific dummy variables, one for each spell year at risk. Data are truncated 3 years after the merger. Industry overlap is at the 4-digit level. Wage residuals were computed from OLS estimation of individual wages using quadratics for age, experience and firm tenure; female, years of education, merger size, and year and industry fixed effects as covariates. We report marginal effects of multinomial probit estimations. Standard errors are clustered by merger. ***/**/* indicates significance at 1/5/10%.

Table 5b: Multinomial Probit Estimation of Post-Merger Movements - Up to 10 years Post-merger

Baseline: stay in establishments in pre-merger firm	Acquiring						Target					
	Mixing				Exit		Mixing				Exit	
	Hard		Soft		dy/dx	s.e.	Hard		Soft		dy/dx	s.e.
dy/dx	s.e.	dy/dx	s.e.	dy/dx			s.e.	dy/dx	s.e.			
Dominance, employee's workforce	-0.010***	(0.002)	0.015	(0.012)	0.064	(0.048)	-0.067***	(0.012)	-0.027***	(0.008)	-0.067**	(0.029)
Related merger	-0.000	(0.001)	0.006	(0.004)	-0.005	(0.017)	0.005	(0.006)	-0.004	(0.004)	-0.011	(0.019)
Partial merger	0.001	(0.001)	0.007	(0.005)	-0.039**	(0.019)	0.001	(0.007)	0.005	(0.006)	-0.009	(0.021)
Pre-merger turnover	0.005	(0.004)	0.060***	(0.017)	0.211***	(0.049)	-0.016	(0.014)	0.017***	(0.006)	0.077*	(0.041)
# establishments, employee's firm	-0.000	(0.001)	-0.000***	(0.000)	0.001**	(0.000)	0.003	(0.002)	0.003***	(0.001)	-0.007	(0.007)
Merger size/100	-0.000	(0.001)	0.001***	(0.000)	-0.000	(0.001)	0.000	(0.001)	-0.000	(0.001)	-0.003**	(0.001)
Age	-0.000*	(0.000)	0.000	(0.001)	-0.020***	(0.001)	0.000	(0.001)	-0.000	(0.001)	-0.018***	(0.002)
Age ²	0.000	(0.001)	-0.000	(0.001)	0.000***	(0.000)	-0.000	(0.001)	0.000	(0.001)	0.000***	(0.000)
Experience	0.000**	(0.000)	0.001***	(0.000)	-0.006***	(0.001)	0.000	(0.001)	0.000	(0.001)	-0.011***	(0.002)
Experience ²	-0.000	(0.001)	-0.000***	(0.000)	0.000**	(0.000)	0.000	(0.001)	-0.000	(0.001)	0.000***	(0.000)
Tenure	-0.000	(0.001)	-0.001***	(0.000)	-0.015***	(0.001)	-0.001	(0.001)	-0.001***	(0.000)	-0.013***	(0.002)
Tenure ²	0.000	(0.001)	0.000	(0.001)	0.000***	(0.000)	-0.000	(0.001)	0.000**	(0.000)	0.000***	(0.000)
Years of schooling	0.001	(0.001)	0.003	(0.002)	-0.035***	(0.010)	-0.003	(0.004)	-0.003	(0.004)	-0.009	(0.013)
Years of schooling ²	-0.000	(0.001)	-0.000	(0.001)	0.001***	(0.000)	0.000	(0.001)	0.000	(0.001)	0.000	(0.001)
Female	-0.000	(0.001)	0.002	(0.001)	-0.009	(0.006)	-0.008***	(0.003)	0.003***	(0.001)	-0.002	(0.008)
Wage residual	0.002	(0.003)	0.003	(0.012)	0.243***	(0.046)	0.124***	(0.027)	0.004	(0.020)	0.260***	(0.082)
Predicted probability	0.003		0.017		0.201		0.028		0.010		0.211	
Log Pseudo Likelihood			-230,848						-39,169			
N			447,690						62,722			

All specifications include industry and year fixed effects. We use a non-parametric baseline by creating duration-interval-specific dummy variables, one for each spell year at risk. Data are truncated 10 years after the merger. Industry overlap is at the 4-digit level. Wage residuals were computed from an OLS estimation of individual wages using quadratics on age, experience, and firm tenure; female, years of education, merger size, and year and industry fixed effects as covariates. We report marginal effects of multinomial probit estimations. Standard errors are clustered by merger. ***/**/* indicates significance at 1/5/10%.

Table 5c: Multinomial Probit Regression of Post-Merger Movements - Up to 3 years Post-Merger, Including Occupations Codes

Baseline: stay in establishments in pre-merger firm	Acquiring						Target					
	Mixing				Exit		Mixing				Exit	
	Hard		Soft		dy/dx	s.e.	Hard		Soft		dy/dx	s.e.
dy/dx	s.e.	dy/dx	s.e.	dy/dx			s.e.	dy/dx	s.e.			
Dominance, employee's workforce	-0.013***	(0.005)	-0.003	(0.009)	-0.017	(0.037)	-0.066***	(0.023)	-0.030**	(0.012)	-0.021	(0.030)
Related merger	-0.001	(0.002)	0.012	(0.011)	-0.029*	(0.015)	-0.007	(0.011)	-0.008	(0.007)	0.011	(0.014)
Partial merger	0.000	(0.002)	0.008	(0.006)	-0.003	(0.015)	0.019	(0.015)	-0.008	(0.006)	0.013	(0.019)
Pre-merger turnover	-0.003	(0.005)	0.008	(0.013)	0.112***	(0.044)	0.019	(0.023)	0.039**	(0.016)	0.095**	(0.039)
# establishments, employee's firm	-0.000	(0.001)	-0.000	(0.001)	0.000	(0.001)	-0.000	(0.003)	0.004*	(0.002)	-0.001	(0.004)
Merger size/100	-0.001	(0.001)	0.000	(0.001)	-0.001	(0.001)	0.001	(0.001)	-0.001	(0.001)	-0.001***	(0.005)
Age	-0.000	(0.001)	0.000	(0.001)	-0.021***	(0.003)	0.001	(0.001)	-0.000	(0.001)	-0.020***	(0.004)
Age ²	0.000	(0.001)	-0.000	(0.001)	0.000***	(0.000)	-0.000	(0.001)	0.000	(0.001)	0.000***	(0.000)
Experience	0.000	(0.001)	0.000*	(0.000)	-0.003*	(0.002)	0.001	(0.001)	0.000	(0.001)	-0.006**	(0.002)
Experience ²	-0.000	(0.001)	-0.000	(0.001)	-0.000	(0.001)	0.000	(0.001)	-0.000	(0.001)	0.000	(0.001)
Tenure	-0.000	(0.001)	-0.001**	(0.000)	-0.011***	(0.002)	-0.002**	(0.001)	-0.000	(0.001)	-0.016***	(0.002)
Tenure ²	0.000	(0.000)	0.000	(0.001)	0.000***	(0.000)	0.000**	(0.000)	-0.000	(0.001)	0.000***	(0.000)
Years of schooling	0.002*	(0.001)	0.008**	(0.003)	-0.008	(0.008)	0.010	(0.007)	-0.003	(0.003)	0.004	(0.018)
Years of schooling ²	-0.000	(0.001)	-0.000**	(0.000)	0.000	(0.001)	0.000*	(0.000)	0.000	(0.001)	-0.000	(0.001)
Female	-0.002**	(0.001)	-0.003**	(0.002)	0.014*	(0.008)	-0.015**	(0.006)	0.001	(0.003)	0.009	(0.010)
Wage residual	-0.009	(0.006)	0.009	(0.020)	0.206***	(0.050)	0.158***	(0.052)	-0.014	(0.034)	0.431***	(0.144)
Managers	0.004**	(0.002)	-0.001	(0.002)	0.018	(0.014)	0.034***	(0.011)	0.002	(0.006)	0.032**	(0.014)
R&D	0.006***	(0.002)	-0.003	(0.003)	-0.012	(0.009)	0.037***	(0.008)	-0.002	(0.005)	0.020	(0.020)
Sales	0.003*	(0.002)	0.000	(0.002)	-0.004	(0.009)	0.024***	(0.007)	-0.001	(0.006)	0.010	(0.015)
Support	0.003**	(0.001)	-0.001	(0.002)	-0.013	(0.008)	0.024***	(0.006)	-0.002	(0.004)	0.011	(0.013)
Predicted probability	0.009		0.004		0.147		0.038		0.011		0.183	
Log Pseudo Likelihood					-37,317						-10,170	
N					83,026						17,027	

All specifications include industry and year fixed effects. We use a non-parametric baseline by creating duration-interval-specific dummy variables, one for each spell year at risk. Data are truncated 3 years after the merger. Industry overlap is at the 4-digit level. Wage residuals were computed from OLS estimation of individual wages using quadratics on age, experience and firm tenure; female, years of education, occupational groups, merger size, and year and industry fixed effects as covariates. Only workers with non missing occupation code are used; baseline for occupation is production workers. We report marginal effects of multinomial probit estimations. Standard errors are clustered by merger. ***/**/* indicates significance at 1/5/10%.

Table 6: Wages & Exit Rates by Type of Mixing

			Year after merger			
			1	2	3	
Acquiring	Not Mixing	hourly wage	mean	178.8	186.4	189.3
			s.d.	99.2	96.6	94.2
		wage growth (%)	mean	3.8	8.4	10.9
			s.d.	29.2	34.1	36.4
		exit (%)		14.0	12.5	11.6
		N		87,183	72,176	57,393
	Hard Mixing	hourly wage	mean	203.3	188.0	205.9
			s.d.	356.2	81.9	106.1
		wage growth (%)	mean	9.7	12.9	14.2
			s.d.	88.7	59.8	42.2
		exit (%)		16.7	16.6	13.1
		N		738	579	718
Soft Mixing	hourly wage	mean	179.2	205.9	209.9	
		s.d.	67.4	119.8	94.2	
	wage growth (%)	mean	4.3	8.3	11.4	
		s.d.	21.7	44.0	29.2	
	exit (%)		18.5	9.3	9.4	
	N		1,510	4,051	4,049	
Target	Not Mixing	hourly wage	mean	165.1	170.3	175.3
			s.d.	77.5	67.4	66.3
		wage growth (%)	mean	3.1	6.5	8.9
			s.d.	29.5	28.2	34.6
		exit (%)		19.9	18.1	14.0
		N		12,582	9,649	6,896
	Hard Mixing	hourly wage	mean	200.8	225.4	205.4
			s.d.	94.8	96.8	163.4
		wage growth (%)	mean	1.7	8.3	11.3
			s.d.	22.2	25.8	72.7
		exit (%)		23.4	15.6	18.8
		N		936	1,163	738
Soft Mixing	hourly wage	mean	195.7	199.9	204.5	
		s.d.	73.4	86.4	127.5	
	wage growth (%)	mean	6.8	14.7	17.0	
		s.d.	54.8	77.5	34.4	
	exit (%)		21.6	18.4	19.4	
	N		347	256	237	

Statistics are for all employees who were at the firm at the time of merger & remain with the merged firm through period t. Wages are real wages in 2001 prices. Wage growth is cumulative real wage growth, $(w(t)-w(t_0))/w(t_0)$. Exit rates at period t are rates of exit from t to t+1, computed only for workers in surviving firms. Not Mixing includes employees who did not change establishments, or changed to an establishment that was in their pre-merger firm at the merger. For reference, in t=0, Acquiring hourly wage is 171.7 (100.2) and Target hourly wage is 161.2 (82.0).

APPENDIX: SAMPLE CONSTRUCTION

We use the *Integrated Database for Labor Market Research* (IDA), one of the central registers of Statistics Denmark, from 1980 to 2001. IDA is a matched employer-employee dataset of all workers and firms in Denmark. Each individual has a unique identification number that can be matched with other IDA datasets. The data provide year-end snapshot information on an individual's job, including earnings, experience, and a unique identification number for each establishment. Information at the establishment level includes year of creation, 5-digit industry code, firm identification number and other variables. Firm number links establishments and firms, while establishment number links workers and establishments. Individual identification numbers do not change when a worker changes firms or leaves the labor market, allowing measure of tenure at current employer.

Merger Identification

Statistics Denmark does not flag mergers, but we are able to identify 2,631 mergers using establishment and firm identification numbers. Establishment identification numbers are unique and do not change when ownership changes, while firm identification numbers change if there is a change of ownership. We isolate cases where establishments change firm identification from one year to the next. While this could identify establishments (and therefore firms) that go through a merger, it could also identify spurious changes, as firm identification codes may not be always consistent over time.¹³ Such cases were rare and dropped from the sample, as they would be falsely classified as mergers. We identified several types of mergers:

¹³ This could happen when a firm changes the location of its headquarters or its legal form. In the data, we would observe such situations if all establishments in a single firm changed to a new firm code in the same year, but no establishments from any other firm changed to the same new firm code at the same time.

Single merger: 2 firms merged, with some or all establishments from one changed to the identifier of the other in the same year. Partial mergers are a subset of this category. The firm whose identifier is used after merger is labeled the Acquiring firm. The firm whose identifier disappears is labeled the Target.

Multiple merger: 3 or more firms merged, partially or fully. Establishments from multiple firms changed to the same previously existing firm identifier in the same year.

Joint merger: Two or more firms merged into a firm with a new identifier.

In prior drafts we included joint mergers, assuming the larger was the Acquirer, and multiple mergers. General conclusions were unchanged. Finally, we exclude publicly owned companies, whether in private or public sector industries.

Occupational Groups

Groups were defined using International Standard Classification of Occupations (ISCO88) codes (ILO 2011). Specific codes within each group are available on request.

Managers: group 1 (managers, legislators, senior officials), managers only.

R&D: groups 2 (professionals) and 3 (technicians) in physical, mathematical, engineering, life science and health sciences occupations.

Sales: groups 3 (technicians), 5 (shop and market sales), and 9 (elementary occupations) in sales occupations.

Support: groups 2 (professionals), 3 (technicians), 4 (clerks), 5 (service workers) and 9 (elementary occupations) in support occupations.

Other: all other occupations.