Does information technology (IT) enable firms to globalize their operations and achieve higher foreign revenues and foreign profits? Although several studies have argued that IT can help firms globalize their operations, few studies have empirically tested this research question. We identify and discuss three mechanisms that explain why IT investments enable firms to globalize their operations – value chain coordination, value chain configuration, and local responsiveness. Using data on 231 multinational firms for the years 1999 – 2006, we find that aggregate IT investments are positively associated with higher levels of revenues and profits from foreign operations. From a research perspective, this study identifies and elaborates on theoretical mechanisms that explain why IT helps firms achieve higher foreign revenues and foreign profits, two key measures of a firm’s globalization. By documenting how IT creates value for firms through enabling globalization, we extend the business value of IT literature that has so far touched on firm-level globalization benefits from IT investments only in passing. This study is also important from a managerial perspective, because an understanding of how IT influences foreign revenues and foreign profits can help firms make appropriate changes in their IT strategies and IT investments to improve competitiveness.

Key words: IT investments, globalization, multinational corporations, foreign revenues, foreign profits, value chain, coordination, configuration, responsiveness, business value of IT.
1. Introduction

Globalization offers significant opportunities for firms to achieve revenue growth, cost reduction and innovation. It presents multinational firms with strategic opportunities that are not available to purely domestic firms, such as the ability to acquire inputs from multiple locations and serve diverse markets. Over the past 50 years, international markets have contributed an increasing share of revenues and profits for U.S. firms. The share of international profits as a percentage of total profits rose from 5% during the 1960s to over 25% in 2008 (Aeppel 2007; Cooper 2008). U.S. and Japanese firms realized higher returns on sales in foreign markets than in domestic markets in the late 1990s (see Ito and Rose 2010). This trend is expected to continue and even accelerate in the future. For example, General Motors believes that in the next 10 years it could see as much as 75% of its car and truck sales outside the U.S. market (Reese 2008). Globalization also enables firms to access global availability of talent to reduce cycle time, spur innovation, and maintain or improve quality (Carmel and Agarwal 2002; Davis et al. 2006; Gupta and Wang 2009; King and Torkzadeh 2008; Lacity, Feeny and Willcocks 2003; Langer et al. 2009; Mani, Barua and Whinston 2006a; Oshri, Kotlarsky and Willcocks 2007; Ramasubbu et al. 2008; Rottman and Lacity 2004; Sobol and Apte 1995).

However, the advantages associated with globalization come with several risks in managing business operations across country borders. A presence in diverse locations presents multinational firms with higher levels of complexity, variability, unfamiliarity and uncertainty (Andersen and Foss 2005; Tractinsky and Jarvenpaa 1995). Entry into foreign markets creates local adaptation costs, and location differences create difficulties to transfer products, services, processes and information between headquarters and subsidiaries in various countries. Executives at multinational firms face the challenge to manage the operations of their
subsidiaries with each other and with headquarters, and to administer the firm as a coordinated
global network. To manage these risks and achieve the desired level of administrative
coordination, firms deploy a wide range of mechanisms (see Jaussad and Schapper 2006), of
which several include a critical role for information technology (IT) systems. Despite a
generally acknowledged importance of IT in enabling global strategy, relatively few studies have
focused on how IT investments facilitate globalization for firms.

This study poses the following research question: Does IT enable firms to globalize their
operations and achieve higher foreign revenues and foreign profits? We identify and discuss
three mechanisms that explain why IT investments enable firms to globalize their operations –
value chain coordination, value chain configuration and local responsiveness. We empirically
test the relationship between IT investments and globalization by using archival data from more
than 200 firms for the years 1999 – 2006.

This study makes important contributions to research and managerial practice. From a
research perspective, this study identifies and elaborates some of the theoretical mechanisms that
explain why IT helps firms to achieve higher revenues and profits from their globalization
efforts. By documenting how IT creates value for firms through globalization, we extend the
business value of IT literature (for reviews of this literature, see Barua and Mukhopadhyay 2000;
Brynjolfsson and Hitt 2003; Dedrick, Gurbaxani and Kraemer 2003; Lucas 1993) that has so far
touched on firm-level globalization benefits from IT investments only in passing. This study is
also important from a managerial perspective, because an understanding of how IT influences
globalization can help firms make appropriate changes in their IT strategies and IT investments
to improve competitiveness.
2. **Background and Theoretical Framework**

2.1 **Background**

Globalization has become an imperative for many large firms for several reasons. Globalization is an important vehicle for firms to simultaneously manage revenue growth and cost reduction (Farrell 2004). Globalization provides opportunities for revenue growth by expanding operations into new geographical areas, and opportunities to reduce costs through economies of scale and scope. For firms based in developed economies, globalization into emerging economies offers access to new markets and new workforce talent (Agtmael 2007; Prahalad and Lieberthal 2003; Wilson and Purushothaman 2003). According to an estimate, the top 10 firms in Dow Jones Industrial Average (which has 30 firms) that get the largest share of their sales from abroad are likely to grow an average of 8% in 2011, while the bottom 10 will only grow an average of 2% (Lahart 2010).

Further, many multinational firms such as General Electric, Danone, Nokia, Hewlett-Packard and Nestlé are using their presence in emerging markets to create disruptive innovations and develop new products and offerings for new customer segments such as the bottom-of-the pyramid (Bower and Christensen 1995; Jana 2009; Prahalad and Hammond 2002). These innovations can then be brought to other markets to compete more effectively or serve underserved segments (Fagan, Yoshino and Bartlett 2006; Jana 2009), a phenomenon characterized as “reverse flows” (Immelt, Govindarajan and Trimble 2009) in contrast to “corporate imperialism” of the past (Prahalad and Lieberthal 2003). Some of these reasons such as access to new technologies, customers and sources of innovation also apply for firms based in emerging markets to expand in developed markets (The Economist 2009; Whitaker et al. 2009). Other factors that are creating a push towards globalization include deregulation, increased
competition, improved transportation infrastructure, and supplier firms following customer firms to new manufacturing locations. These factors and the potential of globalization have motivated many large firms to greatly expand operations outside their home countries.

Although there is a general agreement on the importance and potential of globalization, many significant barriers remain. Some of these barriers relate to cultural, administrative, geographic, political and economic factors (Florida 2005; Freeman 2006; Ghemawat 2001). Despite much hype about the "death of distance" and the world becoming “flatter,” many measures of globalization (e.g., proportion of international telephone calls, foreign immigrants, foreign university students, foreign direct investment and tourist arrivals) are less than 10% of total activity (Ghemawat 2007b; Mithas and Lucas 2010). Even the current globalization of IT services, frequently cited as the most offshored of all business activities, is also around 10% of the immediately addressable market and much less of the total potential market (Farrell 2004; NASSCOM-McKinsey 2005).

Aside from the continuing debate on the problems and prospects of globalization (Bhagwati 2004; Guillen 2001; Rodrik 1997; Stiglitz 2007), researchers beginning with Porter (1985; 1986) have frequently mentioned IT as a facilitator of globalization (Cairncross 1997; Ghemawat 2007b; Tallman 2001). Friedman (2005) argues that IT has played an important role in the ten forces that have contributed to a flat world, and that IT developments such as open source, improved workflow software, and the Internet have created significant opportunities for the cross-border movement of knowledge and businesses. The use of IT by firms to facilitate communication among managers across functional and geographical boundaries enhances the coordination of multinational activities and the development of strategic opportunities (Andersen and Foss 2005; Kettinger, Marchand and Davis 2010; Sia, Soh and Weill 2010). The
globalization of IT has been facilitated by the emergence of global standards such as the Capability Maturity Model (CMMI) (Agrawal and Chari 2007), and the improved maturity and capability of global IT and business process outsourcing (BPO) vendors such as IBM, HP, TCS, Infosys and Wipro. In fact, offshore BPO emerged as IT outsourcing vendors gained understanding during the 1990’s, and then began specializing in functional areas where they would handle business processes along with the underlying IT (Pfannenstein and Tsai 2004).

2.2 Prior Literature

Although prior research has contributed significantly to our understanding of economic drivers of globalization and the relationship between globalization and firm performance (see Tallman 2001 for a review), few studies have investigated whether and how IT helps firms globalize their operations to generate foreign revenues and foreign profits. Observations of Cash et al. (1988, p. 212) about international IT “a major, largely unreported, understudied IT story” still seem relevant, despite significant progress along some key dimensions.

Prior work suggests that IT infrastructure plays an important role in the globalization of firms by facilitating efficiency, responsiveness and learning (Apte and Mason 1995; Boudreau et al. 1998; Ives and Jarvenpaa 1991; Ives, Jarvenpaa and Mason 1993; Jarvenpaa and Ives 1993; Kettinger et al. 2010; Palmisano 2006). Several case studies provide support for these arguments (e.g., Bloch and Schaper 2009; Khanna and Nanda 2006; Mandviwalla and Palmer 2008; Marchand 2002; Puri 2007). IT systems have a pervasive influence on the strategy, structure and operations of multinational firms, and on the relationship between headquarters and subsidiaries to facilitate global management of firm resources (Finnegan and Longaigh 2002; Kettinger et al. 2010; Sambharya, Kumaraswamy and Banerjee 2005).
Among globalization-related studies in the Information Systems literature, researchers have focused primarily on how IT can support global strategy (Ives and Jarvenpaa 1991; Ives et al. 1993; Jarvenpaa and Ives 1993; Kettinger et al. 2010), how firms can manage global IT departments (King and Sethi 1999; Rao, Brown and Perkins 2007; Sia et al. 2010), employment structures and compensation of IT professionals in labor markets outside the U.S. (Ang, Slaughter and Ng 2002; Slaughter and Ang 1995; Slaughter, Ang and Boh 2007), globalization of IT labor and mobility of IT professionals across country borders (Mithas and Lucas 2010), and globalization of IT and other business processes (Apte and Mason 1995; Carmel and Agarwal 2002; Carmel and Tjia 2001; DiRomulado and Gurbaxani 1998; Espinosa, DeLone and Lee 2006; Espinosa et al. 2007; Lacity et al. 2003; Rottman and Lacity 2004; Sobol and Apte 1995). While these studies provide a good understanding of the role of IT infrastructure, IT departments and IT-enabled offshoring in globalization and as important levers to implement global strategy (Ives and Jarvenpaa 1991), there is need to understand the mechanisms through which IT investments contribute to globalization and the extent to which firm-level IT investments have created business value through foreign revenues and foreign profits.

Our work seeks to make unique contributions, although it is related to several prior studies that investigate how IT and diversification influence firm performance. Unlike some studies that examine complementarity between IT and diversification (particularly geographic diversification) in terms of their joint impact on firm performance (Chari, Devaraj and David 2007; Chari, Devaraj and David 2008; Ravichandran et al. 2009; Shin 2006), we study how IT contributes to globalization (to the extent foreign revenues may be considered a form of geographic diversification). In other words, we do not treat foreign revenues (a proxy for globalization or geographic diversification) as an exogenous factor as assumed in prior work;
instead we view allow IT to influence foreign sales and in turn firm performance. We adopt the "mediation" logic, in contrast to the "moderation" logic that informs prior work (see Baron and Kenny 1986 for a discussion of mediation versus moderation distinction). We also consider endogeneity of IT investments in our empirical models as we discuss later, because prior work suggests that diversified firms may have a higher demand for IT investments (Dewan, Michael and Min 1998; Hitt 1999).

2.3 Hypotheses

Drawing on and extending prior research in IS, strategy and international business, we posit that IT enables a firm’s globalization efforts through three mechanisms – value chain coordination or the facilitation of knowledge flows (Huber 1990; Kim, Park and Prescott 2003; Mudambi 2002; Porter 1986), value chain configuration (Apte and Mason 1995; King and Sethi 1999; Kogut 1985; Nachum and Zaheer 2005; Porter 1986; Sambharya et al. 2005), and local responsiveness or flexibility (Boudreau et al. 1998; Kettinger et al. 2010).

2.3.1 Value Chain Coordination

Value chain coordination is the first mechanism through which IT systems contribute to foreign revenues and foreign profits. This mechanism refers to the coordination of similar value chain activities (e.g., research, production, logistics and marketing) across different geographic locations (Porter 1986). Firms face a set of decisions for each value chain activity, and firms must determine the extent to which decisions will be made centrally by headquarters and/or autonomously by subsidiaries (Nohria and Ghosal 1994). As global units in a firm become specialized in particular value chain activities, the units become interdependent and must coordinate and integrate with each other to obtain necessary resources (King and Flor 2008; Peppard 1999). Coordination involves the management and exchange of information to make
decisions related to value chain activities, and the management and exchange of knowledge and resources necessary to perform the activities (Ensign 1999). Prior literature suggests that multinational firms can be viewed as a network of global knowledge flows (Gupta and Govindarajan 1994) and are one of the most efficient organizational vehicles to transfer and recombine knowledge and resources across borders (Kogut and Zander 1993). The ability of multinational firms to leverage knowledge from geographically disparate subsidiaries is an important source of competitive advantage (Immelt et al. 2009; Yang, Mudambi and Meyer 2008).

Foreign subsidiaries represent a means for multinational firms to assimilate new capabilities from local markets and integrate these capabilities across the firm, because foreign subsidiaries frequently take the initiative to engage in entrepreneurial activities and innovations that generate learning and value for the firm (Birkinshaw 1997; Gupta and Govindarajan 1994; Mudambi and Navarra 2004). The transfer of knowledge between subsidiaries and headquarters is critical for firms to develop and market new products, develop capabilities of other subsidiaries, and further expand markets (Lee et al. 2008). Knowledge seeking and market seeking can in turn generate foreign revenues and foreign profits for multinational firms (Nachum and Zaheer 2005).

The complexity of global operations increases the amount of information and knowledge firms must access and process to coordinate across units (Andersen and Foss 2005). IT systems facilitate value chain coordination and knowledge flows through provision of rich transmission channels and knowledge management systems for transfer and absorption of knowledge by headquarters and subsidiaries. These systems include knowledge repositories that contain corporate information and technical expertise, and knowledge directories that connect people
(Hansen, Nohria and Tierney 1999; Hong, Easterby-Smith and Snell 2006; Hsiao 2008; Kankanhalli, Tan and Wei 2007; MacCormack 2002). IT systems greatly expand the type, frequency, speed and volume with which multinational firms can input, store, extract and exchange structured information and unstructured knowledge throughout the firm (Finnegan and Longaigh 2002; Fulk and DeSanctis 1995). The systems enable firms to communicate knowledge to personnel in headquarters or subsidiaries who have the best experience and capabilities to make specific decisions, and provide infrastructure to share, distribute and absorb knowledge across geographic and functional boundaries, coordinate activities, develop strategic opportunities, and improve performance (Andersen and Foss 2005; Jean, Sinkovics and Kim 2008).

Texas Instruments (TI), one of the world’s largest semiconductor manufacturers, is a firm that uses IT for value chain coordination. For example, a financial exchange asked TI to develop a hand-held electronic tracking device for traders (Byrd and Sankar 1995). TI engineers in Texas began working on the design the next day. At the end of the U.S. workday, the TI engineers in Texas electronically transmitted their design work to TI engineers in Japan. At the end of the Japanese workday, the TI engineers in Japan electronically transmitted their design work to TI engineers in France. At the end of the European workday, the TI engineers in France electronically transmitted their design work back to the TI engineers in Texas. Less than 60 hours after the initial request, TI was able to provide a quote and show a computer-generated representation of the design to the customer (Byrd and Sankar 1995). This value chain coordination has enabled TI to leverage its global resources and generate significant foreign revenue. In 2009, TI generated almost 90% of its revenue from outside the U.S.

2.3.2 Value Chain Configuration
Value chain configuration is a second mechanism through which IT systems contribute to foreign revenues and foreign profits (Apte and Mason 1995; King and Sethi 1999; Kogut 1985; Nachum and Zaheer 2005; Porter 1986; Sambharya et al. 2005). This mechanism refers to the manner in which firms build the capacity to perform value chain activities globally and disperse those activities across different geographic locations (Kogut 1985; Porter 1986). Value chain configuration allows a firm to benefit from arbitrage due to cost differences, or economies of scale and scope due to aggregation (Ghemawat 2007a). Firms have two motives to configure their value chains across various geographic locations. One motive is to seek efficiencies or search for low-cost resources or export platforms, and the second motive is to seek new markets and new customers (Nachum and Zaheer 2005; Sambharya et al. 2005). By reconfiguring its value chain activities, a firm can achieve efficiencies through centralized administrative coordination, control of resources, and performance measurement. In addition, firms can produce and innovate in low cost markets and sell in high return markets (Ensign 1999), generating additional foreign revenues and foreign profits.

IT systems can help firms to reconfigure their value chains to standardize functions such as manufacturing and R&D (Hagel III and Brown 2001; Hagel III and Singer 1999), which can improve the profitability of multinational firms (Doz and Prahalad 1984; Hamel and Prahalad 1983). IT allows firms to disaggregate their value chains by codifying, standardizing and modularizing value chain activities (Apte and Mason 1995; Mithas and Whitaker 2007). Firms can use IT to extract information and knowledge components of production inputs and business processes, and move those components around the world to perform each value chain activity in the location where it can be best accomplished (Boudreau et al. 1998; Jarvenpaa and Ives. 1994; King and Sethi 1999). IT systems enable multinational firms to treat subsidiaries as component
pieces, which allows firms to locate activities across subsidiaries and geographies as appropriate (Gupta and Govindarajan 1991; Palmisano 2006). For example, corporate databases encode the firm’s policies and procedures, so subsidiaries are fully informed and can properly perform the procedures (Finnegan and Longaigh 2002). Integrated planning and reporting systems enable subsidiaries to report their progress to headquarters, and facilitate review by headquarters to ensure that policies are followed. The disaggregated and modularized activities can then be performed at the appropriate location and then re-aggregated in a seamless manner to achieve scale and scope economies and serve customer needs (Lacity and Fox 2008; Lewin and Couto 2007; Lewin, Massini and Peeters 2009; Mani, Barua and Whinston 2006b; Whitaker, Mithas and Krishnan 2010).

General Motors (GM), one of the largest global auto manufacturers, is a firm that uses IT for global value chain configuration. GM manufactures and assembles cars in 24 countries, and in 2009 GM generated over 50% of its revenue outside the U.S. GM is in process of transitioning to global vehicle platforms, global sourcing, and global production scheduling, and must manage procurement, research and development, and manufacturing functions across global locations. IT will be an important part of this transition, as GM’s IT personnel are working to extract data from regional systems and provide near real-time information so planners can make timely decisions on supply, demand, and global production management, scheduling, and scenario planning (Reese 2008).

2.3.3 Local Responsiveness

Local responsiveness is a third mechanism through which IT systems can contribute to foreign revenues and foreign profits. Local responsiveness refers to the ability of a firm to be sensitive to differences among individual countries and flexibility to react to unique preferences
and tastes of local customers and markets to create superior customer value (Boudreau et al. 1998; Ghemawat 2007a; Kettinger et al. 2010). Local responsiveness is important for firms operating in foreign markets, because global markets are constantly shifting and firms must tailor their offerings to local customer needs and their production systems to local infrastructure (Ghemawat 2007a). Products and services are frequently perceived differently across country boundaries and cultural contexts, and therefore require significant changes in product features, production and distribution approaches, advertising messages and pricing for tailoring to local markets (Hamel and Prahalad 1983).

IT systems allow firms to be more responsive to various local markets, while at the same time allowing them to replicate mass production of base commodities and support business processes. IT systems are an integral component of a mass customization strategy (Kotha 1995). Firms can use their IT and communications architecture to draw together marketing, R&D and production experts with the unique skills and knowledge of a particular local market, which enables the firm to respond and adapt with products and services that are tailored for customers in that market (Ramarapu and Lado 1995). Firms can also use technologies such as language translation software, the Internet, and CRM systems to customize promotion schemes for local market segments, and offer a personalized and differentiated product without making significant changes to the core product or service (Boudreau et al. 1998; Peppers and Rogers 1999; Pine, Victor and Boynton 1993; Rigby and Ledingham 2004; Sambharya et al. 2005).

Manpower, one of the world’s largest providers of temporary employees, is a firm that uses IT for local responsiveness. In 2009, Manpower generated over 85% of its revenue outside the U.S. Manpower has 4,000 offices in 67 countries, and uses IT to respond to the specific needs of various markets. “There is an abundance of common systems which are 90% the same,
but the last 10% variance has to be retained to give that country a unique competitive advantage or it would lose business,” according to Manpower’s director of IS governance (Vowler 2005). For example, Manpower runs a job posting website in Nordic countries (in addition to temporary staffing) to compete more effectively with its primary competitor in that region, and Manpower sends job information to temporary employees on mobile phones in the Netherlands to be competitive in that market.

Just as the motivations of firms to seek new efficiencies and new markets are not mutually exclusive and are sometimes driven by the same assumptions (Zaheer and Makranhani 2001), the uses of IT for value chain coordination, value chain configuration, and local responsiveness are also not mutually exclusive (Ensign 1999; Peppard 1999). HSBC, one of the largest global banks with $100 billion in annual revenue and 8,000 locations in 80 countries, is a firm that uses IT to achieve all three objectives. For value chain coordination, in 2007 HSBC developed a central database of direct lending exposure to coordinate global risk management and reporting. HSBC also established a group-wide electronic credit application process and corporate credit application system, to standardize business processes and increase profitability. For value chain configuration, HSBC established HSBC Global Technology in India in 2002, then established Global Technology Centers in China and Brazil, and transferred back office processing functions to centers in India and China (Farhoomand and Huang 2009). By 2007, HSBC had over 18,000 employees across Asia serving divisions in North America, Europe, Asia and the Middle East, and generated annual savings of $67 million. For local responsiveness, HSBC deployed IT applications to meet the needs of customers in various geographies. For example, HSBC launched mobile phone banking in Brazil, a country where consumers are particularly technology-savvy; and Merrill Lynch HSBC launched online brokerage and banking
services for affluent customers in Australia and Canada (Farhoomand and Huang 2009). An article on HSBC’s technology strategy illustrates the connected nature of the theoretical mechanisms and their relationship with profitability. “…This project is aimed at improving customer experiences [local responsiveness] and it happens to have a significant cost advantage as well [profitability]…We can now move into a new market relatively easy [value chain configuration]…The project, which links disparate systems, has allowed the bank to automate many of its services [value chain coordination]” (Flinders 2008).

Procter and Gamble (P&G), one of the world’s largest consumer products companies, also illustrates a connection among the theoretical mechanisms. P&G sells products in 180 countries, and generates over 50% of its revenue outside the U.S. P&G wanted to position the SKII beauty product that originated in Japan as a premium brand sold in department stores through counter sales personnel. P&G established IT systems to compliment the personal selling process, track customer transactions, and perform analysis across customer segments (Sia et al. 2010). While P&G positions most of its product lines for the mass market, these IT systems enabled P&G to respond to the needs of upscale Japanese department store shoppers and to establish the SKII product as a premium brand in this market. P&G has now deployed the SKII line and related IT systems in other international markets, progressing from the use of IT for local responsiveness to the use of IT for value chain coordination and knowledge sharing across geographies.

Based on the previous discussion, we hypothesize that IT investments will be associated with higher foreign revenues and foreign profits due to IT-enabled value chain coordination, value chain configuration, and local responsiveness. Thus,
H1: IT investments will be positively associated with foreign revenues for multinational firms.

H2: IT investments will be positively associated with foreign profits for multinational firms.

3. Research Design and Methodology

3.1 Data

The data for this study come from three sources. First, we obtained the data related to firm-level IT investments from InformationWeek surveys for the years 1999 – 2006. InformationWeek surveys are considered to be reliable, and have been used in prior academic studies (Bharadwaj, Bharadwaj and Konsynski 1999; Rai, Patnayakuni and Patnayakuni 1997; Santhanam and Hartono 2003). Respondents are Chief Information Officers, Chief Technology Officers, or other senior-level IT executives with the most knowledge of firm-level IT investments and IT practices (Tallon, Kraemer and Gurbaxani 2000). The IT investment measure includes technology hardware, software, and systems, along with salaries and recruitment of IT professionals, IT-related services, and training. Given the comprehensiveness of this measure in capturing all IT-related expenses, this construct represents the overall information intensity of a firm’s operations.

Second, we collected data on foreign revenues from the Compustat Segments database. Third, we collected data on foreign profits from the Standard and Poor’s Compustat Industrial Annual (North America) database. The InformationWeek surveys include the name of each responding firm, and for publicly-traded firms we matched the IT-related data in the InformationWeek surveys with the revenue and profit data from Compustat. Revenue and profit are two widely used performance measures for multinational firms (Dunning and Lundan 2008;
Luo 2003). We collected complete *InformationWeek* and Compustat data for 776 observations from 231 firms (average 3.4 observations per firm) across the eight years to create an unbalanced panel data set. We control for firm size (employees and assets), firm capital intensity, industry and industry concentration in our models because these variables have been shown to influence firm multinationality (broadly similar to our measure of foreign revenues) (Kirca et al. 2010), and may also influence foreign profits. We also control for year, to account for time-based effects that would be common to all firms.

We use the following dependent variables in this study.

*Foreign revenues:* Foreign revenues, in millions of US dollars. This variable is from the Compustat Segments database.

*Foreign profits:* Foreign profits, in millions of US dollars. This variable is from the Compustat Industrial Annual database.

We use the following explanatory and control variables in this study.

*IT investments:* Aggregate IT investments, in millions of US dollars, including technology hardware, software, and systems, along with salaries and recruitment of IT professionals, IT-related services, and training. This variable is from *InformationWeek.*

*Employees:* Firm size measured by the number of employees, in hundreds of thousands. This variable is from the Compustat Industrial Annual database.

*Assets:* Firm size measured by total assets, in millions of US dollars. This variable is from the Compustat Industrial Annual database.

Manufacturing industry: Whether the firm belongs to the Manufacturing industry as compared with the Services industry (Manufacturing=1, Services=0). We code the industry based on the NAICS (North American Industry Classification System) code from the Compustat Industrial Annual database.

Industry concentration: Industry concentration and industry competitiveness as measured by the Herfindahl Hirschman Index (HHI). Following Hou and Robinson (2006), the HHI for an industry j is measured as follows:

\[ \text{HHI} = \sum s_{ij}^2 \]  where \( s_{ij} \) is the market share of firm i in industry j.

Year: Dummy variable for each year 1999 – 2006.

Table 1 provides descriptive statistics for the firms in our study. On average, firms in our sample have annual foreign revenues of $14.35 billion and annual foreign profits of $0.55 billion, for an average annual profit rate of 3.8% from foreign operations. We also computed foreign revenues as a percentage of total revenues and foreign profits as a percentage of total profits in our sample. Firms in our sample derived 38.0% of their revenues and 18.8% of their profits from foreign operations. We did not include firms in our analysis for which foreign revenues or foreign profits were reported as 100% or greater than total revenues or total profits, respectively. On average, firms in our study spent $0.40 billion on IT each year. Note that this figure represents total global spending on IT, including both domestic and foreign operations. Firms in our study had an average of $23.83 billion in total assets, and 67% of the firms in our study belong to the manufacturing sector.

Table 2 provides year-wise summary statistics for key variables. This table shows that the number of annual observations is reasonably consistent throughout the 1999 – 2006 timeframe of this study. Figure 1 provides trends in average foreign revenues and foreign profits.
as a percentage of total revenues and total profits, respectively. This figure shows a slight downward trend in foreign revenues and foreign profits as a percentage of total revenues and total profits from 1999 – 2001, and a general upward trend in foreign revenues and foreign profits as a percentage of total revenues and total profits from 2001 – 2006. We note that the percentage of foreign revenues for the later years in our data set is consistent with the percentage reported by Aeppel (2007) and Cooper (2008) for the similar timeframe, which provides added confidence in our data and empirical results.

Table 3 reports correlations among variables. As would be expected, foreign revenues are positively correlated with foreign profits (0.67). IT investments are positively correlated with foreign revenues (0.65) and foreign profits (0.58). The correlations of IT investments with foreign revenues and foreign profits are statistically significant at p<0.05, and are consistent with arguments in the theory section.

3.2 Empirical Models and Econometric Issues

We use a linear model estimation approach to relate IT investments with foreign revenues and foreign profits. We specify the following equation for the panel models.

$$ Y_{it} = X_{it} \beta + u_{it} + \varepsilon_{it} $$

where $Y$ represents the endogenous variables foreign revenues and foreign profits; $X$ is the vector of firm and environmental characteristics such as IT investments and time period, respectively; $\beta$s are the parameters to be estimated, $i$ and $t$ are subscripts that refer to firms and time periods, respectively; $u_{it}$ represents unobserved time-invariant fixed factors associated with a firm $i$, and $\varepsilon$ is the error term associated with each observation. In our context, time period may influence the relationship between IT investments and dependent variables, and we test the robustness of our results by accounting for this variable. While there may be other variables that
might influence globalization, to the extent these variables are uncorrelated with IT investments, omitting them from our models is unlikely to bias our estimates. For example, foreign government subsidies may influence the location choice of firms and revenue composition across countries, and transfer pricing policies and currency fluctuations may influence foreign profits. However, foreign subsidies, transfer pricing policies, and currency fluctuations are unlikely to significantly affect firm’s IT investments.

Because of the presence of unobserved time-invariant fixed factors $u_i$ in the composite error term $v_{it} (= u_i + \varepsilon_{it})$, the $v_{it}$ are likely to be serially correlated across time for the same firm. One way to eliminate the $u_i$ is to use the first difference of all variables. An alternative method, called the fixed effect or within transformation, works better if data are available for more than two time periods for the same firm. In this method, instead of subtracting the value of prior observations for a firm as in first differencing, one subtracts the time averages for each variable and then estimates the model. The fixed effects estimator allows for arbitrary correlation between $u_i$ and explanatory variables, but does not allow estimation of parameter estimates for any time-invariant explanatory variables. Therefore, we do not include the industry variable in the fixed effects models. Compared with fixed effect models, random effects models (that utilize variation within each firm through time and variation between firms) provide more efficient parameter estimates while accounting for unobserved time-invariant industry or firm-level factors if they are uncorrelated with explanatory variables (Baltagi 2001). Instead of subtracting time averages from each variable as in fixed effects estimation, random effects models subtract a fraction of time average (a procedure called quasi-demeaning) where the fraction depends on the variance of $u, \varepsilon$ and time periods $T$. After quasi-demeaning of data and using a generalized least
square solution, any resulting serial correlations would be due to the underlying random error $\varepsilon_{it}$ in equation 1 and not to the fixed error $u_i$ (Wooldridge 2002).

Both random and fixed effect models assume exogeneity of $X$s (i.e., $E[\varepsilon_{it} | X_i, u_i] = 0$). We conducted a Hausman (1978) test to assess potential endogeneity of the IT investments variable following a procedure recommended by Wooldridge (2003). In this procedure, we regressed the value of the IT investments variable on lagged values for IT spending and other $X$s in our model. We used the predicted value of IT spending from this model to compute predicted residuals for IT investments. We then used this predicted residual in the foreign sales and foreign profits models along with the contemporaneous IT investments variable. Because the predicted residual was not statistically significant, our test failed to reject the null hypothesis for exogeneity of IT investments. Results of this test alleviate concerns about endogeneity of the IT investments variable in our models.

Table 4 shows the results of the estimation model for IT and foreign revenue, and table 5 shows the results of the estimation model for IT and foreign profits. We report results of the fixed effects models in tables 4 and 5, which allow for arbitrary correlation between $u_i$ and the explanatory variables. Although these models typically use exchangeable covariance structure, we also specified the AR(1) covariance structure as a robustness check and obtained essentially similar results.

4. Results

Hypothesis 1 predicted that IT investments will have a positive association with foreign revenues. We find support for this hypothesis, as a $1$ million increase in IT investments is positively associated with a $2.9$ million increase in foreign revenues (column 1 of table 4).
Hypothesis 2 predicted that IT investments will have a positive association with foreign profits. We also find support for this hypothesis, as a $1 million increase in IT investments is associated with a $0.28 million increase in foreign profits (column 1 of table 5). In addition to increasing foreign profits through IT investments, other research (Mithas et al. 2008) finds that firms also increase total profits by IT investments, so that the total increase in profits is greater than the total investment in IT.

We conducted four additional analyses to check robustness of our results. First, we used random effects models and obtained generally similar results. Second, we estimated our models using seemingly unrelated regression (SURE), which allows error terms of the foreign revenues and foreign profits models to be correlated. Table 6 provides results of the SURE models, and shows that these results are qualitatively similar to results of fixed effects models. Third, we estimated our models using three-stage least squares (3SLS) simultaneous equation models. In this approach, we estimated foreign revenues and foreign profits models while allowing correlations among error terms of these models. As is common in models based on a system of equations, we made identifying assumptions and in particular excluded predetermined variables (such as prior period IT investments) from the foreign revenue and foreign profits models. Table 7 provides results of the 3SLS models, and the 3SLS results are also qualitatively similar to the fixed effects results. Fourth, although we noted the exogeneity of IT investments, we estimated our models using two-stage least squares (2SLS) instrumental variables estimation and obtained qualitatively similar results. These robustness checks provide added confidence in the stability of our results.
5. **Discussion**

5.1 **Main Findings and Research Implications**

This study provides new insights on the extent to which IT enables firms to globalize their operations. We describe the mechanisms of value chain coordination, value chain configuration and local responsiveness, through which firms can apply IT to generate foreign revenues and foreign profits. While anecdotal evidence, case examples, and studies using perceptual measures (for example, Andersen and Foss 2005) suggest that IT has played an important role in globalization, this is one of the first studies to document the empirical relationship by showing a positive association of IT investments with actual foreign revenues and foreign profits of multinational firms. These are important findings because they show that the role of IT in globalization goes far beyond outsourcing and offshoring, topics that have received significant attention in the IS research.

We note four research implications of our study. First, the finding that IT investments are associated with foreign revenues suggests that IT can help overcome some of the challenges and risks associated with globalization and contribute to revenue growth of firms. This finding is particularly relevant for firms operating in developed markets where opportunities for growth are significantly limited due to market saturation, slower population and economic growth, and intense competition. Through prudent IT investments, firms can expand their operations to other countries that may have higher growth potential and relatively less competition, particularly if their competitors do not make necessary IT investments. To the extent that IT-enabled revenue growth is a more important driver of profits than IT-enabled cost reduction (Kaplan, Roberts and Sikes 2008), this finding implies that IT investments targeted at globalization (e.g., to expand overseas operations for marketing goods and services) can improve profits.
Second, the finding that IT investments are associated with foreign profits suggests that IT can help firms to capture the value generated through foreign revenues. Our results indicate that IT allows firms to manage cost effective and profitable growth in new markets. In turn, profits from foreign operations may open new opportunities for firms to invest in other promising markets, or to make further IT and other investments to create mobility barriers for sustained competitive advantage.

Third, although foreign revenues and foreign profits are important metrics to track success of firms on their globalization efforts, particularly from a managerial and stockholder perspective, the success of globalization efforts requires tracking other metrics such as the impact on job creation and wages in the domestic economy. If firms achieve higher revenue and profits outside the U.S. using manufacturing and R&D facilities outside the U.S., then the net impact on the domestic economy in terms of jobs and wages may not be substantial (Grove 2010) even if U.S. firms are able to capture a substantial portion of the overall value (Dedrick, Kraemer and Linden 2009). Some media reports suggest that U.S.-based multinationals cut 2 million jobs in the U.S. while accumulating sizable profits from 2000 – 2005 (Mandel 2008) and adding workers outside the U.S. Such reports raise the temptation to increase taxes on firms that "ship" jobs abroad, although it is not entirely clear if those jobs would remain in the U.S. under a different tax policy. If jobs outside the U.S. substitute for jobs inside the U.S., then creating disincentives to operate abroad may benefit U.S. jobs and wages. However, if jobs outside the U.S. complement jobs inside the U.S. as some argue (Baily, Slaughter and Tyson 2010), then it may be necessary to reconsider the creation of disincentives. For example, from 2000 – 2005 U.S.-based multinationals reduced their workforce by 12.5%, while overall manufacturing employment fell by 18% (Mandel 2008). This preliminary evidence suggests that even as U.S.-
based multinationals expand abroad, they need to maintain some headquarters personnel to serve global markets. There remains a need to fully assess the impact of globalization of U.S. firms on broader measures of economic activity in the domestic economy (e.g., employment and wages), which then has implications for tax and trade policies.

Another implication relates to the measurement of globalization and innovation-related activities for U.S. firms (Mandel and Coy 2009; Mandel, Hamm and Farrell 2006). Although federal government agencies track firm-level activities through the Economic Census (conducted by the Census Bureau every five years) and surveys of Foreign Direct Investment in the U.S. and U.S. Direct Investment Abroad (conducted by the Bureau of Economic Analysis every year), there remains a need to refine and supplement surveys items and reporting units to be consistent with the manner in which firms actually record their innovation investments and with the long-term outputs of those investments. Measuring the full range of innovative activities (not just outcomes such as patents), and accounting for digitization of business processes and products that defy neat classifications of domestic or foreign value-added will require collaborative interdisciplinary research. Such a research program will benefit immensely from the extant business value of IT research and the IS research on outsourcing, offshoring and global service disaggregation.

5.2 Managerial Implications

Our findings have important managerial implications. The finding of a positive association between IT investments and foreign revenues suggests that IT investments can help firms create infrastructure to generate additional revenues from their foreign operations. Further, IT investments can also provide additional profits from foreign operations. To the extent that a robust IT infrastructure is also associated with other benefits such as improved productivity,
customer satisfaction and organizational capabilities (Brynjolfsson and Hitt 1996; Brynjolfsson and Hitt 2003; Dedrick et al. 2003; Mithas, Krishnan and Fornell 2005; Mithas, Ramasubbu and Sambamurthy 2011), our results provide a lower bound of the benefits from IT investments. Based on these findings, managers can use IT-enabled globalization capabilities to justify IT investments.

Another managerial implication of our findings is that senior managers should pay attention to IT governance in their organizations. In the absence of personal involvement and commitment of top executives in IT-related decisions, there may be a greater likelihood for firms to underinvest in IT, which may compromise their organizational capabilities and ability to compete globally. Managers should consider the profit-generating potential of IT investments compared with other expenditures as they allocate their spending.

Finally, while not directly related to our empirical results, managers think of globalization more broadly than cost arbitrage opportunities such as outsourcing and offshoring, because an exclusive focus on short-term costs may or may not be consistent with long-term financial performance. U.S.-based multinational firms need to approach globalization of their business processes and value chains while being responsive to local needs, including sensitivity to concerns about employment generation in their communities, sustainability of their operations, and the positive spillover benefits of educating customers and suppliers. IT can help in these endeavors by facilitating communication and best-practice sharing across stakeholders.

5.3 Limitations and Future Research

We note some limitations of this study that can be overcome in future research. First, while this study uses a firm-level measure of total IT spending, future research using more disaggregated measures of IT spending (i.e., domestic IT spending and foreign IT spending) may
provide additional insights. Second, IT investments can enable firms to generate foreign revenues and foreign profits, and also to become more innovative by harnessing the creativity and talent of a global workforce. While several studies have examined how immigrants contribute to innovation output in an economy (Kerr and Lincoln 2010), the role of IT in the exchange of ideas within a multinational firm to improve innovation output remains an opportunity for research (Prahalad and Krishnan 2008).

In addition to future research to overcome the limitations of this study, there are also at least two more opportunities for future research. First, this study examined the effect of aggregate IT investments on globalization. Further research on how firms optimize their portfolio of IT applications in a global setting and how firms organize their IT governance processes to achieve these financial outcomes can be helpful to guide managerial decision-making. Second, further research is needed to more clearly elaborate how IT facilitates information and knowledge flows in global firms to improve real-time coordination and overcome cultural, administrative, geographical and economic barriers. Case studies and longitudinal studies with detailed data on how multinational firms use IT systems across geographies and subsidiaries, and with specific measures of inter-unit coordination and collaboration, can help to shed light on these issues.

To conclude, this study examines the effect of IT investments on foreign revenues and foreign profits of multinational firms. We identify and discuss three mechanisms that explain why IT investments enable firms to globalize their operations – value chain coordination, value chain configuration, and local responsiveness. We find that IT investments are positively associated with foreign revenues and foreign profits. Because globalization is a key component
of firm-level strategy and has become an imperative for success, these findings have important implications for firms' investments in IT assets to gain competitive advantage.


Hsiao, R.-L. "Knowledge sharing in a global professional service firm," *MIS Quarterly Executive* (7:3) 2008, pp 123-137.


**Figure 1.** Trends in Foreign Revenues and Foreign Profits for Firms in Our Sample

![Graph showing trends in foreign sales and profits from 1998 to 2006.]

**Table 1. Descriptive Statistics (n=776)**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foreign revenue (SMM)</td>
<td>14,349.39</td>
<td>27,769.31</td>
<td>3.49</td>
<td>210,189.30</td>
</tr>
<tr>
<td>Foreign profits (SMM)</td>
<td>548.37</td>
<td>1310.87</td>
<td>-3,166.00</td>
<td>15,375.00</td>
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<tr>
<td>IT investments (SMM)</td>
<td>397.98</td>
<td>840.43</td>
<td>0.00</td>
<td>10,009.20</td>
</tr>
<tr>
<td>Employees (000s)</td>
<td>45.33</td>
<td>69.94</td>
<td>0.80</td>
<td>698.60</td>
</tr>
<tr>
<td>Assets (SMM)</td>
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<td>98,397.16</td>
<td>161.30</td>
<td>1,520,140.00</td>
</tr>
<tr>
<td>Capital intensity</td>
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<td>0.17</td>
<td>0.01</td>
<td>0.79</td>
</tr>
<tr>
<td>Manufacturing</td>
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<td>0.47</td>
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<td>1.00</td>
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<tr>
<td>Industry concentration</td>
<td>0.07</td>
<td>0.06</td>
<td>0.02</td>
<td>0.88</td>
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</table>
Table 2. Year-wise Descriptive Statistics

<table>
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<th>Year</th>
<th>Foreign revenues</th>
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<th>IT investments</th>
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<td>Std. Dev.</td>
<td>Obs.</td>
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<td>398.67</td>
<td>803.63</td>
<td>66</td>
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<tr>
<td></td>
<td>314.08</td>
<td>508.08</td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td>14,936.33</td>
<td>6,547.13</td>
<td>99</td>
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<td></td>
<td>579.06</td>
<td>1,133.80</td>
<td>99</td>
</tr>
<tr>
<td></td>
<td>558.21</td>
<td>1,244.70</td>
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<tr>
<td>2001</td>
<td>12,779.93</td>
<td>20,475.29</td>
<td>94</td>
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<tr>
<td></td>
<td>370.87</td>
<td>1,020.05</td>
<td>94</td>
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<tr>
<td></td>
<td>409.41</td>
<td>680.56</td>
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<tr>
<td>2002</td>
<td>11,191.20</td>
<td>20,564.11</td>
<td>119</td>
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<td>323.23</td>
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<tr>
<td></td>
<td>340.60</td>
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<td>2003</td>
<td>13,452.29</td>
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<td>662.25</td>
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<td>327.08</td>
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<td>2004</td>
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<td>400.95</td>
<td>1,008.99</td>
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<tr>
<td>2005</td>
<td>19,194.30</td>
<td>38,947.78</td>
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<td></td>
<td>778.29</td>
<td>1,567.02</td>
<td>93</td>
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<tr>
<td></td>
<td>322.00</td>
<td>545.20</td>
<td></td>
</tr>
<tr>
<td>2006</td>
<td>18,340.32</td>
<td>38,715.17</td>
<td>87</td>
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<tr>
<td></td>
<td>1,148.10</td>
<td>2,578.49</td>
<td>87</td>
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<tr>
<td></td>
<td>520.23</td>
<td>1,071.24</td>
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<td>Total</td>
<td>14,349.39</td>
<td>27,769.31</td>
<td>776</td>
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<tr>
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<td>548.37</td>
<td>1,310.87</td>
<td>776</td>
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<tr>
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<td>397.98</td>
<td>840.43</td>
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Table 3. Pair-wise Correlations

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<th>6</th>
<th>7</th>
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<tr>
<td>1</td>
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<td></td>
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<td>2</td>
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<tr>
<td>3</td>
<td>0.650*</td>
<td>0.581*</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>4</td>
<td>0.642*</td>
<td>0.419*</td>
<td>0.564*</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>0.538*</td>
<td>0.564*</td>
<td>0.657*</td>
<td>0.360*</td>
<td>1.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>−0.147*</td>
<td>−0.100*</td>
<td>−0.128*</td>
<td>−0.038</td>
<td>−0.121*</td>
<td>1.000</td>
<td></td>
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<tr>
<td>7</td>
<td>0.035</td>
<td>−0.016</td>
<td>−0.040</td>
<td>−0.114*</td>
<td>−0.102*</td>
<td>0.106*</td>
<td>1.000</td>
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<tr>
<td>8</td>
<td>0.002</td>
<td>−0.013</td>
<td>0.059</td>
<td>0.190*</td>
<td>0.057</td>
<td>0.093*</td>
<td>−0.360*</td>
</tr>
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</table>
Table 4. Parameter Estimates for Influence of IT Investments on Foreign Revenues

<table>
<thead>
<tr>
<th></th>
<th>(1) Fixed effects</th>
<th>(2) Fixed effects with AR1</th>
</tr>
</thead>
<tbody>
<tr>
<td>IT investments</td>
<td>2.923*** (0.593)</td>
<td>1.228** (0.554)</td>
</tr>
<tr>
<td>Employees</td>
<td>3.701 (2.381)</td>
<td>-1.402 (2.972)</td>
</tr>
<tr>
<td>Assets</td>
<td>8,336*** (2,368)</td>
<td>16,694*** (2,930)</td>
</tr>
<tr>
<td>Capital intensity</td>
<td>7,992 (9,274)</td>
<td>-1,570 (13,297)</td>
</tr>
<tr>
<td>Industry concentration</td>
<td>-15,996 (24,949)</td>
<td>19,856 (32,977)</td>
</tr>
<tr>
<td>Observations</td>
<td>776</td>
<td>545</td>
</tr>
<tr>
<td>Number of firms</td>
<td>231</td>
<td>175</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.224</td>
<td>0.252</td>
</tr>
<tr>
<td>F statistic</td>
<td>12.79***</td>
<td>10.07</td>
</tr>
</tbody>
</table>

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.10
Models include an intercept and year dummy variables.

Table 5. Parameter Estimates for Influence of IT Investments on Foreign Profits

<table>
<thead>
<tr>
<th></th>
<th>(1) Fixed effects</th>
<th>(2) Fixed effects with AR1</th>
</tr>
</thead>
<tbody>
<tr>
<td>IT investments</td>
<td>0.278*** (0.047)</td>
<td>0.067** (0.032)</td>
</tr>
<tr>
<td>Employees</td>
<td>-385** (187)</td>
<td>12 (186)</td>
</tr>
<tr>
<td>Assets</td>
<td>709*** (186)</td>
<td>440** (189)</td>
</tr>
<tr>
<td>Capital intensity</td>
<td>1,104 (729)</td>
<td>906 (808)</td>
</tr>
<tr>
<td>Industry concentration</td>
<td>-3,825* (1,960)</td>
<td>1,581 (2,092)</td>
</tr>
<tr>
<td>Observations</td>
<td>776</td>
<td>545</td>
</tr>
<tr>
<td>Number of firms</td>
<td>231</td>
<td>175</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.177</td>
<td>0.219</td>
</tr>
<tr>
<td>F statistic</td>
<td>9.53***</td>
<td>8.38***</td>
</tr>
</tbody>
</table>

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1
Models include an intercept and year dummy variables.
Table 6. SURE Results

<table>
<thead>
<tr>
<th></th>
<th>(1) Foreign Revenues</th>
<th>(2) Foreign Profits</th>
</tr>
</thead>
<tbody>
<tr>
<td>IT investments</td>
<td>11.810*** (1.048)</td>
<td>0.507*** (0.054)</td>
</tr>
<tr>
<td>Employees</td>
<td>2.709*** (846)</td>
<td>-98** (44)</td>
</tr>
<tr>
<td>Assets</td>
<td>7.424*** (781)</td>
<td>445*** (40)</td>
</tr>
<tr>
<td>Capital intensity</td>
<td>-15.677*** (4.129)</td>
<td>-329 (214)</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>2.521 (1.547)</td>
<td>-58 (80)</td>
</tr>
<tr>
<td>Industry concentration</td>
<td>-7,937 (12,215)</td>
<td>-802 (632)</td>
</tr>
<tr>
<td>Observations</td>
<td>776</td>
<td>776</td>
</tr>
<tr>
<td>Number of firms</td>
<td>231</td>
<td>231</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.562</td>
<td>0.474</td>
</tr>
<tr>
<td>F statistic</td>
<td>74.9***</td>
<td>66.8***</td>
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</table>

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1
Models include an intercept and year dummy variables.

Table 7. Three-Stage Least Squares Results

<table>
<thead>
<tr>
<th></th>
<th>(1) Foreign Revenues*</th>
<th>(2) Foreign Profits*</th>
<th>(3) Foreign Revenuesb</th>
<th>(4) Foreign Profitsb</th>
</tr>
</thead>
<tbody>
<tr>
<td>IT investments</td>
<td>36.64*** (3.116)</td>
<td>0.24* (0.126)</td>
<td>20.2*** (3.132)</td>
<td>0.46*** (0.133)</td>
</tr>
<tr>
<td>Employees</td>
<td>-60 (1,173)</td>
<td>-94* (54)</td>
<td>2279** (980.6)</td>
<td>-135.4*** (49.17)</td>
</tr>
<tr>
<td>Assets</td>
<td>3,967*** (1.161)</td>
<td>329*** (53)</td>
<td>6510*** (1138)</td>
<td>418.4*** (55.94)</td>
</tr>
<tr>
<td>Capital intensity</td>
<td>-6,344 (4,849)</td>
<td>-4 (224)</td>
<td>-12555*** (4756)</td>
<td>-268.3 (236.6)</td>
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<tr>
<td>Manufacturing</td>
<td>1,412 (1,960)</td>
<td>-146 (91)</td>
<td>2011 (1744)</td>
<td>-118.9 (87.74)</td>
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<td>Industry concentration</td>
<td>-51,197*** (17,627)</td>
<td>-1,385* (815)</td>
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<td>-1150 (775.7)</td>
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<td>Number of firms</td>
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<td>107</td>
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<td>167</td>
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<tr>
<td>R-squared</td>
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<td>0.359</td>
<td>0.449</td>
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<tr>
<td>Chi-square</td>
<td>782***</td>
<td>156***</td>
<td>576***</td>
<td>483***</td>
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</table>

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1
Models include an intercept and year dummy variables.
*One-year and two-year lags of IT investment and year dummy variables used as instruments for IT investment
bOne-year lag of IT investment and year dummy variables used as instruments for IT investment