TECHNOLOGY OFFSHORE OUTSOURCING AND FIRM PERFORMANCE

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I study the impact of technology offshore outsourcing on firm performance. Theoretical arguments from the knowledge-based view (KBV) suggest that technology offshore outsourcing has a negative influence on firm performance because this action erodes the firm's learning capabilities and future competitive advantage. I propose that these arguments are confounding two effects – offshore and outsourcing – and that we need to theoretically separate them when analyzing the impact of technology offshore outsourcing on firm performance. Thus, I argue that, in contrast to the KBV's prediction of a negative effect of outsourcing on firm performance, the offshoring dimension has a positive influence on performance, because it allows the firm access to new technologies that may not be available in the home country and enables the development of cross-border learning capabilities. Results indicate that technology offshore outsourcing has a positive impact on firm performance, while technology onshore outsourcing has no significant influence on performance.

[150 words]

Key words: Offshoring, outsourcing, technology, R&D, learning, performance, international business, technology strategy

INTRODUCTION

This article analyzes the impact of technology offshore outsourcing on firm performance. Technology offshore outsourcing has increased in importance. Offshore outsourcing has gained importance in recent times. While offshore outsourcing was most commonly done in manufacturing industries in the 1980s and 1990s, in recent years firms have begun to outsource services, such as information technologies (IT), back office processing, call center activities, and now the development of technologies through research and development (R&D) (Bhalla, 2008; GAO, 2007). The current worldwide market for technology ranges from US$35 to US$50 billion per year and increasing (Lichtenthaler, 2007). McKinsey Global Institute (2003) estimated that of the total U.S. services offshoring market of US$26 billion in 2001, US$8.3 billion went to Ireland, US$7.7 billion went to India, US$3.7 went to Canada, and the rest went to Caribbean countries. A company like IBM, for example, has been able to increase its technology licensing revenue from US$30 million in 1990 to US$1.9 billion in 2001 (Chesbrough, 2003).

However, the benefits of technology offshore outsourcing are highly debated (e.g., Fifarek et al., 2008; Pyndt and Pedersen, 2006). Two reasons explain the intensity of the debate. First, there is no agreement on the definition of offshore outsourcing (for a review of definitions see Parkhe, 2007). Some scholars define it narrowly as the relocation of business activities that the firm used to perform in-house in the domestic setting to firms in other countries (Fifarek et al., 2008; Harrison and McMillan, 2006). Other scholars, building on the traditional definition of outsourcing as the purchasing of inputs from other firms rather than developing them in-house (Williamson, 1975), define it more broadly as the purchasing of inputs from firms located in other countries (e.g., Amiti and Wei, 2005; Bhagwati et al., 2004). In this paper I follow this broader definition and define technology offshore outsourcing as a firm's purchasing of

technologies developed outside the home country. Second, despite the wealth of studies, empirical evidence of how offshore outsourcing influences firm performance is scarce and inconclusive. Most of the literature has focused on analyzing the determinants of outsourcing in general and offshore outsourcing in particular and how to manage them (e.g., Arora and Ceccagnoli, 2006; Contractor, 1985), rather than studying their impact on firm performance. Studies that focus on the impact of offshore outsourcing on the firm have focused on costs rather than ultimate performance (e.g., Farrell, 2005; Harrison and McMillan, 2006). As a result, recent studies call for more empirical studies explaining whether offshore outsourcing is good or bad for firm's profitability and why (Bhalla et al., 2008).

Therefore, to clarify the debate I analyze the impact of technology offshore outsourcing on firm performance, comparing its effect with that of onshore technology outsourcing. I do this comparison to theoretically and empirically separate two dimensions of the concept, the offshoring dimension and the outsourcing dimension. This separation helps solve some of the conflicting arguments and findings.

Theoretically, the knowledge-based view (KBV) of the firm suggests a negative relationship between technology offshore outsourcing and firm performance. Although some studies have discussed the benefits of comparative advantages (e.g., lower labor costs) in the outsourced countries that could enhance firm performance in the short term (Doh, 2005; Farrell, 2005; Levy, 2005), this is viewed being at the expense of firm's learning capabilities, which negatively affect its profitability in the long term (Cha et al., 2008; Fifarek et al., 2008). Thus, technology outsourcing is viewed as competence destroying because by outsourcing the development of technology to other firms the firm becomes incompetent in learning, "trapped" in

this incompetence, and forced to outsource further. As a result, underperforming firms are the ones that undertake technology offshore outsourcing.

In contrast, I argue that many of these arguments do not theoretically separate the *offshore* dimension of technology offshore outsourcing from the *outsourcing* dimension. I propose that unlike technology outsourcing within the home country, technology offshore outsourcing has a positive impact on firm performance for two reasons. First, technology offshore outsourcing allows the firm access to new technologies that may not be available in the home country and that do not transfer easily across countries (Bartlett and Ghoshal, 1998; Contractor, 1985; Dunning and Narula, 1995; Kogut, 1991; Kogut and Zander, 1993; Westney, 1987). Thus, the firm accesses a greater variety of new technologies developed outside the home country that can help it obtain an advantage over local competitors that do not have such access. Second, by undertaking technology offshore outsourcing, the firm develops cross-border learning capabilities, which further supports its competitive advantage. As a result, firms that undertake technology offshore outsourcing achieve higher performance.

The paper contributes to two literatures. First, it contributes to the knowledge-based view of the firm (e.g., Kogut and Zander, 1992; Spender and Grant, 1996) by explaining how the same theory can generate predictions in the domestic setting that differ from predictions in the international setting. Variation across countries, in this case, the development of technologies and the set of institutions that supports them (Kogut, 1991; Murtha and Lenway, 1994; Furman et al., 2002), alter the theoretical mechanisms and theoretical expectations. Although the KBV recognizes the importance of access to diversity of knowledge for learning and performance (Kogut and Zander, 1992; Nonaka, 1994), it has not been fully developed to study differences in

learning through outsourcing in general and differences in learning between onshore and offshore outsourcing in particular.

Second, the paper contributes to the topic of offshore outsourcing by being among the first to analyze explicitly the impact of technology offshore outsourcing on firm performance. Most studies on this topic have focused on the impact of offshore outsourcing on cost and not performance (e.g., Doh, 2005; Farrell, 2005; Levy, 2005), and have yielded mixed conclusions. By separating the effect of outsourcing dimension from that of offshoring dimension, this study explains and provides evidence that technology offshore outsourcing is good for firms, while onshore outsourcing may not necessarily be positive for them.

THEORY AND HYPOTHESES

Technology Offshore Outsourcing: Separating Offshoring from Outsourcing

There is no consensus on the definition of offshore outsourcing. Its two components – offshore and outsourcing – have been used interchangeably in the press (e.g., Economist, 2004) and in some research (e.g., Fifarek et al., 2008). Some researchers take a narrow view and only include as offshore outsourcing activities that are done by the firm in a foreign country that were previously done in the firm in the home country (e.g., Fifarek et al., 2008; Harrison and McMillan, 2006). Other researchers have a broader view and include the purchase of inputs from a foreign country, independently of whether they were previously done inside the firm or whether they are done abroad by the firm or by another firm (for a recent review of definitions see Parkhe, 2007).

Hence, before analyzing the impact of technology offshore outsourcing on performance, we need to separate the two components and understand what they mean. The two components of offshore outsourcing refer to the location of an activity, but to different locations. Outsourcing

refers to the location of a business activity, that is, whether the activity takes place within the firm or outside it. Offshoring refers to the geographic location of the business activity, that is, whether the activity takes place within the home country of the firm or in a foreign country.

More specifically, outsourcing means a firm purchases inputs from another firm rather than invest internally to develop them, regardless of the geographical location of the other firm (for a recent review of definitions of outsourcing see Espino-Rodriguez and Padron-Robaina, 2006). Scholars argue that firms should develop these inputs internally when the combined costs of production and internal coordination are less than the suppliers' cost of production plus the corresponding transaction costs (Coase, 1937; Williamson, 1975). Outsourcing has been usually discussed in the context of vertical integration decisions, where the firm decides to purchase an input from part suppliers instead of making it in-house (e.g., Dyer and Nobeoka, 2000; Takeishi, 2000; Teece, 1986; Williamson, 1985). It has also been studied in the realm of technology, with the firms choosing to purchase technologies from other companies rather than investing internally to develop them (e.g., Pisano, 1990; White, 2000). Although outsourcing sometimes results in the relocation of an activity that the firm used to perform internally (e.g., Toulan, 2002), this does not always have to be the case. A firm can decide that rather than investing in building the firm's internal capabilities to develop an activity, it is better to outsource its development to another firm that already has the capabilities to make them more effectively and efficiently (e.g., Pisano, 1990). Outsourcing can be done using different contractual means, from licensing the right to use the technologies developed by other firms, to subcontracting the development of specific technologies to another organization (e.g., Contractor, 1981, 1985; Pisano, 1990; Lichtenthaler, 2007). Depending on the contract, the firm not only pays for the use

of the technologies but also knowledge in how to use them in the firm's products and services (Pyndt and Pedersen, 2006).

Different from outsourcing, offshoring refers to the purchase of inputs from foreign countries rather than from the home country, regardless of who undertakes the development of the inputs (for a recent review of definitions of offshoring see Parkhe, 2007). The firm chooses to purchase inputs from another country when the cost of production, transportation and contracting from abroad are lower than the costs of acquisition in the home country because of differences in comparative advantages across countries (e.g., Ricardo, 1819). Offshoring has been discussed in the contexts of the motives for a firm's foreign expansion, with firms moving to other countries to benefit from access to natural resources that are imperfectly distributed across countries, factors of production that have better quality or lower costs than at home, or capabilities and knowledge that are superior to those available in the home country (e.g., Dunning, 1993). Although offshoring may result in the firm ceasing production of the input at home and importing the inputs from abroad, it does not always have to result in this. The firm may maintain production of the input at home and at the same time have production abroad to diversify sources of inputs across the globe to benefit from differences in comparative advantage and the possibility of arbitraging such differences as the comparative advantage evolves over time (Kogut, 1985; Ghemawat, 2007). Offshoring can be done using alternative contractual means, using supply contracts with foreign producers, establishing new Greenfield facilities in a foreign country, acquiring an existing firm in a foreign country, or establishing an alliance with a local producer in a foreign country (e.g., Anderson and Gatignon, 1986; for a review see Datta, Herrman and Rasheed, 2002).

The combination of these two dimensions results in four types of actions regarding the location of an activity: Onshore insourcing, when the firm undertakes the activity internally in the home country; offshore insourcing, when the firm undertakes the activity internally in a foreign country; onshore outsourcing, when the firm subcontracts the activity to another firm located in the home country and, as a result, purchased the outputs of such activity; and offshore outsourcing, when the firm subcontracts the activity to another firm located in a foreign country and, as a result, imports the outputs of such activity. Although the last three are sometimes confounded in the literature, only the last one can be truly considered offshore outsourcing.

Hence, I follow these definitions and classification in the analysis of the impact of technology offshore outsourcing on performance. I analyze the purchase of technologies developed by other firms (outsourcing) that are located in a foreign country (offshore). I will compare this to onshore outsourcing, which will include the acquisition of technologies from other firms (outsourcing) but firms that are located in the same country (onshore). This comparison will enable us to separate the effect of offshoring from onshoring when analyzing the impact of the outsourcing of technologies on performance.

Despite the interest in offshore outsourcing, there are limited empirical studies linking this activity to firm performance and their findings are inconclusive. Many studies analyze the impact of offshore outsourcing of knowledge on cost (e.g., Farrell, 2005; Maskell et al., 2007; Pyndt and Pedersen, 2006), but they do not study the impact on performance. Some studies suggest that cost advantages of offshore outsourcing are offset by other disadvantages, such as transaction and coordination costs, erosion of learning capabilities, and creating competitors out of the outsourced firms (e.g., Fifarek et al., 2008; Contractor and Mudambi, 2008; Pyndt and Pedersen, 2006). Thus, studies analyzing the relationship between offshore outsourcing and

performance remain inconclusive. For example, Bhalla et al. (2008) explores the relationship between the offshore outsourcing of IT, business process, and call centers and did not find any clear link to firm performance, calling for further research on this relationship. Cha et al. (2008) analyze the relationship between outsourcing IT activities and project performance and found a positive relationship with cost saving when the project is short-lived because the supply chain of knowledge in the home country is not affected. However, the reverse is true when the project requires long-lived offshoring because the knowledge supply chain is severely disrupted. However, the authors did not link project performance to firm's financial performance; we do not know whether the short-term cost efficiencies are outweighed by higher transaction costs.

Knowledge-Based View

To explain the impact of technology offshore outsourcing on performance I build on the knowledge-based view because of its focus on knowledge (for a description of the theory, please see the articles in the special issue of *Strategic Management Journal* edited by Spender and Grant, 1996; and the reviews of the theory by Eisenhardt and Santos, 2002). The theory is based on several assumptions that explain why outsourcing affects performance. First, knowledge is the most important productive resource in value creation. The basis for sustained competitive advantage is a firm's ability to acquire new knowledge and combine it with existing knowledge to create rare and valuable knowledge through learning and innovation, and to subsequently build upon, and spread that rare knowledge throughout the firm (Dierickx and Cool, 1989; Leonard-Barton, 1995; Nonaka, 1994). Second, knowledge is subject to economies of scale and scope. Once it is created it can be applied in various settings, enabling the firm to grow and prosper. However, knowledge is difficult to transfer within and outside the firm (Nonaka, 1994), enabling the firm to support a knowledge based competitive advantage. Third, knowledge is

imperfectly distributed in the firm (Tsoukas, 1996). The production of knowledge requires diversity of knowledge that is difficult to obtain (Nonaka, 1994). Therefore, the firm needs to invest in learning mechanisms to develop new knowledge, such as learning routines (Zollo and Winter, 2002), dynamic capabilities (Teece et al., 1997), and training and motivating people to have the right mindsets to explore new knowledge and integrate it with others' existing knowledge for innovations (Kogut and Zander, 1992).

Based on these assumptions, I now discuss the KBV's prediction of a negative effect on firm performance of technology onshore outsourcing as a baseline hypothesis. I then extend the application of the KBV to technology offshore outsourcing and provide the theoretical mechanisms that explain why technology offshore outsourcing would have a positive impact on firm performance.

Technology Onshore Outsourcing and Firm Performance: A Negative Relationship

The logic and assumptions of the KBV suggest that technology onshore outsourcing harms learning and innovation and, as a result, would have a negative effect on firm performance. This is a baseline hypothesis that is a direct outcome of the assumptions on which the KBV is based.

First, a core assumption of the KBV is that knowledge is the most critical productive resource in value creation and that the basis for sustained competitive advantage is a firm's ability to combine knowledge to create new knowledge, new knowledge that is rare and valuable (Dierickx and Cool, 1989; Leonard-Barton, 1995; Nonaka, 1994). Following this assumption, the investments to develop technologies in-house enables the firm to develop the ability to create new knowledge. However, when the firm outsources the development of technologies, it does not invest in developing this ability to create new knowledge. As a result, the firm will not be

able to create new knowledge and unable to innovate its products, which would result in lower financial performance over time.

Second, another assumption of the KBV is that knowledge is subject to economies of scale and scope because knowledge, once created, can be used in alternative applications without additional investments in its creation. Hence, a firm that invests internally to develop its own technologies can use the knowledge developed to not only make its own products for sale in the marketplace, but also to expand into other activities to increase revenues, or even to sell to other firms the right to use the knowledge in their products in exchange for a royalty payment, thus generating additional revenue for an investment already made (e.g., Arora and Fosfuri, 2000). In contrast, a firm that outsources the development of the technologies harms its ability to generate future revenues and profits. By not investing in the development of technology internally, it limits its ability to benefit from economies of scale and scope of the knowledge created. Thus, the firm would not be able to generate additional revenue from previous investments, resulting in lower financial performance.

Third, an additional assumption of the KBV is that the production of new knowledge requires access to diversity of knowledge that is imperfectly distributed in the firm (Tsoukas, 1996) and that is difficult to access because it is tacit (Nonaka, 1994). Thus, a firm that invests internally to develop technologies is at the same time investing in the learning mechanisms needed for making the tacit knowledge explicit, facilitating not only its creation but also its transfer around the firm (Kogut and Zander, 1992; Zollo and Winter, 2002). In contrast, a firm that outsources the development of technologies does not develop such learning capability, limiting not only the transformation of tacit knowledge into explicit, but also the ability to

understand the different knowledge it acquires from other firms (Cohen and Levinthal, 1990), which would harm its revenues and performance.

Thus, from a traditional KBV, technology outsourcing is harmful to the firm. By purchasing technologies instead of developing them internally, the firm limits its innovativeness and competitive advantage, resulting in lower performance. Moreover, the purchase of technology can result in an "incompetence trap". As the firm gradually looses its ability to learn, unable create knowledge and innovate because it purchases rather than develops technology internally, this induces it to purchase more technology because it becomes unable to produce the necessary technologies. As a result, the firm increases its purchase of technology while reduces the development of a distinct competitive advantage, resulting in a reduction of revenues and profitability. At the same time, other firms in the country can purchase the technology the firm has access to; thus, such purchase cannot form the basis of a sustainable competitive advantage. This line of argumentation from a traditional KBV application to the analysis of the relationship between technology outsourcing on performance supports the following baseline hypothesis:

Hypothesis 1: Firm performance is negatively related to technology onshore outsourcing.

Technology Offshore Outsourcing and Firm Performance: A Positive Relationship

In contrast, I argue that the application of the KBV to technology *offshore* outsourcing results in a prediction that technology offshore outsourcing has a positive effect on performance because it actually improves learning and innovation through two mechanisms: Access to foreign technologies that are new and unavailable in the home country and the development of cross-border learning capabilities. Thus, the same theory, KBV, results in different predictions depending on the location of the source of technology, whether domestic (onshore) or foreign (offshore).

Access to foreign technologies. The first reason explaining why technology offshore outsourcing helps the firm improve its performance is that it enables access to technology in other countries, which tends to differ from those found in the home country. Outsourcing technologies from other firms within the home country may provide the firm access to technologies that are slightly different from the ones it develops internally, such as technologies developed in different regional clusters (Porter, 1998; Saxenian, 1994); however, technologies vary more greatly across countries than within the home country (Kogut, 1991; Furman et al., 2002). Therefore, technology offshore outsourcing provides the firms access to greater variety of new technologies that may be unavailable in the home country.

The set of institutions that enables the development of technologies differs across countries. Researchers analyzing the innovative systems of countries examined the roles of local universities and their interaction with firms and government in the development of technologies for the country (e.g., Breznitz et al., 2008; Fransman, 2001). Furman et al. (2002) show that countries differ in their capacities to generate technologies. They explain that a great deal of variation across countries is due to the variation in the level of inputs devoted to innovation such as R&D manpower and spending at the level of the country, and factors associated with differences in R&D productivity, particularly policy choices such as the extent of intellectual property (IP) protection and openness to international trade, the share of research performed by the academic sector and funded by the private sector, the degree of technological specialization, and each individual country's knowledge stock. Other researchers argue that the government also plays a critical role in the development of technologies in different countries by providing the financial and non-financial incentives to develop certain technologies and not others (e.g., Caerteling et al., 2008; Murtha and Lenway, 1994; Roberts and Fukuda, 2004). As a result, these

institutions interact and reinforce each other to support the development of certain technologies and not others (Kogut, 1991).

Additionally, technologies are difficult to transfer across countries. The differences in the institutional contexts of the source country where the technologies are created and of the receiving country contribute to the difficulty of their transfer. Westney (1987) shows how the transfer of practices from the United States to Japan had to be decontextualized and recontextualized before they could be useful in the new context. Kogut (1991) explains how the institutions of the country facilitate the development of certain technologies that are difficult for competitors to imitate across countries, because their institutions support the development of other types of technologies. Kogut and Zander (1993) further explain how the characteristics of knowledge contained in the technology are specific to the institutional context. In their study of technology transfer of Swedish firms, they found that transferable technologies tend to be ones that are codifiable and teachable. Subramaniam and Venkatraman (2001) find that overseas knowledge useful for successful production innovations tend to be tacit contributing to the difficulty of its transfer.

However, despite the difficulty in transferring technologies across countries, firms that offshore outsource the development of technologies do so to access new technologies that may not be available in the home country but that are critical for them to achieve successful innovations. As a result, offshore outsourcing is likely to have a positive impact on firm performance. Studies on international technology transfer show how foreign technologies enable domestic firms to develop products that better meet the needs of customers in the home country. Atuhene-Gima (1993) shows how Australian firms that use foreign technologies in making their products tend to be more competitive than those that do not. Avram (1997) describes how the

purchasing of a computer game technology, Tetris, from Russia by a Japanese firm, Nintendo, enables it to create a product that achieves record profit for the company. Kim and Kim (2000) show how Korean firms have been able to improve competitiveness thanks to the purchasing of technologies from firms in Japan, the United States, the United Kingdom, Germany, and France. Through the purchasing of foreign technologies, firms, like Hyundai Motor, have improved their innovation and become internationally competitive. Pyndt and Pedersen (2006) explain how ship-engine technologies licensed from MBD headquartered in Denmark enables Hyundai Heavy Industries (HHI) to gain market share and international competitiveness.

Development of cross-border learning capabilities. The second reason why offshore outsourcing technology has a positive impact on firm performance is that it enables the firm to develop cross-border learning capabilities. Acquiring knowledge embedded in foreign technologies and combining that with firm-internal knowledge to create new knowledge enables the firm to develop a cross-border learning capability. This capability to acquire and combine new technologies with internal ones to create new knowledge is difficult for competitors to understand and therefore imitate (Kogut, 1991; Kogut and Zander, 1993).

The transfer of offshore outsourced technologies relies primarily on personnel ability, which requires their development. For this exchange to be effective the firm needs to have internally-developed capabilities to absorb and assimilate the technology for its own particular use. Since foreign technologies are different from those developed in the home country, the kind of internally-developed capabilities need to be different from those used to absorb and assimilate domestic technologies. Studies indicate that the transfer of foreign technologies requires repetition of exchange of personnel, training them to understand foreign technologies through research and development, developing routines, and provide incentives to employees to use

foreign technologies. For example, in the case of offshore outsourcing ship-engine technologies by HHI from MBD, Pyndt and Pedersen (2006) describe how in transferring technologies from MBD in the form of "Design Specification", which includes a complete description of the particular engine, all detailed drawings necessary to undertake the production process, MBD has a permanent site office at HHI to facilitate the transfer. MBD sends 2-5 operational, production and design experts on a rotational basis to teach HHI in using the technologies (p. 154). HHI also sends its experts to MBD's headquarters in Copenhagen to learn about the technologies and how they can be applied in HHI. Another example is the transfer of Toyota manufacturing technologies from Japan to the United States in the NUMMI plant that Adler et al. (1999) describe. In addition to the extensive exchange of engineers between the two countries, some elements of the Japanese-style human resource management practices, such as joint-performance based incentive schemes and team-based job design, had to be implemented to achieve successful transfer.

Based on these two ideas, that technology offshore outsourcing provides the firm access to new technologies that may not be available in the home country that are useful for innovation, and that the firm develops cross-border learning capabilities that are difficult for competitors to imitate, I hypothesize that:

Hypothesis 2: Firm performance is positively related to technology offshore outsourcing.

RESEARCH DESIGN

Data

I test the hypotheses on a sample of 785 manufacturing firms operating in Spain during the period of 1990-2002. The study of manufacturing firms in Spain is appropriate for testing the hypotheses. First, tangible products are more likely to be influenced by technology offshore

outsourcing than services. The innovation of services tends to be done internally in a learning-by-doing approach (Dougherty, 2004). Second, Spain is an appropriate empirical setting because it is neither at the forefront of technological development nor at the bottom among countries, which would represent the majority of the countries in the world. Therefore, findings from this study will be directly applicable to most of the countries in the world except the few technology leaders, such as the United States and Japan.

Data come from a survey of manufacturing firms conducted by the Foundation State-Owned Enterprise (*Fundación Empresa Pública*) in Spain, and covers the years 1990-2002. The Ministry of Commerce, Tourism and Industry in collaboration with the Foundation State-Owned Enterprise compiled the data. These organizations chose the firms for the survey based on size. All firms with more than 200 employees are included in the sample. Firms with between 10 and 200 employees are selected through a random stratified sample. The survey is collected through a detailed questionnaire of 107 questions with 500 fields designed to capture all aspects of the strategy of the firm. Firms in the database cover 21 industries and therefore are representative of the underlying population of manufacturing firms in the country.

The way in which data was collected and distributed helps reduce biases inherent in any survey and increases the confidence on the quality of the data. First, the survey is explicitly collected for research purposes. Hence, there is no incentive for the firm to present the state of the firm in a better light to obtain subsidies or to present the state of the firm in a worse manner to avoid tax liabilities. Second, data is collected under a confidentiality agreement. As a result, the database used does not contain variables that would help identify the firm. This limits my ability to collect additional information or verify the data because I do not know the identity of the firm. However, it has the benefit of reducing the incentive of misrepresentation by managers.

Third, the survey uses detailed questions about the variables. It does not use Likert-type scales on the perception of the manager about a particular variable to avoid response bias. Fourth, data collected in one year is checked for errors and discrepancies with previous years to ensure its quality and comparability across time.

The database has been used by other researchers to study diversification (e.g., Merino and Rodríguez, 1997), internationalization (e.g., Salomon and Shaver, 2005), and R&D investment (Un and Cuervo-Cazurra, 2008). However, it has not been used to explore the relationship between technology offshore outsourcing and firm performance.

Variables and Measures

The dependent variable is firm performance. I measure this in three different ways as done in other studies analyzing firm performance (e.g., Contractor, 2007): Return on sale (ROS) (Ramaswamy, 1995), return on assets (ROA) (Gomes and Ramaswamy, 1999), and return on equity (ROE) (Qian, 1997). Return on sales is earnings before interests, taxes and depreciation divided by total sales and multiplied by 100. Return on assets is earnings before interests, taxes and depreciation divided by total assets and multiplied by 100. Return on equity is earnings before interests, taxes and depreciation divided by total equity and multiplied by 100.

The independent variables of interest are technology onshore outsourcing and technology offshore outsourcing. They are based on the amount of money that the firm paid for outsourced R&D, which is the amount of money paid to other firms, to universities, or to other entities dedicated to scientific or technological research, to obtain new scientific or technological knowledge or to develop commercially-viable innovations for the firm. As such, they capture the idea of technology outsourcing as the purchasing or payments made to sources outside the firm for the development of technologies rather than developing them in-house as discussed in this

study. Based on this total outsourced R&D expenditure, technology offshore outsourcing is measured as the ratio of the expenses paid to firms in foreign countries for use of their technologies divided by total sales and multiplied by 100. In the questionnaire, the manager was asked the following question: "Indicate if in the year X the firm paid for licenses and technical assistance from abroad and the amount paid". Technology onshore outsourcing is measured by subtracting out technology offshore outsourcing from total outsourced R&D expenditure divided by total sales and multiplied by 100.

Following other studies on firm performance I control for other determinants of performance[1]. First, I control for previous technology offshore experience because the firm may develop experience over time that supports performance. I measure this with an indicator that the firm has undertaken technology offshore outsourcing in a previous year. Second, I control for whether the firm is a multinational company (MNC) or not. Being an MNC is measured with an indicator that the firm has employees outside Spain and it is not owned by a foreign investor. Third, I also control for whether the firm is part of a foreign MNC, because multinational companies may achieve the benefits of access to diversity of foreign knowledge and cross-border learning without having to purchase foreign technologies (e.g., Bartlett and Ghoshal, 1998; Un and Cuervo-Cazurra, 2008) while at the same time they may face a liability of foreignness that affects firm performance (Zaheer, 1995). Being a subsidiary of a foreign MNC is measured with an indicator that a foreign investor controls part of the stock of the firm. Fourth, I control for the size of the firm because larger firms may stifle innovation (Sorensen and Stuart, 2000) and increase complexity in the firm, affecting performance. I measure size with the natural log of the number of employees. Fifth, I control for the age of the firm because while older firms overcome the liability of newness an improve survival (Stinchcombe, 1965) they tend to generate

[1] I thank anonymous reviewers for suggesting some of these controls.

incremental rather than radical innovations that result in lower performance (Sorensen and Stuart, 2000). I measure age using the number of years it has been in operation since inception. Sixth, I control for the industry of operation of the firm because performance varies across industries thanks to differences the intensity of competition (Porter, 1980). I measure industry with bivariate indicators of the industry of operation of the firm at the two-digit level of the CNAE codes, the Spanish equivalent of the SIC codes. Seventh, I control for the year because the business cycle may affect firm performance. I measure year with a bivariate indicator of the year. Eighth, I control for other unobserved firm-specific factors that affect performance using random or fixed effect model, taking advantage of the panel nature of the dataset.

Methods of Analysis

Since the dependent variables are continuous and I have a panel of 13 years of data (1990-2002), I run multiple analyses to control for potential problems in the error structure and to provide robustness to the results. I lag the variables by one year as actions taken in the previous year are likely to affect performance in the subsequent year; as a result, I have an effective panel of 12 years. First, I run a regression controlling for firm-specific effects using a random and fixed effect models, clustering the error terms by firms to take into account that multiple observations of the firm across years are not independent from each other. Second, I run random and fixed effect regressions with AR1 correction for autocorrelation to take into account that there may be trends in the data. Third, I run a GEE model with controls for serial correlation and clustering errors by firm to take into account both serial correlation and non-independence of firm observations across time. The general specification I use in the models is the following:

$$\textit{Firm performance (ROE, ROS, ROA)}_{it} = \beta_0 + \beta_1 * \textit{Technology onshore outsourcing}_{it-1} + \beta_2 * \textit{Technology offshore outsourcing}_{it-1} + \beta_3 * \textit{Technology offshore outsourcing experience}_{it-1} + \beta_4 *$$

$MNC_{it-1} + \beta_5 * subsidiary\ of\ foreign\ MNC_{it-1} + \beta_6 * Size_{it-1} + \beta_7 * Age_{it-1} + \beta_8 * Industry_j + \beta_9 * Year_k + e$

Hypothesis 1 is supported when β_1 is negative and statistically significant. Hypothesis 2 is supported when β_2 is positive and statistically significant. By including both types of technology outsourcing in the same model we can compare the effect, on firm performance, that technology offshore outsourcing and technology onshore outsourcing has in relationship to not outsourcing technology.

RESULTS

Technology Offshore Outsourcing and Technology Onshore Outsourcing

Before discussing the results from testing the hypotheses, I study in detail the behavior of firms regarding technology outsourcing to provide some background to the discussion of the results. Their study is particularly relevant because there are no previous studies comparing technology offshore outsourcing and technology onshore outsourcing.

First, I analyze the evolution of technology offshore and onshore outsourcing over time. Figure 1 provides the percentage of firms that undertake technology offshore outsourcing in comparison to those that undertake technology onshore outsourcing over the period of 1990-2002. During the period, an average of 11% of firms undertakes technology offshore outsourcing while an average of 20% uses technology onshore outsourcing. While the percentage of firms undertaking onshore outsourcing increases from less than 15% in 1990 to nearly 25% in 2002, the percentage of firms that offshore outsource the development of their technologies remains steady at around 11%. In terms of percentage of firms undertaking outsourcing, more of them outsource from onshore sources rather than from offshore sources. This evidence is contrary to

the claims that more firms are offshore outsourcing the development of their technologies (e.g., Fifarek et al., 2008).

Insert Figure 1 about here

Second, I study the average expenditure on technology offshore outsourcing and technology onshore outsourcing over time. Figure 2 provides the evolution of the figures for firms that are actively outsourcing technology. During the period studied, firms that outsource technology spent an average of 1% of sales on offshore outsourcing and an average of 1.6% of sales on onshore outsourcing. However, whereas the average expenditure on technology onshore outsourcing has remained relatively flat over the period, oscillating between 0.8% and 1.2% of sales, technology offshore outsourcing appears to have an upward trend, moving from 1.1% at the beginning of the period to 2.1% close to the end of the period. Firms that offshore outsource the development of their technologies spent more on foreign technologies than on domestic ones, and they have tended to increase this expenditure.

Insert Figure 2 about here

Third, I study differences in technology offshore outsourcing and onshore outsourcing across industries. Figure 3 shows the percentage of firms that undertake technology offshore outsourcing and onshore outsourcing by industry. Firms are classified into 20 industries by the Foundation State-Owned Enterprise, the provider of the data; grouping industries at the two-digit CNAE code. Technology offshore and onshore outsourcing occurs in all industries, but varies

across industry. The percentage of firms that undertake offshore outsourcing in the chemical, vehicle, and other transportation industries is relatively similar to the percentage of firms that undertake onshore outsourcing. In contrast, in the metallurgy and office equipment industries, more firms outsource technology at home than those that outsource abroad, while in printing more firms use offshore outsourcing than onshore outsourcing. There is no clear pattern of technology offshore or onshore outsourcing across industries.

Insert Figure 3 about here

Fourth, I analyze differences in technology offshore and onshore outsourcing across firms of different sizes. Figure 4 shows the percentage of firms undertaking technology offshore outsourcing and onshore outsourcing by firm size. Whereas small firms tend to use technology onshore outsourcing more frequently than offshore outsourcing, as firms grow the percentages tend to become similar, with a comparable percentage of large firms using technology onshore outsourcing and technology offshore outsourcing.

Insert Figure 4 about here

Impact of Technology Offshore Outsourcing and Technology Onshore Outsourcing on Firm Performance

Table I shows the correlation matrix and additional descriptive statistics for variables that are used in testing the hypotheses. It is interesting to note that there are more positive significant correlation between technology offshore outsourcing with indicators of firm performance than

technology onshore outsourcing and firm performance. Overall, there are limited high correlations among the predictors, reducing the possible multicollinearity problems. Nevertheless, I checked for the possibility of multicollinearity, excluding highly correlated variables from the model such as size. The results of interest do not change significantly, indicating limited multicollinearity problems (Greene, 2005). I also run the variance inflation matrix and found the parameters to be below the levels that would indicate potential multicollinearity problems.

Insert Table I about here

Table II presents the results from testing the hypotheses. Overall, the results support Hypothesis 2 but not Hypothesis 1. The coefficient of technology onshore outsourcing is not statistically significant across models. Therefore, Hypothesis 1 that stated that firm performance is negatively related to technology onshore outsourcing is not supported. In contrast, the coefficient of technology offshore outsourcing is positive and statistically significant in all models. Hence, Hypothesis 2 that indicated that firm performance is positively related to technology offshore outsourcing is supported. The specific coefficients vary across dependent variables and methods of analysis. As an illustration of the magnitude of the impact of technology offshore outsourcing I discuss the impact of this on the three dependent variables under a random effects regression with errors clustered by firm (models 1, 2 and 3). The coefficients of technology offshore outsourcing are 0.007 for ROS, 0.017 for ROA, and 0.019 for ROE, respectively. Taking into account that the dependent variables are expressed in percentage while the independent variable is expressed in per thousandth, these coefficients indicate that

investing an additional 1% of sales in technology offshore outsourcing would increase ROS by 0.07%, ROA by 0.17% and ROE by 0.19% respectively.

Insert Table II about here

These findings are novel and important. Despite the increasing importance of offshore outsourcing and the heated debate regarding its merits, it is not clear whether it is good for firm performance. I have argued and found support for the idea that offshore outsourcing is indeed good for performance. I argued that this was the case for two reasons. First, it provides the firm access to greater variety of new technologies, which are not available in the home country. These technologies enable the firm to achieve innovations. Second, it helps the firm develop the capability to learn across countries, which is difficult for competitors to imitate. These two factors help firms achieve superior performance.

These findings give support to the notion that KBV research on offshore outsourcing needs to take into account not only the outsourcing dimension when analyzing the likely impact on firm performance, but also the offshore dimension, since it is the access to diverse new technologies not available in the country that helps firms improve their performance. Moreover, the ability of firms to acquire knowledge developed abroad and combine it with internal knowledge to create new knowledge, provides sustained competitive advantage because it is difficult for competitors to catch up.

It is interesting to note that some of the coefficients of the control variables are statistically significant. However, their statistical significance does not hold across all dependent variable and models; as a result, the following arguments are only tentative. Being an MNC has a

negative and statistically coefficient in some models, while in others the coefficient is not statistically different from zero. This may capture how the difficulties of being an MNC may overpower the benefits (e.g., Cuervo-Cazurra, Maloney, and Manrakhan, 2007), especially at the beginning of the global expansion (e.g., Contractor, Kundu, and Hsu, 2003; Lu and Beamish, 2004). Being a subsidiary of an MNC has a positive and statistically coefficient in some models, but a coefficient that is not statistically different from zero in others. This is counter to the traditional argument of subsidiaries of foreign MNCs suffering from a liability of foreignness (e.g., Zaheer, 1995), and may be capturing the advantage of being a foreign firm (e.g., Hymer, 1976). Size shows a negative and statistically significant coefficient in a few of the models and coefficients that are not statistically different from zero in most others. Larger firms tend to achieve lower performance because they tend to suffer from complexities and tend to generate incremental rather than radical innovations (Sorensen and Stuart, 2000). Age has a coefficient that is negative and statistically significant in many models, and a coefficient that is not statistically significant in a few models. This seems to support the idea that although older firms may have overcome liability of newness (Stinchcombe, 1965), they tend to be less innovative and therefore achieve lower performance (Sorensen and Stuart, 2000).

I conducted additional analyses, not presented here for the sake of brevity, to check for robustness of results[2]. First, I used the natural logarithm of total sales and the natural logarithm of total assets as alternative measures of size. The results are consistent with the ones reported here. However, I do not use these results because the coefficients of these alternative measures of size show indicators above the threshold indicator that reveal the presence of potential multicollinearity problems. Second, I also tested for the impact of the different levels of foreign ownership of companies on firm performance. Results did not alter the sign and significance of

[2] I thank the anonymous reviewers for suggesting some of these robustness checks.

the coefficient of technology offshore outsourcing. Third, I ran the analyses with an indicator of the total technology outsourcing, which is the sum of offshore and onshore outsourcing, to analyze how technology outsourcing in general affects firm performance. The coefficient of this indicator is not statistically different from zero in the models. This finding adds additional depth to the paper. It reveals that only offshore outsourcing has a positive impact on performance. Fourth, I ran the analyses with additional time lags to analyze how the relationship between technology offshore outsourcing and performance holds over time. I find that the coefficients of technology offshore outsourcing are positive and statistically significant when analyzing data with no time lags and one year of time lag, but that these coefficients loose statistical significance with additional time lags. This finding adds additional depth to the paper. It indicates that technology offshore outsourcing provides firms with a temporary competitive advantage rather than with a sustainable competitive advantage over competitors. Fifth, I excluded MNCs and subsidiaries of foreign MNCs from the analyses to check that the ability of these firms to access foreign markets was not explaining the findings. The results of the analyses that exclude these firms show that the coefficient of technology offshore outsourcing is positive and statistically significant while the coefficient of technology onshore outsourcing is not statistically different from zero. These findings give additional confidence to the analyses presented here. Technology offshore outsourcing is in fact positively related to performance. The benefits that the access to diversity of foreign knowledge and the development of cross-border learning capabilities associated with technology offshore outsourcing help the firm to be better.

CONCLUSIONS

There has been a heated debate about offshore outsourcing of knowledge work, such as the development of technologies; however, there are no empirical studies explaining the impact

of this activity on firm performance. Traditional arguments from the knowledge-based view (KBV) suggest that it has a negative impact on firm performance. Firms that develop their own technologies accumulate knowledge and have the ability to combine different types of knowledge for creating new knowledge. Their profitability is improved, not only by making superior products using the technologies, but also by generating additional revenue by selling the rights to other firms to use their technologies. Therefore, by outsourcing the development of technologies, firms do not develop new learning capabilities and erode the ones that they have since learning capabilities are developed by doing. Hence, only underperforming firms are the ones that undertake technology offshore outsourcing out of necessity because they have no capabilities to develop the technologies internally.

In contrast, I extend the KBV to argue that when we separate the offshoring dimension from the outsourcing dimension and apply the knowledge-based view to the international context, technology offshore outsourcing has a positive effect on firm performance. It provides the firm access to greater variety of new knowledge useful for the firm's innovations; technologies that are unavailable in the home country. Moreover, because technology is difficult to imitate across countries (Kogut and Zander, 1993), the firm's ability to acquire, combine and create new knowledge using technologies developed outside the country provides it a competitive advantage.

The empirical analyses show that technology offshore outsourcing is positively related to firm performance, supporting the arguments presented here. Interestingly, the analyses also show that onshore outsourcing of technologies has no significant effect on firm performance potentially supporting the traditional arguments of the KBV.

Before discussing the important contributions of the paper to both theory and practice, I need to discuss several limitations of the study that can be resolved in future studies. First, I analyze manufacturing firms and therefore results cannot be generalized to service firms. Contractor et al. (2007), for example, shows how internationalization affects firm performance differently depending on whether firms are in the manufacturing or service sector. Second, I study one particular way to obtain foreign technologies, which is purchasing the rights to use technologies developed by firms in other countries. There are other ways to obtain technologies such as undertaking foreign direct investment of R&D, acquisition of companies that are developing the technologies (Dunning and Narula, 1995), and forming R&D alliances (Sampson, 2007). In the present study, I controlled for their effect instead of analyzing them. Future studies can analyze the relative impact of the different ways to obtain foreign technologies on performance. Third, I analyze technology offshore outsourcing and not offshore outsourcing of production, IT, business processes, or call centers. Future studies can compare which type of activity has higher impact on financial performance as it is possible that firms offshore outsource several activities at the same time. Fourth, I analyze firms in Spain, which may not be generalizable to firms in countries at the forefront of technology, like the US. For example, it is argued that US firms are on the cutting edge of many types of technologies; therefore, the offshore outsourcing of the development of technologies to other countries may have different impact on financial performance. However, the findings can be generalized to firms in countries not at the technological frontier, which are the majority of countries in the world. Future studies can analyze how the different levels of technological development of countries affect the impact of technology offshore outsourcing on firm performance. Finally, I do not analyze the different degree of diversity of technologies outsourced from different countries on firm performance. The

main purpose of the study was to examine the impact of offshore outsourcing on firm performance in comparison to the effect of onshore outsourcing on performance. Future studies can examine whether there is a differential impact of sources and recipients of technologies beyond what is done in the present study.

The paper makes important contributions to theory, the literature on offshore outsourcing, and managerial practice. First, it contributes to the KBV by theoretically explaining why technology offshore outsourcing actually helps rather than hurts firm performance. Despite its recognition that access to diversity of knowledge is critical for learning and innovation and thus performance (Kogut and Zander, 1992; Spender and Grant, 1996), it has not realized that knowledge and technologies vary more greatly across countries than within the home country (Furman et al., 2002; Murtha and Lenway, 1994) thereby providing greater learning opportunities. Therefore, we need to distinguish the outsource dimension from the offshore one. Technology offshore outsourcing enables the firm to have access to diverse types of new technologies that are unavailable in the home country that they can use in their innovations (Pyndt and Pedersen, 2006). In the process they develop the ability to combine foreign technologies with internally developed ones that seem to contribute to superior financial performance as it is difficult for competitors to catch up (Kogut and Zander, 1992). It shows that because the international setting provides the firm access to greater diversity of technologies useful for innovation, the diversity that is difficult for firms to develop on their own as they would need to build the scientific infrastructure and other supporting institutions before they can develop these technologies, purchasing them seems to enhance their performance. An important implication here is that a firm can upgrade its technological capabilities and achieve higher performance not only by undertaking foreign direct investment and become a MNC, but also by

offshore outsourcing the development of technologies. Through offshore outsourcing the development of technologies, not only do firms have access to diversity of technologies that are unavailable in the home country and enhance their innovations, they also develop cross-border learning capabilities that are difficult for competitors to imitate. Outsourcing within the home country has no significant impact on performance, which seems to partially support traditional KBV arguments that it will not enhance performance (Spender and Grant, 1996).

Second, the paper also contributes to the literature on the topic of offshore outsourcing (e.g., Bhalla et al., 2008; Fifarek et al., 2008), by being among the first to provide evidence and theoretical explanations for why we need to separate the outsourcing dimension from offshoring dimension to fully understand their impact on firm performance. Different from most studies on offshore outsourcing that tend to focus on the impact on cost (Doh, 2005; Farrell, 2005; Levy, 2005), the evidence and theoretical explanations presented in this study can help advance the debate for whether offshore outsourcing is good or bad for firms.

Finally, this study also contributes to managerial practice. First, for managers who wish to undertake technology offshore outsourcing, the study shows that this is good for profitability. Technology offshore outsourcing provides the firm access to new and different types of technologies that may be unavailable in the home country or impossible for the firm to develop internally. These foreign technologies are useful for the firm to achieve successful innovations and be competitive in the domestic market. Moreover, technology offshore outsourcing enables the firm to accumulate learning about foreign technologies, acquire and combine them with internally developed ones to create new knowledge. These learning processes are difficult for competitors to observe and therefore imitate. As a result, this allows the firm to enjoy a sustainable competitive advantage and superior profitability. Second, managers need to be

cautious about onshore technology outsourcing because it may not have a positive impact on profitability. It does not provide the kind of newness or degree of diversity of technologies that are available in the global market for technologies. Moreover, the firm may not develop learning capabilities, limiting its ability to explore alternative technologies that might enhance its innovations and performance.

In conclusion, this is the first study to explain and analyze the impact of technology offshore outsourcing on firm performance. It opens avenue for further research on the impact of offshore outsourcing on performance. By separating the offshoring dimension from the outsourcing dimension we also see that the theoretical arguments in the domestic setting need to be modified when analyzing the international setting, further advancing theory.

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Figure 1
Percentage of firms undertaking technology offshore outsourcing and technology onshore outsourcing over time

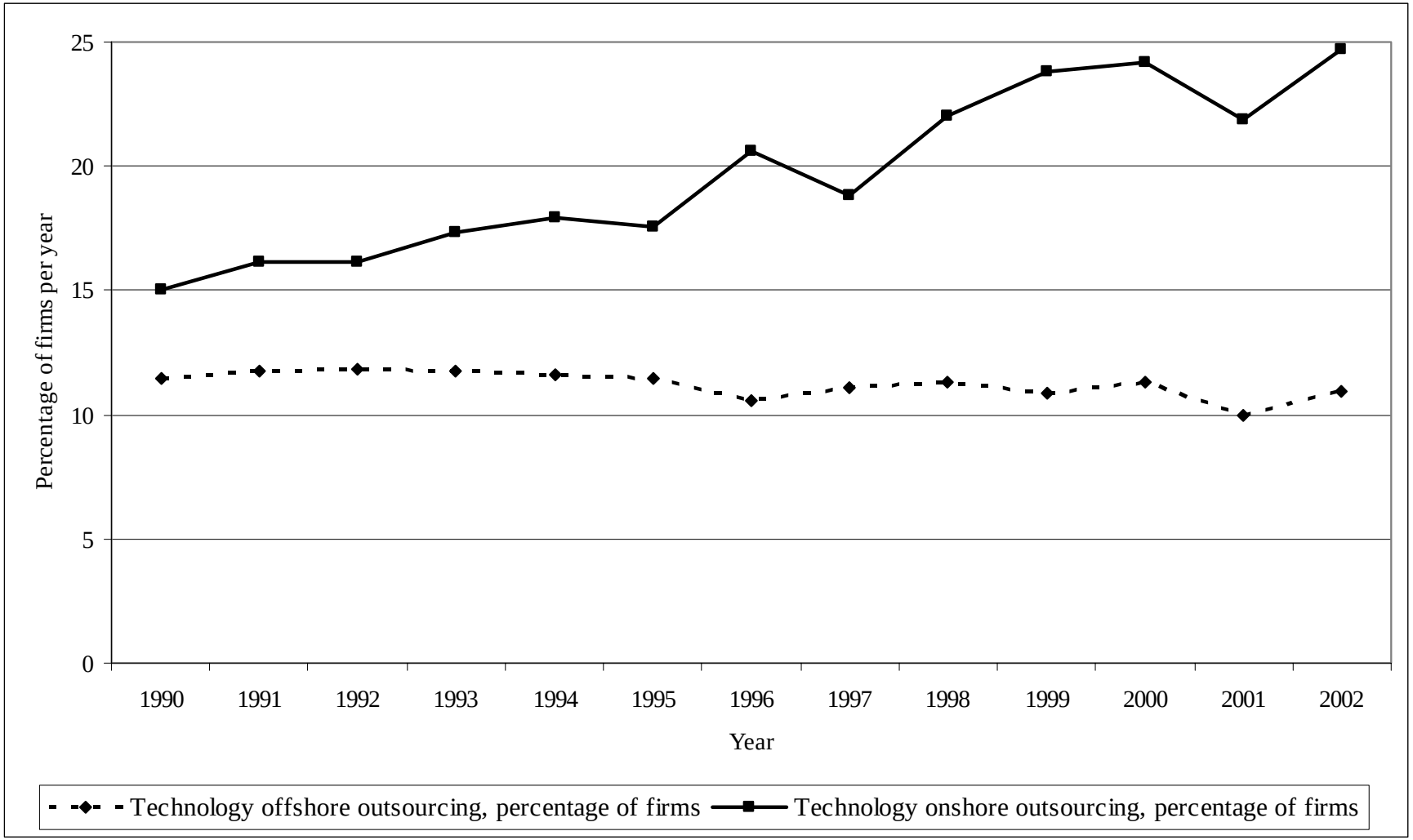

Figure 2
Average expenditures on technology offshore outsourcing and technology onshore outsourcing over time for outsourcing-active firms

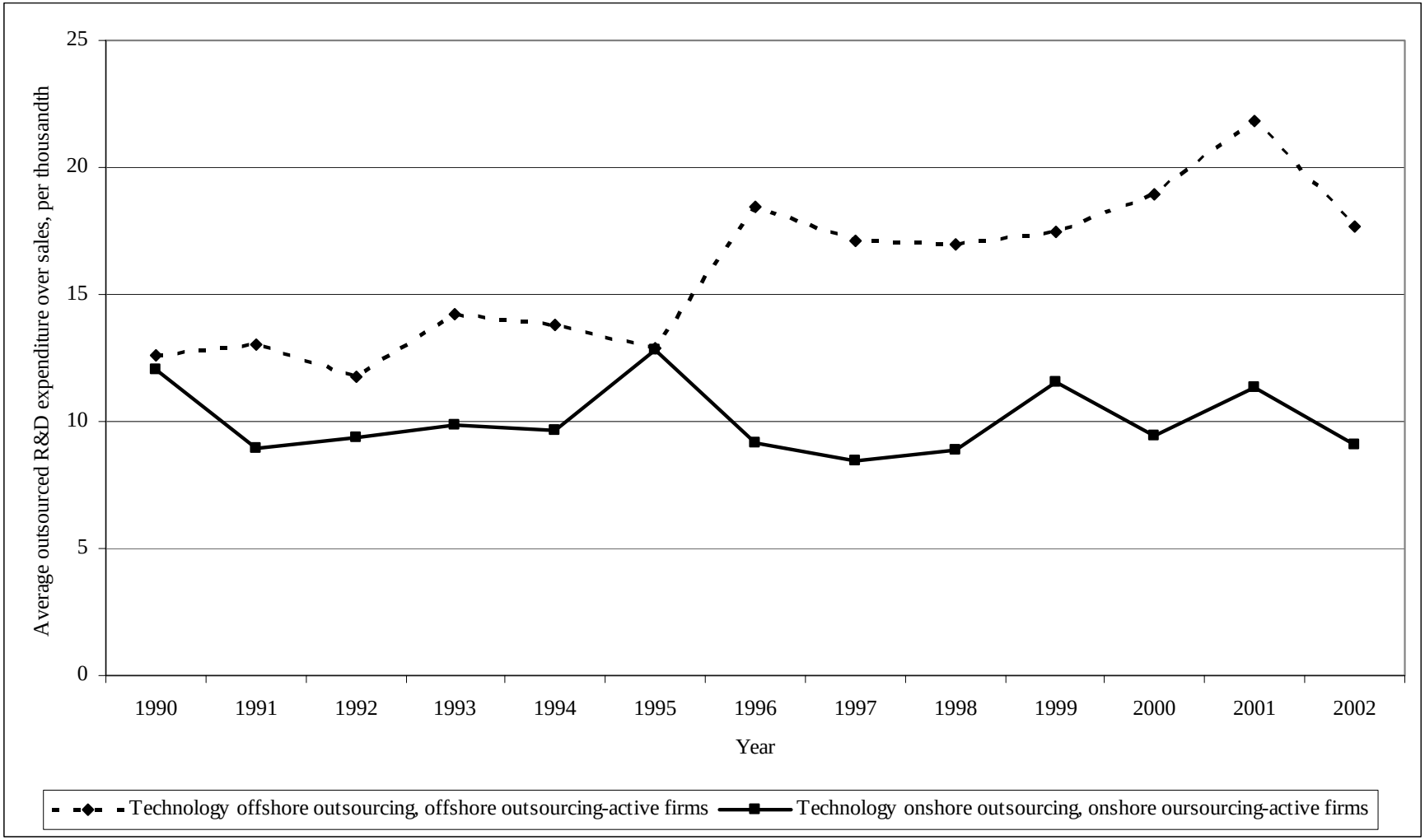

Figure 3
Percentage of firms that undertake technology offshore outsourcing and onshore outsourcing by industry

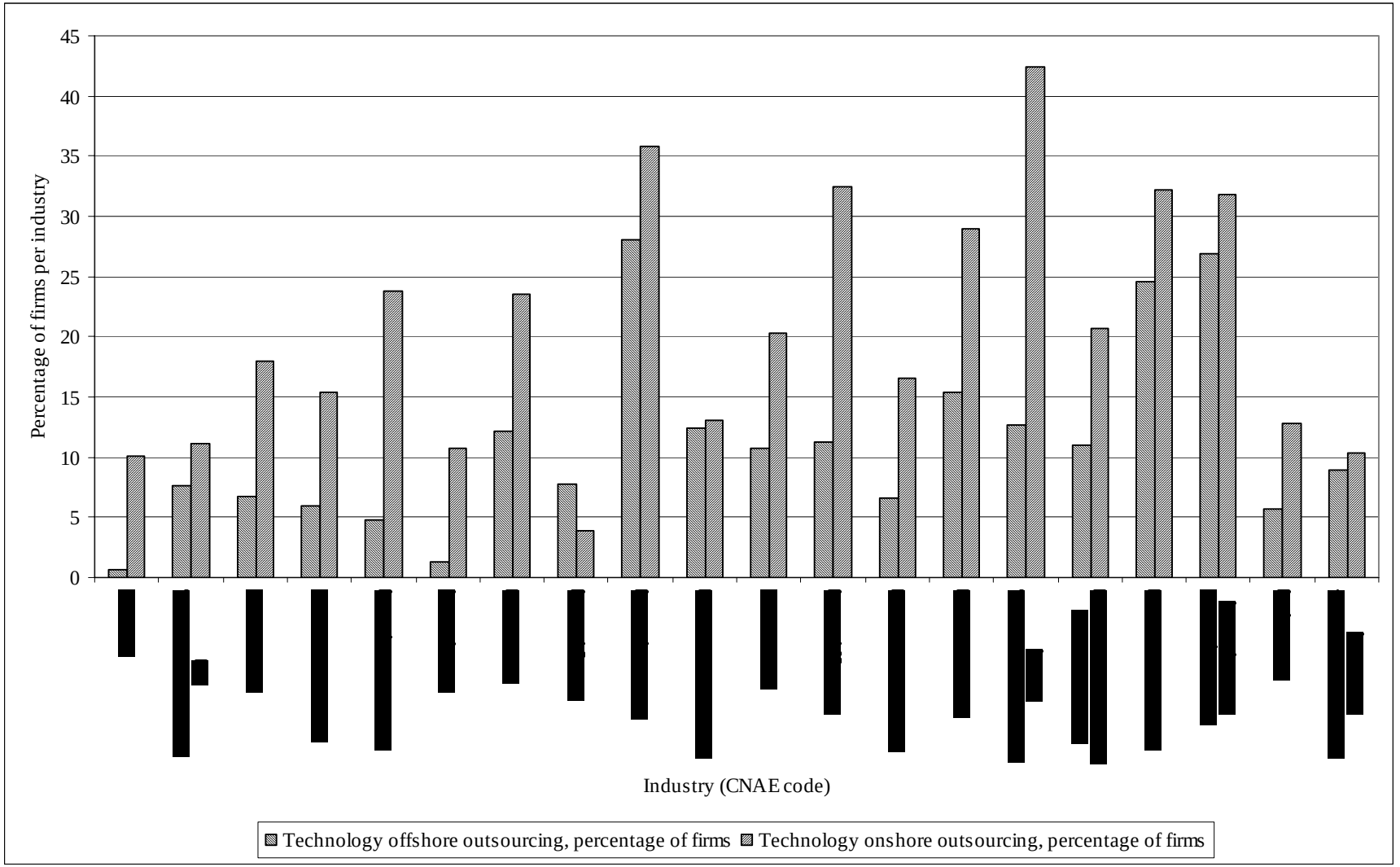

Figure 4
Percentage of firms undertaking technology offshore outsourcing and technology onshore outsourcing by firm size

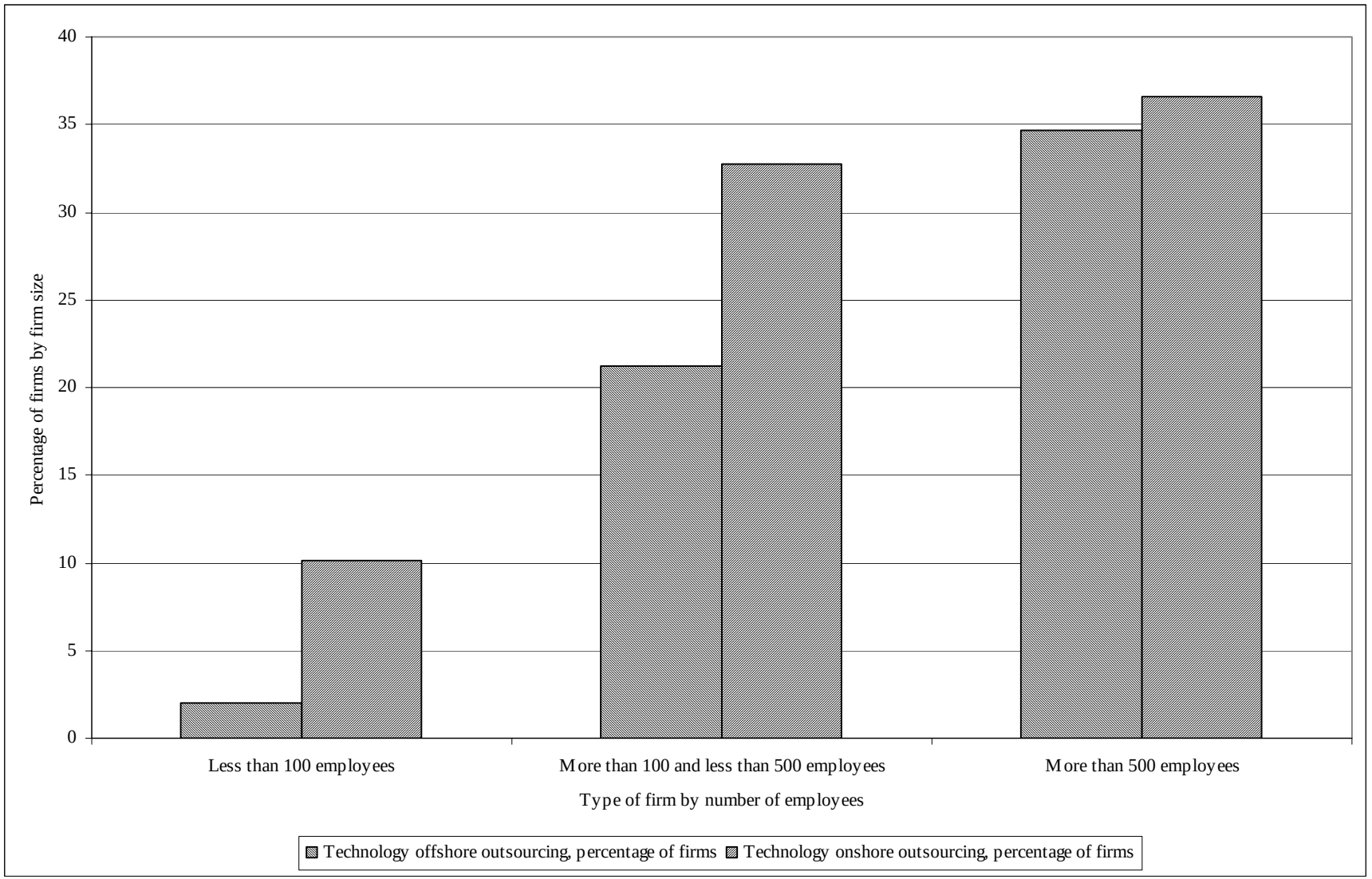

Table I
Summary statistics and correlation matrix

	Mean	Std dev	1		2		3		4		5		6		7		8		9	
1. ROS	9.192	9.798	1.000																	
2. ROA	20.963	23.145	0.615	***	1.000															
3. ROE	27.413	27.845	0.645	***	0.669	***	1.000													
4. Technology onshore outsourcing	2.018	11.544	0.021	+	0.005		0.007		1.000											
5. Technology offshore outsourcing	2.009	9.694	0.041	**	0.003		0.024	*	0.056	***	1.000									
6. Technology offshore outsourcing experience	0.106	0.308	0.049	***	-0.012		0.019	+	0.027	*	0.536	***	1.000							
7. MNC	0.010	0.101	-0.045	***	-0.055	***	-0.044	***	-0.013		-0.009		-0.009		1.000					
8. Subsidiary of foreign MNC	0.230	0.421	0.116	***	-0.043	***	0.049	***	0.009		0.258	***	0.352	***	0.017		1.000			
9. Size	4.406	1.478	0.111	***	-0.064	***	-0.015		0.080	***	0.193	***	0.339	***	0.082	***	0.446	***	1.000	
10. Age	28.251	22.152	0.025	*	-0.082	***	-0.080	***	0.025	*	0.043	***	0.153	***	0.017		0.181	***	0.339	***

Significance levels: + $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table II
Results of the analyses of technology offshore outsourcing and onshore outsourcing on performance

	Random effects regression with errors clustered by firm			Fixed effects regression with errors clustered by firm			Random effects regression with AR1 correction for serial correlation			Fixed effects regression with AR1 correction for serial correlation			GEE population averaged with AR1 disturbances and clustered errors by firm		
Dependent Variable: Return on Sales															
	Model 1			Model 2			Model 3			Model 4			Model 5		
Technology onshore outsourcing	0.004	(0.012)		0.000	(0.011)		0.005	(0.010)		0.000	(0.010)		0.021	(0.014)	
Technology offshore outsourcing	0.007	(0.001)	***	0.007	(0.001)	***	0.009	(0.004)	*	0.050	(0.017)	**	0.009	(0.001)	***
Technology offshore outsourcing experience	-0.082	(0.627)		0.048	(0.717)		-0.164	(0.603)		-0.698	(0.755)		0.112	(0.644)	
MNC	-3.550	(1.558)	*	-0.330	(1.163)		-3.727	(2.103)	+	0.226	(3.225)		-5.632	(2.213)	*
Subsidiary of foreign MNC	1.007	(0.682)		-0.134	(0.920)		1.037	(0.556)	+	-0.156	(0.822)		0.860	(0.602)	
Size	0.143	(0.268)		-0.349	(0.564)		0.173	(0.189)		-0.218	(0.489)		0.372	(0.196)	+
Age	-0.032	(0.015)	*	-0.303	(0.058)	***	-0.032	(0.013)	*	-0.195	(0.195)		-0.032	(0.014)	*
Constant	9.564	(1.633)	***	13.458	(3.588)	***	9.408	(1.613)	***	12.527	(3.887)	***	8.474	(1.653)	***
F or X2	208.300		***	29.320		***	172.320		***	1.800		***	244.020		***
Dependent Variable: Return on Assets															
	Model 6			Model 7			Model 8			Model 9			Model 10		
Technology onshore outsourcing	0.010	(0.021)		0.005	(0.021)		0.017	(0.021)		0.019	(0.023)		0.050	(0.039)	
Technology offshore outsourcing	0.017	(0.003)	***	0.019	(0.003)	***	0.022	(0.009)	*	0.078	(0.027)	**	0.021	(0.003)	***
Technology offshore outsourcing experience	0.203	(1.190)		-0.251	(1.368)		0.295	(1.315)		-1.832	(1.607)		1.343	(1.114)	
MNC	-6.654	(3.298)	+	-0.801	(3.045)		-7.492	(4.557)	+	2.539	(7.204)		-9.386	(4.232)	*
Subsidiary of foreign MNC	-0.467	(1.084)		0.212	(1.401)		-0.696	(1.204)		-0.223	(1.793)		-0.604	(1.181)	
Size	-0.883	(0.484)	+	0.018	(1.273)		-0.933	(0.410)	*	-0.014	(1.128)		-1.353	(0.528)	**
Age	-0.099	(0.028)	***	-1.102	(0.129)	***	-0.094	(0.028)	***	0.089	(0.291)		-0.054	(0.023)	*
Constant	35.852	(3.545)	***	36.302	(8.615)	***	36.115	(3.486)	***	-23.484	(4.335)	***	35.264	(3.563)	***
F or X2	276.740		***	556.960		***	198.750		***	4.670		***	368.590		***
Dependent Variable: Return on Equity															
	Model 11			Model 12			Model 13			Model 14			Model 15		
Technology onshore outsourcing	0.015	(0.022)		0.006	(0.021)		0.019	(0.024)		0.016	(0.025)		0.000	(0.049)	
Technology offshore outsourcing	0.019	(0.002)	***	0.024	(0.003)	***	0.025	(0.010)	*	0.057	(0.028)	*	0.100	(0.046)	*
Technology offshore outsourcing experience	1.424	(1.573)		1.360	(1.900)		0.878	(1.522)		-0.862	(1.929)		2.443	(1.577)	
MNC	-5.494	(4.374)		0.579	(3.912)		-6.729	(5.157)		-0.588	(8.700)		-14.901	(7.937)	+
Subsidiary of foreign MNC	3.126	(1.405)	*	2.140	(2.083)		2.876	(1.381)	*	0.723	(2.188)		3.028	(1.426)	*
Size	-0.297	(0.533)		1.030	(1.508)		-0.413	(0.459)		1.646	(1.374)		-0.491	(0.565)	
Age	-0.129	(0.032)	***	-0.681	(0.147)	***	-0.122	(0.030)	***	0.284	(0.270)		-0.096	(0.030)	**
Constant	36.134	(4.542)	***	35.734	(8.902)	***	36.674	(3.878)	***	-14.730	(4.093)	***	34.937	(4.597)	***
F or X2	261.160		***	318.880		***	133.270		***	3.890		***	120.140		***

Industry and year controls are included in the models but not reported here. Data is lagged by one year. Robust standard errors appear in parentheses.
Number of observations: 9420. Number of firms: 785. Number of years: 12. Significance levels: + $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$