Title
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Journal
MANAGEMENT SCIENCE, 53(3)

ISSN
0025-1909

Authors
Shih, Eric
Kraemer, Kenneth L
Dedrick, Jason

Publication Date
2007

DOI
10.1287/mnsc.1060.0670

MANAGEMENT SCIENCE
Vol. 53, No. 3, March 2007, pp. 521–528
ISSN 0025-1909 | EISSN 1526-5501 | 07 | 5303 | 0521

DOI 10.1287/mnsc.1060.0670

Research Note

Determinants of Country-Level Investment in Information Technology

Eric Shih
Department of Marketing, International Business and Strategy, Brock University,
500 Glenridge Avenue, St. Catharines, Ontario, Canada L2S 3A1, eshih@brocku.ca

Kenneth L. Kraemer, Jason Dedrick
Center for Research on Information Technology and Organizations, University of California,
Irvine, 3200 Berkeley Place North, Irvine, California 92697
{kkraemer@uci.edu, jdedrick@uci.edu}

Investment in information technology (IT) is an important driver of economic growth and productivity in the United States and other developed countries, but as yet it is not shown to be a significant driver in developing countries. Previous research suggests that IT investment and complementary assets are insufficient for developing countries to realize economic benefits. This research note examines the factors that influence IT investment in developed and developing countries to determine how greater investment might be stimulated to achieve productivity gains. We use the flexible accelerator model of investment and find that it is a good predictor of country-level IT investment. We also extend the model to include country-level variables, and find a negative relationship between IT investment and interest rates, but positive and significant relationships between investment, openness to trade, and telecommunications infrastructure. When we include interaction effects between national income levels and country variables, we find that the impacts of interest rates, size of the financial sector, teledensity, and intellectual property rights are strongest in shaping IT investment for developed countries. In contrast, we find that the impact of openness to trade is greater for developing countries, as is the size of government and education levels.

Key words: IT investments; developed countries; developing countries; determinants; country level
History: Accepted by Rajiv D. Banker, information systems; received October 24, 2006. This paper was with the authors 8 months for 2 revisions.

Introduction

Investment in information technology (IT) throughout the economy has been a source of widespread productivity growth in the United States (Oliner and Sichel 2000, Jorgenson 2001) and in other developed countries (Organisation for Economic Cooperation and Development (OECD) 2002, Daveri 2001). However, Dewan and Kraemer (2000) and Pohjola (2001) find that the productivity benefits are not yet significant in developing countries. They hypothesize that IT investment is not yet high enough, and complementary assets are inadequate, for developing countries to realize productivity gains. For this reason, understanding the factors that influence IT investment is an important topic for academic research. It also has implications for the strategies of firms in the IT industry as they seek to exploit new markets. Given that many of the big emerging markets are in developing countries, firms need to understand how the factors shaping investment in developing countries differ from those in developed countries, as these differences might provide insights for firm and industry strategy.

This paper makes three contributions to the study of the determinants of IT investment. First, we extend the standard flexible accelerator investment model to incorporate country-level variables that influence IT investment. Consistent with the model, we find that investment in computer hardware is positively influenced by the existing IT capital stock and economic output (Koyck 1954) and negatively influenced by interest rates (Jorgenson 1963), but also find that additional country variables are significantly associated with IT investment. Second, we employ a fixed-effects model to confirm previous research that country-level IT investment is driven by factors that go beyond relative wealth (Caselli and Coleman 2001). In both the flexible accelerator and fixed-effects models, we find significant impacts from the presence of complementary assets, the information intensity of the economy, openness to external trade, and intellectual property protection. Third, and entirely new, we find that the factors driving IT investment are much different in developed versus developing countries. IT investment in developed countries is driven mainly by interest rates, size of the financial sector, teledensity, and intellectual property protection. In contrast, investment in developing countries is influenced by openness to foreign trade, size of the government sector, and the educational attainment of the labor force.

Literature Review

There has been a substantial body of research showing that IT investment has positive impacts on growth and productivity at the national and firm levels (for recent summaries, see Dedrick et al. 2003 and Melville et al. 2004). However, investigation into the *determinants of IT investment* at the aggregate level is surprisingly lacking. Notable exceptions include Gurbaxani and Mendelson (1990, 1992), which concluded that growth in IT investment in the United States was positively correlated with the growth rate of the economy, the declining cost of computing, and the information intensity of different economic sectors.

Looking across countries, researchers have found certain common drivers of demand. Kraemer and Dedrick (1994) studied 11 Asia-Pacific countries and found that IT investment was associated with diffusion of telecommunications infrastructure, education levels, technical skills, and the percent of the economy in services industries. Caselli and Coleman (2001) studied 89 countries and found that the value of computer hardware imports, an indicator of IT investment, was positively and significantly associated with educational attainment and openness to imports for the three samples of countries they tested. They found evidence in some of their samples of a positive relationship with property rights protection, and negative relationships with agricultural and government share of gross domestic product (GDP).

Although none of the studies analyzed differences in the determinants of investments between developed and developing countries, there is reason to believe that there might be important differences. Studies of national productivity gains indicate that developing countries have not experienced gains associated with IT investment (Dewan and Kraemer 2000, Pohjola 2001, Daveri 2001). Dewan and Kraemer hypothesize that IT investment has not been sufficient to reach levels of IT diffusion and complementary assets that permit developing countries to enjoy productivity benefits. Consequently, we analyze IT investment at the national level as a function of various country-level factors, and we further examine these factors for developed and developing countries. The next section presents the research framework, the variables, and the rationale for their inclusion.

Theoretical Model

We use a country-level flexible accelerator investment model, which states that capital investment is positively correlated with the size of the existing capital stock and with economic output (Koyck 1954). In this model, it is assumed that there is an optimal ratio of capital to output and that there is an ongoing adjustment in capital stock as output changes to reduce the gap between the actual and optimal ratio. Gross investment in any period will consist of two parts: replacement investment needed to offset the depreciation of capital stock during that period, and net investment made in response to changing output levels as the economy adjusts toward the optimal capital to output ratio (Berndt 1991). Jorgenson's (1963) model adds interest rates as a third variable explaining investment levels, measuring the user cost of capital. He finds that investment is positively correlated with existing capital stock and with economic output, and inversely correlated with interest rates.

We extend the flexible accelerator model to identify factors at the country level that influence investment levels across countries, including complementary assets, openness to external knowledge, the information intensity of the economy, and the legal and regulatory environment. We further hypothesize that the influence of these factors differs between developed and developing countries. Each factor is rooted in the theories and empirical studies of technology diffusion in general and IT diffusion in particular at the national level, as will be elaborated below. In addition to the flexible accelerator model, we also estimated a fixed-effects model to test the impacts of country factors with the capital stock variable removed. This is consistent with Caselli and Coleman (2001), but uses a more accurate measure of IT investment.

Complementary Assets

The availability of complementary assets will partly determine the value of IT investments, and thus likely influence the level of investment in a country. The value of computers is greatly enhanced when they are networked, and the ability to network computers beyond the boundaries of a single location or organization generally requires an adequate *telecommunications infrastructure*. Previous empirical studies show a positive association between national teledensity indicators and IT investment or diffusion (Kraemer and Dedrick 1994, Oxley and Yeung 2001, Robison and Crenshaw 2002). Another complementary asset needed to support IT investment is *human resources* with appropriate skills to deploy and use the technology. Educated workers are more flexible, adjust more readily, and offer less opposition to the implementation of new technologies (Bartel and Lichtenberg 1987, Robison and Crenshaw 2002). Also, IT is a skill-biased technology whose value is closely linked to the skill levels available to the firm or country (Krueger 1993, Bresnahan et al. 2002).

Openness to External Knowledge
Effective use of IT requires a broad range of knowledge, both technical and managerial, much of which can be found beyond the borders of any country. Foreign trade facilitates the diffusion of such knowledge across borders as it "provides channels of communication that stimulate cross-border learning of production methods, product design, organizational methods, and market conditions" (Coe et al. 1997, p. 136; see also Grossman and Helpman 1991, Ben-David and Loewy 2000). Openness to trade also may expose a national economy to greater international competition, driving IT investment by local firms as a tool for survival. In addition, doing business internationally may force firms to adopt IT in order to meet the requirements of foreign suppliers or customers who use IT for transactions or for coordination purposes. All these impacts are likely to be greatest when developing countries trade with developed countries who are the main source of such knowledge.

Information Intensity of the Economy
Theory indicates that demand for IT is associated with information-intensive economic activities (Bell 1973, Robison and Crenshaw 2002). This view is supported by empirical studies that find a significant positive association between the size of a country's services sector and IT investment, computer imports, or Internet diffusion (Kraemer and Dedrick 1994, Caselli and Coleman 2001, Robison and Crenshaw 2002, respectively). However, the services sector includes both information-intensive activities such as finance, business services, and government, and very labor-intensive activities such as personal services and food services, for which the value of IT is likely to be limited. Two sectors particularly represent the information-intensive part of the economy: *financial services* (finance, insurance, real estate, and business services), which is highly information and transaction intensive and whose products can be digitized, making it a natural fit for application of IT, and *community services,* which is primarily government, education, and health care.[1]

Legal and Regulatory Environment
The degree to which laws and regulations protect technology producers and users is likely to influence IT investment. Strong intellectual property (IP) protection will encourage businesses to develop and market new software, or to create custom applications for specific users. Protection for businesses and consumers engaged in e-commerce also encourages IT use in business transactions and online sales (Oxley and Yeung 2001). The availability of software and valuable uses of IT are key drivers of demand for hardware, so it is expected that IP and other protections will indirectly encourage hardware investment. However, the availability of free pirated software might also be a driver of hardware demand in developing countries where the cost of legal software can be prohibitive for many users. In that case, strong IP protection might actually discourage hardware investment (Caselli and Coleman 2001).

[1] Financial services firms are the largest users of IT in the United States, spending 8% of their revenues on IT, compared to 2% in retail and 3% in manufacturing (*Information Week* 2002). Government agencies deal primarily with information, and can effectively employ IT for internal operations, service delivery, and information sharing between levels of government (Fountain 2001).

Methods and Data

Flexible Accelerator Model Estimation
We start with the flexible accelerator model of investment and specify investment in IT as follows:

$$I_t = \mu\lambda Y_t + (\delta - \lambda)K_{t-1}.$$

Here, I is a country's gross IT capital investment, K is IT capital stock, μ is the capital output ratio, λ is speed of adjustment to optimal IT capital stock, and δ is rate of replacement IT investment. We augmented the flexible accelerator model with the independent variables, lagged one year to help establish the direction of causality:

$$I_t = \mu\lambda Y_t + (\delta - \lambda)K_{t-1} + \sum \beta X_{t-1}.$$

Country Effects Estimation Without Capital Stock
Because capital stock tends to absorb the majority of the variance in our data, we also model IT investment without capital stock. This approach was used by Caselli and Coleman (2001) to identify the key determinants of IT investment. However, our data set has an advantage in that it directly measures total computer hardware investment at the country level, providing a more accurate indicator of IT investment. Their study used the value of computer hardware imports as a proxy for IT investment. It does not directly measure IT investment, and it misses computers that are produced within a country. Also, our data set is for a more recent time period: 1985–2000 (versus 1970–1990).

Developed vs. Developing Countries
Finally, to investigate the differential effects of the independent variables among developed and developing countries, we analyzed the interaction terms of these variables with GDP per capita. In creating the interaction terms, we re-parameterized the model

by mean centering GDP per capita (subtracting its grand mean) prior to multiplying it with the independent variables. This allows for easy interpretation of coefficients because the main effects can be interpreted as the effect of the independent variable across all countries and times, and the interaction term as the marginal effect, depending on how much a country is above or below the average income of the sample of countries. The procedure, which distinguishes between richer and poorer countries based on GDP per capita, is similar to Dewan and Kraemer (2000), and results in a similar grouping of countries as developed or developing:[2]

$$I_t = \mu\lambda Y_t + (\delta - \lambda)K_{t-1} + \sum \beta X_{t-1} + \sum \gamma(Y_t - \overline{Y})X_{t-1},$$

$$\frac{\Delta I}{\Delta X_i} = \beta_i + \gamma_i(Y_t - \overline{Y}).$$

Variables and Data

For the dependent variable, we use spending on computer hardware per capita as a proxy for IT investment (HARDCAP).[3] International Data Corporation (IDC) provided data on IT investments from 1985 to 2000 for 49 countries. The series captures the value of shipments, which is the revenue paid to vendors (including channel mark-ups) for hardware and systems. Although most of the series starts in 1985, not all country series run the entire 16 years due to data availability. For the IT investment data to be comparable between years, the current dollar flows are converted to 1998 constant dollar flows.[4] That is, the corresponding measure of IT is that amount which one dollar would have purchased in 1998. This conversion was achieved by deflating each current dollar investment by the Bureau of Labor Statistics (BLS) price index for computers to arrive at constant dollar estimates. The price series was extended backward to 1985 in line with Gurbaxani and Mendelson (1990), who showed that hardware costs (per unit of performance) decline exponentially over time. Because the only available price index was for the United States, we deflate IT investments in all countries by the same index. This assumes that quality adjusted prices for IT have similar trends over time in our sample countries. The approach has face validity because most IT components are manufactured in a limited set of countries and traded internationally. Therefore, price declines observed in the United States should be experienced similarly by all countries. The constant dollar stocks of IT capital (HARDSTCK) are computed from the constant dollar flows by assuming constant exponential deterioration ($\delta = 0.15$) and aggregating the investments over a five-year period.

For the independent variables, telecommunications infrastructure was measured by main phone lines per 100 people (TELDEN) from the World Bank's World Development Indicators (WDI) (2004). Education, measured by average years of schooling of workers age 25 and over (AVGSCH)[5] is from the International Labour Organization's (2004) *Yearbook of Labour Statistics*. Openness to external knowledge is measured by the total amount of commodity imports per capita from OECD nations (OECDCAP) from WDI. The economic structure (information intensity) of national economies is measured by the size of employment in the finance, insurance, and real estate sectors (FIRE) and the public sector (GOVE), also from the International Labour Organization. Intellectual property rights protection (RIGHT) is measured using an index ranging from 1 to 10, where 10 is the highest level of protection, from Gwartney et al. (2002). GDP and cost of investment capital (INTEREST), measured by the yearly average prevailing prime interest rate, are from WDI.

Empirical Results

All regression models are estimated as a fixed-effects model with AR(1) process. White heteroskedasticity covariances are estimated. This form of heteroskedasticity is more general than cross-section heteroskedasticity because variances within cross-sections are allowed to differ across time. Five models are estimated (Table 1). Models 1 through 3 include HARDSTCK as prescribed by the flexible accelerator model, while Models 4 and 5 are fixed-effects models without

[2] The mean GDP per capita for the full sample is $15,492, whereas the mean for the upper half is $25,757 and for the lower half is $4,688, clearly distinguishing developed from developing countries.

[3] Admittedly, hardware spending does not capture the entire range of IT investments, which also include software and services. However, any measurement that attempts to incorporate software and services may have inherent flaws. For software, it would be impossible to account for pirated software accurately, and in some countries the levels of illegal software in use runs over 90%. Excluding software should not distort the validity of our proxy measure, as Gurbaxani and Mendelson (1992) found that budget shares between hardware and software tend to remain constant over time after controlling for macroeconomic effects.

For IT services, whether services are purchased or provided internally, they should be considered part of total IT investment. However, data at the national level would only include services provided by outside firms, and would not capture services or customized software development done by firms in-house. IT hardware, by contrast, does not suffer from any of the measurement deficiencies as hardware must generally be purchased, so sales of hardware closely represents actual levels of hardware put into use.

[4] Market rates are used rather than purchasing power parity (PPP) because computers are traded internationally and therefore there is no need to make adjustments for PPP.

[5] Data on years of schooling and intellectual rights protection were available for 1985, 1990, 1995, and 2000. To avoid censuring the data and provide the maximum degrees of freedom in the analysis, the in-between year data were estimated using an annual growth method.

Table 1 Regression Results

	Flexible accelerator			Fixed-effects	
	Model 1 B	Model 2 B	Model 3 B	Model 4 B	Model 5 B
$GDPCAP_t$	7.479***	9.537***	9.513***	5.461*	9.263**
(std. error)	(1.435)	(1.551)	(2.049)	(2.743)	(3.300)
$HARDSTCK_{t-1}$	0.709***	0.474***	0.653***		
	(0.061)	(0.142)	(0.084)		
$LENDIR_{t-1}$		−0.179***	−2.131*	0.081	−1.274*
		(0.068)	(0.958)	(0.072)	(0.556)
$OECDCAP_{t-1}$		4.691*	18.276**	3.350	21.288**
		(1.943)	(5.749)	(4.627)	(7.820)
$FIRE_{t-1}$		2.495	2.020	23.622***	7.238
		(6.319)	(3.555)	(6.248)	(4.285)
$GOVE_{t-1}$		6.309	2.815	−2.165	−0.016
		(3.948)	(1.941)	(2.740)	(3.221)
$AVGSCH_{t-1}$		52.659	8.758	7.140	24.777*
		(55.027)	(11.036)	(13.608)	(12.598)
$TELDEN_{t-1}$		1.419**	0.322*	1.082***	1.174***
		(0.485)	(0.148)	(0.217)	(0.141)
$RIGHT_{t-1}$		−5.433	14.378*	45.351***	34.568***
		(17.158)	(6.772)	(7.980)	(8.757)
$MGDPCAP_t$			−0.179*		−0.116*
$* LENDIR_{t-1}$			(0.083)		(0.055)
$MGDPCAP_t$			−0.630*		−0.884*
$* OECDCAP_{t-1}$			(0.296)		(0.421)
$MGDPCAP_t$			0.414		0.997**
$* FIRE_{t-1}$			(0.363)		(0.379)
$MGDPCAP_t$			0.198		−0.706**
$* GOVE_{t-1}$			(0.208)		(0.257)
$MGDPCAP_t$			−1.802*		−4.393***
$* AVGSCH_{t-1}$			(0.805)		(0.773)
$MGDPCAP_t$			0.044**		0.110***
$* TELDEN_{t-1}$			(0.016)		(0.012)
$MGDPCAP_t$			1.872*		2.130**
$* RIGHT_{t-1}$			(0.778)		(0.815)
Adj. R^2	0.946	0.951	0.968	0.668	0.846
SE regression	35.508	40.119	36.551	105.1142	71.736
Countries	49	40	40	42	42
Observations	538	327	327	506	506

$^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$.

HARDSTCK. R-squared are higher for flexible accelerator models than the fixed-effects models ($0.946 - 0.968$ versus $0.668 - 0.846$), which can be attributed to the existence of HARDSTCK in the regression.

As predicted by the flexible accelerator model, IT capital stock and GDP have strong positive relationships with IT investment in all models. Consistent with Jorgenson (1963), interest rate has a negative effect in all models. However, as indicated by the significant negative interaction effect, higher interest rates tend to depress IT investments more in developed countries (above average income) than developing countries (below average income). At the poorest of countries, interest rates have minimal impact on IT investments.

Openness to external knowledge, or imports from OECD countries, is positively related to IT investments. Further, the negative significant interaction effect indicates that the effect is much stronger for developing countries than developed countries. The information-intensiveness of the economy (employment in financial industries) is positively related to IT investment, particularly for developed countries. There are no significant main effects for employment in government sectors, but the analysis of interactions indicates that such employment is significant in driving IT investments in developing countries.

In terms of complementary assets, the average educational level of the labor force is positively significant as a main effect in Model 5, while telephone main line density is significant across all models. The interaction terms suggest that educational attainment plays a greater role in developing countries, while teledensity has a stronger impact for developed countries.

Finally, IP rights protection is positively related to IT spending as expected. But the significant interaction term suggests that the impact of IP protection is stronger in developed countries.

Discussion

As expected, the results show that the accelerator model as employed here is a good predictor of country-level IT investment (Model 1). Given the rapid depreciation rate of IT capital, a significant amount of investment is needed just to replace retired stock, driving the strong relationship between IT capital stock and IT investment. Likewise, the tendency to maintain an optimal level of IT capital relative to output explains the relationship of IT investment to GDP. These factors actually explain a large share of the variance in annual IT spending by countries, as represented by the high R^2 value in Model 1.

What the flexible accelerator model does not explain are country differences in the relationship between IT investment and output. By extending the model to include country-level variables (Model 2), we find other factors that determine such differences. First, there is a negative relationship between IT investment and interest rates, as predicted by Jorgenson (1963). There also are significant relationships between IT investment and two other factors: openness to trade and telecommunications infrastructure. Using a fixed-effects regression approach (Model 4), we lose the relationship with openness, but find significant main effects for size of the financial sector and IP protection. These findings are generally consistent with theories of technology diffusion and with prior empirical research on IT investment or diffusion, including Kraemer and Dedrick (1994), Caselli and Coleman (2001), and Oxley and Yeung (2001). These models do not find significant main effects for education and size of government.

Developed vs. Developing Countries

When we include interaction effects between national income levels (mean adjusted GDP per capita) and the other country variables (Models 3 and 5), a different and more interesting picture emerges. We find that some factors have greater influence in developed countries while others are more important for developing countries. The impacts of interest rates, size of the financial sector, teledensity, and IP rights are strongest for developed countries. Meanwhile, the impact of openness to trade with OECD countries is greater for developing countries, and we also find that size of government and education levels do have significant impacts for developing countries.

The fact that interest rates have a stronger negative impact on investment in developed countries makes sense considering the greater maturity of the financial practices in these countries. In developed countries, investments are generally financed through debt or equity markets, both of which are sensitive to interest rates. By contrast, in developing countries, investment is often financed through informal local channels or foreign aid for which official interest rates may not be relevant.

The fact that education has more impact in developing countries seems logical given that educational attainment is already relatively high in developed countries. Therefore, the marginal impact of increasing education levels to provide the needed complementary assets to support IT investment will be greater in developing countries where there is more room to improve. The stronger relationship with telecommunications for developed countries suggests the possibility of network effects that intensify the impacts of infrastructure as teledensity increases. Developed countries may be better able to leverage such network effects as a result of their experience dealing with the difficult process of integrating diverse technologies and processes over electronic networks.

The relationship of IT investment to trade with OECD countries is consistent with Caselli and Coleman (2001), and more generally with theoretical arguments about the importance of openness to external sources of knowledge. The fact that the relationship is stronger for developing countries suggests that these countries are farther from the knowledge frontier, and gain more from interaction with more technically advanced countries (Coe et al. 1997).

The fact that the relationship with the size of the financial services sector is stronger for developed countries may suggest that the scale and sophistication of financial service firms in developing countries are not adequate to drive IT investment. On the other hand, our finding of a stronger relation between IT investment and size of government in developing countries may imply that in these countries, governments account for a larger share of investment, and have a greater influence on private investment than in developed countries.

Finally, an interesting finding is that IP protection has a positive impact, but the impact is stronger in developed countries. Strong IP protection may encourage firms in developed countries to produce more software, which allows users to gain more value from their hardware. In developing countries, however, strong IP protection may make imported software prohibitively expensive,[6] while the local software industry may not be capable of producing a wide range of affordable applications. Thus, for developing countries, demand for hardware may be dampened by effective IP protection.

Conclusions

The preceding analysis leads to two general conclusions. First, IT investment at the national level is driven by a set of factors that go beyond relative wealth. While controlling for GDP per capita and IT stock, we find a number of common drivers of demand, including cost of capital, presence of complementary assets such as telecommunications and human resources, the value of IT use as determined by the structure of the economy, and openness to external influences.

Second, the factors driving IT investment are much different for developed and developing economies. Developed countries are more sensitive to interest rates. The relative size of the financial services sector is an important factor in developed countries, while the size of government is more important for developing countries. The level of education influences investment in developing countries, while telecommunications is more important in developed countries. Openness to trade is a bigger factor for developing countries, while IP protection is more important in developed countries.

These findings extend the flexible accelerator model of investment by identifying factors beyond output and capital stock that influence IT investment at the national level. They support the view that technology investment is subject to factors within a national economic system and thus occurs unevenly across countries with different conditions (Nelson 1993).

Management Implications

The findings in this study have useful implications for managers in the IT industry, and possibly for firms in other high-technology industries. They point directly to management action to concentrate resources on markets with the greatest potential. Our results show that a country that is already a heavy IT user relative to its income is likely to stay that way, given the strong relationship of IT investment to GDP and IT

[6] Both local and foreign PC makers in China are selling PCs without Windows (instead installing much cheaper DOS or Linux operating systems) to penetrate the low-end market; see Miyazawa (2004).

stock. Looking at IT investment per capita relative to GDP per capita over time, we have seen that most countries do maintain their position—for instance, the United States, Sweden, the United Kingdom, and Singapore are consistently above the trend line, while Spain, France, Italy, and Japan are consistently below it.

However, IT markets may grow rapidly if countries are experiencing high economic growth rates or if some of the key country factors are changing—for instance, through liberalization of trade or telecommunications, falling interest rates, or rapid growth in the government or finance sectors. The places where such dynamic change is most likely to occur are in the developing world, where higher growth is possible and policy changes may be more dramatic. For instance, China has experienced GDP growth of 7%–9% per year, has invested heavily in telecommunications, and has significantly liberalized trade and investment. Correspondingly, China has seen PC sales grow to 19.3 million units in 2005 (IDC 2006), making it the second-largest PC market in the world. With rapid economic growth, high-education levels, and increasing international trade, places such as China, India, Brazil, Mexico, and Eastern Europe may be primed for growth in IT investment. As a matter of market strategy, therefore, technology companies need to nurture these markets, establish brand names and distribution channels, and put themselves in position to reap the benefits as the markets grow.

Given that the size of the government sector and openness to imports are key factors influencing IT investment in developing countries, two specific strategies are suggested. First, IT firms and industry associations should support government computerization as a stimulus for broader IT investment. Second, the IT industry should support trade liberalization, as increased trade leads to greater IT investment by local companies in response to increased competition at home and new opportunities to participate in global markets and production networks.

Acknowledgments

This research has been supported by grants from the U.S. National Science Foundation (CISE/IIS) and IBM Global Services. The authors thank the department editor, anonymous reviewers of this journal, and reviewers of the WISE Conference, Barcelona, December 2002 for their helpful comments. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation, IBM Global Services, or the reviewers.

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