HUMAN RESOURCE FLOW AND SOFTWARE FIRM PERFORMANCE: THE ROLE OF DIRECT VS. INDIRECT COMPETITORS

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Abstract

Recent years have witnessed increasingly stiff competition for talents among software firms. The economic impact of obtaining workers from or losing workers to competing firms, however, has rarely been quantified. Built on the literature of human resource flow and firm competition, this study examines the impact of human resource flows from and to different types of competitors on company performance. In particular, we divide competitors into direct and indirect competitors according to their market and resource similarity. Using a large dataset on labour mobility derived from LinkedIn.com, we quantify the impact of employees who came from or joined direct and indirect competitors respectively. We find that employees from competitors bring great benefits to the recipient firms. Specifically, a 1 percent increase of the number of employees from direct (indirect) competitors that join the focal company in the previous year increases the company's economic value added by 0.054 (0.074) percent in the current year. Our results also contribute to the existing literature on human resources and company strategy and provide practical implications to recruiters and policy makers in the software industry.

Keywords: Economics of IS, Management of IT Resources, IT Policy and Management, Strategic Group Competition.

1 INTRODUCTION

Competition for human resources has long existed in different industries (Wright et al.1993; Powell et al. 1997). Recent years have also witnessed increasingly stiff competition for talents among software firms (Bagley 2014; Yalcinkaya et al. 2007). As information technology is becoming a key determinant to a company's success, the competition for software talents, or the "Code War" (Gilliland et al. 2014), outbreaks in almost all industries. Software industry fights even fiercer for human intelligence than other industries. For a high-technology company, human IT resources serve as a critical component of frim-specific resources which creates firm-wide IT capability and decides firms' sustain competitive advantages over their competitors (Bharadwaj 2000). For instance, Google offered attractive counter-offers to employees who were fished by Facebook to stop flow of employees to Facebook (Arrington 2010). The Internet giant even considered enforcing a new company policy to make counter-offers within one hour to employees who received Facebook job offers (Elder 2014; Kerr 2014). Companies also devote great efforts to attract and retain talents through improved and exceptional welfare and benefits. For example, Apple and Facebook will cover the cost of freezing the eggs of female employees who want to postpone pregnancy and pursue their careers (The Economist 2015). Despite the prevalence of IT talent fishing, the economic impact of obtaining workers from or losing workers to competing firms has rarely been quantified, making it difficult to justify companies' efforts in talent competition against rivalry firms.

Despite a number of past studies examining the influence of worker mobility on company productivity (Cheyre et al. 2014; Ge et al. 2015; Hosil 2007; Palomeras and Melero 2010), the literature still lags in three aspects which motivate our study. First, prior researches under-explored the relationship between the source and the recipient of mobility events. Indeed, there are only a handful of studies that distinguish the effects to different recipient firms (Campbell et al. 2012). Since companies operate in an interactive environment, the effect of mobility on firm performance not only depends solely on the type of recipient firms, but also relies heavily on the strategic relationship between the two firms. Second, the literature has overlooked the different types of competition among firms in the same industry. While companies in the same industry could be generally regarded as competitors, the extent and type of competition between firms vary significantly with regards to the similarity in their market and resource structure. As a component of firm resources, human capital is also firm specific and the similarity between firms' business might be reflected in the structure of human capital. Thus, the effects of human resource flow between firms that are similar to each other might be different from the flow between firms that are less like (Wright et al. 1993). Third, compared with previous studies that use patent to track mobility, we take the data suggested in Ge et al. (2015) and use employee profile data from LinkedIn as a highly accurate source of job histories. The data hence effectively mitigate the sampling and misclassification problem faced by most patent datasets, which is widely used in the literature for mobility research (Ge et al. 2015).

Built on the literature of human resource flow and firm competition, our study intends to empirically examine how human resource flows from and to different types of competitors may affect firm performance. Specifically, we classify competitors in a certain market for a focal firm into two groups: direct competitors and indirect competitors (Chen 1996). Direct competitors compete in similar markets and might have similar resource structure. Their competition could be fiercer. The behaviour of their employees is also more likely to have direct effects on each other's performance in the market. We restrict our analysis to the software industry. Labour inputs account for more than 80% of the productivity in software industry (Huang and Wang 2009). Such a high reliance on human capital makes software industry more sensitive to human resource flows from and to competitors than other industries. In such a knowledge intensive industry, the success of software companies hence hinge on the internalization of tacit knowledge and skills embedded in their employees. As a result, software industry provides a suitable context for our research topic. Using the LinkedIn profile data and Compustat database from Wharton Research Data Services (WRDS), we employ a fixed-effects linear model and find significant positive effects of employees from both direct and indirect competitors on firm performance. Our preliminary results also support most of our hypotheses.

Our study extends the current literature on human resources and company strategy. Adopting insights from competition and human resource flow literature, we empirically differentiate and quantify the influences elicited by different types of competitors (i.e. direct vs. indirect competitors). We strengthen the literature of resources based view on how a firm could gain sustained competitive advantages by intentionally choosing its employees to form its pool of human capital that is inimitable. Our results also provide several practical implications to recruiters and policy makers. We find that the value of employees from direct competitors might have been overrated in their current practices and the combination of human capital from indirect competitors could benefit the firm

2 THEORETICAL DEVELOPMENT

Human resource mobility has long been studied in previous literature. It is regarded as an important asset of the company (Campbell et al. 2012; Lengnick-Hall and Lengnick-Hall 1988; Steffy and Maurer 1988), which is critical to firm productivity, performance and sustained competitive advantages (Hitt et al. 2001; Huselid et al. 1997; Wright et al. 1994). Since the flow of personnel adds to the firm's knowledge pool with its associated tacit knowledge and skills, such mobility is critical for organizational knowledge transfer. If the transfer of knowledge is not entirely internalized by the source and recipient firms, the transfer will lead to spillover of knowledge (Png and Samila 2013). This creates opportunities for recipient firms to exploit their current assets and explore new innovative ideas that could generate more values to the firms.

Though companies in the same industry could be generally considered as competitors, the extent and type of competition could be further divided based on the overlap of their businesses (Chen 1996). Strategic group literature suggests that some firms within the same industry are more similar and compete more directly than others. Those competitors are denoted as direct competitors and usually declared in these companies' annual reports.

When companies compete with each other more directly, the resources required and market faced to run their businesses are hence similar (Chen 1996). Their human resources are also more similar because of the similarity of the development of their business (Hatch and Dyer 2004). As a result, new employees from direct competitors are likely to have knowledge and skills similar to those needed by the recipient firm. High similarity in knowledge structure increases firm productivity through two manners On the one hand, firms with similar business might offer their employees similar training and as a result, they might be easier to adapt to the new environment quickly and contribute to the recipient firm directly. On the other hand, recipient firms could have higher absorptive capacity (Cohen and Levinthal 1990) to assimilate and take advantages of new employees' skills and knowledge.

Furthermore, overlap in resource and knowledge between direct competitors also allows recipient firms to carry out the exploitation of their existing resources. New joiners from direct competitors bring knowledge similar to recipient firms' core businesses, which enhance recipient firms' existing human capital pool and exploitative capabilities. Previous studies have defined exploitative capabilities as the ability to continuously improve existing resources and processes and found that exploitation helps firms build solid foundation and continually generate values (Yalcinkaya et al. 2007). When a firm possesses a higher capability in exploiting the existing knowledge, they are more likely to monetize on these resources and achieve superior financial performance (Jansen et al. 2006). Thus, better exploitative capabilities increase firm performances.

By recruiting workers from direct competitors, firms achieve higher absorptive capabilities and exploitative capabilities that have a direct improvement effect on companies' performance. Hence, we hypothesize, *H1: Employees who came from direct competitors have positive effects on recipient firm's performance.*

Employees who came from indirect competitors of the focal firm might also bring benefits to the recipient companies. There are two mechanisms that these workers contribute to the recipient companies. Firstly, while employees from indirect competitors possess knowledge not core to the main business of the recipient firms, the new dimensions of knowledge create opportunities for recipient firms to synergize and explore new potentials within their core businesses. Firms could be able to integrate their knowledge and extend the pool of human resources. The increment of new knowledge could be explored by the firm. Literature has defined explorative capabilities as the ability to adopt new processes, products, and services that are unique from those used in the past. It has also shown that explorative capabilities are critical to innovation and competitive advantages (Yalcinkaya et al. 2007). Some existing studies conducted in other industries have shown that exploration often results in uncertain or even negative returns (March 1991). The software industry, however, is characterized by intensive innovation and fast development. In such a high-pace and responsive industry, exploration on innovative ideas and untapped markets becomes extremely important for firms to maintain and succeed. Hence, employees from indirect competitors bring in new knowledge that could hint on revamping of existing products, processes and practices. Consolidation of current and new human talents could hence help companies to explore and renovate their existing core businesses. Secondly, the extension of the human resources brought by employees from indirect competitors also allows companies to tap into brand new areas of businesses. With increased explorative capabilities, firms make innovations and have higher chance to survive the unfamiliar markets. Hence, we posit that employees who came from indirect competitors will also have positive effects on source firm's performance.

H2: Employees who came from indirect competitors have positive effects on recipient firm's performance.

Although employees who came from direct and indirect competitors both possibly increase firms' performance, we posit that the effects from direct competitors are stronger than those from indirect competitors. Firstly, exploration activities are normally more risky than exploitation activities (Yalcinkaya et al. 2007) and hence employees from direct directors are more likely to bring profits to recipient firms on average. Their working experience in similar companies could reduce the employee's learning cost in the new companies and the similarity in business could help them put themselves into work quickly. Secondly, though it takes time for firms to integrate the human capital from its rivals into their original human resources pool, the similarity of their resources structure will reduce their time of dynamic adjustment cost to get the best use of human capital and tailed to the needs in the new environment (Hatch and Dyer 2004). Furthermore, they also have higher odds to succeed in business boosts via exploitation and exploration. Hence, we hypothesize,

H3: Employees who came from direct competitors have larger beneficial impact on recipient firm's performance than those who come from indirect competitors.

On the other hand, when employees join direct competitors' company, source firms lose to the recipient firms the tacit knowledge and skills pertaining to their businesses. Human capital is specific to a firm, the leave of them with their tacit knowledge could be replaced by new employees without such firm-specific knowledge required to contribute to learning by doing (Oliver 1997). It is argued that a rival need time to acquire, develop and deploy the human capital. However, direct competitors might be able to shorten the time required because of the similarity in resources structure (Hatch and Dyer 2004). Thus, though the loss is destined, it might be a greater loss if the employees join the direct competitors of the firm. Since direct competitors face common market and similar resource structure, they are able to exploit the resources and improve productivity quicker than the indirect competitors. In a competitive environment like software industry, the market share and firm productivity of the source firms are inevitably subject to the performance of other actors, especially their direct competitors, in the market. Furthermore, the adverse impact will be exaggerated if the lost employees are key employees with indispensable knowledge to the source firm. Consequently, recipient firms have an indirect adverse impact on source firms' performance because of the increased productivity of recipient firms. Hence, we hypothesize,

> *H4: Employees who joined direct competitors will have negative effects on source firm's performance.*

3 DATA AND VARIABLES

3.1 Sample

We focus on the software industry under the SIC 7372. Many well-known software companies fall into this category, including Google, Microsoft etc. Software industry is a suitable context for our analysis because of its high mobility of human resource and comparably fewer patent or trade secret issues. First, firms in the software industry have a high reliance on human capital, making them highly subject to worker mobility and competitors' actions. Second, although some industries use trade secret laws to prevent ex-employees using technologies of their ex-employers (Png and Samila 2013), trade secret might not be able to provide a reliable protection mechanism for software companies because product functionality are prone to reverse engineering or simply observing-and-redesigning (Mann 2005). Hence, it is less conventional for firms to use patents to gain exclusive rights for certain technologies and achieve competitive advantage in the software industry. Indeed, the tacit knowledge of employees is more valuable to firms and determines firms' product development and innovation abilities.

Instead of using firms' declared competitors in annual reports, we adopt a more objective measurement of direct competitorship in the industry by Hoberg and Phillips (2010). The Electronic Data Gathering, Analysis, and Retrieval system (EDGAR) has public data of firms' 10-K forms, a compulsory annual financial report provided by the firms themselves. The report has a business description part that provides an overview of the firm's business. The similarity between firms' business descriptions could be a hint of competition. If two firms compete in many similar markets and have similar resource combination, their competition could be fiercer and hence classified as direct competitors (Chen 1996). Text-based analysis could then be used to measure similarity between two firms. We use business descriptions of 10-K forms and identify the top ten descriptions that are mostly similar for a certain company. These companies are then regarded as direct competitors of the focal firm.

To track employee mobility, we collected company employee information from the public profiles for all publicly listed software firms with SIC code 7372 at LinkedIn.com using computer programs. We used combination of company names, common English names, as well as frequent IT job titles to search for current or former employees in the software firms repeatedly. The data collection consisted of three rounds. Different search keywords are used to search publicly available profiles on LinkedIn.com. Specifically, company names are used as search keywords in the first round, pair-wise combination of company names and common English names in the second round, and pair-wise combination of company names and frequently used IT job titles in the third round. We have managed to collect 1,075,032 public LinkedIn profiles in all three rounds and construct a relative complete sample. The individual LinkedIn data is then aggregated to general firm level. In particular, after aggregating these one million profiles, we have pair-level data on the total number of employees that leave one firm and join the other firm.

We merge the direct competition data with firm-level LinkedIn data and calculate the total number of employees leaving from or joining direct or indirect competitors for each firm each year. We then use firms' SIC code as distinct identifiers and merge the data with annual firm accounting variables and the official number of employees collected from the Compustat database at Wharton Research Data

Services (WRDS). The constructed final dataset contains 1,342 observations and consists of 240 software firms spanning from 1997 to 2011. On average, we observe 5.592 years of HR flow for each firm with a standard deviation of 4.116.

3.2 Variables

The dependent variable is company performance. We operationalize company performance as economic value added, which is the additional value of the final product over the cost of input material used to produce it from the previous stage of production (*LVA*) (Brynjolfsson and Hitt 1996; Dewan and Min 1997; Kudyba and Diwan 2002). Since there is no clear definition on the input materials from the previous stage in the software industry, we follow the definition in the literature and measure the economic value added as the difference between the total annual sales and the cost of goods sold (Brynjolfsson and Hitt 1996). The independent variables are in and out HR flows from the direct competitors and indirect competitors of the focal software firms (i.e., HR flow to direct competitors *LTDC*, HR flow to indirect competitors *LTNDC*, HR flow from direct competitor *LFDC* and HR flow from indirect competitor *LFNDC*)[1]. The dependent variable and independent variables are logged. We have also included marketing resource intensity (*ADI*), R&D intensity (*RDI*) and existing labour (*LABOR*) as control variables. The descriptive statistics and correlations are shown in Table 1. Since the magnitudes of existing labour are much larger than other variables, we scale the variables by dividing 1000.

Variable	*Obs*	*Mean*	*S.D.*	*Min*	*Max*	*LVA*	*LTDC*	*LTNDC*	*LFNDC*	*LFDC*	*ADI*	*RDI*	*LABOR*
LVA	1323	5.36	1.82	-0.51	10.95	1							
LTDC	1323	0.97	1.38	0.00	6.89	0.60	1.00						
LTNDC	1323	2.01	1.33	0.00	7.00	0.75	0.54	1.00					
LFNDC	1323	2.12	1.38	0.00	7.22	0.77	0.54	0.83	1.00				
LFDC	1323	1.00	1.43	0.00	6.46	0.59	0.89	0.51	0.56	1.00			
ADI	1323	0.03	0.05	0.00	0.72	-0.04	0.01	-0.04	-0.02	0.01	1.00		
RDI	1323	0.17	0.12	0.00	1.54	-0.33	-0.07	-0.15	-0.17	-0.08	0.17	1.00	
LABOR	1323	10.37	42.57	0.02	433.76	0.53	0.33	0.49	0.45	0.32	-0.06	-0.17	1.00

Table 1. Descriptive Statistics and Correlation Table

3.3 Model Specification

To study the impact of HR flow from direct and indirect competitors on company performance, we applied fixed effects linear regression model which accounts for unobserved individual firm specific effects. To avoid potential simultaneous bias, we take lagged of all the independent variables. Literature also suggests last year performance is a strong predictor of performance of current year. We hence also include the lagged dependent variable. Specifically, we estimate the model[2]:

$$\begin{aligned} Performance_{it} &= \alpha_i + \beta_1 Performance_{it-1} + \beta_2 ADI_{it-1} + \beta_3 RDI_{it-1} + \beta_4 LABOR_{it-1} \\ &+ \beta_5 LTDC_{it-1} + \beta_6 LTNDC_{it-1} + \beta_7 LFDC_{it-1} + \beta_8 LFNDC_{it-1} + t + \varepsilon_{it} \end{aligned},$$

[1] The preliminary analysis does not differentiate talent workers from normal workers. Nevertheless, we have included the average working experience of moving workers to control for worker expertise and found consistent results. Due to page limit, the results are not included here but available upon requests.

[2] There is also possibility that the HR flows have a U-shaped relationship with company performance. To rule out this possibility, we test for the U-shape relationship by including quadratic terms of the four independent variables. The re-estimated results suggest that the four HR flows variables are unlikely to have a U-shaped relationship.

where i denotes each individual firm, t are year dummies and α_i are random variables that capture unobserved individual firm heterogeneity.

4 PRELIMINARY RESULTS

The dependent variable used in Table 2 is the logged economic value added. Column (1) to (4) in each table shows the results of our fixed effects model (FE Controls) with only control variables, ordinary least squares (OLS) with all variables, random effects linear panel regression (RE) with all variables and fixed effects linear panel regression (FE) with all variables. Results from Hausman Test show a p-value of 0.000, suggesting fixed effects model should be used than random effects model. Consistent with our model specification, all the independent variables have been taken lagged. Results are also all reported with robust standard errors. Juxtaposing results from Column (2) to (4), we observe consistent results across different model estimations. Therefore, we use the model in Column (4) as our main model for hypothesis testing and interpretation.

Models Dependent Variable：	(1) FE Controls Value Added	(2) OLS Value Added	(3) RE Value Added	(4) FE Value Added
L.LVA	0.681***	0.919***	0.841***	0.641***
	(0.038)	(0.017)	(0.025)	(0.043)
L.LTDC		-0.024+	-0.020	-0.023
		(0.014)	(0.015)	(0.015)
L.LTNDC		-0.051***	-0.017	-0.009
		(0.013)	(0.014)	(0.016)
L.LFDC		0.040**	0.041**	0.054***
		(0.013)	(0.015)	(0.016)
L.LFNDC		0.120***	0.109***	0.074***
		(0.015)	(0.018)	(0.017)
L.ADI	0.074	0.746**	0.595	0.067
	(0.490)	(0.279)	(0.386)	(0.489)
L.RDI	0.132	-0.214	-0.112	0.001
	(0.311)	(0.136)	(0.197)	(0.297)
L.LABOR,	0.001	0.000	0.002**	0.000
	(0.001)	(0.000)	(0.001)	(0.001)
Year Dummies	Y	Y	Y	Y
Constant	1.709***	0.590***	0.901***	1.816***
	(0.208)	(0.108)	(0.132)	(0.204)
R-squared	0.811	0.972		0.820
No. of observations: 974; Number of firm: 193; Hausman Test P-value is 0 with Chi-square 187.2				

*Table 2. Preliminary Results (*** p<0.001, ** p<0.01, * p<0.05, + p<0.1)*

In Table 2, the lagged LFDC has a significant positive coefficient of -0.054, implying that 1 percent increase in the number of employees joining the direct competing companies last year increases the company's economic value by 0.054 percent. The lagged LFNDC also has a significant coefficient, meaning that HR flows to companies that do not directly compete with the focal companies still have impact on company performance. Specifically, with 1 percent increase in the number of employees leaving the focal company and joining indirect competitors in the previous year, there is an increase of 0.074 percent in company's economic value added in the current year. Unfortunately, although LTDC shows a negative coefficient, we observe no significant influence of employees joining direct competitors on company performance. There are two possible reasons. Firstly, the adverse impact of losing valuable employees is manifested indirectly through competition. Hence, the effects might not be so obvious compared to the direct beneficial effects of acquiring new employees from direct competitors. Secondly, we only lag one year to test the effects of worker mobility. Since the adverse effect from competition is indirect, it might need more time to respond and reflect on companies' performance. Hence, results in Table 2 suggest that H1 and H2 are supported while H4 is not supported. To compare the effects of employees from direct and indirect competitors, we perform dominance analysis (Budescu 1993), a quantitative measure of importance that allows more general inferences because dominance is defined as "achieved" only when one variable excels the other in all models. Consistent with the relative magnitude in Table 2, results from dominance analysis also shows that employees from indirect competitors have larger weights than those from direct competitors, rejecting H3. Nevertheless, from the point of view of economic significance, the difference between the two effects is only around 0.02 percent. Hence, it means that employees coming from both direct and indirect competitors are likely to contribute to firm performance.

5 DISCUSSIONS AND CONCLUSIONS

In this study, we examine the impact of human resource flows from and to different types of competitors on company performance. In particular, we divide competitors into direct and indirect competitors according to their business and resource similarity. Our results contribute to the current literature on human capital resources. Based on resource based view, the extension of human capital resources benefit firms' performance. Hence, the integration of different sources of competitors helps firms form inimitable human resources and gain strength in the market competition. We argue that employees from direct and indirect competitors could add in the original human capital pool as well as extend it by bringing new perspective of knowledge. They can also contribute to the recipient firms' productivity through increased exploitative and explorative capability respectively. Apart from the direct implications of acquiring new human resources from competitors, we also propose that loss of human resources to competitors could put the source firms disadvantaged. The improved productivity of recipient firms might have adverse impact on source firms indirectly through market competition.

Our preliminary empirical evidence also provides practical implications to human resource staff. Firstly, consistent with our hypotheses, we find that human resources flows have significant impact on company performance. By further categorizing human resources in and out flows in terms of direct and indirect competitors of the focal company, we manage to quantify and differentiate the values brought by new employees from different types of source firm. From our preliminary results, human resources flows from indirect competitors have a slightly larger impact on company performance than those from direct competitors. This suggests that the value of employees from direct competitors might have been overrated in their current industrial practices. Secondly, companies could also gain a deeper understanding of the benefits and costs of involving in talent competition, which guides companies' adjustment of their hiring or fishing strategies.

Our study also has several limitations that shed light on future research. Firstly, we currently use fixed effects linear model to account for unobserved firm-specific effects that might result in omitted variable biases. Nevertheless, we have not controlled the quality of HR in and out flows in our preliminary data analysis. Although using the total number of employees as a proxy to human capital mobility is sufficient to our current analysis, it might be more interesting to examine the different effects of various types and quality of moving employees. Secondly, the labour inputs might be endogenous. Although we take lag of the independent variables to mitigate the simultaneity issues, we cannot rule out the alternative situation where employees join another company because they expect the company' sales to grow or have insider information about the company. Hence, we will employ more identification strategy (e.g. using instrumental variables etc.) in the future study. Thirdly, the current empirical model is a simple fixed effects linear regression. In the future, we will consider using Cobb-Douglas production function and more sophisticated techniques such as Arellano and Bond estimator (Arellano and Bond 1991) and Olley and Pakes' estimation method (Olley and Pakes 1992). Nonetheless, our findings add to the current literature of human resources and company competition, which still lacks understanding of knowledge spillover through labour inputs. By quantifying the value of employees from direct and indirect competitors via empirical evidence, our study hence provides valuable insights to the recruiters and companies in the software industry.

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