

## ***Reevaluating the Global Digital Divide: Socio-Demographic and Conflict Barriers to the Internet Revolution\****

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The Global Digital Divide (GDD) in Internet and related forms of information technologies has gained some press and scholarly attention in recent years. Although the contours and causes of Internet diffusion around the globe are now better understood, a number of questions and avenues remain unanswered or unexplored, particularly concerning the role of socio-demographic structures and even conflict processes on Internet diffusion. This study addresses the current state of the digital divide and sheds new light on the barriers that continue to inhibit developing nations' lag with the West in Internet connectivity. Focusing on a large sample of the world's developing nations, this project finds that although the GDD is narrowing, the gap is still large and that specific demographic properties (high fertility) and conflict processes threaten to keep many societies in the periphery of cyberspace. The authors also find that urban agglomerations work to amplify Internet demand over time and that maturing economies may no longer require democratization as a pathway to Internet development. Implications of these findings and future directions of research are briefly discussed.

Within the past 20 years the world has witnessed the emergence of an entirely new form of social interaction made possible by the blending of telecommunications and computer technologies we call the "Internet." Although many promises have been made about the benefits of free-flowing information to the globe's *have-nots*, the stark reality has been that conventional economic and political divides translate into a Global Digital Divide (GDD). Previous research on the global diffusion of information technologies (ITs) demonstrates that Internet usage is not driven entirely by affluence but also by important social and political structures historically characteristic of the West. Developing nations that want to see an increase in Internet connectivity may therefore require a confluence of social, economic, and political factors such as affluence, political and economic freedoms, and technological culture. As many lag behind the West in these and other ways the question remains as to how long will this GDD linger.

This digital gap has not gone unnoticed, of course. Numerous journalists, scholars, governments, and non-governmental agencies have focused on the causes of and solutions to the GDD. Undoubtedly this attention has influenced the promotion and funding of Internet deployment across the globe. Work by the United Nations, including two summits on the GDD (2003/2005), has been instrumental in drawing attention to this gap, and the International Telecommunications Union (ITU) has been active in fostering research on the digital. Indeed, there have been some successes in this top-down approach; the World Bank recently reported that the GDD is narrowing (BBC 2005; UN 2005). Nevertheless, in spite of these efforts and ongoing development and democratization in some parts of the developing world, the GDD persists and thus the important question for both developing communities and Internet researchers is simply, why?

This project attempts to further deepen our understanding of this ongoing divide in several ways that fill important gaps in the empirical literature. Little research has considered the ground-level social factors that play a role in Internet deployment; most scholarship focuses primarily on national aggregations of economic or political variables. For example, no previous research has considered the impact of political violence on Internet development even though it is widely acknowledged that political violence adversely affects entire economies (Seonjou and Meernika 2005). Furthermore, few scholars have considered whether specific demographic trends play a central role in affecting Internet capacity. In addition, most research has only part of the story about the connection of both economics and politics to Internet development. We maintain that development forces now trump political openness in their impacts on Internet growth. Next, we first discuss the persisting and in some cases growing GDD and then move toward a theoretic discussion of previously unexplored contextual barriers that inhibit the global diffusion of the Internet. Finally, we generate and empirically test several hypotheses on a sample of the world's nations.

### **The Growing Relevance of Internet Diffusion**

As a rapidly maturing global technology, the Internet is having an increasing impact on the world's economic, political, and social affairs. The primary scholarly focus has been on the economic impact of advanced telecommunications (Cronin et al. 1991; Dholakia and Bari 1994; Saunders, Warford, and Wellenius 1994). Telecommunications minimize both costs and uncertainty governing the distribution of goods and services in a high mass consumption society (Hudson 1997; Hufbauer 1996; Rostow 1990). As with transportation arteries, telecommunication's major economic impact is through the efficiency it provides in transitions. Previous research demonstrates a likely

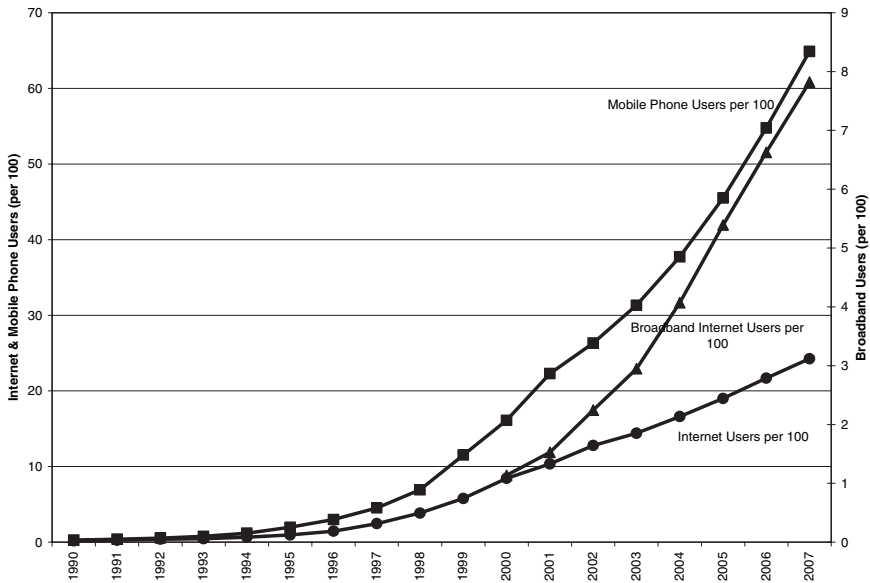
causal relationship between telecommunications and economic development. (Cronin et al. 1991; Dholakia and Bari 1994; Madden and Savage 2000; Saunders, Warford, and Wellenius 1994). As a form of telecommunications that is more extensive and revolutionary in depth and breadth of data transmission, the Internet is especially important for the global economy. Even peripheral areas of the world are not unaffected by the Internet; anecdotes abound about the Internet's and even mobile phone's usefulness to poor farmers in India and Africa for market information (Kamarck 2008).

Although there is little cross-national empirical work linking political and social outcomes with Internet connectivity, it stands to reason that IT such as the Internet should play a significant role in social mobilization, the emergence/strengthening of civil societies, and the international constraints on states that follow from the interdependence of "world polity." For instance, Baber (2002) notes how civil society has been strengthened in Singapore by Web sites devoted to constitutional rights, various social movements, and opposition parties. Others note the pros and cons of Internet connectivity in international activism against the forces of economic globalization (Clark and Themudo 2005). Another mechanism whereby the Internet may build participatory democracy is the growing necessity of governmental service Web sites, or "virtual cities" (Fernandez-Maldonado 2005). As the Internet increases interaction between government and its citizens, opportunities for activism and reform multiply over time.

As scholars' and the public's awareness of the advantages of the digital revolution grows, so too has our understanding of the gap that separates the digital haves from the have-nots. The West's dominance of the Internet—in terms of both supply and consumer demand—is widely acknowledged; however, that dominance is shrinking as the foregoing evidence suggests.

### **State of the GDD**

First, data to date demonstrate the increase in IT demand at the global level. Figure 1 presents the explosive rate of growth in Internet use, broadband subscription, and mobile phone technologies—the tools of cyberspace—across the globe between 1990 and 2007. Since 1990, the number of Internet users per 100 has increased from a global average of nearly 2 to over 24 in 2007. Over the same time period, mobile phone usage grew from under 1 per 100 individuals on average to over 64, whereas broadband subscribership went from a low of 1 per 100 to almost 8 between 2000 and 2007. Notably, the higher prevalence of mobile phone usage further paves the way for Internet usage as voice and data transmission become more and more fused in hand-held devices. Clearly, since the mid-1990s the IT revolution has gained speed with no apparent plateau in sight. Given the benefits growing digitalization



**Figure 1**  
International Growth in Information Technology: 1990–2007.

confers upon populations, this graph might convey a sense of optimism about the prevalence of digital inequities. Nonetheless, these trend lines cloak important regional and national disparities in IT access around the globe.

Table 1 illustrates the GDD as it exists across the world's regions in terms of the percent increase in Internet users per 1,000 from 1995 to 2007 and also as the ratio of Internet users of each region to Internet users in North America (for both 1995 and 2007).<sup>1</sup> Several comments follow from this table. First, the data for 1995 and 2007 suggests the every single one of the world's regions is closing the gap with North America (i.e., the United States and Canada). For example, the North African Internet user rate grew a whopping 100,000 percent between 1995 and 2007 whereas North American rates have grown over the same time period at (only) 1,108 percent. Sub-Saharan rates grew at 11,000 percent whereas Middle Eastern rates topped 13,000 percent. However, sub-Saharan's rates are a mere .07 or 7 percent of North American rates in 2007. In fact, to date the entire developing world has yet to reach the half-way mark of the level achieved by North America.

Not surprisingly the sole exception to this disparity is Western Europe, whose rates have almost reached parity with North America at .95 or 95 per-

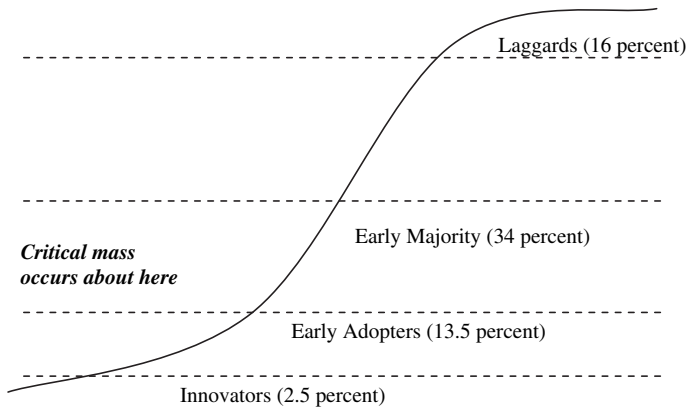
**Table 1**

The Average Number of Internet Users per 1,000 by Region: Percent Increase in both Penetration Rate and Inequality in North America between 1995 and 2007

Region	1995	2007	% increase 1995-2007	Inequality ratio of region to N. America (1995)	Inequality ratio of region to N. America (2007)
North Africa	.13	132.94	104,007.04	.002	.214
Sub-Saharan Africa	.40	44.14	11,000.84	.008	.071
Middle East	1.50	202.39	13,430.84	.029	.326
Latin America	4.54	263.24	5,694.51	.089	.424
Eastern Europe	5.61	301.14	5,266.45	.109	.485
Asia	5.99	250.33	4,078.46	.117	.403
Oceania	10.70	213.14	1,892.78	.208	.344
Western Europe	29.88	593.18	1,885.53	.582	.956
North America	51.32	620.48	1,108.97	—	—

cent. Latin American, Oceanian, and Middle Eastern rates are roughly over one-third by stark contrast. Eastern Europe has rocketed ahead of Latin America and Asia since 1995, whereas Africa's progress, although impressive, still puts it far behind the rest of the world in developing Internet connectivity. Yet despair in the face of these glaring gaps is not entirely warranted.

These patterns of growth are to be expected given what we know about technological diffusion. As Rogers (1995) notes, the process of technological adoption in a population can be characterized as a sigmoid (or s-shaped) curve. As depicted in Figure 2, early adopters typically require the innovation to hold some obvious advantage for them (given the high initial costs of adoption), and progress is therefore relatively slow. As more and more people, organizations and nations adopt a technology, however, a critical mass begins to build, exerting "homophilic pressure" on all "laggards" to adopt the technology. Adoption rates climb sharply until the "market" (i.e., the pool of potential adopters) is saturated and adoption rates begin to level off. In sum, then, the closing gap between North American penetration rates and other regions is to be expected, but it still leaves the United States many years



**Figure 2**

Based on Everett Rogers, *Diffusion of Innovations*, 1995 (pp. 262, 314).

ahead of the most of the world. The fact that the rate at which the gaps are closing has such wide variation across regions suggests that the barriers to Internet development are themselves regionally or nationally variable and thus any understanding of the ongoing global digital divide needs to be rooted in cross-national research.

### **Social Structure and Internet Diffusion**

The foregoing evidence evinces a clear and ongoing digital divide in spite of the advances the developing world has made in catching-up with the West. Fortunately, there is now a fairly rich empirical literature to explain the various structural factors involved in this spread of technology across the globe.

### ***Global Cities and Networks***

At this point the economics behind Internet diffusion are reasonably well understood and most of the empirical research has focused on techno-economic indicators such as GDP per capita, telephone penetration, or costs of telecommunications services (Andrés et al. 2003; Chinn and Fairlie 2004; and Crenshaw and Robison 2006; Guillen and Suarez 2004; Kiiski and Pohjola 2002). Global development as channeled through international trade and investment linkages also foster Internet diffusion (Gibbs, Kraemer, and Dedrick 2002; Chinn and Fairlie 2004; Milner 2003; Crenshaw and Robison 2006). However, we argue that is not simply raw economics that primarily matter, but the social pooling or concentration of the right mix of individuals who create Internet demand and supply.

In particular, the world's cities and their networks are significant engines of technological advance (Crenshaw and Robison 2006). Large cities in developing countries ease Internet adoption because they provide ready markets for Internet capacity, given that the bulk of a developing country's upper and middle classes are found in its large urban agglomerations. Specifically, urban areas are incubators of IT and other technological innovation in no small part because major and well-endowed universities are located in urban areas. This has the consequence of spatially clustering technologically oriented occupations and firms that require close orbit of urban-oriented tech and education sectors.<sup>2</sup> Additionally, very large cities enable alternative bridges to the developed world via other modes of communication and transportation (e.g., seaports and commercial airparks) that in turn ease the flow of new ideas and innovations. In fact, much of the developing world's economic and technological growth are the products of their globalized cities.

We therefore predict that the presence of large urban agglomerations will promote the development of Internet capacity. Moreover, large urban areas should interact with previous accumulations of Internet demand to supercharge subsequent Internet development; Internet like other telecommunications further enhances communication between key adopters and innovators in socially and spatially relevant technological sectors. In other words, urban areas are pools of information and technology diffusion that accelerate burgeoning demand for Internet capacity thereby jump-starting Internet growth.

Hypothesis 1: Net of other global and national economic influences, nations with large urban populations should accelerate the effect of previous demand for Internet consumption.

### *Demography*

The urbanization of populations is not the only demographic component that plays a role in predicting Internet capacity. Although urbanization may prove productive for Internet diffusion and development, other demographic structures may actually retard it. We expect population growth's impact on Internet development to roughly correspond to its more established influence on economic development. Although there is no ample evidence that labor force growth (or the growth in productive adults) increases per capita growth (Crenshaw, Ameen, and Christenson 1997), rapid fertility apparently has the opposite (or Malthusian) effect. Accordingly, high fertility forces families and communities to consume savings, thereby depleting national-level capital formation and investment rates. Moreover, high youth dependency ratios force countries to invest scarce resources in an effort to catch-up with the West by providing education, jobs, and infrastructure for a rapidly expanding labor force (Simmons 1988). Allocating capital to less-productive segments of the

population (e.g., educational expenditures) forces nations to undercapitalize those already in the labor force (Bloom and Freeman 1987), resulting in sub-optimal investment patterns and subsequent under-performance in economic growth. We would expect these pernicious patterns to be less marked for Internet development (e.g., given its relationship to education), whereas on balance we think that anything that reduces economic growth will likely hamper Internet capacity, particularly business-to-business Internet development. Also, as populations with large urban agglomerations also have lower fertility, controlling for fertility would help us to understand and clarify the direct effects of either demographic variable on Internet deployment.

Furthermore, if Internet development is affected negatively by nations' young age structure in the aforementioned manner, it is also likely that it is positively enhanced by large percentages of individuals who serve as early adopters of computer technology, namely, the percentage of the population that are in their teens and twenties. Although a plethora of young children are a resource drain on technological role-out and economic productivity in modernizing societies, a critical mass of young, technologically savvy and also heavily urbanized individuals accelerates demand for Internet and computer technologies. Combining the effects of fertility and young adult populations we hypothesize the following.

Hypothesis 2: Higher fertility will reduce Internet development while higher percentages of young adults will promote Internet development.

### ***Democratic Governance***

Aside from general development, globalization and demographic processes, prior research argues that that political openness (i.e., as measured by broader indicators of democracy) promote Internet development because democratic regimes have fewer reasons and less power to control decentralized forms of communication that link citizens to one another (or to actors within the government; Beilock and Dimitrova 2003; Buchner 1988; Crenshaw and Robison 2006; Wunnava and Leiter 2009). In brief, democratic states allow for citizen participation in politics and afford their citizens freedoms of assembly and speech—conditions that promote a free-flow of information among citizens and between citizens and their leaders. Nations that are therefore more liberal in political participation and civil rights will tend to have fewer restraints on freedom of speech and assembly in virtual space, signaling the green-light for commercial roll-out of Internet technologies to consumers. In addition, other qualities of democracies affect Internet diffusion including a government's respect for individual and collective property rights (Norris 2001; Robison and Crenshaw 2002), policies that allow for or favor



telecommunications privatization (Guillen and Suarez 2004; Wallesten 2002), and/or competition (Dasgupta, Hall, and Wheeler 2000) and overall regulatory environments conducive to free market enterprise (Chinn and Fairlie 2004). In short, general liberalization paves the way for domestic Internet deployment.

However, as Corrales and Westhoff (2006) note, not all autocratic systems are equality *intolerant* of Internet development. While non-capitalist systems have governments that often discourage most forms of international communication, pro-capitalist autocracies (e.g., China) and semi-autocracies involved in global trade allow many forms of telecommunications for the sake of commerce. Authoritarian states that want to stay in the economic game of world capitalism have to conform to some of democratic-capitalism's basic requirements to stay competitive—they have to adopt competitive education, scientific/engineering, infrastructure and other technical and technological standards. Diffusion theory would therefore predict that globally conscious autocratic states would be in many ways no different from more open regimes as they pursue adoption strategies of those global technologies that pave the way for development and modernization. Moreover, earlier communication adoptions/innovations by their very globally networked nature link citizens to global sources of information and thus further apprise individual adopters of newer innovations that facilitate subsequent roll-out of more advanced technologies such as the Internet. In short, once the technological juggernaut of development commences and once a regime engages in policy choices that promote technological adoption for the sake of development then nothing can stop technologies like the Internet from maturing. Thus, it is likely that the importance of democratic governance for Internet development declines as economic development increases (i.e., countries enmeshed in global trade, regardless of polity, are likely to embrace Internet technology). As such, we formally hypothesize the following.

Hypothesis 3: Economic development reduces the effect of political liberalization on Internet development.

### ***Political Stability***

Demographics and development are not the only factors that predict Internet diffusion. The appalling adverse effects of bloody conflicts for national economies and societies are well documented (Seonjou and Meernika 2005) as development, democracy, and the broad welfare of large numbers are adversely affected by war, terrorism, and warlordism. Surprisingly, no previous research has examined the impact of political conflict upon Internet development even though the effects of violent conflict on Internet use can be seen in at least a few of ways. Conflict may indirectly upset growth in Internet

capacity by virtue of its direct negative effect on the economy—as the economy falters due to destroyed stockpiles of skill, capital, and infrastructure, less income either at the citizen or state levels is available for Internet Service Provider (ISP) funding or roll-out, or for consumption of non-essential and luxuries such as computers and digital technologies. Furthermore, conflict would exert a direct negative effect upon Internet deployment by its destruction of transportation and telecommunications infrastructure as rebels and even government forces may engage in direct sabotage of the lines of communication for enemy forces. Also, conflict may promote government surveillance and retractions of freedoms that are relevant to telecommunications usage as regimes attempt to reign-in threats by any means necessary even including limiting user access or censoring Internet sites. In brief, retractions of civil liberties in the wake of violence may have the effect (intended or not) of deterring Internet use. Turmoil within a government as a result of illegitimate regime transitions (e.g., coups or palace revolutions) also creates an uncertain regulatory and investment environment that may undermine telecommunications infrastructure investments by actors within the private sector. Instability may also create brain-drains where talented and educated individuals seek safer employ and residence outside of their afflicted countries. For these reasons, we expect the following hypothesis.

Hypothesis 4: Socio-political conflict will undermine Internet development.

In sum, we expect that at higher levels of development, capitalization will simply begin to trump democracy in paving the way for Internet capacity while large urban areas and high percentages of young adults supercharge Internet demand. We also expect that higher fertility rates and conflictual social and political environments will further stall Internet deployment. These hypotheses are testable using data available at the nation-state level over time.

### **Analytic Strategy**

We test the foregoing hypotheses using a large sample of the world's developing nations (approximately 143 nations) for the 1990–2004 time period.<sup>3</sup> We use a pooled cross-section time series or panel design to maximize sample size and to better capture causality by including temporal variations in the data. However, panel data have a significant disadvantage in that the error structure is complicated by the inclusion of nations that may have non-random variation over spatial and temporal units. This methodology thus often violates standard ordinary least squares assumptions—that the errors are homoscedastic and uncorrelated. Using panel data with an improper model specification may also lead to the conclusion that the error terms are heteroscedastic and autocorrelated when, in fact, they are not (Podesta 2002).

To accommodate these problems, we follow Beck and Katz (1995, 1998) and use an ordinary least squares model with panel-corrected standard errors.<sup>4</sup> This procedure corrects for both heteroscedasticity and spatial autocorrelation, whereas the inclusion of a lagged dependent variable accommodates serial autocorrelation. To further rule out autocorrelation, we also include a panel-specific first-order autocorrelation correction.

Unfortunately, we cannot use fixed effects methodologies as a means of controlling for unobserved unit-specific heterogeneity because of the limited variability of some of our predictors (more than one predictor in our models is a dummy variable whereas others are limited-range rank-ordinal). As our time period is limited and some of our variables are time-invariant or near time-invariant, using fixed effects dummies for every case would absorb a large number of degrees of freedom (and improperly obscure some genuine relationships in the data). As such our models follow a standard ordinary-least squares design with the panel-corrected standard errors and a lagged dependent variable. The generic model can be specified as follows:

$$Y_{i,t} = \alpha + \beta Y_{i,t-1} + \beta X_{i,t-1} + \varepsilon_{i,t-1}.$$

We include on the right-hand side of this equation a 1-year lagged dependent variable for a couple of reasons. First, it is theoretically likely that a nation's level of Internet use in the preceding year would create multiplier effects (and positive externalities), making the Internet more attractive to potential users and thus inviting growth in capacity that subsequently ripples through later years. Second, including a lagged dependent variable partially accommodates serial autocorrelation (Beck and Katz 1995; Podesta 2002). The inclusion of both the lagged dependent variable and the built-in autocorrelation correction feature renders our tests extremely conservative in that much less variance is left for our theoretical variables to explain. Finally, we log variables where appropriate to correct for skewness of the data.<sup>5</sup>

### Dependent Variable

Our dependent variable in this study is the number of Internet users per 1,000 individuals (i.e., the raw number of Internet users divided by the total population and multiplied by a 1,000) and comes from the *International Telecommunications Union Indicators* database (ITU 2008). The ITU derives these data principally through annual surveys accomplished by the ITU's Telecommunications Development Bureau and supplemented by national reports from host governments. Internet users are individuals aged two and up who have used dialup, broadband and/or lease-line Internet within the past thirty days. As with many data at the cross-national level, the Internet user data are potentially limited in that when the ITU relies on national level

surveys, some governments measure Internet users at different ages from what others or the ITU requires. Unfortunately the ITU is not forthcoming with information about what nations under-report data in these ways and thus it is unclear exactly what effects, if any, these have on the results. However, the ITU feels that data across time and country units are essentially comparable and hence useful for free distribution and analyses (ITU 2009).

Although not a perfect measure of Internet development, these data have the advantage of measuring both Internet demand and supply (as use requires infrastructure development) over the only other available data such as “Internet hosts” (ISC 2009) which measures mere computer supply but not the population that actually uses the technology. Furthermore, the alternative measure that counts the number of Internet-connected computers is problematic given that the methodology for counting does not guarantee that Internet-connected computers for Argentina, for instance, are actually located in Argentina (ISC 2009). For both statistical and theoretical reasons, we include a lagged version of the dependent variable as an independent variable.

### **Independent Variables**

#### ***Socio-Demographic Effects***

Our two main demographic variables come to us from the World Bank. We include total fertility rates (the average number of births per woman) within nations. In review, this measure proxies for youthful dependent populations. Essentially high fertility rates create large populations of youth who consume more resources than they produce thus reducing discretionary income at the individual and societal levels that would otherwise finance Internet supply/demand. We also include the percent of a nation’s population that is between the ages of 15 and 24 as people of this age are often the first adopters of telecommunications technologies.

#### ***Global Cities***

To measure the effect of networked islands of technology and global culture (i.e., urban agglomerations), we borrowed a global urbanization variable from a previous study (Crenshaw and Robison 2006) that was calculated using data from the World Bank’s (2006) *World Development Indicators* database. This measure is a nation’s annual percent share of the total world urban population. We divided the urban population of a nation in a given year by the total world’s urbanized population for that year. This global urban variable indicates a nation’s share or rank in the global network of urban areas and thus serves as a rough proxy for postindustrial islands known as megacities. Such massive urban concentrations not only provide and fuel the necessary

capital and infrastructure, but also the market demand from educated or skilled urban consumers and their firms and other institutions for significant Internet capacity, linking all with the “post-industrial” world. These urban islands should even generate significant demand in nations that are currently below average technologically.

To evaluate the hypothesis that urbanization amplifies the effects of prior Internet demand, we interact urbanization with the lagged dependent variable (i.e., the prior year’s number of Internet users standardized by population). If the amplification process we discuss is correct, then the interaction of the two variables will be positive and statistically significant.

### ***Economic and Political Development***

The effects of economic development (i.e., national and personal incomes) on Internet use and development need little mention here. We make use of the World Bank’s (2006) measure of gross domestic product (GDP) per capita as an indicator of national income and a proxy for individual wealth—essential sources of capital for Internet supply and demand. Previous research has also demonstrated that one of the major non-economic factors predicting Internet capacity is democracy or political freedoms consonant with democratic states (Wunnava and Leiter 2009; Crenshaw and Robison 2006; Beilock and Dimitrova 2003). In this tradition, we measure democratic governance as a composite (additive) index of the two *Freedom House* indices of political and civil liberties (2007). Political liberties refer to citizen rights for political access/participation and constraints imposed upon chief executives while civil liberties refer to freedoms such as assembly and speech. Both the political and civil rights measures are rank-ordinal indices ranging from a low score of 1 and a high of 7. Nations ranking as highly free on either index would receive close or equal to a 7. When combined, the possible scores range from 2 to 14 with the highest possible score indicating the most free in terms of both political and civil rights. We test our hypothesis that political freedoms should diminish in the face of increasing economic development by interacting our measure of political freedom and the indicator of development (GDP). If development reduces the effect of democratic rights on Internet development we should see a negative interaction effect.

### ***Social and Political Conflicts***

We employ several measures to test the hypothesis that social/political conflict undermines Internet usage. To measure state instability, we include a dummy that measures adverse regime transitions from the *Polity IV* database (Marshall and Jagers 2007). We measure social violence in two ways; first we incorporate a count of low-level acts of political violence—or

terrorism—from the *International Attributes of Terrorism* database (Mickolus 2005) and second we include a dummy variable that indicates the occurrence of an ongoing internal or external wars from Gleditsch et al. (2002). War is defined as “a contested incompatibility that concerns government and/or territory where the use of armed force between two parties, of which at least one is the government of a state, results in at least 1,000 battle-related deaths.” The definition of internal conflict is “a conflict between a government and a non-governmental party, with no interference from other countries,” whereas the definition of external conflict is a conflict between two or more regimes (Gleditsch et al. 2002). We also include a measure of systemic state repression (Gibney, Cornett, and Wood 2002; Poe and Neal Tate 1994).<sup>6</sup> The indicator is ranked as a five-point scale with 1 indicating the relative absence of government abuses (i.e., extrajudicial killings, torture, political imprisonment, and disappearances) and a high of 5 indicating abuses are widespread throughout the population.

### Control Variables

Aside from our important theoretical tests shown before, we also control for salient features of the national and global contexts that could complicate and obscure the exact nature of any empirically tested relationships. Prior research suggests that one important factor is the cost of using the Internet (Chinn and Fairlie 2004; Guillen and Suarez 2004). To control for costs of using the Internet, we use an indicator that measures the average costs of a 3-minute call from the ITU (2004). This important measure taps both the general telecom infrastructure and the degree to which dial-up and DSL Internet usage costs impose constraints on Internet development. We also employ a general population size measure from the World Bank to serve as a control for the effect of overall market size and to capture other features of demographic regimes that affect Internet diffusion.

Given the role previous research has found for global connections and Internet diffusion (Milner 2003; Robison and Crenshaw 2002; Shchetinin and Baptiste 2008), we employ controls tapping two dimensions of global networks: social and economic ties. Global context and connections may potentially outweigh even national-level factors given the global-networked nature of telecommunications like the Internet. At the very least, we believe that controlling for external factors should render our tests of national-level ones extremely conservative.

We expect that international social connections and flows in terms of people will stimulate Internet demand and consumption as well as raw global financial transactions simply because people from abroad—and particularly the developed world—bring to developing nations expectations and skill for

information technologies that put pressure on receiving nations to expand their own technological supply. To capture the influences of this form of social globalization, we include the number of tourist arrivals per 10,000 visiting a nation derived from the World Bank (WDI 2006). We expect that major tourist destination centers experience strong demand for current and instantaneous information and communications between nations sending and receiving tourists—a situation readily apparent in the significant numbers of well financed tourist Internet sites created by national tourism bureaus and travel agencies. Moreover, the majority of tourists and business travelers are from affluent nations and have come to rely upon digital communications. In short, their presence in a country should generate demand for personal computer through cybercafés and hotel wireless bubbles, ISPs, and other supporting infrastructure that in turn stimulate local demand by being more widely available in the national market.

Of course, social flows are not the only globalizing forces that work to promote Internet usage within nations. Monetary flows that directly finance development, infrastructure and consumer demand are essential drivers of the Internet. Our economic globalization measures are trade and foreign direct investment both calculated as percentages of GDP and are from the World Bank (2006). Both investment and trade should supply the requisite growth in externally oriented employment sectors that not only put money into the pockets of workers but more importantly require electronic connections to the rest of the world (i.e., the West) that subsequently create demand for workers literate and skilled in computers and information processing. Furthermore, off-shored multinational firms in developing nations bring educated workers and staff who require adequate information and telecommunications infrastructure—another source of demand that pressures a developing state to roll-out Internet capacity for the population in general.

### **Findings and Discussion**

Table 2 presents the descriptive statistics in both the logged and unlogged forms for our variables as employed in Tables 3–5. Table 3 presents findings for our demographic, political, and economic indicators. Although population level has inconsistent influence on Internet development, the cost of an average telephone call negatively predicts Internet development in all of the models of Table 3 (with the exception of the insignificant finding in model 1). Technically, phone costs (with a range of 0–1.3) reduce Internet use by about four percentage points for each 10 percent increase in cost.

Model 1 provides a test for hypothesis 1 which predicts that large urban areas amplify the effect of previous Internet capacity on subsequent Internet growth by employing an interaction effect between our global urban share and

**Table 2**  
Descriptive Statistics with Logged and Unlogged Versions of the Variables

	Variables	N	Mean	SD	Minimum	Maximum
Unlogged	Costs of phone call (3 min; $t - 1$ )	1,097	.1	.1	0	2.7
Logged	Costs of phone call (3 min; $t - 1$ )	1,097	.1	.1	0	1.3
Unlogged	Fertility rate, total (births per woman; $t - 1$ )	1,097	3.4	1.6	1.1	7.3
Logged	Fertility rate, total (births per woman; $t - 1$ )	1,097	1.4	.4	.7	2.1
Unlogged	FH Political+Civil Rights Index ( $t - 1$ )	1,097	8.5	3.5	2	14
Unlogged	GDP/ $c(t - 1)$	1,097	2,777.9	3,701.9	90.2	23,235.1
Logged	GDP/ $c(t - 1)$	1,097	7.2	1.3	4.5	10.1
Unlogged	Internet users per 1,000 ( $t - 1$ )	1,097	28.4	64.5	0	609.7
Logged	Internet users per 1,000 ( $t - 1$ )	1,097	1.9	1.7	0	6.4
Unlogged	Percent of population aged 15–24 ( $t - 1$ )	1,097	.3	.1	.2	.4
Logged	Percent of population aged 15–24 ( $t - 1$ )	1,097	.3	.1	.1	.4
Unlogged	Population ( $t - 1$ )	1,097	33,000,000	120,000,000	97,400	1,300,000,000

(Continued)



Table 2  
(Continued)

	Variables	N	Mean	SD	Minimum	Maximum
Logged/ unlogged						
Logged	Population ( $t - 1$ )	1,097	15.8	1.7	11.5	21
Unlogged	Urban global share (%; $t - 1$ )	1,097	.7	1.8	0	21.5
Logged	Urban global share (%; $t - 1$ )	1,097	.3	.5	0	3.1
Unlogged	State failures ( $t - 1$ )	988	0	.2	0	1
Unlogged	State repression ( $t - 1$ )	988	2.6	1.1	1	5
Unlogged	Terrorist attacks ( $t - 1$ )	988	.9	4.8	0	105
Logged	Terrorist attacks ( $t - 1$ )	988	.3	.6	0	4.7
Unlogged	Wars dummy ( $t - 1$ )	988	.1	.3	0	1
Unlogged	FDI/GDP% ( $t - 1$ )	911	3.3	4.7	-5.7	51.3
Logged	FDI/GDP% ( $t - 1$ )	911	4.5	0	4.4	4.9
Unlogged	Tourists per 10,000 ( $t - 1$ )	911	2,199.8	4,143.8	1.4	32,153.2
Logged	Tourists per 10,000 ( $t - 1$ )	911	6.4	1.8	.3	10.4
Unlogged	Trade/GDP% ( $t - 1$ )	911	79.8	39.1	14.7	228.9
Logged	Trade/GDP% ( $t - 1$ )	911	4.3	.5	2.7	5.4

Notes: SD, standard deviation; FH, freedom house; FDI, foreign direct investment; GDP, gross domestic product.

**Table 3**

Regression with Panel-Corrected Standard Errors of Internet Users per 1,000 on Democracy, Development, Demography, and Theoretically Important Interaction Effects

	1	2	3	4
Internet users per 1,000 ( $t - 1$ )	.921*** [46.73]	.909*** [46.72]	.908*** [45.94]	.908*** [48.82]
Population ( $t - 1$ )	-.028* [1.80]	-.042*** [2.70]	-.034* [1.95]	-.028 [1.58]
GDP/ $c(t - 1)$	.086*** [4.25]	.052** [2.36]	.064*** [3.14]	.163*** [6.18]
FH Political+Civil Rights Index ( $t - 1$ )	.007* [1.81]	.001 [.11]	.001 [.37]	.091*** [5.08]
Costs of phone call (3 min; $t - 1$ )	-.409* [1.94]	-.426** [2.17]	-.393* [1.94]	-.349* [1.79]
Urban global share (%; $t - 1$ )	-.047 [1.10]	-.047 [1.07]	-.07 [1.37]	-.093* [1.84]
Urban global share×Internet users ( $t - 1$ )	.058*** [5.35]	.065*** [6.55]	.062*** [5.62]	.060*** [5.59]
Fertility rate, total (births per woman; $t - 1$ )		-.229*** [6.22]	-.407*** [4.67]	-.424*** [4.98]
Percent of population aged 15–24 ( $t - 1$ )			1.487** [2.39]	1.463** [2.47]
Political+Civil Rights Index×GDP/ $c(t - 1)$				-.012*** [4.62]
Constant	.323 [1.15]	1.187*** [3.96]	.847** [2.50]	.069 [.20]
Observations	1,097	1,097	1,097	1,097
Number of uncc	137	137	137	137

*Notes:* z-statistics are given in brackets. \*, \*\* and \*\*\* indicate significances at 10, 5, and 1 percent levels, respectively. GDP, gross domestic product; uncc, United Nations country codes.

the 1-year lagged dependent variable. In confirmation of this hypothesis, we indeed find that the multiplicative term is positive and statistically significant meaning that as the size of urban areas increase by one unit the effect of prior

**Table 4**  
Regression with Panel-Corrected Standard Errors of Internet Users per 1,000  
on Social and Political Conflict Variables

	1	2	3	4
Internet users per 1,000 ( $t - 1$ )	.926*** [43.93]	.926*** [43.85]	.926*** [43.81]	.925*** [43.72]
Population ( $t - 1$ )	-.028 [1.37]	-.027 [1.36]	-.027 [1.36]	-.031 [1.58]
GDP/ $c(t - 1)$	.153*** [5.99]	.154*** [6.03]	.153*** [5.75]	.156*** [5.83]
FH Political+Civil Rights Index ( $t - 1$ )	.083*** [4.83]	.083*** [4.82]	.082*** [4.52]	.087*** [4.78]
Costs of phone call (3 min; $t - 1$ )	-.359** [2.27]	-.362** [2.28]	-.362** [2.28]	-.343** [2.14]
Urban global share (%; $t - 1$ )	-.065 [1.23]	-.065 [1.24]	-.065 [1.21]	-.072 [1.32]
Urban global share×Internet users ( $t - 1$ )	.052*** [4.67]	.051*** [4.65]	.051*** [4.70]	.052*** [4.67]
Political+Civil Rights Index×GDP/ $c(t - 1)$	-.011*** [4.42]	-.011*** [4.42]	-.011*** [4.19]	-.011*** [4.32]
Fertility rate, total (births per woman; $t - 1$ )	-.413*** [4.38]	-.413*** [4.37]	-.412*** [4.27]	-.420*** [4.41]
Percent of population aged 15–24 ( $t - 1$ )	1.568** [2.54]	1.566** [2.53]	1.560** [2.48]	1.576** [2.53]
Terrorist attacks ( $t - 1$ )	-.033** [1.99]	-.033** [1.99]	-.033* [1.84]	-.039** [2.11]
State failures ( $t - 1$ )		.004 [.07]	.004 [.08]	-.002 [.05]
Wars dummy ( $t - 1$ )			-.006 [.17]	-.022 [.58]
State repression ( $t - 1$ )				.021* [1.77]
Constant	.07 [.18]	.061 [.16]	.067 [.18]	.038 [.10]
Observations	988	988	988	988
Number of uncc	131	131	131	131

Notes: z-statistics are given in brackets. \*, \*\* and \*\*\* indicate significances at 10, 5, and 1 percent levels, respectively. GDP, gross domestic product.

**Table 5**  
Regression with Panel-Corrected Standard Errors of Internet Users per 1,000  
on Globalization Indicators

	1	2	3
Internet users per 1,000 ( $t - 1$ )	.934*** [44.05]	.934*** [43.71]	.933*** [43.70]
Population ( $t - 1$ )	-.043** [2.05]	-.043** [1.96]	-.043** [1.98]
GDP/ $c(t - 1)$	.152*** [4.56]	.152*** [4.56]	.162*** [4.90]
FH Political+Civil Rights Index ( $t - 1$ )	.090*** [4.12]	.089*** [4.08]	.092*** [4.36]
Costs of phone call (3 min; $t - 1$ )	-.344*** [2.33]	-.343** [2.28]	-.372** [2.46]
Urban global share (%; $t - 1$ )	-.033 [.64]	-.032 [.65]	-.03 [.61]
Urban global share×Internet users ( $t - 1$ )	.046*** [3.96]	.046*** [3.93]	.048*** [3.98]
Political+Civil Rights Index×GDP/ $c(t - 1)$	-.012*** [3.75]	-.012*** [3.73]	-.012*** [4.04]
Fertility rate, total (births per woman; $t - 1$ )	-.367*** [3.38]	-.365*** [3.57]	-.341*** [3.16]
Percent of population aged 15–24 ( $t - 1$ )	1.237* [1.73]	1.231* [1.76]	1.137 [1.55]
Terrorist attacks ( $t - 1$ )	-.037** [2.04]	-.037** [2.03]	-.033* [1.81]
State failures ( $t - 1$ )	-.002 [.04]	-.002 [.04]	-.003 [.07]
Wars dummy ( $t - 1$ )	-.044 [1.13]	-.044 [1.14]	-.049 [1.32]
State repression ( $t - 1$ )	.018 [1.46]	.018 [1.45]	.016 [1.21]
Tourists per 10,000 ( $t - 1$ )	.0001 [.01]	-.0002 [.03]	-.0001 [.01]
Trade/GDP% ( $t - 1$ )		.004 [.16]	-.007 [.31]

(Continued)

**Table 5**  
(Continued)

	1	2	3
FDI/GDP% ( $t - 1$ )			.534* [1.73]
Constant	.286 [.66]	.264 [.56]	-2.138 [1.47]
Observations	882	882	882
Number of uncc	122	122	122

*Notes:* z-statistics are given in brackets. \*, \*\* and \*\*\* indicate significances at 10, 5, and 1 percent levels, respectively. FDI, foreign direct investment; GDP, gross domestic product.

Internet market size becomes more positive by about .06 units (this effect and coefficient size remains throughout the rest of the models in the table). Conversely, this also suggests that as the size of Internet market share in the previous year increases by one unit, the effect of urban area size also becomes more positive by the same .06 units. Although both may be true, we prefer the theoretical explanation that prior Internet use is more directly consequential for subsequent usage (i.e., band-wagon effects) and that as an indirect role urban concentrations of Internet demand and supply simply compound the positive externalities of prior use.

Models 2 and 3 introduce our evaluation of the effects of fertility and youth age structure—a test of hypothesis 2. The effect of the total fertility rates variable (with a range of .7 to over 2.1) in model 2 is negative and statistically significant meaning that higher fertility rates net of development and other key factors decreases the number of Internet users over time (by about 2.3 percentage points for each ten percent increase in fertility). In other words, societies with a large, dependent population have fewer resources to devote toward Internet infrastructure development or consumption and instead funnel meager savings presumably toward basic living. The finding that higher total fertility rates drive down Internet consumption is consistent with the observation that dependent populations are a resource drag that inhibit saving rates at the national and individual levels and thus undermine development across the board. This effect persists when including the young adult cohort variable in

model 3 (with a range of .1–.4, logged). Not surprisingly, the young adult variable is also statistically significant and positive suggesting that populations with large percentages of first adopters (young adults) experience more robust growth in the Internet. Also, the inclusion of this variable undermines the significance of the negative effect of over population size likely because general size was capturing this and other demographic effects.

Our final consideration of Table 3 brings us to model 4. An initial interpretation of the statistically significant and positive effect of development (GDP ranging from 4 to under 10 logged units) across the models would suggest that development increases the rate of Internet development (models 1–3), net of other factors. Political democracy (with a range of 2–14) only makes a weak impact earlier in the table and yet returns to significance only when the interaction effect is included. Yet, these are main effects in a multiplicative model; it is the confluence of these two factors that we believe is more important and interesting.

In model 4, we test our third hypothesis—that economic development reduces the effect of liberal democracy over time—by performing a multiplicative term between our measure for development and political freedoms. This interaction term tells us that as the log of economic development increases by one unit, the effect between the political freedom index and Internet use *declines* by .009 units. To put it differently, the negative interaction effect suggests that as development increases, the beneficial effect of increased political democratization actually recedes. Democracy seems to matter less once development fuels a critical mass of Internet demand. As such, it is commerce and capital as well as a financially driven need for lucrative connections to the global digital economy that increasingly matter for Internet development and not the social benefits of democratization. We prefer this explanation over the alternative—that political freedoms drive down the effects of economics on Internet growth—in part because of the more direct and obvious dependence of Internet supply and demand upon pure income. Also, the importance of costs of phone service as evidenced here further serves to highlight the importance of economics to the roll-out of the Internet.

Table 4 borrows model 4 from Table 3 and subjects our aforementioned findings to several indicators measuring social and political conflicts. Of the four measures (terrorism, wars, state failures and state repression) that we use to test hypothesis 4, only terrorism (with a logged attack count range of 0–4.7) is statistically significant (and negative). Either alone or in combination with other conflict measures, the logged number of terrorist attacks appears to reduce growth in Internet capacity presumably because of the chilling effects violence has on investment and funding of Internet infrastructure and/or on freedoms of speech as they apply in cyberspace. Furthermore,

the lack of personal safety in a situation where political violence targets civilians likely drives technology innovators and adopters out and into more hospitable and secure places. Given that innovators are disproportionately educated and affluent (Rogers 1995), they will have more opportunity to escape danger that targets them personally. Curiously, the indicator for more severe and widespread types of violence (the dummy for any war that results in at least 1,000 annual deaths) does not attain significance. The crudeness of the indicator may be one explanation behind why low-level and yet more varying indicators such as terrorism outperform the war measure. The same may also be true of the state failure indicator (a dummy) which is neither significant nor negative. Curiously, the state repression indicator is weakly but positively influential on Internet development. This finding would seem to be at odds with our prediction that instability in the form of state violence/repression would undermine Internet growth. It is possible that instead repression forces individuals to seek safer alternatives of mobilization through clandestine, online networks, but the crudeness of the variable (ranging from rough categories of 1 to 5) and the weakness or absence of the finding (see Table 5) make us cautious in drawing any substantive conclusions. Perhaps future research with better data on specific state acts of repression can shed further light on this peculiar finding.

Also, nations that have experienced major wars have less Internet development to begin with, likely because of the same reasons they experience war (poor development, lack of modernization); thus, they do not have as far to fall in terms of Internet capacity in the first place. In fact, the significant terrorism finding may be keying upon developing nations that are maturing as Internet societies but remain nevertheless vulnerable to small security threats. Regardless, it is on the whole surprising that we find only a modicum of evidence here that conflict undermines Internet development. It is perhaps a testament to the growing perception of the Internet's importance to national economies that usage remains unaffected by earth shattering factors. As such, we tentatively maintain that hypothesis four is partially confirmed—at least some forms of conflict undermine growth in the Internet.

Table 5 tests all of our hypothesized effects against a set of important globalization control variables. Model 1 controls for the relationship between tourist arrivals and Internet users while models 2 and 3 step in our two variables for economic globalization (trade and investment as a percentage of GDP). Most importantly, the theorized interaction effects from Tables 3 and 4, the effect of fertility, and the effect of terrorism retain their statistical significance whereas the other political violence measures continue to remain unimportant, including the state repression variable. Interestingly, the effect of the young adult cohort is no longer significant when foreign investment is

added. This suggests that investment is enough to spread Internet development across the population, regardless of the existence of a critical mass of young adults. It could also be that investment is drawn to a climate of young, educated workers and thus the youth effect is also picking up the effects of investment. A further curiosity that emerges from Table 5 is that population size is now negatively related to Internet development, in spite of the independent component effects of fertility and young adult cohorts, tempting us to conclude that large and geographically decentralized populations take longer to serve with the necessary infrastructure to promote Internet deployment particularly when investment and trade fall short. It is possible that another demographic component is playing an independent role net of the globalization controls. However, subsequent analyses with a range of demographic indicators have failed to turn up a convincing explanation behind this odd finding.<sup>7</sup> Thus, it will have to await future research with more nuanced data on demographic trends. As for the globalization controls, a few observations are worth making.

Surprisingly, we see only a marginally significant positive effect for foreign investment (with a range of around -6 to a high of almost 51 unlogged units) and no effect at all for tourism or trade thus generally failing to confirm previous research's findings that globalization builds the requisite capital, infrastructure, and skills within a population necessary to enable Internet growth (Crenshaw and Robison 2006; Guillen and Suarez 2004). Whether this is because of different samples, time frames, or data sources for the dependent variable will require further investigation. Regardless, the positive effect of investment is in line with the view that foreign investment supplies needed capital in developing societies to finance Internet infrastructure as well as businesses that in turn employ workers skilled in computer literacy.

### Conclusion

In summary, this study has demonstrated the importance of several factors in Internet development within the developing world. We presented evidence that robust economic development lessens the effect of political democratization on Internet development. Our findings suggested that large urban areas accelerate the effects of prior Internet usage on subsequent Internet growth whereas high fertility—resulting in high dependency rates—and low-level socio-political conflicts (e.g., terrorism) retard it. Although we did not find meaningful effects of other forms of violence or globalization, we nevertheless found some confirmation of all four major hypotheses. Essentially our study suggests that nations wanting to accelerate their participation in the global digital network need to implement policies that reduce fertility rates to more sustainable levels, allowing for the emergence of a population of



young and productive workers whose resources are not drained by very large dependent populations. In addition, the need to prevent acts of violence—even at the lower level—goes without saying. The good news that emerges from the lack of adverse effects of more severe forms of conflict or state failure on Internet development is that nations plagued by ongoing legacies of strife are not permanently disabled from participation in the global network. As such, these nations may benefit from the money, ideas, and influencers connectivity brings, perhaps even providing solutions to civil discord (just as the international media has placed constraints on repression and violence).

Most importantly, the observation that economics at a certain point reduces the positive effects of democratization may also signal good news in that even authoritarian states are embracing the Internet. The Internet has become so vitally important for financial reasons that even autocratic states are going online. However, the allowance of a critical mass of Internet use in their society may in turn breed democratic movements. Combined with the supercharging effect of large urban areas on subsequent Internet growth, rapidly urbanizing authoritarian societies may finally be losing their grip.

Although these findings and their implications are interesting, the present study is limited in a number of ways. First, we are limited by the available data which at present is confined to broad surveys of Internet usage and does not tap the scope or intensity of usage among users or across social group lines within nation-states. A small but growing literature has been focusing on specific national digital divides but most of these studies examine the United States or Organization for Economic Cooperation and Development nations. More research and data gathering that focuses on varying types of digital inequalities within the developing world should be pursued. Secondly although we now have a substantive period of time to cover in our analyses the fact remains that the Internet is still a relatively new technology and thus we are in the early stages of an emerging new social organization that makes many of our hypotheses and observations tentative. In brief, those factors that mobilize early adopters may not have as much bearing on late-comers. This can already be seen in the use of wireless Internet connectivity in third-world hinterlands thereby bypassing the need for deployment of old-fashioned telephone lines and services.

In the meantime, future research should consider how many of the predictors found in previous research (especially those that receive mixed confirmation) are trended, that is, how they change over time. Moreover, the Internet is evolving toward faster and more substantive connectivity (i.e., broadband). Some cross-national data currently exists on broadband from the ITU but is obviously of limited time frame. Nevertheless, studies evaluating the analytic differences between broadband and non-broadband use would go a step further in evaluating another level of the digital divide and those factors that drive

them. Finally, little research has considered the effects of Internet diffusion and the digital divide on international economic development. In the big picture, it is these avenues of research that make the GDD an interesting and increasingly salient topic for scholars and policymakers.

## ENDNOTES

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<sup>1</sup>For instance, North Africa's Internet user rate stood at .13 in 1995 whereas in contrast North America's stood at 51.32 making an inequality ratio of .13/51.32 or .002 for Africa relative to North America. Put differently, North African Internet user rates in 1995 were a mere .2 percent of North America's rate for the same year. This ratio score allows us a way to compare Internet rates across regions with the Internet heavy weight of North America.

<sup>2</sup>We would like to thank an anonymous reviewer for this suggestion.

<sup>3</sup>(\* , not in Table 4; ~ , not in Table 5): Albania (1996–2003) Algeria (1995–2004) Angola (1997–2003) Antigua/Barbuda (1996–2000)\*~ Argentina (1993–2004) Armenia (1998–2004) Azerbaijan (1995–2003) Bahrain (1996–2003)\*~ Bangladesh (1998–2004) Barbados (2000–2002) Belarus (1995–2003) Belize (1996–2004) Benin (1997–2004) Bhutan (2000–2004) Bolivia (1997–2001) Botswana (1990–2004) Bosnia–Herz. (1997–2004) Brazil (1995–2002) Bulgaria (1994–2004) Burkina Faso (1997–2003) Burundi (1991–2004) Cambodia (1998–2004) Cameroon (1998–2003) Cape Verde (1998–2002) Central African Republic (1997–2003) Chad (1998–2003) Chile (1994–2004) China, People's Republic (2003–2004) Colombia (1995–2004) Comoros (1998–2004) Costa Rica (1994–2004) Ivory Coast (1996–2004) Croatia (1994–2004) Cyprus (1993–2004) Czech R. (1994–2004) Djibouti (1996–2004) Dominica (2002–2003)\* Dominican Republic (2001–2003) Ecuador (1993–2004) Egypt (1994–2004) El Salvador (1997–2002) Equatorial Guinea (1999–1999)\*~ Eritrea (1994–2003) Estonia (1993–2004) Ethiopia (1996–2003)\* Fed States of Micronesia (1997–2004)\*~ Fiji (1994–2004) Gabon (59–) (1997–2004) Gambia, The (1996–2003) Georgia (2001–2003) Ghana (1996–2003) Greece (1992–2004) Grenada (1998–2004)\* Guatemala (1996–2002) Guinea (58–) (1995–2003)\*~ Guinea–Bissau (1998–1998)\*~ Guyana (1997–2004) Honduras (1996–2003) Hungary (1992–2004) India (1993–2004) Indonesia (including East Timor 76–) (1995–2004) Iran (1995–2004) Israel (1991–2003) Jamaica (1996–2004) Jordan (1996–2004) Kazakhstan (1995–2003)\*~ Kenya (1996–2003) Kiribati (1999–2004)\*~ Korea, South (Republic) (1991–2004) Kuwait (1996–2004) Kyrgyzstan (2003–2003) Laos (2000–2004) Latvia (1997–2004) Lebanon (1996–2004) Lesotho (1997–2003) Lithuania (1997–2004) Macedonia (1996–2002) Madagascar (1997–2003) Malawi (1998–2003) Malaysia (1993–2004) Maldives (1996–2004) Mali (1997–2002) Malta (1996–2003)\*~ Mauritania (58–) (1998–2004)\*~ Mauritius (1997–2003)\* Mexico (1992–2002) Moldova, Republic Of (1995–2004) Mongolia (1997–2004) Morocco (1996–2004) Mozambique (1997–2002)\*~ Namibia (1996–2004)\*~ Nepal (1991–2004) Nicaragua (1995–2004) Niger (1999–2002) Nigeria (2004–2004)\*~ Oman (1997–2003) Pakistan (1996–2004) Panama (1995–2002) P. New Guinea (1999–2004) Paraguay (1997–2002) Peru (1995–2003) Philippines (1995–2004) Poland (1992–2004) Romania (1994–2004) Russia (1993–2000)\* Rwanda (1997–2003) Samoa (Western) (1998–2004) Sao Tome and Principe (1999–2003) Saudi Arabia (1996–2004)\*~ Senegal (1996–2004) Seychelles (1997–2004) Sierra Leone (1994–2002) Slovakia (1994–2002) Slovenia (1994–2003)\* Solomon Islands (1997–2004) South Africa (1993–2004) Sri Lanka (1995–2004) St. Kitts and Nevis (1997–1997) St. Lucia (1996–2003) St. Vincent (1996–2001) Sudan (1995–2004)

Suriname (1996–2003)\*~ Swaziland (1996–2004) Syrian Arab Republic (1990–2002) Tajikistan (2000–2004) Tanzania(70–)(1997–2003) Thailand (1992–2004) Togo (1990–2003) Tonga (1996–2003)\* Trinidad and Tobago (1996–2004) Tunisia (1995–2004) Turkey (1994–2004) Uganda (1996–2003) Ukraine (1998–2000) United Arab E. (1996–2003)\*~ Uruguay (1995–2001) Uzbekistan (1999–2002) Vanuatu (2000–2004) Venezuela (1993–2004) Vietnam (1997–2004) Yemen (1998–2003) Zambia (1995–2003) Zimbabwe (1995–2002).

<sup>4</sup>Stata command `xtpcse y x1 x2...`, pairwise correlation(`psar1`).

<sup>5</sup>We do not log the *Freedom House* and dummy variables owing to lack of variance in their structure.

<sup>6</sup><<http://www.politicalerrorscale.org>>

<sup>7</sup>We used variables that measure elder dependent cohorts (65 + ), population density, and population growth to no avail.

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