

## **E-COMMERCE READINESS**

### ***INSTITUTIONAL ENVIRONMENT AND INTERNATIONAL COMPETITIVENESS***

JOANNE OXLEY  
University of Michigan Business School  
[oxlev@umich.edu](mailto:oxlev@umich.edu)

BERNARD YEUNG  
Stern School of Business  
New York University  
[byeung@stern.nyu.edu](mailto:byeung@stern.nyu.edu)

## 1. Introduction

Despite its widely cited potential to change the face of global business as we know it, e-commerce is, as yet, predominantly a North American phenomenon. Estimates vary, but it is generally accepted that upwards of 75% of business conducted online is confined within US borders.<sup>1</sup> The slow diffusion of e-commerce is puzzling, given the intuitive appeal of the notion that the dawn of the digital age implies the "death of distance" (Cairncross, 1997). However, while this puzzle has been the subject of much speculation, systematic analysis is sparse. In particular, to our knowledge, there has been little systematic cross-country analysis of the conditions necessary for the development of viable online markets. The aim of this paper is to offer such analysis.

Any assessment of the obstacles to the development of e-commerce naturally starts with the lack of necessary physical infrastructure in many countries – particularly household access to personal computers and a cost-effective telecommunications system.<sup>2</sup> However, insights from the New Institutional Economics (NIE) suggest that, if we are to gain a more fundamental understanding of the development of new markets such as e-commerce, we must look beyond these proximate indicators and examine how the *institutional environment* in a country contributes to (or undermines) confidence in the market, and supports private investment in the new medium.

Based on our examination of trading hazards in online markets, we argue – and show empirical evidence – that the integrity of the institutional environment, particularly with respect to the "rule of law," is important for the development of e-commerce. For e-commerce to flourish, potential consumers must have confidence that, should they purchase goods and services online, they will receive the promised items in a timely manner, and that products will be of the advertised quality. On the other side of the transaction, sellers must have confidence that they will receive timely payment for products sold. Unfortunately, such confidence is often missing (or misplaced), particularly in international transactions. For example, a 1997 study sponsored by the European Commission reported that citizens and businesses in Europe have lost up to 60 billion ECUs – much of it because of fraud involving sites on the Web that appeared to be for legitimate businesses, but were in fact fronts for criminal operations (Ghosh, 1998). And Digital River, a US-based online wholesaler that sells software and music to the Internet operations of retailers around the globe, has resorted to using software that tracks which country a potential customer is coming from, in order to evaluate the potential for fraud. CIO Randy Womack reported that the system thwarted more than \$13 million in attempted fraud in 1999, by identifying and giving extra scrutiny to potential buyers from countries such as Malaysia and Russia which, he says, are responsible for a high proportion of online scams (Dalton, 1999).

Of course the elevated trading hazards of online markets have not prevented the rapid growth of e-commerce in the US. This can, in part, be attributed to the rise of specialized intermediaries that improve the reliability of commercial information available to consumers on the web (Morck, *et al.*, 1999). However, we should not overlook the role of the institutional environment in the US, which supports the emergence of a vibrant e-commerce sector. Property rights in the US are, by and large, relatively well-defined, courts are efficient in resolving disputes, and consumer credit and consumer protection regulations are well established

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<sup>1</sup>"First America, then the world," *The Economist*, February 26<sup>th</sup> - March 3<sup>rd</sup>, 2000, E-Commerce Survey, p. 49.

<sup>2</sup> Europe, for example, is considered to be five years behind in developing its Internet infrastructure and the lag in many other countries is even greater (see, "Late to the party," *Wall Street Journal*, July 12, 1999).

and enforced. In sum, there is a strong tradition of the "rule of law" in the US which contributes to transactional integrity in e-commerce.

In our empirical analysis we draw on these insights from the New Institutional Economics to investigate various aspects of "e-commerce readiness" in a cross-section of countries. Our key findings are that, while physical infrastructure measures (personal computers and phones per capita, and telephone service charges), are important in explaining cross-country variation in basic Internet use, for e-commerce activity itself (here proxied by the number of Internet hosts per capita), the strength of the rule of law is an additional factor of significance. The availability of reliable electronic payment mechanisms, such as credit cards, is also a consideration. These results hold, even controlling for the level of economic development in a country (proxied by GDP/capita) and thus are supportive of our argument that the development of e-commerce in a country depends on the presence of an institutional environment which facilitates the building of transactional integrity in online markets.

The remainder of the paper is organized as follows: In Section 2 we discuss the issue of transactional integrity in online markets and summarize the role of emerging institutions in supporting the growth of e-commerce in the US. In Section 3 we develop an analytical framework for cross-country comparisons of the environment for e-commerce, focusing on both the proximate facilitators of growth – such as physical infrastructure – and on the underlying features of the institutional environment that contribute to transactional integrity in online markets. Section 4 contains the empirical observations of relevant country characteristics and preliminary analysis of the available data. Finally, Section 5 draws out the implications of our analysis for the development of e-commerce markets and for international competitiveness in this sector.

## 2. *Transactional Integrity in E-Commerce*

### **The hazards of online markets**

In this section we take a closer look at the hazards faced by online transactors. We argue that although the Internet may significantly reduce the cost of information gathering, transactional integrity in online markets is actually diminished relative to more traditional markets. This is due to difficulties in evaluating information gathered online.<sup>3</sup> Such difficulties are, we argue, inherent to online markets, originating as they do in fundamental information asymmetries, exacerbated by low entry and exit costs.

Information problems impede the efficient execution of many transactions in the economy because information is often asymmetrically distributed between buyer and seller. Information asymmetry is further exacerbated in e-commerce markets since it encompasses not only the "usual" problem of private information regarding product attributes (Akerlof, 1970) but also potential uncertainty about the very identity of the trading partner one is dealing with. The situation is most extreme in online auction markets, where traders are identified essentially by e-mail addresses, many of which are virtually impossible to trace and very easy to change; but the problem also exists in e-commerce retailing. As a 1997 Economist editorial mused: "What is behind that Web article image of a superstore? Might it be just a teenager with a graphics program?"<sup>4</sup>

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<sup>3</sup> This section draws extensively on Morck, Oxley & Yeung, 1999.

<sup>4</sup> "Timorous Trade," *The Economist*, May 10, 1997, p. E14.

Fundamentally, all one needs in order to enter e-commerce is a web-site. The lowering of barriers to entry that this implies is often touted as one of the greatest promises of e-commerce. But minimal barriers to entry are not an unequivocal plus. On the one hand, ease of entry and exit reduces market power and can bring lower prices. On the other hand, when firms can effectively change identity at a moment's notice, traditional forms of fraud become easier and entirely new dimensions of fraud open up.

One novel type of Internet fraud involves "pagejacking"—misdirecting web surfers to false copies of legitimate businesses and tricking them into revealing passwords and PIN numbers, or diverting them from seemingly benign sites to online pornography sites from which they are unable to escape.<sup>5</sup> And in a twist on the old international pay-per-call scam, America Online subscribers last year received an e-mail apparently confirming an order for unspecified goods, and notifying them that their credit card would be billed for the amount due (over \$300). Since no return e-mail was given, thousands of subscribers called the customer service phone number listed—which was actually a number in Dominica, West Indies, connected to an X-rated recording—and were charged \$3 and up for the call.<sup>6</sup>

Even for "quasi-legitimate" businesses, Web technology makes it simple to change the name and appearance of the company, in order to shake off a bad reputation. Thus "entry" and "exit" take on quite different meanings than in traditional product markets, since a company can essentially exit the business and re-enter with a different identity at very low cost, and with no perceptible break in activity. This exacerbates the problem of asymmetric information, discussed above. Information is easier to gather, but its quality and reliability suffers.

The global reach of e-commerce is also double-edged in its impact on consumers. There is great attraction to the idea that e-commerce renders geographic distance and political boundaries meaningless, bringing far-flung and highly competitive suppliers to the buyer's doorstep. However, that attraction may quickly fade when a dispute arises: tracking down a dishonest or delinquent trading partner and pursuing litigation in a different state or a foreign country may be prohibitively costly, particularly if the value of the transaction is relatively low.

#### **Mitigating online transaction hazards: the role of private organization and the institutional environment**

The above discussion illustrates how the characteristics of the Internet may indeed exacerbate the hazards facing transactors in e-commerce. However, in the US, rather than stifling the growth of online markets, these transaction hazards have been met with a robust response from the private sector, where new organizations have emerged to mitigate the elevated hazards. These new

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<sup>5</sup> See "Regulators Crack Down on Web Pornographers" by John Simons, *Wall Street Journal*, Sept. 23, 1999 and "Trapped in the Web Without an Exit," J.D. Biersdorfer, *New York Times*, October 7, 1999.

<sup>6</sup> "Online scam made to order," *The Washington Post*, May 19, 1999, p. C04. Three dollars may seem a trivial sum, but according to the Washington Post article, America Online received 20,000 complaints about the phone scam, so the overall "revenue potential" for the scam artists was far from inconsequential. Although the FTC were able to obtain a US District Court order freezing disbursement of payments from the calls to the Dominica number, this was not until some payments had already been made. The court order also requires American telephone carriers to return or credit the charges to consumers who made the calls.

organizations – primarily specialized e-commerce intermediaries – have the effect of increasing the credibility of information delivered over the Internet, and promoting satisfactory performance of online transactions (Morck, *et al*, 1999).<sup>7</sup>

There is general consensus in the US that government intervention in e-commerce should only be undertaken as a “last resort,” and that e-commerce companies and other intermediaries can be effective in mitigating the hazards raised by online markets.<sup>8</sup> However, this does not mean that we should discount the role of public institutions in supporting the development of e-commerce. As emphasized by researchers in the New Institutional Economics, governments play a critical role in creating the environment in which private investment can flourish. So, for example, Williamson (1996, p. 332) suggests that “nation-states that pose severe investment hazards support lower levels of specialized, durable investments...than do more credible investment regimes, and nation-states with problematic judiciaries are similarly disadvantaged.”

In the case of e-commerce, there is little doubt that American consumers' confidence in the integrity of e-commerce transactions would be greatly diminished were it not for the generally supportive legal environment in the US. It is precisely because consumers (and producers) believe that the courts are effective in dealing with the more serious cases of fraud that the new intermediaries are effective in creating confidence in e-commerce. Below, we look more closely at relevant features of the institutional environment supporting transactional integrity in online markets, and develop a more general analytical framework for a comparative analysis of the “e-commerce readiness” of countries around the globe.

### **3. “E-commerce Readiness:” An Analytical Framework for Cross-Country Comparisons**

According to Davis and North (1971, pp. 6-7), the institutional environment is defined as “[that] set of fundamental political, social and legal ground rules that establishes the basis for production, exchange and distribution. Rules governing elections, property rights and the right of contract are examples.” There is now an established tradition of research within NIE connecting characteristics of the institutional environment to the extent and nature of private investment. Some of this work has examined

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<sup>7</sup> These intermediaries come in many shapes and sizes and play a variety of roles. One category of sites, for example, are explicitly designed to evaluate products available online (e.g., Epinions, Deja.com) or even online merchants themselves (e.g., Bizrate.com). Others, such as Amazon.com, execute transactions connecting many buyers and many sellers, so pooling risks and decreasing the cost of “insuring” each transaction. Furthermore, for such companies, the cost of developing a bad reputation (by renegeing on promises to consumers) is greater than that for an individual producer. (See Morck, *et al*, 1999, for a more complete discussion of intermediaries in e-commerce).

<sup>8</sup> The US government's policy on this issue has been primarily one of removing perceived barriers to e-commerce. Thus, for example, under an initiative announced in November 1999, a working group invited public comment on “laws and regulations that may obstruct or hinder electronic commerce.” (White House Press Release, Nov. 29, 1999, available at <http://www.ecommerce.gov/usdocume.htm>.)

the impact of general characteristics of the nation-state, as alluded to in the quote from Williamson (1996), above,<sup>9</sup> while others have focused on specific aspects of the legal environment.<sup>10</sup>

What aspects of the institutional environment are most important for promoting transactional integrity in e-commerce (and hence in supporting investment in these new markets)? Our analysis of the trading hazards in online markets, above, points us towards two key features: (1) the overall integrity of the nation's trading system, related to the degree to which the economy is governed by the "rule of law" and (2) the credibility of payment channels available to e-commerce participants, which in turn is a function of the country's financial institutions and regulations.

### **The rule of law**

A country with a strong "rule of law" has "sound political institutions, a strong court system, and provisions for orderly succession of power..." as well as "... citizens [who] are willing to accept the established institutions and to make and implement laws and adjudicate disputes" (*International Country Risk Guide*, 1996).<sup>11</sup>

The strength of the rule of law has both direct and indirect effects on transactional integrity in e-commerce, and the likelihood of investment in such markets. The direct effect of a strong rule of law is that there is greater transparency and stability regarding the boundaries of acceptable behavior under the law. This reduces transactors' uncertainty about what legal protection they can expect, and enhances their ability to successfully litigate at least the more serious cases of fraudulent online dealings; where the rule of law is weak, that ability is undermined.

The indirect effects of a strong rule of law are twofold. First, effective punishment of transgressors lowers the cost of reputation-building for honest businesses, as signals are more credible when defectors face high sanctions. Second (and relatedly), a strong rule of law influences people's general attitudes towards markets and contracting; attitudes that, we would argue, are of particular importance in e-commerce, given our earlier discussion of information asymmetries in online markets. As North (1986, p. 232) suggests:

In the context of the high cost of measurement, the degree to which individuals are constrained by their views of the legitimacy and fairness of contracts makes a difference. If it were not costly to measure and enforce performance, people's attitudes toward the contract would make no difference at all, since violators would be punished. But the higher the costs of measurement, the more the attitudes of the individuals concerned do play a role.

Consider, then, a country with a weak rule of law, where people have little sense of the legitimacy of contracts. Here, transactors are likely to be leery of any business dealings with faceless strangers and, conversely, may not hesitate to cheat a stranger with

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<sup>9</sup> Examples include Levy & Spiller, 1996; Murtha & Lenway, 1994; Henisz & Zelner, 1999.

<sup>10</sup> Oxley (1999), for example, discusses the impact of intellectual property protection on foreign investment.

<sup>11</sup> This definition of the rule of law also resonates with North's (1986) argument that the key to economic growth is "efficient economic organization," involving, among other things, a well-specified legal system, an impartial judiciary and a "set of attitudes towards contracting and trading that encourage people to engage in [markets] at low cost" (North, 1986, p. 236, cited in Henisz & Zelner, 1999)

whom they *do* trade. In such circumstances, close-knit trading communities often arise to facilitate the disciplining effects of reputation through a system of informal sanctions (e.g., Grief, 1993; Fisman and Khanna, 1998). As the antithesis of a close-knit trading community, e-commerce is thus unlikely to flourish where the rule of law is weak.<sup>12</sup>

### **Credible payment channels**

To understand the importance of credible payment systems to e-commerce, consider the role played by traditional financial intermediaries, such as credit card companies, in combating potential online fraud. Credit card companies play an important monitoring and certification role in commercial transactions, providing assurance to both buyers and sellers. If a buyer pays with a credit card, as opposed to a check, the seller's payment is assured. On the other side of the transaction, the buyer also has protection. In the US, for example, in the case of a disputed charge, the buyer has the right (under the Fair Credit Billing Act of 1993) to withhold payment while the credit card company investigates the claim. In the event that the card number is stolen and used for illegitimate charges, the card holder's liability is limited to \$50, provided it is reported in a timely fashion. The major credit card companies extend similar (albeit not identical) rights in other countries, even where local laws are more relaxed. Thus, credit card companies can provide at least partial assurance of satisfactory performance, which may otherwise be lacking in online markets and, as such, they are important facilitators of e-commerce.<sup>13</sup>

### **Physical infrastructure**

To complete our analytical framework for assessing the e-commerce readiness of a country we must return to the availability of the necessary physical infrastructure. Without access to personal computers and Internet connections at a reasonable cost, consumers are unable to migrate from traditional markets to e-commerce. However, as suggested by our discussion above, the presence of the requisite Internet infrastructure is, in our view, a necessary but not sufficient condition for the development of e-commerce. Having access to the necessary equipment may bring people onto the Internet, but without adequate confidence in the integrity of transactions undertaken online they will not become active participants in e-commerce.

## **4. Empirical Observations and Analysis**

Our empirical study is designed to assess the significance of the various aspects of e-commerce readiness (identified above) in explaining the development of e-commerce in countries around the globe. In particular, we wish to test our conjecture that physical infrastructure is a necessary precondition for e-commerce, since it creates a viable population of Internet users, but that only in countries where there is also a strong rule of law and credible payment channels available will active e-commerce markets

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<sup>12</sup> La Porta, *et al* (1997) also show that companies based in countries with a stronger rule of law can more easily raise external financing. Barro (1996) provides additional empirical evidence linking measures of the rule of law with variation in aggregate private investment and economic growth.

<sup>13</sup> This does not mean that credit card companies can fully assure satisfactory performance of online transactions: Disputes about the quality of a product are not covered by regulations governing credit card use, even in the US, and the degree of protection against "disappointment" varies among credit card issuers. Furthermore, because most online purchases are completed without a customer's actual signature, merchant protection is incomplete.

develop. To this end, we assembled cross sectional data, for 62 countries,<sup>14</sup> on Internet usage and indicators of e-commerce activity (the dependent variables in our analysis) and on three categories of explanatory variables: physical infrastructure measures, payment channels, and rule of law indicators. Details of sources and measures for each of these categories of data are given below.

## Data sources and measures

### *Internet usage and e-commerce activity*

1998 data on the number of Internet users in a range of countries are available from the International Telecommunication Union's *Yearbook of Statistics 2000*.<sup>15</sup> We use this data, along with population data from the same source, to calculate the number of Internet users per capita (USERPC).

Developing viable measures of actual e-commerce activity is a significant challenge. At present only the US has initiated national data collection on the dollar value of goods purchased online, and that initiative was announced only in March, 2000.<sup>16</sup> Estimates of e-commerce activities in different parts of the world are available from various consulting firms specializing in e-commerce (see Table 1), but this data is not usable for cross-country comparisons: Most companies provide data only for selected regions, and even those that give more complete global coverage (e.g. IDC) do not use consistent methodologies for estimates across regions, and cannot provide reliable data at the country level. As is apparent from Table 1, there is wide variation in detailed assessments of e-commerce activity in any particular country (where more than one estimate is available), although there is general consensus that activity is concentrated in the US, and secondarily in Europe.

[Table 1 about here]

In the absence of reliable data on e-commerce spending (or investment), we turn to a more indirect measure of e-commerce activity: the number of Internet "hosts" in a particular country domain. This data is based on a semi-annual domain name survey, sponsored by the Internet Software Consortium (<http://www.isc.org>), and represents the most well-accepted count of Internet hosts, i.e. computers with active Internet Protocol (IP) addresses connected to the Internet.<sup>17</sup> We use the number of hosts ending in a particular country code (HOSTPC, scaled by population) as a rough proxy of the "supply side" of e-commerce activity in that country.

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<sup>14</sup> For several of the variables, data is only available for a subset of these countries, as indicated in Table 2. Therefore the samples in our regression analysis are significantly reduced (see Table 4). All data is for 1998 unless otherwise noted.

<sup>15</sup> The data are also available at ITU's web site, at <http://www.itu.int/ti/industryoverview>.

<sup>16</sup> See <http://www.ecommerce.gov/>

<sup>17</sup> This data is widely reported in international statistical reports such as the World Development Indicators (World Bank, 1999) and the International Telecommunications Union annual report (ITU, 1998, 1999). See <http://www.isc.org/ds/new-survey.html> for more details of the domain name survey.



Although HOSTPC represents, we believe, the best proxy currently available for our purposes, we acknowledge several serious shortcomings in the measure, and emphasize the preliminary nature of our empirical analysis. First, although the assignment of an IP address is a prerequisite to setting up a commercial web site, there is no guarantee that every IP address has an active site attached to it. Therefore, our count will tend to overstate the actual number of active sites. Second, we cannot distinguish between hosts of commercial and noncommercial web sites. Our count thus may include governmental, educational and non-profit hosts in addition to those relevant to e-commerce. To the extent that these noncommercial hosts represent different fractions of the total hosts in any particular country domain, the host count may be a biased measure of e-commerce sites in some countries.<sup>18</sup>

The third shortcoming of the Internet hosts measure is that there is no guarantee that a company registering a particular national domain name (e.g., widgets.co.uk) is located in that nation, nor that the host computer is physically located there. We do not see this as a major source of error, however, since companies generally register domain names in the countries where they (or their affiliates) are located. An important exception to this is generic domain names such as ".com." Although .coms are highly concentrated in the US, there are undoubtedly companies from other countries registered under this domain name, and there is no definitive method for distributing hosts with this address among nations. In order to be conservative, we omit such generic domains,<sup>19</sup> and also omit the US from our empirical analysis.

#### *Physical infrastructure*

Our physical infrastructure measures are intended to assess the availability of reasonably-priced access to the Internet. For most current applications, Internet access requires a personal computer, plus a phone connection to the Internet, although access via mobile phone is becoming a viable alternative in some applications.<sup>20</sup> 1998 data on the total number of personal computers, phone lines and mobile phones in each country are taken from the International Telecommunication Union yearbook (ITU, 2000). We scale each of these totals by population to produce per-capita measures, PCPC, PHONEPC, and MOBILEPC.

In addition to the physical presence of a personal computer and phone line, the cost of Internet access is also a significant issue: much attention has been paid to the high telecommunications charges in many countries, and the barrier that these pose to

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<sup>18</sup> Although we cannot be certain of the direction of error in this case, we can get some idea by looking at the distribution of government spending as a proportion of GDP. Data is available for a subset of our sample countries for 1996 (from the World Bank's 1999 *World Development Indicators*), and we find that there is a negative and significant correlation (-0.314) between government spending/GDP and the rule of law. This suggests that countries with a weaker rule of law will tend to have a greater proportion of public sector Internet hosts, relative to private sector sites. As such the bias created by inclusion of public sector hosts will tend to inflate the host count in low rule-of-law countries, and so will tend to work against us in hypothesis testing.

<sup>19</sup> Omitted names are .com, .org, .gov, .edu, .net, and .int.

<sup>20</sup> Internet access via mobile phones using Wireless Application Protocol (WAP) technology is projected to rise dramatically in popularity over the next few years (e.g., Forrester Research projects that over 50% of Europeans will carry Internet-enabled phones by 2004. <http://www.forrester.com>). However, at present, the content available via this medium is limited and, outside of the Nordic countries, few mobile phone users have Internet access.

Internet use.<sup>21</sup> Estimates of annual telephone charges (based on 20 hours of off-peak usage per month) in various countries are derived from *Internet and Electronic Commerce Indicator's Update* (OECD, 1999).<sup>22</sup> Our measure, TELEFEE, is estimated annual telephone charges divided by per capita GDP (see below) in each country.

#### *Payment Channels*

As suggested in our earlier discussion, credit cards are an important facilitator of e-commerce as they provide a credible payment channel for online transactions. We therefore include in our empirical model 1998 estimates of the number of credit cards in use in each country (taken from Faulkner and Gray's *2000 Global Card Directory*),<sup>23</sup> scaled by population, to derive a per capita measure, CREDITPC. Debit cards are also a common payment vehicle in some countries, although the protection offered to users of such cards (both consumers and merchants) varies widely. Since the degree of protection offered is likely to affect the actual usage rate of cards (in addition to whether individuals hold cards) we use, as an alternative proxy for the credibility of payment channels, a per capita measure of credit and debit card use, CARDUSE. This measure is derived from 1998 data on the total estimated number of "card transactions" in a country (also from the *2000 Global Card Directory*).

#### *Rule of Law*

We adopt a widely-accepted measure of the rule of law (ROLAW) produced by the country risk rating agency International Country Risk.<sup>24</sup> This measure, available from La Porta, *et al* (1997) as an average for the years 1982-95, takes on a value between one and ten; higher values indicate a greater tradition of law and order in a country.

#### *Economic Development*

Since e-commerce activity, as well as several of our explanatory variables (e.g., rule of law, and infrastructure measures), can be expected to correlate significantly with the level of economic development in a country, it is important that we control for this aspect of country difference. We therefore include in our empirical model a control variable, LGDPPC, the natural log of GDP per capita in each country.<sup>25</sup>

### **Descriptive statistics and empirical results**

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<sup>21</sup> See, for example, "Japan's costly connection; steep phone fees add up for Internet users," *The Washington Post*, August 16, 1999, p. A01; "Good news for Net users," *The Times*, London, March 10, 2000, p. 40).

<sup>22</sup> Telephone charges for additional non-OECD Latin American countries were obtained from the 1999 Inter-American Biodiversity Information Network Conference (<http://www.iabin.org/document/internet/report.html>).

<sup>23</sup> For details, see <http://www.faulknergray.com/>

<sup>24</sup> The rule of law is defined in Section 3, above (pp.8-9).

<sup>25</sup> These data are for 1997 (the latest available) and are drawn from the ITU yearbook (ITU, 2000).

Definitions and descriptive statistics for each of the variables described above are given in Table 2, and a Pearson correlation matrix is shown in Table 3. Note that to correct for the narrow dispersion and skewness of the data, a logarithmic transformation was performed on the dependent variables, where the transformed variable (e.g., LTHOSTS for the hosts per capita variable) is given by:

$$\text{LTHOSTS} = \log(\text{HOSTPC}/(1-\text{HOSTPC}))$$

The correlation matrix reveals a degree of colinearity among our explanatory variables: almost all of the pairwise correlation coefficients are highly significant. Given these high correlations, there is a distinct possibility of multicollinearity in the data, in which case standard errors will be inefficient. However we note that parameter estimates are still unbiased and consistent in OLS with multicollinearity present.<sup>26</sup>

[Table 2 and Table 3 about here]

Examination of the correlation matrix reveals that the simple pairwise relationships between the variables are generally consistent with our hypotheses: users and hosts are positively correlated with per capita ownership of personal computers (PCPC) and phones (whether via traditional phone lines, PHONEPC or mobile phones, MOBILEPC), and negatively correlated with estimated telephone charges (TELEFEE). Credit card use, both in terms of the number of cards per capita (CREDITPC) and number of card transactions per capita (CARDUSE) are also positively correlated with users and hosts, as is our measure of the rule of law (ROLAW). Also, as expected, there is a strong correlation between GDP per capita and our measures of e-commerce, as well as many of the other explanatory variables.

We turn to OLS estimation to investigate these relationships further, and in particular to test our conjecture that although physical infrastructure is a necessary precondition for e-commerce (since it creates a viable population of Internet users) it is only in countries where there is also a strong rule of law and credible payment channels available that active e-commerce markets will develop. If our conjecture is correct, then our measures of the rule of law and credit card use should have explanatory power in estimating hosts per capita but not necessarily in explaining the number of Internet users. Table 4 shows estimation results for several alternative empirical specifications.

[Table 4 about here]

The empirical results are quite supportive of our theoretical prediction. LTUSERS is the dependent variable in Models 1-4 and we see that the only consistently significant parameter estimates are those related to physical infrastructure: the number of Internet users per capita is positively related to the number of personal computers,<sup>27</sup> mobile phones, and lower telephone charges. The number of phone lines per capita is not significant, however, which is somewhat puzzling in light of the significant effect of mobile phones. It is highly unlikely that mobile phones were themselves a primary vehicle for accessing the Internet in 1998.

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<sup>26</sup> We also note that the F-statistics for each of our reported regressions are highly significant, as are F-statistics testing the joint significance of just our focal variables.

<sup>27</sup> Although the coefficient on PCPC drops out of significance in Model 3, it does so only marginally: the significance level in a two-sided t-test is 0.1094.

However this variable may be behaving as a proxy for the sophistication of the phone system more generally (including, for example, cable connections and high-speed phone lines) which would facilitate increased access to the Internet more so than basic phone service of uncertain quality.

The strength of the rule of law in a country (ROLAW) does not appear to have a significant effect on the number of users (excepting a marginally significant (0.093) effect in Model 4). This stands in marked contrast to the consistently positive and statistically significant effect of ROLAW on the number of hosts per capita (LTHOSTS), in Models 5-8. The physical infrastructure variables are consistently signed across all models, but with some reductions in significance in Models 5 and 6. Together these results provide support for the notion that access to physical infrastructure is a sufficient condition for bringing people onto the net, and a necessary but insufficient condition for e-commerce; the strength of the rule of law is an additional factor of importance to the growth of e-commerce.

The picture with respect to the credibility of payment channels is less clear. The number of Internet users appears to be somewhat related to the penetration of credit cards in a country: the coefficient estimates on CREDITPC in Models 1 and 2 have significance levels of 0.09 and 0.08, respectively, but the coefficient on card transactions per capita (CARDUSE) is insignificant in Models 3 and 4. As to hosts, there is no statistically significant relationship between CREDITPC and the number of hosts per capita (Models 5 and 6), but CARDUSE has a positive and statistically significant impact (Models 7 and 8). Overall, these findings are consistent with our argument that the credibility of payment channels (and credit card use in particular) is a facilitator of e-commerce, but it is unclear exactly how this feature of the institutional environment plays into the decisions of potential users of e-commerce. This issue is discussed further in "limitations and extensions," below.

Finally, a note on our control variable, the log of GDP per capita. We do not observe a significant positive impact of per capita GDP on the number of Internet users in a country, or on the number of hosts. Indeed, the sign of the coefficient on LGDPPC is consistently negative, albeit insignificant in all but Model 8. This suggests that any positive impact of per capita GDP is being absorbed by the other significant factors in the models, particularly the infrastructure variables, which are themselves positively related to the level of economic development. Nonetheless, the fact that we find significant effects for our institutional variables even when controlling for per capita GDP adds greater support for our arguments.

### **Limitations and proposed extensions**

As discussed above, the empirical results are generally supportive of our argument that the development of e-commerce in a country depends on the presence of an institutional environment which facilitates the building of transactional integrity in online markets. However, the analysis is preliminary, and there are several limitations in the data that call for caution in interpreting the results. In this section we discuss these limitations and outline extensions, where feasible, that should serve to strengthen the analysis.

The most salient limitation in our data is in the definition and interpretation of our measure of e-commerce activity, Internet hosts per capita. As detailed earlier (pp. 10-11), there are several reasons to expect that the number of Internet hosts within a given country's domain designation will be a biased estimate of e-commerce activity. Furthermore, it is difficult to predict the overall direction of bias. Take, for example, our exclusion of ".com" hosts. Assuming that these hosts are concentrated primarily in the US, and secondarily in other countries with a strong rule of law (such as Canada and EU countries), then this will lead to a downward bias in our estimate of the number of hosts in high ROLAW countries. Since this bias would actually work *against*

finding statistical significance in our hypothesized effect of the institutional environment, this does not interfere with our interpretation of the empirical results.

Our theoretical arguments are also consistent with a second source of bias, but this time in the other direction: Take an e-commerce company based in a country with a weak rule of law, such as Colombia or the Philippines. Given the perceived lack of transactional integrity in these countries' markets, e-commerce companies based there may not wish to draw attention to their nationality. In that case, a greater proportion of local companies may register under the generic domain name, ".com." Under this hypothetical scenario, omitting ".coms" from the count of Internet hosts would tend to underestimate the number of hosts in countries with a weak rule of law. Although such a bias in the estimate of Internet hosts would tend to reinforce our statistical results, we should note that the scenario leading to such a bias assumes that firms are acting in accordance with our theory.

Given the above, although we cannot come to a definitive conclusion as to the extent or direction of systematic measurement error in our dependant variable, caused by the omission of generic domain names, we do not believe that resultant bias materially undermines our interpretation of the empirical results. Nonetheless, there is clearly great room for improvement in our dependent variable. We are optimistic that data will eventually become available from which we can construct a more direct measure of e-commerce activity by country – either dollar value of goods and services sold online, or number of e-commerce companies operating. However, it will undoubtedly be some time before reliable documentation of e-commerce catches up with practice, especially in the international arena.

The second significant limitation of our data is the incomplete country coverage for our explanatory variables, and the consequent reduction in sample size. Although we start out with data on Internet users and hosts in 62 countries (excluding the US), missing data on various explanatory variables means that the empirical models reported in Table 4 include as few as 25 countries. While the remaining sample includes a fair spectrum of countries (e.g., Mexico, Turkey, South Korea, Chile, Denmark, Finland, Japan and Australia), comparison of the variable means for the smallest set of 25 firms (Table 5) with those for the initial sample (Table 2), shows that the restricted sample is somewhat biased towards countries with higher values of the dependent and independent variables. Unfortunately, this is a difficult limitation to overcome, rooted as it is in the scarcity of relevant data. We therefore simply urge caution in generalizing our results to the least developed nations

[Table 5 about here]

The final set of data limitations that we should address are those related to our measures of the institutional environment, particularly with respect to credible payment channels. In our analysis, we focus primarily on the availability of credit cards, and the frequency with which cards (either credit or debit) are used by the populace in a given country. Our findings with respect to the number of Internet hosts – that the availability of cards is not a significant explanatory factor but that card transactions is – points to a possible drawback of this emphasis on credit cards. The availability of credit cards may not be a good proxy for the credibility of payment channels if there is a lack of trust in credit cards in a particular country (which may in turn be a sign of weak regulation) or if alternative credible payment systems exist. The case of Japan is illustrative: Japanese consumers are

apparently reluctant to use their credit cards for online purchases because of security fears.<sup>28</sup> Our data on credit cards and card use is also consistent with this observation: Japanese hold an above-average number of credit cards (1.6 cards per capita, compared with a mean of 0.28 in our sample of countries), but use their cards relatively infrequently (11.3 card transactions per capita, compared with a sample mean of 34.2).

The distrust of credit cards has not by itself stifled the development of e-commerce in Japan: at 0.009 hosts per capita, Japan is close to our sample mean (0.010). One possible explanation for this is that Japanese convenience stores, or "combinis," appear to be substituting for credit cards as a credible payment mechanism in Japanese e-commerce. Japanese consumers order goods and services online which are then delivered to their local combini, where they can be picked up and paid for in cash.<sup>29</sup> Although this payment and delivery mechanism seems, on its face, incompatible with more widespread diffusion of e-commerce in Japan, it nonetheless suggests a couple of useful extensions to our empirical analysis. First, it may be useful to get other measures of the confidence placed in credit card transactions in a particular country. One possible indicator of relevance here would be the extent of credit card fraud in different countries (measures of which are available from Visa International). Second, to the extent that other credible electronic payment channels, such as "micropayment" systems,<sup>30</sup> develop and are adopted in some countries these should be incorporated into the analysis.

## 5. Conclusions

One of the central concerns of researchers in the New Institutional Economics is to understand and articulate the role of institutions in economic development, particularly in emerging markets. At its most fundamental level, the rise of e-commerce – itself an emerging market – presents us with a valuable experimental setting for studying this question.

In this paper we argued, and found empirical evidence, that cross-country variation in e-commerce activity can be explained, in part, by the capacity of the institutional environment to enhance transactional integrity in online markets, thus encouraging private investment in the new medium. If these empirical results prove reliable – and only the passage of time will tell, as more adequate data become available – then they offer significant new evidence that characteristics of the institutional environment play an important role in shaping the commercialization of innovation and in the capturing of market potential.

A more direct implication of our empirical analysis is that, if we are to understand the emergence and development of e-commerce markets around the world, we must look beyond simple indicators of a country's e-commerce readiness, such as access to personal computers and low-cost phone service, and focus more attention on the underlying characteristics of the institutional

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<sup>28</sup> See "E-Commerce the Japanese way; Ubiquitous convenience stores branch into cyberspace," *New York Times*, March 18, 2000. This reluctance to use credit cards has also been reported more widely in Asia, and in some countries within Europe ("It's clicking in Europe, slowly," *The Washington Post*, December 23, 1999, pp. E1-3)

<sup>29</sup> "E-Commerce the Japanese way; Ubiquitous convenience stores branch into cyberspace," *New York Times*, March 18, 2000.

<sup>30</sup> Such technologies are already becoming available, but as yet, credit cards still account for 95% of online sales ("New online payment options emerging" *Computerworld*, January 31, 2000)

environment. We find that the rule of law in particular is a significant factor in this regard. The availability of credible payment channels also appears to be of importance, although interpretation of this result is more speculative.<sup>31</sup>

What are the implications of our results for the international competitiveness of the e-commerce sector in various nations? Given the preliminary nature of our results, we must be somewhat circumspect here. Nonetheless, we venture a few conjectures. First, in countries with a weak rule of law, it will be difficult to attract businesses into the new sector and there will be a slower migration of transactions from traditional markets to online markets. This means that the e-commerce sector will make up a smaller proportion of the overall economy. Furthermore, as consumers do migrate to the Web, they are more likely to turn to companies from countries where transactional integrity is greater, and in particular to firms whose reputation for honest dealing is more well-established.<sup>32</sup>

The prospect of foreign dominance in e-commerce is already a significant concern for policymakers in developing countries. For example, at a 1999 WTO seminar on electronic commerce and development, the representative of Senegal commented that less developed countries might become "further marginalized" in a world driven by electronic commerce, absent adequate investment in infrastructure and human resource development.<sup>33</sup> Our analysis suggests that, since the effectiveness of such infrastructure investments may also depend on the presence of a supportive institutional environment, institutional reform that strengthens the rule of law will be of continued importance.

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<sup>31</sup> In a rank ordering of the economic significance of the explanatory variables, the rule of law is second in importance to access to personal computers.

<sup>32</sup> The empirical validity of this conjecture is testable, given appropriate data: The argument implies that a weaker rule of law will be associated with lower e-commerce activity in a country, and that imports will make up a greater proportion of total spending.

<sup>33</sup> *Summary Report of the Seminar on Electronic Commerce and Development*, WTO Committee on Trade and Development, 23 March 1999. Available at [http://www.wto.org/wto/ecom/e\\_news.htm](http://www.wto.org/wto/ecom/e_news.htm)

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**Table 1: Example Estimates of Global Distribution of E-Commerce Activity**

Region/Country • Source	1999 (\$ millions)	2000 (\$ millions)	2003 (\$ millions)
<b>Worldwide</b>			
• IDC (1999)	111,000	217,600	1,317,400
• EStats	22,800	41,000	161,700
• Dataquest	31,200		380,000
• Forrester			3,000,000
<b>US</b>			
• IDC (1999)	74,400	133,100	707,900
• Dataquest	20,500		115,000
• Forrester	20,252	38,755	143,758
<b>Europe</b>			
• IDC (1999)	18,800	49,400	430,300
• Dataquest	5,400		115,000
• Forrester	7,915	21,547	
<b>France</b>			
• Datamonitor			162
<b>Germany</b>			
• Datamonitor			143
<b>Italy</b>			
• Sterling		374	
<b>Spain</b>			
• Sterling		254	
• Datamonitor			25
<b>United Kingdom</b>			
• Datamonitor			155
<b>Asia/Pacific (excl. Japan)</b>			
• IDC (1999)	1,900	3,900	27,500
<b>Japan</b>			
• IDC (1999)	5,300	10,900	44,900
• Lehman	4,300	9,300	
<b>Latin America</b>			
• IDC (2000)	459		8,021
• BCG	77		3,800
• eMarketer	740		84,200

Boston Consulting Group (BCG): E-commerce market size, reported in "Digital mass," *Latin Trade*, March 2000.

Datamonitor: Online shopping forecast, reported in "Racing against Internet time," *Card Technology*, Nov. 1999

Dataquest: B2C estimate, reported in "Euro e-tailers learned from US mistakes," *New Media Age*, October 21, 1999.

eMarketer: E-commerce market size, reported in "Digital mass," *Latin Trade*, March 2000.

eStats: Worldwide B2C e-commerce, reported in "Racing against Internet time," *Card Technology*, November 1999.

Forrester: Estimated total internet revenues, various 1999 reports, available at <http://www.forrester.com>

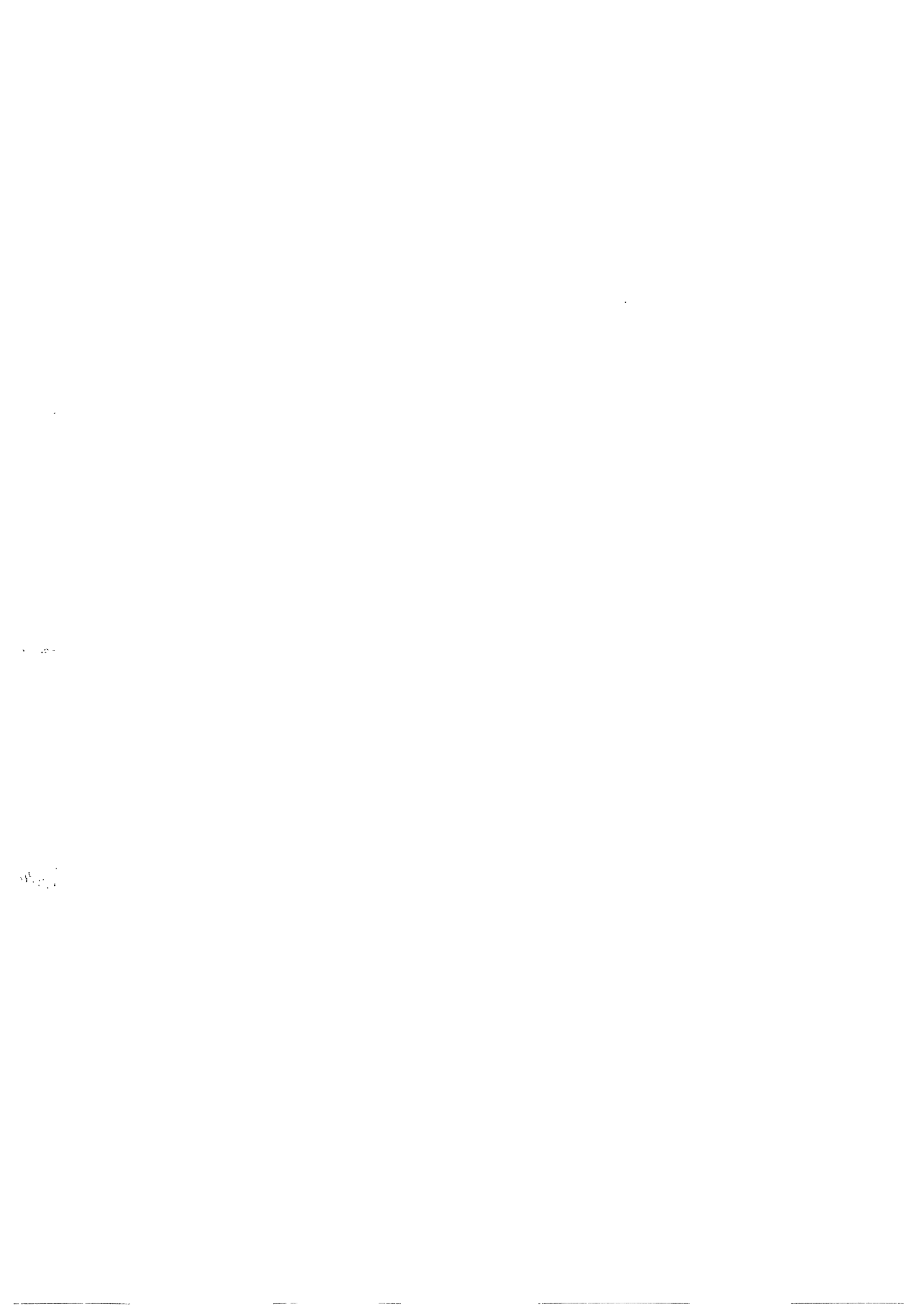
International Data Corporation (IDC): Estimated e-commerce spending, reported in "Act globally, think locally," *Internet Week*, November 15, 1999 and "Digital mass," *Latin Trade*, March 2000.

Lehman Bros.: Est. e-commerce revenues, reported in "The Internet in Japan," *Satellite International*, Oct. 22, 1999.

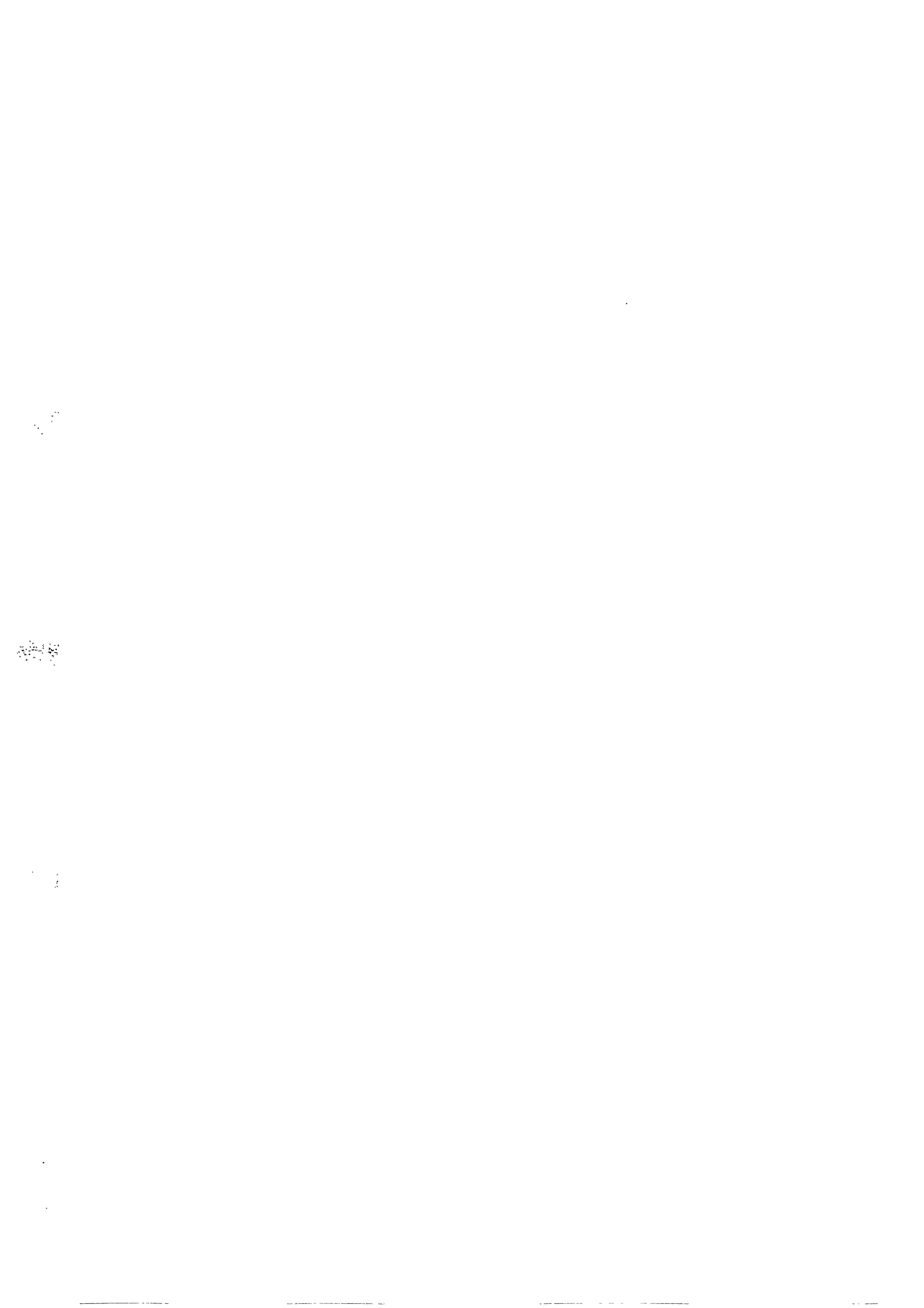
Sterling Marketing: E-commerce market, reported in "Going worldwide via the Web," *Catalog Age*, Feb. 2000.

**Table 2: Descriptive Statistics**

Variable name	Definition	N	Mean	Std Dev	Minimum	Maximum
USERPC	Internet users per capita, 1998	62	0.0763	0.0885	0.0005	0.3955
LTUSERS	Transformed variable, USERPC	62	-3.4014	1.7543	-7.5825	-0.4243
HOSTPC	Internet hosts per capita, 1998	62	0.0100	0.0173	0.0000	0.0874
LTHOSTS	Transformed variable, HOSTPC	62	-6.3428	2.4503	-13.2093	-2.3460
LGDPPC	Log of GDP per capita, 1997	62	8.9058	1.1337	6.0831	10.4875
ROLAW	Rule of Law, 1982-95	41	7.2700	2.4402	2.0800	10.0000
CREDITPC	Credit cards per capita, 1998	47	0.2754	0.3479	0.0003	1.6114
CARDUSE	Card transactions per capita, 1998	47	34.221	34.985	0.1178	174.79
PHONEPC	Phone lines per capita, 1998	62	0.3321	0.2032	0.0220	0.6755
MOBILEPC	Mobile phones per capita, 1998	62	0.1616	0.1417	0.0009	0.5722
PCPC	Personal computers per capita, 1998	62	0.1434	0.1330	0.0000	0.4589
TELEFEE	Estimated 1999 telephone charges, as proportion of GDP/capita	35	0.0542	0.0507	0.0137	0.1881



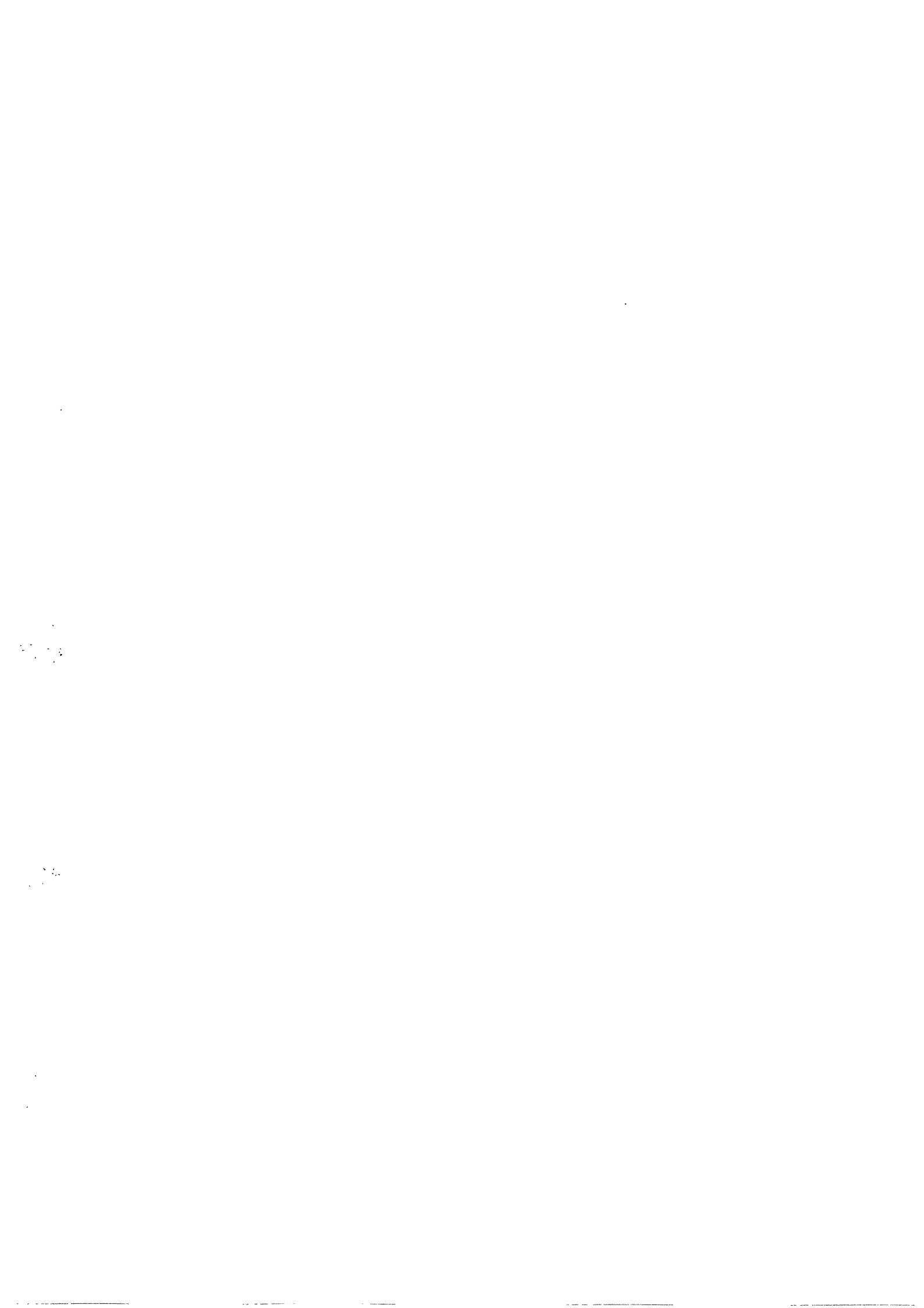




**Table 4: Estimation Results**

	Dependent variable LTUSERS				Dependent variable LTHOSTS			
	1.	2.	3.	4.	5.	6.	7.	8.
INTERCEP	0.2736 (3.8716)	0.1691 (3.3243)	-0.5707 (4.0398)	1.1717 (3.4837)	-5.4121 (4.1522)	-6.3224 (3.7497)	-4.6774 (3.5793)	-2.7210 (2.6444)
LGDPPC	-0.5778 (0.4839)	-0.5419 (0.4036)	-0.4262 (0.4871)	-0.6766 (0.4160)	-0.4120 (0.5190)	-0.2612 (0.4553)	-0.4090 (0.4316)	-0.6864* (0.3158)
ROLAW	0.1485 (0.1111)	0.1506 (0.1019)	0.2319 (0.1565)	0.2337 † (0.1316)	0.2651* (0.1192)	0.2644* (0.1150)	0.3199* (0.1386)	0.3255** (0.1000)
CREDITPC	0.5812 † (0.3299)	0.5559 † (0.3025)		0.2786 (0.3538)		0.2479 (0.3412)		
CARDUSE			0.0020 (0.0040)	0.0022 (0.0034)			0.0077* (0.0035)	0.0079** (0.0026)
PHONEPC	2.0644 (1.5363)		-0.2144 (1.9273)		2.7396 (1.6476)		-0.0128 (1.7076)	
MOBILEPC		2.6477* (1.0420)		2.4873* (0.9666)		2.5369* (1.1753)		2.8907** (0.7337)
PCSPC	3.8319* (1.8341)	4.1718* (1.5956)	3.6772 (2.1836)	3.3378 † (1.6960)	5.3414* (1.9670)	5.9750** (1.7998)	5.5779** (1.9347)	5.2964** (1.2874)
TELEFEE	-13.4492** (4.5930)	-13.6082** (4.2092)	-19.1727** (6.13091)	-17.8789** (4.8801)	-8.1752 (4.9258)	-8.4510 † (4.7478)	-16.0620** (5.4321)	-14.8384** (3.7044)
N	30	30	25	25	30	30	25	25
Adjusted R <sup>2</sup>	0.8402	0.8655	0.8385	0.8818	0.8922	0.8996	0.9269	0.9607

Standard errors are in parenthesis. \*\* : Significant at 0.01 level, \* : Significant at 0.05 level † : Significant at 0.10 level



**Table 5: Descriptive Statistics for Reduced Sample**

Variable name	N	Mean	Std Dev	Minimum	Maximum
USERPC	25	0.0987	0.0798	0.0022	0.2860
LTUSERS	25	-2.7137	1.3277	-6.1395	-0.9148
HOSTPC	25	0.0169	0.0216	0.0002	0.0874
LTHOSTS	25	-5.0545	1.7486	-8.7005	-2.3460
LGDPPC	25	9.6046	0.7634	7.9488	10.4875
ROLAW	25	8.3724	1.7842	5.1800	10.0000
CREDITPC	25	0.3541	0.3709	0.0374	1.6114
CARDUSE	25	41.0857	34.2343	3.0594	139.0954
PHONEPC	25	0.4439	0.1778	0.1036	0.6755
MOBILEPC	25	0.2288	0.1355	0.0350	0.5722
PCPC	25	0.2184	0.1310	0.0232	0.4219
TELEFEE	25	0.0034	0.0034	0.0011	0.0143



