Drivers of E-Business Activity in Developed and Emerging Markets

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***Abstract*—This paper presents the results of an empirical analysis of the determinants of e-business activity across a sample of 26 developed countries and 52 emerging markets. Several "e-readiness" indicators predict actual e-business activity, including Internet infrastructure, computer infrastructure, affordable telephone service, literacy rates, English language capabilities, and logistics infrastructure. No support was found for a linkage between e-business and institutional factors (i.e., country risk, economic freedom, and transparency) or payment infrastructure. Moreover, evidence of path dependence suggests that sustainable first-mover advantages are conveyed upon early adopters of Internet technologies. Important regional differences also exist, with Asia leading other emerging markets and Eastern Europe lagging. Finally, analysis of a subsample of countries suggests that entrepreneurship rates drive e-business activity. The results document the persistence of the global digital divide and support a broad view of e-readiness, whereby a country's e-business activity depends not only upon information and communication technology (ICT) infrastructure but also upon human capital and logistics infrastructure. The absence of a link between institutional factors and e-business suggests that e-business arises not only when supporting economic institutions exist but also as a means of overcoming inadequate institutional conditions.**

***Index Terms*—Determinants of e-business activity, digital divide, e-business policy for countries, e-commerce issues, emerging markets, entrepreneurship and e-business, models of e-commerce usage, statistical analysis of e-commerce parameters.**

I. Introduction

A GREAT DEAL of attention has been placed recently on the digital divide that separates countries by the extent of domestic access to information and communications technologies (e.g., Organization for Economic Cooperation and Development [22], United Nations Conference on Trade and Development [54], and World Economic Forum [58]). In addition to preventing universal access to technological innovations, this divide inhibits commercial applications of these technologies, known as e-business. The digital divide is drawn primarily along economic and social lines, which raises concerns that developing countries will not be able to access the productivity-enhancing technologies needed for economic development and poverty alleviation.

The implications of the digital divide extend beyond economic policy to include issues and opportunities for firms. In particular, firms based in countries that are on the less developed side of the digital divide may find it increasingly difficult to be competitive not only in global e-business markets, which are characterized by worldwide competition between the global networks of multinational firms [20], but also in multidomestic and local markets that were previously shielded from foreign competition. First, e-business and related technologies have led to a reduction in the number of markets that can be viewed as strictly local. These technologies may enable foreign entrants to implement country-specific approaches that characterize what is alternatively referred to as multidomestic or multinational strategies [5], such as a single Web site that is not only translated into local languages but features locally-produced content and customized product offerings. Second, even when local e-business markets continue to matter and to favor local players, these markets are unlikely to grow without the presence of enabling conditions such as technological, human capital, and distribution infrastructure. For these reasons, it is important for managers and entrepreneurs to understand the conditions that enable e-business activity in both developed and emerging markets [8].

This paper presents the results of an empirical analysis of e-business activity at the country level. Drawing from a cross section of 78 countries, we find that the level of e-business activity taking place within a given country is dependent upon the country's information and communication technology infrastructure, human capital, and logistics/fulfillment infrastructure. This paper also finds evidence of path dependence suggesting the persistence of first-mover advantages over time. Moreover, regional differences exist even after accounting for various indicators of e-readiness. Finally, entrepreneurship rates are associated with e-business activity, which highlights the importance of e-business as a channel for entrepreneurial activity, and as well as the importance of a healthy entrepreneurial climate for successful e-business.

II. Global E-Business and the Digital Divide

Although initial expectations of e-business growth were often overly optimistic, there is no doubt that commercial applications of Internet-, Intranet-, and related technologies have rapidly assumed an important position in the global economy. E-business eludes effective measurement of market size due to the inherently intangible nature of trade in the sector, as well as variation in how e-business in defined. As pointed out by the United Nations Conference on Trade and Development [54], forecasts of e-business may vary by a factor of 10, and even estimates of current Internet users often vary by 100%. Regardless of whether the size of the global e-business market is closer to lower end estimates of $300 billion per year or higher end estimates of $3 trillion per year, it is difficult to dispute the important role that e-business has rapidly assumed in the global economy [55].

Manuscript received August 1, 2003; revised September 1, 2004. Review of this manuscript was arranged by Department Editor A. Chakrabarti.

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Digital Object Identifier 10.1109/TEM.2005.844464

The growth in global e-business is important primarily for the manner in which it is altering the overall business environment and for the productivity-enhancing practices that e-business enables [3], [24], [50]. Though national markets remain important, e-business alters the competitive landscape by reducing the barriers between geographic markets. The basis upon which efficiency is determined is also altered—in some cases, a limited number of firms gain advantages by achieving previously unthinkable economies of scale, while in other cases a reduction in essential fixed costs precipitates a substantial decline in the minimum efficient scale, thereby allowing room for a greater number of competitors [33], [60]. In addition to the impact on competitive dynamics, e-business has enabled a broad set of productivity-enhancing practices. First, Scupola [48] suggests that by enabling more open communication systems, the Internet has increased the cost-effective flow of information and that markets reflect perfect information and, thus, enable more efficient resource allocation. The Internet also has increased the need for secure and reliable sources of information in a medium, where security, privacy, and reliability of information is key and many firms have been established to make these functions available to all users. Data mining is also needed due to the volume of data available in this open system.

In at least some cases, e-business fosters disintermediation and serves to undermine monopoly power. This might apply to sellers and buyers due to the disintermediation of the value chain and deregulation in some countries, but it has not led to a reduction of monopoly power in manufacturers who hold proprietary intellectual property. Second, in a more dynamic sense, e-business enables a more rapid diffusion of existing innovations and supports the development of further innovations, such as in the realm of supply chain management. Although the ability of individual firms to reap extraordinary profits was initially overestimated, there is little doubt that the social gains to e-business innovations have been dramatic [29]. There are also other factors that have been felt due to the use of the Internet such as replacement of paper by digital information, impersonal business relationships through the Web, difficulty of coordinating, and integrating the various Web and non-Web relationships/interactions. These factors have changed the way we do business and may have contributed to the reluctance of some from joining this medium. The forces for Internet use and counterforces have been strong and depend on network externalities, whereby as more people join the users group, there is likely more pressure for other to join if they want to partake in the benefits.

However, not all countries have experienced the same trajectory of e-business adoption. Certain countries, notably the United States and Scandinavian nations, were early innovators and/or adopters of Internet technologies and associated commercial applications, while other countries lagged in initiating adoption and often remain behind [23]. Emerging markets, in particular, were largely excluded from the first wave of the e-business boom, but have attempted to compensate for their late-mover status through more recent investment in e-business [12].

One factor that is clearly associated with the rate and extent of e-business adoption within a country is economic development. Most technological advancements in Internet-related technologies and e-business have originated in industrialized nations and have initially been targeted at customers in the same set of countries. According to our own calculations based on data from the World Bank [57] and eMarketer [14]), high-income nations accounted for more than 80% of Internet users and more than 90% of global e-commerce in 2001. This disparity in Internet and e-business adoption, often referred to as the digital divide [35], indicates that the benefits of the digital age are not evenly dispersed around the globe.

From the perspective of developing countries, the digital divide is most troubling, particularly since developing countries are likely to have the greatest needs for economic development, and they may also be in the best position to experience gains in social welfare through the adoption of e-business. This is true because market forces tend to be subject to greater impediments in developing countries than in developed countries. If e-business technologies help alleviate impediments to market forces by increasing the quantity, quality, and speed of information flowing through the economy, then developing countries stand to benefit more from e-business adoption than do developed countries.

Understanding the factors that drive e-business activity is, therefore, an important element in understanding economic development. Gaining an enhanced understanding of the drivers of e-business will also inform practice: entrepreneurs who understand which geographic markets are ready to support e-business activity will be better able to implement international e-business strategies. Finally, this issue is also important for scholars of international business, management, and entrepreneurship, since e-business is an important new channel for entrepreneurial activity, and studying international variation in e-business will contribute to ongoing research on cross-national variation in overall entrepreneurial activity [42].

III. What Factors Drive E-Business Activity at the Country Level?

The main purpose of this paper is to explain variation in the level of e-business activity observed in different countries. Academic and practitioner communities have shown substantial interest in what is often referred to as "e-readiness," i.e., assessing the extent to which given countries exhibit the characteristics needed to enable e-business. Consulting firms such as the Economist Intelligence Unit, Pyramid Research, eMarketer, IDC, Bain, and Forrester Research have explored the issue of e-readiness to distinguish between countries that present the greatest opportunities for successful e-business. Governmental and nongovernmental organizations such as the OECD, UNCTAD, APEC, European Union, and World Economic Forum have undertaken efforts to better understand e-readiness in order to identify the factors that lead to a healthy e-business climate, which in turn is believed to foster economic development. Finally, academics [30], [41] have begun to document the link between e-readiness indicators and Internet activity.

It is widely believed that differences in e-business activity between countries are largely attributable to initial differences in the factors that enable e-business. Drawing from prior academic and practitioner-oriented research such as eMarketer [14], OECD [39], [40], UNCTAD [54], the European Union

[11], and World Economic Forum [59], this paper identifies four broad categories of factors that are believed to drive e-business activity: information and communication technology infrastructure, human capital, the institutional environment, and logistics/fulfillment infrastructure. Furthermore, this paper explores whether or not the adoption of e-business is a path-dependent process, whether or not regional differences persist after controlling for other factors, and whether or not variation in entrepreneurial activity drives e-business levels.

A. E-Readiness: Information and Communication Technology (ICT) Infrastructure

Though the intangible nature of e-business is often highlighted, the Internet communication associated with e-business remains heavily dependent upon capital-intensive investments in physical ICT infrastructure. ICT infrastructure includes network equipment and equipment present at each node on the network (e.g., personal computers, telephone lines), and limits to bandwidth at any point along the network may slow down communications and commerce. While sheer access to infrastructure is of central importance, reliability and affordability are also major concerns. For instance, while most Western European countries compare favorably with the United States in terms of access and reliability, the practice of charging for local telephone calls by the minute has been widely seen as a primary reason why European countries lag in e-business, particularly in B2C commerce.

B. E-Readiness: Human Capital

Apart from a country's physical ICT infrastructure, human infrastructure is also important to enable e-business [6]. As information and communication technologies mature, they become more user-friendly and require less specialized training in order to be utilized. However, most forms of electronic communication require basic education. Moreover, although technical education is not necessarily a prerequisite for exploitation of the Internet, language skills are likely to be useful. In particular, English was initially the *lingua franca* of the Internet, and the overwhelming majority of Internet communication continues to take place in English. For this reason, basic education skills and English language capabilities should play important roles in enabling e-business.

C. E-Readiness: Institutional Environment

In less than 20 years, a dramatic shift has taken place around the globe in recognition of a widely held belief that the building block of economic development is economic freedom [59]. Although the general trend is for governments to engage in increasing privatization, deregulation, and liberalization of commerce, impediments to economic freedom often persist [49]. Countries around the world continue to exhibit substantial variation in economic freedom, protection of property rights for physical and intangible assets, transparency, and rule of law.

Diversity in institutional attributes is expected to drive variation in e-business [41]. Electronic channels for sales and distribution are vulnerable to opportunistic actions such as misrepresentation and outright fraud, particularly due to the increased anonymity associated with electronic transactions. When the potential for opportunism—defined as self-interest seeking with guile [56]—is high, appropriate governance mechanisms must be created to preempt opportunistic actions and/or reduce the cost of their consequences. In some cases, the chance of opportunistic action transpiring may be reduced by technological solutions (e.g., technologies that aid in the verification of identities or that increase the security of electronic transmissions). However, technological innovations to preempt opportunism are often followed by technological innovations that enable new forms of opportunism (e.g., new means of compromising secure transactions). Therefore, the appropriate legal, economic, and social institutions likely continue to play an important role in enabling economic transactions in the digital economy.

D. E-Readiness: Logistics Infrastructure and Fulfillment Capabilities

Along with economic and legal institutions, a country's logistics infrastructure and fulfillment capabilities will likely influence e-business transactions by determining the ease with which products can be reliably delivered and payments can be securely made. While fulfillment capabilities depend on the overall economic and legal institutions that provide for the protection of property rights and the rule of law, they are also dependent upon physical institutions, such as logistics and payments infrastructure. Two important elements of this infrastructure include the availability, reliability, and affordability of third-party courier services, as well as the availability of financial institutions that can handle on-line payments.

E. Path Dependence

Path dependence is the notion that "history matters" [36]. Due to self-reinforcing mechanisms such as large fixed costs, learning effects, coordination effects, and adaptive expectations, the evolution of economic activity and institutions over time is generally shaped by initial conditions, long after the factors that created those initial conditions become irrelevant [4], [10]. Determining whether or not historical conditions continue to impact present e-business activity is of utmost importance to countries that were not early adopters of the Internet and e-business. In our case, 1995 and 2001 are used as milestone dates for the number of Internet hosts found in the country. The choice of years is predicated on the fact that 1995 is an indicator of early adopters of the new technology, whereas the number in 2001 establishes the groups that have joined the bandwagon after the huge success of the Internet between 1995 and 2001.

F. Regional Differences

Casual observation of Internet adoption and e-business activity across the globe indicates that important regional differences exist, and initial claims that the Internet would reduce the importance of geography have since been refuted [28]. It is less clear, however, if these regional differences are entirely the result of variation in the factors outlined above (i.e., ICT infrastructure, human capital, institutional environment, logistics/fulfillment infrastructure), as well as overall economic development, or rather if these regional differences persist even after accounting for the main drivers of e-business activity, which would indicate that region-specific factors such

TABLE I
DEVELOPED AND EMERGING MARKETS INCLUDED IN SAMPLE, BY REGION

High-Income Countries	Emerging Markets: Asia	Emerging Markets: Latin America	Emerging Markets: Eastern Europe	Emerging Markets: Rest of World
Australia	Bangladesh	Argentina	Bulgaria	Bahrain
Austria	China	Bolivia	Croatia	Egypt
Belgium	India	Brazil	Czech Republic	Iran
Cyprus	Indonesia	Chile	Estonia	Jordan
Denmark	Korea	Colombia	Hungary	Kenya
Finland	Malaysia	Costa Rica	Latvia	Lebanon
France	Mongolia	Ecuador	Lithuania	Morocco
Germany	Pakistan	Guatemala	Poland	Namibia
Greece	Philippines	Honduras	Romania	Saudi Arabia
Iceland	Thailand	Mexico	Slovakia	South Africa
Ireland	Vietnam	Nicaragua	Ukraine	Syria
Israel		Peru		Tanzania
Italy		Trinidad & Tobago		Tunisia
Japan		Venezuela		Turkey
Luxembourg				Uganda
Malta				Yemen
Netherlands				
New Zealand				
Norway				
Portugal				
Singapore				
Spain				
Switzerland				
UAE				
UK				
USA				

as historical events and cultural attributes shape e-business development.

G. Entrepreneurial Activity

E-business represents an important new mechanism through which entrepreneurial activity may take place [7], [45], [46]. While certain e-business models are complementary with the preexisting strategies and resources of established firms, other e-business models undermine the established positions of incumbent firms and instead present new opportunities for successful new venture creation [2]. Substantial efforts have been made recently [42] to explain variation in entrepreneurship rates between countries, which result from factors such as variation in economic growth, demographic and cultural attributes, government policy, and economic and legal institutions. Entrepreneurship rates and e-business activity are expected to go hand in hand.

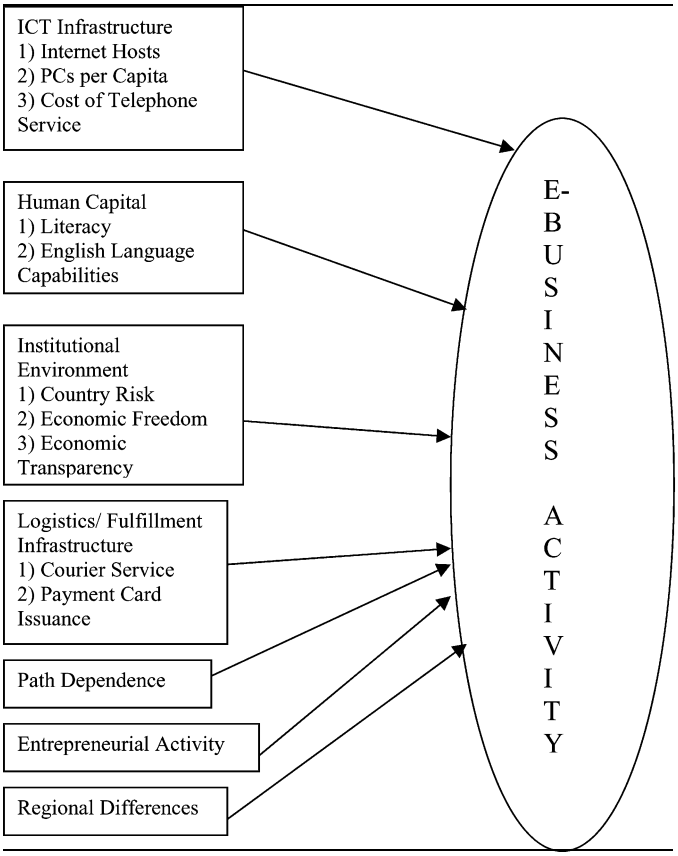
IV. METHODOLOGY

In order to identify the determinants of e-business activity at the national level and to compare developed countries with emerging markets, this paper assembled a cross-sectional database of all countries for which the relevant data are available. This approach yielded a sample of 78 countries, of which 52 are classified as emerging markets and 26 are classified as developed countries. Although there is no consensus definition of emerging markets and developed countries [19], this paper defines developed countries as all countries classified as "high-income countries" by the World Bank, and have classified all other countries as emerging markets. To ensure that the results are not dependent upon a single definition of emerging markets, the data was reanalyzed with various classification schemes. The International Monetary Fund, for instance, distinguishes between "advanced economies"' and "emerging market and developing countries" in its biannual World Economic Outlook report (http://www.imf.org/external/pubs/ft/weo/weorepts.htm). The IMF classification scheme varies slightly from the World Bank by classifying Malta and the United Arab Emirates as emerging markets and South Korea as a developed economy. Alternative analysis using this classification as well as one classifying Singapore as an emerging market was performed. In no case did the choice of classification scheme impact the results in a meaningful manner. For the sake of external validity, the World Bank income classification scheme was utilized for the results reported in this paper. Table I presents a list of the countries included in our sample. Altogether, the sampled countries account for approximately 91% of global population, 95% of global economic output, and 96% of global e-business activity.

The analytical model employed in Table II, which portrays the hypothesized relationships between e-business activity and the explanatory variables. Operational definitions are provided in the next section.

Number of Web sites = f (Internet Hosts in 2001, Personal Computers per Capita, Cost of Telephone Service, Literacy Rate, English Language Capabilities, Country Risk, Economic Freedom, Economic Transparency, Courier Service, Payment Card Issuance, Path Dependence, Regional Differences, GDP per Capita, Population, Entrepreneurship Rates).

TABLE II
EMPIRICAL MODEL OF THE DRIVERS OF E-BUSINESS ACTIVITY IN DEVELOPED AND EMERGING MARKETS



A. Defining and Measuring E-Business Activity

The Internet has created new opportunities for businesses to generate profits. Many names have been used to describe this activity with two of the most popular being e-business and e-commerce. Acknowledging the ongoing debate between researchers about what constitutes e-commerce and e-business and the different variations between them, Davis [11] reports on the OECD definition of e-commerce and e-business: e-commerce refers to the Internet-based sale or purchase of goods or services between two entities with such entities described as individuals or organizations from multiple walks of life, whereas e-business refers to the more inclusive processes that are possible due to the new information and communications technologies (ICT). Laudon and Traver [27] differentiate between e-business and e-commerce referring to e-business as the enablement of internal transactions within the firm and e-commerce as the transactions outside the firm. Riggins and Rhee [44] suggest that the internal and external uses of the Internet are becoming more integrated as one often cannot separate internal activities from external functions. While some have defined e-business in terms of transactions that are fully mediated via the Internet, Lam and Harrison–Walker [25] have indicated that e-business models may play a major role in shaping firm strategy and performance without entailing online transactions; instead, many e-business models are structured around corporate communication, network development, and product/channel enrichment.

In this paper, e-business is defined as the activities that are described by many authors [1], [16], [18], [21]) to include the following.

a) The ability to reach customers through business to consumer (B2C) channels of marketing and distribution.
b) The ability to maintain just-in-time supply and cost-efficient sourcing through business to business (B2B) models.
c) The consolidation of customer purchasing power models through portals as in travel, books, and auctions.
d) The ability to push information to customers in areas where change is rapid and difficult to predict.
e) The administrative processes that can increase productivity through customers entering information into the system. This works with government processes such as tax filing, with university systems such as course registration systems, and surveys of customer feedback.
f) Services such as financial transactions and electronic payment are done to reduce the cost of service and subsequently the price charged customers for these services.

This paints an expansive model of e-business, whereby online technologies are used to perform many useful, convenient, and cost-effective functions in a connected world. The definition used is inclusive in the sense that it encompasses multiple forms of interaction (e.g., business-to-business, business-to-consumer), Internet-mediated transactions, as well as e-business models that may not necessarily entail on-line transactions (e.g., brand building, on-line product enhancement, dealer support), and both revenue-generating and cost-reducing forms of e-business. The inclusive nature of this definition enables the inclusion of all forms of e-business that may impact economic performance at country level and/or at the firm level.

B. Dependent Variable: E-Business Activity

Even if it were possible to achieve consensus in defining e-business, measuring e-business activity at the national level is a difficult task, particularly in emerging markets. National statistics bureaus, such as the U.S. Department of Commerce, Statistics Canada, and Statistics Singapore, have recently derived procedures for measuring e-commerce within their respective countries [29]. Most countries, however, have not developed such procedures, and even when they do, it will take even longer to generate statistics that are internationally comparable. For instance, the U.S. Department of Commerce excludes many travel expenditures from e-commerce statistics, while other countries include such expenditures. Consulting firms, in their effort to evaluate and compare market activity and opportunities across countries, have developed estimates of market size for the explicit purpose of comparing countries. However, these estimates are only available for a small number of countries. A list of these estimates was compiled from firms such as eMarketer, IDC, Forrester Research, and Boston Consulting Group, and was used to evaluate the reliability and validity of our primary measure of e-business activity.

To measure national e-business activity, a list of all e-business Web sites located in each country was compiled during December 2001, as listed in the Yahoo directory (www.yahoo.com). Yahoo is the global market leader in the Internet directory field, and businesses have a direct interest

in ensuring a listing on the Yahoo directory in order to reach a broad customer base. Listings on the Yahoo directory are determined and classified by Yahoo's editors; most are initially suggested by individual users including self nominations (http://docs.yahoo.com/info/suggest). B2B and B2C e-business activity were measured through a count measure of all Web sites listed under the categories "Business to Business" and "Shopping and Services" in each country's section of the Yahoo directory. A measure of total e-business intensity was then generated by summing B2B and B2C activity and dividing by the country's population. In order to permit the use of OLS regression, this measure was then transformed using a logarithmic function to approximate a normal distribution.

As measured, the dependent variable represents a count measure of e-business activity, adjusted for population, rather than a measure of transaction volume or value. This is based on both practical and theoretical rationale. From a practical perspective, it is easier to measure the number of e-business websites in a country than the volume or value of transactions mediated over those Web sites. From a theoretical perspective, many important e-business models do not entail Internet-mediated transactions, so a transaction-based measure of e-business would be less comprehensive.

Although our measure of e-business activity may omit a limited number of e-business Web sites, we were able to verify the validity and reliability of our measure—as well as relate our count-based measure of e-business to estimates of market size—by drawing a comparison to the aforementioned estimates of market size generated by consulting firms. For the limited number of countries for which multiple consultants' estimates of market size were available $(n = 23)$, there is a correlation of 0.98 between market size and the total number of e-business Web sites. The strong correlation between these measures is particularly remarkable when one considers that estimates of market size are intended to reflect transaction value within a country, while the count measure of e-business sites reflects the number of establishments active within the country. This suggests that countries vary primarily in the *quantity* of e-business activity present (i.e., number of e-business Web sites), and that differences in the *quality* of e-business activity (e.g., transaction value) are proportionate to differences in quantity.

C. Independent Variables: E-Readiness Indicators

Ten indicators of e-readiness that have been suggested by academic researchers, business consultancies, and development organizations were used. For each variable, data from the most recent year available, which ranged from 1998 to 2001, were used. When appropriate, variables were transformed to approximate a normal distribution. The e-readiness variables and their source are listed as follows.

- **ICT infrastructure—Internet hosts**: To account for Internet infrastructure, the number of Internet hosts registered in each country during January 2001, as reported by the Internet Software Consortium's Internet Domain Survey (www.isc.org) was used.
- **ICT infrastructure—Personal computers per capita**: Computer infrastructure is represented by the number of personal computers per 1000 inhabitants, as reported in the World Bank's Human Development Indicators database (World Bank [57]).
- **ICT infrastructure—Cost of telephone service**: To account for the extent to which telephone service is affordable for each country's population, a measure of the cost of telephone service adjusted for GDP per capita was included. The cost figures came from the World Bank Human Development Indicators database [57]. Higher values indicate greater telephone costs and, hence, lower affordability. In the initial analysis, a per capita measure of the total number of telephones (landline and mobile) and an alternative measure of landline telephones were used since landline telephones may be more useful in enabling e-business. As might be expected, these measures were highly correlated with other independent variables, particularly PCs per capita $(r = 0.89)$. A test for multicollinearity identified this variable as the sole variable exceeding the threshold variation inflation factor of 10 [53]. To avoid misspecification of the model, the variable representing telephones per capita has been dropped from all reported regressions. Once that variable was dropped, no additional instances of multicollinearity were observed.
- **Human capital—Literacy**: A measure of illiteracy rates from the World Bank Human Development Indicators database [57] was utilized.
- **Human capital—English language capabilities**: Since English is the most commonly utilized language on the Internet, which would appear to convey advantages upon English-speaking countries, a dummy variable that indicated whether or not English is an official language in the sampled country was added. A value of 1 indicates an English-speaking country, and 0 indicates that English is not an official language.
- **Institutional environment—Country risk**: The measures of overall country risk reported in the International Country Risk Guide, published by the PRS Group (www.countrydata.com) were included. This measure of overall country risk is derived from three separate scores for political risk, economic risk, and financial risk. The ICRG index and its component elements are widely utilized by investors and researchers [26], [41] to account for the level of risk inherent in a country's operating environment. Higher values indicate lower levels of country risk. In a separate regression analysis that is available from the authors, the overall country risk measure was substituted by one of its components, the rule of law, since this measure was found by Oxley and Yeung [41] to influence e-readiness. In our analysis, neither the overall country risk measure nor the rule of law component was significantly related to e-business activity.
- **Institutional environment—Economic freedom**: To account for the extent to which a country provides ample protection of property rights and does not impede commerce via regulations, tariffs, and taxes, two measures of economic freedom in alternative specifications (i.e., models 2 and 3) were used. The first measure is derived from an annual report produced by the Heritage Foundation, in which higher values indicate lower levels

of economic freedom. In the second operationalization, which is derived from the Fraser Institute's annual ranking of economic freedom and utilizes a different methodology and a different set of countries, higher values indicate higher levels of economic freedom. Both measures were utilized since the two organizations employ different methodologies, even though both view economic freedom as the extent to which one can pursue economic activity without interference from government (www.fraser.ca; www.heritage.org).

- **Institutional environment—Economic transparency**: The paper uses a measure of economic transparency that is derived from the scores assigned in Transparency International's (www.transparency.org) annual report on transparency around the globe. Higher values indicate higher levels of transparency and, by extension, lower levels of bribery and corruption.
- **Logistics/fulfillment infrastructure—Courier service**: The logistics infrastructure and fulfillment capabilities within the institutional environment by incorporating a measure of the number of DHL courier drop-off locations within the given country were used in the model. Although multiple companies provide package delivery service, DHL is the most global firm in scope and is less dependent upon a single national market than competitors such as Federal Express; hence, their coverage should be reflective of the overall package delivery market. Only two of the sampled countries, Trinidad and Tobago and Tunisia, are not serviced by DHL.
- **Logistics/fulfillment infrastructure—Payment card issuance**: Three measures of payment card usage were utilized to account for the availability of this important means of payment within each country: a per capita measure of the number of credit cards issued, a per capita measure of the number of payments cards issued including both credit and debit cards, and a per capita measure of the number of payment cards transactions processed each year. All three measures are obtained from a report published by the Faulkner & Gray [15] division of Thomson Financial Services.

D. Independent Variables: Path Dependence

Path dependence refers to "the powerful influence of the past on the present and future" [37]. In other words, in the presence of path dependence, historical levels of a particular attribute continue to influence the present even after accounting for present levels of the same attribute. In this context, the presence of path dependence was tested by including a historic measure of Internet infrastructure (i.e., hosts) during January 1995, while controlling for the level of Internet infrastructure in January 2001. We selected January 1995 to capture a point near the beginning of the Internet boom. Due to the high correlation that naturally exists between a single variable measured at two points in time, an orthogonalization of the two measures was performed to avoid problems of multicollinearity. In an alternative, unreported specification, an analysis of the residuals of present infrastructure levels regressed on historic infrastructure levels was performed. There were no meaningful differences in results from the two alternative specifications.

E. Independent Variables: Regional Differences

Regional differences in e-business activity clearly exist, but it is less clear whether or not these differences are merely a result of variation in economic development, population, and e-readiness indicators. This paper tested whether or not there are regional differences among emerging markets even after controlling for e-readiness indicators and other factors. Separate dummy variables were included for emerging markets in Asia, Eastern Europe, Latin America, and the rest of the world (i.e., Middle East, Africa). The omitted dummy variable is that of developed countries, which serve as a base group.

F. Independent Variables: Control Variables

GDP per capita and population figures were used to reflect differences in overall economic development using data from the World Bank Human Development Indicators database. Both variables have been transformed by a logarithmic function.

G. Independent Variables: Entrepreneurial Activity

For the first time, the existence of a rigorous international study of entrepreneurial activity enables the cross-national comparison of entrepreneurship rates, albeit among a relatively small number of countries. The researchers coordinating the Global Entrepreneurship Monitor project [43] monitor entrepreneurial activity and draw a further distinction between opportunity entrepreneurship (i.e., entrepreneurial activity motivated by the high level of opportunities inherent in the country's operating environment) and necessity entrepreneurship (i.e., entrepreneurial activity motivated by a paucity of opportunities for employment in existing businesses). For the purposes of this paper, measures of opportunity entrepreneurship were used in a regression of a subsample of 26 countries. The opportunity entrepreneurship measure was included because necessity entrepreneurship is less likely to motivate the creation of new e-business ventures, particularly in emerging markets. Due to the small number of observations, the entrepreneurship variable is employed in a separate regression, which includes only the control variables so as to maintain statistical power.

V. RESULTS

A correlation matrix is presented in Table III, followed by two tables reporting the results of the OLS regression models. The main analytical model is presented in Model 1. Models 2–4 incorporate alternative measures of institutional conditions, while Models 5 and 6 employ alternative measures for payment capabilities; these variables were introduced in separate models because they represent closely related constructs and are highly correlated. Variance inflation factor tests indicated no evidence of multicollinearity in the models reported.

The regression models presented in Table IV indicate that ICT infrastructure, human capital, and logistics/fulfillment infrastructure are all important drivers of e-business activity, while coefficients for variables representing the institutional environment are not significant. There is also evidence of path dependence and of persisting regional differences. Furthermore, a more limited model incorporating entrepreneurship rates is reported in Table V, and indicates that countries exhibiting

TABLE III
CORRELATION MATRIX

	Mean	Std. Dev.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1 ln(total # e-business sites per capita)	3.15	1.89	1.00															
2 ln(GDP per capita)	8.92	0.99	0.77	1.00														
3 ln(population)	16.51	1.68	-0.49	-0.29	1.00													
4 ln(Internet hosts 2001)	-0.09	0.87	0.47	0.48	-0.36	1.00												
5 PCs per capita	127.01	146.56	0.79	0.80	-0.25	0.22	1.00											
6 cost of local telephone call	0.07	0.05	0.29	0.41	-0.08	0.12	0.50	1.00										
7 illiteracy rate, as % of pop.	10.05	12.55	-0.59	-0.67	0.22	-0.39	-0.52	-0.35	1.00									
8 English as official language	0.22	0.42	0.24	-0.10	0.04	0.06	0.16	0.07	0.26	1.00								
9 ICRC country risk	73.59	9.61	0.67	0.80	-0.34	0.29	0.78	0.40	-0.52	-0.01	1.00							
10 DHL drop-off sites per capita	0.80	1.04	0.52	0.40	-0.45	0.28	0.34	0.08	-0.31	0.00	0.33	1.00						
11 Payment cards per capita	0.74	0.60	0.34	0.34	-0.02	0.09	0.53	0.18	-0.19	0.22	0.38	0.13	1.00					
12 ln(Internet hosts 1995)	0.26	1.01	0.68	0.79	-0.15	0.11	0.81	0.46	-0.67	-0.08	0.67	0.28	0.36	1.00				
13 Asian emerging markets	0.14	0.35	-0.24	-0.35	0.44	-0.28	-0.27	-0.34	0.29	0.05	-0.25	-0.23	-0.19	-0.29	1.00			
14 Latin emerging markets	0.18	0.39	-0.24	-0.18	0.01	0.16	-0.29	-0.04	0.09	-0.17	-0.31	-0.19	-0.21	-0.25	-0.19	1.00		
15 Eastern Eur. Emerging markets	0.14	0.35	-0.07	-0.02	-0.14	0.07	-0.16	-0.07	-0.31	-0.21	-0.02	0.13	-0.10	0.14	-0.16	-0.19	1.00	
16 Other emerging markets	0.21	0.41	-0.34	-0.40	0.01	-0.27	-0.34	-0.14	0.42	0.12	-0.32	-0.17	-0.09	-0.46	-0.21	-0.24	-0.21	1.00

To conserve space, the correlation matrix includes all variables incorporated into the principal regression model, Model #1.
Correlation matrices including alternative operationalizations of variables used in Models 2-7 are available from the authors.

Number of observations = 78. Correlation value above 0.22 are significant at p = .05, and values above 0.29 are significant at p = .01.

higher entrepreneurship rates also exhibit greater e-business activity. Overall, the regressions provide broad support for the hypothesized indicators of e-readiness, and the independent variables collectively explain a very large portion of cross-national variation in e-business activity ($R^2 = 0.87$).

The results strongly support the important influence of ICT infrastructure on e-business activity. As shown in Model 1, the coefficients for each of the indicators of ICT infrastructure are significant. Higher rates of e-business activity are driven by greater numbers of Internet hosts, greater availability of personal computers, and greater affordability of telephone service.

The results also provide clear evidence of the link between a country's human capital and its e-business activity. In each model specification, both literacy rates and an indicator variable for English-speaking countries are strongly significant. The finding concerning English language capabilities is particularly interesting, given the otherwise mixed evidence regarding the Internet dominance of the English language. During the early stages of the Internet's development, English was clearly the dominant language. Although this dominance has recently begun to diminish, our results suggest that English-speaking countries maintain a strong advantage in e-business.

In contrast with findings regarding ICT infrastructure and human capital, the results provide no support for the contention that international differences in institutional factors drive e-business. In alternative models (i.e., models 2–5), this paper accounts for legal and economic institutions by using four correlated but conceptually independent measures: country risk, two different measures of economic freedom, and transparency. None of the coefficients are significant, and only two are of the anticipated sign. These results are incompatible with seemingly intuitive theoretical arguments and prior empirical research [41].

Moderate support was found for the contention that a country's logistics infrastructure and fulfillment capabilities are important drivers of e-business. As a whole, the variables explain a significant portion of the variance, and the variable representing logistics infrastructure (i.e., DHL courier drop-offs) is significant in each specification. However, this paper does not find that payments capabilities influence e-business activity. To minimize the possibility that our nonfinding is a product of measurement bias, this paper reports on three alternative measures of payments capabilities, corresponding to payment cards (i.e., credit and debit) per capita (models 1 and 5, using two alternative methods of accounting for missing data) and credit cards per capita (model 6), with nonsignificant results in each case.

Regarding path dependence, past levels (from 1995) of Internet infrastructure were found to influence current (2001) e-business activity even after accounting for current Internet infrastructure. This finding implies that like other aspects of economic development [36], e-business development is a path dependent process, and historical events play a major role in shaping the evolution of a nation's economic institutions. In this case, countries that lagged in the development of Internet infrastructure continue to lag in e-business, even when they have caught up in terms of infrastructure development. This finding is most troublesome for policy makers and entrepreneurs in those emerging markets that were late movers in the adoption of Internet technologies. While many have argued that late-moving emerging markets have the opportunity to leap-frog technologies and to learn from mistakes made in other countries [9], [31], [32]), the analysis in this paper suggests that this has not occurred.

In terms of regional differences, measures of e-readiness used do not explain all regional differences. In particular, Asian emerging markets are ahead of other emerging markets as well as developed markets in e-business activity after accounting for differences in infrastructure, human capital, and institutional environments. Eastern European emerging markets, in contrast, lag in this respect. These persisting differences may be the result of cultural factors that influence a region's propensity to engage in electronic communication and online commerce, differences

TABLE IV
MODEL ESTIMATION

Model	1	2	3	4	5	6
Observations (N)	78	78	73	67	78	78
Model F	35.76***	34.91***	34.16***	29.40***	35.76***	35.22***
Adjusted-R^2	0.871	0.869	0.874	0.866	0.871	0.870
Control Variables:						
ln(GDP per capita)	0.338 (0.234)	0.218 (0.213)	0.450† (0.234)	0.185 (0.300)	0.347 (0.233)	0.360 (0.234)
ln(population)	-0.332*** (0.062)	-0.314*** (0.064)	-0.256*** (0.068)	-0.277*** (0.073)	-0.317*** (0.067)	-0.344** (0.064)
ICT Infrastructure:						
ln(Internet hosts 2001)	0.322* (0.148)	0.357* (0.158)	0.185 (0.166)	0.389* (0.198)	0.332* (0.149)	0.317* (0.149)
PCs per capita	0.004** (0.001)	0.004** (0.001)	0.003* (0.001)	0.003 (0.002)	0.004** (0.001)	0.004* (0.002)
Cost of a local call	-4.660* (1.985)	-4.830* (2.087)	-5.601** (2.076)	-5.435* (2.187)	-4.683* (1.987)	-4.354* (2.014)
Human Capital:						
Illiteracy rate, as % of population	-0.035*** (0.010)	-0.034** (0.010)	-0.035** (0.011)	-0.035** (0.012)	-0.035*** (0.010)	-0.034** (0.010)
English as official Language	1.222*** (0.232)	1.233*** (0.235)	1.397*** (0.249)	1.398*** (0.274)	1.222*** (0.231)	1.208*** (0.235)
Institutional Environ.:						
ICRG country risk	-0.019 (0.016)				-0.018 (0.016)	-0.019 (0.016)
Economic Freedom, Heritage Foundation		0.002 (0.225)				
Economic Freedom, Frazer Institute			0.015 (0.012)			
Econ. Transparency, Transparency Int'l				0.058 (0.108)		
Logistics Infrastructure:						
DHL drop-off sites per Capita	0.232** (0.092)	0.249** (0.092)	0.264** (0.092)	0.357** (0.131)	0.228* (0.093)	0.234* (0.094)
Payment cards per cap, missing values = mean	-0.147 (0.164)	-0.153 (0.168)	-0.240 (0.170)	-0.190 (0.173)		
Payment cards per cap, missing values = 0.2					-0.165 (0.176)	
credit cards per capita, missing values = mean						0.004 (0.355)
Path Dependence:						
ln(Internet hosts 1995)	0.514* (0.214)	0.576** (0.218)	0.395† (0.233)	0.669* (0.288)	0.541** (0.214)	0.530* (0.216)
Regional Differences:						
Asian emerging Markets	0.886* (0.441)	0.906* (0.454)	0.734 (0.459)	0.845 (0.518)	0.895* (0.438)	0.968* (0.436)
Latin American Emerging markets	0.039 (0.385)	0.128 (0.384)	0.164 (0.387)	0.176 (0.459)	0.053 (0.383)	0.078 (0.385)
East European Emerging markets	-0.612† (0.370)	-0.617† (0.374)	-0.330 (0.401)	-0.669 (0.445)	-0.640† (0.372)	-0.601 (0.373)
Other emerging Markets	0.256 (0.400)	0.331 (0.402)	0.249 (0.415)	0.105 (0.497)	0.267 (0.399)	0.283 (0.402)
Constant term	6.580 (2.174)	5.981 (2.234)	2.015 (2.797)	5.469 (2.797)	6.185 (2.199)	6.505 (2.188)

Key: † $p \le .10$; * $p \le .05$; ** $p \le .01$; *** $p \le .001$; Standard errors in parentheses.
Dependent Var= ln(total# e-business sites per capita).

in the suitability of each region's products for e-business, or institutional factors that are not captured in our measures. In depth analysis of Asian emerging markets may provide useful information for other countries wishing to cultivate e-business activity.

Finally, though limitations in data availability prevent us from incorporating entrepreneurship rates into the main model with other variables, the regression reported in Table V (model 7) provides support for the contention that international variation in entrepreneurial activity drives differences in e-business activity. E-business is one of several mechanisms through which entrepreneurial activity may be channeled, but e-business is less likely to thrive in a country unless the country's business climate fosters a healthy level of entrepreneurial activity.

TABLE V
MODEL ESTIMATION

Model	7
Observations (N)	26
Model F	7.22^{***}
Adjusted-R^2	0.427
Control Variables:	
ln(GDP per capita)	1.585^{**} (0.553)
ln(population)	-0.230 (0.220)
Entrepreneurship:	
Opportunity Entrepreneurship rate, GEM	$0.166^{\dagger}$ (0.090)
	-8.311 (8.016)

Key: $^{\dagger}p \le .10$; $^{*}p \le .05$; $^{**}p \le .01$; $^{***}p \le .001$; Standard errors in parentheses.
Dependent Var= ln(total# e-business sites per capita).

VI. DISCUSSION

To our knowledge, this is the first study to empirically link hypothesized indicators of e-readiness to actual e-business activity, rather than proxies such as Internet activity. We find that the number of e-business Internet sites in a given country is driven by the country's ICT infrastructure, human capital, and logistics/fulfillment infrastructure, as well as historical conditions, regional differences, and entrepreneurial activity. These results support a very broad perspective of e-readiness that extends beyond conventional technological indicators.

A. Implications for Policy and Practice

These results provide clear implications for policy makers and entrepreneurs in emerging markets. Most importantly, the digital divide between developed and emerging markets clearly exists and can largely be explained in terms of differences in ICT infrastructure, human capital, logistics infrastructure, and entrepreneurship. In order to bridge the gap, public and private sector entities in emerging markets should invest in physical and intangible assets that enable e-readiness, including Internet and computer infrastructure, affordability of telecommunications, literacy, English-language capabilities, courier distribution infrastructure, and entrepreneurship. Nevertheless, early movers in e-business are likely to retain their advantage, and since most of the early movers were developed countries, emerging markets may find it nearly impossible to catch up.

The implications for private firms differ somewhat from the policy implications. On the one hand, e-business firms can benefit by operating in countries that offer abundant endowments in the resources that determine e-readiness. In such cases, firms are less likely to experience underinvestment in essential complementary assets [47] on the part of customers, suppliers, and other complementors (e.g., customer investment in Internet access and know-how, supplier investment in distribution capability, partner investments in transaction-processing capabilities). On the other hand, e-business firms may also profit in countries that have inadequate endowments of certain resources. For instance, if a country has ample endowments of all the relevant resources except package delivery infrastructure, an e-business firm may become uniquely positioned to profit from the market by undertaking internal investments in order fulfillment capabilities. In the more extreme case of countries that are missing several key determinants of e-readiness, however, potential e-business firms will find it more difficult to become profitable under any circumstance.

The data utilized in our study were collected during the latter stage of the dot-com bust (i.e., December 2001) and, therefore, many of the failed firms had already dropped out prior to the sample period. Still, one potential source of optimism for emerging markets that lagged in Internet and e-business adoption is that they may be able to tap into the experience gained through the enormous number of failings without having to bear the direct costs. If this is the case, then one should be able to observe a higher survival rate for e-business oriented firms in late-moving countries than in early adopters.

B. Do Institutions Matter?

Important implications may be drawn from our nonsignificant findings, particularly regarding institutional conditions. Of note is the lack of any significant relationship between economic and legal institutions (the degree of economic freedom, political risk, the rule of law, and transparency) and e-business activity. More tangible aspects related to the institutional environment (i.e., courier service infrastructure) did, however, have a significant impact on e-business. This is counterintuitive since Oxley and Yeung [41] maintain that factors that support stable operating environments would help e-business activities. Although caution should be exercised to avoid the over-interpretation of nonsignificant results, the fact that none of the four institutional economic and legal stability factors were significant indicates that the stability and predictability of the institutional environment is unlikely to have a strong influence on e-business.

This can be interpreted as an indication that e-business markets support what Olson [38] called "irrepressible markets." Olson points out that while many people have highlighted the fact that all wealthy countries use markets extensively, markets are ubiquitous in underdeveloped countries as well. Certain markets may require a sound institutional environment in order to function. Other markets, however, are spontaneous and irrepressible [38], meaning they are able to exist under a variety of institutional environments, and may in fact emerge to compensate for institutional shortcomings. E-business enables

markets that are flexible in adapting to unfavorable and/or changing legal environments, and is notoriously difficult to regulate. It may be that e-business activity thrives equally well under either a business-friendly institutional environment (i.e., strong protection of property rights, economic freedom, transparency, low country risk) or a more hostile institutional environment, in which case the inadequacy of more traditional channels for entrepreneurial activity leads entrepreneurs to utilize e-business.

C. Entrepreneurship and E-Business

While institutional conditions do not appear to directly influence e-business activity, entrepreneurship rates show significant relationships to these activities. There are two ways to interpret the combined nonsignificance of institutional factors and significance of entrepreneurship in predicting country-level e-business activity. First, one may argue that the institutional environment indirectly influences e-business by fostering or inhibiting the necessary conditions for entrepreneurial activity. If this were the case, however, institutional factors would have shown significant relationships to e-business activity since these were entered into separate regressions from entrepreneurship.

Instead, an alternative explanation is offered. Entrepreneurship is a more critical prerequisite for the development of e-business activity than are institutional conditions. First, as discussed in the previous section, entrepreneurial activity may be initiated via irrepressible markets to bridge missing institutions. Moreover, entrepreneurship may even arise to *exploit* the absence of well-developed institutions. Entrepreneurship forms have been defined as value-creating or rent-seeking and newly created e-business ventures may take the form of either productive or unproductive entrepreneurship. In practice, a single venture may take on both dimensions. The online peer-to-peer file-sharing service Kazaa (www.kazaa.com), for instance, which was registered in Vanuatu, was both productive and unproductive in a social sense by allowing a cost-effective mechanism for matching supply and demand while simultaneously creating a new mechanism for the piracy of intellectual property.

Entrepreneurship theorists, particularly Austrian economists such as Hayek [17], Mises [34], and Kirzner [22], have long viewed the entrepreneur as responsible for improving the flow of information in the economy and moving markets toward equilibrium [51]. It follows that opportunities for these "equilibrating actions" [52]) are likely to be greatest precisely when market conditions are volatile and unpredictable. The countries that are most likely to exhibit volatile and unpredictable market conditions are those in which the institutional environment is characterized by high country risk, low economic freedom, and poor transparency; and these same characteristics may actually create rather than inhibit entrepreneurial opportunities [13]. This has been partially borne out by the Global Entrepreneurship Monitor reports [42], whose authors acknowledge that underdeveloped institutions may inhibit certain forms of entrepreneurship while promoting others.

ACKNOWLEDGMENT

The authors wish to thank the IEEE TRANSACTIONS ON ENGINEERING MANAGEMENT Editor Prof. G. Farris, the e-Commerce Department Editor Professor A. Chakrabarti, and the three anonymous reviewers for their helpful comments.

REFERENCES

[1] A. Afuah and C. L. Tucci, *Internet Business Models and Strategies: Text and Cases*. New York: McGraw-Hill, 2001.
[2] ——, "A model of the Internet as creative destroyer," *IEEE Trans. Eng. Manage.*, vol. 50, no. 4, pp. 395–402, Nov. 2003.
[3] R. Amit and C. Zott, "Value creation in e-business," *Strategic Manage. J.*, vol. 22, no. 6/7, pp. 493–520, Jun./Jul. 2001.
[4] B. Arthur, "Self-reinforcing mechanisms in economics," in *The Economy as an Evolving Complex System*, P. W. Anderson, K. J. Arrow, and D. Pines, Eds. Reading, MA: Addison-Wesley, 1988.
[5] C. A. Bartlett and S. Ghoshal, *Transnational Management*, 3rd ed. New York: McGraw-Hill, 2000.
[6] G. Becker, *Human Capital*, 3rd ed. Chicago, IL: Univ. of Chicago Press, 1993.
[7] F. Betz, *Managing Technological Innovation: Competitive Advantage From Change*. New York: Wiley, 1998.
[8] S. Chen, "The real value of 'e-business models'," *Bus. Horiz.*, vol. 46, no. 6, pp. 27–33, Nov.–Dec. 2003.
[9] A. Chong and A. Micco, "The Internet and the ability to innovate in Latin America," *Emerging Markets Rev.*, vol. 4, no. 1, pp. 53–72, Mar. 2003.
[10] P. David, "Clio and the economics of QWERTY," *Amer. Econ. Rev.*, vol. 75, no. 2, pp. 332–337, May 1985.
[11] T. Davis, "E-commerce measurements and analysis," in *Joint UNECE/UNCTAD/UIS/ITU/OECD/EUROSTAT Statistical Workshop, Monitoring the Information Society: Data, Measurement and Methods* , Geneva, Switzerland, Dec. 2003.
[12] R. De Gouvea and S. Kassicieh, "Brazil.com," *Thunderbird Int. Bus. Rev.*, vol. 44, no. 1, pp. 105–117, Jan./Feb. 2002.
[13] D. Di Gregorio, "Rethinking country risk: Insights from entrepreneurship theory," *Int. Bus. Rev.*, submitted for publication.
[14] EMarketer. (2002) eMarketer online database. [Online]. Available: www.emarketer.com
[15] Faulkner & Gray, *Global Card Directory*. New York: Faulkner & Gray Thomson Fin. Serv., 2000.
[16] P. Fingar, H. Kumar, and T. Sharma, *Enterprise E-Commerce*. Tampa, FL: Meghan-Kiffer, 2000.
[17] F. A. Hayek, "The use of knowledge in society," *Amer. Econ. Rev.*, vol. 35, no. 4, pp. 519–530, 1945.
[18] C. W. Holsapple and M. Singh, "Toward a unified view of electronic commerce, electronic business, and collaborative commerce: A knowledge management approach," *Knowl. Process. Manage.*, vol. 7, no. 3, pp. 151–164, Jul./Sep. 2000.
[19] R. Hoskisson, L. Eden, C. Lau, and M. Wright, "Strategy in emerging economies," *Acad. Manage. J.*, vol. 43, no. 3, pp. 249–267, Jun. 2000.
[20] T. Hout, M. E. Porter, and E. Rudden, "How global companies win out," *Harvard Bus. Rev.*, pp. 98–107, Sep.–Oct. 1982.
[21] R. Kalakota and M. Robinson, *E-Business 2.0: Roadmap for Success*. Reading, MA: Addison-Wesley, 2001.
[22] I. M. Kirzner, *Competition and Entrepreneurship*. Chicago, IL: Univ. of Chicago Press, 1973.
[23] S. Kotha, V. Rindova, and F. Rothaermel, "Assets and actions: Firm-specific factors in the internationalization of U.S. Internet firms," *J. Int. Bus. Studies*, vol. 32, no. 4, pp. 769–791, 2001.
[24] R. Krovi, "Surveying the e-landscape: New rules of survival," *Inf. Syst. Manage.*, vol. 18, no. 4, pp. 22–30, Fall 2001.
[25] L. W. Lam and L. J. Harrison-Walker, "Toward an objective-based typology of e-business models," *Bus. Horiz.*, pp. 17–26, Nov.–Dec. 2003.
[26] R. La Porta, F. Lopez de Silanes, A. Schleifer, and R. Vishny, "Legal determinants of external finance," *J. Finance*, vol. 52, no. 3, pp. 1131–1150, Jul. 1997.
[27] K. C. Laudon and C. G. Traver, *E-Commerce: Business, Technology, Society*. Reading, MA: Addison-Wesley, 2003.
[28] E. Leamer and M. Storper, "The economic geography of the Internet age," *J. Int. Bus. Studies*, vol. 32, no. 4, pp. 641–665, 2001.
[29] K. D. Loch, D. W. Straub, and S. Kamel, "Diffusing the Internet in the Arab world: The role of social norms and technological culturation.," *IEEE Trans. Eng. Manage.*, vol. 50, no. 1, pp. 45–63, 2003.

[30] H. Lucas and R. Sylla, "The global impact of the Internet: Widening the economic gap between wealthy and poor nations?," Univ. Maryland, College Park, MD, Working Paper, 2000.
[31] C. Mann, "Electronic commerce, networked readiness, and trade competitiveness," in *Global Information Technology Report, World Economic Forum*. Oxford, U.K.: Oxford Univ. Press, 2002.
[32] ——, "Achieving the benefits of connectivity and global e-commerce," UNCTAD Experts Meeting, Geneva, Switzerland, [Online.] Available: www.iie.org (Washington Inst. Int. Econ.), 2002.
[33] R. Mansell, "Digital opportunities and the missing link for developing countries," *Oxford Rev. Econ. Policy*, vol. 17, no. 2, pp. 282–295, 2001.
[34] L. von Mises, *Human Action*. New Haven, CT: Yale Univ. Press, 1949.
[35] P. Norris, *Digital Divide: Civic Engagement, Information Poverty and the Internet Worldwide*. Cambridge, U.K.: Cambridge Univ. Press, 2001.
[36] D. North, *Institutions, Institutional Change and Economic Performance*. Cambridge, U.K.: Cambridge Univ. Press, 1990.
[37] ——, "Economic performance through time," *Amer. Econ. Rev.*, vol. 84, no. 3, pp. 359–368, Jun. 1994.
[38] M. Olson, *Power and Prosperity*. New York: Basic Books, 2000.
[39] Organization for Economic Cooperation and Development, "OECD information technology outlook: ICT's and the information economy," OECD, Paris, France, 2002.
[40] ——, "A framework document for information society measurements and analysis," OECD, Paris, France, DSTI/ICCP/IIS/(2003)9, 2003.
[41] J. Oxley and B. Yeung, "E-commerce readiness: Institutional environment and international competitiveness," *J. Int. Bus. Studies*, vol. 32, no. 4, pp. 705–723, 2001.
[42] P. Reynolds, S. Camp, W. Bygrave, E. Autio, and M. Hay, "Global entrepreneurship monitor: 2001 Summary report," London Bus. School and Babson College, London, U.K., 2001.
[43] P. D. Reynolds, W. D. Bygrave, and E. Autio. (2004) Global entrepreneurship monitor: 2003 Executive report. [Online]. Available: www.gem consortium.org
[44] F. J. Riggins and H. Rhee, "Toward a unified view of electronic commerce," *Commun. ACM*, vol. 41, no. 10, pp. 88–95, Oct. 1998.
[45] E. B. Roberts, *Entrepreneurs in High Technology: Lessons From MIT and Beyond*. New York: Oxford Univ. Press, 1991.
[46] R. Rothwell, "SMF's, interfirm relationships and technological change," *Entrepreneurship Reg. Develop.*, vol. 1, no. 1, pp. 89–103, 1989.
[47] D. Teece, "Profiting from technological innovation: implications for integration, collaboration, licensing, and public policy," *Res. Pol.*, vol. 15, pp. 295–305, 1986.
[48] A. Scupola, "The impact of electronic commerce on industry structure—the case of scientific, technical, and medical publishing," *J. Inf. Sci.*, vol. 28, no. 4, pp. 275–284, 2002.
[49] A. Sen, *Development as Freedom*. New York: Random House, 1999.
[50] N. Singh and S. Kundu, "Explaining the growth of e-commerce corporations (ECCs): An extension and application of the eclectic paradigm," *J. Int. Bus. Studies*, vol. 33, no. 4, pp. 679–697, 2002.
[51] S. Shane, *A General Theory of Entrepreneurship: The Individual-Opportunity Nexus*. Aldershot, U.K.: Edward Elgar, 2003.
[52] K. G. Smith and D. Di Gregorio, "Bisociation discovery, and the role of entrepreneurial action," in *Strategic Entrepreneurship: Creating a New Mindset*, M. A. Hitt, R. D. Ireland, S. M. Camp, and D. L. Sexton, Eds., 2002, pp. 129–150.
[53] Stata Corporation, "Stata User's Manual," Stata Corporation, College Station, TX, 1999.
[54] United Nations Conference on Trade and Development, "E-Commerce and Develop. Rep. 2001," United Nations, New York, Doc. No. UNCTAD/STDE/ECB/1, 2002.
[55] J. Westland and T. Clark, *Global Electronic Commerce*. Cambridge, MA: The MIT Press, 1999.
[56] O. E. Williamson, "Opportunism and its critics," *Managerial and Decision Economics*, vol. 14, no. 2, pp. 97–107, Mar./Apr. 1993.
[57] World Bank, *World Development Indicators (Electronic Database)*. New York: World Bank, 2002.
[58] World Economic Forum, *Global Information Technology Report*. Oxford, U.K.: Oxford Univ. Press, 2002.
[59] D. Yergin and J. Stanislaw, *The Commanding Heights*. New York: Simon and Schuster, 1998.
[60] D. Yoffie and M. Cusumano, "Judo strategy: The competitive dynamics of Internet time," *Harvard Bus. Rev.*, vol. 77, no. 1, pp. 71–81, Jan.–Feb. 1999.

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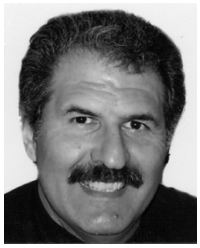

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