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Information Technology, Revenues and Profits: Exploring the Role of Foreign and Domestic Operations

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Abstract

How does information technology (IT) enable firms to globalize their operations and achieve higher foreign profits? We use archival data for multinational firms publicly-traded in the United States for the years 1999 – 2006, and find indirect evidence for the role of IT to help firms achieve higher foreign profits through revenue growth rather than cost reduction. Our findings suggest that foreign responsiveness plays a more important role in generating foreign profits than does value chain structure. Our exploratory analyses for the effect of IT on domestic revenues and profits suggest some evidence for equalization of returns across foreign and domestic operations. Among additional results, we find that R&D is positively associated with foreign revenues and foreign profits with an effect greater than that of IT, and advertising is positively associated with foreign revenues with an effect greater than that of IT. By documenting how IT creates value for firms through globalization, we extend the business value of IT and international business literatures that have so far touched on firm-level globalization benefits from IT only in passing. The findings can help managers decide how to allocate discretionary expenditures to achieve strategic objectives such as foreign and domestic revenues and profits, and the role of revenue versus cost mechanisms.

Key words: Globalization, multinational corporations, foreign revenues, foreign profits, IT expenditures, business value of IT.

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1. Introduction

Globalization is a double-edged sword. On one hand, globalization offers significant opportunities for firms to achieve revenue growth, cost reduction and innovation by presenting strategic opportunities that are not available to purely domestic firms, such as the ability to acquire inputs from other geographies and serve global markets. The share of international profits as a percentage of total profits for U.S. firms rose from 5% during the 1960's to over 25% in 2008 (Aeppel 2007). Apple, one of the world's most valuable firms by market capitalization, derived 65% of its net sales outside the U.S. and 63% of its segment operating income outside the Americas in 2015 (Apple 2015 Form 10K). Similar

patterns in globalization can also be found in emerging market multinational firms (Ramamurti 2012). On the other hand, a presence in diverse locations presents multinational firms with higher levels of complexity, variability, unfamiliarity and uncertainty (Andersen and Foss 2005). Entry into foreign markets creates adaptation costs, and location differences create difficulties to transfer products, services, processes and information between headquarters and subsidiaries. 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, few studies have focused on the manner in which IT spending facilitates globalization and the resulting implications for firm performance.

This study examines the effect of IT expenditures on foreign profits, an objective measure of success for a firm's globalization efforts.¹ We identify and discuss two theoretical mechanisms to explain why IT spending enables firms to globalize their operations – value chain structure and foreign responsiveness. We map these mechanisms to the measures of foreign costs and foreign revenues, respectively, and empirically test the relationship between IT expenditures and foreign profits using archival data for firms publicly-traded in the U.S. for the years 1999 – 2006. For further insights, we assess the relative magnitude of IT and other discretionary expenditures on foreign operations. We also conduct exploratory analyses for the effects of IT on revenues and profits for domestic operations. Because prior theory does not provide guidance for the comparative effects of IT in foreign versus domestic settings, we believe these exploratory analyses will create opportunities for "progressively more refined concepts and hypotheses" (Ragin 2014, p. 164) in future research, consistent with the practical and more encompassing view of scientific enquiry and theory-building (Davis 2010).

This study makes important contributions to research and managerial practice. From a research perspective, we believe this is the first study to explore whether and how firm-level IT expenditures influence foreign profits as a key dependent variable.² We use data on firm-level IT expenditures instead of industry-level IT data used in other studies (Nachum and Zaheer 2005; Rangan and Sengul 2009). We identify and elaborate the theoretical mechanisms to explain why IT helps firms achieve higher foreign profits. Prior literature argues that IT can enable firms to become more responsive and generate higher sales (revenue effects of IT) and/or IT can reduce coordination costs (cost effects of IT). However, whether firms actually realize differential IT-driven benefits from their foreign versus domestic

¹ We classify domestic and foreign activities based on the classifications in Compustat for firms that are publicly-traded in the U.S. Our sample does not include any overseas firms that are traded as American Depositary Receipts (ADRs) in the U.S. We use terms such as IT expenditures and IT spending interchangeably to describe our data on firm-level global IT expenditures, although some related studies use terms such as IT investments. There is little distinction among these terms in our context because from an accounting perspective, most large publicly-traded firms fully expense amounts for IT during the year in which those amounts are incurred.

² See Table A1 (Online Supplement) for the contributions of this study vis-a-vis related studies.

operations is an open empirical question. In addition, knowing the relative impact of theoretical mechanisms can help distinguish whether a firm's financial profits from globalization are determined more through revenue effects or cost effects, consistent with studies that articulate strategic focus using such objective measures (Kohli 2007; Mithas and Rust 2016; Mithas, Tafti, Bardhan and Goh 2012; Oh and Pinsonneault 2007). From a managerial perspective, an understanding of how IT influences globalization can help firms adjust their global IT strategies (revenue- vs. cost-focus) and IT expenditures to improve competitiveness because revenue and cost mechanisms have implications for the types of IT applications a firm should deploy. For example, if the revenue mechanism is more important, then firms may be better off deploying customer relationship management (CRM) systems that enhance their ability to generate higher foreign revenues. Alternatively, if the cost mechanism is more important, then firms may be better off implementing enterprise resource planning (ERP) systems to reduce costs through improved coordination.

2. Theoretical Framework

Globalization, defined as entry and expansion of business activities in multiple markets (Su 2013), has been argued as an imperative for large firms to simultaneously manage revenue growth and cost reduction (Farrell 2004; Ghemawat 2007b). Despite the acknowledgement of a role for IT to facilitate globalization (Andersen and Foss 2005; Kettinger, Marchand and Davis 2010; Sia, Soh and Weill 2010), some argue that diverse cultural and institutional factors will continue to demand sensitivity to the needs of foreign markets as firms globalize their operations (Kraemer, Dedrick, Melville and Zhu 2006). Although prior research provides a good understanding of the role of IT infrastructure, IT departments and IT-enabled offshoring in globalization, there remains a need to understand the mechanisms through which IT expenditures contribute to globalization and the extent to which firm-level IT expenditures have created business value through foreign profits.

From a theoretical perspective, we use the aforementioned revenue versus cost logic to inform our discussion of how IT enables globalization. We do not treat foreign revenues, often used as a proxy for globalization or geographic diversification, as an exogenous factor. Instead, we allow IT to influence foreign revenues, foreign costs, and in turn foreign profits as a measure of firm performance. This logic is consistent with prior research that finds indirect support for the manner in which IT platforms enable globalization.

Based on our review of prior research in IS, strategy and international business, we identify two mechanisms which we call value chain structure (Mudambi 2002; Porter 1986; Sambharya, Kumaraswamy and Banerjee 2005) and foreign responsiveness (Boudreau, Loch, Robey and Straub 1998; Kettinger, Marchand and Davis 2010). We argue that IT enables a firm's globalization efforts through these two mechanisms to help the firm achieve higher foreign profits. These mechanisms are consistent

with those in the strategy literature on globalization (Ghemawat 2007a), such as adaptation (related to foreign responsiveness), and aggregation and arbitrage (related to value chain structure). Selection of these mechanisms is also based on the recommendation in prior research (Preacher and Hayes 2008) to "select mediators that represent unique constructs with as little conceptual overlap as possible" (p. 887).

2.1 Value Chain Structure

We define value chain structure as the manner in which firms coordinate and configure their global activities (Chesbrough and Teece 2002). Value chain structure includes two components (1) the coordination of similar value chain activities (e.g., IT, procurement, research and development, and marketing) across different geographic locations (Porter 1986), and (2) configuration of dispersed value chain activities globally across different geographic locations (Kogut 1985; Porter 1986).³ We now discuss these two components.

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 to perform the activities. The ability of multinational firms to leverage knowledge from geographically-disparate subsidiaries is an important source of competitive advantage (Padmanabhan 2015; Yang, Mudambi and Meyer 2008). Foreign subsidiaries represent a means for multinational firms to assimilate new capabilities from foreign 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 (Mudambi and Navarra 2004). IT systems provide rich transmission channels and knowledge management systems for transfer and absorption of knowledge by headquarters and foreign subsidiaries. These systems include knowledge repositories that contain corporate information and technical expertise, and knowledge directories that connect professionals in the firm (Hong, Easterby-Smith and Snell 2006; Ravichandran, Han and Mithas 2016). 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

³ Although researchers have also proposed typologies such as value shops and value networks to conceptualize organizations (Stabell and Fjeldstad 1998), value chain remains the dominant perspective. Whether firms use the same or different value chain structures across functional areas is not settled, although our observations suggest that there is no a priori reason for firms to use uniform practices across all functional areas (this issue does not affect our empirical analyses). Because of the firm-level nature of this study, we focus on internal value chains of multinational firms (Porter 2008) rather than on inter-firm extensions such as value systems or value streams. Although some industries are marked by global value chains consisting of multiple firms in multiple locations (Gereffi, Humphrey and Sturgeon 2005), and in such arrangements a firm's IT expenditures may require complementary expenditures by value chain partners, our analyses at the firm level are still informative because managers have much greater control over IT decisions for their own firm than they have over decisions by partner firms. Even though industry or national context may matter for firm-level analyses, for parsimony and to the extent that such factors may not be systematically related to both firm-level dependent variables and explanatory variables, it may not be appropriate to include such variables or "bad controls" in empirical models (Angrist and Pischke 2010; Davis 2015).

Longaigh 2002). The systems enable personnel to work across geographic and functional boundaries in order to coordinate activities, develop strategic opportunities, and improve performance (Andersen and Foss 2005; Jean, Sinkovics and Kim 2008).

In addition to coordination, IT also contributes to foreign profits through configuration of value chain structures. *Configuration* 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). Configuration allows a firm to benefit from cost differences through arbitrage or from economies of scale and scope through aggregation (Ghemawat 2007a). 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 to generate additional foreign revenues and foreign profits. Firms can use IT to modularize business processes, and to move those processes around the world to perform each value chain activity in the location where it can be best accomplished (Boudreau, Loch, Robey and Straub 1998; Jarvenpaa and Ives 1994; King and Sethi 1999; Mithas and Whitaker 2007). IT systems enable multinational firms to treat subsidiaries as component pieces, which allows firms to locate specific activities across subsidiaries and geographies. For example, corporate databases encode the firm's policies and procedures to keep subsidiaries fully informed so they can properly perform the necessary 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 compliance with policies. The disaggregated and modularized activities can be performed at the appropriate location and then re-aggregated in a seamless manner to achieve scale and scope economies and to serve customer needs (Lewin, Massini and Peeters 2009; Whitaker, Mithas and Krishnan 2011).

Let us consider the example of General Motors (GM) for the manner in which a firm can use IT to configure its global value chain structure. GM produces cars in 24 countries, and in 2015 GM generated 31% of its revenue outside the U.S. IT is an important part of GM's transition to global vehicle platforms, global sourcing and global production scheduling (Murphy 2012; Rosenbush 2013). GM uses IT to extract data from regional systems and provide near real-time information to help planners make timely decisions on global production management, scheduling and scenario planning (Reese 2008).

2.2 Foreign Responsiveness

Foreign responsiveness is a second mechanism through which IT systems can contribute to foreign profits. Foreign responsiveness refers to the ability of a firm to be sensitive to differences among individual countries, and the flexibility to react to unique preferences and tastes of foreign customers and markets to create superior customer value (Boudreau, Loch, Robey and Straub 1998; Kettinger, Marchand and Davis 2010). Foreign responsiveness is important because global markets are constantly shifting, and

firms must tailor their offerings to foreign customer needs and their production systems to foreign infrastructure (Johnson 2014). 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 to tailor for foreign markets (Hamel and Prahalad 1983).

IT systems allow firms to simultaneously be more responsive to foreign markets and to replicate mass production and other critical business processes. 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 foreign market, which enables the firm to respond and adapt with products and services 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 foreign market segments, and offer a personalized and differentiated product without making significant changes to the core product or service (Boudreau, Loch, Robey and Straub 1998; Sambharya, Kumaraswamy and Banerjee 2005). In addition, knowledge management systems can allow firms to enhance foreign responsiveness by leveraging the expertise of colleagues in other markets that have gone through a similar cycle of market maturity (Edmondson, Moingeon, Dessain and Jensen 2008).

Manpower, one of the world's largest providers of temporary employees, is a firm that uses IT for foreign responsiveness. In 2015, Manpower generated 78% of its revenue outside the Americas. Manpower has 2,900 offices in 80 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 addition to temporary staffing) in Nordic countries 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.

Firms can also pursue both value chain structure and foreign responsiveness simultaneously (Ensign 1999; Peppard 1999) consistent with the logic of ambidexterity or dual focus (e.g., simultaneous focus on revenue growth and cost reduction, or on differentiation and low-cost) in strategy literature (Mithas and Rust 2016; O'Reilly III and Tushman 2013). 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 both objectives. For value chain structure, 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. Another example of value chain structure involved 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). For foreign 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).

Procter and Gamble (P&G) also uses IT to enhance both value chain structure and foreign responsiveness. One of the world's largest consumer products companies, P&G sells products in 180 countries and generated 63% of its 2015 revenue outside the U.S. P&G wanted to position the SKII beauty product (that originated in Japan) as a premium brand in department stores. P&G established IT systems to complement the personal selling process at department store counters, track customer transactions, and perform analysis across customer segments (Sia, Soh and Weill 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 foreign responsiveness to the use of IT for value chain structure through coordination across geographies.

Based on the foregoing discussion, we ask first, whether and to what extent IT expenditures affect foreign profits; second, whether this effect is through foreign responsiveness represented by foreign revenues; and third, whether the effect is through value chain structure represented by foreign costs. More formally, we posit the following hypotheses:

H1: IT expenditures are positively associated with foreign profits.

H2: IT expenditures are positively associated with foreign revenues.

H3: IT expenditures are negatively associated with foreign costs.

We will also explore the effect of IT on domestic revenues and domestic profits. On one hand, the effect of IT could be smaller in the foreign context than in the domestic context because of the "liabilities" associated with globalization (Ghemawat 2001; Zaheer 1995). On the other hand, if IT effects are similar across the foreign and domestic contexts, this equalization of returns could suggest that the role of IT in globalization is beginning to mature.⁴ Because existing theory does not provide strong guidance whether the effect of IT on foreign revenues and foreign profits will be different from the effect on domestic revenues and domestic profits, we present exploratory findings to assist future theory-building and empirical investigations.

⁴ We thank the associate editor for this observation.

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 expenditures from *InformationWeek* surveys for the years 1999 – 2006. *InformationWeek* surveys are considered to be reliable, and have been used in academic studies (e.g., Kim, Mithas and Kimbrough 2017; Tafti, Mithas and Krishnan 2013). Respondents are Chief Information Officers, Chief Technology Officers, or other senior-level IT executives with the most knowledge of firm-level IT expenditures and IT practices (Preston, Karahanna and Rowe 2006; Tallon, Kraemer and Gurbaxani 2000). Second, we collected data on foreign revenues from the Compustat Segments database. Third, we collected data on foreign profits and total costs from the Compustat Fundamentals Annual (North America) database. In our unbalanced panel of 258 firms, 73 firms appear once, 49 appear twice, 33 appear three times, 31 appear four times, 33 appear five times, and the remaining 39 appear six or more times.⁵

We use foreign costs as a proxy for value chain structure and foreign revenues as a proxy for foreign responsiveness, consistent with prior research.⁶ For example, Nachum and Zaheer (2005) argue that sales of affiliates in foreign markets "directly measures the magnitude of activity directed towards the local market" (p. 753). The foreign revenue measure aggregates such efforts and provides a reasonable proxy for foreign responsiveness, although we recognize that it is not a perfect measure because it does not take into account competitor activities in the same market, or the firm's response time and flexibility with respect to competitive moves. Finally, because we want to understand how IT contributes to success of a firm's globalization efforts, we use foreign profits as a proxy to judge the effectiveness of globalization, similar to the approach in other studies that use profit as a measure of overall effectiveness.

We collected data on a number of important control variables to rule out alternative explanations for our main findings. We control for number of *foreign subsidiaries* because the establishment of foreign subsidiaries is an important element of the internationalization process for firms and represents the 'legal' presence of a firm in foreign countries. We also control for *foreign long-lived assets* which represent the 'physical' presence of a firm in foreign countries. We control for *mergers and acquisitions*

⁵ Our summary statistics describe the initial sample resulting from the match of our three main data sources. Our final panel regression models required additional control variables that are available for only 223 of those firms.

⁶ Prior research provides support for choosing an indirect measure such as costs (See Hanson, Mataloni and Slaughter 2005). We recognize that the mapping of value chain structure to foreign costs may not be perfect, and two firms could have nearly identical value chain structures with different foreign costs (e.g., the global value chains for laptop PCs are similar for major vendors, but their costs can vary). Similarly, while foreign revenue is not a perfect proxy for foreign responsiveness, it is a reasonable proxy. For example, acquisitions in foreign markets (which increase foreign revenue) can be considered as being responsive to those markets and acquiring companies that already know how to operate there. We do not suggest that IT expenditures drive foreign acquisitions, and instead we make a more limited assertion that firms can use acquisitions as a tool to globalize and increase foreign sales.

because firms may increase foreign profits by acquiring other firms with foreign operations. We control for *inter-segment sales* because firms can use transfer pricing to shift profits between domestic headquarters and foreign subsidiaries.⁷

3.2 Variables

Foreign profits: In millions of U.S. dollars. This is the 'Pretax Income Foreign' variable from the Compustat Fundamentals Annual database. Firms that are publicly-traded in the U.S. are required to report Pre-Tax Foreign Income in their Securities and Exchange Commission (SEC) 10-K reports. To validate that Pre-Tax Foreign Income is an accurate representation of foreign profits, we ran a correlation of Pre-Tax Foreign Income and Foreign Operating Income for firms in our sample that reported both items (firms are not required to report Foreign Operating Income). We found a correlation above 0.90, which suggests that Pre-Tax Foreign Income is a good proxy for Foreign Operating Income and thus foreign profits.

Foreign revenues: In millions of U.S. dollars. This variable is the sum of 'Net Sales' (by Geographic Segment) for nondomestic geographic segments from the Compustat Segments database.

Foreign costs: In millions of U.S. dollars, measured by subtracting the 'Pretax Income Foreign' variable from the Compustat Fundamentals database from the sum of 'Net Sales' (by Geographic Segment) for nondomestic geographic segments from the Compustat Segments database.

Domestic profits: In millions of U.S. dollars. This is the 'Pre-Tax Income Domestic' variable from the Compustat Fundamentals Annual database.

Domestic revenues: In millions of U.S. dollars. This variable is derived by subtracting the sum of 'Net Sales' (by Geographic Segment) for nondomestic geographic segments from the Compustat Segments database from 'Revenue – Total' from the Compustat Fundamentals Annual database.

⁷ While there may be other variables that could influence globalization, to the extent these variables are uncorrelated with IT expenditures, omitting them from our models is unlikely to bias our estimates. For example, foreign regulatory regimes or foreign government subsidies may influence the location choice of firms and revenue composition across countries, and currency fluctuations may influence foreign profits. However, foreign subsidies and currency fluctuations are unlikely to systematically and significantly influence firms' total IT expenditures. Even if foreign governments provide subsidies to firms, such subsidies are typically realized in the reduction of long-term tax liabilities that generally have a weak correlation with short-term foreign profits. For many global firms such as Apple, the relationship between foreign profits and tax liabilities is notably weak (Yadron, Linebaugh and Lessin 2013). Government subsidies have a weak correlation with foreign profits because governments often subsidize investments in manufacturing or research and development (R&D), but generally do not subsidize revenue-generating mechanisms such as distribution channels or marketing. The value chain structure makes a difference in this context. For example, Apple outsources manufacturing to Taiwanese companies in China. The Chinese government provides an indirect subsidy by giving Apple access to the Chinese consumer market, in part because Apple's value chain involves almost one million workers in China. In contrast, Google does not have similar leverage and does not receive that type of indirect subsidy in China. Although the practice of relocating a corporation's legal domicile to a lower-tax country while maintaining material operations in the higher-tax country of origin (corporate inversion) to reduce or defer taxes is receiving significant media attention (Merle 2016; O'Keefe and Jones 2015), this issue is not likely to affect our parameter estimates for foreign revenues or profits because such tax strategies are not likely to be correlated with IT expenditures of firms.

IT expenditures: In millions of U.S. dollars, including all domestic and foreign expenses reported for IT activities. This includes capital and operating expenses for infrastructure (telecom, networking, hardware, applications maintenance, applications development, and packaged applications), Internet, salaries and recruitment, IT services and outsourcing, and training. Researchers have argued that expenditures in IT infrastructure and IT applications are necessary for firms to develop their operational, dynamic and improvisational capabilities (El Sawy and Pavlou 2008) and to improve firm performance (Mithas, Ramasubbu and Sambamurthy 2011; Mithas, Tafti, Bardhan and Goh 2012; Tafti, Mithas and Krishnan 2013). We follow the convention that relates flows of IT expenditures to other flow-type measures such as profitability or market value (Aral and Weill 2007; Bharadwaj, Bharadwaj and Konsynski 1999; Rai, Patnayakuni and Patnayakuni 1997; Tafti, Mithas and Krishnan 2013). Rai et al. (1997, p. 91) argue that use of flow-type measures for IT is important in an environment of accelerating "technological obsolescence and in which current expenditure has a significant role in producing short-term business benefits." Such flow measures avoid measurement errors involved in aggregating capital stock (Chwelos, Ramirez, Kraemer and Melville 2010; Kleis, Chwelos, Ramirez and Cockburn 2012). While we do not know the split between domestic and foreign IT expenditures for firms in our sample, arguably IT expenditures at both the headquarters and subsidiary levels are required for the headquarters and subsidiaries to coordinate global activities. To mitigate reverse causality and endogeneity, we use IT expenditure data for the year prior to that of the corresponding profit and revenues variables.⁸

R&D expenditures: Annual expenditures, in millions of U.S. dollars. This is the 'Research and Development Expense' variable in the Compustat Fundamentals Annual database. Firms in an industry with higher R&D expenditures may be in better position to develop new products that will increase profits. We used a two-step procedure to resolve cases in which R&D expenditure values were missing in Compustat. First, we manually searched the firm's SEC 10-K reports, and when we located R&D expense amounts we incorporated those into our data. Next, where R&D expenses were still missing after the Compustat download and manual search of SEC 10-K reports, we used regression imputation to estimate the firm's R&D expenditure based on market share, assets, capital intensity, relative diversification and indicators for each year.

Advertising expenditures: Annual expenditures, in millions of U.S. dollars. This is the 'Advertising Expense' variable in the Compustat Fundamentals Annual database. Firms in an industry with higher advertising expenditures may be in better position to generate increased profits through

⁸ Because *InformationWeek* surveys do not pinpoint the month of IT expenditures in the previous year, it is difficult to be more precise about the exact lag. Also, because the purchasing power of a dollar of IT has changed significantly over time consistent with Moore's law, it is possible for firms to achieve more IT capability with less IT expenditures over time. However, the relatively short timeframe for our panel suggests that this is not a serious issue in our data. Other studies that use data on aggregate IT expenditures data do not make such price adjustments for IT expenditures (e.g., Mithas, Tafti, Bardhan and Goh 2012; Tafti, Mithas and Krishnan 2013).

increased revenues. We used the same two-step procedure for missing values as with R&D, first searching the firm's SEC 10-K reports and then using regression imputation for the remaining missing values.

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

Assets: Firm size measured by total assets, in millions of U.S. dollars. This is the 'Assets – Total' variable from the Compustat Fundamentals Annual database.

Capital intensity: Market-share weighted average capital intensity, defined in Waring (1996) as physical capital/net income. To compute capital intensity, we divided the variable 'Property, Plant and Equipment – Total (Gross)' by the variable 'Net Income (Loss)', both of which are from the Compustat Fundamentals Annual database.

Market share: Firms with higher market share may possess greater leverage to increase profits due to their relative influence in the industry. We control for market share, measured as the ratio of firm revenues over total revenues generated by all firms in the same three-digit NAICS (North American Industry Classification System) industry. We used the 'Revenue – Total' variable and the 'NAICS' classifier from the Compustat Fundamentals Annual database to aggregate revenues of all publicly-traded firms in an industry.

Period: Dummy variable=1 for the period 2003 – 2006 to account for trends in foreign exchange rate (Base value=0 for the period 1999 – 2002). During 2003 – 2006 the U.S. dollar weakened against a basket of currencies, and we account for this movement by including a dummy variable for the 2003 – 2006 period.⁹

Number of subsidiaries incorporated in foreign jurisdictions: This variable represents the firm's organization structure related to globalization, to control for the fact that firms can add management resources in foreign locations to increase foreign revenues and foreign profits. These foreign subsidiaries represent one mechanism through which firms learn about foreign markets, increase their commitment to foreign markets (Johanson and Vahlne 1977), and coordinate their sales, production and financial activities across markets. While this variable is not recorded in Compustat, firms publicly traded in the U.S. are required to report their subsidiaries with jurisdiction of incorporation in Exhibit 21 of SEC 10-K reports. We manually reviewed and coded Exhibit 21 of the SEC 10-K reports for the firm/year observations in our sample, and include the natural log of the number of foreign subsidiaries as a control variable.

⁹ We thank the associate editor for suggesting the use of an explicit time dummy for 2003 – 2006 in our models. The main results do not change when we use dummy variables for each year in the panel. We deflate all monetary figures to a common year using gross domestic product (GDP) deflators.

Long-lived assets located in foreign countries: This variable represents the firm's physical capital structure related to globalization. Firms publicly traded in the U.S. are required to report their international long-lived assets in a footnote to the financial statements, whenever international long-lived assets exceed 10% of total long-lived assets. Because the Compustat Segments Database does not correctly report Foreign Assets when the jurisdiction for Foreign Assets does not match the jurisdiction for Foreign Revenue, we manually collected this data from the "Segment Information" notes to the financial statements in the SEC 10-K reports for the firm/year observations in our sample. We include the natural log of international long-lived assets as a control variable.

Mergers and acquisitions: This variable represents the firm's merger and acquisition activity in millions of U.S. dollars, to control for the fact that firms can increase foreign revenues and foreign profits through acquisitions as well as organic growth. We collected the dollar volume of mergers and acquisitions based on statements of cash flows from the Compustat Fundamentals Annual database.

Intersegment eliminations (geographic): This variable represents sales between geographic segments in the same firm, to control for the possibility that transfer pricing may impact foreign profits. This is the 'Intersegment Eliminations' variable in the Compustat Segments Database. We control for the log of inter-segment sales as a proxy for the extent to which firms transfer products between foreign subsidiaries and domestic headquarters.

Table 1 provides descriptive statistics for the firms in our study. On average, firms in our sample have annual foreign revenues of \$5.6 billion and annual foreign profits of \$0.54 billion, for an average annual profit rate of 9.6% from foreign operations. Firms in our sample derived an average of 40% of revenues and 23% of profits from foreign operations. On average, firms in our sample spent \$0.40 billion on IT each year. Note that this figure represents total global expenditures in IT including domestic and foreign operations. Firms in our sample had an average of \$22.6 billion in total assets, and 67% of the firms in our sample belong to the manufacturing sector. Figure 1 provides trends in average foreign revenues (profits) as a percentage of total revenues (profits). We note that the percentage of foreign revenues for the later years in our dataset is consistent with the percentage reported by Aeppel (2007) for the similar timeframe, which provides added confidence in our data and empirical results.¹⁰

3.3 Empirical Models and Econometric Considerations

We use a linear model estimation approach to relate IT expenditures with dependent variables and specify the following equation for our panel models.

$$Y_{it} = X_{it} \beta + u_i + \varepsilon_{it} \quad (1)$$

¹⁰ Table A2 in the Online Supplement provides year-wise summary statistics for key variables. Table A3 in the Online Supplement reports correlations for variables in our data.

where Y represents dependent variables such as foreign revenues and foreign profits; X is the vector of firm and environmental characteristics such as IT expenditures and time period, respectively; β s are the parameters to be estimated, i and t are subscripts that refer to firms and time periods, respectively; u_i represents unobserved time-invariant fixed factors associated with a firm i , and ε is the error term associated with each observation. In our context, time period may influence the relationship between IT expenditures and dependent variables because of foreign exchange movements compared to the U.S. dollar.

Table 2 shows the results of the main estimation models. Panel models assume exogeneity of X s (i.e., $E[\varepsilon_{it} | X_i] = 0$). We conducted a Hausman (1978) test to assess potential endogeneity of the IT expenditures variable following a procedure recommended by Wooldridge (2003). In this procedure, we regressed the IT expenditures variable on one-year lagged values for IT expenditures and other control variables in our model. Based on the predicted values of IT expenditures from this model, we computed the residuals of IT expenditures. We then used these residual IT expenditure values in the foreign revenues and foreign profits panel regression models, along with the contemporaneous IT expenditure variable. The residuals of IT expenditures had no statistically-significant relationship with foreign revenues or foreign profits, and the test does not reject the null hypothesis for exogeneity of IT expenditures. Results of this test alleviate concerns about endogeneity of the IT expenditures variable in our models.¹¹

As an additional robustness check, we conducted the Arellano-Bover/Blundell-Bond (AB-BB) dynamic panel models with appropriate lags subject to data limitations.¹² We conducted the Nijman-Verbeek test for sample selection, and results of this test show no evidence for selection bias due to the structure of the unbalanced panel. We conducted a series of Kolmogorov-Smirnov sample selection tests at the two-digit and three-digit NAICS codes to compare firm-level variables in our sample with those in the overall population of firms in Compustat that report over \$1 million in annual sales. Across all represented industries, the sample selection tests do not indicate significant differences in relevant

¹¹ We conducted additional Hausman tests to compare random effects and fixed effects panel estimates of our main results for foreign revenues, foreign profits and foreign costs. The Hausman test statistics show no statistically-significant difference between estimates ($p < 0.01$) for foreign revenues, and the fixed-effects model estimates corroborate the coefficient estimates in significance and direction for our hypothesis tests. This provides assurance that our random effects results are not biased by unobserved firm-specific quasi-fixed factors, such as organizational culture or management style, while still allowing us to capture the cross-sectional heterogeneity in the data.

¹² Our key results are robust to potential endogeneity of IT expenditures, foreign costs and foreign revenues. Insignificant Sargan statistics suggest that residuals are uncorrelated with regressors in the dynamic panel models, further allaying any potential concerns about endogeneity. As an additional way to rule out endogeneity of IT expenditures, instead of using contemporaneous values of dependent variables (foreign revenue and foreign profits), we used lagged values of dependent variables, and did not find any evidence that IT expenditures are related to prior year foreign revenues or profits at the 5% level of significance. We also did not find any evidence that current year foreign revenues or profits are related to future years of IT expenditures at a 5% level of significance.

attributes such as diversification, profitability, revenues, cash flow or number of employees between firms in our sample and the population of firms publicly-traded in the U.S. These additional analyses and robustness checks support provide confidence for our main findings.

4. Results

Hypothesis 1 predicted that IT expenditures will have a positive association with foreign profits. We find support for this hypothesis, as a \$1 million increase in IT expenditures is associated with a \$0.20 million increase in foreign profits (column 1 of Table 2).

Hypothesis 2 predicted that IT expenditures will have a positive association with foreign revenues. We find support for this hypothesis, as a \$1 million increase in IT expenditures is positively associated with a \$0.57 million increase in foreign revenues (column 2 of Table 2). The effect of IT on foreign revenues is higher than on foreign profits as expected, because profits are by definition revenues net of costs. For example, the profits of Fortune 500 firms were 1% of revenues in 2009 and 4% of revenues in 2010 (the historical average for profits is 4.7% of revenues) (Tully 2010).

Hypothesis 3 predicted that IT expenditures will have a negative association with foreign costs. We do not find support for this hypothesis, because the coefficient of IT is not statistically significant (see column 3 of Table 2), suggesting that IT does not help to reduce foreign costs.

Results in Table 2 allow us to compare the effects of IT and other discretionary expenditures such as R&D and advertising on foreign profits, foreign revenues and foreign costs. We find that R&D is positively associated with foreign revenues and foreign profits with an effect greater than that of IT. While advertising is positively associated with foreign revenues with an effect greater than that of IT, advertising has no statistically-significant relationship with foreign profits. Interestingly, IT contributes less to the increase in foreign costs than do R&D and advertising.¹³

We conducted two additional analyses for further insights and to check robustness of our results. First, we specified the autoregressive AR(1) covariance structure to account for any serial correlation in error terms across the same firm, and found results qualitatively similar to those in Table 2 (see Table 3). Second, to assess robustness of foreign profit results to foreign exchange fluctuations, we collected

¹³ *InformationWeek* reports the total worldwide IT spending (budget) for each firm in each year. This is the only source of data we know for IT expenditures, because the SEC does not require publicly-traded firms to report IT expenditures. *InformationWeek* data does not indicate whether IT expenditures are expensed or capitalized for financial statement purposes, and the SEC does not require firms to report this information for IT expenditures. As a result, we are unable to know whether firms expense or capitalize their IT expenditures. Based on their review, Sandino and Kaplan (2001) conclude "At least in the U.S., however, few major companies are choosing to classify any portion of their software development costs as meeting the standard for capitalization" (p. 7), which suggests that most multinational firms such as those in our data are likely to expense their IT expenditures. The Financial Accounting Standards Board's (FASB) Statement of Financial Accounting Standard (SFAS) No. 2 requires that most R&D expenditures incurred by firms be expensed in the period incurred. For advertising, the American Institute of Public Accountants (AICPA) Statement of Position (SOP) 93-7 indicates that most advertising costs should be expensed either as incurred or the first time the advertising takes place.

Foreign Exchange Income (Loss) from the Compustat Fundamentals database. Foreign exchange income and losses are less than 1.5% of foreign revenues in our data and do not appear to be a significant factor. Also, this variable has negligible correlations with foreign revenues and profits. To the extent that currency fluctuations are not correlated with foreign profits or revenues, we do not expect our findings to be driven by exchange rates (our results do not change when we include foreign exchange income/loss as a control variable in our model).

Next, as part of our exploratory analyses, we assessed the relative magnitude of IT and other discretionary expenditures on domestic operations, and estimated additional exploratory models for domestic revenues and domestic profits using the same specification as for foreign revenues and profits (see columns 4 - 6 of Table 2). Comparing the coefficients across columns in Table 2, we find that while IT has larger effects on domestic revenues than on foreign revenues, the effects of IT on foreign profits and domestic profits are comparable. R&D and advertising have significant effects on domestic revenues and domestic profits, and these effects are larger than that of IT. These exploratory findings that show the relative effects of three categories of discretionary expenditures on foreign and domestic revenues and profits are new to the literature, and are informative to research and practice. Similarity in the effects of IT on foreign and domestic profits indicates a maturing role of IT in globalization as we discuss further in the next section.

We note some limitations of this study before we discuss implications of this research in the next section. First, while this study uses a firm-level measure of total IT expenditures, future research using more disaggregated measures of IT expenditures (i.e., use of specific IT applications or capabilities) may provide additional insights (Rai, Pavlou, Im and Du 2012; Saldanha, Mithas and Krishnan 2017). Studying specific IT applications may give insights into the types of IT that facilitate more efficient and effective value chain structure. For example, Rai et al. (2012) show that IT expenditures in logistics management (coordination, automation, integration, synchronization) are useful to extract value from inter-firm partnerships. Similarly, one would expect the types of IT expenditures that facilitate value chain structure to be different from those that facilitate foreign responsiveness. There would be value from understanding the types of IT expenditures that facilitate these different mechanisms.

Second, while the firms in our study are publicly-traded in the U.S., the findings may not hold for smaller firms or multinational firms based in other regions. Examining whether our findings apply to firms headquartered in India and China will help to increase generalizability of this study because emerging market multinational firms may compete differently than developed market multinational firms (Hennart 2012; Ramamurti 2012). For example, emerging market multinational firms may make greater use of arbitrage than developed market multinational firms who may focus on innovation or other intangible sources of competitive advantage. From a methodological perspective, the use of qualitative

comparative methods such as crisp-set Qualitative Comparative Analysis (csQCA) and fuzzy-set Qualitative Comparative Analysis (fsQCA) (See Fiss 2011; Ragin 2014) may be particularly valuable to gain a better understanding of contextual factors in globalization (see El Sawy, Malhotra, Park and Pavlou 2010). For example, use of fsQCA may allow an investigation of configurations that lead to better cost, revenue and profit performance, as opposed to the focus on "variables" and their "net effects" as is the common practice in most quantitative social sciences research. Such methodologies may permit use of detailed data on the IT management and governance practices that contribute to successful globalization.

5. Discussion

5.1 Main Findings

Our goal in this research is to examine the link between IT and foreign profits by studying how IT contributes to foreign profits through the mechanisms of value chain structure represented by foreign costs and foreign responsiveness represented by foreign revenues. We use data on multinational firms publicly-traded in the U.S. for the period 1999 – 2006 to test our conceptual model. The study provides new insights on the extent to which IT enables firms to globalize their operations. We find that IT expenditures are positively associated with foreign revenues and foreign profits. We also find that the IT-enabled increase in foreign revenues is the dominant mechanism for the effect on foreign profits. The findings provide evidence for the relative importance of underlying theoretical mechanisms to explain the effect of IT on foreign profits. Our results suggest that IT allows firms to increase foreign revenues, lending indirect support for the mechanism of foreign responsiveness. This is an important finding because it shows that the role of IT in globalization goes far beyond cost-reduction effects such as outsourcing and offshoring, topics that have received significant attention in IS research.

Our results also indicate that IT expenditures are associated with an increase in domestic costs but not an increase in foreign costs.¹⁴ Although surprising, this finding is consistent with the notion of "joint probabilities," first proposed in the context of evaluating outsourcing options that promise cost savings but entail higher risks due to coordination difficulties (see Tiwana 2014 for a detailed discussion). Even though one might theoretically expect IT to reduce domestic costs and foreign costs, the increased complexity of operations may cause overall coordination costs to rise. The costs may also increase due to the phenomenon of "red queen competition" or "arms race" (Barnett and Pontikes 2008; Tiwana 2014)

¹⁴ We thank an anonymous reviewer for offering an insightful interpretation of our findings by noting that the marginal increase in costs is less than the increase in IT costs, implying that a positive coefficient in domestic cost models may be consistent with an overall cost reduction. Shin (1999) observed a positive or null effect of IT on coordination costs in some of his cross-sectional OLS models using 1988–1992 data, particularly in the transportation and utilities sectors. Although Shin reported a negative effect of IT on costs, he cautioned that "results should only be used to draw conclusions about the direction of the impact rather than the magnitude" (p. 142) because some of the negative coefficients were small in economic significance. We also note that as the level of cost decreases, it becomes increasingly harder to further reduce costs ("floor effects").

that firms face in their domestic markets, leading to a cost increase just to maintain the same position in the face of hyper-competition from domestic competitors. To the extent that firms face a different set of competitors in each of their foreign markets, the dynamic of "red queen competition" may not be as strong in foreign markets for the differentiated products offered by multinational firms. Perhaps as a result of this phenomenon, we do not see as strong an effect of IT on foreign costs. It is worth noting that cost reduction is not the only reason that firms pursue globalization or foreign markets – firms often globalize to diversify their risks across global markets even if the diversification results in higher costs.¹⁵

Our additional analyses suggest that R&D expenditures have a positive relationship with foreign revenues and profits higher than that of IT expenditures. Advertising expenditures have a positive relationship with foreign revenues higher than that of IT expenditures, but no statistically-significant relationship with 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, we believe this is the first study to document the empirical relationship by showing a positive association of IT expenditures with actual foreign revenues and foreign profits of multinational firms, and by comparing the effect of IT with other discretionary expenditures on foreign and domestic financial performance.

5.2 Research Implications, and Future Research

We note four primary research implications of our study. First, the finding that IT expenditures are positively associated with foreign revenues suggests that IT can help overcome some of the challenges and risks associated with globalization, and can help contribute to revenue growth of firms. This finding is particularly relevant for firms operating in developed markets where opportunities for growth are limited due to market saturation, slower population or economic growth, and intense competition from incumbents with advanced IT capabilities (The Economist 2010). Through prudent IT expenditures, firms can expand their operations to other countries such as emerging economies that may have higher growth potential and relatively less competition, particularly if incumbents are not as sophisticated in their management and IT practices (Bloom and Van Reenen 2007). To the extent that IT-enabled revenue growth is a more important driver of profits than IT-enabled cost reduction (Mithas, Tafti, Bardhan and Goh 2012), this finding implies that IT expenditures to expand overseas operations for marketing goods

¹⁵ This point was forcefully articulated by Ratan Tata, Emeritus Chairman of the Tata group, when he noted: "The country [India] went through a severe recession in 1999–2000 when the market for commercial vehicles shrank by about 40 per cent due to liquidity and financing issues, even though Tata Motors maintained its market share. That experience became a catalyst for our pursuit of globalization in the subsequent years which helped to mitigate seeming obscurity that can come from focusing only on the domestic market...Our efforts to infuse cash and our endeavour to build and grow the companies we acquired paid off in several cases... I feel that our group as a whole is now stronger because of its broader pursuit and awareness of world markets." (Tata 2015, p xiii).

and services can improve profits if increased profitability due to higher revenue sufficiently offsets any increase in costs.

Second, our results suggest that the cost-based mechanism is relatively less important than the revenue-based mechanism for realizing foreign profits. This finding is consistent with prior research that uses alternative datasets on total firm-level revenues and operating costs (Mithas, Tafti, Bardhan and Goh 2012), adding to cumulative evidence that firms may be better off focusing on revenue benefits compared with cost benefits as they allocate IT expenditures. The evidence corroborates the observation that while cost benefits from IT may be easier to justify and implement, they may be more replicable than revenue benefits from IT. As discussed above, overall costs may increase with IT expenditures due to "red queen" dynamics in domestic markets. Managers face greater complexity and risks when they overlook the "joint probabilities" and overestimate their chances of success in each foreign market while ignoring the dependencies and complexity of IT-enabled coordination (Tiwana 2014). In contrast to a sole focus on cost reduction strategy, a more sustainable strategy may be to also focus on revenue growth that is more difficult for competitors to imitate (Mithas, Tafti, Bardhan and Goh 2012), although successful pursuit of such dual strategies may require higher IT expenditures (Mithas and Rust 2016).

Third, the finding that IT expenditures are associated with foreign profits suggests that IT can help firms to capture the value generated through foreign revenues, and manage 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 expenditures that create mobility barriers for sustained competitive advantage. For example, IT expenditures may allow a virtuous cycle of expenditures and learning such that firms that invest in IT in period 1 may reap benefits and then invest more in IT in period 2 (Aral, Brynjolfsson and Wu 2006; Mithas, Tafti, Bardhan and Goh 2012). By magnifying such benefits over time, some firms will have higher expenditures in IT and more opportunities to learn from their occasional failures to become better at managing IT (Mithas, Tafti, Bardhan and Goh 2012). In addition, continued expenditures and experience in managing IT systems can improve the capability of firms to leverage information and develop other important capabilities (El Sawy, Kraemmergaard, Amsinck and Vinther 2016; Gregory, Keil, Muntermann and Mahrng 2015; Grover and Ramanlal 1999; Mithas, Ramasubbu and Sambamurthy 2011; Mithas and Rust 2016; Tiwana 2010).

Fourth, although we did not posit an a priori expectation, we found that the effects of IT on foreign profits and domestic profits are generally comparable. This result implies that firms may be allocating their IT dollars efficiently across domestic and foreign operations, and that the role of IT in globalization is maturing. This equalization of returns on IT across foreign and domestic markets, perhaps due to efficient allocation of resources across markets, is similar to the efficient markets

hypothesis (Fama 1998) for the inability of stock market participants to earn abnormal returns.¹⁶ Whether our results are due to the maturity of multinational firms operating primarily in developed economies, the institutional environment and governance processes of multinational firms, or whether these results also apply to emerging markets where firms may face some constraints in exploring growth opportunities across foreign and domestic markets, are topics worthy of further research. For example, it is possible that the effect of IT on foreign versus domestic profits for multinational firms may change if the U.S. changed the corporate tax code related to taxation of income earned abroad. In 2009 President Obama complained about the existing U.S. tax code that incentivizes U.S.-based multinational firms to invest abroad and helps these firms "pay lower taxes if you create a job in Bangalore, India, than if you create one in Buffalo, New York" (Calmes and Andrews 2009, p. A3). Using the Indian context as another example, some argue that the pre-1991 regime did not favor the globalization of Indian firms, and in such settings one may expect the effects of IT for Indian firms to be greater for domestic profits than for foreign profits. This may also be true for other investments of India-based multinational firms, and anecdotal evidence suggests that with few exceptions (such as Mittal and Aditya Birla Group), few Indian firms ventured outside India before 1991. Even if the equalization of returns in this paper is viewed as an anomaly by some, documentation of such an anomaly can be valuable if it generates opportunities for further theoretical development and empirical testing.¹⁷

We note some opportunities for future research. First, research is needed to more clearly elaborate how IT facilitates information and knowledge flows in global firms to improve real-time coordination and overcome geographical and economic barriers as firms globalize their operations (Yu, Han and Mithas 2013). Some practitioners suggest that mechanisms such as strong brands are critical for success in globalization. For example, Ratan Tata noted in 2015 (Tata 2015, p xiii): "We succeeded with globalization for branded products that have global markets (such as those served by Jaguar Land Rover), but not in enterprises that produce commodities (such as steel)." Clearly, an opportunity for research will be to formally and rigorously assess the role of such firm-specific advantages and how they moderate the effect of IT on dimensions of firm performance. Case studies and longitudinal studies with detailed data on how multinational firms use and govern IT systems across geographies and subsidiaries, including specific measures of inter-unit coordination and collaboration, can shed light on these issues (for an example of this type of research, see Tiwana and Kim 2015).

¹⁶ The debates on efficient market hypothesis are far from settled (Barberis and Thaler 2003; Fornell, Mithas and Morgeson 2009; Kumar 2016).

¹⁷ Carlile and Christensen (2004, p. 9) note the usefulness of anomalies in research: "Indeed, productive theory-building research is almost invariably prompted or instigated by an anomaly or a paradox (Poole and Van De Ven 1989)."

Second, there is need for research is to explore the notion of "disciplined autonomy" in global settings. IT can be viewed as an enabler for discipline through standardized systems and templates, and an enabler for autonomy through loose-coupling and governance processes that facilitate exploration and digital innovations of third party complementors (Foerderer, Kude, Mithas and Heinzl 2016; Saldanha, Mithas and Krishnan 2017). We call for studies that generalize this notion of "disciplined autonomy" to other managerial practices beyond IT by drawing on related information systems research (Gregory, Keil, Muntermann and Mahring 2015; Im and Rai 2008; Lee, Sambamurthy, Lim and Wei 2015; Mithas et al. 2016; Tiwana 2010).

5.3 Managerial Implications

Our findings have important managerial implications. The finding of a positive association between IT expenditures and foreign revenues suggests that IT expenditures can help firms to generate additional revenues and profits from their foreign operations. Our findings also suggest that the revenue mechanism is more important than the cost mechanism for foreign profits. Therefore, IT expenditures that show greater promise for revenue growth (e.g., CRM systems) may be more relevant to foreign profits than IT expenditures that promise cost savings alone (e.g., SCM systems). 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; Dedrick, Gurbaxani and Kraemer 2003; Mithas, Krishnan and Fornell 2005; Mithas, Ramasubbu and Sambamurthy 2011; Pavlou and El Sawy 2010; Tafti, Mithas and Krishnan 2013), our results provide a lower bound of the benefits from IT expenditures. Based on these findings, managers can use IT-enabled globalization capabilities to justify IT expenditures.

Another managerial implication of our findings is that senior managers should pay attention to IT governance in their organizations (Tiwana 2014; Weill and Ross 2005; Xue, Mithas and Ray 2014). 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 expenditures compared with other expenditures such as R&D and advertising as they allocate expenditures. Our results comparing the effects of discretionary expenditures on foreign revenues and profits provide useful insights to allocate resources depending on a firm's opportunity set and growth objectives. While not directly related to our empirical results, managers should think of globalization more broadly than cost arbitrage opportunities such as outsourcing and offshoring, because an exclusive focus on costs may not always be consistent with long-term financial performance. Similarly, globalization initiatives rarely succeed without the personal involvement and commitment of top executives, and proper management of IT resources can help to create opportunities for profitable revenue

growth through globalization. Because globalization is a key component of firm-level strategy, these findings have important implications for firms' IT expenditures to grow profitably and gain competitive advantage.

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Table 1. Descriptive Statistics

Variable	Observations	Mean	Standard Deviation
Foreign revenues (\$MM)	822	5,591	10,859
Domestic revenues (\$MM)	822	8,362	17,134
Foreign profits (\$MM)	822	536	1,283
Domestic profits (\$MM)	822	1,747	4,111
Domestic costs (\$MM)	822	6,333	13,393
Foreign costs (\$MM)	822	5,055	10,020
IT expenditures (\$MM)	822	402	838
Foreign subsidiaries (log)	768	3.59	1.35
Acquisitions (\$MM)	822	123	780
Intersegment revenues (\$MM)	822	49	1,149
Employees (000's)	822	46	71
Foreign assets (log)	783	6.25	1.77
Total assets (log)	822	8.75	1.36
Capital intensity	822	0.26	0.17
Market share	822	0.05	0.08
R&D (\$MM)	822	506	1,152
Advertising (\$MM)	822	182	597
Employees (log)	822	3.10	1.18

Descriptive statistics reported are based on nominal dollar values.

Table 2. Influence of IT Expenditures on Profits, Revenues and Costs (Random effects panel models)

	(1) Foreign profits	(2) Foreign revenues	(3) Foreign costs	(4) Domestic profits	(5) Domestic revenues	(6) Domestic costs
IT expenditures	0.203*** (0.038)	0.572* (0.249)	0.385 (0.243)	0.260*** (0.076)	0.794*** (0.280)	0.651** (0.272)
R&D	0.343*** (0.057)	1.747*** (0.359)	1.416*** (0.346)	0.444*** (0.125)	1.430*** (0.473)	0.947** (0.436)
Advertising	-0.171 (0.120)	5.028*** (0.738)	5.171*** (0.709)	1.981*** (0.275)	7.321*** (1.060)	6.032*** (0.946)
Foreign subsidiaries (log)	-8.1 (30.8)	-164.7 (195.0)	-147.9 (189.0)	-231.1*** (64.9)	-267.8 (242.6)	-65.4 (228.5)
Acquisitions	0.136*** (0.027)	-0.371 (0.172)	-0.507*** (0.168)	0.291*** (0.053)	0.613*** (0.193)	0.331 (0.188)
Intersegment revenues	0.019 (0.031)	0.212 (0.197)	0.191 (0.192)	-0.186*** (0.061)	-0.623*** (0.225)	-0.470** (0.218)
Foreign assets (log)	1.5 (37.4)	453.3 (236.0)	452.0** (228.6)	-33.3 (79.1)	-716.4** (296.4)	-693.0** (278.2)
Total assets (log)	470*** (71)	2,108*** (435)	1,644*** (418)	1,071*** (160)	4,340*** (615)	3,345*** (552)
Capital intensity	-418 (324)	-6,922*** (2,012)	-6,559*** (1,939)	34 (723)	-5,354 (2,754)	-5,215** (2,503)
Market share	-234 (741)	11,019** (4,551)	11,141** (4,373)	4,766*** (1,687)	48,557*** (6,472)	42,098*** (5,809)
Employees (log)	-181.1*** (63.1)	-192.1 (386.2)	-13.1 (370.7)	-99.4 (146.0)	80.5 (563.8)	101.7 (499.8)
Years 2003-2006	103.6*** (40.0)	397.9 (259.0)	288.7 (253.0)	-132.5 (79.7)	-813.0*** (293.6)	-684.7** (284.4)
Observations	748	748	748	748	748	748
Firms	223	223	223	223	223	223
Wald chi-square	365	501	435	503	539	424

All models include an intercept. Standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$

Table 3. Parameter Estimates for Influence of IT Expenditures on Foreign Profits, Revenues and Costs (Random effects with AR1)

	(1) Foreign Profits	(2) Foreign Revenues	(3) Foreign costs
IT expenditures	0.078*** (0.027)	0.499** (0.220)	0.391 (0.216)
R&D	0.374*** (0.056)	2.026*** (0.362)	1.657*** (0.350)
Advertising	-0.070 (0.118)	4.469*** (0.739)	4.586*** (0.710)
Foreign subsidiaries (log)	0.5 (28.1)	-72.7 (195.1)	-65.9 (189.1)
Acquisitions	0.091*** (0.027)	-0.206 (0.188)	-0.307 (0.184)
Intersegment revenues	0.013 (0.028)	0.102 (0.201)	0.086 (0.196)
Foreign assets (log)	34.4 (35.1)	471.7** (240.3)	447.4 (232.7)
Total assets (log)	468*** (69)	2,102*** (436)	1,640*** (419)
Capital intensity	-554 (309)	-7,094*** (2,004)	-6,602*** (1,931)
Market share	170 (687)	13,056*** (4,431)	12,763*** (4,262)
Employees (log)	-201*** (60)	-191 (379)	-4.990 (364)
Years 2003-2006	46.8 (37.8)	275.5 (277.5)	200.5 (271.0)
Observations	748	748	748
Firms	223	223	223
Wald chi-square	332	526	451

All models include an intercept. Standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$

Figure 1. Foreign Revenues and Profits as a Percentage of Total Revenues and Profits, Respectively, For Firms in Our Final Sample

