E-COMMERCE READINESS

INSTITUTIONAL ENVIRONMENT AND INTERNATIONAL COMPETITIVENESS

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Abstract

A systematic cross-country analysis of e-commerce activity reveals that although physical infrastructure explains much of the variation in basic Internet use, e-commerce activity also depends significantly on the "rule of law" and, secondarily, on availability of credible payment channels such as credit cards. These results suggest that an institutional environment that facilitates the building of transactional integrity is critical to the development of e-commerce.

INTRODUCTION

Despite its widely cited potential to transform global business, e-commerce is, as yet, predominantly a North American phenomenon. Estimates vary, but it is generally accepted that upwards of 75% of online transactions are confined within U.S. borders (The Economist, 2000, p. 49). The slow development of e-commerce in other countries is puzzling, given the intuitive appeal of the notion that the digital age brings with it the "death of distance" (Cairncross, 1997). While this puzzle has been the subject of much speculation, systematic analysis is sparse. In particular, to our knowledge, there has been little empirical analysis of the conditions necessary for the development of viable online markets.

Arguably the most salient obstacle to the development of e-commerce in many countries is the lack of necessary physical infrastructure – particularly household access to personal computers and a cost-effective telecommunications system. However, insights from the New Institutional Economics (NIE) suggest that we should look beyond these proximate indicators to examine how the *institutional environment* in a country contributes to (or undermines) confidence in a new market such as e-commerce 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. Only in such an environment can participants in e-commerce transactions have confidence of satisfactory performance – or adequate legal recourse should the transaction break down.

Our analysis of "e-commerce readiness" in a cross-section of countries confirms that physical infrastructure measures are most important in explaining variations in basic Internet use.

However, e-commerce activity (proxied by the number of Internet hosts per capita) also depends significantly on the strength of the "rule of law" and, secondarily, on the availability of credible payment channels, such as credit cards. These results hold, even after 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 depends on the presence of an institutional environment that facilitates the building of transactional integrity in online markets.

In the remainder of the paper we first discuss the issue of transactional integrity in online markets and summarize the role of institutions in supporting the growth of e-commerce. Then 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. Empirical observations of relevant country characteristics and preliminary analysis of the available data follow. In the final section we draw out implications of our analysis for e-commerce development and for international competitiveness in this sector.

TRANSACTIONAL INTEGRITY IN E-COMMERCE

The Hazards of Online Markets

Reducing the cost of information gathering represents perhaps the most obvious and immediate benefit of the Internet (Larsson & Lundberg, 1988). However, we argue below that transactional integrity in online markets is undermined by difficulties in evaluating information gathered online – difficulties that are 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 heightened further in e-commerce markets, encompassing not only the "usual" problem of private information regarding product attributes (Akerlof, 1970) but also potential uncertainty about the very identity of one's trading partner.[1] Fundamentally, all one needs, to enter e-commerce, is a web-site. This lowering of entry barriers is often touted as one of the great promises of e-commerce. But minimal barriers to entry are not an unequivocal plus. Ease of entry and exit reduces market power and can bring lower prices. However, 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 cannot escape (Biersdorfer, 1999). 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 (Washington Post, 1999a).[2]

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; a fly-by-night company may exit the business and re-enter with a different identity at very low cost, with no perceptible break

in activity. This magnifies information asymmetries: 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. While e-commerce can bring far-flung and highly competitive suppliers to the buyer's doorstep, this may be at the cost of uncertain recourse in the event of a dispute. Tracking down a 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. Digital River – a U.S.-based online wholesaler selling software and music worldwide – has resorted to using software that tracks the national origin of prospective customers, 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 that are responsible for a high proportion of online scams (Dalton, 1999).

Mitigating Online Transaction Hazards

The above discussion illustrates how the characteristics of the Internet can exacerbate the hazards facing transactors in e-commerce. One might expect these elevated hazards to stifle the growth of online markets but this does not appear to have happened, at least in the U.S. One explanation perhaps lies with new organizations that have emerged – primarily specialized e-commerce intermediaries – that have the effect of increasing the credibility of information delivered over the Internet and promoting satisfactory performance of online transactions (Morck, Oxley & Yeung, 1999).[3]

There is general consensus in the U.S. 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. However, we should not

discount the role of public institutions in supporting the development of e-commerce. Researchers in the New Institutional Economics (NIE) emphasize the critical role governments play in creating an environment that fosters private investment (e.g., North, 1986). Indeed there is little doubt that U.S. consumers' confidence in the integrity of e-commerce transactions would be greatly diminished were it not for the generally supportive legal environment. It is precisely because consumers (and producers) believe that the courts can handle 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 cross-country comparative analysis of e-commerce "readiness."

E-COMMERCE READINESS

According to Davis and North (1971, pp. 6-7), the institutional environment is "[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 the impact of general characteristics of the nation-state (e.g., Levy & Spiller, 1996; Murtha & Lenway, 1994; Henisz & Zelner, 1999), while others have focused on specific aspects of the legal or regulatory environment (e.g., Oxley, 1999).

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 discussion 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" is defined as one having "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). This definition of the rule of law 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)

The strength of the rule of law affects transactional integrity in e-commerce, and thus investment in such markets, in three ways. First, a strong rule of law generates greater transparency and stability regarding the boundaries of acceptable behavior. 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. Second, effective punishment of transgressors lowers the cost of reputation-building for honest businesses, as signals are more credible when defectors face high sanctions. Third, a strong rule of law influences people's general attitudes, increasing the level of trust in markets and contracting. This trust is particularly important in e-commerce, given our earlier discussion of information asymmetries in online markets.

To illustrate the importance of these features of a strong rule-of law, consider countries where citizens grant little legitimacy to legal contracts, relying on more informal approaches when conducting business. Here, personal relationships are important, and people will likely be leery of any business dealings with faceless strangers (and, conversely, may not hesitate to cheat a stranger with whom they *do* trade). In such circumstances, close-knit trading communities often arise to strengthen the disciplining effects of reputation through a system of informal sanctions (e.g., Greif, 1993; Fisman and Khanna, 1998). However, as the antithesis of a close-knit trading community, e-commerce is unlikely to flourish in such an environment.[4]

Credible Payment Channels

To understand the importance of credible payment channels to e-commerce, consider the role of 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, rather than with a check, the seller's payment is assured. On the other side of the transaction, the buyer also has protection. In the U.S., 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, although there is significant variation in local laws (Consumers International, 1999). Thus, credible electronic payment channels, such as those that credit card companies provide, can at least partially assure satisfactory performance, which may

otherwise be lacking in online markets. As a consequence, credit cards or other credible electronic payment channels are important facilitators of e-commerce.[5]

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, even with access to the necessary equipment, people will not become active e-commerce participants unless they have reasonable confidence in the integrity of transactions undertaken online. Thus, we posit that the presence of an adequate Internet infrastructure is a necessary but not sufficient condition for the development of e-commerce:

DATA

To assess the significance of these various aspects of e-commerce readiness in explaining the development of e-commerce in countries around the globe, we assembled cross sectional data, for 62 countries, on Internet usage and indicators of e-commerce activity (the dependent variables in our analysis) and on three categories of explanatory variables: physical infrastructure, payment channels, and rule of law indicators. Details of sources and measures for each of these categories of data are given below.

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*.[6] We use these 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 U.S. has initiated national data collection on the value of goods purchased online, and that initiative was announced only in March, 2000. Estimates of e-commerce activities in different parts of the world are available from consulting firms specializing in e-commerce, but this type of data is not usable for large sample cross-country comparisons. Most companies provide data only for selected regions; those that give more complete global coverage use different methodologies for estimates in different regions and cannot provide reliable data at the country level. As a result, there is wide variation in detailed assessments of e-commerce activity at the country level, although there is general consensus that activity is concentrated in the U.S. and, secondarily, in Europe.

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. These data are based on a semi-annual domain name survey sponsored by the Internet Software Consortium (ISC) and represent the most well-accepted count of Internet hosts.[7] More specifically, we use data provided by ISC on the number of (non-duplicate) hosts within each top-level domain name.[8] These top-level domain names include those assigned to specific countries (e.g., .uk for the United Kingdom, as in http://www.amazon.co.uk.) We use the number of hosts ending in a particular country code, scaled by population (HOSTPC) as a rough proxy of the "supply side" of e-commerce activity in that country.

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. Data limitations are discussed in detail later, but one issue that directly influences our sample selection is noted here: In general, there is no one-

to-one correspondence between a particular domain name and the physical location of the host computer, or of the company that controls the associated web site. This is unlikely to be a major source of error for national domain names, since companies generally register domain names in the countries where they (or their affiliates) are located. However, this is not the case for generic top-level domain names such as ".com." Although .coms are highly concentrated in the U.S., there are many companies from other countries registered under this domain name, and there is no definitive method for distributing hosts with this address among nations. To be conservative, we exclude such generic top-level domain names,[9] and also omit the U.S. from our empirical analysis.

Rule of law

We adopt the most widely-accepted measure of the rule of law (defined earlier) – one developed by the country risk rating agency, The PRS Group, in its *International Country Risk Guide (ICRG)*. More specifically, we use a measure, derived from the ICRG data and documented in La Porta, *et al* (1997), representing an average assessment of the rule of law in a given country for the years 1982-95. This measure (ROLAW) takes on a value between one and ten; higher values indicate a stronger rule of law in a country. Although the measure is not contemporaneous with our other empirical observations, it has the advantage of being averaged across several business cycles, so that it is not confounded by perceptions of current macroeconomic conditions in a particular country.

Payment channels

As suggested in our earlier discussion, credit cards are important facilitators of e-commerce as they provide a credible payment channel for online transactions. We therefore include in our empirical model estimates of the number of credit cards in use in each country in 1998 (from

Faulkner and Gray's *2000 Global Card Directory*), 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 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 (Faulkner & Gray, 2000).

Physical infrastructure

Our physical infrastructure measures focus on 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. 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 Internet use (e.g., Times, 2000). Estimates of annual telephone charges (based on 20 hours of off-peak usage per month) are derived from *Internet and Electronic Commerce Indicator's Update* (OECD, 1999)[10] and scaled by per capita GDP to produce our measure: TELEFEE.

Economic development

Since e-commerce activity, as well as several of our explanatory variables (e.g., rule of law, infrastructure measures), are likely 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. These data are for 1997 (the latest available) and are drawn from the ITU yearbook (ITU, 2000).

EMPIRICAL RESULTS

Table 1 presents the definitions and descriptive statistics for the above variables. Missing observations significantly reduce the sample size available for our regressions; Table 2 provides a complete list of countries represented in the regressions, and the corresponding values of our focal variables.[11] Note that to correct for the narrow dispersion and skewness of the data, a logistic transformation was performed on the dependent variables. For hosts per capita, the transformed variable is LTHOSTS= log (HOSTPC/(1-HOSTPC)). An equivalent transformation was performed on users per capita (USERPC) to create LTUSERS.[12]

The correlation matrix in Table 3 reveals that the simple pair-wise correlations among the variables are generally consistent with our hypotheses: users and hosts are positively and significantly 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 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.

Given that virtually all of the pair-wise correlations are significant, there is a distinct possibility of multicollinearity among our explanatory variables. However we note that parameter estimates are still unbiased and consistent in OLS in the presence of multicollinearity. Further, the F-statistics for each of our reported regressions (below) are highly significant, as are F-statistics testing the joint significance of just our focal 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 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 our regression results.

The empirical results are quite supportive of our theoretical argument. 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 per capita availability of personal computers,[13] mobile phones, and to lower telephone charges. The number of phone lines per capita is not significant, however, which is puzzling in light of the significant effect of mobile phones.[14] It is highly unlikely that mobile phones were themselves a primary vehicle for accessing the Internet in 1998. It is possible that this variable is behaving as a proxy for the general sophistication of the phone system, including, for example, cable connections and high-speed phone lines, which may facilitate increased access to the Internet more so than basic phone service of uncertain quality. However, in the

absence of available measures of phone system quality across countries, this speculation cannot be tested directly in our empirical analysis.

The strength of the rule of law in a country (ROLAW) does not appear to have a significant effect on the number of users per capita (excepting a marginally significant (0.093) effect in Model 4), but ROLAW is consistently positively signed and statistically significant in models featuring the number of hosts per capita (LTHOSTS, in Models 5-8), as hypothesized.[15] 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 our conjecture that access to physical infrastructure is 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. Further support for this argument is provided if we calculate the economic significance of the various factors in explaining hosts per capita using the parameter estimates from model 8. Personal computers per capita is the most economically significant factor: with all variables set at their mean value, a one standard deviation increase in personal computer ownership increases the estimated hosts per capita by 68%. The rule of law is the next most important factor in terms of economic significance, with a one standard deviation improvement in the rule of law estimated to increase hosts per capita by 57%.[16]

The picture with respect to the credibility of payment channels is less clear. The number of Internet users is 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 although, as discussed below, there may be additional features of the institutional environment that contribute to payment channel credibility.

Finally, a note on our control variable, the log of GDP per capita. We do not observe a significant positive impact of this variable on the number of Internet users per capita in a country, or on the number of hosts per capita. 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 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 credence to our arguments.

Given the small sample size in each of our regressions, it is important to check for the influence of outliers.[17] We do so using influence diagnostic procedures available in SAS and find two significant outliers. First, in those models using PHONEPC (Models 1-2 and 5-6), Finland is an outlier. This is quite intuitive: Finland has a very high level of internet activity and hosts per capita, but because of the early adoption of mobile phones, the density of traditional phone lines is quite low. Finland was also one of the first countries to actively adopt wireless access protocol for internet access and e-commerce applications. As a consequence, Finland is an outlier in model specifications incorporating traditional phone lines (PHONEPC), but not in those with mobile phones (MOBILEPC). This latter specification includes the model used in our

calculations of economic significance (Model 8). Removing Finland from the sample does not materially affect our results or their interpretation.[18]

The other outlier is more consequential: Venezuela is an influential outlier in most of the model specifications, due to an extremely high level of telephone fees and low levels of internet activity and hosts per capita. Removing Venezuela from the sample and re-estimating Model 8 does not materially change the level or significance of any other variables *except* for TELEFEE, which becomes much smaller and insignificant. Thus it appears that the high Venezuelan telephone fees are driving the telephone fee result. This suggests that moderately high telephone access charges are not a significant obstacle to internet use and e-commerce development; only very high access fees appear to be problematic.[19]

LIMITATIONS AND EXTENSIONS

Our empirical results are generally supportive of the 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, our analysis is preliminary, and data limitations prompt caution in interpreting the results. In this section we discuss these limitations and outline extensions, where feasible, that would serve to strengthen the analysis.

Internet Hosts

The most salient data limitation is in the definition and interpretation of our measure of e-commerce activity, Internet hosts per capita. There are several reasons to expect that this measure may be a biased estimate of e-commerce activity. However, 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 U.S., 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 per capita 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.

On the other hand, E-commerce companies based in countries with a weak rule of law may not wish to draw attention to their nationality, precisely because of the concerns discussed earlier. 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 per capita in countries with a weak rule of law. Such a bias would tend to reinforce our statistical results, but we should note that the scenario leading to the bias assumes that firms are acting in accordance with our theory.

Finally, our Internet hosts measure may be biased because we cannot distinguish between hosts of commercial and noncommercial web sites. Our count thus may include governmental and other 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. Again we cannot be certain of the direction of error in this case. However, the cross-country distribution of government spending as a proportion of GDP provides some clues. For the subset of countries for which data is available (World Bank, 1999), there is a negative and significant correlation (-0.314) between government spending/GDP and the rule of law, suggesting that the bias created by inclusion of public sector hosts will tend to be greater in low rule-of-law countries. This will again tend to work against us in hypothesis testing.

Overall, we cannot come to a definitive conclusion regarding the extent or direction of systematic measurement error, but we do not believe that resultant bias in our dependant variable materially undermines our interpretation of the empirical results. Nonetheless, there is clearly room for improvement in our measure of e-commerce activity. We are optimistic that data will eventually become available to allow construction of more direct measures, such as monetary value of goods and services sold online, or number of e-commerce companies operating, by country. However, it will undoubtedly be some time before reliable documentation of e-commerce catches up with practice, especially in the international arena.

Alternative Payment Mechanisms

Our measures of credible payment channels also suffer from limitations. 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. However, 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 (New York Times, 2000).[20] Our data on credit cards and card use is consistent with this observation: Japanese hold an above-average number of credit cards but use their cards relatively infrequently (see Table 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 (New York Times, 2000). The existence of this alternative payment and delivery mechanism suggests some useful refinements for future empirical analysis. First, to the extent that other credible electronic payment channels, such as "micropayment" systems develop and are adopted in some countries these should be incorporated into the empirical analysis.[21] Second, it would be useful to explore whether alternatives to electronic payment systems have developed in other countries outside of Japan, and to include information on such alternative systems in the analysis.

More broadly, the above discussion suggests an exciting direction for future theoretical and empirical research: i.e., examining the extent to which alternative regulatory or informal arrangements are able to substitute for deficiencies in the "formal" institutional environment (as captured in our rule-of-law measure) to support the development of e-commerce.

CONCLUSIONS

A central concern 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 in part be explained 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 capturing 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 pay attention to the underlying characteristics of the institutional 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 be of importance, although interpretation of this result is more speculative.

Given the preliminary nature of our results, we are reluctant to overplay their implications for the international competitiveness of a country's e-commerce sector or for firm strategy. However, we would conjecture that 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 to online markets. Furthermore, as consumers do migrate to the Web, they are more likely to turn to companies from countries where transactional integrity is greater,[22] and in particular to firms whose reputation for honest dealing is well established. This suggests that firms located in countries with a weak rule of law may be advised to ally with foreign firms, effectively marrying their own knowledge of the local market with the reputational capital of the foreign partner. In this way local firms may be able to signal to consumers that they can provide a level of transactional integrity approaching that in the foreign firm's home market.

More generally, the problem of transactional integrity suggests the possibility of significant first-mover advantages stemming from prior investments in reputation building, perhaps to the extent of creating a "winner-takes-all" outcome in e-commerce markets. In so much as

reputations for transactional integrity carry over from traditional markets, this will give established bricks-and-mortar companies a competitive advantage as they enter e-commerce. To date, start-up companies have often been able to overcome the reputational advantages of established firms by offering a product or service that is sufficiently novel and attractive. However, as bricks-and-mortar companies overcome their ignorance of the new medium and are able to mimic the offerings of start-ups in many cases, then reputational capital related to transactional integrity is likely to re-emerge as a key determinant of competitive advantage. In such an environment, e-commerce companies may face the stark choice of allying with an established, high-reputation firm, or seeing their market share dwindle and disappear.

Exploring these and other implications of our observations of the institutional environment and e-commerce readiness for government policy and firm strategy represents an important avenue for further research – albeit one that goes well beyond the scope of this paper. We invite others to take up the challenge.

ENDNOTES

[1] As an Economist (1997, p. E14) editorial mused: "What is behind that Web article image of a superstore? Might it be just a teenager with a graphics program?"

[2] AOL reportedly received 20,000 complaints about the phone scam. In response, payments for calls to the Dominica number were frozen by court order, but only after some payments had been made. The court order also required U.S. telephone carriers to reimburse affected consumers.

[3] These intermediaries take several forms and play a variety of roles, such as evaluating online products (e.g., Epinions, Deja.com) and merchants (e.g., Bizrate.com), or executing transactions connecting many buyers and sellers (e.g., Amazon.com).

[4] The government also plays an active administrative role in regulating the form and content of Internet activity in some countries, potentially substituting for a strong rule-based institutional environment. If unchecked, however, governments may opportunistically reverse policy commitments at will (Weingast, 1993). As a result, e-commerce companies may be unwilling to make sunk investments in technology and reputation-building in the absence of an independent judiciary (i.e. a strong rule-of-law).

[5] Credit card companies cannot provide full assurance of online transactions: Quality disputes are not covered by regulations governing credit card use, even in the U.S., and protection thus varies among credit card issuers. Furthermore, because most online purchases are completed without a customer's actual signature, merchant protection is also incomplete.

[6] The data are also available at ITU's web site, at http://www.itu.int/ti/industryoverview.

[7] These data are widely reported in international statistical reports (e.g., ITU, 1999; World Bank, 1999). See http://www.isc.org/ds/new-survey.html for full details of the domain name survey.

[8]Data available at http://www.isc.org/ds/WWW-9807/dist-bynum.html

[9] Omitted names are .com, .org, .gov, .edu, .net, and .int.

[10] 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).

[11] The countries in the regression analysis are biased towards those with higher levels of e-commerce activity, and of infrastructure and institutional variables. We therefore urge caution in generalizing our results to the least developed nations.

[12] The logistic transformation is chosen over alternative variable transformations because USERPC is theoretically bounded between zero and one. Adoption of the logistic transformation is standard practice for such a variable; it allows the theoretical domain of the dependent variable to stretch between minus and positive infinite. On the other hand, a natural log transformation will keep the domain of the dependent variable between minus infinite and zero which is less desirable. HOSTPC is not theoretically bounded at one, so a natural log transformation could be used in this case. However, the log and logistic transformations produce materially identical results for HOSTPC (with slightly higher levels of statistical significance for the log transformation in some of the models), since all observed values of this variable are close to zero. We therefore opt to use the logistic transformation for both variables for consistency and simplicity of presentation and exposition.

[13] PCPC drops out of significance in Model 3, but only marginally: the significance level is 0.1094.

[14] Adding the two measures together yields qualitatively identical results to those using PHONEPC alone, as the combined measure is very highly correlated (0.971) with PHONEPC.

[15] Some alternative specifications of the empirical model (specifically those using log transformations of all per capita measures) also yield significant effects for the rule of law in estimations of Internet users per capita. However, these alternative specifications are inferior overall in terms of fitting the observed data. Given the exploratory nature of the empirical exercise here we allow overall explanatory power to guide our specification of the empirical model.

[16] The rank order of economic significance for the remaining variables in Model 8 are GDP, mobile phones, card use, and telephone fee.

[17] We also test for missing variables that may cause potentially spurious results, using a White's χ^2 test for heteroskedasticity. We find no evidence of such a problem.

[18] The only impact of removing Finland on the parameter estimates in Model 8 is that LGDPPC becomes insignificant at the 10% level.

[19] Colombia also has very high telephone fees, but does not appear in Model 8 because of missing data on CARDUSE. In models where it does appear (Models 1-2 and 5-6), Colombia is also an outlier.

[20] This reluctance to use credit cards has also been reported more widely in Asia, and in some countries within Europe (Washington Post, 1999b).

[21] Such technologies are becoming available, but as yet, credit cards still account for 95% of online sales (Computerworld, 2000).

[22] The prospect of foreign dominance in e-commerce already worries policymakers in developing countries. For example, at a 1999 WTO seminar, Senegal's representative 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 (WTO, 1999). We would add institutional reforms strengthening the rule of law to the policy agendas of host countries seeking effective participation in the electronic economy.

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TABLE 1: DESCRIPTIVE STATISTICS

Variable name	Definition	N	Mean	Std Dev	Minimum	Maximum
USERPC	Internet users per capita, 1998	62	0.076	0.089	0.001	0.396
LTUSERS	Transformed variable, USERPC	62	-3.401	1.754	-7.583	-0.424
HOSTPC	Internet hosts per capita, 1998	62	0.010	0.017	0.000	0.087
LTHOSTS	Transformed variable, HOSTPC	62	-6.343	2.450	-13.21	-2.346
LGDPPC	Log of GDP per capita, 1997	62	8.906	1.134	6.083	10.49
ROLAW	Rule of Law, 1982-95	41	7.270	2.440	2.080	10.00
CREDITPC	Credit cards per capita, 1998	47	0.275	0.348	0.000	1.611
CARDUSE	Card transactions per capita, 1998	47	34.22	34.99	0.118	174.79
PHONEPC	Phone lines per capita, 1998	62	0.332	0.203	0.022	0.676
MOBILEPC	Mobile phones per capita, 1998	62	0.162	0.142	0.001	0.572
PCPC	Personal computers per capita, 1998	62	0.143	0.133	0.000	0.459
TELEFEE	Estimated 1999 telephone charges, as proportion of GDP/capita	35	0.054	0.051	0.014	0.188

TABLE 2: DATA IN REGRESSION ANALYSIS

COUNTRY	USERPC	HOSTPC	LGDPPC	ROLAW	CREDITPC	CARDUSE	PHONEPC	MOBILEPC	PCPC	TELEFEE
Argentina	0.0083	0.0006	9.0011	5.35	0.2572	15.1520	0.1975	0.0700	0.0443	0.0620
Australia	0.1603	0.0356	9.9543	10.00	0.4458	71.9360	0.5120	0.2855	0.4115	0.0191
Austria	0.1351	0.0134	10.1388	10.00	0.1776	25.5650	0.4910	0.2817	0.2334	0.0240
Belgium	0.0789	0.0087	10.0880	10.00	0.0747	39.3080	0.5003	0.1732	0.2860	0.0210
Brazil	0.0181	0.0007	8.4864	6.32	0.1327	4.7010	0.1205	0.0468	0.0302	0.0667
Canada	0.2475	0.0277	9.9236	10.00	1.1650	77.7690	0.6339	0.1756	0.3300	0.0153
Chile	0.0202	0.0012	8.5399	7.02	0.1467	2.5850	0.2056	0.0651	0.0482	0.0945
Colombia	0.0046	0.0003	7.7640	2.08	0.0492	na	0.1735	0.0491	0.0279	0.1711
Denmark	0.1887	0.0301	10.3717	10.00	0.0579	65.2830	0.6596	0.3644	0.3774	0.0137
Finland	0.2860	0.0874	10.0687	10.00	0.2934	48.3500	0.5544	0.5722	0.3495	0.0155
France	0.0335	0.0056	10.0588	8.98	0.0570	58.4120	0.5697	0.1878	0.2078	0.0216
Germany	0.0731	0.0121	10.1516	9.23	0.1841	38.3080	0.5668	0.1697	0.3047	0.0234
Greece	0.0330	0.0025	9.3336	6.18	0.1285	na	0.5222	0.1941	0.0519	0.0562
Ireland	0.0815	0.0104	9.8967	7.80	0.3533	39.9180	0.4348	0.2571	0.2717	0.0169
Italy	0.0520	0.0042	9.8967	8.33	0.1734	14.3250	0.4507	0.3553	0.1734	0.0163
Japan	0.1323	0.0092	10.4087	8.98	1.6114	50.1900	0.5027	0.3738	0.2372	0.0217
Mexico	0.0141	0.0004	8.3426	5.35	0.0374	1.7510	0.1036	0.0350	0.0470	0.1215
Netherlands	0.1017	0.0242	10.0390	10.00	0.2859	43.6180	0.5932	0.2129	0.3177	0.0178
New Zealand	0.1539	0.0434	9.7212	10.00	0.4947	174.7920	0.4790	0.2026	0.2821	0.0234
Norway	0.2247	0.0643	10.4479	10.00	0.2903	84.4720	0.6596	0.4735	0.3730	0.0178
Peru	0.0081	0.0001	7.8744	2.50	0.0203	na	0.0667	0.0300	0.0182	0.0582
Portugal	0.0602	0.0040	9.2351	8.68	0.2183	45.1010	0.4133	0.3088	0.0813	0.0527
South Korea	0.0668	0.0026	9.1622	5.35	0.8170	4.2440	0.4327	0.3019	0.1568	0.0151
Spain	0.0440	0.0043	9.5101	7.80	0.2717	29.3160	0.4137	0.1791	0.1448	0.0365
Sweden	0.3955	0.0361	10.1929	10.00	0.2207	na	0.6740	0.4642	0.3616	0.0139
Switzerland	0.1407	0.0161	10.4875	10.00	0.3990	21.3570	0.6755	0.2352	0.4219	0.0139
Turkey	0.0067	0.0004	7.9488	5.18	0.1067	6.9340	0.2542	0.0525	0.0232	0.0975
UK	0.1357	0.0168	9.9918	8.57	0.6898	51.6030	0.5569	0.2523	0.2629	0.0203
Uruguay	0.0699	0.0031	8.7126	5.00	0.4954	na	0.2503	0.0596	0.0912	0.0583
Venezuela	0.0022	0.0002	8.2438	6.37	0.1111	4.2540	0.1167	0.0867	0.0430	0.1715

TABLE 3: CORRELATION MATRIX

1.	USERPC	1.00											
		(0.00)											
2.	LTUSERS	0.80	1.00										
		(0.00)	(0.00)										
3.	HOSTPC	0.83	0.62	1.00									
		(0.00)	(0.00)	(0.00)									
4.	LTHOSTS	0.75	0.93	0.66	1.00								
		(0.00)	(0.00)	(0.00)	(0.00)								
5.	LGDPPC	0.67	0.83	0.55	0.81	1.00							
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)							
6.	ROLAW	0.71	0.80	0.62	0.84	0.85	1.00						
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)						
7.	CREDITPC	0.48	0.54	0.24	0.46	0.52	0.32	1.00					
		(0.00)	(0.00)	(0.11)	(0.00)	(0.00)	(0.05)	(0.00)					
8.	CARDUSE	0.65	0.62	0.64	0.70	0.59	0.64	0.37	1.00				
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.03)	(0.00)				
9.	PHONEPC	0.79	0.87	0.64	0.87	0.89	0.85	0.50	0.59	1.00			
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)			
10.	MOBILEPC	0.79	0.78	0.71	0.75	0.80	0.68	0.53	0.45	0.83	1.00		
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)		
11.	PCPC	0.82	0.80	0.73	0.80	0.84	0.83	0.48	0.64	0.89	0.78	1.00	
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	
12.	TELEFEE	-0.58	-0.73	-0.49	-0.75	-0.87	-0.71	-0.42	-0.54	-0.79	-0.69	-0.76	1.00
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
		1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.

TABLE 4: ESTIMATION RESULTS

	Dependent variable LTUSERS				Dependent variable LTHOSTS			
	1.	2.	3.	4.	5.	6.	7.	8.
INTERCEP	0.274	0.169	-0.571	1.172	-5.412	-6.322	-4.677	-2.7210
	(3.872)	(3.324)	(4.040)	(3.484)	(4.152)	(3.750)	(3.579)	(2.6444)
LGDPPC	-0.578	-0.542	-0.426	-0.677	-0.412	-0.261	-0.409	-0.6864 *
	(0.484)	(0.404)	(0.487)	(0.416)	(0.519)	(0.455)	(0.432)	(0.3158)
ROLAW	0.149	0.151	0.232	0.234 †	0.265 *	0.264 *	0.320 *	0.3255 **
	(0.111)	(0.102)	(0.157)	(0.132)	(0.119)	(0.115)	(0.139)	(0.1000)
CREDITPC	0.581 †	0.556 †			0.279	0.248		
	(0.330)	(0.303)			(0.354)	(0.341)		
CARDUSE			0.002	0.002			0.008 *	0.0079 **
			(0.004)	(0.003)			(0.004)	(0.0026)
PHONEPC	2.064		-0.214		2.740		-0.013	
	(1.536)		(1.927)		(1.648)		(1.708)	
MOBILEPC		2.648 *		2.487 *		2.537 *		2.8907 **
		(1.042)		(0.967)		(1.175)		(0.7337)
PCSPC	3.832 *	4.171 *	3.677	3.338 †	5.341 *	5.975 **	5.578 **	5.2964 **
	(1.834)	(1.596)	(2.184)	(1.696)	(1.967)	(1.800)	(1.935)	(1.2874)
TELEFEE	-13.449 **	-13.608 **	-19.173 **	-17.879 **	-8.175	-8.451 †	-16.062 **	-14.8384 **
	(4.593)	(4.209)	(6.1309)	(4.880)	(4.926)	(4.748)	(5.432)	(3.7044)
N	30	30	25	25	30	30	25	25
F-statistic	26.42 **	32.10 **	21.76 **	30.85 **	41.01 **	44.30 **	51.72 **	98.90 **
Adjusted R^2	0.840	0.865	0.839	0.882	0.892	0.900	0.927	0.961

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