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Skill-biased acquisitions? Human capital and target employee mobility in small technology firms

Jing Xiao* & Åsa Lindholm Dahlstrand**

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Abstract:

The purpose of this study is to investigate the relationship between acquisitions and mobility of knowledge workers and managers in small technology companies and how individual skills and capabilities moderate the relationship. Relying on the matched employer-employee data of the Swedish high-tech sectors from 2007 to 2015, we find that acquisitions increase the likelihood of employee departures, mainly in the form of switching to another employer, but that these acquisition effects are weaker for employees with technological competences. Moreover, we also find that managers, compared to other employees, are more likely to exit from the (national) labor market after acquisitions. Our results show that acquiring firms tend to gain access to and retain knowledge workers with engineering background.

Key words: Acquisitions; Target employee mobility; High-tech sectors; Knowledge workers; Technological capabilities; Managerial capabilities

JEL Classification: G34 J63 L26 C23

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1. Introduction

Human resource management is a critical element which matters for post-acquisition integration and performance (Larsson & Finkelstein 1999). Scholars have emphasized the importance of retention of target employees in facilitating post-acquisition knowledge transfer and integration, particularly for acquisitions in knowledge-intensive sectors (Park et al., 2018; Ranft & Lord, 2000). However, acquisitions are usually followed by large-scale employee departures (Krug et al., 2014; Walsh, 1988; Wu & Zang, 2009). Who leaves and who stays? It is essential to advancing our understanding of what factors cause and influence target employee mobility following an acquisition.

Over the recent decades, the increasing importance of high-skilled knowledge workers have been reflected in the changing nature of acquisitions. In high-tech sectors, human capital has become a major asset that is valued or even targeted in many acquisitions, especially when target firms are small technology ventures (Colombo & Grilli, 2005; Ranft & Lord, 2000). A term of “acqui-hiring” has recently emerged to describe the phenomenon of gaining access to target employees through acquisitions of small firms. This has become a new trend for many technology companies in Silicon Valley, such as Google and Facebook, to obtain talented engineers (Coyle & Polsky, 2013; Chatterji & Patro, 2014). However, extant literature has exclusively focused on the antecedents of post-acquisition turnover of target executives of large public companies (Hambrick & Cannella, 1993; Krug & Hegarty, 1997; Krug et al.; 2014; Walsh, 1988). So far, no attention has been paid to target employees of small technology ventures, especially those knowledge workers who are perceived as the knowledge core of acquired firms (Paruchuri et al., 2006).

To fill this gap, this study seeks to advance the understanding of how acquisitions impact on mobility of target knowledge workers and managers in small technology companies. More specifically, we explore whether and when there exists “acqui-hiring” effects on post-acquisition mobility (i.e., when acquisitions exhibit negative effects on employee departures). Previous theories suggest that acquisitions, as a disruptive event, cause a major organizational change and uncertainty which may lead to new job matching processes between employees and employers. This could be reflected as a higher employee turnover shortly after acquisitions in acquired firms on average. We posit that, if “acqui-hiring” effects exist, that is, human capital is the major assets valued by acquirers, the new matching/selection processes following acquisitions should be influenced by human capital characteristics. We hypothesize that individual skills and capabilities moderate the relationship between acquisitions and target employee departures. Among others, we focus on the role of technological and managerial skills of target employees, given that they are both argued to constitute the major source of competence of a small technology firm.

The existing literature has emphasized two important factors when explaining what causes the phenomenon of high turnover rates of target executives following an acquisition. The first is acquisition motive, which is related to involuntary turnover. Earlier studies focus on the motive of corporate control. This strand of research argues that managerial teams use acquisitions as a mechanism of market discipline to compete for managing corporate resources (Jensen & Ruback, 1983; Manne, 1965). Managerial teams of acquiring firms are thus expected to replace inefficient managerial teams of acquired firms after acquisitions to realize potential synergy gains (Lowenstein, 1983). The second factor is psychological state, which is related to voluntary turnover. This group of studies turn to the factors related to executives’ psychological attributes or perceptions, such as perceptions of lost job status,

autonomy, or fears of alienation, which are found to be positively associated with post-acquisition departure of target executives (Hambrick & Cannella, 1993; Krug et al., 2014; Krug & Nigh, 2001). Little is known about the role of human capital in post-acquisition employee mobility. One exception is the study by Buchholtz, Ribbens and Houle (2003), finding that acquiring firms tend to retain the CEOs who are expected to generate higher returns from investment on their human capital. Although this study distinguished between general and specific human capital, it focused on the role of human capital accumulation, e.g., using CEO age and tenure as proxies for human capital. To the best knowledge of the authors, there has been no systematic study exploring how post-acquisition turnover of target employees is influenced by specializations of individual skills or capabilities.

This study employs matched employer-employee data on the population of Swedish firms to test our hypotheses. We follow knowledge workers and managers of small and medium-sized enterprises (SMEs) in the Swedish high-tech sectors from 2007 to 2015. We adopt two measures of employee departures. The first measure focuses on total departures, that is, departures without considering of how the individuals leave their current jobs. The second measure distinguishes departures by switching to another job from departures by exiting from the labor market. We compare the differences in mobility both between acquired firms and non-acquired firms and before and after acquisitions. We use entropy balancing approach (Abadie et al., 2010; Distel et al., 2019) to account for potential endogeneity if more (or less) mobile individuals are more likely to choose working in acquired firms. Using high-dimensional fixed effects models which account for heterogeneity at both individual and firm levels, we find that acquisitions increase the likelihood of employee departures, mainly in the form of switching to another employer, but the acquisition effects are weaker for employees with technological skills. Moreover, we also find that managers, compared to other employees, are more likely to exit from the (national) labor market after acquisitions.

The rest of the paper proceeds as follows. In the next section, we discuss the theoretical framework and propose the hypotheses. In Sect.3, we present the data and methodology. In Sect.4, we report the results. In Sect.5, we discuss the implications and conclude the paper.

2. Theoretical framework and hypotheses

2.1 Organizational change and employee turnover

Employee turnover involves both involuntary and voluntary turnover. Involuntary turnover is independent of the control of employees, referring to job cessation caused by external or unexpected events, such as organization's management strategies, or death of the employee (Morrell et al., 2001). On the contrary, voluntary turnover refers to job cessation initiated by employees. Voluntary turnover can be explained by a wide range of factors, e.g., job satisfaction, job alternatives, individual traits, psychological status, organizational factors, job performance etc. (Jackofsky, 1984; Lee & Mitchell, 1994; March & Simon, 1958; Morrell et al., 2001; Morrell et al., 2004a; Morrison & Robinson, 1997). Organizational change is a salient factor which is related to both involuntary and voluntary turnover. It often entails a significant transition of organizational structure, culture, or business strategy. In this sense, organizational change may trigger a set of implementation strategies from the management to strive for the intended aims. These initiatives may include downsizing or restructuring programs and thus could lead to a large scale of involuntary turnover. Moreover, organizational change brings organizational instability and uncertainty, which may become a "shock" to prompt the thoughts of job search or final decisions of employees to leave voluntarily (Lee & Mitchell, 1994; Morrell et al., 2004a; 2004b).

2.2 Acquisition effects from the perspective of human capital theory

Human capital theory views employee turnover as a result of evaluation on human capital investment (Becker, 1962; Buchholtz et al., 2003). This process is jointly influenced by three sets of factors: individual characteristics, employer (and job) characteristics, and job matching processes between individuals and employers (Fujiwara-Greve & Greve, 2000; Granovetter, 1981; Jovanovic, 1979). Acquisitions involve transactions of ownership rights between legal bodies (Lindholm, 1994). After the ownership change, both new owners and existing employees may reevaluate the expected returns of human capital investment from their own perspectives. This could break the current equilibrium of employee-job matches in target firms.

Acquisition effects on involuntary turnover

From the perspective of employers, new owners may have different insights about which human capital to invest in. All acquisitions are driven by some specific motives. Post-acquisition integration and implementation strategies are directed by the major motives behind acquisitions. For example, mergers and acquisitions in the 1960's or 1970's were mainly driven by the purposes of corporate growth/diversification or financial synergies (Matsusaka, 1993; Kolev et al., 2012). In this case, a large scale of layoffs is expected as the outcome of removing redundancy after acquisitions to realize operational synergies (Trautwein, 1990). Over recent decades, acquisitions are more often driven by gaining access to technological capabilities or even human capital per se (Arora et al., 2001; Coyle & Polsky, 2013; Chatterji & Patro, 2014). In this case, new owners may be more precise about which human capital they value and invest in. Post-acquisition employee turnover can be seen as a process of selecting and integrating human resources by acquirers. No matter which motives an acquirer holds, an acquisition could cause a reshuffle of human resources and lead to a higher involuntary turnover on average.

Acquisition effects on voluntary turnover

From the perspective of employees, acquisitions may trigger “shocks” and thus alter their evaluation on whether they keep investing in firm-specific human capital in the current organization. Previous studies find that post-acquisition turnover of target executives is much influenced by their perceptions of social status after acquisitions (Hambrick & Cannella, 1993; Krug & Nigh, 2001). After acquisitions, target executives may perceive or worry about the situations like lost job status/autonomy or alienation, which are found to be positively related to post-acquisition departures (Hambrick & Cannella, 1993; Krug et al., 2014; Krug & Nigh, 2001). Although existing empirical evidence concentrates mainly on post-acquisition mobility of top executives, there is indirect evidence showing that other employees are also influenced by acquisitions. The study by Paruchuri, Nerkar and Hambrick (2006) show that the productivity of technical personnel, especially those who lost their social status after acquisitions, is much impaired by post-acquisition integration. Hence, the first hypothesis is proposed as follows:

H1: Target employees have a higher likelihood of job departures after acquisitions than employees in non-acquired firms.

2.3 Moderating effects of human capital

Moderating effects on involuntary turnover

Human capital contains an individual stock of knowledge, skills and capabilities which can generate future returns through investment on it (Becker, 1962). Prior studies argue that employees with high-quality human capital, such as high level of innate ability, better

education, or rich working experience, are at an advantage in terms of relative bargaining power, job status or authority (Campbell et al., 2012; Castanias & Helfat, 2001). One reason is because high-quality human capital constitutes a major component of a firm's competitive advantage, which is expected to create important value for employers (Barney, 1991; Campbell et al., 2012). It is also because employers may worry about losing high-quality human assets to competitors to cause unfavorable knowledge leakage (Wezel et al., 2006). In this sense, acquiring firms may view investment in high-level human capital as a rational decision and thus prefer to retain employees with high-level human capital relative to low-level human capital.

Moderating effects on voluntary turnover

As pointed out by Ranft and Lord (2000), unlike other types of assets, human assets cannot be purchased or owned outright. Even though new owners may intend to retain some employees, these employees can still choose to leave voluntarily. The voluntary turnover literature indicates that cognitive or decision processes may differ across various populations (Lee et al., 1999; McBey & Karakowsky, 2001). Compared to full-time employees, marginal and temporary employees are found to be less sensitive to job satisfaction and other push factors of turnover (McBey & Karakowsky, 2001). Based on the finding, we could infer that employee with high-level human capital are more sensitive to job satisfaction because they tend to value a feeling of accomplishment that they gain from work more than other employees. In this sense, employees with high-level human capital may be more likely to confront psychological loss due to changes induced by acquisitions and prompt the decision processes of quitting.

Technological skills and capabilities

Individuals do not only possess divergent levels of knowledge, skills or capabilities but also specialize in different subjects. Technological capability has been recognized as one major source of firm's competence (Colombo & Grilli, 2005; Ranft & Lord, 2000). According to the knowledge-based view, technological capabilities are argued to be mainly embodied in the complex knowledge of individuals (Grant, 1996; Kogut & Zander, 1992; Ranft & Lord, 2000). For example, learning-by-hiring of scientists or inventors has been highlighted as one critical mechanism for firms to search for technologically distant knowledge (Rao & Drazin, 2002; Rosenkopf & Almeida, 2003; Tzabbar, 2009, Palomeras & Melero, 2010; Kaiser et al., 2018). This makes professionals with technological competences targeted assets for many acquisitions or even the major motive that drives acquisitions (Coyle & Polsky, 2013; Chatterji & Patro, 2014). Moreover, a large amount of evidence in the mobility literature shows that the mobility of technical or R&D personnel is a major source of knowledge diffusion or spillovers (Moen, 2005; 2007; Kaiser et al., 2015). This may make employers worry about losing professionals with key technological capabilities to competitors and undermining the competences of the firms. Thus, we expect that acquiring firms tend to retain the employees with technological skills after acquisitions.

From the perspective of employees, there is no evidence showing that employees with technological skills are more likely to confront psychological loss after acquisitions than other employees with a similar level human capital. Hence, we propose our second hypothesis as follows.

H2: Target employees have a higher likelihood of job departures after acquisitions, but the effects are weaker for target employees with technological skills.

Managerial skills and capabilities

Similarly, managerial capability is another major source of firm's competence (Castanias & Helfat, 2001). Managers are a group of employees who possess key knowledge of the firm and relational capital with the stakeholders (Krug et al., 2014). When it comes to small ventures, managerial skills and capabilities required for these types of organizations are distinctively different than those for large incumbent firms (see, e.g., Krishnan & Scullion, 2017). Studies show that small firms facilitate the development of entrepreneurial human capital as small firms are important agents of spawning new entrepreneurs (Elfenbein et al., 2010). For acquisitions that are driven by gaining access to technologies and capabilities, acquiring firms need not only technological capabilities, but also the corresponding managerial capabilities and experience to facilitate knowledge integration and to better manage the acquired personnel who are used to the organizational culture of small firms. It is also possible that some firms are searching for managers who could combine entrepreneurial skills and managerial experience to help create entrepreneurial capacity in acquiring firms (Lavie, 2006). As managerial knowledge is usually tacit and requires a long-term experiential learning process to accumulate (Castanias & Helfat, 1991), it is difficult to obtain through education or on-the-job training in an organization which lacks a nurturing environment of entrepreneurship.

On the other hand, acquisitions could also be driven by the motive of corporate control. In such a scenario, efficient managerial teams could use acquisitions as a mechanism of market discipline to replace inefficient managerial teams of acquired firms (Jensen & Ruback, 1983; Lowenstein, 1983; Manne, 1965). Then, acquirers are more likely to replace target managers, on the one hand, to save operational costs, on the other hand, to eliminate potential resistance from target managers and increase control of acquired firms (Krug et al., 2014).

From the perspective of individuals, managers (especially top executives) may be more likely to confront status or psychological loss after acquisitions and choose to leave, because they are used to be the decision makers of the target firm and have own images on how to develop and manage the firm (Buchholtz et al., 2003).

Being managers may exert opposite effects on post-acquisition departures. The opposite effects could offset each other, and it is difficult to draw the definite hypotheses concerning the net moderating effects. Thus, we propose a set of competing hypotheses as follows.

H3a: Target employees have a higher likelihood of job departures after acquisitions, but the effects are weaker for target employees with managerial skills.

H3b: Target employees have a higher likelihood of job departures after acquisitions, and the effects are stronger for target employees with managerial skills.

H3c: Target employees have a higher likelihood of job departures after acquisitions, and the effects are not significantly different for target employees with managerial skills.

3. Data and empirical strategy

3.1 Data

We test our hypotheses using the matched employer-employee data compiled by Statistics Sweden (SCB) for the period of 2007 – 2015. The data from SCB contain anonymized matched employer-employee statistics of the whole population of Swedish firms and working population. We have access to detailed firm and labor market information, such as firm

dynamics, firm-level characteristics (e.g., firm size, industry etc.), individual labor market records (e.g., age, gender, education level, education subject, occupation, business owners etc.). We assemble a longitudinal dataset containing variables at both individual and firm levels.

Identifying SMEs in high-tech sectors

In this study, we define small technology firms as SMEs in high-tech industries in both manufacturing¹ and knowledge-intensive services. High-tech sectors are identified according to the Eurostat typology (NACE Rev.2).² Following the definition of European Commission (2009), we identify SMEs as firms with less than 250 employees. To capture the relatively young firms, we only include the SMEs founded after 1990.

Identifying acquired firms (treatment group) and non-acquired firms (control group)

We identify independent SMEs from 2007 to 2013 and follow them until 2015.³ An acquisition is identified when a firm's ownership is observed to change from being independent to being controlled by an existing business group (Andersson & Xiao, 2016). To avoid acquisitions made for the purpose of share restructuring instead of real changes of owners, we exclude acquisitions when acquirers and targets share same organizational numbers. We also exclude SMEs with more than one ownership change during the observation period because frequent and multiple ownership changes make it difficult to link acquisition effects to a specific acquisition. To build a control group, we identify non-acquired firms as SMEs which are independent during the whole observation period.

Linking individuals to firms

At the individual level, we identify the employees who worked in acquired and non-acquired firms when the firms were first time observed in the data. Since this study focuses on post-acquisition mobility of knowledge workers and managers, we only keep individuals with professional or managerial positions. In Appendix 1, we discuss the details of how we identify knowledge workers and managers.

We follow the individuals over time to identify whether the individual has experienced any change in employer. For individuals in acquired firms, we follow them until the 4th year after acquisitions. The first reason is to keep consistent with previous studies (e.g., Buchholtz et. al, 2003; Hambrick & Cannella, 1993), so that we could compare the results from previous research. The second reason is because post-acquisition integration and restructuring activities are found to concentrate within 4 years after acquisitions (Xiao, 2018).

The final dataset is organized in a person-year format, containing 87,974 observations. At firm level, the final dataset contains 831 acquired firms and 14,658 non-acquired firms. About 92% of the firms are in high-tech knowledge-intensive services sectors and the remaining 8% are in high-tech manufacturing sectors. At the individual level, the dataset contains 23,165 individuals.⁴

¹ We include both high-tech and medium-high-tech manufacturing because medium-high-tech manufacturing may also include some important tech firms. Our main findings are robust when we exclude medium-high-tech manufacturing industries.

² https://ec.europa.eu/eurostat/cache/metadata/Annexes/htec_esms_an3.pdf

³ In this way, we can observe at least one year after acquisitions for acquired firm.

⁴ There are 1,335 individuals who have worked in more than one target firm at different times. We follow them separately as they could have different occupations or firm-specific human capital.

3.2 Variables

Dependent variables

We distinguish between three types of post-acquisition employee status: *stay*, *switch* and *exit*. The reference state is *stay*, which refers to the situation when an employee still stays in the target firm. *Switch* refers to the situation when an employee switches the job to another firm. *Exit* refers to the situation when an individual drops out of the (national) labor market, for example to be unemployed, or to become a student or move outside the country.

Independent and moderating variables

- Acquisition status
Acquisition status is coded as one when and after target firms experienced ownership changes.
- Technological/managerial skills
As discussed in Sect.2.3, managerial skills depend much on experiential learning process to accumulate. Managers, especially those in small firms, could have diverse education or subject background. We thus use work content with managerial responsibilities as proxy for managerial skills.

Comparatively, educational background is more important for the identification of technological skills. The accumulation of technological skills requires some entry level of technological knowledge and competences, which are usually acquired through formal education. As technology is related to applications of scientific knowledge in practices and industries, we use education background (based on their highest education) in engineering disciplines as proxy for technological skills.

Control variables

We follow the literature and use a set of indicators to proxy the levels of three types of human capital: general, firm-specific, and industry-specific human capital.

- General human capital
We construct the dummy variable of *college* to indicate educational level, with one referring to individuals who have education at or above college level (≥ 2 -year post-secondary education). The variable of *age* is used to indicate general work experience of an employee.
- Firm-specific human capital
The variables of *tenure* and *salary* are used to measure individual firm-specific human capital at target firms. We construct *tenure* by tracing the records of employers from 1990 (the earliest available year for individual data that we have access), calculating the number of years that the individual worked in the target firm. The variable of *salary* is annual salary income (in thousands of Swedish Kronor). We deflate *salary* by using the CPI index with the base year of 2007.
- Industry-specific human capital
We use industry experience to measure industry-specific human capital. This variable is calculated based on the number of years that the individual worked in the target industry (two-digit NACE level). Because of the frequent updates of industry classification schemes over time, we can only measure this variable consistently until 2010. For individuals who worked in a firm entering after 2010, this variable is missing. We thus only include this variable in the robustness check.

It is quite common that business owners of target firms also work in their own firms. But the post-acquisition mobility of owners may be influenced by some restrictive agreements, such as non-compete agreements. We thus include a variable of *owner* to distinguish the individuals who were business owners from the other employees.

We also include the variables of *gender* and *children* to control for the impacts of gender and having young children on employee mobility (Albrecht et al., 2018; Valcour & Tolbert, 2003). Children is measured on whether the individual has any children under 18 years old.

To account for the potential impacts of determinants at organizational level, we include a set of firm-level/industry-level variables.

- **Industry**
To account for the potential differences in employee mobility between manufacturing and service sectors, we distinguish firms in high-tech manufacturing sectors (*Manu*) from high-tech knowledge-intensive services sectors (the reference group).
- **Firm size**
Firm age and size are widely recognized as two fundamental indicators of firm attributes (Evans, 1987; Jovanovic, 1982). Since our sample focuses on young firms, firm age is highly correlated with individual tenure. Thus, we only include *Firm size* (measured by numbers of employees) of target firms to account for its potential impacts on employee mobility.
- **Firm productivity**
To account for the different levels of performance between firms, we include the variable of *Productivity*, defined as value-added per employee. Productivity is deflated by using the CPI index with the base year of 2007. To reduce the potential measurement error, e.g., the existence of unreliable values, we exclude the observations if the values of value added are below the 5th percentile. We only include this variable in the robustness check because of missing values.

In addition, we include year dummy variables to account for potential impacts of the macro-economic situation on employee mobility. Except for dependent variables, *acquisition status* and year dummy variables, all the other variables are time-invariant⁵ and measured when firms/individuals were first time observed in the data.

3.3 Empirical strategy

As the outcome of our analysis is a binary response, non-linear regressions are usually used for estimations. However, non-linear models, like logit or probit model, suffer from the problem of interpretability, especially for interaction terms. Studies point out that the moderating effect in a non-linear model is not indicated by the estimated coefficient, sign, or statistical significance of the interaction term (Ai & Norton, 2003; Wiersema & Bowen, 2009). Moreover, since moderating effects in a non-linear model depend on the joint values of all the model variables (Wiersema & Bowen, 2009), it is difficult to summarize and present the effects.

⁵ One reason is because the changes for most of the control variables are quite marginal over the observation period, such as variables related to educational level or background. Time-invariant variables can capture the main characteristics between individuals and firms and are less prone to multi-collinearity problem. Another reason is because there are more missing values for time-variant variables. Using time-variant variables we would lose many observations in regressions.

Given this situation, we use linear probability regression as the benchmark model for estimations. In recent years, more scholars have emphasized the merits of using a linear probability model as an alternative for non-linear models on many occasions (Hellevik, 2009; Von Hippel, 2015). Since the main interest of this study is on the moderating effects, the use of a linear model would make the interpretation of results more intuitive. Moreover, Hellevik (2009) shows that the impact of violating the homoscedasticity assumption, which was argued to be one major disadvantage of linear probability model for modeling a binary dependent variable, is quite marginal. In practice, this violation can be solved by calculating heteroscedasticity-consistent standard errors.

Since the individual data are collected from multiple years and nested within firms, we include fixed effects at both individual and firm levels to control for heterogeneity at individual and firm levels respectively (high-dimensional fixed effects estimator). The benchmark model of our analysis is displayed in Model (1). To test moderating effects, we extend the model by including the interaction terms between acquisition and moderators, see Model (2).

$$y_{ijt} = \alpha + \beta * \text{acqui} + \theta + \mu_j + \rho_t + \varepsilon_{ijt} \quad (1)$$

$$y_{ijt} = \alpha + \beta * \text{acqui} + \gamma_1 \text{acqui} * \text{tech} + \gamma_2 \text{acqui} * \text{manager} + \theta_i + \mu_j + \rho_t + \varepsilon_{ijt} \quad (2)$$

Since this study aims to explore acquisition effects on employee mobility, a potential endogeneity may arise if more (or less) mobile individuals are more likely to choose working in acquired firms. To account for the potential “self-selection” biases, we use entropy balancing approach to pre-balance the data based on observed covariates (Abadie et al., 2010; Distel et al., 2019). Like other matching strategies, the rationale of entropy balancing is to make treatment and control group as “similar” as possible so that the treatment can be assumed as a “random” event conditional on observed characteristics. The balancing is achieved by constructing a synthetic control group, which is a weighted average of control observations (Abadie et al., 2010). With this approach, scholars do not need to assume any functional form or intervene the balancing process (Distel et al., 2019). This is one major advantage that distinguishes the approach from other matching strategies, such as propensity score matching or coarsened exact matching (Bandick & Görg, 2010; Grimpe et al., 2019). In our regression analysis, we employ all the control variables to balance between treatment and control groups. The weights created by entropy balancing are inserted into regressions to account for the potential “self-selection” biases.

4. Results

4.1 Descriptive analysis

Table 1 displays descriptive statistics of the main variables. In terms of dependent variables, about 16% of the individuals have experienced job departures. 12% have switched to a different firm and 4% have dropped out of the (national) labor market. In terms of independent and moderating variables, 9% of the individuals work in acquired firms, 43% of the individuals have a background in engineering fields, and 20% are managers. The average employee in our dataset is about 42 years old and has worked in the firm for 3 years and in the industry for 8 years. The annual salary is about 320,000 SEK (2007 price level) on average. In addition, 56% of the individuals have (at least) college education, 86% are males and 46% have one or more children under 18 years old. It is interesting to note that 62% of the individuals are also owners of the firms. In terms of firm-level characteristics, around 10% of the individuals work in the (high-tech) manufacturing sectors. The average firm has 8

employees and the value added per employee is about 630,000 SEK (2007 price level). The correlation matrix for independent variables is shown in Table A1 in Appendix 2.

Table 1. Main variables and descriptive statistics

Variables	Obs.	Mean	Std. Dev.	Min.	Max.
Switch	87974	0.1228	0.3282	0	1
Exit	87974	0.0408	0.1979	0	1
Acqui	87974	0.0906	0.2871	0	1
Tech	86735	0.4348	0.4957	0	1
Manager	87974	0.1971	0.3978	0	1
College	87606	0.5569	0.4968	0	1
Age	87974	42.0639	10.4891	17	84
Tenure	87974	3.1422	3.3177	1	17
Salary	87974	320.8099	227.3650	0	3154.339
Indus_exp	72881	7.8770	5.1753	1	21
Owner	87974	0.6207	0.4852	0	1
Gender	87974	0.8578	0.3493	0	1
Children	87974	0.4626	0.4986	0	1
Manu	87974	0.1005	0.3006	0	1
Firm size	87974	8.1473	18.4395	1	181
Productivity	83824	628.9881	775.1124	1.568	14621.44

Note: Except for acquisition status, all the other variables are measured when firms/individuals were first time observed in the data. There are missing values in some variables.

We pre-balance the data between treatment and control groups based on the entropy balancing approach. We compare the mean values of covariates between treatment and control groups before and after balancing, respectively, in Table A2 in Appendix 2.⁶ It is noted that there are no significant differences in mean values of covariates after balancing.

4.2 Regression analysis

In the regression analysis, we adopt two measures of employee departures. The first measure focuses on total departures, regardless of how individuals leave their current jobs. The second measure distinguishes departures by switching to other jobs from departures by exiting the (national) labor market. Table 2 presents the results of acquisition effects on job departures based on Model (1). Before we include entropy balancing weights, acquisitions are found to increase total job departures significantly. Employees in acquired firms are associated with a 7% higher probability to leave their firms after acquisitions. However, when we distinguish the effects between departure routes, we find different effects of acquisitions on *switch* and *exit* respectively. Employees in acquired firms are associated with an 8% higher probability to move to a different firm but a 1% lower probability to exit from the labor market. After we include entropy balancing weights, the magnitudes of acquisition effects decrease, no matter if we take account of total departures or when we distinguish between departure routes. However, the sign of acquisition effects on *exit* flips to be positive but becomes insignificant after controlling for the “self-selection” effects. The results confirm that compared to their counterparts in non-acquired firms, employees in acquired firms are indeed more likely to

⁶ All continuous variables are logged.

leave their firms after acquisitions. Therefore, H1 is supported. But the job departures after acquisitions are mainly in the form of switching to another job.

Table 3 presents the results based on Model (2) where the interaction terms are added. The coefficients of interaction terms capture the moderating effects – the impacts of technological or managerial skills on the relationship between acquisitions and job departures. From the panel without including entropy balancing weights, it is noted that the coefficients of *acqui*tech* are all negative and significant, no matter if we take account of total departures or when we distinguish between departure routes. By contrast, the moderating effect of managerial skills is only significant (positive) when the dependent variable is *exit*. The moderating effects exhibit a similar pattern even after including entropy balancing weights. The results confirm that the acquisition effects on job departures are weaker for employees with technological skills. Therefore, H2 is supported. When we focus on total departures in general, we don't find that the acquisition effects on job departures are significantly different for managers, which supports H3c. However, when we distinguish between departure routes, managers, compared to other employees, are found to be more likely to exit from the (national) labor market after acquisitions. We also conduct robustness checks to show the robustness of our findings. More details are shown in Appendix 3.

Table 2 Acquisition effects on job departures

Variables	Without entropy balancing weights			With entropy balancing weights		
	Total departures	By departure routes		Total departures	By departure routes	
		Switch	Exit		Switch	Exit
Acqui	0.0674*** (0.00769)	0.0761*** (0.00704)	-0.00870** (0.00351)	0.0537*** (0.00828)	0.0518*** (0.00767)	0.00191 (0.00363)
Constant	-0.128*** (0.00297)	-0.0932*** (0.00252)	-0.0343*** (0.00147)	-0.146*** (0.00503)	-0.120*** (0.00463)	-0.0259*** (0.00196)
Obs	82,777	82,777	82,777	72,209	72,209	72,209
R squared	0.334	0.337	0.325	0.342	0.341	0.321
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Individual fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. Singleton observations are dropped because of controlling for fixed effects.

Table 3 Moderating effects on the relationship between acquisitions and job departures

Variables	Without entropy balancing weights			With entropy balancing weights		
	Total departure	By departure routes		Total departures	By departure routes	
		Switch	Exit		Switch	Exit
Acqui	0.0989*** (0.0119)	0.109*** (0.0110)	-0.00963* (0.00533)	0.0854*** (0.0123)	0.0842*** (0.0114)	0.00115 (0.00545)
Acqui*Tech	-0.0720*** (0.0150)	-0.0554*** (0.0138)	-0.0165** (0.00665)	-0.0720*** (0.0151)	-0.0558*** (0.0140)	-0.0161** (0.00664)
Acqui*Manager	0.00757 (0.0176)	-0.0246 (0.0156)	0.0322*** (0.00934)	0.00860 (0.0177)	-0.0238 (0.0158)	0.0324*** (0.00929)
Constant	-0.126*** (0.00297)	-0.0924*** (0.00253)	-0.0337*** (0.00146)	-0.145*** (0.00502)	-0.120*** (0.00463)	-0.0255*** (0.00195)
Obs	81,641	81,641	81,641	72,209	72,209	72,209
R squared	0.334	0.337	0.325	0.343	0.342	0.322
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Individual fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. Singleton observations are dropped because of controlling for fixed effects.

5. Discussion and conclusion

This paper studies the relationship between acquisitions and mobility of knowledge workers and managers in small technology companies and how individual skills and capabilities moderate the relationship. Our results show that acquisitions increase the likelihood of knowledge employees to leave their current employers, which is consistent with the findings from previous research that focused on target executives (Krug et al., 2014; Walsh, 1988; Wu & Zang, 2009). We also find that post-acquisition departures of target employees are mainly in the form of switching to another job. However, the acquisition effects on employee departures are found to be weaker for individuals with technological skills. When it comes to managerial skills, the pattern is less clear-cut. We find that in general the acquisition effects on job departures are not significantly different for managers. It is either because acquirers don't value the managers or there are opposite effects of being managers on involuntary and voluntary departures respectively. When we distinguish between departure routes, managers, compared to other employees, are found to be more likely to exit from the (national) labor market after acquisitions. This may be because managers leave the national labor market to work abroad, perhaps being redeployed to another business unit of the acquiring firm. This may also reflect the possibility of existence of "market discipline" effects (Jensen & Ruback, 1983; Manne, 1965), where managers are intended to be replaced by new managerial teams.

This paper contributes to the literature in three folds. First, this study provides new insights to the field by showing how acquisitions impact on target knowledge workers and managers in small technology firms. Extant studies have exclusively focused on target executives in large public companies. However, the nature of acquisitions has been changing substantially over recent decades. Acquisitions of small private firms have been a popular strategy for large incumbents to source technological capabilities externally (Andersson & Xiao, 2016; Desyllas & Hughes, 2008). The main assets and competences of a small technology venture are argued to be embedded in the human capital of its founding team and key employees (Colombo & Grilli, 2005; Ranft & Lord, 2000). In this sense, knowledge workers with technological competences are supposed to be the key assets that acquiring firms strive to retain, or on many occasions, even to be the major motive that drives the acquisitions (Coyle & Polsky 2013; Chatterji & Patro 2014). Our findings support this argument and suggest future research on post-acquisition employee mobility should go beyond target executives and give more attention to target knowledge professionals, which may shed important light on post-acquisition knowledge selection and integration processes.

Second, this study shows that specializations of individual skills and capabilities matter for post-acquisition knowledge selection, which complements the extant research which either neglects the role of human capital or focuses only on levels of human capital (Buchholtz et al., 2003).

Third, this study provides a systematic analysis of post-acquisition employee mobility based on large-scale data. Previous studies in this topic have depended either on small-scale surveys or on post-acquisition observations of target employees (see, e.g., Buchholtz et al., 2003; Hambrick & Cannella, 1993; Krug & Hegarty, 1997; 2001; Walsh, 1988). Lack of control groups fails to account for the natural rate of employee turnover, which limits the interpretation and generalizability of the findings in a broader context. Lack of pre-acquisition observations fails to control for time-invariant heterogeneity between individuals, which may bias the results and limit the causal inference of the findings. Our dataset derives from the whole population of Swedish firms and contains both acquired and non-acquired firms and information both before and after acquisitions. Relying on fixed effects models combined

with an entropy balancing approach, our analysis accounts for time-invariant heterogeneity at both individual and firm levels and the potential “self-selection” bias. Our analysis also distinguishes between departure routes. With this information, our findings shed important light on by which route individuals leave their jobs.

One limitation of this study is that we cannot measure acquisition motives directly. The motives behind acquisitions are a critical element which not only characterizes the nature of acquisitions but also influences post-acquisition implementation and integration processes. We believe that to distinguish the motives of the acquirers could be a critical point of departure to address the changing nature of acquisitions and disentangle the complexity of post-acquisition activities. We suggest that future research could focus on the emergence of new acquisition motives and exploring how acquisitions are used innovatively to cope with the accelerating technological change.

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Appendix 1 Identification of knowledge professionals and managers

We identify the knowledge professionals and managers based on the classification codes of SSYK96. SSYK96 is the Swedish Standard Classification of Occupations 1996, adapted based on the International Standard Classification of Occupations (ISCO-88). The SSYK96 scheme classifies occupations based on two dimensions. The first dimension captures the tasks or duties of an occupation. The second dimension measures the skill levels. Managers are identified as individuals in positions with managerial responsibilities and skills, and professionals are identified as individuals in positions that require theoretical competence and a university or postgraduate university degree, or the equivalent. According to Statistics Sweden (2016), the assessment of skill levels of SSYK96 considers knowledge and skills acquired from both formal education and work experience. The consideration of work experience makes SSYK96 a more comprehensive scheme than educational qualification to identify important human capital.

Appendix 2 Tables

Table A1 Correlation table of independent variables

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Acqui (1)	1.0000													
Tech (2)	0.0339	1.0000												
Manager (3)	0.0208	0.0456	1.0000											
College (4)	0.0099	0.0392	-0.1947	1.0000										
Age (5)	-0.0818	-0.0544	0.1978	-0.0765	1.0000									
Tenure (6)	-0.0660	0.0427	0.1607	-0.1252	0.2658	1.0000								
Salary (7)	0.1418	0.0827	0.1230	0.0592	0.0321	0.1190	1.0000							
Indus_exp (8)	-0.0670	0.0117	0.0680	-0.1111	0.3515	0.4150	0.1673	1.0000						
Owner (9)	-0.2399	-0.0066	0.0539	-0.0578	0.2226	0.1468	-0.1807	0.2043	1.0000					
Gender (10)	0.0021	0.2452	0.0395	-0.0936	-0.0151	0.0290	0.0738	0.0807	0.1214	1.0000				
Children (11)	0.0130	0.0332	0.0221	-0.0004	-0.0895	0.0182	0.1010	0.0772	0.0120	-0.0246	1.0000			
Manu (12)	0.0347	0.1295	0.4109	-0.1761	0.1735	0.2018	0.0400	0.0410	-0.0228	0.0485	-0.0284	1.0000		
Firm size (13)	0.2963	0.0289	0.0708	0.0171	-0.0570	0.0323	0.2669	-0.0419	-0.3677	-0.0797	0.0154	0.0897	1.0000	
Productivity (14)	0.0153	0.0282	-0.0356	0.0580	0.0154	0.0575	0.2517	0.0728	-0.0555	0.0044	0.0346	-0.0456	0.1173	1.0000

Table A2 Mean values of treatment and control observations before and after entropy balancing

Variables	Before balancing		After balancing	
	Treatment	Control	Treatment	Control
Tech	0.4932	0.2456	0.4932	0.4932
Manager	0.2448	0.162	0.2448	0.2448
College	0.5692	0.2464	0.5692	0.5692
Age (log)	3.642	0.05961	3.642	3.642
Tenure (log)	0.6663	0.8131	0.6663	0.6663
Salary (log)	5.945	1.028	5.945	5.945
Owner	0.2636	0.2313	0.2636	0.2636
Gender	0.8602	0.1236	0.8602	0.8602
Children	0.4874	0.2495	0.4874	0.4874
Manu	0.1481	0.09175	0.1481	0.1481
Firm size (log)	2.412	1.285	2.412	2.412

Appendix 3 Robustness checks

The first robustness check tests whether the findings are sensitive to adding more control variables. We include two more control variables, industry experience and firm productivity, to pre-balance the data between treatment and control groups, and re-estimate Model (2) with the updated weights. The results are reported in Table A3, showing that the findings hold. It is noted that the number of observations is reduced as there are more missing values related to the two variables.

The main advantage of a fixed effects estimator is to remove unobserved heterogeneity at group levels (e.g., individual- and firm-level heterogeneity in our case). However, estimations of fixed effects draw only on within-group variation in the data. The second robustness check thus tests whether our findings are sensitive to using a random effects estimator where between-group variation is also accounted for. Since our data are hierarchically structured, multilevel modelling has become a viable choice which can take account of multiple levels of information. We re-estimate Model (2) with entropy balancing weights by allowing random intercepts at both individual and firm levels. In addition to the control variables, we also add a variable to distinguish individuals in acquired firms from non-acquired firms. The results are reported in Table A4, where we can find that the findings still hold. It can be noted that the moderating effect of technological skills on *switch* is only significant at 10% level now. But it does not alter the main conclusions we draw from the main analysis. One possible explanation of the change in significance level could be that the moderating effects (and acquisition effects) mainly reside in within-group variation.

Table A3 Robustness check: moderating effects (pre-balancing the data with additional variables)

Variables	With entropy balancing weights		
	Total departures	By departure routes	
		Switch	Exit
Acqui	0.0872*** (0.0127)	0.0851*** (0.0117)	0.00208 (0.00577)
Acqui*Tech	-0.0756*** (0.0155)	-0.0600*** (0.0143)	-0.0157** (0.00704)
Acqui*Manager	0.00893 (0.0182)	-0.0256 (0.0161)	0.0345*** (0.00980)
Constant	-0.124*** (0.00462)	-0.102*** (0.00424)	-0.0220*** (0.00184)
Obs	58,285	58,285	58,285
R squared	0.333	0.331	0.311
Year dummies	Yes	Yes	Yes
Individual fixed effects	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes

Notes: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. Singleton observations are dropped because of controlling for fixed effects.

Table A4 Robustness check: moderating effects (multilevel model)

Variables	With entropy balancing weights		
	Total departures	By departure routes	
		Switch	Exit
Acqui	0.105*** (0.0150)	0.0894*** (0.0143)	0.0152*** (0.00444)
Acqui*Tech	-0.0267** (0.0118)	-0.0196* (0.0113)	-0.00997** (0.00466)
Acqui*Manager	0.0219* (0.0133)	0.0104 (0.0121)	0.0129** (0.00651)
Obs	76,589	76,589	76,589
Other controls	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes
Individual fixed effects	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes

Notes: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.