THE ECONOMIC IMPACT OF KNOWLEDGE INTENSIVE IT OUTSOURCING

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Abstract

How does IT outsourcing affect firm performance? What is the role of internal IT experience in IT outsourcing? Prior research has provided different answers for these two questions. This study attempts to address the inconsistencies in the literature. We distinguish between knowledge intensive IT outsourcing (KITO) and infrastructural IT outsourcing (IITO) and suggest that these two types of IT outsourcing have different impacts on firm performance. Our analysis based on a panel data from the US economy shows that KITO has a negative effect on economic performance, while IITO may have a positive effect. Moreover, internal IT experience can mitigate the negative effect of KITO on economic performance. Therefore, strong internal IT experience can help firms to gain from KITO by leveraging the IT capabilities of external vendors.

Keywords: knowledge intensive IT outsourcing (KITO), internal IT experience, economic value, panel model

1. INTRODUCTION

Since the landmark decision by Kodak to hand over IT functions to IBM and other outside vendors, the practice of outsourcing of IT facilities and services has become increasingly popular (Lacity et al. 2010; Dibbern et al. 2004). Nowadays, IT outsourcing services have become a huge global market. According to a Gartner report, worldwide spending for IT outsourcing services has reached $288 billion in 2013, with fast-growing segments such as cloud computing services. IT outsourcing is defined as "a significant contribution by external vendors in the physical and/or human resources associated with the entire or specific components of the IT infrastructure in the user organization" (Loh & Venkatraman 1992a). In particular, IT outsourcing may involve IT functions such as system integration services, communication and network services, facilities management services, application development services, etc. (Cullen et al. 2005).

Researchers have investigated a variety of IT outsourcing issues, such as the antecedents, potential risks, relationship management, service level agreements, and outcomes of IT outsourcing. Dibbern et al. (2004) provided a comprehensive review of IT outsourcing literature from 1992 to 2000 and discussed all the major issues in IT outsourcing. They found that the issue of IT outsourcing outcomes has received considerable research attention. Lacity et al (2010) examined 164 empirical IT outsourcing articles published between 1992 and 2010 in 50 journals and found that influential elements on IT outsourcing outcomes include relationship characteristics, IT outsourcing decision, client firm capabilities, transaction attributes, contractual governance, supplier firm capabilities, client firm characteristics, and decision characteristics. In general, it is found that if companies make appropriate choices on above elements, IT outsourcing can lead to preferable outcomes.

However, many research gaps still remain in the IT outsourcing literature (Lacity et al. 2010). For example, how does IT outsourcing affect firm performance? What is the role of a firm's internal IT experience in IT outsourcing? For the first question, the literature has provided different opinions and findings. While some scholars propose that IT outsourcing improves firm performance because IT outsourcing helps firms to use advanced external IT capabilities (Willcocks et al. 2007; Nevo et al. 2007), other suggest that IT outsourcing may hurt a firm's IT capabilities and eventually result in low performance (Aubert et al. 2005; Qu et al. 2010). In addition, the role of a firm's internal IT experience in IT outsourcing is also not clear in the literature. While some scholars suggest that IT outsourcing and internal IT knowledge contribute to firm performance in a complementary way (Willcocks et al. 2007; Han et al. 2013), others claim that they may substitute to each other (Nevo et al. 2007).

In this study, we attempt to address above inconsistencies in the literature. We distinguish between *knowledge intensive IT outsourcing (KITO)* and *infrastructural IT outsourcing (IITO)* and suggest that these two types of IT outsourcing has different impacts on firm performance. We define KITO as the practice of outsourcing IT activities that involves intensive human knowledge, such as system planning, system design, and system implementation (Miozzo & Grimshaw 2005). When IT outsourcing only involves IT infrastructure or infrastructure-related services (without intensive human knowledge directly involved), we call it IITO. The remainder of the paper is organized as follows. In Section 2, we review previous research on how IT outsourcing affects firm performance. Section 3 proposes our hypotheses about the effects of KITO and IITO on firm performance. In Section 4, we use economic data to test the hypotheses. Finally, Section 5 provides a brief concluding remark.

2. RESEARCH BACKGROUND

The impacts of IT outsourcing on business/economy has been widely studied in prior research (Lacity et al. 2010). Broadly, three types of IT outsourcing outcomes have been examined. One stream of research investigates whether the perceived benefits of IT outsourcing (e.g., cost savings, technology improvement, etc.) have been achieved. Several studies have uncovered the perceived economic and technological benefits that arise from IT outsourcing. For example, Grover et al. (1996) posited that IT outsourcing confers substantial benefits on firms only when strategic, economic, and technological

considerations are fully taken into account in the outsourcing-related decisions. Based on survey data collected from 188 firms, they found that outsourcing highly commoditized and non-asset specific IT functions (e.g., systems operations and telecommunications management) is more likely to be successful than is outsourcing IT functions that are difficult to commoditize. Similarly, based on a study of 61 outsourcing and insourcing decisions, Lacity and Willcocks (1998) found that all types of IT sourcing mechanisms (i.e., total outsourcing, selective outsourcing, and total insourcing) are effective for cost savings, while selective IT outsourcing arrangements are found to be the most effective. With regard to the partnership issue, Lee and Kim (1999) assessed the impact of partnership quality on outsourcing outcomes based on several attributes (e.g., trust, business understanding, benefit and risk sharing, etc.) that shape the quality of partnerships. Analyzing survey data on 74 outsourcing arrangements, they found that all components of partnership quality, with the exception of business understanding, are significantly associated with outsourcing outcomes. Lee et al. (2004) evaluated the three explanations pertaining to outsourcing success (universalistic, contingency and configurational) and found that the configurational explanation is superior to the other two in its ability to account for variations in outsourcing success. Based on data collected from 311 firms, the study revealed that arm's-length and embedded configurations in IT outsourcing yield the benefits of cost-efficiency and technology catalysis, respectively. Gorla and Somers (2014) surveyed 337 firms form different industries and found that IT outsourcing has a negative impact on perceived usefulness of IS and IS user satisfaction. In addition, a higher level of IT outsourcing will lead to lower perceived IS service quality, which in turn leads to lower IS user satisfaction. Their study suggests that IT outsourcing has a negative effect of IS success, both directly and indirectly.

The second stream of research focuses on the reaction of stock market to IT outsourcing announcement. Their findings suggest that the reaction of stock market depends on the specific characteristics of the announced IT outsourcing. For instance, based on 76 IT outsourcing announcements during 1990-1997, Hayes et al. (2000) found that the number of announcements with positive abnormal returns are almost equal to the number of announcements with negative abnormal returns. By investigating these announcements further, they found that stock market react more positively to IT outsourcing of small firms or to IT outsourcing in service industry. Florin et al. (2005) showed that IT outsourcing receives positive reaction from stock market in the short term, based on 66 IT outsourcing announcements between 1997 and 2003. However, they also show that the organizational restructuring activities negatively moderate the relationship between short-term abnormal returns and long-term abnormal returns. That is, if firms conduct intensive organizational restructuring after IT outsourcing, the stock market will react negatively in the long term. By examining 96 e-business-related announcements during 1999–2002, Agrawal et al. (2006) found that stock market reacts positively to e-business outsourcing with the objective of commercial exploitation, with the objective of swift execution of e-business project, or with high task complexity. However, stock market reacts negatively to e-business outsourcing without such objectives or with low task complexity. Based on 192 IT outsourcing announcements during 1995–2003, Oh et al. (2006) showed that for each day within the 11-day interval of announcement, the reactions of stock market are mixed. For instance, on the actual date of the announcement, 97 announcements lead to negative reaction (i.e., negative cumulative abnormal return) and 95 announcements lead to positive reaction. They further showed that IT outsourcing with small contract size, low monitoring difficulty, low asset specificity, high cultural similarity, and large IT suppliers is more likely to receive positive reaction from stock market.

The third stream of research investigates how IT outsourcing affect firm/economic performance, which is most relevant to the current study. In general, this line of research the effect of IT outsourcing on firm/economic performance is mixed. For instance, Loh and Venkatraman (1995) examined the effect of IT outsourcing on a firm's financial performance as measured by market value and return on equity. Their results suggest that firms with unfavorable operational cost structures could potentially benefit more from IT outsourcing than could firms with favorable cost structures. This is because firms that are structurally inefficient in IT cost management can achieve greater cost reductions through IT outsourcing. Based on data collected from 135 Fortune Global 500 firms, Bhalla et al. (2008) showed that the extent of IT-related offshoring is not related to firm performance. This result is confirmed by different analytic methods such as ANOVA, regression analysis, and

non-parametric resting. Wang et al. (2008) collected data from 120 public firms and investigated their performance in the three years after IT outsourcing. They showed that IT outsourcing does not have a positive effect on firm performance measures such as ROA, ROE, and ROI. In some case, IT outsourcing even has negative influence on firm performance. On the other hand, their findings suggested that IT outsourcing usually contribute to process-level performance such as selling, general, and administrative (SGA) expenses and depreciation expenses. Gwebu et al. (2010) investigated the impact of IT outsourcing on both the process-level and firm-level performance of 100 firms in manufacturing or retail industries. Overall they findings regarding the performance impact of IT outsourcing on firm's value chain activities are mixed. The results provide no evidence that outsourcing firms were able to improve overall firm performance (ROA and ROS). On the process level, the results indicate that IT outsourcing initiatives help firms improve their performance on inbound logistics and supporting activities, but no improvements for efficiency of outbound logistics and operations. Qu et al. (2010) compared the performance impacts of IT investments on outsourcing and insourcing (i.e., IT budget on internal IT spending) based data from 92 *Information Week 500* firms. They showed that while IT insourcing investments can contribute to internal IT-enabled business processes and thus improve firm performance such as stock market value and ROA, IT outsourcing investments do not have a positive effect on IT-enabled business processes and firm performance. Finally, Han et al. (2011) used industry-level data (1998-2006) from the US government and examined the economic impacts of IT outsourcing. Although Han et al. suggested that IT outsourcing contributes to the productivity of the US economy in general, the analysis results are mixed. While they find a positive relationship between IT outsourcing and productivity using FGLS and OLS-PCSE models, the relationship is not significant when using fixed effects model and random effects model.

The main observation from the first stream of research is that firms in general are satisfied with the outcomes of IT outsourcing in terms of cost saving and technological aspects, especially when firms follow best practices, such as outsourcing only commoditized IT functions and developing partnerships with IT vendors (Grover et al. 1996; Lee et al. 2004; Saunders et al. 1997; Seddon et al. 2007). On the contrary, the third stream of research shows that the impacts of IT outsourcing on firm/economic performance are mixed. Some studies show that IT outsourcing has no significant impact on firm/economic performance (e.g., Qu et al. 2010; Gwebu et al. 2010; Bhalla et al. 2008), some studies show both significantly positive and non-significant impacts of IT outsourcing on performance (e.g., Han et al. 2011), while other studies show both significantly negative and non-significant association between IT outsourcing and performance (e.g., Wang et al. 2008).

Why IT outsourcing can save costs and improve technological aspects, but cannot contribute to firm/economic performance? One reason may be that the first stream of research examines the direct impact of IT outsourcing such as cost saving or client satisfaction, while the third stream of research investigates the overall impact (including both direct and indirect impacts) of IT outsourcing. Although IT outsourcing has many direct benefits, it also involves an indirect problem—its negative effect on firms' internal IT capabilities, which in turn may hurt firm performance (Qu et al. 2010; Earl 1996). In sum, although IT scholars have provided some insights about the effect of IT outsourcing on firm performance, this effect is not well studied and related empirical evidence is still lacking. Therefore, in order to understand the effect of IT outsourcing, we distinguish between two types of IT outsourcing—knowledge intensive IT outsourcing (KITO) and infrastructural IT outsourcing (IITO). Based on the knowledge based view of the firm (Grant 1996; Nahapiet & Ghoshal 1998), we develop a theoretical framework to explain why these two types of IT outsourcing affect firm performance differently. Furthermore, we use industry-level census data from the US economy to verify the framework empirically.

3. THEORIES AND HYPOTHESES

3.1 The knowledge-based view and KITO

Regarding the effect of IT outsourcing on firm performance, mainly there are two perspectives. On the one hand, some scholars suggest that the use of IT outsourcing may enhance firm performance

because IT outsourcing may deliver strategic, economic, and technological benefits to firms (Grover et al. 1996; Han et al. 2011). For instance, Willcocks et al. (2007) suggested that IT outsourcing can be used to reduce costs, improve service levels, access new skills, and improve capital management. On the other hand, there are also scholars suggesting that relying heavily on IT outsourcing may hurt a firm's IT capabilities because the outsourcing of IT activities will prevent firms from experience-based learning, which will eventually lead to the loss of internal IT capabilities and low firm performance (Aubert et al. 2005; Earl 1996). Qu et al. (2010), for instance, reported that IT outsourcing is less effective than internal IT units in developing IT-enabled business processes and in contributing to firm performance.

We distinguish KITO and IITO and suggest that the impacts of these two types of IT outsourcing on firms are different. For IITO, IT outsourcing vendors have the cost and technological advantages due to the economy of scale and a complementary set of core competencies in IT operations (Levina & Ross 2003; Loh & Venkatraman 1992a). Therefore, client firms may benefit from IITO because outsourcing vendors may provide more advanced IT infrastructure with lower costs. Therefore, we propose the following hypothesis.

Hypothesis 1: Infrastructural IT outsourcing (IITO) is positively associated with firm performance.

However, for KITO, it can be a different story. Qu et al. (2010) provided an explanation for why KITO may hurt firm performance. More specifically, the knowledge-based view of the firm claims that the firm exists because it has advantages over the market in knowledge creation and innovation (Grant 1996; Kogut & Zander 1992). In particular, coordination mechanisms and shared knowledge within a firm can contribute to knowledge creation and innovation (Gulati & Singh 1998; Nahapiet & Ghoshal 1998). For instance, coordination mechanisms (e.g., rules and directions, routines etc.) and common knowledge (e.g., shared language and meaning) that exist within firms make the firm a better governance mechanism than the market for integrating specific knowledge (Grant 1996).

Firms need to integrate IT knowledge with business knowledge in order to effectively explore and exploit IT in business processes (Nevo & Wade 2010), The smooth coordination and shared knowledge between the IT unit and business units within firms can help to integrate IT and business knowledge. For instance, Lind and Zmud (1991) suggested that rich interaction between technical and managerial units are necessary elements with regard to the effective utilization of IT in business. Bassellier et al. (2003) showed that shared knowledge between IT and business units can improve the IT-business partnership and contribute to the utilization of IT in business.

However, the coordination and shared knowledge between IT and business units can be problematic during KITO. Under KITO, the coordination is between outside IT vendors and business clients, which is more difficult than the coordination between internal IT units and business units because coordination mechanisms within firms (e.g., routine meetings and co-location) are likely to encourage interaction and communication between internal IT and business units. Furthermore, the shared knowledge between IT vendors and client firms can also be lacking under KITO. Share knowledge is typically developed over a long period of time (Ray et al. 2005). Therefore, when firms rely on outsourcing, the shared knowledge between IT vendors and client firms is not likely to be fully developed and utilized because the two parties usually have an arm-length relationship. For instance, it is found that IT vendors are difficult to deliver IT-based business innovation because of a lack of knowledge about their clients' strategic goals (Willcocks et al. 2004). Due to the problems in coordination and shared knowledge between IT vendor and client firms during KITO, we believe that KITO will hinders the effective utilization of IT in business processes. Therefore, we propose the following hypotheses.

Hypothesis 2: Knowledge intensive IT outsourcing (KITO) is negatively associated with firm performance.

The negative effect of KITO on firm performance may be mitigated by client firms' internal IT experience. We define a firm's "internal IT experience" as the firm's own experience in conducting IT activities that involves intensive human knowledge, such as system planning, system design, and system implementation (Miozzo & Grimshaw 2005). Firms with a high level of internal IT experience

should have better IT-related knowledge. Superior internal IT knowledge can work as a facilitator for the knowledge integration between IT vendors and clients's business units. In fact, if a firm has superior internal IT knowledge, it can manage IT outsourcing vendors better and can leverage IT resources from vendors to fit its own business needs. For instance, Han et al. (2011) suggested that superior internal IT knowledge can help firms effectively manage IT outsourcing and capture value from IT outsourcing. Similarly, Willcocks et al. (2007) reported that firms with better internal IT knowledge can benefit more from IT outsourcing. Therefore, we propose that internal IT experience will mitigate the negative effect of KITO on firm performance.

Hypothesis 3: The negative effect of KITO on firm performance will weaken with the increase of internal IT experience

4. RESEARCH METHOD

4.1 Productivity framework

Following Han et al. (2011), we adopt a Cobb-Douglas production function form to test hypotheses. To investigate the economic value of KITO, we use an extended Cobb-Douglas production function form:

$$Y = AK^{\alpha}L^{\beta}M^{\gamma}X^{\omega}Z^{\theta}$$

Here, Y is gross output and A is a technological change parameter. K, L, and M are capital, labor, and intermediate inputs (excluding KITO and IITO), respectively. X is the knowledge intensive IT outsourcing inputs, i.e., KITO, and Z is infrastructural IT outsourcing. α, β, γ, ω, and θ are output elasticity for capital, labor, intermediate inputs (excluding KITO and IITO), KITO, and IITO, respectively. For estimation, we transfer the extended Cobb-Douglas form to an additive form by using the natural log:

$$y = a + \alpha k + \beta l + \gamma m + \omega x + \theta z$$

Each lowercase variable represents the log of the corresponding uppercase variable.

To incorporate the moderating effect of internal IT experience on relationship between IT outsourcing and economic value, we follow Cheng and Nault's (2012) approach by making the output elasticity of KITO a linear function of internal IT experience. More specifically, we define:

$$\omega = \mu + \eta c$$

where the output elasticity of KITO (ω) is determined by a direct effect (μ) and an interaction effect (η) with an industry's internal IT experience (c). This form is the simplest form that allows for an element of the pure effect of KITO on economic value and an element that depends on internal IT experience.

4.2 Data and variables

Our data are from the annual industry account of the U.S. Bureau of Economic Analysis (BEA) for the period of 1998-2011 (we use data from this period because BEA changed data structure after 2011). The use of industry-level data for a study of IT outsourcing may require a few explanations. Essentially, by using industry data we assume that the industry average corresponds to a 'representative' firm in the industry. The same approach has been used in previous studies (e.g., Nachum & Zaheer 2005; Sahaym et al. 2010).The entire private sector of the U.S. economy consists of 61 industries, which are based on the 2002 North American Industry Classification System (NAICS) mainly at the three-digit level. As prior studies, we used chained value to show the growth of output or other variables over time, holding prices constant. We obtained chained values by dividing nominal values by the chain-type price indices. Table 1 provides details of the variables in the model.

For *industry output*, we used data from the annual industry account of the BEA. For *labor*, we obtain its value by multiplying the number of full-time equivalent employees by the average work hours of

2,080 hours, as did in Han et al. (2011). The data for capital stock are from the BEA's Fixed Assets Tables. The *capital* value can be obtained by summing the total net stock of private fixed assets.

We measured the *KITO* of an industry as the knowledge intensive IT services it purchases from the Computer Systems Design and Related Services industry (NAICS 5415). The data are from the Use table of the BEA industry account, which reports the amount of goods or services produced by one industry that serve as an input for another industry. This industry comprises establishments primarily engaged in one or more of the following activities: (1) writing, modifying, testing, and supporting software to meet the needs of a particular customer; (2) planning and designing computer systems that integrate computer hardware, software, and communication technologies; (3) on-site management and operation of clients' computer systems and/or data processing facilities; and (4) other professional and technical computer-related advice and services. As this industry covers most knowledge intensive IT outsourcing activities that have been listed in the literature (Cullen et al. 2005; Dibbern et al. 2004), we use it as the provider industry of KITO. We measured the *IITO* of an industry as IT infrastructure or services it purchases from the Internet Service Providers, Web Search Portals, and Data Processing Services industry (NAICS 518), which provides IT infrastructure related services. As IT infrastructure related services provided by this industry usually do not involve intensive human knowledge directly, we use it to measure *IITO.* The *intermediate inputs (excluding KITO and IITO)* of an industry are measured as the goods/services that the industry purchases from other industries as intermediate inputs. Its value can be obtained by subtracting *KITO* and *IITO* from the total intermediate inputs.

Variable	Source	Measure (Chained value in 2005 U.S. dollars)
Output (Y)	Annual Industry Account	Gross output
Capital (K)	Fixed Assets Tables	Stock of private fixed assets.
Labor (L)	Annual Industry Account	Full-time equivalent employees multiplied by 2,080 hours.
KITO (X)	Use Tables	Knowledge intensive IT services purchased from NAICS 5415.
IITO (Z)	Use Tables	IT infrastructure related services purchased from NAICS 518.
intermediate inputs, excluding ITO (M)	Use Tables	Intermediate inputs excluding IT outsourcing
Internal IT experience (C)	Fixed Assets Tables; Annual Industry Account	Stock in own account software divided by full-time equivalent employees.

Table 1: Data Source and Measure

We used an industry's investment in own account software as an approximate for *internal IT experience*. Own account software refers to software developed in-house for own use and the data are from the Fixed Assets Tables. Although the value of own account software mainly represent the technical capabilities of an industry, it may also reflect IT knowledge in general because the planning, design, and implementation of own account software require not only technical knowledge, but also business-related IT knowledge.

The summary statistics of key variables is shown in Table 2, with chained value in 2005 U.S. dollar. In particular, an industry spent around 1.5 billion per year in KITO on average, with a minimum of 10 million and a maximum of 19.9 billion. In addition, the industry stock of own account software ranges from 5 million to 40 billion, with a mean of around 2.9 billion.

Variable	Mean	Std. Dev.	Min.	Max.
Output (Y)	320418	347032	18032	2187837
Capital (K)	228933	272795	13914	1533612
Labor (L) (in million work hours)	3539	4934	75	28542
Intermediate inputs (M)	144985	135754	3304	723537
IITO (Z)	795	1546	1	16328

KITO (X)	1496	2157	10	19921
Own account software (C)	2878	5775	5	40018

Table 2: Summary Statistics: 61 U.S. Industries (1998–2011) (in million 2005 U.S. dollar)

4.3 Analytical procedure

Our data set is a panel data with variables from 61 industries from 1998 to 2011. Thus we analyzed the data with a panel model. Panel models represent a preferred way to efficiently estimate the parameters for panel data (Greene 2000). We used the following model to investigate the economic value of KITO:

$$y_{it} = a + \alpha k_{it} + \beta l_{it} + \gamma m_{it} + \mu x_{it} + \eta c_{it} x_{it} + \theta z_{it} + f_i + e_{it}$$

where y_{it} is the gross output of industry i at year t. Independent variables include capital (k_{it}), labor (l_{it}), intermediate inputs (excluding IT outsourcing) (m_{it}), KITO (x_{it}), IITO (z_{it}), and the interaction of internal IT experience with KITO ($c_{it}x_{it}$). The f_i in the model represents unobserved time-invariant fixed factors associated with industry i (e.g., manufacturing versus services). e_{it} is the error term associated with each observation. Because of the presence of f_i in the composite error term ($f_i + e_{it}$), the composite error term is likely to be serially correlated across time for the same industry. One way to get rid of f_i is to use the fixed effects model. The fixed effects approach subtracts the time average of each industry for each variable, which removes f_i from the model and then estimates other estimates (Wooldridge 2002).

We adopted the fixed effects model, rather than the random effects model in our analysis for two reasons: (1) a Hausman test ($\chi^2(6) = 54.7$, $p < 0.001$) rejected the assumption of a random effects model that error term would be uncorrelated with other regressors (Greene 2000), and (2) the industries in our data represent all private industries in the US economy and may not be viewed as a random sample (Wooldridge 2002). We used the "xtreg" command in Stata to estimate the fixed effects model with thirteen year dummies.

In order to check the robustness of our results, we also analyzed our data using feasible GLS. Our panel data may involve autocorrelation across time and heteroskedasticity across industries. Using the Wooldridge test for autocorrelation in panel data, we found that first-order autocorrelation (AR1) is present ($F=69.2;\ p<0.001$). Therefore, we adjusted for first-order autocorrelation in our FGLS analysis, using both a common autocorrelation (AR1) and panel specific autocorrelation (PSAR1). Using the likelihood ratio test for the presence of panel-level heteroskedasticity, we rejected the null hypothesis that the errors are homoskedastic ($\chi^2=915,\ p<0.001$). Thus, we also adjusted for heteroskedasticity in the FGLS analysis. In addition, following Cheng and Nault (2012), we also added thirteen year dummies (1998-2011) and six sector dummies for farms and forestry (NAICS 11); oil, gas and mining (NAICS 21); manufacturing (NAICS 31–33); transportation, communications, and public utilities (NAICS 22 and 48–49); wholesale and retail trade (NAICS 42, 44–45, and 72); finance, insurance, and real estate (NAICS 52–53); and services (NAICS codes 51, 54, 56, 61, 62, 71, and 81). The "xtgls" command in Stata is used for the FGLS analysis.

4.4 Results

Parameter	Fixed effect	FGLS(AR1)	FGLS (PSAR1)
Capital (K)	0.214** (0.029)	0.209** (0.014)	0.250** (0.014)
Labor (L)	0.311** (0.026)	0.319** (0.013)	0.289** (0.013)
Intermediate inputs (M)	0.436** (0.019)	0.485** (0.015)	0.502** (0.014)
IITO (Z)	0.014* (0.007)	0.003 (0.005)	0.002 (0.004)
KITO (X)	-0.057** (0.012)	-0.022** (0.007)	-0.023** (0.007)
IT capability * KITO	0.002**	0.002**	0.002**

(CX)	(0.0002)	(0.0003)	(0.0003)

** p<0.01; * p<0.05

Table 3: Results of Three Models

The analysis results are presented in Table 3. As shown in the table, although all the coefficients for IITO are positive, only the coefficient from the fixed effect model is significant (θ=0.014, $p < 0.05$). Therefore, Hypothesis 1 is only partially supported. For KITO, all three models reveal that KITO has a negative effect on gross output (μ=-0.057 for the fixed effect model; μ=-0.022 for the FGLS model with AR1; and μ=-0.023 for the FGLS model with PSAR1; all $p < 0.01$). These results support Hypothesis 2 that KITO is negatively associated with performance. In terms of the moderating role of internal IT experience in the impact of KITO on economic performance, we find that the product of IT knowledge and KITO has a positive association with gross output for all three models (η=0.002 for all three models; p <0.01). The results support Hypothesis 3 that internal IT experience moderates the relationship between KITO and performance.

5. CONCLUSION

There are different opinions about value of IT outsourcing. While some scholars suggest that, as a promising business practice, IT outsourcing can deliver strategic, economic, and technological benefits (Grover et al. 1996; Loh & Venkatraman 1992b), other scholars suggest that relying heavily on IT outsourcing, may prevent firms from learning-by-doing in IT activity, which will eventually lead to the loss of internal IT capability and hurt firm performance (Aubert et al. 2005; Qu et al. 2010). Our results suggest that we need to distinguish two types of IT outsourcing. While infrastructural IT outsourcing (IITO) seems beneficial to firms, knowledge intensive IT outsourcing (KITO) has negative effect on firm performance. Because our analysis is based on a large scale of data (the whole US economy from 1998 to 2011), we believe that our results provide substantial evidence to help solve the inconsistencies in the literature. Research has suggested that the development of internal IT capabilities is path-dependent and the outsourcing of IT activities may break this path and hurt firm performance eventually (Qu et al. 2010; Ray et al. 2005). Our results of KITO are consistent with this view and suggest that firms need to be cautious in outsourcing knowledge-intensive IT activities.

Furthermore, the role of internal IT experience in influencing the value of IT outsourcing is also not clear in the literature. Some scholars suggest that superior internal IT knowledge can help firms effectively manage IT outsourcing and exploit external IT services (Han et al. 2011; Willcocks et al. 2007). However, empirical evidence is still lacking. Our analysis results on KITO support the view that internal IT experience positively moderates the relationship between IT outsourcing and firm performance. Indeed, IT outsourcing involves a range of risks (Aubert et al. 2005; Bahli & Rivard 2005) and the effective management of IT outsourcing requires a high level of IT skills and expertise (Han et al. 2011; Willcocks et al. 2007). Our results imply that superior internal IT knowledge plays a facilitating role in leveraging external IT expertise and capabilities.

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