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Impacts of Globalization on E-Commerce Use and Firm Performance: A Cross-Country Investigation

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This article develops and tests a model examining the relationship between firm globalization, scope of e-commerce use, and firm performance, using data from a large-scale cross-country survey of firms from three industries. We find that globalization leads to both greater scope of e-commerce use and improved performance, measured as efficiency, coordination, and market impacts. Scope of e-commerce use also leads to greater firm performance of all three types. Globalization has differential effects on B2B and B2C e-commerce, however, such that highly global firms are more likely to do B2B but *less* likely to do B2C. Our findings provide support for Porter's (1986) thesis that upstream business activities (namely, B2B) are more global while downstream business activities (B2C) are more local or multidomestic.

Two powerful and sometimes controversial current social and economic trends are globalization and the widespread adoption of information and communication technologies (ICTs). Many argue that these two trends are closely associated, each driving the other forward, and both being driven by other common forces, such as trade liberalization, deregulation, migration, and the expansion of capitalism and democracy (cf. Held et al., 1999). Pohjola

(2002) argues that the twin forces of globalization and the ICT revolution are combining to create the so-called New Economy, marked by higher rates of economic and productivity growth. Technology is both driven by and a driver of globalization, as both forces continually reinforce one another (Bradley et al., 1993).

The process of globalization creates new challenges and opportunities for firms. The opportunities include access to new markets that were previously closed due to cost, regulation, or indirect barriers, the ability to tap resources such as labor, capital, and knowledge on a worldwide basis, and the opportunity to participate in global production networks that are becoming prevalent in many industries such as automotive, electronics, toys and textiles. Challenges come from foreign competitors entering firms' domestic markets, and from domestic competitors reducing their costs through global sourcing, moving production offshore, or gaining economies of scale by expanding into new markets. Globalization challenges firms to become more streamlined and efficient while simultaneously extending the geographic reach of their operations.

Responding to these opportunities and challenges increasingly requires a fundamental restructuring of organizational strategy and processes (Bradley et al., 1993). Due to increased competitive pressure, companies are using new technologies to extend their products and operations into the international marketplace (Snow et al., 1996). They are also using these technologies to achieve new innovative transnational organizational forms (Sturgeon, 2002).

The adoption and use of ICTs such as the Internet makes it cheaper and easier for firms to extend their markets, manage their operations, and coordinate value chains across borders (Cavusgil, 2002; Globerman et al., 2001; Williams et al., 2001). As Alan Greenspan (2001) has said, "By lowering the costs of transactions and information, technology has reduced market frictions and provided significant impetus to the process of broadening world markets." ICT use fosters globalization by reducing transaction and coordination costs and creating new and expanded markets

with economies of scale (Mann et al., 2000; Steinfield & Klein, 1999).

This article draws on theory on international management and business strategy, impacts of information technology (IT), and diffusion theory to study the relationship between globalization and the use of a particular set of ICTs, namely, the Internet and electronic commerce, at the firm level. The goal is to move beyond general arguments about these "megatrends" and to look at their actual dynamics in the operations of business establishments. This requires thinking about the impacts of the two separate but interrelated forces on individual firms. Much of the literature on globalization and IT is lacking in empirical analysis, but implicitly treats globalization as the dependent variable and examines the impacts of IT and the Internet. While we acknowledge that there is a reciprocal relationship between the two and do not make absolute claims of causality, we reverse the typical hypothesized ordering of effects and suggest that globalization occurs first, which then creates the conditions for firms to adopt and use e-commerce. We thus examine the impacts of globalization on e-commerce and firm performance due to the fact that the process of globalization has preceded Internet and e-commerce adoption in time and it is still too early to observe reciprocal effects.

Our study makes several notable contributions to theory and empirical research. First, it empirically tests relationships between firm globalization, business-to-business (B2B) and business-to-consumer (B2C) e-commerce, and firm performance. Second, we find that a specific kind of IT use —namely, B2C e-commerce—is actually more localized than B2B e-commerce. This latter finding, based on primary data from a large-scale survey of more than 2100 firms in 10 countries across 3 industries (manufacturing, retail, finance), adds strong empirical support to other recent research by Globerman et al. (2001), which is limited to secondary data from one industry in one country. Third, it extends theoretical insights from the work of Porter (1986) and Globerman et al. (2001) to differentiate between high global and low global firms, which have different patterns of e-commerce use and different impacts.

CONCEPTUAL FRAMEWORK

Globalization has been defined as the growing interconnectedness of the world through cross-border flows of information, capital, and people (cf. Held et al., 1999). While globalization affects economic, social, cultural, political, and other aspects of contemporary life, we focus here on the economic aspects, using the firm as the unit of analysis. Furthermore, since we are investigating impacts at the firm level, we do not attempt to measure the process of globalization directly but rather the degree to which com-

panies are globalized, in terms of the internationalization of their operations, revenues, and the competitive pressure they face. Taken together, these factors provide an indication of the level of company globalization. The objective is to better understand the relationship of globalization to e-commerce use by firms and its impacts on firm performance. We define e-commerce broadly as the use of the Internet to buy, sell, or support products and services.

The process of globalization is logically a powerful driver for firms to adopt specific ICTs such as the Internet and e-commerce as it usually has occurred earlier in time. There is also empirical evidence supporting the relationship. Macroeconomic evidence indicates that countries with more globally oriented economies (open in terms of trade and foreign investment) have higher levels of ICT investment (OECD, 1999). Since it is firms that are making most of these investments, it is reasonable to expect that more globally oriented firms would be more likely to adopt technologies such as the Internet and e-commerce. Research has confirmed that this is the case (Caselli & Coleman, 2001; Shih et al., in press). Other empirical studies at the country level support the argument that the opening of markets to trade and foreign investment leads domestic firms to invest in ICTs to remain competitive (e.g., Dedrick et al., 2001). Thus, the process of globalization is logically and empirically shown to be a driver for firms to adopt specific ICTs such as the Internet and e-commerce.

The analysis in this article is based on a conceptual framework that relates globalization, e-commerce use, and the impacts of use on firm performance, as shown in Figure 1. The framework posits that the degree to which a firm is already globalized will influence the extent to which it uses e-commerce and the types of e-commerce activities it undertakes. It also posits that the degree of globalization will influence firm performance directly as well as indirectly, by influencing the extent and nature of firm e-commerce activities, which also influence impacts on firm performance. The key variables in the framework are defined below in the methodology section. We construct hypotheses from the relationships among these variables in the model, as represented by the arrows in Figure 1.

Globalization and E-Commerce Use

Firm globalization is heralded as a key driver of e-commerce use (Steinfield & Klein, 1999). As explained more fully later (Concepts and Measures), we conceptualize two dimensions of e-commerce use: scope and type. We define scope of use as the extent of e-commerce use for different activities in the firm's value chain from advertising and marketing to sales, procurement, service and support, data exchange with customers and suppliers, and integration of business processes. We define type of use as business-to-business (B2B) and business-to-consumer
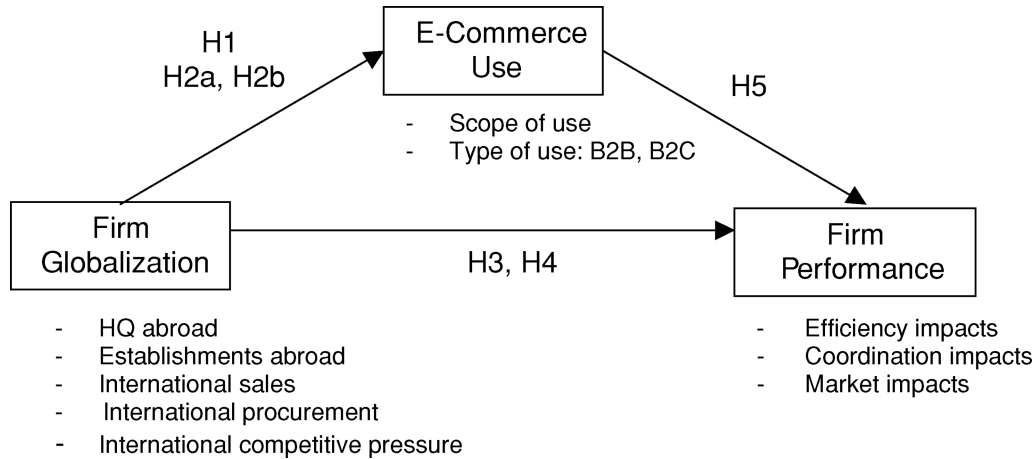
FIG. 1. Conceptual framework.

(B2C) in order to account for fundamental differences in business and consumer transactions.

Globalization and Scope of Use. We expect that highly global firms are likely to employ a greater scope of e-commerce use than less global firms, for several reasons. First, firms facing foreign competition are under greater pressure to adopt technologies such as e-commerce that enable them to protect or expand market share and operate more efficiently. Competitive pressure has been identified through several studies as an important determinant of the scope of IT use, whether the extent of electronic document interchange (EDI) diffusion (Banerjee & Golhar, 1993; Ramamurthy et al., 1999; Webster, 1995), adoption of IT innovations (Gatignon & Robertson, 1989; Grover, 1993), or degree of computerization (Dasgupta et al., 1999). It has also been found to be a significant determinant of the scope of e-commerce use specifically (Zhu et al., 2002).

Second, firms doing business outside their own country may be more motivated to lower their transaction and coordination costs by using information technology to a greater extent (Malone et al., 1987). We would expect that this is true also in the specific case of Internet-based e-commerce. Using the Internet for more internal transactions and coordination can save time and money on delivery of goods by using rich information flows to simplify, streamline, or substitute for the flows of physical goods in the supply chain (Kraemer & Dedrick, 2002; Sturgeon, 2002). In addition, firms that buy and sell in international markets are under pressure from trading partners to adopt and utilize e-commerce for external transactions (especially B2B) to reduce transaction and coordination costs with other members of the value chain. This is especially true in the case of global production networks and commodity chains dominated by multinational corporations (MNCs) that may require partners to use e-commerce in order to

do business with the MNC (Chen, 2002; Gereffi, 2001). It is equally true of Dell or Wal-Mart, for example. These considerations lead to our first hypothesis.

> H1. Highly global firms will have a greater overall scope of e-commerce use.

Globalization and Type of Use. There is a theoretical basis in the business strategy literature for expecting that some industries and business activities will tend toward global convergence while others will be marked by local divergence. Porter (1986) distinguishes between global industries, in which firms gain competitive advantage by integrating their activities worldwide, and multidomestic industries, in which competition occurs independently within each country. Further, he divides the value chain into upstream and downstream business activities. Upstream activities such as inbound logistics and operations are not dependent on location, and can be organized globally to achieve economies of scale. On the other hand, downstream activities such as marketing, sales, and customer service are location dependent and must be organized on a multidomestic basis.

Globerman et al. (2001) apply Porter's theories to e-commerce specifically. They contend that the impacts of e-commerce differ across various stages of an industry's value chain, and that purchase of business inputs (B2B) is becoming globalized while purchase of end services by consumers (B2C) remains localized. Although their analysis is limited to secondary data on the retail brokerage industry, they conclude that retail (B2C) e-commerce is relatively unaffected by globalization and is characterized by multidomestic competition due to the heterogeneity of consumers and different national regulatory systems. By contrast, they find that e-commerce for wholesale brokerage activity (B2B) is more globalized. As a result, they argue that e-commerce is not inherently a globalizing

force, but one that can actually enhance local competitive advantage.

Steinfield and Klein (1999) argue similarly that rather than fostering seamless global markets equally open to all businesses, much e-commerce activity (particularly B2C) is regionally focused. Steinfield and his colleagues furthermore argue that local businesses can develop Web strategies that successfully leverage their local physical presence (Steinfield et al., 1999; Steinfield & Whitten, 1999). Thus, firms that leverage their local presence with their online business strategy may have a competitive advantage over firms with only a virtual presence, for several reasons. First, embeddedness in preexisting relationships enhances consumer trust and recognition of online firms. Second, integrating online business with local presence helps serve diverse consumer preferences and shopping habits and leverage local knowledge. Finally, such firms can take advantage of an existing infrastructure for delivering physical goods and services (Steinfield & Whitten, 1999).

Research at the country level also suggests that global convergence might be taking place in B2B e-commerce through integration of business processes and systems, but that B2C e-commerce remains more of a local phenomenon due to national divergence in consumer preferences and habits (Gibbs et al., 2003). Based on theory and these empirical findings, we hypothesize that globalization has different effects on B2B versus B2C e-commerce use, with highly global companies engaging more in B2B and less global companies engaging more in B2C.

> H2a. Highly global firms will have higher levels of B2B e-commerce use. H2b. Highly global firms will have lower levels of B2C e-commerce use.

Globalization and Firm Performance

We also expect that there will be a direct relationship between firm globalization and performance. We would expect highly global firms to perform better in terms of increased efficiency, coordination with trading partners, and improved market position. It is likely that global firms will realize greater impacts on performance, because they can employ resources and capabilities developed throughout their global operations to improve business processes and more effectively deploy technologies such as e-commerce (Bartlett & Ghoshal, 1998). Global firms are also in a better position to benefit from e-commerce as they can achieve economies of scale and global reach (Porter, 1986). Finally, firms with greater global scope are likely to face greater transaction costs due to their expansion into diverse geographic regions, and e-commerce use may help reduce such transaction costs (Garicano & Kaplan, 2001; Malone et al., 1987). A firm's global scope has been found to be a significant predictor of e-commerce value in the financial services industry (Zhu et al., 2004). Globalization should also have an indirect effect on performance through the scope of e-commerce use, since highly global firms will use e-commerce more extensively, and more extensive use will result in improved performance. E-commerce use will thus mediate the effects of globalization on firm performance. These direct and indirect effects of globalization should have additive functions. This leads to our third and fourth hypotheses.

> H3. Highly global firms will experience greater performance impacts (in efficiency, coordination, and market position) since they began using e-commerce.
> H4. Scope of e-commerce use will mediate the impacts of globalization on performance.

E-Commerce Use and Firm Performance

Use of new information technologies is expected to improve performance, by reducing transaction costs and increasing coordination of activities among business partners (e.g., Malone et al., 1987). E-commerce specifically (especially B2B) is predicted to result in lower coordination costs due to automation of transactions online, as well as productivity and efficiency gains (Amit & Zott, 2001; Lucking-Reiley & Spulbur, 2001; Wigand & Benjamin, 1995). E-commerce also is expected to facilitate entry into new markets or extension of existing markets (Garicano & Kaplan, 2001), and greater integration of systems with suppliers and customers (Wigand & Benjamin, 1995). Thus, three dimensions of e-commerce impact on performance have been identified in prior research, namely, market impacts, efficiency impacts, and coordination impacts (Kohli & Devaraj, 2003).

Firms can also use IT to help improve the performance of different business activities along the value chain (Porter, 1985), categorized into three dimensions: downstream activities such as sales and marketing, customer service and support, activities internal to the firm such as production, operations and logistics, and upstream activities such as information sharing with suppliers (Mahmood & Soon, 1991). IT use for downstream activities is theorized to lead to greater market impacts, while internal operational use results in greater internal firm efficiency, and upstream IT use facilitates coordination with suppliers and business partners (Tallon et al., 2000).

Thus, we would expect that a firm's e-commerce use leads to specific types of performance improvements along these three dimensions. Based on diffusion theory (Rogers, 1983; Tornatzky & Fleischer, 1990), we propose that a greater scope of e-commerce use (that is, use of e-commerce for a greater number of business activities) will yield greater impacts on firm performance. To illustrate, we would expect a firm that uses the Internet for sales and marketing, for procurement, and to coordinate and

share information with suppliers and customers would see greater impacts on performance than one that simply has a web site with marketing information. If this is the case, then there should be a direct relationship between scope of use and performance, in terms of increased efficiency, coordination with suppliers and business partners, and sales and market position. This leads to our fifth hypothesis.

> H5. Firms with a greater scope of e-commerce use will experience greater performance impacts (efficiency, coordination, and market position).

METHODOLOGY

This article is part of a study of the globalization of e-commerce in 10 countries. The research employs a mix of quantitative and qualitative methods, and levels of analysis (country, industry, and firm).

Survey Design and Sample

Data were gathered through a telephone survey of 2139 establishments (defined as a physical location or site that uses the Internet to buy, sell, or support products and services). These establishments were located in 10 countries—Brazil, China, Denmark, France, Germany, Japan, Mexico, Singapore, Taiwan, and the United States. Data collection took place from February to April 2002. A stratified random sample was used, drawing from company lists representative of each local market and stratified by industry and firm size within each country. Countries were selected to include developed, newly industrializing, and developing nations in the three major regions of the world. Establishments were selected from three major industry sectors known to be more advanced users of e-commerce—manufacturing, distribution (wholesale and retail), and finance (banking, insurance, and financial services).

The sample includes 300 establishments in the United States and approximately 200 in each of the other countries. It is evenly split by the three industries, and by firm size, between small (defined as 25 to 249 employees) and large (defined as 250 or more employees) firms in each country. Respondents were primarily chief information officers (CIOs), chief executive officers (CEOs), or information systems (IS) managers responsible for making the firm's IT-related decisions. The overall response rate was 13%. Response rates varied by country, ranging from 8% to 39%.[1] Table 1 presents the sample profile.

Concepts and Measures

Indices were created for each of the independent and dependent variables and tested for validity and reliability. Such composite measures are frequently used in social science research to better measure variables for which no clear and unambiguous single indicators exist (Babbie, 2004). We created indices to measure our study variables by combining several items into a single measure. We used an additive method of aggregating items into each index and then averaging them. Examination of frequencies and correlations indicated that the variables were fairly normally distributed and that multicollinearity was not a problem. Standardized z-scores were used for all except the control variables to ensure that their coefficients were comparable. Table 2 displays summary statistics (means, standard deviations, and alphas) for the research variables. Table 3 contains factor loadings for the three performance variables, and Table 4 contains interitem correlations for the firm globalization, e-commerce use, and performance variables.

Firm Globalization.   We conceptualize firm globalization as the degree to which firms conduct business internationally and face international competition. This includes the extent to which they buy and sell abroad (i.e., outside of the establishment's home country), have operations in multiple countries, and compete with foreign firms, either in domestic or international markets. We measure the degree of firm globalization through five items: (1) whether the company has its headquarters abroad (yes/no); (2) whether it has other establishments abroad (yes/no); (3) international sales as a share of the establishment's total sales (0–100%); (4) international procurement as a share of the establishment's total procurement (0–100%); and (5) degree to which the establishment is affected by competitors from abroad (5-point Likert scale ranging from 1 = not at all affected to 5 = significantly affected). The first two items are structural indicators of the location of the firm's business activities, and the second two are related to foreign revenues. The fifth item is exogenous to the firm, as it relates to the competitive environment in which the firm does business. We created a Globalization Index from these five items to measure the level of firm globalization. Scores for each of the items were standardized by rescaling each to a 0–1 scale and then aggregating them, such that the index ranges from 0 to 5. A higher score indicates a greater degree of company globalization. Reliability analysis confirmed a relatively high alpha of .7 and provided justification for combining these items into an index of firm globalization.[2]

E-Commerce Use.   We define e-commerce broadly as use of the Internet to buy, sell, or support products and services. We conceptualize two dimensions of e-commerce use,[3] measuring (1) the scope of use and (2) the type of e-commerce use (B2B versus B2C). Both scope and type of use are categories commonly used in the innovation, IT, and e-commerce literatures (cf. Gibbs & Kraemer, 2004; Xu et al., 2004).

TABLE 1
Sample profile ($n = 2139$)

	Manufacturing	Distribution	Finance	Total
Industry and firm size	364	357	365	1086
Small firms (25–249)				
Large firms (250+)	379	344	330	1053
Total	743	701	695	2139
Industry and globalization				
Low global (bottom 25%)	66	140	244	450
High global (top 25%)	212	126	101	439
Total	278	266	345	889

Respondent job title		n	%
CEO, president, owner, managing director		76	3.6
CIO, CTO, VP of IS		363	17.0
IS manager, director, planne		759	35.5
Other IS manager		449	21.0
COO, business operations manager		103	4.8
CFO, administration/finance manager		172	8.0
Other (IS analyst, other manager or VP)		217	10.2
Number of employees			
25–99		624	29.2
100–199		321	15.0
200–499		733	34.3
500+		461	21.6

	Response rate (%)	n	%
Country			
Brazil	15	200	9.4
China	39	204	9.5
Denmark	18	200	9.4
France	9	201	9.4
Germany	8	202	9.4
Japan	10	227	10.6
Mexico	12	201	9.4
Singapore	27	202	9.4
Taiwan	38	202	9.4
United States	8	300	14.0
Total	13	2139	100.0

We define *scope of use* as the extent of e-commerce use for a number of different activities in the value chain, from advertising and marketing to sales, procurement, service and support, data exchange with customers and suppliers, and integration of business processes. It was measured by an index that was created by aggregating seven items regarding Internet use for various business activities, each rated on a yes/no scale. The items are use of the Internet for: (1) advertising and marketing, (2) online sales, (3) after-sales customer service and support, (4) online purchases, (5) exchange of operational data with suppliers, (6) exchange of operational data with business customers, and (7) formal integration of the same business processes with suppliers or other business partners. The scope of use is the total number of these Internet uses, ranging from 0–7.

Type of use is based on a different set of questions that distinguish between use for business-to-business (B2B) commerce and business-to-consumer (B2C) commerce. This distinction is drawn to account for fundamental differences in terms of the size and types of transactions

TABLE 2
Summary statistics of research variables

Variables	n	Mean	Standard deviation	Standardized alpha	Number of items in scale
Firm Globalization[a]	1745	1.18	1.16	.70	5
Scope of EC use[b]	2075	3.26	1.92	—	7
Type of EC use					
B2B use[c]	2124	0.77	0.759	—	2
B2C Use[c]	2124	0.71	0.769	—	2
Firm performance					
Market[d]	2006	2.64	0.98	.83	5
Efficiency[d]	2052	2.88	1.13	.77	2
Coordination[d]	1981	2.42	1.06	.79	3
Controls					
Firm size[e]	2006	2.92	0.90	—	1
Industry (mfg.)	2139	0.35	0.48	—	1
Industry (dist.)	2139	0.33	0.47	—	1
Industry (fin.)	2139	0.32	0.47	—	1

[a]Score ranges from 0 "low globalization" to 5 "high globalization."
[b]Score ranges from 0 "low EC use" to 7 "high EC use."
[c]Scores range from 0 "no use" to 1 "sales or services use" to 2 "both sales and services use."
[d]Scores are based on a 5-point Likert scale, where 1 is "no impact" and 5 is "great impact."
[e]Score is number of total employees (log-transformed).

involving businesses as opposed to consumers. We created a set of indices distinguishing B2B and B2C e-commerce use by aggregating responses to a different set of items on whether the establishment conducts B2B and B2C ecommerce sales and services and then dividing responses into 0–2 where 0 is no e-commerce, 1 is either sales or services, and 2 is both sales and services. We chose this scale to add further nuance by distinguishing between e-commerce use for different activities rather than simple adoption versus nonadoption. Two variables were created, called "B2B E-Commerce Use" and "B2C E-Commerce Use." The first variable consists of B2B sales and B2B services, and the second one is comprised of B2C sales and B2C services.

Firm Performance. We focus on three dimensions of performance. The first is operational *efficiency*, which refers to more efficient internal processes and greater staff productivity. The second dimension is *coordination*, which includes both lower procurement and inventory costs and improved coordination with suppliers. The third performance dimension is expansion of the firm's *market*, in terms of increased sales, widened sales area, improved customer service, and competitive position. The specific aspects of performance measured by each of these categories have been theorized and tested in previous research (cf. Mahmood & Soon, 1991; Tallon et al., 2000; Zhu et al., 2004).

We measured firm performance through a set of 10 items. These items concerned the degree to which the firm had experienced the following since using the Internet for

TABLE 3
Factor loadings of firm performance variables

Variables	Factors		
	1	2	3
Market			
Widened sales area	.831		
Increased sales	.748		
Increased international sales	.665		
Improved competitive position	.644		
Improved customer service	.546		
Coordination			
Decreased procurement costs		.845	
Decreased inventory costs		.795	
Improved coordination with suppliers		.641	
Efficiency			
More efficient internal processes			.825
Increased staff productivity			.774

Note. Principal component analysis with eigenvalues set at 0.96. Factor entries are varimax rotated loadings. Three-factor solution explained 69% of variance; $n = 1910$.

TABLE 4
Intercorrelations among study variables ($n = 2139$)

Variables	1	2	3	4	5	6	7	8	9	10
1. Firm globalization	—									
2. Scope of EC use	.10***	—								
Type of EC use										
3. B2B Use	.17***	.45***	—							
4. B2C Use	-.08**	.39***	.35***	—						
Firm performance										
5. Market	.20***	.33***	.26***	.23***	—					
6. Efficiency	.13***	.23***	.14***	.11***	.57***	—				
7. Coordination	.19***	.25***	.13***	.05*	.58***	.53***	—			
Controls										
8. Size (number of employees)	.43***	.14***	.11***	.13***	.08**	.10***	.12***	—		
9. Industry (mfg.)	.22***	-.05*	.08**	-.21***	.00	.00	.07**	-.03	—	
10. Industry (dist.)	-.04†	-.00	-.03	.03	-.01	-.01	.07**	-.01	-.51***	—
11. Industry (fin.)	-.18***	.05*	-.04	.18***	.01	.01	-.14***	.06**	-.51***	-.48***

†$p < .10$, *$p < .05$, **$p < .01$, ***$p < .001$.

business activities: (1) more efficient internal processes, (2) increased staff productivity, (3) increased sales, (4) widened sales area, (5) improved customer service, (6) increased international sales, (7) decreased procurement costs, (8) decreased inventory costs, (9) improved coordination with suppliers, and (10) improved competitive position. Items were rated on a 5-point Likert scale ranging from 1 = not at all to 5 = a great deal.

The 10 items were factor analyzed using principal component analysis with varimax rotation, with eigenvalues set at 0.96. The factor analysis identified three factors, confirming the dimensions of Efficiency, Market, and Coordination impacts. Factor loadings are reported in Table 3. All three indices are highly reliable. The Efficiency index consists of items 1 and 2 and has an alpha of .77. The Market index consists of items 3–6 and 10 and has an alpha of .83. Finally, the Coordination index consists of items 7–9 and has an alpha of .79.

Control Variables. We also tested for effects of *firm size*, *industry*, and *country* in our models. Firm size has been identified in previous research as an important predictor of IT diffusion and use. Larger organizations have been found to be more likely to adopt ICTs as they possess greater resources and knowledge to invest in and implement technology (Dasgupta et al., 1999; Iacovou et al., 1995; Kuan & Chau, 2001; Tornatzky & Fleischer, 1990; Rogers, 1983). We included firm size in our models to ensure that firm globalization was not just a proxy for size. Firm size was operationalized as the total number of employees in the organization, log-transformed to reduce data variance (Raymond, 1990; Zhu et al., 2004).

We also tested for industry effects. E-commerce use and performance impacts are also likely to vary across industries. For example, EDI use has been particularly strong in the manufacturing industry, used to integrate the firm's activities with its supply chain. Manufacturing firms are thus likely to make heavier use of B2B e-commerce to coordinate activities with their trading partners. Service-based industries such as retail and finance, on the other hand, are more likely to do B2C e-commerce with their customers. We included industry as a control variable in the models we tested. Due to our interest in examining B2B and B2C separately, we distinguished between manufacturing, which is more business- focused, and distribution and finance, which require relatively more interaction with consumers. The industry control variable was measured by dummy variables for distribution and finance firms, using manufacturing as the baseline.

A country control variable was also included. Most prior firm-level studies of EDI and IT use have been conducted in developed countries, and most often in a single national context. However, recent cross-country studies have found gross domestic product (GDP) per capita to be the strongest determinant of e-commerce and IT diffusion (Beilock & Dimitrova, 2003; Caselli & Coleman, 2001; Shih et al., in press) and have found significant differences in diffusion between countries at different stages of economic development. For this reason, we included country dummies as control variables, based on the country in which the establishment was located. The country dummies used were Brazil, China, Denmark, France, Germany, Japan, Mexico, Singapore, and Taiwan. The United States was used as the baseline.

Descriptive statistics revealed that the highly global firms in the sample were heavily weighted toward foreign manufacturers, as 55% of them were headquartered abroad and 48% were from the manufacturing industry. The global firms did an average of 45% of their sales and 40% of their procurement internationally, compared to less than 1% each for local firms. Local firms, by contrast, were primarily in the finance industry (54%), and did more business with consumers. Firms in the distribution industry were evenly split between high and low global, presumably due to the balance between wholesale and retail in our sample. Although both global and local firms sold products and services to businesses (92% of global versus 75% of local firms), significantly more local firms (75%) sold to consumers compared to global firms (49%).

RESULTS

Hypotheses were tested using ordinary least squares regression. Models were run for both measures of e-commerce use—scope of use and type of use (B2B vs. B2C). Each model examines the combined impacts of firm globalization and e-commerce use (scope or type) on firm performance, measured by efficiency, coordination and market impacts.

All five hypotheses were confirmed. Tables 5, 6 and 7 summarize the results of the regression analyses for both models. The three regressions in Table 5 and the four regressions in Table 6 show the interrelationships between globalization, scope of e-commerce use, and the three dimensions of firm performance and address H1, H3, H4, and H5. The five regressions in Table 7 show interrelationships between globalization, B2B, B2C, and firm performance and address H2a, H2b, H3, and H5.

H1, that firm globalization would lead to a greater scope of e-commerce use, was confirmed. Table 6 shows that more globalized firms tended to have higher scope of use ($b = .13$, $p < .001$), when size, industry, and country effects were controlled. Independent size, industry, and country effects were also apparent. Larger firms were likely to have higher e-commerce use ($b = .09$, p < .01), and finance firms were also likely to have higher e-commerce use ($b = .09$, $p < .01$). Firms in all countries

TABLE 5
Regression coefficients[a] for globalization and performance model

Variables	Efficiency	Coordination	Market
Firm globalization	.129***	.095**	.177***
Size—total employees	.040	.078**	−.005
Industry—distribution	.007	.010	.015
Industry—finance	.033	−.126***	.041
Country—Brazil	.045	−.009	−.038
Country—China	−.024	.029	.060*
Country—Denmark	−.104**	−.079**	−.134***
Country—France	−.134***	−.134***	−.190***
Country—Germany	−.114***	−.091**	−.129***
Country—Japan	−.073*	−.115***	−.215***
Country—Mexico	.027	.058*	−.031
Country—Singapore	−.020	.060†	.029
Country—Taiwan	−.008	.034	.035
F	7.885	14.570	20.735
Significance	.000	.000	.000
df	13	13	13
Std. error	0.974	0.951	0.931
Adj. R^2	.05	.10	.13

[a]Coefficients are standardized betas.
†$p < .10$, *$p < .05$, **$p < .01$, ***$p < .001$.

TABLE 6
Regression coefficients[a] for e-commerce scope of use and performance model

Variables	E-commerce scope of use	Efficiency	Coordination	Market
Firm globalization	.126***	.102**	.063*	.135***
E-commerce scope of use	—	.217***	.253***	.331***
Size—total employees	.085**	.021	.056*	−.033
Industry—distribution	.042	−.002	.000	.001
Industry—finance	.087**	.015	−.148***	.013
Country—Brazil	−.062*	.059*	.007	−.018
Country—China	−.212***	.022	.082**	.130***
Country—Denmark	−.053†	−.093**	−.065*	−.117***
Country—France	−.289***	−.071*	−.061*	−.094**
Country—Germany	−.087**	−.095**	−.069*	−.100***
Country—Japan	−.208***	−.028	−.063*	−.147***
Country—Mexico	−.101***	.049†	.084**	.002
Country—Singapore	−.213***	.026	.114***	.100**
Country—Taiwan	−.206***	.037	.086**	.103***
F	17.181	13.061	22.263	36.570
Significance	.000	.000	.000	.000
df	13	14	14	14
Std. error	0.942	0.953	0.921	0.877
Adj. R^2	.11	.09	.15	.23

[a]Coefficients are standardized betas.
†$p < .10$, *$p < .05$, **$p < .01$, ***$p < .001$.

TABLE 7
Regression coefficients[a] for type of use and performance model

Variables	B2B use	B2C use	Efficiency	Coordination	Market
Firm globalization	.143***	−.123***	.126***	.086**	.177***
B2B use	—	—	.084**	.087**	.161***
B2C use	—	—	.078**	.026	.185***
Size—total employees	.051[†]	.170***	.022	.069*	−.045[†]
Industry—distribution	−.048[†]	.126***	.002	.011	−.001
Industry—Finance	−.044	.210***	.021	−.127***	.010
Country—Brazil	−.097**	−.040	.056[†]	.001	−.015
Country—China	−.100**	−.074*	−.010	.039	.090**
Country—Denmark	.009	−.022	−.103**	−.079**	−.132***
Country—France	−.211***	−.125***	−.107***	−.112***	−.133***
Country—Germany	−.051[†]	−.003	−.109***	−.086**	−.120***
Country—Japan	−.100**	−.072**	−.059*	−.105***	−.186***
Country—Mexico	−.078**	−.008	.034	.065*	−.017
Country—Singapore	−.130***	−.037	−.006	.073*	.057*
Country—Taiwan	−.042	.011	−.005	.037	.040
F	10.623	12.932	8.906	13.868	30.172
Significance	.000	.000	.000	.000	.000
df	13	13	15	15	15
Std. error	0.964	0.956	0.966	0.946	0.890
Adj. R^2	.07	.09	.07	.11	.21

[a]Coefficients are standardized betas.

[†]$p < .10$, *$p < .05$, **$p < .01$, ***$p < .001$.

other than the United States had significantly lower scope of e-commerce use than firms in the United States.

H2a and H2b address a different e-commerce indicator, type of use (B2B or B2C). H2a predicted that globalization would have a positive effect on B2B e-commerce use. As shown in Table 7, this hypothesis was strongly supported ($b = .14$, $p < .001$). Size and industry had only marginal effects on B2B use, with large firms likely to adopt more B2B and distribution firms less likely to adopt it. Firms from all countries except for Denmark and Taiwan were significantly less likely to adopt B2B than U.S. firms. Support for H2b, predicting a negative effect of globalization on B2C use, was also evident, as higher globalization led to less B2C e-commerce use ($b = −.12$, $p < .001$). A strong industry effect was also evident with regard to B2C, as both finance firms ($b = .21$, $p < .001$) and distribution firms ($b = .13$, $p < .001$) were much more likely to adopt B2C e-commerce than manufacturing firms. This effect is probably explained by the fact that finance and distribution firms deal with consumers much more often than firms in the manufacturing industry. Size also had a significant effect and was a positive predictor of B2C e-commerce use ($b = .17$, $p < .001$). Country effects were less pronounced for B2C than for B2B use.

H3, that globalization would lead to greater impacts, was also substantiated. Table 6 shows that, controlling for the effects of e-commerce use, size, industry, and country, globalization had a significant positive direct effect on all three types of performance, efficiency ($b = .10$, $p < .01$), coordination ($b = .06$, $p < .05$), and market ($b = .14$, $p < .001$). Even stronger effects are evident in Table 7, when controlling for B2B and B2C e-commerce use, as well as size, industry, and country effects. Size had a positive association with coordination impacts ($b = .06$, $p < .05$), while finance industry had a negative effect on coordination ($b = −.15$, $p < .001$). In general, firms from the developed countries in Europe and Japan were less likely to experience performance impacts than U.S. firms, while firms from developing countries (especially those in Asia) were more likely to experience improved coordination and market impacts.

H4, that scope of e-commerce use would act as a mediator between globalization and firm performance, was supported as well. To test for mediation, additional analyses were run regressing the dependent variables (the three dimensions of firm performance) on globalization and the two control variables. Results of these regressions are reported in Table 5. According to Baron and Kenny (1986),

mediation can be established by showing that the effect of the independent variable on the dependent variable is less when the mediating variable is included in the regression model than without it. Following their recommendations, we compare the relationship of the dependent variable (performance) to the independent variable (globalization) with and without the mediating variable (scope of e-commerce use). Comparing the regression coefficients for globalization and all three dimensions of performance in Table 5 (without the mediator) and Table 6 (with the mediator), it is evident that the effects of globalization on each performance dimension are less when scope of e-commerce use is included in the model. This indicates that scope of e-commerce use somewhat dampens the effects of globalization and mediates its relationship with firm performance.

H5 predicted that scope of use would have a positive effect on firm performance. This hypothesis was also supported, as scope of use had strong positive impacts on all three types of performance. Table 6 indicates that controlling for the impacts of firm globalization, size, industry, and country, scope of use had significant effects on all three types of impacts: market ($b = .33$, $p < .001$), coordination ($b = .25$, $p < .001$), and efficiency ($b = .22$, $p < .001$).

In terms of type of use, Table 7 shows that the use of B2B e-commerce had significant market ($b = .16$, $p < .001$), coordination ($b = .09$, $p < .01$) and efficiency $b = .08$, $p < .01$) impacts. Use of B2C had significant positive market $b = .19$, $p < .001$), and efficiency ($b = .08$, $p < .01$) impacts, but no significant relationship to coordination impacts ($b = .03$, $p > .10$). Thus H5 was supported, but with some qualifications: While scope of use predicted all three dimensions of performance and both B2B and B2C e-commerce led to market-related impacts such as increased sales and efficiency-related impacts such as greater productivity, B2B use was likely to lead to increased coordination, but B2C was not.

DISCUSSION

Each of the five hypotheses was supported by the analysis. The following is a discussion of the findings, including additional data from chi-square analysis comparing characteristics of "high global" (top 25%) and "low global" (bottom 25%) segments of the sample. These comparisons provide a richer and more detailed picture of the data, and provide a basis for explaining the results.

H1 regarding globalization and scope of e-commerce use was supported, as firm globalization was a significant predictor of scope of use. This is consistent with the view that global firms face increased pressure to use e-commerce as a response to international competition and the operational need to coordinate more effectively across national borders. Looking specifically at the types of activities that global firms conducted on the Internet, we found that the difference between high global and low global firms was explained by a particular set of activities that high global firms were more likely to carry out online. Figure 2 shows that highly global firms were significantly more likely to use the Internet for exchanging information with customers and suppliers, integrating business processes, and after sales service and support, but not for sales, procurement, and marketing. This might be explained by the fact that business processes of global companies are more difficult to integrate, and they must coordinate with more business partners over greater distances. Thus global firms can reap greater benefits from using the Internet as a tool for integration and coordination. Sales and marketing, on the other hand, are more local in nature, so potential benefits are similar for both global and local firms.

It is somewhat surprising that there is no difference in online procurement, as one might expect that global firms are buying from a more geographically dispersed set of suppliers and could achieve greater impacts in terms of reducing procurement costs by utilizing the Internet. One explanation might be that global firms are more likely to be already using EDI. If this is the case, they may be using the Internet in the search and negotiation process, but using EDI for the actual transaction.

H2a and H2b regarding globalization and type of e-commerce use were confirmed as well. This supports the argument that upstream activities, which involve B2B relationships, are more global in nature, while downstream activities that involve consumer interactions are more local or multidomestic (Porter, 1986). B2B e-commerce can be applied in a standardized way on a global basis and thus benefits from economies of scale, while B2C e-commerce requires significant adaptation for each local environment and therefore might not result in economies of scale. Instead, local firms may have inherent advantages over global firms in doing business online with consumers. These could include better knowledge of consumer preferences, established brand names, and effective distribution channels that can be used to support a "click and mortar" strategy for e-commerce.

These findings are partially explained by industry effects; namely, the highly global firms tend to be concentrated in the manufacturing industry and engage in more B2B e-commerce in general than low global firms, which are dominated by finance and do more business with consumers. However, globalization did have significant effects on B2B and B2C use, *over and above* the evident industry effects. Globalization also had effects on e-commerce use that were independent of firm size and country. These findings suggest that globalization is more than a proxy for industry or firm size, and that it transcends individual country effects.
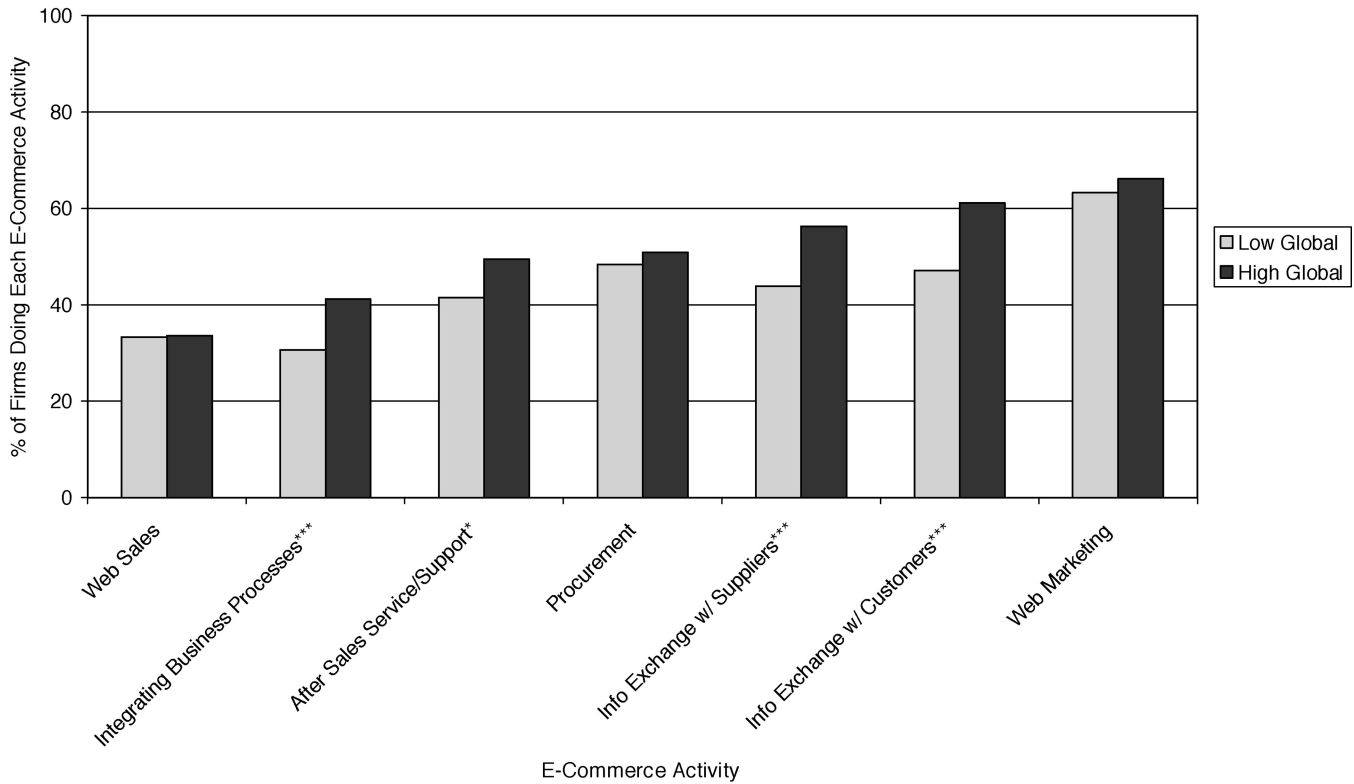
FIG. 2. Scope of e-commerce use, high vs. low global firms. *Note*: *$p < .05$, **$p < .01$, ***$p < .001$.

Looking at the differences between high and low global firms at a more detailed level yields additional interesting findings. As Figure 3 shows, highly global firms were more likely to engage in both B2B sales and services than low global firms. But looking at B2C, we find that the two groups were actually equally likely to engage in B2C sales. This implies that any advantages or greater motivation local firms have in the consumer market do not make a difference in terms of actually selling online. Instead, the big difference is in B2C services, which local firms were significantly more likely to conduct online via their web sites.

One explanation might be that highly global firms (over half of which were foreign headquartered) provide fewer services overall to consumers, and that they are more likely to outsource the services they do provide in other countries rather than performing them directly. Global firms may see less payoff or competitive advantage in providing online services to consumers. Knowledge of B2C is less transferable from country to country, and it is expensive to get local knowledge. Global firms may be deterred from providing B2C e-commerce services by challenges due to national differences in language, culture, and regulations, which may be especially important in the often highly regulated financial sector. If this is the case, the difference is

simply explained by the fact that local firms are more service oriented, not that they have a higher proclivity for providing those services online.

On the other hand, it could be that for any given level of consumer services, local firms are more likely to provide them online. The reasons could have to do with better ties to local supply chain partners. Two examples are product availability information and order tracking, both of which are common services offered on B2C web sites. Providing these services online requires integration with warehouses, distribution centers, and shipping companies to track inventory and shipment information. This may be easier for local firms that have well-established relationships with local partners.

Broadly, the foregoing findings regarding H1 and H2 confirm previous theories and findings that B2B e-commerce supports upstream activities and tends to be more global, whereas B2C supports downstream activities and tends to be more localized (Globerman et al., 2001; Porter, 1986), as well as arguments for the advantage of local presence for B2C e-commerce in particular (Steinfeld et al., 1999; Steinfeld & Whitten, 1999).

The third and fourth hypotheses regarding globalization and performance were also supported. The findings show that global firms enjoyed greater positive impacts
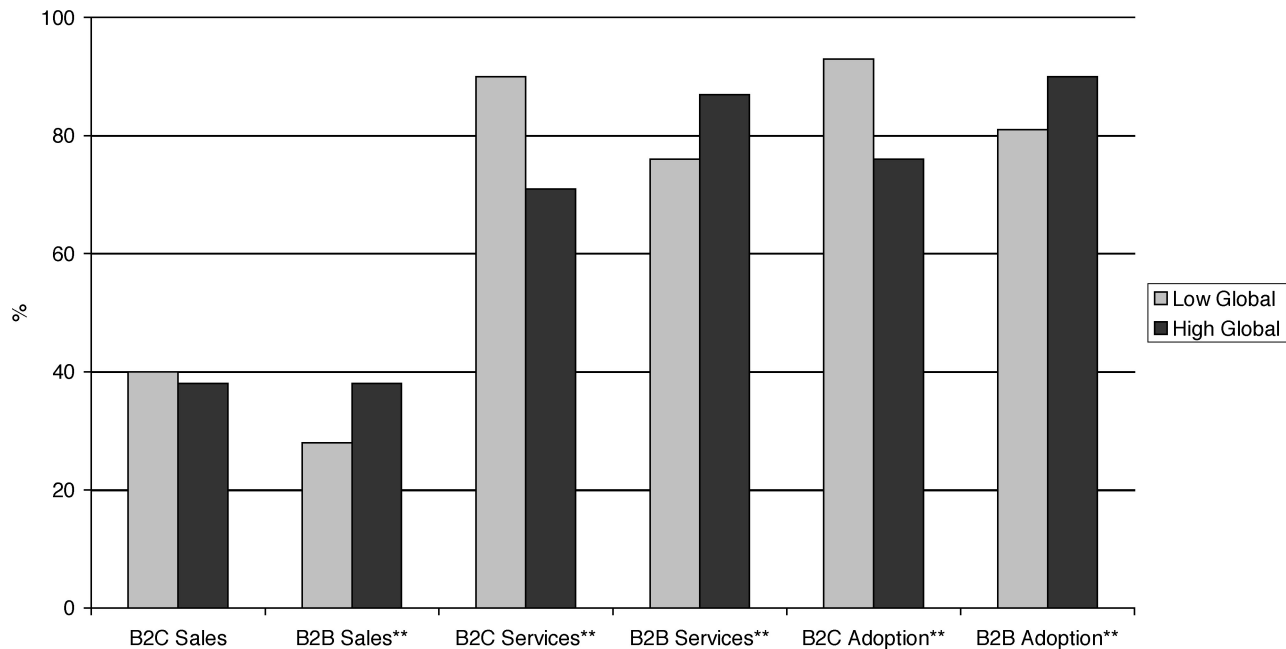
FIG. 3. Type of e-commerce use—B2B Vs. B2C, high vs. low global firms. *Note*: *$p < .05$, **$p < .01$, ***$p < .001$.

on firm performance, in terms of efficiency, coordination, and market impacts. This effect is, however, mediated by scope of e-commerce use. The fact that e-commerce use is a mediator means that globalization also has an indirect effect on performance. Globalization leads to higher levels of e-commerce use, which in turn has positive impacts on performance. Comparing high and low global firms, Figure 4 shows that highly global firms were more likely to experience improvements on every item surveyed than low global firms. Differences were significant for all types of performance, but were most pronounced regarding increased international sales, improved coordination with suppliers, and decreased procurement and inventory costs. Globalization thus appears to lead to performance improvements, particularly in terms of increased coordination.

There are two likely explanations for these differences. First, global firms may have greater opportunities for performance improvement. This may be because they are more inefficient and ineffective in each area and have more room for improvement. On the other hand, their scale and scope may give them more opportunities to realize benefits from using the Internet than local firms with more limited scale and scope (Porter, 1986). A second explanation, posited earlier, is that global firms have access to a larger reservoir of resources and capabilities to draw on when implementing IT innovations such as the Internet, and thus have an advantage in effectively deploying the technology and in making needed process changes to reap the benefits from use (Bartlett & Ghoshal, 1998). Both

of these possible explanations warrant systematic examination in future studies, but were beyond the scope of this research.

The fifth hypothesis regarding e-commerce scope and performance was supported as well, with important qualifications. E-commerce scope of use was positively associated with improved performance. This shows that more broad-based use of e-commerce (i.e., use of the Internet for a wider range of activities) results in greater performance gains. However, the separate analysis of B2B and B2C e-commerce reveals that the two different types of use were linked to different performance dimensions. Both B2B and B2C use drove market- sand efficiency-related performance improvements, but B2B use led to greater coordination as well, while B2C use did not. Overall, B2B use appeared to have more fundamental impacts on firm performance, as it led to a broader range of improvements (market position, coordination, and efficiency). The impacts of B2C use were more limited to market position and efficiency, although it did have a stronger association with market-related impacts than did B2B use.

Overall, our research findings are in line with theory suggesting that B2B e-commerce should lead to greater impacts on upstream activities such as coordination with suppliers and business partners, while B2C e-commerce should lead to greater downstream impacts on sales and market position (Mahmood & Soon, 1991; Porter, 1985, 1986; Tallon et al., 2000). In light of this prior theory, it is not surprising that B2C e-commerce would not have major impacts on coordination with suppliers and customers, as
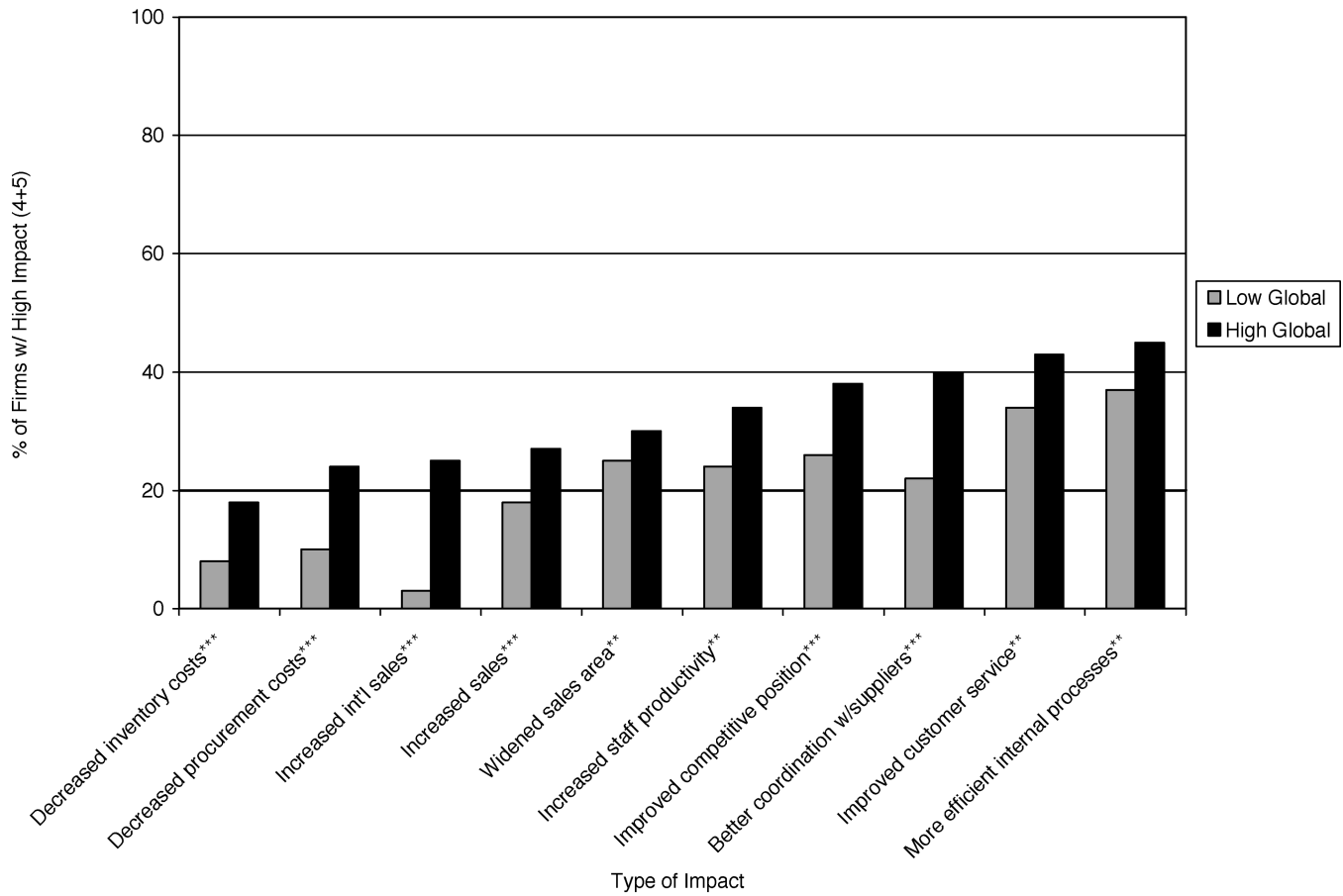
FIG. 4. Firm performance (% high impact), high vs. low global firms. *Note*: *p < .05, **p < .01, ***p < .001.

sales to consumers do not require coordinating activities in the same way as do supply-chain activities with business partners, which are facilitated by B2B e-commerce. Although B2B requires upstream coordination between firms and integration of their information systems and processes, B2C involves the downstream relationship between the firm and the consumer. Thus, it makes sense that B2B would have an impact on the upstream dimension of coordination (including decreased procurement and inventory costs and improved coordination with suppliers), but that B2C would not, as it has greater impacts on downstream activities such as sales and market position.

However, the findings also suggest that these distinctions are not so neat, as both types of e-commerce use also yield impacts beyond each of these dimensions. The fact that B2C e-commerce was associated with efficiency gains supports arguments that providing services online can lead to major cost savings: for instance, by eliminating the need for customer service and technical support staff (Kraemer et al., 2000; Kraemer & Dedrick, 2002). Online banking is supposed to reduce the need for customers to visit branches or use call centers, while online retailing likewise reduces

the need for in-store or call center staff. Overall, the greatest impact from e-commerce use was improved sales and competitive position, which resulted from use of both B2B and B2C.

Limitations

Despite the large scale of our study, it is limited in several ways. First, the results are based on a cross-sectional survey conducted at one point in time. As such, they cannot establish causality. We rely on the logical argument that the process of firm globalization has been occurring longer than Internet-based e-commerce has been in existence, so it precedes it chronologically. However, we would argue that over time, greater e-commerce use in turn leads to greater firm globalization. Second, due to the methodology used, the models in our study explain a low amount of variance. We chose to focus on the effect of firm globalization on e-commerce use and impacts, rather than being explicitly interested in a range of factors explaining different types of impacts. Given the robustness of our estimates, the results indicate that globalization does have an effect

on e-commerce use. It also has an impact on performance, both independently and through the mediating influence of scope of e-commerce use. Third, our study used subjective measures of firm performance. Although this was a necessity given the scale and multicountry aspect of the study, the results would be stronger if objective performance measures could have been included, especially if both types of measures could have been used in order to examine the correspondence between such measures.

Future cross-country research should rely on some external data on firm performance in addition to perceptual data when the latter must be used. It should also include country-level variables such as the evenness of the IT infrastructure across the different countries in which each firm operates, as well as more extensive indicators of firm globalization, such as the number of countries or continents of operation, to better measure global scope. Finally, longitudinal study of these relationships over time will help to better assess causality and investigate reverse effects of the scope of e-commerce use on firm globalization.

CONCLUSIONS AND IMPLICATIONS

This research shows that the relationship between globalization and e-commerce is complex and varied. Among firms using the Internet to conduct business, global firms use the technology more extensively across their value chains, engaging in a wider variety of e-commerce activities than less global firms. However, when e-commerce is broken down in terms of the type of business relationship involved, we find a very different picture for B2B and B2C e-commerce, with global firms more likely to engage in the former and local firms in the latter. The findings provide empirical support for Porter's (1986) thesis that upstream activities, which involve B2B transactions, are more global in nature, while downstream activities involving B2C interactions are more local, or multidomestic. The empirical findings reinforce qualitative research on e-commerce that suggests that global convergence is occurring in B2B through the coordination and integration of business processes and operations, but that B2C remains more of a local phenomenon due to divergence in consumer preferences and habits (Gibbs et al., 2003).

This study makes an important contribution as the first study to empirically test relationships between firm globalization, B2B and B2C e-commerce, and firm performance, through a large-scale study across 10 countries and 3 industries. Our results help refine the literature on IT and globalization, much of which assumes or argues that IT use drives globalization or is an inherent part of it. We find that this is not always the case, as certain typses of IT use (namely, B2C e-commerce) are actually more localized than global.

Although globalization has a negative effect on B2C, firms derive most of their performance benefits from B2B rather than B2C, so the net effect of globalization seems to be a positive one on firm performance. Local firms do appear to be benefiting from e-commerce though, especially B2C services, which drive increased sales. Global firms get more performance improvements from e-commerce use than local firms overall, as they tend to adopt B2B, which has greater impacts across a broader range (efficiency, coordination, and market) than B2C, which is a driver only of increased market and efficiency. Global firms also get more direct impacts from e-commerce, presumably as they have greater resources and scope to use it better.

Overall, the findings support the notion that e-commerce is reinforcing rather than transforming existing commerce patterns. Our major finding is that B2B e-commerce sales and services tend to be global, while B2C tends to be local or multidomestic, which matches the pattern hypothesized for upstream and downstream business activities (Porter, 1986): namely, that global firms (particularly manufacturing firms) are more likely to do business with other businesses, while local firms (especially finance and distribution) are more likely to provide sales and services to consumers.

Managerial Implications

The finding that global firms are the ones primarily engaging in B2B—which constitutes the majority of all e-commerce—implies that e-commerce will reinforce existing international competitive advantages, rather than leveling the playing field and enabling local firms to compete with global firms in international markets. Doing business across national borders involves more than simply setting up a web site and offering products or services to the world. The virtual world of commerce must be supported with physical, financial, and information processes that global firms are more likely to already have in place, and that local firms cannot duplicate easily or cheaply. This challenges the claims in the popular press and elsewhere that e-commerce will level the playing field among firms. For example, Cavusgil (2002, p. 24) proclaimed that "e-commerce is a great equalizer! It creates a level playing field between small and large firms, experienced and inexperienced, and domestic and foreign." In general, our findings indicate that e-commerce tends to reinforce existing advantage rather than equalize advantage between firms.

On the other hand, these inequalities do not preclude local firms from participating in e-commerce. In fact, as Porter and others suggest, local firms may have valuable resources that put them at a competitive advantage in their home markets. These include local knowledge, strong brand names, distribution channels, financial and payment

mechanisms, and customer service infrastructure. These resources can be an advantage in B2C e-commerce and are not easy for global firms to replicate in each national market around the world. Even purely virtual firms such as Yahoo and eBay partner with local firms in different countries around the world to provide their products and services in local languages with payment in the local currency. This implies that low global firms can look for opportunities in local markets rather than trying to use the Internet to reach far-flung international markets. If these firms do want to expand globally, they are more likely to do so by adopting B2B e-commerce to break into the global production networks of multinational corporations than by trying to sell directly to foreign consumers.

The Internet is still relatively new as a medium for conducting business, having been opened to commercial use for just over a decade, and its ultimate impacts are still to be seen. In time, it may have a transformative effect on many industries, just as earlier innovations such as railroads, electricity, the telephone, and computers have done. For now, however, the changes are more supportive than disruptive of existing industry structures and competitive environments.

NOTES

1. We tested for response bias in our data set because our sample consists of both IS and non-IS managers and executives, since IS managers may be positively biased when rating the impacts of e-commerce on firm performance due to their higher level of investment in the technology. To test for bias, we conducted a comparison of responses by IS managers versus non-IS managers to determine whether a systematic difference exists. This comparison was done using a Mann–Whitney *U*-test to compare the means across the two groups, and the Kolmogorov–Smirnov test to examine the hypothesis that the sample distribution of the IS managers is equal to that of the non-IS managers. The test showed that there were no statistically significant differences between these two groups on any of the items except one, "international sales increased." Thus we conclude that the responses from the two groups do not differ significantly in terms of the sample mean and sample distribution.

2. Conceptually, we felt that including both internal and external measures of firm globalization strengthened the measure by making it more multidimensional. We also felt that combining the endogenous and exogenous items into a single measure was appropriate since the index is more reliable with all five items than excluding the exogenous international competitive pressure variable (the alpha score without this item is only .65). In addition, a factor analysis confirmed that the five items loaded as a single factor.

3. Earlier studies of EDI and e-commerce have mainly studied either adoption or "intent to adopt." This was primarily due to the fact that these studies were conducted early on in the adoption of the technology and researchers were trying to understand the factors that might lead to adoption. We focus on firms already using e-commerce, so it is appropriate for us to study scope and type of use rather than adoption or intent to adopt.

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