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6-18-2013

Human Resource Flow within Software Industry: A Firm-Level Investigation

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HUMAN RESOURCE FLOW WITHIN SOFTWARE INDUSTRY: A FIRM-LEVEL INVESTIGATION

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Abstract

In a knowledge-intensive industry such as information technology, human resource management plays a central role in the success of software firms. This study takes a firm-level analysis and examines the effects of the human resource inflows and outflows on software firm performance. Moreover, we investigate how the specific human capital variables (e.g. education, experience) embedded in the human resource flows affect firm performance. We collect a unique dataset from LinkedIn.com for the human resource flows and human capitals embedded. Our analysis shows that the human resource outflow but not inflow has significant impacts on firm performance. Meanwhile, the human capital variables such as education level and IT experience embedded in the human resource inflow have significant impacts on firm performance. Our study contributes to the research on IT turnover and IT human resource management by highlighting the importance of human capital embedded in the human resource flows. Our findings also suggest that researchers and practitioners should not only focus on the human resource inflow and outflow (i.e., quantity of the human resource flow), but also need to pay attention to the specific human capitals embedded in the flows (i.e., quality of the human resource flow).

Keywords: Human Resource Flow, Human Capital, Software Firm Performance.

1 INTRODUCTION

The Information technology (IT) industry is well known as one of the most human-capital-intensive industries. In a knowledge-intensive industry such as IT, human resource management (HRM) plays a central role in the production process and service provision. This is particularly true for software firms because a significant portion of the technical knowledge is embedded in individuals (Song, Almeida et al. 2003).

However, software firms generally face high turnover rate due to the existence of many job alternatives for IT professionals. This leads to a "turnover culture", which is characterized by Moore and Burke (2002), in IT industry. The topic of IT professionals' turnover has already drawn a considerable amount of academic studies in the discipline of information systems (Reich & Kaarst-Brown 1999; Moore, Yager et al. 2001; Joseph, Ng et al. 2007). Researchers have identified human capital variables such as working experience, IT experience and education changes as the antecedents of the turnover of IT professionals. However, most of these existing studies are at individual level.

Software firms have made continuous efforts to win the well-known "talent war", which is further intensified by the globalization and recent shortage of skilled IT professionals in the labor market. For example, Google had to offer a 15% raise and $500,000 bonus to retain its top talents (BusinessInsider 2010). Meanwhile, there is the other side of the "talent war". Recently, several giant IT companies such as Google, Apple, Adobe, Intel and a few others have been sued for the "No Poach" agreement, which aims to eliminate competition for skilled IT professionals (TechCrunch 2012). This is all because that turnover, as a flow of knowledge from a company to another, is critical to the production and service provision of software firms.

The notion of 'Human Resource Flows' was coined by the work of Beer et al. (1984) as part of the "Harvard Model" in HRM. This seminal Harvard model states that people are the main assets within the company and therefore 'employee influence' plays a major role (Beer, Spector et al. 1984). As one of the key policy area of the "Harvard Model", human resource flows focus on business processes including recruitment, selection, placement, promotion, appraisal and assessment, termination, etc. Specifically, the flow through organizations can be split into inflow (e.g. planning, hiring, recruiting, selecting and inducting), internal flow (training, developing, giving appraisal and rewarding) and outflow (retirement, lay-offs, dismissal and having a new job).

This study takes a firm-level perspective and mainly focuses on the inflow and outflow of human resource. On the one hand, although an inflow of human resource could bring new knowledge and skills to the firm, it could also hurt business because it also increases administrative expenses associated with recruiting, hiring and training replacements processes. On the other hand, an outflow of human resource means a loss of valuable organization's knowledge, skill and know-how through employment turnovers (Somaya & Williamson 2008). However, outflow could sometimes have a positive effect if the employees leaving the firm are less productive. Overall, the effects of both the inflow and outflow on firm performance are ambiguous. There is a need for software firms to develop an in-depth understanding of what factors in these inflow and outflow will influence, and how these factors influence firm performance. Knowing more about these factors will help software firms better formulate effective human resource strategy and thus take a better position in this "talent war" within IT industry.

Today, the emergence of professional social network has made human resource flows publicly visible on Internet. As of November of 2012, a well-known professional social network, LinkedIn.com, announced that it had 187 million users in over 200 countries and territories (LinkedIn.com 2012). Users on LinkedIn.com usually post a CV-like public profiles, which include professional data such as education background, employment history and other job related information. LinkedIn as a two-sided platform has greatly reduced the cost of job searching and recruiting thus greatly facilitated human resource flow. With this in mind, software firms are able to have a more holistic view of their human resource management by leveraging these publicly available social network data on LinkedIn.com.

By utilizing these public data on LinkedIn.com, we analyze how human resource flows affect firm performance at the firm level. We aim to fill this research gap by leveraging a unique dataset that we collected. As human resource inflow and outflow represent distinct processes of human resource management, they could have different impacts on firm performance. This has not been done by previous research.

With the above motivations in mind, the research questions of this study are: (1) How do human resource flows generally affect the firm performance of software firms? (2) How do the specific human capital variables (e.g. education, experience) embedded in the human resource flow affect the firm performance of software firms? To answer these two questions, we explicitly divide human resource flows into two types: human resource inflow and outflow, and further examine how the human capital variables associated with human resource inflow and outflow affect firm performance differently. We believe that answers to these two questions could help software firms better manage their human resources effectively.

We collected data from LinkedIn.com, the dominant professional social network worldwide. We collect the CV-like public profiles of IT professionals working in public software firms in U.S. To alleviate potential sampling bias, we limit the target firms of this study to software firm with less than 2,000 employees. We also construct a firm-level panel dataset, which consists of human resource flow of 170 firms from year 2000 to 2009. We employ fixed-effect linear panel regression to investigate the impacts of human resource inflow and outflow on firm performance.

Our analysis shows that human resource outflow has a significant impact on firm performance in general. In contrast, the effect of human resource inflow on firm performance is not significant. In other words, the number of incoming IT professionals does not matter, while the number of outgoing IT professionals is negatively associated with firm performance. Interestingly, when looking at the specific human capital variables, both the level of education and IT experience embedded in human resource inflow have significant impacts on firm performance. It means that although the number of incoming people does not matter, their education and experience in previous IT jobs do matter and are both positively associated with firm performance. The effects of the level of education and IT experience embedded in human resource outflow are not significant. Details of the analysis and results are discussed in Section 4.

This study contributes to the research on IT turnover and IT human resource management by highlighting the importance of both the flows of human resource and the human capital variables that are embedded in these flows. We found that human resource inflow and outflow and the human capital embedded have distinct impacts on firm performance. Moreover, this study shows that simply focusing on the total number of turnovers in human resource flows may produce inaccurate predictions of firm performance. Instead, our findings suggest that HR manager should not only focus on the human resource inflow and outflow (i.e. Quantitative nature of human resource flow), but also the specific human capital variables embedded in these flows.

This paper is organized into six sections. Section 2 reviews the related literature and develops the hypotheses. Section 3 describes the data and the research model. Section 4 presents and discusses the findings. Finally, Section 5 concludes the paper.

2 LITERATURE AND HYPOTHESES

This study contributes to the literature on IT turnover and human resource management. We adopt the perspective from human capital theory to explore the nature of human resource flow. Relevant literature in the disciplines of information systems, human resource management and labour economics are also discussed.

2.1 Human Resource Flow and Human Capital Embedded

Human capital has long been considered as a critical resource in most firms (Pfeffer 1994). It refers to worker attributes such as education and experience (Mincer 1970). These attributes reflect the level of an individual's investments in formal education in school or on-the-job work experience (Ang, Slaughter et al. 2002). For example, market signaling theory (Spence 1973) indicates that individuals' productivity is generally not observable but indicated by education and experience.

This study investigates the influences of the human resource flows, as well as the embedded human capital variables, which mainly capture the knowledge, expertise and experience in IT jobs associated with the human resource flows. Since human resource flows are essentially formed by incoming and outgoing job mobility (see Figure 1 for illustration) of IT professionals. We can use human capital variables such as education and experience embedded in the job mobility to measure the impacts of the human resource flow on firm performance.

The inflow of human resource will bring the focal firm external knowledge and skills. Intuitively, the newcomers will possess the knowledge and skills he/she had learned in his/her education institutions or previous employer. This is particularly true when the incoming persons are from the competitors of the focal firm. In contrast, the outflow of human resource generally represents a loss of organizational knowledge and skills of the focal firm. It could also harm the firm if the outgoing persons possess the key knowledge and later join the competitors of the firm.

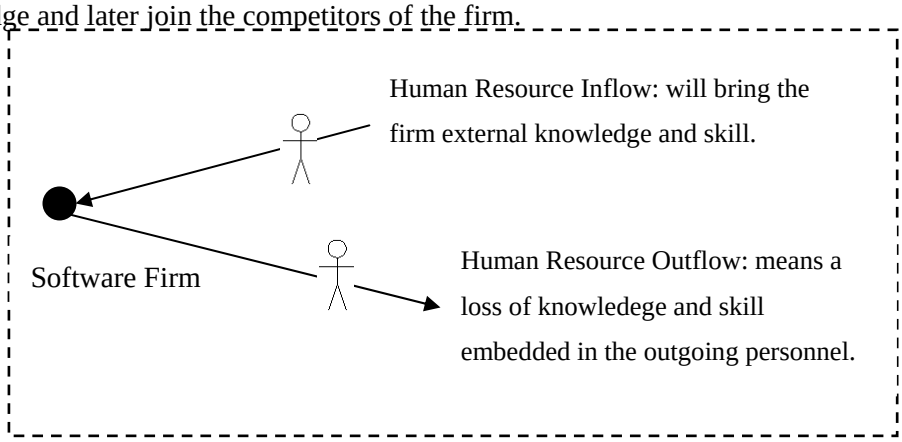

Figure 1. The Inflow and Outflow of Human Resource

2.2 Human Resource Flow and Firm Performance

Firms do perform better when they possess high quality human capital. Hitt et al. (2001) showed that the leveraging of human capital exhibited a positive effect on professional service firm performance. Banker et al. (2008) found that average education level was associated with a positive firm performance in IT industries. Especially, IT firms that invest in highly skilled employees were in a better position to take advantage of R&D investments. Moretti (2004) found that more educated workers would make other workers more productive, which indicated potential synergy gain resulting from higher quality of human capital. Besides, Srivastava and Gnyawali (2011) found a positive synergy between portfolio resources[1] for technologically weaker firms, and eventually for stronger firms when they overcome some of their competency traps.

Besides, there is both anecdotal and empirical evidence that organizations have come to rely more and more on the acquisition of human assets from other organizations, as opposed to internal development

[1] A firm generates portfolio effects through the acquisition of portfolio resources, co-development with partners, and creation of inter-partner synergy among the portfolio elements (Srivastava and Gnyawali, 2011).

and promotion, to satisfy their human resource needs (Somaya, Williamson et al. 2008). The mobility of knowledge workers between firms has acquired great significance for firm performance (Kacmar, Andrews et al. 2006).

Human resource inflow brings inflow of human capital. In practice, few organizations internally generate all the knowledge required for continuous technological development (Song, Almeida et al. 2003). This is because its acquisition can be difficult (Kogut & Zander 1992). A significant portion of the knowledge that organizations seek to acquire is embedded in individuals, given the tacit and complex nature of most valuable knowledge (Song, Almeida et al. 2003). Thus, firms often bring in personnel from rivals to gain tacit knowledge and skills (Madsen, Mosakowski et al. 2003).

This "learning-by-hiring" strategy can greatly facilitate inter-firm knowledge transfer, especially for patent holder or inventors (Song, Almeida et al. 2003). In this way, the resulting knowledge spill-over from the incoming personnel will also improve the innovation activities of the software firms. In other words, human resource inflow can be used as a mechanism to absorb externally developed knowledge and skills. As a result, these skills and knowledge in the human resource inflow could generally have a positive impact on firm performance. Therefore, we hypothesize:

H1a. *The human resource inflow is positively associated with firm performance.*

In contrast, human resource outflow means that firms are losing important human capital associated with those employees who are leaving the organization. Moreover, the knowledge and skill loss are particularly valuable firm-specific knowledge. Firm-specific knowledge is considered more important and researchers have found that IT professionals possessing more firm-specific knowledge are even paid much higher salary (Mithas & Krishnan 2008). Thus, the loss of such critical knowledge would decrease the firm's overall productivity and firm performance as well. As a result, these skills and knowledge embedded in the human resource outflow in general should have a negative impact on firm performance. Compared with human resource inflow, human resource outflow is expected to have a more direct impact on firm's performance. Thus, we hypothesize:

H1b. *The human resource outflow is negatively associated with firm performance.*

2.3 Human Capital Variables and Firm Performance

Note that H1a and H1b discussed in the previous sub-section primarily focus on the general human resource inflow and outflow, i.e., whether the inflow and outflow measured as the total number of incoming and outgoing IT professionals benefit the software firms. Those two hypotheses focus on the quantity of the human resource flows. In order to take a deeper look at the nature of the human resource flows, we further consider the human capital variables embedded in the human resource flow. In this way, the human capital variables reflect the quality of the human resource flows. This study aims to examine how this quantity-quality trade-off of the human resource flows behaves in the software industry.

From the human capital perspective, the knowledge and skills embedded in the human resource flow can be generally interpreted as the education level and working experience (The personal profile of an IT employee on LinkedIn.com includes the complete education and his/her career portfolio, which allows us to capture most of his/her human capital variables). Moreover, previous research has mainly used these two variables to measure human capital.

If the incoming mobility in the human resource flow (i.e., inflow) possesses more knowledge and skill, then the focal software firm is more likely to be able to broaden their knowledge stock and have better performance. Generally, higher level of education of IT employees indicates higher quality of incoming human capital, which could have a positive impact on firm productivity and performance. Similarly, IT professionals with more IT experience are expected to bring new tacit knowledge and skills that can benefit the firm. And IT firms do value IT experience. For example, Mithas and Krishnan (2008) have found that IT experience of IT professionals was valued more than non-IT experience. Moreover, they also found that firms value IT experience at other firms much more than

they value firm-specific IT experience. In other words, firms do value IT experience in the inflow of human resource.

As a result, we expect that education level and IT experience embedded in the human resource inflow are positively related to firm performance.

H2a. *The average education level of the human resource inflow will be positively associated with firm performance.*

H2b. *The average IT experience of the human resource inflow will be positively associated with firm performance.*

Similar to the previous discussion, losing employees with higher levels of education and IT experience indicates a great loss of critical knowledge and skills through job mobility, which could eventually leads to negative impacts on firm performance.

H3a. *The average education level of the human resource outflow will be negatively associated with firm performance.*

H3b. *The average IT experience of the human resource outflow will be negatively associated with firm performance.*

3 DATA AND METHOD

3.1 Data and Variables

Our data set is collected from LinkedIn.com, the dominant professional social network around the world. The CV-like public profiles on LinkedIn.com provide us unique opportunities using real job-related data to study human resource related research questions. LinkedIn.com is particularly popular among IT professionals because of the "turnover culture" in the IT workforce. The professional profiles not only contain users' complete timelines of education details but also their employment histories.

We use computer program to crawl these public profiles of IT professionals and construct our unique dataset. We recognized that there could still be inevitable sampling bias, because not all of the employees in these firms have LinkedIn profiles, as well as that we are not able to collect all of the existing profiles for large firms. To alleviate the influence of sampling bias, we set our target as those public listed software firms with less than 2,000 employees. Therefore, we are able to collect almost all of their existing LinkedIn profiles for these companies. We managed to construct a turnover database based on the employment history of these employees and calculate the firm-level human capital variables. We also use computer programs to categorize and compute their highest degree, job type (IT vs. non-IT) and so on.

After further data cleaning, we manage to construct a panel dataset for our empirical test. In our data organization, each turnover has date (e.g. Feb 2009) and direction, i.e., into or out of a focal company. With this in mind, we are able to calculate the total number of inflow (or outflow) personnel of a company in a given year. Moreover, we can also aggregate the human capital variables of these individuals who have turnovers and calculate the corresponding firm-level human capital variables.

We use Return on Assets (ROA) of the public software firms to measure firm performance since it is a widely accepted measure of firm performance both in the literature and in practice. Yearly ROA of each software firm is calculated using annual financial data obtained from COMPUSTAT. Combined with the LinkedIn data, we have an unbalanced panel dataset of human resource flow (both inflow and outflow) of 170 public software firms from year 2000 to 2009.

Table 1 presents the detailed definition of the variables, while the descriptive statistics of the variables is displayed in Table 2.

Variable	Definition
ROA	Firm Performance. Return on Asset. Dependent variable.
BachelorIn	The proportion of bachelor degree holders in human resource inflow
MasterIn	The proportion of Master degree holders in human resource inflow
PhDIn	The proportion of PhD degree holders in human resource inflow
ITexpIn	Average total working experience in IT jobs (in years) in human resource inflow
BachelorOut	The proportion of bachelor degree holders in human resource outflow
MasterOut	The proportion of Master degree holders in human resource outflow
PhDOut	Proportion of PhD degree holders in human resource outflow
ITexpOut	Average total working experience in IT jobs (in years) in human resource outflow
Inflow	The proportion of new employees coming to the firm, defined as the total incoming number of employees on LinkedIn.com divided by the total number of employee.
Outflow	The proportion of employees leaving the firm, defined as the total outgoing number of employees on LinkedIn.com divided by the total number of employee.
Emp	Firm's total number of employees
FirmSize	Firm size in Assets (the natural logarithm of total assets)
R&DExp	R&D expense of the firm normalized by firm size
ExpIn	Average total working experience (in years) in human resource inflow
ExpOut	Average total working experience (in years) in human resource outflow
Years	Year dummies from 2000-2009

Table 1. Definitions of Variables

Variable	Observations	Mean	Std. Dev.	Min	Max
ROA	862	-0.209	1.095	-18.766	0.954
BachelorIn	862	0.632	0.294	0	1
MasterIn	862	0.295	0.273	0	1
PhDIn	862	0.036	0.116	0	1
ITexpIn	862	2.663	2.729	0	33.917
Inflow	862	0.027	0.035	0.001	0.6
BachelorOut	862	0.621	0.330	0	1
MasterOut	862	0.299	0.304	0	1
PhDOut	862	0.044	0.152	0	1
ITexpOut	862	2.847	2.881	0	27.667
Outflow	862	0.023	0.047	0.005	0.778
Emp (in thousands)	862	0.585	0.499	0.005	2
FirmSize	862	4.580	1.421	-1.650	8.247
R&DExp	862	4.151	3.189	-12.501	18.639
ExpIn	862	9.705	4.104	-0.5	32
ExpOut	862	10.261	4.589	-8	58.5
Year 2000	862	0.084	0.277	0	1
Year 2001	862	0.087	0.282	0	1
Year 2002	862	0.085	0.279	0	1
Year 2003	862	0.099	0.298	0	1
Year 2004	862	0.113	0.316	0	1
Year 2005	862	0.111	0.315	0	1
Year 2006	862	0.114	0.318	0	1
Year 2007	862	0.121	0.326	0	1
Year 2008	862	0.099	0.298	0	1

Table 2. Descriptive Statistics

3.2 Model Specification

In this study, we implemented a panel linear analysis to examine the effects of the human resource inflow and outflow on firm performance of software firms. The unit of analysis is the human resource flow for firm *i* in year *t*.

The dependent variable is firm performance, which is measured as ROA. The human resource flow and human capital variables are independent variables. We also include a few control variables. Specially, we control for total years of working experience, firm characteristics such as firm size and R&D expense, as well as year dummies.

$$\begin{aligned} ROA_{it} = {} & \alpha_i + \beta_0 + \beta_1 BachelorIn_{it} + \beta_2 MasterIn_{it} + \beta_3 PhDIn_{it} + \beta_4 BachelorOut_{it} \\ & + \beta_5 MasterOut_{it} + \beta_6 PhDOut_{it} + \beta_7 ExpIn_{it} + \beta_8 ExpOut_{it} \\ & + \beta_9 IT\exp In_{it} + \beta_{10} IT\exp Out_{it} + \beta_{11} Inflow_{it} + \beta_{12} Outflow_{it} + \beta_{13} Emp_{it} \\ & + \beta_{14} FirmSize_{it} + \beta_{15} R\&DExp_{it} + Years_t + \varepsilon . \end{aligned}$$

where *i* denotes firm *i* and t denote the year *t*; $Years_t$ denotes a series of year dummies; ε is the error term. Please refer to Table 1 for a detailed description of variable definitions. We have checked the correlation of independent variables and multicollinearity is not a significant issue in the specification.

We mainly employed fixed-effect linear panel analysis to estimate the above model. Fixed-effect panel analysis allows us to control for firm-specific unobserved characteristics (e.g. firm's HR policy including salary or promotion scheme), which are the main potential sources of endogeneity.

4 FINDINGS AND DISCUSSIONS

The estimation results are display in Table 3. We examined four models. Model 1-3 are estimated using fixed-effect panel regressions, while Model 4 is estimated using random-effect regression. Model 1 only includes the independent human resource related variables from LinkedIn.com, which are our main interest. Model 2 is built on Model 1 and further controls for some firm characteristics including firm size, total number of employees, and R&D expense. Model 3 further adds in year dummies to control for the year effects. Lastly, Model 4 reruns the model using random effect for robustness check Model 3 is the final model we prefer. The R-square of our full model estimation (Model 3) is 0.22, which shows acceptable predictive power of the model.

Generally, the result shows that the human resource inflow does not have a significant impact on firm performance. **H1a is not support.** However, we found significantly negative impact of human resource outflow on firm performance. **H1b is supported.** Both results are quite robust across different model estimations.

These two results together show that: while human resource outflow does have negative impacts as we predict, human resource inflow may not necessarily benefit the firm's performance. A possible reason for the insignificant result of inflow could be that human resource inflow often requires additional expense on recruiting, training and other human resource activities. These short-term extra HR-related expenses would lower the firm's financial performance in the same year. Moreover, the incoming human resource may not make significant short-term contribution to the company performance in the same year. Besides, whether the firm can effectively absorb the incoming knowledge and skills possessed by the newcomers could also influence firm performance.

	(1) ROA	(2) ROA	(3) ROA (f.e.)	(4) ROA (r.e.)
BachelorIn	**1.061*****	**1.036*****	**1.044*****	**1.113*****
	(0.000)	(0.000)	(0.000)	(0.000)
MasterIn	**0.993*****	**0.958*****	**0.971*****	**1.010*****
	(0.000)	(0.000)	(0.000)	(0.000)
PhdIn	**1.177*****	**1.220*****	**1.222*****	**1.287*****
	(0.000)	(0.000)	(0.000)	(0.000)
BachelorOut	-0.007	-0.127	-0.174	-0.182
	(0.974)	(0.506)	(0.361)	(0.333)
MasterOut	0.198	0.043	-0.013	-0.029
	(0.352)	(0.827)	(0.949)	(0.880)
PhdOut	0.193	-0.066	-0.098	-0.093
	(0.488)	(0.800)	(0.703)	(0.715)
ExpIn	-0.003	-0.006	-0.011	-0.007
	(0.721)	(0.343)	(0.105)	(0.271)
ExpOut	0.003	0.003	-0.002	-0.000
	(0.587)	(0.570)	(0.760)	(0.983)
ItexpIn	0.012	**0.020****	**0.021****	**0.023****
	(0.256)	(0.043)	(0.029)	(0.015)
ItexpOut	0.003	-0.004	-0.003	-0.002
	(0.737)	(0.697)	(0.762)	(0.818)
Inflow	-0.709	-0.905	-1.222	-1.290
	(0.484)	(0.336)	(0.198)	(0.166)
Outflow	**-2.057*****	**-1.802****	**-1.827****	**-2.578*****
	(0.007)	(0.011)	(0.011)	(0.000)
Emp		**-0.338****	**-0.353****	**-0.443*****
		(0.029)	(0.027)	(0.002)
Fsize		**0.474*****	**0.442*****	**0.501*****
		(0.000)	(0.000)	(0.000)
R&Dexp		**-0.099*****	**-0.098*****	**-0.093*****
		(0.000)	(0.000)	(0.000)
Year 2000			**-0.286****	**-0.225***
			(0.016)	(0.054)
Year 2001			**-0.296****	**-0.252****
			(0.010)	(0.026)
Year 2002			**-0.263****	**-0.204***
			(0.026)	(0.076)
Year 2003			-0.096	-0.023
			(0.389)	(0.833)
Year 2004			-0.019	0.016
			(0.857)	(0.878)
Year 2005			-0.110	-0.075
			(0.290)	(0.462)
Year 2006			-0.070	-0.040
			(0.485)	(0.685)
Year 2007			-0.030	0.007
			(0.757)	(0.943)
Year 2008			-0.058	-0.019
			(0.551)	(0.849)
Intercept	-1.263***	-2.633***	-2.230***	-2.668***
	(0.000)	(0.000)	(0.000)	(0.000)
N	862	862	862	862
Overall R^2	0.066	0.200	0.220	0.266

Table 3. Estimation Results

From the perspective of human capital, our result suggests that average education level in the human resource inflow could have significant impacts on firm performance, but not for the outflow. It means

that although the number of incoming personnel does not matter, their education and experience in previous IT jobs do matter and are both positively associated with firm performance. In contrast, although the number of outgoing personnel matters, their human capital does not.

Therefore, **H2a is supported and H3a is not supported.** The results of H2a are also robust across the four different estimation models. Moreover, the results are consistent across different types of education degrees. From the regression coefficients, we can see that the marginal contribution of PhD holders to firm performance is the largest, while the marginal contribution of master holders is the smallest among the three degrees.

Furthermore, we also found significant impact of IT experience on firm performance for human resource inflow, but not for human resource outflow. **H2b is supported while H3b is not supported**. It means that, the incoming IT experience is important to firm performance improvement, while the outgoing IT experience does not significantly influence firm performance. A possible reason is that the loss of human resource with outflow can be often mitigated by the human resource inflow. Please refer to Table 4 for a summary of the hypotheses testing results.

The above results also show the importance of investigating the human resource flows from human capital perspective. On the one hand, the human resource outflow has significant impacts on firm performance while human resource inflow does not. On the other hand, human capital variables embedded in human resource inflow do play significant roles in improving firm performance. This implies that it is not accurate by merely focusing on the number of IT professionals in human resource inflow and outflow. The nature of such human resource flows has more significant impacts on firm performance.

Hypothesis	Supported	Not supported
H1a		×
H1b	√	
H2a	√	
H2b	√	
H3a		×
H3b		×

Table 4. Summary of the Results of Hypotheses Testing

We also found significant impacts from several control variables. Firm size and R&D expense are found to be significantly related to firm performance. Furthermore, among the year dummy variables, the variable for year 2000 to 2002 are significant. This time period is indeed the well-known “Dotcom Crash” period

5 CONCLUSION

This study has used a unique dataset from LinkedIn.com to study the impacts of the human resource flows on software firm performance. The results provide a few insights on IT human resource management. First, we find that the human resource outflow has a significant impact on firm performance. However, the effect of human resource inflow on firm performance is not significant. Second, when we further look at those specific human capital variables, we find that both the level of education and IT experience for the human resource inflow have significant and positive impacts on firm performance.

This study contributes to the research on IT turnover and IT human resource management in several ways. First, this study shows that both the human resource inflow and outflow, and the human capital

embedded in these flows have distinct impacts on firm performance, which fill a gap in the literature. Second, our study enhances the understanding of these human resource flows from the perspective of human capital. Our results show that simply focusing on the total number of turnovers in the human resource flows may produce inaccurate prediction of firm performance. Lastly, this study also demonstrates a way to explore the value of millions of available career-related data on professional social network.

Our findings also provide important implications for HR practices in IT firms. First, it is critical for IT companies to utilize these big data on professional social networks to understand the various impacts of different human resource flows on firm performance. Second, HR managers can take note of the different impacts of both the human resource inflow and outflow and employ different HR strategies correspondingly. Last but not least, HR managers should not only focus on the human resource inflow and outflow (i.e., quantity of the human resource flows), but should also pay attention to the specific human capital embedded in the flows (i.e., quality of the human resource flows) in order to develop more effective HR strategy.

This study has a few limitations. First, this study does not distinguish voluntary turnover and lay-off due to limitation of data. However, in IT industry with fierce “talent war”, most of the job mobility can be treated as voluntary turnover. Second, we ignore the location of the firms, which has been addressed by many research on the human resource flows (e.g. Madsen et al. (2003), Song et al. (2003)). This problem can be minimized because we mainly focus on software companies in the United States. Finally, we mainly focus on the human resource inflow/outflow and omit the internal human resource flow within software firms. Internal human resource flows have been widely adopted by many firms nowadays in order to retain IT talent. These flows may also significantly influence the job mobility and the performance of software firms.

This study is an exploratory research on the human resource flows within software industry, which are not yet addressed in the existing IS literature. We hope this study provides important insights and discussions on topics of human resource flows in IS communities. Finally, we hope this study also helps researchers and IT practitioners better understand the nature of IT human resource flows and their impacts on firm performance.

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