

Doctoral Thesis

Communication Technologies: Commercial Adoption and Institutional Environment

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To my parents

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1. Foreword

1.1. Information Technology

Information technology can transform the structure of markets and firms. The rapid growth of electronic commerce and integrated logistics has forced companies to adopt new business models, changing the balance of power in entire industries. Information technology also has a profound impact on productivity and business value. Economy-wide, investments in information technology have contributed greatly to the spectacular growth of the US economy in the 1990's. The dynamism that Internet, mobile telephony and other forms of information and communication technology (ICT) introduce, raises complex questions about the role of intermediation in economic transactions, the gap between those who can benefit from the technological advances and those who cannot, and the determinants of this gap. Using formal models and empirical tests, this work seeks to provide answers to these intriguing questions.

This thesis is organized as follows. First, I study the role of commercial intermediation and analyze theoretically and empirically the determinants of the behavior of established traditional retailers when adopting e-commerce. In Chapter three, I single out the factors, which influence the adoption of two types of information technologies at the country level. The analysis shows that the quality of the institutional environment, and subsequently the security of investments, has a strong, but distinct, impact on technology adoption. In Chapter four, I argue that the quality of the institutional environment, measured by the

degree of property rights protection, is endogenously determined by complex political processes, and as such, it cannot be easily changed by legal transplants and external intervention. I argue that information technologies, which are less sensitive to institutional underdevelopment, can provide us with business models that are viable in institutionally hostile environments.

1.2. Online Disintermediation: Differences in the Behavior of Traditional Retailers in Adopting E-commerce

In Chapter two I study the ambiguous effects that the Internet has on the transaction costs structure in the case of retailing. I model the Internet as a low-cost distribution technology that needs substantial customer acceptance and a specific business model in order to be a viable alternative to traditional retailing. The prediction of the model is that different types of traditional retailers have incentives to follow different strategies with respect to e-commerce, depending on their pre-Internet retailing format. This hypothesis is confirmed by empirical evidence of the adoption strategies followed by a sample of well-established US-based retailers. In essence, I find that retailers, whose traditional selling technology is best approximated by e-commerce, are more likely to reap early the benefits of low-cost online retailing.

1.3. Can Progress Be Resistant to Bad Institutions? The Case of ICT

Chapter three presents an empirical study of the determinants of worldwide Internet and cellular phone penetration levels since 1980. I show that cross-country differences in the use of information and communication technologies (ICT) are to a considerable extent due to differences in investment climate, which determines the incentives to adopt technologies based on site-specific assets. Using three measures of the quality of the investment climate, I find that diffusion of fixed-line Internet access is strongly dependent on the quality of the institutional environment. On the other hand, cellular phone telephony, based on less site-specific re-deployable modules, is less dependent on institutional parameters. I argue that the existence of technologies that are less sensitive to institutional underdevelopment is an opportunity for the investor community.

1.4. Unwelcome Political Consensus

In Chapter four I develop and test a theory regarding the effect that electoral formats and government configurations have on the degree of property rights protection. First, I propose a formal model, which establishes a negative relationship between the number of institutions of consensual collective decision-making and the degree of property rights protection. Second, using a sample of 63 democratic countries, I find evidence that those with less consensual (more majoritarian) institutions of collective decision-making score higher on measures of property rights protection, and thus benefit from a better investment climate. In addition, I contrast the conjectured collective choice explanation to the legal origin hypothesis, which states that the Anglo-American common law tradition is superior

to the Continental European civil law tradition in property rights protection. The evidence suggests that electoral formats and government configurations are better predictors of the degree of property rights protection than the country's legal origin.

1.5. Contributions

This research contributes to several fields of knowledge. First, it adds to the business strategy literature, as it studies the strategic decisions that retailing firms have to make regarding a potential new entrant or an additional distribution channel. By looking at the strategic and marketing aspects of e-commerce, I study the incentives for retailing firms to move online. I provide a model consistent with the data emphasizing how e-commerce, as a novel technology, affects the established business format of long-standing firms in the retailing sector. The analysis first underscores the core competences that traditional retailers might exploit in the Internet era and, second, highlights their strategic interaction with potential entrants in an environment with lower entry barriers. I empirically test the predictions of the theoretical model using a new measure of similarity between traditional and electronic commerce formats. The results confirm the prediction of the model, namely that retailers whose business format shares more similarities with e-commerce are more likely to adopt online retailing.

The research contained in this thesis also provides insights about how productivity and business value can be enhanced through diffusion of information technologies. I draw attention to the overlooked relationship between the technological parameters of different ICT and growth opportunities. I empirically show that three measures of the institutional quality of a country have a stronger impact on the adoption of Internet services than on

cellular telephony. My hypothesis is that Internet access relies on more site-specific assets, while cellular telephony uses mobile re-deployable modules, which are less subject to ex-post expropriation, and thus less dependent on institutional safeguards. The evidence points to the existence of business formats that can be successful in a hostile institutional environment, and that mobile telephony can provide a paradigm for successful business models in institutionally (and economically) underdeveloped countries. The results suggest that development economists may increase the success rate of directed institutional reforms if they complement their efforts with those of engineers. The latter can deliver versions of established technologies whose diffusion is less dependent on the quality of institutions.

Finally, I single out the protection of property rights as the most important market supportive institution. I then study the effect that electoral formats and government configurations have on property rights protection. I build a theory and find supporting evidence that countries with less consensual (more majoritarian) institutions of collective decision-making score higher on measures of property rights protection and thus enjoy a better investment climate. Thus it seems that the degree of property rights protection and, as a consequence, an investor-friendly business climate, is determined by complex political processes and as such, it is endogenous to the society. For this reason, legal transplants will rarely be successful in improving the investment environment, despite the argument of some researchers that the Anglo-American common law tradition has clear advantages in creating a business-friendly investment climate. The proposed framework establishes a relationship between political economy and institutional economics, a connection that fills a long-standing gap in the literature.

1.6. Future research

Commercial adoption of new information technologies offers numerous areas for future research. These include (1) measuring the competitive pressures introduced by new purely online firms; (2) studying the changes in organizational architecture motivated by the integration of e-commerce; (3) analyzing the transactional problems related to trust and quality assurance; and (4) examining consumer behavior issues associated with the new presentation methods used in e-commerce.

The political determinants of the adoption of information technologies present an equally rich field of research. Following the example of cellular telephony, it would be worthwhile to study the feasibility of mobile versions of established technologies and to compare their costs to the cost of institutional reforms that might have facilitated the adoption of a standard technology. Moreover, further exploration of the institutional determinants of a business-friendly climate must include studying the effects that property rights protection has on preferences for certain political systems or collective choice mechanisms. Another related issue is how different organizational forms and compensation systems work in institutionally and economically underdeveloped countries and what their impact is on the quality of the business environment.

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2. Online Disintermediation: Differences in the Behavior of Traditional Retailers in Adopting E-commerce¹

Management Research, 2003, 1(3), 279-290.²

In this Chapter I study the ambiguous effects that the Internet has on the transaction costs structure. I model e-commerce as a low-cost selling technology that needs substantial customer acceptance and a specific business model in order to serve as a viable alternative to traditional retailing. The hypothesis is that different types of traditional retailers follow different strategies with respect to e-commerce, depending on their pre-Internet retailing format. This claim is supported by empirical evidence from the adoption strategies followed by a sample of well-established US-based retailers. I find that retailers, whose traditional selling technology is best approximated by e-commerce, are more likely to reap early the benefits of low-cost online retailing.

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² Edited version.

2.1. Introduction

The Internet as a direct selling technique has attracted the attention of established retailers and potential entrants. Although the concept of direct selling is not a novelty for the sector, the opportunities that the Internet offers are much broader than the scope of traditional direct selling techniques like catalogs and TV shopping. This new communication and distribution tool has raised questions regarding the necessity of traditional distribution channels in areas like software and music, and is increasingly used in hardware and book selling. The penetration of the Internet in consumer markets, however, is far from being only a success story. While some analysts see in Business-to-Business transactions an opportunity for huge cost cuts and profit generation (Garicano and Kaplan, 2000), the opinions about Business-to-Consumer trade are divided. On the one hand, Internet connections among companies offer a good alternative to the Enterprise Resource Planning (ERP) systems and its adoption results in important cost reductions (Geyskens, Gielens and Dekimpe, 2002). On the other, many purely online retailers are already out of business or announcing losses. Nevertheless, some observers claim the sector has actually taken off. A study issued by the Boston Consulting Group (2000), for example, suggests that 38 percent of the 221 online retailers included in the report make a profit and that this trend is particularly representative for retailers that have been selling for at least one year.

In this chapter I propose a theoretical framework that models the strategic choices that incumbent retailers have to make as a function of their existent or antecedent retailing

format. First, I study the ambiguous effects that the Internet has on the transaction costs structure in the case of retailing. Next, I identify how the characteristics of the potential adopters of e-commerce condition their strategic choices. I argue that electronic commerce provides different opportunities for different classes of traditional retailers, depending on their antecedent retailing technology, and offer empirical evidence to support this claim.

The approach of this chapter differs in several ways from the existing literature. First, its main objective is to analyze, both theoretically and empirically, the strategic decision of adding a new distribution channel and not the consequent pricing strategies (Brynjolfsson and Smith, 2000; Clay, Krishnan and Wolff, 2001; Friberg, Ganslandt and Sandtröm, 2001; Sorensen, 2000) or internal organization issues (Cattani, Gilland and Swaminathan, 2002; Lasry, 2001). Second, it focuses on the strategic choice of an established retailer of whether to incorporate a new distribution channel, rather than on the competition between traditional retailers and direct marketers (Balasubramanian, 1998). Finally, it is different from the approach adopted in recent work on e-commerce (Croson and Fang, 2001; Mazon and Pereira, 2001) because it facilitates the analysis of the behavior of different classes of traditional retailers as a function of their established retailing format. The chapter is close in spirit to the literature defending the active role of distribution channels in the producer-final consumer relationship (Anderson and Anderson, 2002; Arruñada, 2000), and more generally, to the resource compatibility literature (Barney, 1986; Prahalad and Hamel, 1990; Wernerfelt, 1984).

The rest of this chapter is organized as follows. In the next section I present an overview of the functions that convert retailers, and more generally middlemen, into an indispensable part of business transactions. Building on this analysis, I hypothesize that, even though the Internet is a disintermediation technology, it does not pose an inescapable

threat for the incumbent retailers because it cannot fully substitute all the functions they perform. Next, I develop a theoretical model of the strategic choices that an incumbent retailer is forced to make in a situation with a possible new entry. My focus is on the pre-existing retailing technology as a factor conditioning the incumbent's strategy. Finally, I present empirical evidence supporting the claim that established retailing technology conditions the strategic choices of incumbents in a situation where new technology facilitates entry.

2.2. The role of middlemen

In order to understand the behavior of retailers, both incumbent and new, attention should be paid to the characteristics and the importance of the intermediation function they perform between manufacturers and consumers. Scholars have argued that retailers and more generally middlemen exist because of four reasons (Biglaiser and Friedman, 1994).

First, middlemen reduce search costs. Consumers have to make their choices limited by not only budget, but also time and availability constraints (Rubinstein and Wolinsky, 1987). In a world without middlemen these constraints would be a lot more binding, forcing consumers to choices that they would not otherwise make. Second, the economic efficiency of the distribution system's design can explain why in the presence of middlemen, total selling costs may happen to be lower than the costs without middlemen. By reducing the number of transactions necessary to achieve final-consumer sales, middlemen become an efficiency improving mechanisms for the whole economy. How well middlemen can perform this function remains a separate question, whose answer depends on both demand characteristics and product attributes (Michael, 1994). Third, middlemen

can help to solve the adverse selection problem related to quality. For example, Biglaiser (1993) derives middlemen's efficiency from their role as experts using two arguments: first, a middleman buys many more goods than a traditional buyer, and second, it places a higher importance on its reputation than a traditional producer of a single good. The fourth argument in favor of the middlemen found in the literature states that they engage in policing activity, thus alleviating the producer moral hazard about product quality, and at the same time, maintain their own reputation (Biglaiser and Friedman, 1994). According to this logic, the reputation spillover over the middlemen raises the cost of defection and gives them the right incentives to provide correct information about producers' quality.

Summarizing the arguments, middlemen exist because they save on both the logistic parameters of the transactions—reducing search and distribution costs, and on the motivation ones—alleviating adverse selection and moral hazard problems (Milgrom and Roberts, 1992).

E-commerce, however, poses a threat to middlemen on some, not on all, of these dimensions. The Internet, as a means for locating merchandise and performing price comparisons, makes search constraints shrink further. As search-cost-reducing mechanism, middlemen and the Internet are strong competitors, being the latter probably a more efficient search device. The gain in distribution efficiency in an Internet-connected world, however, is less clear. While distribution of digitized goods like software, sounds and images can be performed at virtually zero cost, distribution of non-digitized goods may result more costly, given the need for a distribution system designed to serve a multitude of individual buyers located at numerous sites. The ability of retailers to deal with this facet of e-commerce probably determines their success or failure. More importantly, the Internet

has not been able to develop novel institutions that alleviate problems of information asymmetry.

Traditionally, the middlemen have been solving problems of moral hazard and adverse selection, and *virtual* middlemen are called into existence to perform this role online. First, the *virtual* middleman in its role of adverse-selection-problem alleviator is as well positioned to develop expertise knowledge about product quality as a traditional retailer is. By the same token, it has strong incentives to engage in policing activities aimed at maintaining its reputation and, at the same time, alleviating the producer moral hazard problem. Having fulfilled these functions for decades, the traditional retailers have advantages to position themselves as *virtual* middlemen. If in fact the business of retailing is not about moving producer goods to buyers but about creating value to customers (Anderson and Anderson, 2002), then the traditional retailers, with established reputation and knowledge about tailoring goods and services to specific needs, enjoy a privileged position with respect to new entrants in the business of *virtual* retailing. Moreover, *virtual* retailing seems to be a viable business opportunity given that most e-commerce is not, and probably will not be, performed directly between producers and customers (Geyskens et al., 2002). This argument strongly supports the idea that traditional retailers have a chance to use their established reputation and previous experience in the implementation of Internet retailing channels. The next section studies how traditional retailers can benefit from e-commerce and the strategic choices they have to make in the presence of entry-enabling technology.

2.3. What can incumbents do about e-commerce?

Most traditional retailers base their business models on the advantage of location. E-commerce has the potential to depreciate the importance of location and poses two main challenges to the incumbent retailers: first, given the lower entry barriers in e-commerce, they should decide how to deal with potential entry; and second, they should evaluate the impact of self-cannibalization in case of performing online operations. These two issues are treated subsequently.

There is no unique incumbent's reaction to entry and an overview of the literature suggests that incumbents act selectively. Incumbent behavior ranges from no reaction (Biggadike, 1976; Robinson, 1988; Yip, 1982) to some reaction, in cases when markets are static and dominated by a single firm (Cubbin and Domberger, 1988) or in highly concentrated industries with low entry barriers (Bunch and Smiley, 1992). One of the most popular explanations of the lack of incumbents' reaction is the well-known fact that entry is easy but survival is not: if most entrants are likely to fail and if the survivals need five to six years to become competitive, incumbents have weak incentives to react (Geroski, 1995). Even in the case when they do react, the established firms change only a single element of their marketing mix (Robinson, 1988). The suggested "myopia" of the incumbents is also confirmed in more recent research (Yamawaki, 2002). Moreover, delays in the incumbents' response are even claimed justifiable from theoretical standpoint (Kalra, Surendra and Kannan, 1998).

The second concern of the incumbents is the threat of self-cannibalization. Geyskens *et al.* (2002) quote a recent survey performed by Forester Research, where 66 percent of the

consumer goods manufacturers indicate that the channel conflict, a form of self-cannibalization, was the biggest problem they face in their online strategies. A review of the empirical work in the field is again inconclusive as to what extent this is a reasonable concern. Chandy and Tellis (1998) argue that the introduction of a radical product innovation associated with self-cannibalization of sales depends on organizational issues—internal markets, product champion influence, and focus on future markets—and attitudinal factors. In the context of tobacco industry, cigarette line extensions are found to generate a sales increase that more than compensates a possible cannibalization effect (Reddy, Holak and Bhat, 1994). In the mainframe industry, however, an introduction of a close product substitute is found to increase the probability of firm failure by 250 percent (Greenstein and Wade, 1998). The mixed evidence in the literature on self-cannibalization suggests that we cannot have a single prediction about the way, in which retailers should respond to e-commerce. In fact, some analysts accused them of following fads, while others, advocating first mover advantage (Lee, Smith, Grimm and Schomburg, 2000), had the impression that retailers, plagued with organizational inertia, moved slowly online. The theoretical framework proposed below seeks to systematize the forces that shape the incumbent retailers' behavior and give some structure to what might appear to be a chaotic process.

2.4. Modeling Internet retailing

Two features of the e-commerce are particularly relevant for understanding incumbent retailers' behavior. First, e-commerce is treated as a substitute, even though not a perfect

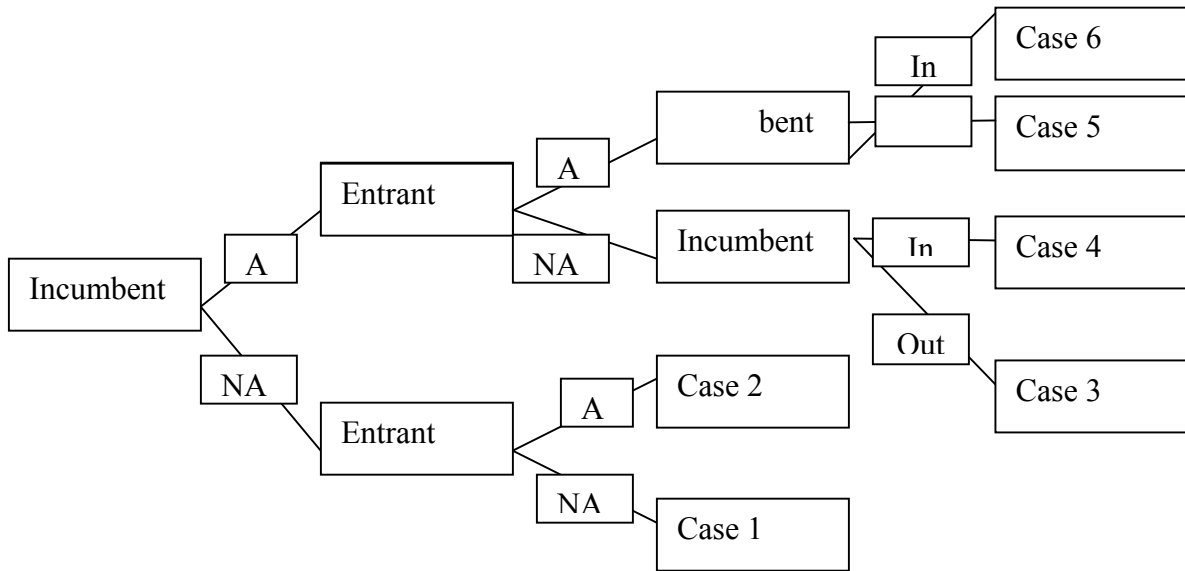
one, to the traditional retailing format, and second, it is modeled as a low cost alternative to traditional retailing.

I assume horizontal differentiation between traditional and online selling because the choice of a distribution channel implies differences in delivery period, personal experience, privacy considerations and return practices, among other dimensions, and thus, it changes the attributes of a product. The intensity of these differences is captured by a parameter $\theta \in (0,1)$. The bigger the value of the parameter, the greater the similarity between the characteristics of online and traditional distribution channels.³

The second feature of the e-commerce highlighted here is that it is a low cost alternative to traditional retailing formats. This approach is motivated by recent research that estimates the savings in distribution costs for tangible goods as being somewhere between 12 (Cope, 1996) and 25 percent (Organization for Economic Cooperation and Development, 1999). The reductions in marginal cost are frequently attributed to facilitated transaction processing, reduced paperwork, human errors, customer disputes (Geyskens *et al.*, 2002), and more generally to improved operational efficiency (Burke, 1997). In this framework the advantage that the e-commerce offers can be appreciated by the difference in marginal costs that characterize traditional (\bar{c}) and online selling (\underline{c}).

³ E-commerce improves some elements of the purchasing process like convenience and home delivery; however, it damages others such as the possibility of inspection before purchase and perception of secure payment. Because of the uneven impact that e-commerce produces on various characteristics of the purchasing process, it is modeled as horizontally, not vertically, differentiated technology.

The game tree



Using these assumptions about online retailing, the following four-stage duopoly game is solved. In Stage 1 the incumbent retailer chooses whether to add a new online channel, paying a fixed set-up cost F .⁴ In Stage 2 a potential purely online retailer (a pure play) decides whether to enter the retailing business, paying a fixed set-up cost F . In Stage 3 the incumbent retailer chooses whether to stay in its traditional retailing business. If it decides to close traditional outlets, it should pay exit cost E . In Stage 4 firms play the duopoly game.

The inverse demand function for each technology is given by the expressions:

$$p_o = a - b(q_o + \theta * q_n) \text{ for the old retailing technology and}$$

$$p_n = a - b(q_n + \theta * q_o) \text{ for the new retailing technology, where } p_n \text{ and } q_n \text{ (} p_o \text{ and } q_o \text{)}$$

are the price and the quantity demanded.⁵

Although the literature does not express a uniform opinion as to what is the base of the competition between traditional retailing channels and the e-commerce, most modeling efforts have assumed price competition (for example, Chiang, Chhajed and Hess, 2003; Kumar and Ruan, 2002; Rhee, 2001). Given that the purpose of this chapter is to establish a relationship between the incentives of the incumbents to adopt e-commerce and their traditional selling practices, competition in both price and quantity has been analyzed, while only results of price competition are included in the Appendix. The incumbent's incentives to adopt e-commerce, as a function of its traditional selling technology is

⁴ The fixed cost of adopting new technology is F . In the case of e-commerce adoption, it includes the purchase of hardware and software, the costs of Internet hosting services, the advertising expenditures in order to create awareness and so on. The size of the investment in the new distribution channel is affected by the similarity between e-commerce and traditional retailing technology, where the greater the similarity, the smaller the cost of adoption.

⁵ It is also assumed that before the new technology became available the incumbent had been a profit maximizing monopolist, so that $a > \bar{c}$.

qualitatively the same under assumptions of price and quantity competition. The following propositions describe the strategic implications for incumbent retailers of adding an e-commerce channel.

Proposition 1a. Under the assumption of negligible entry ($F \approx 0$) and exit ($E \approx 0$) costs, the incumbent retailer will always choose to add a new e-commerce channel.

With negligible entry and exit costs, irrespective of the degree of substitutability, the incumbent can benefit from the lower marginal costs of the new retailing technology. In the case of considerable similarities between traditional and online selling, the incumbent will switch completely to e-commerce retailing format. In the case of low degree of substitutability between retailing technologies, the incumbent can derive profits from both online and traditional markets.

The predictions about incumbent's behavior depend crucially on three parameters: the size of the entry costs F , the size of the exit costs E , and the degree of substitutability between the retailing technologies, θ , and so far these have been treated as completely independent of one another. The independence assumed for simplicity and tractability presents limitations for generating testable hypothesis and performing empirical investigation because frequently this assumption is violated. For example, a company that successfully adopts e-commerce is not the one that simply maintains a web page with transactional capabilities. In fact, this strategy does not necessarily improve the firm's profitability because it implies an additional delivery charge that customers strongly resist to accept (Sheth and Sisodia, 1997). What is needed, in order to benefit from the e-commerce cost advantage, is a business model that is optimized for home shopping. The existence of such a capacity is conditioned by the retailer's prior experience as a direct

seller and has a negative effect on the cost of adoption of profitable e-commerce. In this way, the traditional retailing model affects the incumbent's adoption decision not only directly through the degree of substitutability between the technologies, but also indirectly through the entry costs. For example, a retailer, whose traditional selling technology is similar to the model of e-commerce, can easily benefit not only because it can substitute the antecedent technology for one that incurs lower marginal costs, but also because it can do this paying lower fixed costs. The following proposition takes into account the relationship between the fixed costs F and the degree of substitutability θ and Figure 1 illustrates the conjectured relationship between entry costs, exit costs and degree of substitutability.

Proposition 1b. If there exists $F(\theta)$, such that $F'(\theta) < 0$ and $F(1) = 0$, then

- (i) it is not always optimal for the incumbent to add a new e-commerce channel.
- (ii) the incentives to adopt e-commerce depend on the level of substitutability θ .

Generally, the greater the substitutability, the stronger the incentives to adopt e-commerce.

If the low level of substitutability between the retailing formats is translated into sufficiently high cost of e-commerce adoption, then the incumbent can be prevented from generating profits online and as a consequence it will choose not to add an e-commerce channel.

Proposition 2. Under the assumption of non-zero entry and exit costs, the incumbent might choose not to add a new e-commerce channel.

Entry into the e-commerce business depends crucially on the size of the initial investment required for an effective entry. If these costs are superior to the perceived benefits from entry the incumbent will choose a no-adoption strategy.

Proposition 3. Under the assumption of decreasing over time entry costs, the rate of e-commerce adoption will be increasing.

Under the assumption of constant technological improvements that contribute to decreasing entry costs over time, more traditional retailers will find it profitable to adopt e-commerce.

Proposition 4. Under the assumptions of negligible exit ($E \approx 0$) costs, there exists a critical level of technological substitutability, $\theta = \frac{a - \bar{c}}{a - \underline{c}}$, above which the incumbent will choose to close its traditional outlets and to sell through the online channel only.

If the retailing model used by an incumbent retailer is threatened by the e-commerce because of considerable similarities between the two retailing technologies, the incumbent retailer will find it profitable to completely substitute its traditional retailing technology for the e-commerce, thus benefiting from lower marginal costs.

Proposition 5. There exists a critical level of technological substitutability, $\theta = \frac{a - \bar{c}}{a - \underline{c}}$, below which the incumbent will choose to operate with both a traditional and an e-commerce channel.

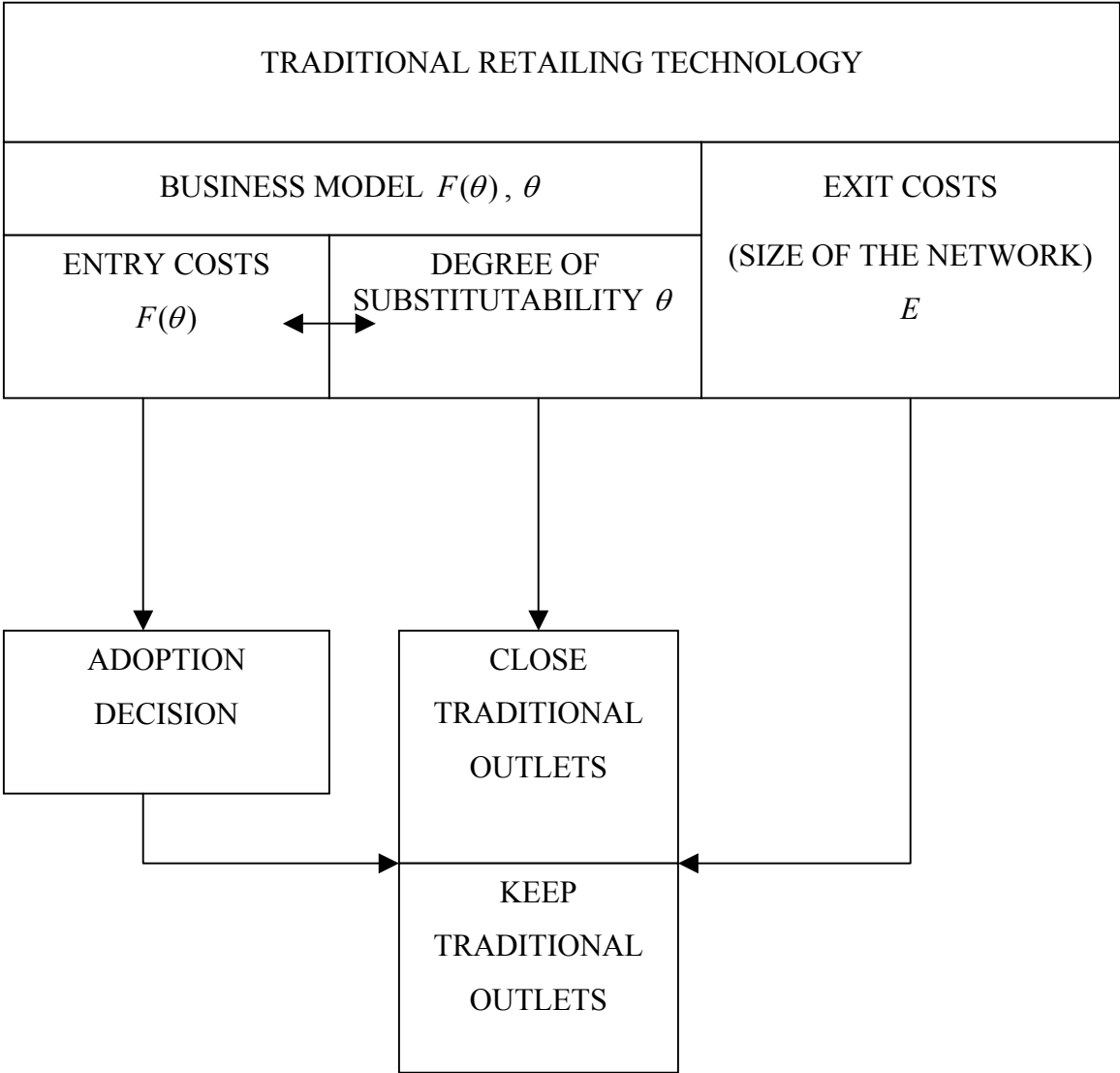
When the traditional retailing technology of the incumbent and the e-commerce format do not share considerable similarities, the incumbent retailer does not have incentives to close its established distribution outlets and substitute them for an e-commerce channel. In this case, its decision as to how to profit from the e-commerce will not be conditioned by the cost of closing traditional outlets.

Proposition 6. Under the assumptions of non-negligible exit costs, the incumbent might choose to operate with both a traditional and an e-commerce channel.

The complete substitution of the traditional selling technology for the e-commerce, when these share many similarities in the format, might be hampered by difficulties in closing traditional retailing outlets. These difficulties derive most frequently from paying damages for contract incompleteness and reputation loss.

The above-proposed relationships are summarized in the following testable hypothesis:

Figure 1
 Factors affecting the decision of e-commerce adoption



Hypothesis 1. The incentives of a traditional retailer to operate an e-commerce channel are negatively related to the size of the entry costs and thus positively related to the level of substitutability.

According to this hypothesis, resource compatibility facilitates the e-commerce adoption. The greater the number of similarities between the traditional retailing format and the e-commerce, the lower the costs of effectively establishing an Internet channel. This conjecture contrasts with alternative explanations, which state that establishing on-line transactional capabilities is not motivated by a quest for profits, but by a desire to imitate competitors in their image of being cutting edge and technologically savvy.

Hypothesis 2. If the entry costs of adopting e-commerce are decreasing over time, the number of traditional retailers adopting e-commerce is increasing, independently of their antecedent retailing models.

This hypothesis highlights the sensitivity of retailers to technological progress related to home shopping.

Hypothesis 3. The incentives to close traditional outlets and operate with an e-commerce channel are increasing in the degree of similarities between e-commerce and the incumbent antecedent retailing model and decreasing in the size of the exit costs.

Given that the e-commerce can be used either as an additional or as a unique distribution channel, the number of relevant parameters to take into account is reduced to two: the shared similarities between the traditional retailing format and the e-commerce and the difficulties to close traditional outlets.

2.5. Empirical evidence

In this section I analyze the behavior of a group of US-based traditional retailer chains with strong brand-name recognition and I focus on the strategy with respect to e-commerce each of them has adopted. The sample represents a subset of the 80 companies studied by Morgan Stanley Investment Research (The Internet Retailing Report, 1997) when analyzing the world of Internet retail. Five of the originally studied companies were dropped out of the analysis because of mergers, acquisitions and bankruptcy, while the further reduction of the sample is due to data availability. The data was collected from publicly available sources like data bases and company web pages, while on several occasions the information was obtained directly from a company representative.

The observations are classified into eight retailing categories following previous research (The Internet Retailing Report, 1997). These are mall-based specialty apparel, off-price specialty apparel/strip center, department stores, footwear retailers, discount stores, direct marketers, hardlines and niche retailers. This classification divides retailers according to their selling technology and consequently to the type of merchandise matching it. Several authors, among them Alba *et al.* (1997), have discussed at length the search, experience, and credence attributes of the products as determinants for their suitability to a particular retailing channel. The approach adopted here is to take product attributes and their suitability to different kinds of distribution channels as given and does not discuss consumer behavior issues in detail.

By focusing on the strategy dimension, the theoretical model presented above suggests that those retail business formats, that resemble most the e-commerce and whose clients are used to distant purchase, are more likely to have online transactional capability. In this

respect, direct marketers and retailers with catalog operations have two advantages, when compared to retailers that do not have experience in direct sales (*NoDirectExperience*). On the one hand, their clients are used to distance purchase, and on the other, they can easily adopt the e-commerce, integrating the new technology with their traditional operations at low cost. These advantages place direct marketers and retailers with experience in catalog operations in a strong position to adopt online retailing. In fact, as Table 1 shows, these types of retailers are the fastest to move online.

In 2001 most retail groups in the sample had average online transaction experience of more than two years. However, off-price specialty apparel retailers choose predominantly a no-entry strategy, while direct marketers have considerably older online operations (5 years) than the next coming groups of hardlines, niche, and mall-based specialty apparel retailers (3 years). Off-price specialty apparel centers are probably the most poorly positioned retailer group to take the advantages that the e-commerce offers. They are already focused on a low-cost strategy that can be only marginally reinforced by online operations, and they lack experience with distance selling. Direct marketers are positioned at the other end of the spectrum. They are specialized in distant selling and the e-commerce is a cheap and close substitute for their traditional technology. As expected, direct marketers are the first to adopt e-commerce. Between these two extremes the rest of the retailer groups follow a stable pattern of e-commerce adoption. Retailers that have experience with catalog sales (department stores, hardlines, niche and mall-based specialty apparel retailers) have older online transactional capability than retailers that have no experience with catalog sales (discount stores and footwear retailers).

Table 1

Selling techniques and age of online operations

Average age of online operations per retailing group in 2001	No experience with catalogue operations	Experience with catalogue operations
0 years	Off-price centers	
1.44 years	Discount stores	
2.67 years	Footwear retailers	
3 years		Department stores/ Mall-based specialty apparel
3.17 years		Niche
3.36 years		Hardlines
5.43 years		Direct marketers

degree of substitutability



A direct test of the above-proposed hypotheses implies measuring the degree of substitutability θ between the antecedent business model and the e-commerce, which poses some measurement challenges. By now, researchers have gone as far as using a dummy variable when controlling for the presence of direct-to-consumer fulfillment systems (Lasry, 2001). In this chapter I use factor analysis methodology to test the importance of the compatibility between the retailers' antecedent business model and the e-commerce. Factor analysis, as a multivariate method, applicable to both continuous and discrete data extracts subsets of observed variables correlated among them and uncorrelated with other variables.⁶ It is useful for the purpose of the argument, because it produces estimation of latent-variable values, in this case θ , that underline the relationship between observed and directly measurable variables. The set of variables included in the empirical analysis and their descriptive statistics are presented in Table 2.

Table 3 contains the results of principal component factor analysis with varimax rotation. Varimax rotation is the most widely used orthogonal rotation method, which maximizes the variance of the squared loadings for each factor and polarizes them, so that it is easier to identify factors with specific variables (Hamilton, 1992). Four factors are extracted applying the standard criteria of eigenvalue greater than 1 and need of interpretability of factors. Because of their weak loadings on any single factor, the variables *FootwearS*, *Off-priceS* and *NicheS* are taken out of the factor analysis.

⁶ I use principal components method of factor extraction. As there is not a well-developed theoretical framework in favor of one or another method, I use principal components because it provides more robust results than the alternative maximum-likelihood factor analysis (Hamilton, 1992).

Table 2

Definition and descriptive statistics of all variables

<i>Variable names</i>	<i>Explanation</i>	<i>Mean</i>	<i>Standard deviation</i>	<i>Maximum</i>	<i>Minimum</i>
<i>Dependent variables</i>					
<i>Online95</i> ^a	Dummy variable equal to 1 if a retailer has online operations in 1995, 0 otherwise.	0.09	0.28	1	0
<i>Years_on_line</i>	Years of e-commerce practice measured since 1995 to 2001.	2.98	2.09	7	0
<i>Independent variables</i>					
<i>Age</i>	Years since incorporation.	32.63	26.61	98	4
<i>DepartmentS</i>	Dummy variable equal to 1 if a retailer is a department store, 0 otherwise.	0.14	0.34	1	0
<i>DiscountS</i>	Dummy variable equal to 1 if a retailer is a discount store, 0 otherwise.	0.13	0.33	1	0
<i>FootwearS</i>	Dummy variable equal to 1 if a retailer is a footwear store, 0 otherwise.	0.08	0.28	1	0
<i>HardlineS</i>	Dummy variable equal to 1 if a retailer is a hardline store, 0 otherwise.	0.20	0.40	1	0
<i>Inertia</i>	Scores of factor analysis of standardized <i>Department</i> , <i>TotalAssets</i> and <i>Age</i> .	0	1	2.62	-1.45
<i>Mall-basedS</i>	Dummy variable equal to 1 if a retailer is a mall-based specialty apparel store, 0 otherwise	0.12	0.33	1	0
<i>NicheS</i>	Dummy variable equal to 1 if a retailer is a niche store, 0 otherwise.	0.18	0.39	1	0
<i>NoDirectExperience</i>	Dummy variable equal to 1 if a retailer is not a direct marketer or has no catalog operations.	0.51	0.50	1	0
<i>Off-priceS</i>	Dummy variable equal to 1 if a retailer is an off-price store, 0 otherwise.	0.04	0.20	1	0
<i>Profitability</i>	Scores of factor analysis of standardized <i>Mall-based</i> and <i>ProfitMargin</i> .	0	1	1.64	-2.76
<i>ProfitMargin</i>	Profit margin in the year before online adoption, or in 2001 if no adoption.	6.50	4.50	17.4	-2.8
<i>Scope</i>	Scores of factor analysis of standardized <i>Hardline</i> and <i>International</i> .	0	1	2.49	-1.47
<i>Stores</i>	Log number of commercial outlets in 2001.	2.57	0.90	3.66	0
<i>Substitutability</i>	Scores of factor analysis of standardized <i>CatalogDirect</i> , <i>Stores</i> and <i>Discount</i> .	0	1	1.93	-2.12
<i>TotalAssets</i>	Log value of total assets in the year before online adoption, or in 2001 if no adoption.	6.04	0.71	7.69	4.44
<i>International</i>	Dummy variable equal to 1 if a retailer has operations outside USA, 0 otherwise.	0.51	0.50	1	0

^a Variables *Online96*, *Online97*, *Online98*, *Online99*, *Online00* and *Online01* take value of one when a retailer has e-commerce operations in a given year, and zero otherwise.

Table 3

Rotated factor loadings and communalities. Varimax rotation

Variable	Factor 1	Factor 2	Factor 3	Factor 4	Communality
<i>Age</i>	0.76	-0.05	-0.07	0.22	0.64
<i>DepartmentS</i>	0.76	0.22	-0.26	-0.04	0.70
<i>TotalAssets</i>	0.73	-0.27	0.50	-0.01	0.86
<i>NoDirectExperience</i>	-0.11	-0.76	-0.18	0.05	0.63
<i>DiscountS</i>	0.05	-0.72	-0.08	0.09	0.53
<i>Stores</i>	0.15	-0.65	0.44	-0.42	0.82
<i>HardlineS</i>	-0.02	0.08	0.71	0.33	0.63
<i>International</i>	0.20	0.23	0.63	0.28	0.56
<i>Mall-basedS</i>	-0.19	0.16	-0.07	-0.76	0.65
<i>ProfitMargin</i>	0.01	-0.07	0.01	-0.76	0.58
Variance	1.81	1.74	1.46	1.59	6.60
% Var.	0.18	0.17	0.14	0.16	0.66

Factor 1 captures most of the data variation and is determined by *TotalAssets*, *Age* and *DepartmentS* variables. *Age* together with the size proxy, *TotalAssets*, is frequently used to explain conservatism and rigidities in incumbents' behavior (Amburgey *et al.*, 1993; Delacroix and Swaminathan, 1991; Hannan and Freeman, 1984). Thus, the dimension defined by Factor 1 is best approximated by what researchers have called organizational *Inertia*.

Factor 2 (*Substitutability*) captures the dimension determined by lack of experience in direct sales (*NoDirectExperience*) and the retailing model of discount stores (*DiscountS*), which is based on dense networks of numerous stores (*Stores*). It can be interpreted as a good approximation of the degree of substitutability θ between the characteristics of e-commerce and the traditional store-based retailing model.

Factor 3 (*Scope*) captures predominantly the local or international nature of retailing operations, while Factor 4 defines the *Profitability* of the traditional business model.

Reduced dimensionality, and more importantly, indirect measurement of the degree of substitutability θ allows for testing the validity of H1 and H2. Table 4 contains the results of the regression analysis. The probability of adopting online transactional capabilities between 1995 and 2001 is tested using a binary logistic regression with a dependant variable equal to 1 if the retailer had such operations, and 0 otherwise. In all but one regression equations the *Substitutability* variable has a positive and statistically significant effect on the odds of adopting e-commerce. The evidence of such a strong and persistent effect gives support to H1 stating that the similarities between the e-commerce and the incumbent's ancestral retailing model, that is, high value of *Substitutability*, increase the probability of online presence. An alternative test of the antiquity of the online operations

(*Years_on_line*) confirms the robustness of the relationship implied by H1. Moreover, independently of the *Substitutability* effect, the probability of adopting e-commerce is increasing over time, and this effect can be appreciated by the statistical significance and increase in the value of the constant (CONST) over time. The existence of this effect provides support to H2, which states that the probability to adopt e-commerce is increasing over time, independently from the characteristics of the antecedent retailing model. No statistically significant effect on the e-commerce adoption is found for the *Inertia*, *Profitability* and *Scope* variables. One possible reason may be the weak reliability of two of these constructs.⁷ Cronbach alpha for *Profitability* and *Scope* is 0.43 and 0.20, respectively, while the cut-off point for acceptable internal consistency in exploratory factor analysis is 0.6 (Nunnally, 1978). Cronbach alpha of *Inertia* and *Substitutability* is 0.7 and 0.6, respectively. In order to check for possible errors of measurement and factor interpretation, I perform factor analysis with the variables that strongly correlate with the first two factors, *Inertia* and *Substitutability*, and include the rest of the variables in the subsequent regressions. Table 5 contains the rotated factor loadings (varimax rotation) and communalities and Table 6—the regression results. These confirm the robust effect of *Substitutability* on the odds to add an e-commerce channel. Again, I fail to find any impact of *Inertia* on the decision to adopt e-commerce, however I do find some effect of the *International* versus domestic profile of a company on its decision to go online. The fact that a company does business internationally has a statistically significant and positive effect on the adoption of e-commerce.

⁷ The analysis of reliability is not included in the original paper (Andonova, 2003). It has been suggested later as a robustness test of the originally reported results.

Unfortunately, given the current stage of development of e-commerce and the characteristics of the sample, H3 cannot be tested statistically. Up to now, only a few retailers have switched completely to online selling and closed their traditional outlets. The only such example in the sample is Egghead.com, which failed to manage its online operations in a profitable way and filed for bankruptcy in August 2001.

Table 4

Results of OLS and Logit regression analysis of e-commerce adoption decision

Independent variable	Years on line	Online95	Online96	Online97	Online98	Online99	Online00	Online01
<i>Inertia</i>	-0.29	-0.72	0.17	-0.19	-0.62 [†]	-0.19	-0.28	0.03
<i>Profitability</i>	0.13	0.80	0.76	0.10	-0.06	-0.16	0.29	-0.05
<i>Scope</i>	0.16	0.35	0.45	-0.02	0.06	0.06	0.15	0.98*
<i>Substitutability</i>	1.14***	1.49	2.05 [†]	1.09*	1.06**	0.99**	1.30**	1.14**
<i>FootwearS</i>	-0.03	-18.91	-18.09	0.31	-0.76	0.43	0.47	0.899
<i>NicheS</i>	0.41	-19.34	-19.06	-0.11	0.36	1.41	1.19	1.72
<i>Off-priceS</i>	-2.28*	-18.25	-17.82	-19.66	-20.06	-20.93	-22.51	-22.28
CONST	2.90***	-3.29**	-3.44**	-1.44**	-0.62	0.21	1.32**	1.23**
Log-Likelihood		-9.63	-11.31	-25.16	-28.70	-28.64	-21.13	-20.29
Pearson ^a		17.89	18.95	49.07	48.34	51.20	46.13	48.04
Godness-of-fit		(0.999)	(0.999)	(0.430)	(0.459)	(0.349)	(0.550)	(0.471)
Adjusted R ²	31.1%							
F	4.54***							
N observ.	56	56	56	56	56	56	56	56

^a p-value for the Pearson Goodness-of-Fit test in the parenthesis.[†] for p<0.1. * for p<0.05, ** for p<0.01 and *** for p<0.001.

Table 5

Rotated factor loadings and communalities. Varimax rotation

Variable	Factor 1	Factor 2	Communality
<i>Age</i>	0.78	-0.04	0.66
<i>DepartmentS</i>	0.76	0.29	0.61
<i>TotalAssets</i>	0.84	-0.32	0.80
<i>NoDirectExperience</i>	-0.26	-0.71	0.56
<i>DiscountS</i>	0.04	-0.72	0.52
<i>Stores</i>	0.27	-0.73	0.61
Variance	2.03	1.74	3.77
% Var.	0.34	0.29	0.63

Table 6

Results of OLS and Logit regression analysis of e-commerce adoption decision

Independent variable	Years on line	Online95	Online96	Online97	Online98	Online99	Online00	Online01
<i>Inertia</i>	-0.21	-0.80	0.17	-0.09	-0.55	0.00	-0.39	0.19
<i>Substitutability</i>	1.00***	1.19	1.33 [†]	0.97*	0.95*	0.96**	1.47**	0.97**
<i>FootwearS</i>	-0.25	-19.15	-18.45	0.35	-0.74	0.30	-0.28	0.78
<i>HardlineS</i>	-0.49	-0.59	-1.39	-0.41	-0.73	-1.38	-0.25	1.46
<i>International</i>	1.19*	2.61	3.16 [†]	1.17	1.58*	1.52*	0.59	1.24
<i>Mall-basedS</i>	-0.38	-20.60	-20.48	0.26	0.66	0.43	-1.35	-0.68
<i>NicheS</i>	-0.03	-20.56	-20.86	-0.40	0.07	1.02	0.45	1.45
<i>Off-priceS</i>	-2.58*	-18.62	-18.59	-19.66	-20.18	-21.34	-23.15	-22.50
<i>ProfitMargin</i>	-0.06	-0.27	-0.36	-0.07	-0.10	-0.11	-0.01	0.074
CONST	2.98***	-2.70	-2.12	-1.49**	-0.69	0.60	1.69	-0.01
Log-Likelihood		-9.63	-7.73	-24.21	-26.74	-26.17	-20.81	-21.37
Pearson ^a		13.12	14.78	53.60	49.44	51.54	43.59	49.35
Godness-of-fit		(0.999)	(0.999)	(0.206)	(0.337)	(0.266)	(0.574)	(0.341)
Adjusted R ²	32.1%							
F	3.89***							
N observ.	64	56	56	56	56	56	56	56

^a p-value for the Pearson Goodness-of-Fit test in the parenthesis.[†] for p<0.1, * for p<0.05, ** for p<0.01 and *** for p<0.001.

2.6. Concluding remarks

This chapter presents a comprehensive picture of the effect of the Internet on direct retailing from the perspective of the existing strategic, industrial organization, and marketing literature. I offer a theoretical framework and empirical evidence showing that there exists a systematic pattern in companies' decisions to go online. The main result is that the degree of substitutability between traditional and online retailing formats strongly affects the decision to engage in online retailing. The higher the degree of substitutability between the antecedent retailing model and the e-commerce, the stronger the retailer's incentives to add an e-commerce channel, thus benefiting from the low cost of online operations. The difficulty of directly measuring unobservable variables like the degree of substitutability between the retailing technologies is overcome as I build a measure of substitutability using principal component factor analysis.

The relative novelty of e-commerce puts natural limitations on the analysis and presents many fields for future research. These include (1) measuring of competitive pressures introduced by new purely online retailers; (2) studying the internal organizational changes motivated by the integration of e-commerce; (3) analyzing the transactional problems related to trust and quality assurance; (4) and examining the consumer behavior issues related to new presentation methods used in e-commerce.

2.7. Appendix

Proposition 1a. Under the assumption of negligible entry ($F \approx 0$) and exit ($E \approx 0$) costs, the incumbent retailer will always choose to add a new e-commerce channel.

Proof:

$$\text{Section 1. } \Pi_{case2}^i = \frac{[a(1-\theta)(2+\theta) + \underline{c}\theta - \bar{c}(2-\theta^2)]^2}{b(1-\theta^2)(4-\theta^2)^2} \text{ vs. } \Pi_{case3}^i = \frac{(a-\underline{c})^2}{4b}$$

$$2(a-\bar{c})(2-\theta^2) \text{ vs. } (a-\underline{c})[(4-\theta^2)\sqrt{1-\theta^2} + 2\theta]$$

$$\Pi_{case3}^i > \Pi_{case2}^i \text{ when } \theta = 0 \text{ and when } \theta = 1.$$

The above expressions are polynomials, so they are continuous functions.

Their respective partial derivatives with respect to θ are negative (for the left-hand side expression) and positive (for the right-hand side). As a result, $\Pi_{case3}^i > \Pi_{case2}^i$.

Section 2.

$$\Pi_{case2}^i = \frac{[a(1-\theta)(2+\theta) + \underline{c}\theta - \bar{c}(2-\theta^2)]^2}{b(1-\theta^2)(4-\theta^2)^2} \text{ vs.}$$

$$\Pi_{case4}^i = \frac{(a-\bar{c})[a(1-\theta) + \underline{c}\theta - \bar{c}] + (a-\underline{c})[a(1-\theta) + \bar{c}\theta - \underline{c}]}{4b(1-\theta^2)}$$

$$4[(a-\bar{c})(2-\theta^2) - \theta(a-\underline{c})]^2 \text{ vs. } (4-\theta^2)^2[(a-\bar{c})^2(1-\theta) + (a-\underline{c})^2(1-\theta) + \theta(\underline{c}-\bar{c})^2]$$

$$\Pi_{case4}^i > \Pi_{case2}^i \text{ when } \theta = 0 \text{ and when } \theta = 1.$$

Following the same reasoning as in Section 1, it follows that $\Pi_{case4}^i > \Pi_{case2}^i$.

Proposition 1b. If there exists $F(\theta)$, such that $F'(\theta) < 0$ and $F(1) = 0$, then

- (i) it is not always optimal for the incumbent to add a new e-commerce channel.

(ii) the incentives to adopt e-commerce depend on the level of substitutability θ .

Generally, the greater the substitutability, the stronger the incentives to adopt e-commerce.

Proof:

$$\text{Section 1. } \Pi_{case3}^i = \frac{(a-c)^2}{4b} - F(\theta)$$

From the proof of Proposition 1a we know that

$$\frac{[a(1-\theta)(2+\theta) + c\theta - \bar{c}(2-\theta^2)]^2}{b(1-\theta^2)(4-\theta^2)^2} < \frac{(a-c)^2}{4b}$$

$$\text{Define the function } X(\theta) \text{ such that, } \frac{(a-c)^2}{4b} - \frac{[a(1-\theta)(2+\theta) + c\theta - \bar{c}(2-\theta^2)]^2}{b(1-\theta^2)(4-\theta^2)^2} = X(\theta)$$

Note that $X'(\theta) > 0$

If there exists $0 < \tilde{\theta} < 1$ such that, $F(\tilde{\theta}) = X(\tilde{\theta})$, then for $\forall \theta > \tilde{\theta}$, the incumbent will adopt e-commerce; and for $\forall \theta < \tilde{\theta}$, the incumbent will not adopt.

Indeed, note that if $\theta > \tilde{\theta}$ then $F(\theta) < X(\theta)$. As a result,

$$\frac{(a-c)^2}{4b} - F(\theta) > \frac{[a(1-\theta)(2+\theta) + c\theta - \bar{c}(2-\theta^2)]^2}{b(1-\theta^2)(4-\theta^2)^2}.$$

Section 2.

$$\Pi_{case2}^i = \frac{[a(1-\theta)(2+\theta) + c\theta - \bar{c}(2-\theta^2)]^2}{b(1-\theta^2)(4-\theta^2)^2} \text{ vs.}$$

$$\Pi_{case4}^i = \frac{(a-\bar{c})[a(1-\theta) + c\theta - \bar{c}] + (a-c)[a(1-\theta) + \bar{c}\theta - c]}{4b(1-\theta^2)} - F(\theta)$$

Using simulations we find that if $F(0) > \frac{(a-c)^2}{4b}$, then there exists $\tilde{\theta}$ such that,

for $\forall \theta > \tilde{\theta}$, the incumbent will adopt e-commerce and for $\forall \theta < \tilde{\theta}$, the incumbent will

choose not to adopt e-commerce. In addition, if $F(0) < \frac{(a-c)^2}{4b}$, then there exist $\hat{\theta}$ and

$\hat{\theta}$ such that for $\forall \theta \in (\hat{\theta}; \hat{\theta})$, the incumbent will not adopt e-commerce and for $\theta < \hat{\theta}$ or

$\theta > \hat{\theta}$ the retailer will adopt e-commerce.

Proposition 4. Under the assumptions of negligible exit ($E \approx 0$) costs, there exists a

critical level of technological substitutability, $\theta = \frac{a-\bar{c}}{a-\underline{c}}$, above which the incumbent will

choose to close its traditional outlets and to sell through the online channel only.

Proposition 5. There exists a critical level of technological substitutability, $\theta = \frac{a-\bar{c}}{a-\underline{c}}$,

below which the incumbent will choose to operate with both a traditional and an e-commerce channel.

Proof of Proposition 4 and Proposition 5:

$$\Pi_{case4}^i = \frac{(a-\bar{c})[a(1-\theta) + \underline{c}\theta - \bar{c}] + (a-\underline{c})[a(1-\theta) + \bar{c}\theta - \underline{c}]}{4b(1-\theta^2)} \text{ vs. } \Pi_{case3}^i = \frac{(a-\underline{c})^2}{4b}$$

$$\frac{a-\bar{c}}{a-\underline{c}} \text{ vs. } \theta$$

When $\theta \in \left(0; \frac{a-\bar{c}}{a-\underline{c}}\right)$, $\Pi_{case4}^i > \Pi_{case3}^i$ and when $\theta \in \left(\frac{a-\bar{c}}{a-\underline{c}}; 1\right)$, $\Pi_{case4}^i < \Pi_{case3}^i$.

3. Can Progress Be Resistant to Bad Institutions? The Case of ICT⁸

In this chapter, I empirically study the determinants of worldwide Internet and cellular phone penetration levels since 1980. I show that cross-country differences in the use of information and communication technologies (ICT) are to a considerable extent due to differences in the investment climate, which determine the incentives to adopt technologies based on site-specific assets. Using three measures of quality of the institutional environment, I find that the diffusion of Internet access is strongly dependant on the quality of the institutional environment. However, cellular phone telephony, based on less site-specific re-deployable modules is less dependent on institutional parameters. I argue that the existence of technologies that are immune to institutional underdevelopment is an opportunity for the investment community and can contribute to a better understanding of the constraints and opportunities for growth.

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3.1. Introduction

Many argue that telecommunications, as a mechanism for reducing information asymmetry, are a major stimulus for market development and economic growth. As with most technologies, both demand side (such as GDP per capita, literacy rate, and price) and supply side factors (such as security of property rights, development of financial markets, and tax policy) affect the diffusion pattern of information and communication technologies (ICT). The individual effects of these forces prove hard to disentangle.

Empirical research has shown that ICT development facilitates growth and that economic progress spurs investments in ICT (Garbade and Silber, 1978; DuBoff, 1980; Hardy, 1980; Nathaniel, 1984; Norton 1992). However, this virtual circle takes place only when other complementary factors, many of which are institutionally determined, are present. In fact, the effect that technology can have on economic growth seems to have strong limitations unless technological deployment takes place in a supportive institutional environment. This result might be of little comfort because in most developing and transition countries institutional reforms have been so difficult to carry out. The changing technological parameters of ICT, however, might provide ways to overcome institutional underdevelopment and spur economic growth in places with a deficient business climate.

In this chapter, I offer a reassessment of the established relationship between ICT diffusion, institutions and growth in light of the altered technological parameters of present-day information technology. I argue that differences in ICT use between rich and poor nations in the Internet age are largely a product of institutional differences, of which

differences in adoption of information technology, frequently called digital divide, are only a symptom. Using three measures of the quality of the investment climate, I show that cellular telephony, based on less site-specific re-deployable modules, is less dependent on institutional parameters. Thus, it can be expected that wireless technology has the potential to moderate cross-country differences in the usage of ICT and make it easier for market dynamics to endogenously change institutions. As a result, mobile communications are seen as a paradigm for a viable business model in an environment of relatively poor property rights protection.

The chapter begins with a brief discussion about the digital divide and an exploration of its determinants. Next, I present three hypotheses about the relationship between information and telecommunication technology and the institutional environment. I argue that, in a cross-country setting, Internet usage is largely conditioned by the size of the fixed-line network and hence, by the institutional environment. Wireless telephony, in contrast, due to lower initial investments and re-deployable assets, is less prone to hold-up problems and is less institutionally dependent. Finally, I discuss the implications of the results for economic growth and endogenous institutional change.

3.2. Determinants of the digital divide

Digital divide is defined as the difference between those with permanent and effective access to new information and telecommunication technologies and those with none (Powell, 2001; Wilson III, 2001). Digital divide can occur both at national level, among different social groups (Hoffman, Novak and Schlosser, 2000), and at international level, among different countries. Concerns about international digital divide have given rise to

numerous studies, whose goal is to facilitate the use of new information and communication technology and help breach the gap (Kenny, 2001; Roycroft and Anantho, 2003; Wilson III and Wong, 2003).

As a general rule, researches have focused on socio-cultural and economic forces behind the digital divide, assuming that these might produce persistent malleable effects on the international income distribution and the growth possibilities of the lagging countries. Recently this widely-held view has been challenged, as some analysts argue that in *relative terms* developing countries show faster rates of growth in network development (Fink and Kenny, 2003). Even though developing countries might be catching up in terms of per dollar of GDP telephone infrastructure and Internet use, this does not prove that the digital divide is going to disappear. First, ICT are characterized by network economies, where *absolute* numbers matter, and second, the *proper* use of these technologies depends on complementary factors like education level and infrastructure. Consequently, understanding the factors, which contribute to different levels of technology diffusion, remains the key for formulating viable policies for developing nations.

One possible reason for investment differences in ICT is that the positive effect of these is not easily recognized. The positive externalities generated are not immediately evident, thus making unclear the short-term benefits of such investments. For example, for many years economists failed to find a relationship between investments in information technology and productivity, and defined this phenomenon as a “productivity paradox” (Berndt and Morrison, 1995). Recently this relationship has been empirically confirmed (Basu, Fernald, Oulton and Srinivasan, 2003; Brynjolfsson and Hitt, 1995; 1996; Dunne, Foster, Haltiwanger and Troske, 1999) and non-linearities in it became evident.

A second possible reason for the existence of the digital divide is that, whenever governments are directly involved in investments, they have limited resources to satisfy competing ends. If countries differ in their priorities for improvements in information and telecommunication facilities, their investment decisions contribute to cross-country differences. Moreover, if governments are concerned about maintaining an oppressive and non-democratic status quo, they might intentionally limit the diffusion of information and telecommunication technologies (Buchner, 1988).

Thirdly, people in different countries might have different demands for ICT. Factors like wealth, price levels, experience with complementary technologies (for example a PC), size of the technological network, and various cultural and social dimensions (see Gefen and Straub [1997] for a discussion of the effect of gender differences on technology diffusion) might affect the way people perceive and consequently use ICT. For example, countries like Hong Kong or South Korea have many more mobile phone subscribers than Internet users. The increase of Internet users in Japan has been largely attributed to the introduction of i-mode, a technology that allows Internet connection from a mobile phone (ITU, 2002). On the other hand, in North America a combination of receiving-party-pays schemes for mobile phones, together with a monthly fee including unlimited number of local calls for fixed phones, boosted the demand for Internet connectivity at the expense of mobile phone growth (ITU, 2002). The result was a penetration rate of 26% for mobile phones, while the rates in Japan and the Scandinavian countries were 37% and 50%, respectively (The Economist, 1999). Although regulatory policies and market structure might explain differences in the penetration levels of the two technologies in roughly comparable institutional settings, differences in penetration rates across countries at

different stages of economic development are arguably due to differences in the requirements that a particular technology imposes on the receiving country.

Lastly, an additional reason for the existence of the digital divide lies in the institutional differences that guarantee security for private investments and reduce the temptation of governments to expropriate these (Henisz and Zelner, 2001; Levy and Spiller, 1996). According to this argument, differences in provision of utilities in general, and of telecommunication services in particular, stem from differences in the institutional parameters that condition the size of the investments. Under this framework, credible and effective governments provide adequate environment and property rights protection needed for the development of new information and telecommunication technologies, while nations having unbalanced, corrupt, unstable or unpredictable governments inevitably fall behind. The institutional divide, product of historic, geographic and ad-hoc factors, thus determines the growth potential of nations and their opportunities for social and economic transformation triggered by ICT. Although most evidence supports the existence of such institutional determinism, new mobile technologies might have the potential, as I argue below, to improve the future for the nations on the wrong side of the divide.

3.3. Institutional environment for telecommunications development

A well-developed line of research highlights the connection between geographic conditions, historical accidents, ad-hoc factors and institutions (Acemoglu, Johnson and Robinson, 2002; Arruñada and Andonova, 2004; Barro and McCleary, 2003; Engerman and Sokoloff, 2002). In addition, a set of comparative studies establishes empirically a

positive relationship between institutional characteristics, investment protection (La Porta, Lopez-de-Silanes, Schleifer and Vishny, 1998) and infrastructure development (Henisz and Zelner, 2001), and these in turn, are generally believed to affect development and growth. A feedback between general economic development and institutional parameters is also suggested, magnifying the effects of the initial conditions on growth. The prediction of this path-dependant framework for the future of the digital divide is that, if it is in fact institutionally determined, it is going to persist because market-supporting institutions develop over a considerable time span and are difficult to influence (Williamson, 1985).

Comparative studies together with field research on the influence of the institutional environment over the development of fixed-line telecommunications, point to the risk of expropriation, or hold-up, as the single most important institutional parameter (Henisz and Zelner, 2001; Levy and Spiller, 1996). Henisz and Zelner (2001, p. 127) define the hold-up problem as “the absence of credible commitment by the political actors at the helm of the state not to expropriate capital assets or the returns generated, [which in its turn] increases the risk associated with investment in assets that are largely sunk—i.e. that cannot be redeployed without significant loss of value and therefore have large quasi-rents”. In their analysis, investments in basic telecommunications infrastructure is a classical example of investment with a high potential for a hold-up problem, and thus very sensitive to a market-oriented, that is, respectful of private property rights, set-up. Consequently, the development of basic telecommunication services appears to be conditioned on path-dependent parameters, as institutionally guaranteed property rights, and, from this perspective, the digital divide seems unavoidable. Disruptive innovations, however, have the potential to interrupt the path-dependency loop and attenuate the impact of the institutional environment.

Mobile, and in general, wireless telephony along with the Internet are both novel communication venues and major demand drivers for telecommunication services. Although they share some features, they profoundly differ in the requirements that each imposes on the receptive institutional environment. Present day Internet connectivity and wireless telephony rely on assets of different degree of specificity and initial investment. Mobile technologies composed of less site-specific assets are less dependent on the institutional setting than technologies based on site-specific assets like fixed-line telecommunications, the latter providing the base of Internet connectivity these days⁹.

Wireless telephony has the potential to give access to information and telecommunication services in previously isolated and institutionally underdeveloped regions. It is built on cheaper and easily re-deployable infrastructure, and may achieve a high degree of connectivity in hostile institutional environments. As exemplified by the satellite link Internet service, mobile connectivity can be operational in 90 days, and by the use of high-speed wireless modems the cost of telecommunications can be reduced in half, while doubling the bandwidth (Wilson III and Wong, 2003). This technology needs less investments than fixed-lines communication technology, the latter still being the most common way the Internet enters the houses of today's users. In addition, mobile networks are constructed at a faster pace than fixed-line networks; need fewer subscribers in order to reach minimum efficient scale, and their modules are mobile and easily transportable.¹⁰ To sum up, the difference between fixed-line and wireless telecommunications networks from

⁹Site-specific assets are one type of specific assets, the other types being physical, human and dedicated assets. Site-specific assets are developed in the context of specific transactions and remain immobile as their relocation costs are great. Parties to a transaction involving site-specific assets operate in a bilateral exchange relation for the useful life of the assets (Williamson, 1985).

¹⁰ For example, after the 1998's earthquake in Honduras mobile base stations were deployed in a matter of days (The Economists, 1999).

an institutional standpoint lies in the size of the sunk costs and the associated investment risk. From this perspective, the insight that business opportunities in telecommunications in laggard countries are very risky because of possible expropriation by the government, probably fails to describe the current state of nature because it does not consider the reduced institutional requirements characterizing wireless telephony. Taking into account the previous argument, I conjecture the following relationships between investment-friendly climate and ICT diffusion:

Hypothesis1: Investment-friendly institutional environment, characterized by lower investor risks and good property rights protection, has a positive effect on ICT diffusion.

Hypothesis2: Investment-friendly institutional environment characterized by lower investor risks has a stronger positive impact on the diffusion of those ICT, which rely more heavily on site-specific assets and require larger up-front investments.

Hypothesis3: Investment-friendly institutional environment characterized by lower investor risks has a weaker positive impact on the diffusion of those ICT, which rely more heavily on easily transportable and re-deployable modules.

3.4. Key variables

To test empirically the above-hypothesized relationships, I study the impact that institutional variables have on the penetration rate of (1) per capita main telephone lines in operation (*Main Lines*), (2) per capita number of computers in an economy that are directly linked to the worldwide Internet network (*Internet Hosts*), (3) estimated per capita number of Internet users (*Internet Users*) and (4) per capita cellular telephone subscribers (*Cellular Phone Subscribers*). The underlying assumption is that the diffusion of those ICT, which

rely heavily on site specific assets and require larger up-front investments like deployment of basic infrastructure and provision of Internet connectivity, will show higher dependence on institutional variables than technologies like cellular telephony, which are built on mobile and re-deployable modules.

I estimate several reduced-form equations for ICT adoption rates including institutional variables (*Civil Liberties, POLCON, Political Rights*) and demand side controls for infrastructure, prices (*Business Charge, Business Subscription, Cellular Charge, Cellular Subscription, Cost of a 3-min call, Main Lines, Personal Computers, Residential Charge, Residential Subscription*), demographics (*Illiteracy, Urban Population*) and economic development (*GDP per capita*).

The data for this study has been collected for five-year periods between 1980 and 2000 for 190 countries mainly from the World Bank and the International Telecommunication Union (ITU) databases.

Table 1

Variable names, definitions and sources

Variable	Variable description	Source
<i>Business Charge</i>	Business telephone connection charge (US\$)	ITU
<i>Business Subscription</i>	Business telephone monthly subscription (US\$)	ITU
<i>Cellular Charge</i>	Cellular connection charge (US\$)	ITU
<i>Cellular Subscription</i>	Cellular monthly subscription (US\$)	ITU
<i>Cellular Phone Subscribers</i>	Cellular mobile telephone subscribers divided by population.	ITU
<i>Civil Liberties</i>	The inverse of the score on Civil Liberties originally ranging from 1 to 7.	Freedom House
<i>Civil Liberties(Res)</i>	Variance of <i>Civil Liberties</i> unexplained by <i>Latitude</i> and <i>GDP per capita₋₁(Res)</i> .	
<i>Cost of a 3 min call</i>	Cost of a local 3 minute call (peak rate) (US\$)	ITU
<i>GDP per capita₋₁</i>	5-year lag of <i>GDP per capita</i> .	
<i>GDP per capita₋₁(Res)</i>	Variance of <i>GDP per capita₋₁</i> unexplained by <i>Latitude</i>	
<i>GDP per capita</i>	Gross domestic product divided by midyear population in constant 1995 US\$.	WDI
<i>GDP per capita(Res)</i>	Variance of <i>GDP per capita</i> unexplained by <i>Latitude</i> , <i>GDP per capita₋₁(Res)</i> , <i>POLCON(Res)</i> , <i>Urban Population(Res)</i> , <i>Illiteracy(Res)</i> .	
<i>Illiteracy</i>	Illiterate people aged 15 and above as a percentage of total population aged 15 and above.	WDI
<i>Illiteracy(Res)</i>	Variance of <i>Illiteracy</i> unexplained by <i>Latitude</i> , <i>GDP per capita₋₁(Res)</i> , <i>POLCON(Res)</i> and <i>Urban Population(Res)</i> .	
<i>Internet Hosts</i>	Number of computers in an economy that are directly linked to the worldwide internet network divided by population.	ITU
<i>Internet Hosts(Res)</i>	Variance of <i>Internet Hosts</i> unexplained by <i>Latitude</i> , <i>GDP per capita₋₁(Res)</i> , <i>GDP per capita(Res)</i> , <i>POLCON(Res)</i> , <i>Urban Population(Res)</i> , <i>Illiteracy(Res)</i> and <i>Main Lines(Res)</i> .	
<i>Internet Users</i>	Estimated number of Internet users divided by population.	ITU
<i>Latitude</i>	The absolute value of the latitude of the country, scaled to take values between 0 and 1.	La Porta <i>et al.</i> (1999)
<i>Main Lines</i>	Main telephone lines in operation divided by population.	ITU
<i>Main Lines(Res)</i>	Variance of <i>Main Lines</i> unexplained by <i>Latitude</i> , <i>GDP per capita₋₁(Res)</i> , <i>GDP per capita(Res)</i> , <i>POLCON(Res)</i> , <i>Urban Population(Res)</i> , <i>Illiteracy(Res)</i> .	
<i>Personal Computers</i>	Number of personal computers in use in a country divided by population.	ITU
<i>Personal Computers(Res)</i>	Variance of <i>Personal Computers</i> unexplained by <i>Latitude</i> , <i>GDP per capita₋₁(Res)</i> , <i>GDP per capita(Res)</i> , <i>POLCON(Res)</i> , <i>Urban Population(Res)</i> , <i>Illiteracy(Res)</i> and <i>Main Lines(Res)</i> .	

<i>POLCON</i>	POLCONIII	POLCON data set
<i>POLCON</i> ₋₁	5-year lag of <i>POLCON</i> .	
<i>POLCON(Res)</i>	Variance of <i>POLCON</i> unexplained by <i>Latitude</i> and <i>GDP per capita</i> ₋₁ (<i>Res</i>).	
Δ <i>POLCON(Res)</i>	Variance of <i>POLCON(Res)</i> unexplained by <i>POLCON</i> ₋₁ .	
<i>Political Rights</i>	The inverse of the score on Political Rights originally ranging from 1 to 7.	Freedom House
<i>Political Rights(Res)</i>	Variance of <i>Political Rights</i> unexplained by <i>Latitude</i> and <i>GDP per capita</i> ₋₁ (<i>Res</i>).	
<i>Residential Charge</i>	Residential telephone connection charge (US\$).	ITU
<i>Residential Subscription</i>	Residential monthly telephone subscription (US\$).	ITU
<i>Urban Population</i>	Urban population as a percentage of total population.	WDI
<i>Urban Population(Res)</i>	Variance of <i>Urban Population</i> unexplained by <i>Latitude</i> and <i>GDP per capita</i> ₋₁ (<i>Res</i>) and <i>POLCON(Res)</i> .	

Although the ITU database is the only large-scale data source on ICT for the last several years, it has some limitations: first, the number of personal computer reported in it may understate the real use of computers in countries, where mainframe computers are prevalent; and second, given the methodology with which the number of Internet users is estimated, the Internet use may be understated in developing countries (Chinn and Fairlie, 2004).

The data on economic and demographic variables is from the World Bank's World Development Indicators database. I also use institutional variables from the Freedom House Scores and the POLCON 2002 database. As these institutional variables are central to the present argument, I discuss them in detail.

POLCON captures the quality of the country's institutions and, in particular, the political system of a country, in a simplified and internationally comparable way. It is taken from POLCON 2002 database, ranges from 0 to 1 and represents a "structurally derived and internationally comparable measure of the degree of constraints on policy change" (Henisz, 2000). Drawing from political science databases, the index represents a measure of institutional hazards, taking into account the number of veto points on a policy change and the homogeneity of preferences of political players (Henisz, 2000). The *POLCON* index is calculated for five-year periods between 1960 and 2002 and is a measure of how securely investors' interests are protected by a given polity.

In addition, I use *Political Rights* and *Civil Liberties* variables in order to check the robustness of the hypothesized relationship between the quality of the institutional environment, when measured by POLCON, and the ICT penetration rates. Both *Political Rights* and *Civil Rights* can be used as proxies for investment and more generally property rights protection, as these usually show strong positive correlation. The different

methodology, by which these two indices are created, when compared to POLCON, makes them suitable for a robustness check.

PoliticalRights and *CivilLiberties* are measures of political freedom and civil liberties, respectively, and represent the country scores provided by the Annual Freedom in the World for 2000-2001. They reflect survey results obtained by the Freedom House and are indicators of the quality of institutions shaping the political and social environment. As originally provided, both of these indices range from 1, implying a high level of political rights and civil liberties, to 7, indicating their absence. A more natural interpretation of the empirical results requires a transformation of X^{-1} of the original measures, so that the higher values of *Political Rights* and *Civil Liberties* should be interpreted as an indication for higher degree of political freedom and civil liberties. I present the empirical test using *Political Rights* and *Civil Liberties* in the appendix to the paper.

Dependent variables

Main Lines are per capita telephone lines connecting the subscriber's terminal equipment (telephone set) to a public switched network, which have a dedicated part in the telephone exchange equipment (ITU).

Internet Hosts are per capita computers in an economy that are directly linked to the worldwide Internet network. This measure is based on the country code in the host address and thus may not correspond to the actual physical location (ITU).

Internet Users is per capita estimated number of Internet users based on the reports of Internet Access Provider subscriber counts or calculated by multiplying the number of Internet hosts by an estimated multiplier (Chinn and Fairlie, 2004).

Cellular Phone Subscribers represents per capita users of portable telephone subscribing to an automatic public mobile telephone service, which provides access to the

Public Switched Telephone Network (PSTN) using cellular technology. This can include analogue and digital cellular systems. Subscribers to fixed wireless, public mobile data services, or radio-paging services are not included (ITU). Although optimally I should have used *wireless* telephone subscribers for testing the hypotheses, I am using *Cellular Phone Subscribers* as a proxy because of data availability. This said, however, it should be kept in mind that the proxy variable might in some cases provide a considerably understated figure of the real penetration of the wireless telephony. Although this is not a severe problem in the present state of telecommunications development, it is likely to present more serious limitations for future empirical research.

Control variables

The literature has offered mixed evidence about the importance of competitive markets as well as other variables affecting the demand for telecommunications services (Buse, 2000; Doyle and Smith, 1998; Guillén and Suárez, 2001). I have included many of these variables as controls.

First, I include an extensive list of price variables in the regression equations. The price variables can be broadly divided into two groups: those that measure the access price of telephony (*Business Subscription, Cellular Subscription, Residential Subscription*) and those that measure the price of use (*Business Charge, Cellular Charge, Cost of a 3 min call, Residential Charge*). As a general trend, I find that access prices have some statistical affect on the diffusion rates of information technologies, while the price of use has none.

Secondly, I use as a control variable the percentage of people ages 15 or above who cannot with understanding read and write a short, simple statement of their everyday life (*Illiteracy*). I do this, because an important factor for technology adoption is the degree of knowledge and training needed for its proper use. In a study related to Internet penetration

Anthony Wilhelm (2000) reports that education is stronger determinant of Internet connectivity than any other traditional socio-economic indicator. A number of studies have found positive effect of human capital on the penetration rate of ICT, however, researchers have not agreed about which is the best way to measure human capital (years of schooling or illiteracy rate, for example). As in the majority of studies, I find that my measure of human capital is a strong predictor for information technology adoption.

Thirdly, I use *Urban Population* as a measure of the percentage of the total population that is urban, given that differences in urbanization might be related to differences in infrastructure development.

Unlike any other study on the determinants of the ICT, I have included as a control variable the absolute latitude of a country (*Latitude*). Absolute latitude has been found to affect both GDP per capita (Theil and Galvez, 1995; Hall and Jones, 1999; Irwin and Tervio, 2002) and its growth rate. (Sala-i-Martin, 1997a; 1997b). In addition, these effects are shown to be robust to differences in institutional environment (Zuleta, 2003). The inclusion of absolute latitude as a control variable makes a much-needed connection between the latest advancement in the development literature and ICT diffusion. The empirical results suggest that absolute latitude has a statistically significant effect on the adoption rate of information technologies, independent of the effect of economic and institutional development.

Lastly, I control for the English language network effect with a dummy variable, which takes value of 1 if a country has English as its national or official language, and 0 otherwise (Ethnologue, 2003). A number of authors have suggested that proficiency in English gives advantage to Internet users, and Guillén and Suárez (2001) have shown in a cross-country setting a statistically significant effect of English proficiency on the Internet

usage rate in the early years of the Internet development. The coefficient of this variable is not statistically significant at conventional levels in any of the regression equations, thus failing to show the persistence of any English language network effect. I choose not to report the coefficient of this variable in the results below.

By using ordinary least squares hierarchical regression I estimate the effect of the institutional environment on the equilibrium penetration rate of (1) per capita main telephone lines in operation (*Main Lines*), (2) per capita number of computers in an economy that are directly linked to the worldwide Internet network (*Internet Hosts*), (3) estimated per capita number of Internet users (*Internet Users*) and (4) per capita cellular telephone subscribers (*Cellular Phone Subscribers*) controlling for several socio-economic variables. Hierarchical regression of the following form is used to residualize variable influence in data with multicollinearity problems:¹¹

$$(1) \text{Log}(GDP \text{ per capita}_{.1}) = \alpha_1 + \beta_1 \log(\text{Latitude}) + \varepsilon_1,$$

where $\varepsilon_1 = GDP \text{ per capita}_{.1}(\text{Res})$

$$(2) \text{POLCON} = \alpha_2 + \beta_2 \log(\text{Latitude}) + \beta_3 \varepsilon_1 + \varepsilon_2,$$

where $\varepsilon_2 = \text{POLCON}(\text{Res})$

$$(3) \text{Log}(\text{Urban Population}) = \alpha_3 + \beta_4 \log(\text{Latitude}) + \beta_5 \varepsilon_1 + \beta_6 \varepsilon_2 + \varepsilon_3,$$

where $\varepsilon_3 = \text{Urban Population}(\text{Res})$

$$(4) \text{Log}(\text{Illiteracy}) = \alpha_4 + \beta_7 \log(\text{Latitude}) + \beta_8 \varepsilon_1 + \beta_9 \varepsilon_2 + \beta_{10} \varepsilon_3 + \varepsilon_4,$$

where $\varepsilon_4 = \text{Illiteracy}(\text{Res})$

$$(5) \text{Log}(GDP \text{ per capita}) = \alpha_5 + \beta_{11} \log(\text{Latitude}) + \beta_{12} \varepsilon_1 + \beta_{13} \varepsilon_2 + \beta_{14} \varepsilon_3 + \beta_{15} \varepsilon_4 + \varepsilon_5,$$

¹¹ A model of simultaneous equations has been rejected as an empirical method because of the no multicollinearity assumption (Tacq, 1997).

where $\varepsilon_5 = \text{GDP per capita(Res)}$

$$(6) \text{Log(Main Lines)} = \alpha_6 + \beta_{16} \log(\text{Latitude}) + \beta_{17}\varepsilon_1 + \beta_{18}\varepsilon_2 + \beta_{19}\varepsilon_3 + \beta_{20}\varepsilon_4 + \beta_{21}\varepsilon_5 + \varepsilon_6,$$

where $\varepsilon_6 = \text{Main Lines(Res)}$

$$(7) \text{Log(Internet Hosts)} = \alpha_7 + \beta_{22} \log(\text{Latitude}) + \beta_{23}\varepsilon_1 + \beta_{24}\varepsilon_2 + \beta_{25}\varepsilon_3 + \beta_{26}\varepsilon_4 + \beta_{27}\varepsilon_5 + \beta_{28}\varepsilon_6 + \varepsilon_7,$$

where $\varepsilon_7 = \text{Internet Hosts(Res)}$

$$(8) \text{Log(Personal Computers)} = \alpha_8 + \beta_{29} \log(\text{Latitude}) + \beta_{30}\varepsilon_1 + \beta_{31}\varepsilon_2 + \beta_{32}\varepsilon_3 + \beta_{33}\varepsilon_4 + \beta_{34}\varepsilon_5 + \beta_{35}\varepsilon_6 + \beta_{36}\varepsilon_7 + \varepsilon_8,$$

where $\varepsilon_8 = \text{Personal Computers(Res)}$

As robustness checks two additional estimations have been performed using *Political Rights* and *Civil Liberties* instead of *POLCON* in equation (2). The results are presented in the appendix.

I find a strong and statistically significant effect of the institutional environment on the penetration levels of basic telephone infrastructure, Internet usage, and cellular telephony subscription (Table 2). The evidence supports the conjecture that the institutional environment, associated with lower investment risks and better property rights protection (*POLCON*) has a positive effect on the adoption rate of information technology (*Hypothesis 1*). Additional evidence about the robustness of this relationship is provided in the appendix, where two alternative measures of institutional development (*Political Rights* and *Civil Liberties*) are used. Relying on the Wald test of difference between coefficients, I test if the impact of better institutional environment is different, in this case stronger, for communication technologies using more site-specific assets (fixed-line telephony and

present-day Internet) than for communication technologies relying on less specific assets (wireless, and in this case, cellular telephony). I estimate a system of regression equations and then, using the Wald test, examine if the coefficients of the POLCON variables are the same across the equations. The Wald test computes the test statistic by estimating the unrestricted regression system without imposing the coefficient restrictions specified by the null hypothesis. The null hypothesis in this case is that the coefficients of the POLCON variables are the same in each pair of equations. The Wald statistic measures how close the unrestricted estimates come to satisfying the restrictions under the null hypothesis and low p-values lead to the rejection of the null hypothesis. In eight out of ten different model specifications, the measure of the institutional environment (*POLCON*) has a stronger and statistically significant impact on the number of Internet users and hosts than on the number of cellular phone subscribers. In general, this evidence suggests that better institutional environment has stronger effect on Internet technology penetration than on cellular telephony. Contrary to the expected, however, I fail to find a distinct effect of the institutional environment on cellular and fixed-line telephony diffusion levels, although these technologies rely on assets with different degree of specificity. Eventually, I do find evidence that fixed-line and cellular telephony depend to a different extent on the quality of the institutional environment, although the relationship is subtler. Table 3 contains the results of a hierarchical regression, where the effect of initial institutional quality and its improvement are estimated separately.

The results show that the adoption levels of both fixed-line and cellular telephony are conditioned to a similar extent by the initial state of institutional development (for *Main Lines*, $POLCON_{-1}(Res) = 1.088$; for *Cellular Phone Subscribers*, $POLCON_{-1}(Res) = 1.625$; Wald test for difference between coefficients is $p = 0.201$).

Table 2

Political Constraints as Determinants of Worldwide ICT Adoption

Independent Variables	Dependent Variables							
	Main Lines		Internet Hosts		Internet Users		Cellular Phone Subscribers	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>GDP per capita_t(Res)</i>	0.946*	0.937*	1.867*	1.733*	1.311*	1.208*	1.254*	1.323*
	(0.023)	(0.023)	(0.132)	(0.118)	(0.094)	(0.067)	(0.108)	(0.059)
<i>GDP per capita(Res)</i>	0.754*	0.732*	-0.676	0.347*	-0.158	0.827*	0.339	1.334*
	(0.070)	(0.068)	(0.429)	(0.415)	(0.319)	(0.244)	(0.323)	(0.182)
<i>Illiteracy(Res)</i>	-0.495*	-0.473*	-1.131*	-0.944*	-0.988*	-0.763*	-0.785*	-0.438*
	(0.495)	(0.031)	(0.149)	(0.135)	(0.105)	(0.078)	(0.134)	(0.075)
<i>Internet Hosts(Res)</i>					0.605*	0.342*		
					(0.064)	(0.052)		
<i>Latitude</i>	0.632*	0.624*	0.716*	0.763*	0.410*	0.431*	0.547*	0.538*
	(0.029)	(0.029)	(0.150)	(0.133)	(0.110)	(0.078)	(0.114)	(0.062)
<i>Main Lines(Res)</i>			1.275*	0.591*	1.774*	0.965*	1.308*	0.565*
			(0.274)	(0.267)	(0.195)	(0.157)	(0.231)	(0.130)
<i>Personal Computers(Res)</i>			1.595*	0.494*	1.256*	0.364**		
			(0.231)	(0.272)	(0.193)	(0.159)		
<i>POLCON(Res)^{a,b}</i>	1.495*	1.294*	4.585*	3.639*	3.870*	2.877*	2.711*	1.386*
	(0.152)	(0.154)	(0.766)	(0.695)	(0.548)	(0.400)	(0.674)	(0.372)
<i>Urban Population(Res)</i>	1.262*	1.215*	1.480*	1.251*	1.551*	1.338*	0.472	0.632*
	(0.080)	(0.078)	(0.498)	(0.442)	(0.352)	(0.251)	(0.418)	(0.228)
<i>Trend</i>		0.142*		2.039*		2.458*		2.284*
		(0.029)		(0.334)		(0.221)		(0.105)
<i>Intercept</i>	-2.059*	-2.572*	-9.209*	-17.89*	-6.306*	-16.90*	-4.597*	-14.11*
	(0.063)	(0.124)	(0.313)	(1.449)	(0.224)	(0.967)	(0.244)	(0.455)
<i>Adj. R Sq.(N)</i>	0.882	0.888	0.724	0.786	0.820	0.906	0.496	0.851
	(404)	(404)	(139)	(139)	(136)	(136)	(209)	(209)

Notes: * Significant at 1% level; ** Significant at 5% level;

^a Wald test of difference between coefficients: $POLCON(Res)_{(1)} = POLCON(Res)_{(3)}$, $p = 0.000$; $POLCON(Res)_{(1)} = POLCON(Res)_{(5)}$, $p = 0.000$; $POLCON(Res)_{(1)} = POLCON(Res)_{(7)}$, $p = 0.078$; $POLCON(Res)_{(3)} = POLCON(Res)_{(5)}$, $p = 0.448$; $POLCON(Res)_{(3)} = POLCON(Res)_{(7)}$, $p = 0.066$; $POLCON(Res)_{(5)} = POLCON(Res)_{(7)}$, $p = 0.182$.

^b Wald test of difference between coefficients: $POLCON(Res)_{(2)} = POLCON(Res)_{(4)}$, $p = 0.001$; $POLCON(Res)_{(2)} = POLCON(Res)_{(6)}$, $p = 0.000$; $POLCON(Res)_{(2)} = POLCON(Res)_{(8)}$, $p = 0.814$; $POLCON(Res)_{(4)} = POLCON(Res)_{(6)}$, $p = 0.343$; $POLCON(Res)_{(4)} = POLCON(Res)_{(8)}$, $p = 0.004$; $POLCON(Res)_{(6)} = POLCON(Res)_{(8)}$, $p = 0.006$.

Table 3

The Differential Impact of the Institutional Environment on Basic Telephone Infrastructure
and Cellular Telephony

Independent Variables	Dependant Variables	
	Main Lines	Cellular Phone Subscribers
<i>GDP per capita₋₁(Res)</i>	0.958* (0.027)	1.224* (0.067)
<i>GDP per capita(Res)</i>	0.615* (0.074)	1.379* (0.202)
<i>Illiteracy(Res)</i>	-0.426* (0.033)	-0.425* (0.080)
<i>Latitude</i>	0.605* (0.029)	0.469* (0.067)
<i>Main Lines(Res)</i>		0.538* (0.132)
<i>ΔPOLCON(Res)</i>	1.008* (0.199)	0.439 (0.511)
<i>POLCON₋₁(Res)</i>	1.088* (0.164)	1.625* (0.387)
<i>Urban Population(Res)</i>	1.098* (0.085)	0.700* (0.239)
<i>Trend</i>	0.139* (0.029)	2.240* (0.105)
<i>Intercept</i>	-2.804* (0.123)	-14.371* (0.449)
<i>Adj. R Sq.(N)</i>	0.892 (394)	0.857 (205)

Fixed-line telephony, however, is on average at least twice as sensitive to improvements in the institutional environment than cellular telephony (for *Main Lines*, $\Delta POLCON (Res) = 1.008$; for *Cellular Phone Subscribers*, $\Delta POLCON (Res) = 0.439$; Wald test for $\Delta POLCON_{main\ lines} = 2\Delta POLCON_{cellular\ phone\ subscribers}$ $p = 0.902$). For the standard levels of statistical significance, improvements in the investment climate do not affect the adoption level of cellular telephony, indicating that this technology is less dependent on improvements of the institutional environment than fixed-line telephony, which relies more heavily on investments in specific assets. The economic significance of this result also deserves attention because an improvement of 0.1 in the *POLCON* index is estimated to produce an increase of 10.5% in the per capita main lines measure, while its effect on cellular telephony is statistically indistinguishable from zero. This evidence supports the claim that institutional *improvements* associated with lower investment risks and better property rights protection affect less strongly the adoption level of technologies, relying on mobile and re-deployable modules (*Hypothesis3*) than the diffusion of technologies built on site-specific assets (*Hypothesis2*).

In addition, I find that both current and past levels of economic development (*GDP per capita(Res)* and *GDP per capita.₁(Res)*) have positive and statistically significant effect on the adoption level of information technologies, where past economic performance (*GDP per capita-1(Res)*) usually produces a stronger impact for basic infrastructure and Internet adoption and weaker impact for cellular phone adoption (See Table 2, Table 4, Table 5, Table 6, and Table 7). This suggests that for fixed-line telecommunication technologies there exists an extended time lag between the moment investments are realized and the

moment they affect technology adoption levels. In cellular telephony, however, the current stage of economic development presents a stronger immediate effect, which implies that cellular telephony has a clear advantage over fixed-line technologies in increasing the short-term rates of ICT diffusion.

A second control variable, which has a distinct effect on basic infrastructure and Internet penetration than on cellular telephony, is the percentage of urban population. I find that higher urban concentration facilitates the development of fixed-line technologies to a greater extent than it helps the adoption of cellular telephony. This result supports that anecdotal evidence that many distant rural areas obtained for the first time a reliable connection to the rest of the world by using wireless technology, whose costs are less affected by network density.

Unsurprisingly, the percentage of illiterate population (*Illiteracy (Res)*) as a measure of the stock of human capital shows a strong negative effect on the diffusion of telecommunication technologies. This effect is stronger for the adoption of Internet, which requires reading and writing skills, than for the adoption of telephony, being it fixed-line or cellular. In addition, I find that the adoption of Internet technology depends on the development of basic telephone infrastructures and the number of personal computers in the economy. These complementarities between fixed-line infrastructure and Internet use are not surprising given that present-day Internet connectivity is largely dependant on the development of fixed-line networks. In the same way, the most popular access terminal to the Internet nowadays is a personal computer, converting the PC into a necessary complement to the Internet technology. Naturally, the results indicate that the number of Internet users is positively related to the number of computers connected to the World Wide Web (*Internet Hosts(Res)*).

Table 4

Political Constraints as Determinants of Worldwide ICT Adoption

Independent Variables	Dependent Variables							
	Main Lines		Internet Hosts		Internet Users		Cellular Phone Subscribers	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>Cellular Charge</i>	-0.001 (0.001)	-0.001 (0.001)	0.001 (0.001)	-0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)	-0.001 (0.001)
<i>Cellular Subscription</i>	-0.002 (0.002)	-0.004 (0.002)	-0.04** (0.016)	-0.012 (0.016)	-0.04** (0.012)	-0.007 (0.009)	-0.045* (0.009)	-0.02** (0.006)
<i>Cost of a 3 min call</i>	-3.644* (0.646)	-3.616* (0.633)	8.577** (4.476)	6.829 (4.082)	-1.412 (3.127)	-1.502 (2.250)	-1.057 (2.498)	-1.987 (1.568)
<i>GDP per capita_{t-1}(Res)</i>	0.961* (0.035)	0.944* (0.035)	1.861* (0.162)	1.718* (0.151)	1.399* (0.112)	1.278* (0.082)	1.163* (0.137)	1.187* (0.086)
<i>GDP per capita(Res)</i>	0.649* (0.107)	0.697* (0.106)	-0.311 (0.574)	0.362 (0.544)	0.257 (0.436)	0.738** (0.319)	1.198* (0.399)	1.718* (0.254)
<i>Illiteracy(Res)</i>	-0.461* (0.046)	-0.456* (0.045)	-0.915* (0.187)	-0.820* (0.171)	-1.109* (0.128)	-0.936* (0.094)	-0.543* (0.162)	-0.425* (0.102)
<i>Internet Hosts(Res)</i>					0.603* (0.083)	0.404* (0.064)		
<i>Latitude</i>	0.580* (0.036)	0.572* (0.036)	0.735* (0.183)	0.778* (0.166)	0.404* (0.126)	0.455* (0.091)	0.598* (0.111)	0.564* (0.069)
<i>Main Lines(Res)</i>			0.897* (0.344)	0.384 (0.335)	1.783* (0.237)	1.073* (0.190)	0.464 (0.276)	0.309 (0.173)
<i>Personal Computers(Res)</i>			1.523* (0.261)	0.596** (0.323)	1.136* (0.217)	0.361** (0.181)		
<i>POLCON(Res)^{a,b}</i>	1.337* (0.213)	1.265* (0.211)	3.653* (0.987)	2.992* (0.909)	3.718* (0.677)	2.779* (0.499)	0.889 (0.803)	1.591** (0.507)
<i>Urban Population(Res)</i>	1.084* (0.118)	1.087* (0.116)	1.834* (0.633)	1.238** (0.591)	2.152** (0.438)	1.464* (0.326)	0.538 (0.505)	0.926** (0.318)
<i>Trend</i>		0.173** (0.059)		1.958* (0.464)		2.423* (0.288)		2.345* (0.191)
<i>Intercept</i>	-1.800* (0.099)	-2.477* (0.252)	-8.831* (0.523)	-17.49* (2.107)	-5.806* (0.371)	-16.66* (1.317)	-2.948* (0.365)	-13.79* (0.912)
<i>Adj. R Sq.(N)</i>	0.897 (187)	0.901 (187)	0.747 (90)	0.795 (90)	0.867 (88)	0.932 (88)	0.658 (108)	0.867 (108)

Notes: * Significant at 1% level; ** Significant at 5% level;

^a Wald test of difference between coefficients: $POLCON(Res)_{(1)} = POLCON(Res)_{(3)}$, $p = 0.022$; $POLCON(Res)_{(1)} = POLCON(Res)_{(5)}$, $p = 0.001$; $POLCON(Res)_{(1)} = POLCON(Res)_{(7)}$, $p = 0.590$; $POLCON(Res)_{(3)} = POLCON(Res)_{(5)}$, $p = 0.956$; $POLCON(Res)_{(3)} = POLCON(Res)_{(7)}$, $p = 0.029$; $POLCON(Res)_{(5)} = POLCON(Res)_{(7)}$, $p = 0.007$.

^b Wald test of difference between coefficients: $POLCON(Res)_{(2)} = POLCON(Res)_{(4)}$, $p = 0.064$; $POLCON(Res)_{(2)} = POLCON(Res)_{(6)}$, $p = 0.005$; $POLCON(Res)_{(2)} = POLCON(Res)_{(8)}$, $p = 0.552$; $POLCON(Res)_{(4)} = POLCON(Res)_{(6)}$, $p = 0.837$; $POLCON(Res)_{(4)} = POLCON(Res)_{(8)}$, $p = 0.178$; $POLCON(Res)_{(6)} = POLCON(Res)_{(8)}$, $p = 0.095$.

Table 5

Political Constraints as Determinants of Worldwide ICT Adoption

Independent Variables	Dependent Variables							
	Main Lines		Internet Hosts		Internet Users		Cellular Phone Subscribers	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>Business Charge</i>	-0.001 (0.001)	-0.001 (0.001)	-0.001 (0.001)	-0.001 (0.001)	-0.001 (0.001)	-0.001 (0.001)	-0.01** (0.001)	-0.001 (0.001)
<i>Business Subscription</i>	-0.023* (0.005)	-0.023* (0.005)	0.033 (0.028)	0.009 (0.025)	0.042** (0.019)	0.026 (0.014)	0.068** (0.024)	0.031** (0.014)
<i>GDP per capita_{t-1}(Res)</i>	0.957* (0.029)	0.941* (0.028)	1.853* (0.152)	1.738* (0.134)	1.256* (0.102)	1.199* (0.073)	1.232* (0.119)	1.282* (0.066)
<i>GDP per capita(Res)</i>	0.754* (0.086)	0.799* (0.086)	-0.99** (0.484)	0.185 (0.464)	-0.117 (0.345)	0.789** (0.263)	0.149 (0.336)	1.172* (0.194)
<i>Illiteracy(Res)</i>	-0.485* (0.037)	-0.466* (0.037)	-1.102* (0.164)	-0.907* (0.146)	-1.087* (0.109)	-0.865* (0.081)	-0.764* (0.139)	-0.458* (0.079)
<i>Internet Hosts(Res)</i>					0.629* (0.065)	0.377* (0.053)		
<i>Latitude</i>	0.619* (0.034)	0.608* (0.034)	0.739* (0.165)	0.744* (0.144)	0.396* (0.110)	0.421* (0.079)	0.617* (0.115)	0.525* (0.064)
<i>Main Lines(Res)</i>			1.256* (0.336)	0.499 (0.318)	1.886* (0.225)	1.118* (0.178)	1.258* (0.264)	0.576* (0.151)
<i>Personal Computers(Res)</i>			1.621* (0.246)	0.491 (0.283)	1.162* (0.194)	0.389** (0.158)		
<i>POLCON(Res)^{a,b}</i>	1.302* (0.192)	1.207* (0.190)	4.212* (0.834)	3.402* (0.738)	3.461* (0.555)	2.743* (0.404)	1.738** (0.725)	1.524* (0.402)
<i>Urban Population(Res)</i>	1.345* (0.106)	1.328* (0.104)	0.997 (0.575)	0.942 (0.500)	1.309* (0.381)	1.202* (0.273)	0.040 (0.459)	0.634** (0.257)
<i>Trend</i>		0.179* (0.052)		2.135* (0.351)		2.275* (0.222)		2.448* (0.129)
<i>Intercept</i>	-1.785* (0.090)	-2.543* (0.238)	-9.373* (0.455)	-18.36* (1.530)	-6.652* (0.304)	-16.36* (0.973)	-4.689* (0.337)	-15.15* (0.586)
<i>Adj. R Sq.(N)</i>	0.889 (239)	0.895 (239)	0.725 (124)	0.793 (124)	0.847 (122)	0.922 (122)	0.562 (167)	0.866 (167)

Notes: * Significant at 1% level; ** Significant at 5% level;

^a Wald test of difference between coefficients: $POLCON(Res)_{(1)} = POLCON(Res)_{(3)}$, $p = 0.001$; $POLCON(Res)_{(1)} = POLCON(Res)_{(5)}$, $p = 0.001$; $POLCON(Res)_{(1)} = POLCON(Res)_{(7)}$, $p = 0.560$; $POLCON(Res)_{(3)} = POLCON(Res)_{(5)}$, $p = 0.453$; $POLCON(Res)_{(3)} = POLCON(Res)_{(7)}$, $p = 0.025$; $POLCON(Res)_{(5)} = POLCON(Res)_{(7)}$, $p = 0.059$.

^b Wald test of difference between coefficients: $POLCON(Res)_{(2)} = POLCON(Res)_{(4)}$, $p = 0.004$; $POLCON(Res)_{(2)} = POLCON(Res)_{(6)}$, $p = 0.001$; $POLCON(Res)_{(2)} = POLCON(Res)_{(8)}$, $p = 0.476$; $POLCON(Res)_{(4)} = POLCON(Res)_{(6)}$, $p = 0.433$; $POLCON(Res)_{(4)} = POLCON(Res)_{(8)}$, $p = 0.025$; $POLCON(Res)_{(6)} = POLCON(Res)_{(8)}$, $p = 0.032$.

The test of the complementarity between cellular telephony and basic telephone infrastructure produces mixed results. On the one hand, I find a robust positive relationship between the development of basic infrastructure and the number of cellular subscribers, which suggests complementarities between the two technologies and thus a possible network effect. Such complementarities between cellular telephony and fixed lines have been found in previous empirical studies (Hamilton, 2003; Gruber and Verboven, 2001). However, my results also imply that this network effect or complementarity is to some extent limited by the size of the access prices of the fixed telephony. Higher access prices for fixed-line telephony have a statistically significant positive effect on the number of cellular phone subscribers. That is, even though the two types of telephony are found to complement each other, this effect is counterbalanced by the price sensitivity of consumers: first, the higher the price for cellular subscription, the lower the number of cellular phone subscribers (*Cellular Subscription* in Table 4); and second, the higher the price of fixed-line telephony, the higher the number of consumers who prefer cellular technology (*Business Subscription* in Table 5 and *Residential Subscription* in Table 6).

In general with regard to price levels, I find robust and significant price effects on the number of cellular phone subscribers, but I fail to find such a direct relationship between price levels and Internet penetration. Moreover, it seems that the only component of telephony price that matters is the access price to the network. The price of using the network seems to have no effect on the diffusion of both the Internet and cellular telephony (*Cellular Charge* in Table 4, *Business Charge* in Table 5 and *Residential Charge* in Table 6)

As for the *Latitude* variable, I find that it has robust and statistically significant effect on technology adoption. This result suggests that geography has a persistent effect

Table 6
Political Constraints as Determinants of Worldwide ICT Adoption

Independent Variables	Dependent Variables							
	Main Lines		Internet Hosts		Internet Users		Cellular Phone Subscribers	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>GDP per capita_{t-1}(Res)</i>	0.976*	0.961*	1.774*	1.648*	1.276*	1.185*	1.234*	1.266*
	(0.027)	(0.026)	(0.149)	(0.132)	(0.104)	(0.074)	(0.118)	(0.065)
<i>GDP per capita(Res)</i>	0.809*	0.844*	-1.05**	0.122	-0.132	0.804*	0.218	1.185*
	(0.079)	(0.077)	(0.470)	(0.451)	(0.345)	(0.258)	(0.329)	(0.187)
<i>Illiteracy(Res)</i>	-0.430*	-0.417*	-1.157*	-0.968*	-1.089*	-0.877*	-0.779*	-0.478*
	(0.035)	(0.034)	(0.163)	(0.145)	(0.111)	(0.081)	(0.139)	(0.078)
<i>Internet Hosts(Res)</i>					0.619*	0.353*		
					(0.068)	(0.054)		
<i>Latitude</i>	0.613*	0.603*	0.697*	0.708*	0.383*	0.406*	0.616*	0.521*
	(0.031)	(0.030)	(0.160)	(0.139)	(0.110)	(0.077)	(0.112)	(0.062)
<i>Main Lines(Res)</i>			1.459*	0.744*	1.882*	1.169*	1.349*	0.678*
			(0.338)	(0.317)	(0.238)	(0.181)	(0.278)	(0.157)
<i>Personal Computers(Res)</i>			1.555*	0.465*	1.154*	0.372**		
			(0.241)	(0.275)	(0.195)	(0.156)		
<i>POLCON(Res)^{a,b}</i>	1.317*	1.224*	4.006*	3.190*	3.518*	2.718*	1.845*	1.539*
	(0.174)	(0.171)	(0.814)	(0.721)	(0.558)	(0.400)	(0.713)	(0.392)
<i>Residential Charge</i>	-0.001*	-0.001*	0.001	0.001	-0.001	-0.001	-0.01**	-0.001
	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
<i>Residential Subscription</i>	-0.064*	-0.063	0.128**	0.102**	0.056	0.058**	0.117*	0.070*
	(0.008)	(0.009)	(0.053)	(0.046)	(0.038)	(0.027)	(0.041)	(0.022)
<i>Urban Population(Res)</i>	1.283*	1.273*	1.125**	0.965**	1.494*	1.309*	0.380	0.799*
	(0.095)	(0.092)	(0.522)	(0.455)	(0.357)	(0.253)	(0.438)	(0.242)
<i>Trend</i>		0.179*		2.083*		2.328*		2.442*
		(0.047)		(0.340)		(0.219)		(0.127)
<i>Intercept</i>	-1.589*	-2.341*	-9.895*	-18.68*	-6.678*	-16.76*	-4.768*	-15.28*
	(0.088)	(0.215)	(0.501)	(1.500)	(0.350)	(0.979)	(0.372)	(0.585)
<i>Adj. R Sq.(N)</i>	0.904	0.909	0.735	0.801	0.844	0.923	0.567	0.870
	(244)	(244)	(125)	(125)	(123)	(123)	(168)	(168)

Notes: * Significant at 1% level; ** Significant at 5% level;

^a Wald test of difference between coefficients: $POLCON(Res)_{(1)} = POLCON(Res)_{(3)}$, $p = 0.001$; $POLCON(Res)_{(1)} = POLCON(Res)_{(5)}$, $p = 0.001$; $POLCON(Res)_{(1)} = POLCON(Res)_{(7)}$, $p = 0.472$; $POLCON(Res)_{(3)} = POLCON(Res)_{(5)}$, $p = 0.621$; $POLCON(Res)_{(3)} = POLCON(Res)_{(7)}$, $p = 0.046$; $POLCON(Res)_{(5)} = POLCON(Res)_{(7)}$, $p = 0.065$.

^b Wald test of difference between coefficients: $POLCON(Res)_{(2)} = POLCON(Res)_{(4)}$, $p = 0.007$; $POLCON(Res)_{(2)} = POLCON(Res)_{(6)}$, $p = 0.001$; $POLCON(Res)_{(2)} = POLCON(Res)_{(8)}$, $p = 0.460$; $POLCON(Res)_{(4)} = POLCON(Res)_{(6)}$, $p = 0.567$; $POLCON(Res)_{(4)} = POLCON(Res)_{(8)}$, $p = 0.044$; $POLCON(Res)_{(6)} = POLCON(Res)_{(8)}$, $p = 0.035$.

Table 7

Political Constraints as Determinants of Worldwide ICT Adoption

Independent Variables	Dependent Variables							
	Main Lines		Internet Hosts		Internet Users		Cellular Phone Subscribers	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>Business Charge</i>	0.000 (0.000)	0.000 (0.000)	0.001 (0.002)	0.001 (0.002)	-0.000 (0.001)		0.000 (0.001)	0.000 (0.001)
<i>Business Subscription</i>	-0.008 (0.007)	-0.009 (0.007)	-0.000 (0.000)	-0.043 (0.036)	0.045 (0.027)	0.020 (0.020)	0.029 (0.036)	-0.010 (0.022)
<i>Cellular Charge</i>	-0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)
<i>Cellular Subscription</i>	-0.004 (0.002)	-0.01** (0.002)	-0.04** (0.016)	-0.015 (0.016)	-0.034* (0.013)	-0.008 (0.009)	-0.043* (0.008)	-0.019* (0.006)
<i>Cost of a 3 min call</i>	-2.803* (0.620)	-2.733* (0.613)	6.310 (4.905)	4.200 (4.463)	-0.419 (3.387)	-0.979 (2.443)	-0.665 (2.567)	-1.971 (1.600)
<i>GDP per capita_{t-1}(Res)</i>	0.996* (0.033)	0.981* (0.033)	1.806* (0.181)	1.698* (0.166)	1.324* (0.125)	1.242* (0.091)	1.067* (0.141)	1.148* (0.088)
<i>GDP per capita(Res)</i>	0.744* (0.103)	0.783* (0.103)	-0.611 (0.597)	0.081 (0.565)	0.171 (0.449)	0.632** (0.328)	1.080* (0.401)	1.597* (0.253)
<i>Illiteracy(Res)</i>	-0.441* (0.044)	-0.434* (0.043)	-0.969* (0.193)	-0.858* (0.177)	-1.145* (0.132)	-0.963* (0.098)	-0.615* (0.163)	-0.486* (0.102)
<i>Internet Hosts(Res)</i>					0.589 (0.088)	0.389* (0.068)		
<i>Latitude</i>	0.596* (0.034)	0.592* (0.033)	0.736* (0.188)	0.802* (0.171)	0.366* (0.129)	0.443* (0.094)	0.551* (0.113)	0.558* (0.070)
<i>Main Lines(Res)</i>			1.139* (0.386)	0.552 (0.376)	1.968* (0.268)	1.229* (0.214)	0.740** (0.321)	0.582* (0.200)
<i>Personal Computers(Res)</i>			1.516* (0.268)	0.592 (0.328)	1.159* (0.222)	0.412** (0.185)		
<i>POLCON(Res)^{a,b}</i>	1.399* (0.201)	1.349* (0.199)	3.479* (1.044)	3.002* (0.951)	3.329* (0.719)	2.566* (0.527)	0.699 (0.823)	1.564* (0.517)
<i>Residential Charge</i>	-0.001** (0.000)	-0.01** (0.000)	0.000 (0.002)	0.000 (0.002)	0.000 (0.001)	0.000 (0.001)	-0.002 (0.002)	-0.000 (0.001)
<i>Residential Subscription</i>	-0.044* (0.013)	-0.04** (0.012)	0.133 (0.085)	0.143 (0.076)	-0.009 (0.062)	0.013 (0.044)	0.071 (0.061)	0.098* (0.037)
<i>Urban Population(Res)</i>	1.229* (0.119)	1.215* (0.118)	1.643** (0.708)	1.252** (0.647)	1.769* (0.494)	1.260* (0.362)	0.518 (0.565)	1.030* (0.354)
<i>Trend</i>		0.132** (0.058)		1.969* (0.473)		2.382* (0.294)		2.321* (0.192)
<i>Intercept</i>	-1.346* (0.111)	-1.886* (0.261)	-9.344* (0.662)	-17.85* (2.130)	-6.319* (0.465)	-16.83* (1.339)	-3.624* (0.527)	-14.26* (0.937)
<i>Adj. R Sq.(N)</i>	0.922 (175)	0.924 (175)	0.761 (89)	0.807 (89)	0.875 (87)	0.936 (87)	0.687 (107)	0.880 (107)

Notes: * Significant at 1% level; ** Significant at 5% level;

^a Wald test of difference between coefficients: $POLCON(Res)_{(1)} = POLCON(Res)_{(3)}$, $p = 0.050$;
 $POLCON(Res)_{(1)} = POLCON(Res)_{(5)}$, $p = 0.009$; $POLCON(Res)_{(1)} = POLCON(Res)_{(7)}$, $p = 0.409$;
 $POLCON(Res)_{(3)} = POLCON(Res)_{(5)}$, $p = 0.905$; $POLCON(Res)_{(3)} = POLCON(Res)_{(7)}$, $p = 0.036$;
 $POLCON(Res)_{(5)} = POLCON(Res)_{(7)}$, $p = 0.016$.

^b Wald test of difference between coefficients: $POLCON(Res)_{(2)} = POLCON(Res)_{(4)}$, $p = 0.088$;
 $POLCON(Res)_{(2)} = POLCON(Res)_{(6)}$, $p = 0.030$; $POLCON(Res)_{(2)} = POLCON(Res)_{(8)}$, $p = 0.688$;
 $POLCON(Res)_{(4)} = POLCON(Res)_{(6)}$, $p = 0.184$; $POLCON(Res)_{(4)} = POLCON(Res)_{(8)}$, $p = 0.698$;
 $POLCON(Res)_{(6)} = POLCON(Res)_{(8)}$, $p = 0.174$.

on technology adoption, an effect, which is independent of GDP or institutions. This empirical outcome deserves more attention and future research, as presently we have only limited understanding about the mechanisms through which absolute latitude affects economic development, and we do not have any theory about the relationship between the absolute latitude and the technological adoption.

3.5. Discussion

This analysis has at least two implications. First, it shows that many of the differences we observe in the usage of information technologies, frequently called the digital divide, are derived from deeper differences in what might be called the institutional divide. Consequently, narrowing the gap between technological haves and have-nots implies changing this environment either directly or indirectly—through disruptive technological change. Moreover, it contains a lesson about how institutional reforms might be shaped. Most efforts by governments and international organizations today are focused on changing institutions by direct intervention. However, it might be useful to consider changing them indirectly by the introduction of technologies that are less sensitive to institutional underdevelopment, which in turn, through market dynamics, will endogenously change institutions. As it has been recently speculated, modular and mobile technologies relying on low initial investments are a viable business opportunity in institutionally underdeveloped countries (Hart and Christensen, 2002).

Finally, a more balanced international development and a narrowing of cross-country differences will result as a byproduct of firms' quests for profit, whenever there are technologies and business models that are viable in institutionally underdeveloped

environment. This, however, is not to say that efforts to directly influence institutions are useless and that we should wait and see how market-supporting institutions develop by themselves. Probably the most successful strategy to narrow the gap in international development is a combination of institutional reforms backed with technological know-how that supports change and is largely immune to hostile business environments.

3.6. Appendix

Table 8

Civil Liberties as Determinants of Worldwide ICT Adoption

Independent Variables	Dependent Variables							
	Main Lines		Internet Hosts		Internet Users		Cellular Phone Subscribers	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>Civil Liberties (Res)^{a,b}</i>	1.583* (0.175)	1.520* (0.168)	2.546* (0.759)	2.652* (0.678)	2.855* (0.535)	2.857* (0.375)	1.858** (0.753)	1.526* (0.399)
<i>GDP per capita₁(Res)</i>	1.027* (0.025)	1.017* (0.024)	1.874* (0.129)	1.776* (0.116)	1.383* (0.091)	1.297* (0.064)	1.268* (0.118)	1.337* (0.063)
<i>GDP per capita(Res)</i>	0.756* (0.074)	0.727* (0.071)	-0.556 (0.425)	0.321 (0.408)	-0.103 (0.312)	0.779* (0.232)	0.611 (0.371)	1.626* (0.202)
<i>Illiteracy(Res)</i>	-0.479* (0.031)	-0.441* (0.030)	-1.335* (0.145)	-1.046* (0.139)	-1.096* (0.102)	-0.758* (0.077)	-0.852* (0.137)	-0.419* (0.075)
<i>Internet Hosts(Res)</i>					1.286* (0.194)	0.291 (0.162)		
<i>Latitude</i>	0.675* (0.029)	0.667* (0.028)	0.743* (0.149)	0.787* (0.133)	0.462* (0.108)	0.470* (0.076)	0.575* (0.117)	0.568* (0.062)
<i>Main Lines(Res)</i>			1.372* (0.280)	0.621** (0.282)	1.842* (0.199)	0.917* (0.162)	1.449* (0.243)	0.482* (0.136)
<i>Personal Computers(Res)</i>			1.615* (0.233)	0.490 (0.284)	0.595* (0.064)	0.342* (0.050)		
<i>Urban Population(Res)</i>	1.244* (0.079)	1.178* (0.077)	1.562* (0.486)	1.288* (0.437)	1.595* (0.342)	1.325* (0.241)	0.687 (0.438)	0.687* (0.232)
<i>Trend</i>		0.168* (0.028)		2.009* (0.345)		2.538* (0.222)		2.376* (0.105)
<i>Intercept</i>	-1.886* (0.066)	-2.491* (0.119)	-8.994* (0.306)	-17.496* (1.487)	-6.058* (0.219)	-16.963* (0.965)	-4.471* (0.259)	-14.359* (0.459)
<i>Adj. R Sq.(N)</i>	0.883 (400)	0.892 (400)	0.721 (139)	0.779 (136)	0.980 (136)	0.912 (136)	0.483 (206)	0.856 (206)

Notes: * Significant at 1% level; ** Significant at 5% level;

^a Wald test of difference between coefficients: $Civil\ Liberties(Res)_{(1)} = Civil\ Liberties(Res)_{(3)}$, $p = 0.216$; $Civil\ Liberties(Res)_{(1)} = Civil\ Liberties(Res)_{(5)}$, $p = 0.024$; $Civil\ Liberties(Res)_{(1)} = Civil\ Liberties(Res)_{(7)}$, $p = 0.721$; $Civil\ Liberties(Res)_{(3)} = Civil\ Liberties(Res)_{(5)}$, $p = 0.739$; $Civil\ Liberties(Res)_{(3)} = Civil\ Liberties(Res)_{(7)}$, $p = 0.520$; $Civil\ Liberties(Res)_{(5)} = Civil\ Liberties(Res)_{(7)}$, $p = 0.281$.

^b Wald test of difference between coefficients: $Civil\ Liberties(Res)_{(2)} = Civil\ Liberties(Res)_{(4)}$, $p = 0.105$; $Civil\ Liberties(Res)_{(2)} = Civil\ Liberties(Res)_{(6)}$, $p = 0.001$; $Civil\ Liberties(Res)_{(2)} = Civil\ Liberties(Res)_{(8)}$, $p = 0.989$; $Civil\ Liberties(Res)_{(4)} = Civil\ Liberties(Res)_{(6)}$, $p = 0.791$; $Civil\ Liberties(Res)_{(4)} = Civil\ Liberties(Res)_{(8)}$, $p = 0.153$; $Civil\ Liberties(Res)_{(6)} = Civil\ Liberties(Res)_{(8)}$, $p = 0.015$.

Table 9

Civil Liberties as Determinants of Worldwide ICT Adoption

Independent Variables	Dependent Variables							
	Main Lines		Internet Hosts		Internet Users		Cellular Phone Subscribers	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>Cellular Charge</i>	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)
<i>Cellular Subscription</i>	0.004 (0.003)	0.002 (0.003)	-0.04** (0.016)	-0.011 (0.016)	-0.037* (0.012)	-0.009 (0.009)	-0.072* (0.011)	-0.025* (0.008)
<i>Civil Liberties (Res)^{a,b}</i>	1.695* (0.218)	1.725* (0.213)	1.993** (0.890)	2.005** (0.815)	3.323* (0.621)	2.968* (0.443)	1.750** (0.721)	1.948* (0.482)
<i>Cost of a 3 min call</i>	-3.617* (0.617)	-3.630* (0.603)	9.446** (4.588)	7.331 (4.232)	-1.700 (3.239)	-2.267 (2.300)	-1.781 (2.397)	-2.120 (1.599)
<i>GDP per capita_{t-1}(Res)</i>	1.021* (0.035)	1.009* (0.034)	1.879* (0.149)	1.742* (0.141)	1.538* (0.103)	1.391* (0.075)	1.274* (0.123)	1.258* (0.082)
<i>GDP per capita(Res)</i>	0.607* (0.101)	0.652* (0.099)	-0.205 (0.540)	0.410 (0.517)	0.271 (0.405)	0.782* (0.293)	1.188* (0.369)	1.732* (0.251)
<i>Illiteracy(Res)</i>	-0.438* (0.043)	-0.424* (0.042)	-1.079* (0.179)	-0.922* (0.169)	-1.145* (0.123)	-0.913* (0.091)	-0.443* (0.151)	-0.370* (0.101)
<i>Internet Hosts(Res)</i>					1.154* (0.220)	0.321 (0.183)		
<i>Latitude</i>	0.614* (0.035)	0.607* (0.034)	0.764* (0.178)	0.787* (0.163)	0.484* (0.123)	0.508* (0.087)	0.669* (0.105)	0.605* (0.071)
<i>Main Lines(Res)</i>			1.036* (0.366)	0.452 (0.365)	1.813* (0.253)	1.017* (0.202)	0.552** (0.278)	0.279 (0.187)
<i>Personal Computers(Res)</i>			1.539* (0.263)	0.616 (0.332)	0.595* (0.083)	0.403* (0.063)		
<i>Urban Population(Res)</i>	1.062* (0.111)	1.067* (0.108)	1.853 (0.587)	1.222** (0.559)	2.247* (0.405)	1.523* (0.299)	0.693 (0.464)	0.952* (0.310)
<i>Trend</i>		0.175* (0.056)		1.889* (0.468)		2.461* (0.283)		2.300* (0.208)
<i>Intercept</i>	-1.732* (0.100)	-2.400* (0.237)	-8.736* (0.527)	-17.07* (2.119)	-5.413* (0.377)	-16.45* (1.295)	-2.137* (0.396)	-13.31* (1.046)
<i>Adj. R Sq.(N)</i>	0.906 (187)	0.910 (187)	0.747 (91)	0.791 (91)	0.865 (89)	0.933 (89)	0.683 (108)	0.860 (108)

Notes: * Significant at 1% level; ** Significant at 5% level;

^a Wald test of difference between coefficients: $Civil\ Liberties(Res)_{(1)} = Civil\ Liberties(Res)_{(3)}$, $p = 0.744$; $Civil\ Liberties(Res)_{(1)} = Civil\ Liberties(Res)_{(5)}$, $p = 0.013$; $Civil\ Liberties(Res)_{(1)} = Civil\ Liberties(Res)_{(7)}$, $p = 0.942$; $Civil\ Liberties(Res)_{(3)} = Civil\ Liberties(Res)_{(5)}$, $p = 0.220$; $Civil\ Liberties(Res)_{(3)} = Civil\ Liberties(Res)_{(7)}$, $p = 0.832$; $Civil\ Liberties(Res)_{(5)} = Civil\ Liberties(Res)_{(7)}$, $p = 0.098$.

^b Wald test of difference between coefficients: $Civil\ Liberties(Res)_{(2)} = Civil\ Liberties(Res)_{(4)}$, $p = 0.739$; $Civil\ Liberties(Res)_{(2)} = Civil\ Liberties(Res)_{(6)}$, $p = 0.011$; $Civil\ Liberties(Res)_{(2)} = Civil\ Liberties(Res)_{(8)}$, $p = 0.671$; $Civil\ Liberties(Res)_{(4)} = Civil\ Liberties(Res)_{(6)}$, $p = 0.298$; $Civil\ Liberties(Res)_{(4)} = Civil\ Liberties(Res)_{(8)}$, $p = 0.952$; $Civil\ Liberties(Res)_{(6)} = Civil\ Liberties(Res)_{(8)}$, $p = 0.118$.

Table 10

Civil Liberties as Determinants of Worldwide ICT Adoption

Independent Variables	Dependent Variables							
	Main Lines		Internet Hosts		Internet Users		Cellular Phone Subscribers	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>Business Charge</i>	-0.001** (0.000)	-0.000 (0.000)	-0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.001** (0.000)	-0.000 (0.000)
<i>Business Subscription</i>	-0.022* (0.005)	-0.021* (0.005)	0.035 (0.027)	0.019 (0.024)	0.032 (0.018)	0.0224 (0.0129)	0.065* (0.024)	0.028** (0.013)
<i>Civil Liberties (Res)^{a,b}</i>	1.433* (0.207)	1.479* (0.200)	2.255* (0.807)	2.517* (0.711)	2.840* (0.543)	2.934* (0.381)	1.647** (0.774)	1.755* (0.417)
<i>GDP per capita₋₁(Res)</i>	1.042* (0.031)	1.025* (0.029)	1.836* (0.1445)	1.754* (0.128)	1.361* (0.097)	1.306* (0.068)	1.250* (0.132)	1.288* (0.071)
<i>GDP per capita(Res)</i>	0.744* (0.091)	0.803* (0.088)	-0.770 (0.479)	0.206 (0.453)	0.003 (0.343)	0.785* (0.251)	0.491 (0.394)	1.536* (0.219)
<i>Illiteracy(Res)</i>	-0.452* (0.037)	-0.423* (0.036)	-1.322* (0.157)	-1.019* (0.148)	-1.152* (0.106)	-0.834* (0.079)	-0.775* (0.144)	-0.443 (0.079)
<i>Internet Hosts(Res)</i>					1.199* (0.198)	0.327** (0.161)		
<i>Latitude</i>	0.659* (0.034)	0.649* (0.033)	0.781* (0.164)	0.772* (0.144)	0.464* (0.111)	0.468* (0.077)	0.654* (0.117)	0.561* (0.063)
<i>Main Lines(Res)</i>			1.404* (0.337)	0.602 (0.327)	1.899* (0.229)	1.054* (0.179)	1.300* (0.282)	0.499* (0.157)
<i>Personal Computers(Res)</i>			1.641* (0.247)	0.489 (0.294)	0.617* (0.066)	0.371* (0.052)		
<i>Urban Population(Res)</i>	1.285* (0.105)	1.271* (0.101)	1.115** (0.548)	0.909 (0.483)	1.480* (0.366)	1.231* (0.257)	0.279 (0.482)	0.838* (0.261)
<i>Trend</i>		0.216* (0.050)		2.112* (0.362)		2.386* (0.222)		2.506* (0.128)
<i>Intercept</i>	-1.623* (0.091)	-2.528* (0.228)	-9.193* (0.435)	-18.12* (1.577)	-6.300* (0.294)	-16.55* (0.977)	-4.530* (0.343)	-15.18* (0.576)
<i>Adj. R Sq.(N)</i>	0.893 (238)	0.901 (238)	0.723 (124)	0.787 (124)	0.844 (122)	0.924 (122)	0.541 (166)	0.867 (166)

Notes: * Significant at 1% level; ** Significant at 5% level;

^a Wald test of difference between coefficients: $Civil\ Liberties(Res)_{(1)} = Civil\ Liberties(Res)_{(3)}$, $p = 0.324$; $Civil\ Liberties(Res)_{(1)} = Civil\ Liberties(Res)_{(5)}$, $p = 0.015$; $Civil\ Liberties(Res)_{(1)} = Civil\ Liberties(Res)_{(7)}$, $p = 0.789$; $Civil\ Liberties(Res)_{(3)} = Civil\ Liberties(Res)_{(5)}$, $p = 0.548$; $Civil\ Liberties(Res)_{(3)} = Civil\ Liberties(Res)_{(7)}$, $p = 0.587$; $Civil\ Liberties(Res)_{(5)} = Civil\ Liberties(Res)_{(7)}$, $p = 0.207$.

^b Wald test of difference between coefficients: $Civil\ Liberties(Res)_{(2)} = Civil\ Liberties(Res)_{(4)}$, $p = 0.161$; $Civil\ Liberties(Res)_{(2)} = Civil\ Liberties(Res)_{(6)}$, $p = 0.000$; $Civil\ Liberties(Res)_{(2)} = Civil\ Liberties(Res)_{(8)}$, $p = 0.551$; $Civil\ Liberties(Res)_{(4)} = Civil\ Liberties(Res)_{(6)}$, $p = 0.605$; $Civil\ Liberties(Res)_{(4)} = Civil\ Liberties(Res)_{(8)}$, $p = 0.356$; $Civil\ Liberties(Res)_{(6)} = Civil\ Liberties(Res)_{(8)}$, $p = 0.037$.

Table 11

Civil Liberties as Determinants of Worldwide ICT Adoption

Independent Variables	Dependent Variables							
	Main Lines		Internet Hosts		Internet Users		Cellular Phone Subscribers	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>Civil Liberties (Res)^{a,b}</i>	1.383*	1.421*	2.196*	2.480*	2.808*	2.922*	1.532**	1.729*
	(0.192)	(0.184)	(0.782)	(0.687)	(0.544)	(0.376)	(0.770)	(0.410)
<i>GDP per capita₋₁(Res)</i>	1.052*	1.037*	1.769*	1.678*	1.381*	1.298*	1.246*	1.276*
	(0.028)	(0.027)	(0.141)	(0.125)	(0.098)	(0.068)	(0.130)	(0.069)
<i>GDP per capita(Res)</i>	0.804*	0.850*	-0.803	0.172	-0.031	0.792*	0.562	1.547*
	(0.084)	(0.081)	(0.464)	(0.439)	(0.342)	(0.248)	(0.389)	(0.213)
<i>Illiteracy(Res)</i>	-0.408*	-0.386*	-1.359*	-1.063*	-1.156*	-0.844*	-0.794*	-0.461*
	(0.034)	(0.033)	(0.153)	(0.143)	(0.107)	(0.079)	(0.143)	(0.078)
<i>Internet Hosts(Res)</i>					1.195*	0.315**		
					(0.199)	(0.158)		
<i>Latitude</i>	0.649*	0.641*	0.749*	0.744*	0.454*	0.457*	0.647*	0.557*
	(0.031)	(0.029)	(0.158)	(0.138)	(0.110)	(0.076)	(0.116)	(0.062)
<i>Main Lines(Res)</i>			1.608*	0.839*	1.888*	1.099*	1.444*	0.604*
			(0.335)	(0.321)	(0.241)	(0.181)	(0.294)	(0.162)
<i>Personal Computers(Res)</i>			1.583*	0.459	0.610*	0.349*		
			(0.241)	(0.284)	(0.069)	(0.053)		
<i>Residential Charge</i>	-0.001*	-0.001*	0.000	0.000	-0.000	0.000	-0.001**	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
<i>Residential Subscription</i>	-0.059*	-0.058*	0.134*	0.117*	0.039	0.051**	0.120*	0.066*
	(0.009)	(0.000)	(0.049)	(0.044)	(0.036)	(0.025)	(0.040)	(0.022)
<i>Urban Population(Res)</i>	1.230*	1.222*	1.259**	1.011**	1.586*	1.323*	0.559	0.974*
	(0.095)	(0.091)	(0.504)	(0.444)	(0.348)	(0.242)	(0.469)	(0.251)
<i>Trend</i>		0.218*		2.072*		2.431*		2.498*
		(0.045)		(0.349)		(0.219)		(0.125)
<i>Intercept</i>	-1.461*	-2.365*	-9.732*	-18.52*	-6.302*	-16.89*	-4.678*	-15.30*
	(0.088)	(0.206)	(0.474)	(1.539)	(0.337)	(0.985)	(0.374)	(0.569)
<i>Adj. R Sq.(N)</i>	0.905	0.913	0.735	0.798	0.841	0.945	0.544	0.871
	(243)	(243)	(125)	(125)	(123)	(123)	(167)	(167)

Notes: * Significant at 1% level; ** Significant at 5% level;

^a Wald test of difference between coefficients: $Civil\ Liberties(Res)_{(1)} = Civil\ Liberties(Res)_{(3)}$, $p = 0.312$; $Civil\ Liberties(Res)_{(1)} = Civil\ Liberties(Res)_{(5)}$, $p = 0.013$; $Civil\ Liberties(Res)_{(1)} = Civil\ Liberties(Res)_{(7)}$, $p = 0.851$; $Civil\ Liberties(Res)_{(3)} = Civil\ Liberties(Res)_{(5)}$, $p = 0.520$; $Civil\ Liberties(Res)_{(3)} = Civil\ Liberties(Res)_{(7)}$, $p = 0.545$; $Civil\ Liberties(Res)_{(5)} = Civil\ Liberties(Res)_{(7)}$, $p = 0.176$.

^b Wald test of difference between coefficients: $Civil\ Liberties(Res)_{(2)} = Civil\ Liberties(Res)_{(4)}$, $p = 0.137$; $Civil\ Liberties(Res)_{(2)} = Civil\ Liberties(Res)_{(6)}$, $p = 0.000$; $Civil\ Liberties(Res)_{(2)} = Civil\ Liberties(Res)_{(8)}$, $p = 0.492$; $Civil\ Liberties(Res)_{(4)} = Civil\ Liberties(Res)_{(6)}$, $p = 0.573$; $Civil\ Liberties(Res)_{(4)} = Civil\ Liberties(Res)_{(8)}$, $p = 0.348$; $Civil\ Liberties(Res)_{(6)} = Civil\ Liberties(Res)_{(8)}$, $p = 0.032$.

Table 12

Civil Liberties as Determinants of Worldwide ICT Adoption

Independent Variables	Dependent Variables							
	Main Lines		Internet Hosts		Internet Users		Cellular Phone Subscribers	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>Business Charge</i>	0.000 (0.000)	0.000 (0.000)	0.000 (0.002)	0.000 (0.001)	0.000 (0.001)	-0.000 (0.000)	0.000 (0.001)	0.000 (0.001)
<i>Business Subscription</i>	-0.008 (0.000)	-0.008 (0.007)	-0.022 (0.038)	-0.037 (0.034)	0.032 (0.026)	0.013 (0.019)	0.017 (0.033)	-0.010 (0.022)
<i>Cellular Charge</i>	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	0.001** (0.000)	0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)
<i>Cellular Subscription</i>	0.003 (0.003)	0.000 (0.003)	-0.04** (0.016)	-0.014 (0.016)	-0.039* (0.013)	-0.011 (0.009)	-0.069* (0.012)	-0.023* (0.008)
<i>Civil Liberties (Res)^{a,b}</i>	1.550* (0.204)	1.596* (0.201)	2.139** (0.919)	2.099** (0.837)	3.466* (0.649)	3.078* (0.460)	1.822** (0.723)	2.041* (0.477)
<i>Cost of a 3 min call</i>	-2.796* (0.606)	-2.763* (0.595)	6.840 (4.984)	4.598 (4.571)	-1.297 (3.512)	-2.113 (2.481)	-1.766 (2.429)	-2.189 (1.602)
<i>GDP per capita₋₁(Res)</i>	1.047 (0.033)	1.036* (0.033)	1.842* (0.162)	1.718* (0.150)	1.507* (0.113)	1.381* (0.081)	1.209* (0.126)	1.234* (0.083)
<i>GDP per capita(Res)</i>	0.696* (0.098)	0.735* (0.097)	-0.473 (0.561)	0.121 (0.531)	0.284 (0.420)	0.735** (0.301)	1.121* (0.371)	1.631* (0.249)
<i>Illiteracy(Res)</i>	-0.423* (0.042)	-0.408* (0.041)	-1.112* (0.185)	-0.959* (0.172)	-1.138* (0.128)	-0.911* (0.094)	-0.488* (0.154)	-0.420* (0.101)
<i>Internet Hosts(Res)</i>					1.179* (0.228)	0.367** (0.187)		
<i>Latitude</i>	0.625* (0.033)	0.622* (0.032)	0.785* (0.182)	0.815* (0.166)	0.473* (0.128)	0.514* (0.091)	0.645* (0.107)	0.611* (0.071)
<i>Main Lines(Res)</i>			1.265* (0.398)	0.647 (0.394)	1.943* (0.283)	1.139* (0.221)	0.837* (0.316)	0.575* (0.209)
<i>Personal Computers(Res)</i>			1.537* (0.269)	0.613 (0.335)	0.582* (0.089)	0.384* (0.066)		
<i>Residential Charge</i>	-0.001** (0.000)	-0.01** (0.000)	0.000 (0.002)	0.000 (0.002)	0.000 (0.002)	0.000 (0.001)	-0.002 (0.002)	-0.000 (0.001)
<i>Residential Subscription</i>	-0.040* (0.012)	-0.039* (0.012)	0.137 (0.084)	0.147** (0.077)	-0.009 (0.062)	0.013 (0.044)	0.079 (0.058)	0.098* (0.038)
<i>Urban Population(Res)</i>	1.172* (0.113)	1.155* (0.111)	1.779* (0.627)	1.236** (0.586)	2.076* (0.440)	1.430* (0.319)	0.725 (0.509)	1.072* (0.337)
<i>Trend</i>		0.148* (0.056)		1.900* (0.471)		2.458* (0.289)		2.280* (0.207)
<i>Intercept</i>	-1.339* (0.112)	-1.932* (0.249)	-9.179* (0.622)	-17.49* (2.135)	-5.701* (0.447)	-16.67* (1.326)	-2.771* (0.507)	-13.78* (1.056)
<i>Adj. R Sq.(N)</i>	0.927 (175)		0.761 (90)		0.870 (88)		0.707 (107)	

Notes: * Significant at 1% level; ** Significant at 5% level;

^a Wald test of difference between coefficients: $Civil\ Liberties(Res)_{(1)} = Civil\ Liberties(Res)_{(3)}$, $p = 0.532$; $Civil\ Liberties(Res)_{(1)} = Civil\ Liberties(Res)_{(5)}$, $p = 0.004$; $Civil\ Liberties(Res)_{(1)} = Civil\ Liberties(Res)_{(7)}$, $p = 0.717$; $Civil\ Liberties(Res)_{(3)} = Civil\ Liberties(Res)_{(5)}$, $p = 0.238$; $Civil\ Liberties(Res)_{(3)} = Civil\ Liberties(Res)_{(7)}$, $p = 0.787$; $Civil\ Liberties(Res)_{(5)} = Civil\ Liberties(Res)_{(7)}$, $p = 0.091$.

^b Wald test of difference between coefficients: $Civil\ Liberties(Res)_{(2)} = Civil\ Liberties(Res)_{(4)}$, $p = 0.559$; $Civil\ Liberties(Res)_{(2)} = Civil\ Liberties(Res)_{(6)}$, $p = 0.003$; $Civil\ Liberties(Res)_{(2)} = Civil\ Liberties(Res)_{(8)}$, $p = 0.390$; $Civil\ Liberties(Res)_{(4)} = Civil\ Liberties(Res)_{(6)}$, $p = 0.305$; $Civil\ Liberties(Res)_{(4)} = Civil\ Liberties(Res)_{(8)}$, $p = 0.952$; $Civil\ Liberties(Res)_{(6)} = Civil\ Liberties(Res)_{(8)}$, $p = 0.117$.

Table 13

Political Rights as Determinants of Worldwide ICT Adoption

Independent Variables	Dependent Variables							
	Main Lines		Internet Hosts		Internet Users		Cellular Phone Subscribers	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>GDP per capita</i> ₁ (Res)	0.989*	0.979*	1.845*	1.724*	1.334*	1.232*	1.254*	1.306*
	(0.024)	(0.023)	(0.126)	(0.113)	(0.088)	(0.064)	(0.114)	(0.060)
<i>GDP per capita</i> (Res)	0.765*	0.739*	-0.622	0.301*	-0.132	0.787*	0.557*	1.619*
	(0.073)	(0.071)	(0.425)	(0.407)	(0.309)	(0.235)	(0.368)	(0.200)
<i>Illiteracy</i> (Res)	-0.472*	-0.439*	-1.237*	-0.966*	-1.037*	-0.742*	-0.787*	-0.403*
	(0.031)	(0.031)	(0.153)	(0.143)	(0.107)	(0.081)	(0.143)	(0.077)
<i>Internet Hosts</i> (Res)					1.304*	0.339**		
					(0.193)	(0.163)		
<i>Latitude</i>	0.642*	0.634*	0.690*	0.728*	0.404*	0.412*	0.547*	0.537*
	(0.029)	(0.027)	(0.149)	(0.133)	(0.108)	(0.077)	(0.115)	(0.061)
<i>Main Lines</i> (Res)			1.316*	0.564**	1.817*	0.946*	1.405*	0.472*
			(0.281)	(0.279)	(0.198)	(0.162)	(0.242)	(0.135)
<i>Personal Computers</i> (Res)			1.594*	0.436	0.603*	0.342*		
			(0.236)	(0.284)	(0.064)	(0.051)		
<i>Political Rights</i> (Res) ^{a,b}	1.116*	1.036*	2.677*	2.314*	2.565*	2.07	1.859*	1.129*
	(0.118)	(0.115)	(0.531)	(0.475)	(0.379)	(0.275)	(0.500)	(0.266)
<i>Urban Population</i> (Res)	1.233*	1.169*	1.603*	1.312*	1.620*	1.341*	0.687	0.681*
	(0.079)	(0.077)	(0.488)	(0.436)	(0.341)	(0.244)	(0.439)	(0.232)
<i>Trend</i>		0.162*		2.051*		2.473*		2.377*
		(0.029)		(0.341)		(0.223)		(0.105)
<i>Intercept</i>	-1.991*	-2.573*	-9.091*	-17.809*	-6.216*	-16.861*	-4.528*	-14.453*
	(0.063)	(0.119)	(0.309)	(1.477)	(0.219)	(0.973)	(0.249)	(0.458)
<i>Adj. R Sq.</i> (N)	0.883	0.892	0.719	0.781	0.822	0.910	0.481	0.856
	(400)	(400)	(139)	(139)	(136)	(136)	(206)	(206)

Notes: * Significant at 1% level; ** Significant at 5% level;

^a Wald test of difference between coefficients: $Political\ Rights(Res)_{(1)} = Political\ Rights(Res)_{(3)}$, $p = 0.004$; $Political\ Rights(Res)_{(1)} = Political\ Rights(Res)_{(5)}$, $p = 0.000$; $Political\ Rights(Res)_{(1)} = Political\ Rights(Res)_{(7)}$, $p = 0.148$; $Political\ Rights(Res)_{(3)} = Political\ Rights(Res)_{(5)}$, $p = 0.864$; $Political\ Rights(Res)_{(3)} = Political\ Rights(Res)_{(7)}$, $p = 0.262$; $Political\ Rights(Res)_{(5)} = Political\ Rights(Res)_{(7)}$, $p = 0.260$.

^b Wald test of difference between coefficients: $Political\ Rights(Res)_{(2)} = Political\ Rights(Res)_{(4)}$, $p = 0.009$; $Political\ Rights(Res)_{(2)} = Political\ Rights(Res)_{(6)}$, $p = 0.000$; $Political\ Rights(Res)_{(2)} = Political\ Rights(Res)_{(8)}$, $p = 0.749$; $Political\ Rights(Res)_{(4)} = Political\ Rights(Res)_{(6)}$, $p = 0.657$; $Political\ Rights(Res)_{(4)} = Political\ Rights(Res)_{(8)}$, $p = 0.029$; $Political\ Rights(Res)_{(6)} = Political\ Rights(Res)_{(8)}$, $p = 0.014$.

Table 14

Political Rights as Determinants of Worldwide ICT Adoption

Independent Variables	Dependent Variables							
	Main Lines		Internet Hosts		Internet Users		Cellular Phone Subscribers	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>Cellular Charge</i>	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)
<i>Cellular Subscription</i>	0.004 (0.003)	0.002 (0.003)	-0.035** (0.016)	-0.011 (0.016)	-0.037* (0.012)	-0.008 (0.009)	-0.072* (0.011)	-0.025* (0.009)
<i>Cost of a 3 min call</i>	-3.629* (0.616)	-3.630* (0.604)	10.820** (4.624)	7.857 (4.340)	-0.768 (3.308)	-1.998 (2.375)	-2.185 (2.407)	-2.326 (1.605)
<i>GDP per capita₋₁(Res)</i>	0.991* (0.034)	0.979* (0.034)	1.829* (0.146)	1.702* (0.139)	1.470* (0.101)	1.333* (0.074)	1.249* (0.122)	1.226* (0.082)
<i>GDP per capita(Res)</i>	0.606* (0.101)	0.648* (0.100)	-0.149 (0.538)	0.409 (0.518)	0.238 (0.403)	0.776* (0.296)	1.179* (0.367)	1.735* (0.249)
<i>Illiteracy(Res)</i>	-0.431* (0.043)	-0.421 (0.042)	-1.093* (0.182)	-0.926* (0.174)	-1.091* (0.125)	-0.878* (0.093)	-0.400* (0.155)	-0.347* (0.103)
<i>Internet Hosts(Res)</i>					1.203* (0.224)	0.333 (0.190)		
<i>Latitude</i>	0.584* (0.034)	0.577* (0.034)	0.731* (0.176)	0.752* (0.163)	0.416* (0.122)	0.455* (0.088)	0.639* (0.104)	0.572* (0.069)
<i>Main Lines(Res)</i>			1.121* (0.363)	0.498 (0.373)	1.837* (0.251)	1.033* (0.203)	0.508 (0.275)	0.267 (0.184)
<i>Personal Computers(Res)</i>			1.594* (0.263)	0.656** (0.345)	0.591* (0.083)	0.402* (0.063)		
<i>Political Rights(Res)^{a,b}</i>	1.218* (0.152)	1.208* (0.149)	1.499** (0.615)	1.491* (0.568)	2.737* (0.453)	2.311* (0.328)	1.461* (0.513)	1.411* (0.342)
<i>Urban Population(Res)</i>	1.046* (0.110)	1.049* (0.108)	1.882* (0.578)	1.234** (0.560)	2.288* (0.401)	1.521* (0.301)	0.705 (0.461)	0.945* (0.308)
<i>Trend</i>		0.160* (0.057)		1.843* (0.482)		2.451* (0.287)		2.291* (0.207)
<i>Intercept</i>	-1.826* (0.098)	-2.440 (0.237)	-8.954* (0.516)	-17.02* (2.164)	-5.692* (0.374)	-16.61* (1.306)	-2.198* (0.389)	-13.37* (1.043)
<i>Adj. R Sq.(N)</i>	0.894 (238)	0.901 (238)	0.720 (124)	0.788 (124)	0.846 (122)	0.923 (122)	0.539 (166)	0.868 (166)

Notes: * Significant at 1% level; ** Significant at 5% level;

^a Wald test of difference between coefficients: $Political\ Rights(Res)_{(1)} = Political\ Rights(Res)_{(3)}$, $p = 0.657$; $Political\ Rights(Res)_{(1)} = Political\ Rights(Res)_{(5)}$, $p = 0.001$; $Political\ Rights(Res)_{(1)} = Political\ Rights(Res)_{(7)}$, $p = 0.6494$; $Political\ Rights(Res)_{(3)} = Political\ Rights(Res)_{(5)}$, $p = 0.105$; $Political\ Rights(Res)_{(3)} = Political\ Rights(Res)_{(7)}$, $p = 0.962$; $Political\ Rights(Res)_{(5)} = Political\ Rights(Res)_{(7)}$, $p = 0.062$.

^b Wald test of difference between coefficients: $Political\ Rights(Res)_{(2)} = Political\ Rights(Res)_{(4)}$, $p = 0.629$; $Political\ Rights(Res)_{(2)} = Political\ Rights(Res)_{(6)}$, $p = 0.002$; $Political\ Rights(Res)_{(2)} = Political\ Rights(Res)_{(8)}$, $p = 0.586$; $Political\ Rights(Res)_{(4)} = Political\ Rights(Res)_{(6)}$, $p = 0.212$; $Political\ Rights(Res)_{(4)} = Political\ Rights(Res)_{(8)}$, $p = 0.903$; $Political\ Rights(Res)_{(6)} = Political\ Rights(Res)_{(8)}$, $p = 0.057$.

Table 15

Political Rights as Determinants of Worldwide ICT Adoption

Independent Variables	Dependent Variables							
	Main Lines		Internet Hosts		Internet Users		Cellular Phone Subscribers	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>Business Charge</i>	-0.001** (0.000)	-0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.001* (0.000)	-0.000 (0.000)
<i>Business Subscription</i>	-0.021* (0.005)	-0.021* (0.005)	0.034 (0.027)	0.017 (0.024)	0.033 (0.018)	0.024 (0.013)	0.065* (0.024)	0.028** (0.013)
<i>GDP per capita₋₁(Res)</i>	1.006* (0.029)	0.988* (0.029)	1.819* (0.142)	1.708* (0.126)	1.313* (0.095)	1.238* (0.067)	1.239* (0.129)	1.249* (0.069)
<i>GDP per capita(Res)</i>	0.761* (0.089)	0.819* (0.088)	-0.849 (0.478)	0.193 (0.453)	-0.048 (0.336)	0.801* (0.252)	0.425 (0.389)	1.540* (0.216)
<i>Illiteracy(Res)</i>	-0.439* (0.038)	-0.415* (0.037)	-1.235* (0.000)	-0.947* (0.155)	-1.107* (0.112)	-0.832* (0.084)	-0.704* (0.149)	-0.423* (0.082)
<i>Internet Hosts(Res)</i>					1.227* (0.197)	0.377** (0.162)		
<i>Latitude</i>	0.628* (0.033)	0.616* (0.032)	0.732* (0.167)	0.713* (0.146)	0.411* (0.111)	0.418* (0.079)	0.628* (0.116)	0.525* (0.062)
<i>Main Lines(Res)</i>			1.350* (0.342)	0.543 (0.328)	1.891* (0.228)	1.099* (0.179)	1.239* (0.283)	0.486* (0.157)
<i>Personal Computers(Res)</i>			1.638* (0.251)	0.447 (0.296)	0.626* (0.065)	0.372* (0.052)		
<i>Political Rights (Res)^{a,b}</i>	1.033* (0.139)	1.015* (0.135)	2.456* (0.566)	2.159* (0.497)	2.558* (0.385)	2.129* (0.277)	1.766* (0.521)	1.285* (0.281)
<i>Urban Population(Res)</i>	1.282* (0.105)	1.267* (0.102)	1.146** (0.553)	0.939** (0.484)	1.487* (0.365)	1.235* (0.261)	0.309 (0.484)	0.843* (0.261)
<i>Trend</i>		0.204* (0.050)		2.143* (0.357)		2.311* (0.221)		2.502* (0.127)
<i>Intercept</i>	-1.723* (0.088)	-2.582* (0.228)	-9.285* (0.445)	-18.38* (1.565)	-6.463* (0.297)	-16.41* (0.977)	-4.571* (0.341)	-15.27* (0.574)
<i>Adj. R Sq.(N)</i>	0.894 (238)	0.900 (238)	0.720 (124)	0.788 (124)	0.846 (122)	0.923 (122)	0.538 (166)	0.868 (166)

Notes: * Significant at 1% level; ** Significant at 5% level;

^a Wald test of difference between coefficients: $Political\ Rights(Res)_{(1)} = Political\ Rights(Res)_{(3)}$, $p = 0.014$; $Political\ Rights(Res)_{(1)} = Political\ Rights(Res)_{(5)}$, $p = 0.000$; $Political\ Rights(Res)_{(1)} = Political\ Rights(Res)_{(7)}$, $p = 0.174$; $Political\ Rights(Res)_{(3)} = Political\ Rights(Res)_{(5)}$, $p = 0.882$; $Political\ Rights(Res)_{(3)} = Political\ Rights(Res)_{(7)}$, $p = 0.369$; $Political\ Rights(Res)_{(5)} = Political\ Rights(Res)_{(7)}$, $p = 0.221$.

^b Wald test of difference between coefficients: $Political\ Rights(Res)_{(2)} = Political\ Rights(Res)_{(4)}$, $p = 0.026$; $Political\ Rights(Res)_{(2)} = Political\ Rights(Res)_{(6)}$, $p = 0.000$; $Political\ Rights(Res)_{(2)} = Political\ Rights(Res)_{(8)}$, $p = 0.387$; $Political\ Rights(Res)_{(4)} = Political\ Rights(Res)_{(6)}$, $p = 0.958$; $Political\ Rights(Res)_{(4)} = Political\ Rights(Res)_{(8)}$, $p = 0.125$; $Political\ Rights(Res)_{(6)} = Political\ Rights(Res)_{(8)}$, $p = 0.032$.

Table 16

Political Rights as Determinants of Worldwide ICT Adoption

Independent Variables	Dependent Variables							
	Main Lines		Internet Hosts		Internet Users		Cellular Phone Subscribers	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>GDP per capita₋₁(Res)</i>	1.021*	1.004*	1.755*	1.635*	1.335*	1.229*	1.240*	1.238*
	(0.027)	(0.026)	(0.139)	(0.122)	(0.095)	(0.067)	(0.000)	(0.067)
<i>GDP per capita(Res)</i>	0.814*	0.862*	-0.880	0.162	-0.081	0.807*	0.488	1.549*
	(0.083)	(0.080)	(0.464)	(0.438)	(0.335)	(0.248)	(0.386)	(0.211)
<i>Illiteracy(Res)</i>	-0.390*	-0.373*	-1.282*	-0.999*	-1.109*	-0.841*	-0.725*	-0.442*
	(0.034)	(0.033)	(0.166)	(0.152)	(0.113)	(0.083)	(0.150)	(0.081)
<i>Internet Hosts(Res)</i>					1.220*	0.362**		
					(0.198)	(0.159)		
<i>Latitude</i>	0.619*	0.610*	0.704*	0.689*	0.400*	0.405*	0.623*	0.522*
	(0.030)	(0.029)	(0.160)	(0.139)	(0.110)	(0.077)	(0.000)	(0.061)
<i>Main Lines(Res)</i>			1.557*	0.782**	1.877*	1.147*	1.377*	0.588*
			(0.341)	(0.323)	(0.239)	(0.181)	(0.296)	(0.162)
<i>Personal Computers(Res)</i>			1.586*	0.423	0.619*	0.348*		
			(0.244)	(0.286)	(0.068)	(0.054)		
<i>Political Rights (Res)^{a,b}</i>	1.048*	1.020*	2.404*	2.131*	2.543*	2.120*	1.689*	1.265*
	(0.128)	(0.123)	(0.549)	(0.481)	(0.386)	(0.273)	(0.518)	(0.275)
<i>Residential Charge</i>	-0.001*	-0.001	0.000	0.000	-0.000	-0.000	-0.001**	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
<i>Residential Subscription</i>	-0.060*	-0.059	0.131*	0.113*	0.041	0.055**	0.117*	0.065*
	(0.008)	(0.008)	(0.050)	(0.043)	(0.036)	(0.025)	(0.040)	(0.022)
<i>Urban Population(Res)</i>	1.234*	1.224*	1.284**	1.026**	1.604*	1.327*	0.577	0.974*
	(0.094)	(0.091)	(0.509)	(0.445)	(0.347)	(0.244)	(0.471)	(0.251)
<i>Trend</i>		0.204*		2.106*		2.365*		2.497*
		(0.044)		(0.345)		(0.219)		(0.124)
<i>Intercept</i>	-1.542*	-2.393*	-9.811*	-18.78*	-6.463*	-16.81*	-4.702*	-15.41*
	(0.086)	(0.205)	(0.483)	(1.529)	(0.338)	(0.987)	(0.375)	(0.569)
<i>Adj. R Sq.(N)</i>	0.907	0.914	0.732	0.798	0.843	0.924	0.539	0.872
	(243)	(243)	(125)	(125)	(123)	(123)	(167)	(167)

Notes: * Significant at 1% level; ** Significant at 5% level;

^a Wald test of difference between coefficients: $Political\ Rights(Res)_{(1)} = Political\ Rights(Res)_{(3)}$, $p = 0.016$; $Political\ Rights(Res)_{(1)} = Political\ Rights(Res)_{(5)}$, $p = 0.000$; $Political\ Rights(Res)_{(1)} = Political\ Rights(Res)_{(7)}$, $p = 0.229$; $Political\ Rights(Res)_{(3)} = Political\ Rights(Res)_{(5)}$, $p = 0.836$; $Political\ Rights(Res)_{(3)} = Political\ Rights(Res)_{(7)}$, $p = 0.343$; $Political\ Rights(Res)_{(5)} = Political\ Rights(Res)_{(7)}$, $p = 0.186$.

^b Wald test of difference between coefficients: $Political\ Rights(Res)_{(2)} = Political\ Rights(Res)_{(4)}$, $p = 0.025$; $Political\ Rights(Res)_{(2)} = Political\ Rights(Res)_{(6)}$, $p = 0.000$; $Political\ Rights(Res)_{(2)} = Political\ Rights(Res)_{(8)}$, $p = 0.415$; $Political\ Rights(Res)_{(4)} = Political\ Rights(Res)_{(6)}$, $p = 0.984$; $Political\ Rights(Res)_{(4)} = Political\ Rights(Res)_{(8)}$, $p = 0.118$; $Political\ Rights(Res)_{(6)} = Political\ Rights(Res)_{(8)}$, $p = 0.027$.

Table 17

Political Rights as Determinants of Worldwide ICT Adoption

Independent Variables	Dependent Variables							
	Main Lines		Internet Hosts		Internet Users		Cellular Phone Subscribers	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>Business Charge</i>	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.001)	-0.000 (0.001)	-0.000 (0.000)	0.000 (0.001)	0.000 (0.001)
<i>Business Subscription</i>	-0.007 (0.007)	-0.000 (0.000)	-0.018 (0.037)	-0.035 (0.034)	0.035 (0.026)	0.013 (0.019)	0.016 (0.033)	-0.011 (0.022)
<i>Cellular Charge</i>	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	0.001** (0.000)	0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)
<i>Cellular Subscription</i>	0.003 (0.003)	0.000 (0.002)	-0.039** (0.016)	-0.014 (0.016)	-0.038* (0.012)	-0.010 (0.009)	-0.069* (0.011)	-0.023* (0.008)
<i>Cost of a 3 min call</i>	-2.771* (0.597)	-2.726* (0.588)	8.493 (5.019)	5.266 (4.699)	0.039 (3.611)	-1.657 (2.593)	-2.104 (2.455)	-2.374 (1.616)
<i>GDP per capita_{t-1}(Res)</i>	1.019* (0.032)	1.008* (0.032)	1.782* (0.159)	1.675* (0.149)	1.433* (0.112)	1.318* (0.081)	1.179* (0.126)	1.198* (0.083)
<i>GDP per capita(Res)</i>	0.709* (0.096)	0.748* (0.096)	-0.408 (0.557)	0.123 (0.532)	0.253 (0.418)	0.730** (0.305)	1.117* (0.369)	1.639* (0.247)
<i>Illiteracy(Res)</i>	-0.407* (0.042)	-0.394* (0.042)	-1.134* (0.186)	-0.968 (0.177)	-1.095* (0.129)	-0.886* (0.096)	-0.451* (0.157)	-0.400* (0.103)
<i>Internet Hosts(Res)</i>					1.243* (0.232)	0.389** (0.196)		
<i>Latitude</i>	0.596* (0.032)	0.592* (0.032)	0.752* (0.180)	0.781* (0.166)	0.407* (0.127)	0.462* (0.091)	0.612* (0.106)	0.575* (0.069)
<i>Main Lines(Res)</i>			1.385* (0.400)	0.709 (0.409)	1.994* (0.283)	1.171* (0.226)	0.792** (0.317)	0.557* (0.209)
<i>Personal Computers(Res)</i>			1.598* (0.268)	0.662 (0.349)	0.576* (0.088)	0.383* (0.067)		
<i>Political Rights (Res)^{a,b}</i>	1.153* (0.142)	1.161* (0.139)	1.567** (0.625)	1.549* (0.576)	2.742* (0.467)	2.322* (0.338)	1.467* (0.510)	1.454* (0.336)
<i>Residential Charge</i>	-0.001** (0.000)	-0.001** (0.000)	0.000 (0.002)	0.000 (0.002)	0.000 (0.002)	0.000 (0.001)	-0.002 (0.002)	-0.000 (0.001)
<i>Residential Subscription</i>	-0.043* (0.012)	-0.043* (0.012)	0.137 (0.083)	0.147* (0.077)	-0.012 (0.062)	0.015 (0.044)	0.077 (0.058)	0.098* (0.038)
<i>Urban Population(Res)</i>	1.156* (0.111)	1.140* (0.109)	1.788* (0.618)	1.245** (0.587)	2.099* (0.436)	1.435* (0.322)	0.728 (0.508)	1.069* (0.336)
<i>Trend</i>		0.137** (0.055)		1.843* (0.487)		2.436* (0.294)		2.274* (0.206)
<i>Intercept</i>	-1.424* (0.110)	-1.974* (0.247)	-9.465* (0.622)	-17.42* (2.179)	-6.035* (0.452)	-16.79* (1.340)	-2.827 (0.512)	-13.84* (1.056)
<i>Adj. R Sq.(N)</i>	0.928 (175)	0.931 (175)	0.767 (90)	0.805 (90)	0.872 (88)	0.935 (88)	0.707 (107)	0.875 (107)

Notes: * Significant at 1% level; ** Significant at 5% level;

^a Wald test of difference between coefficients: *Political Rights (Res)₍₁₎* = *Political Rights (Res)₍₃₎*, $p = 0.518$; *Political Rights (Res)₍₁₎* = *Political Rights(Res)₍₅₎*, $p = 0.001$; *Political Rights(Res)₍₁₎* = *Political Rights(Res)₍₇₎*, $p = 0.553$; *Political Rights(Res)₍₃₎* = *Political Rights(Res)₍₅₎*, $p = 0.132$; *Political Rights(Res)₍₃₎* = *Political Rights(Res)₍₇₎*, $p = 0.902$; *Political Rights(Res)₍₅₎* = *Political Rights(Res)₍₇₎*, $p = 0.065$.

^b Wald test of difference between coefficients: *Political Rights(Res)₍₂₎* = *Political Rights(Res)₍₄₎*, $p = 0.512$; *Political Rights(Res)₍₂₎* = *Political Rights(Res)₍₆₎*, $p = 0.001$; *Political Rights(Res)₍₂₎* = *Political Rights(Res)₍₈₎*, $p = 0.421$; *Political Rights(Res)₍₄₎* = *Political Rights(Res)₍₆₎*, $p = 0.246$; *Political Rights(Res)₍₄₎* = *Political Rights(Res)₍₈₎*, $p = 0.886$; *Political Rights(Res)₍₆₎* = *Political Rights(Res)₍₈₎*, $p = 0.068$.

4. Unwelcome Political Consensus¹²

In this chapter, I develop and test a theory about the effect that electoral formats and government configurations have on the degree of property rights protection. First, I propose a formal model, which establishes a negative relationship between the number of institutions of consensual collective decision-making and the degree of property rights protection. Second, using a sample of 63 democratic countries I find evidence that those with less consensual (more majoritarian) institutions of collective decision-making score higher on measures of property rights protection and thus, potentially benefit from better investment climate. Lastly, I contrast the collective choice explanation to the legal origin hypothesis, which states that the Anglo-American common law tradition is superior to the Continental European civil law tradition in property rights protection. The evidence suggests that electoral formats and government configurations are better predictors of the degree of property rights protection than the country's legal heritage.

¹² Previous versions of this article have been circulated under the title “Property Rights and the Structure of Political Competition”. I am grateful to the Institute for Law and Economics, Hamburg University for hosting me during my research and the European Commission for financial support. I also thank Enriqueta Aragonés, Benito Arruñada, Josep Maria Colomer, Itai Sened, Hernando Zuleta and conference participants in the ISNIE 2002 and ESNIE 2002 meetings for helpful comments. This work has received financial support from the CICYT, an agency of the Spanish Government, through grants SEC99-1191 and SEC2002-04471-C02-02. The usual disclaimer applies.

4.1. Introduction

Present day societies are heterogeneous and multicultural. It is often difficult to find a set of values, customs and even a language shared by all society members. Diversity puts pressure on the institutions of collective decision-making and some of them prove more appropriate than others in dealing with this situation. In reality, diversity cannot be fully respected by democratic practice, since societies make collective choices by achieving a certain level of agreement, which is usually far from unanimity. One consequence of this is the rise of two approaches treating the tyranny of the majority in collective decision-making, which can be described as the Rousseau's hopes for a moralized citizenry and the constitutional provision of a bill of rights (Reeve and Ware, 1992).

Rousseau's idea of a moralized citizenry implies intrinsically homogeneous preferences. An endeavor to implement this solution has been recently made in several European countries where, in atmosphere of growing concern over the integration of immigrants, some EU members have tried to make newcomers identify more strongly with the values of their countries of residence. For example, the government of the Netherlands announced a program to educate Muslim religious leaders in the values of the Dutch democracy. Although important, these kinds of policies are not going to be central to my analysis, since they focus on intrinsic preference change.

A more immediate mechanism of protection against the tyranny of the majority is the protection of rights, including property rights, by means of the legal and the judicial systems. Using this approach, I develop and test a theory about the effect that electoral formats and government configurations have on the degree of property rights protection. I propose that there exists a negative relationship between the number of institutions of consensual collective

decision-making and the degree of property rights protection. Using a sample of 63 democratic countries, I find evidence that those with less consensus-oriented (that is, more majoritarian) institutions of collective decision-making score higher on measures of property rights protection. In addition I challenge the collective choice explanation to the legal origin hypothesis, which states more or less explicitly that the Anglo-American common law tradition is superior to the Continental European civil law tradition in safeguarding property rights. The evidence suggests that electoral formats and government configurations are better predictors of the degree of property rights protection than the country's legal origin.

The rest of the chapter is organized as follows: In Section 2 I describe different models of democracy as a function of their election rules and governance structures. Section 3 contains a simple model and states the central claim of this paper, namely, that the type of the democratic model determines the degree of property rights protection. In Section 4 I offer a short overview of the differences and similarities between the two main Western legal traditions, as these have been used to explain cross-country differences in the degree of property rights protection. Section 5 describes the data and the empirical test of the hypothesis. Section 6 discusses the implications of the empirical findings in light of growing concerns about the success of institutional reforms in transition and developing countries.

4.2. Election rules and executive power

One of the most detailed quantitative comparative studies of modern democracies and their collective decision making mechanisms is done by Arend Lijphart (1999). When characterizing a democratic model, he uses ten variables, among which the party systems, the electoral rules, the power of the executive, the presence of interest groups, the degree of (de)centralization, and the independence of the central bank. These variables are employed

to build a conceptual map of democracy, out of which two basic forms of democratic models stand out—a majoritarian model and a consensus-oriented model. The majoritarian model concentrates all political power in the hands of a bare majority, and often in the hands of a minority, while the consensual model is based on a broader support, as it tries to share, disperse, and limit power in a variety of ways.

Building on this basic dichotomy, I present a parsimonious model emphasizing two out of the ten variables originally studied by Lijphart (1999)—electoral rules and relative power of the executive—and consequently assess the impact of these variables on property rights protection. A detailed description of different democratic governance systems and their transposition to the majoritarian—consensual dichotomy is presented below.

4.3. Electoral rules

4.3.1. ABSOLUTE MAJORITY RULE

Absolute majority rule belongs to the family of voting rules, which by construction produce only one winner. It has been most frequently used in presidential elections and less frequently in parliamentary elections and it can be designed in several ways: categorical vote in one round, majority preferential vote, and majority vote with a second round.

Categorical vote in one round often fails to produce a majority winner in cases of three or more candidates. It is also vulnerable to the introduction of new candidates and as a consequence, it may produce uncertainty about the election results. For all these reasons it is not used in practice.

The size of the majority—simple or qualified—also influences the stability and certainty of the final election. The majority preferential vote takes into account not only the first preference of the voters, but also the second, the third, and so on. The purpose of this rule is to obtain a candidate with a broader support. The majority vote with a second round is designed so that the two candidates with most votes in the first round compete in a second round. The winner in the second round is the winner of the elections. This rule is used both for parliamentary and presidential elections.

4.3.2. RELATIVE MAJORITY RULE

According to the relative majority (plurality) rule, the candidate who obtains most votes, no matter how many, is the absolute winner, and thus, the rule frequently produces winners supported by the largest *minority*. This rule makes the winning candidate even more vulnerable to the existence of alternative contestants and thus increases the uncertainty of the final result. In spite of the existence of several forms of relative majority rule, only categorical vote with relative majority is now used in mass elections. The general elections in the United Kingdom and most British colonies, as well as the presidential election in the United States, are some examples. This rule produces only one winner (one-party cabinet) and in many cases the winner represents the biggest *minority*.

4.3.3. PROPORTIONAL RULE

The proportional rule turns out multiple winners. It is consensus-oriented and has two distinctive features. First, it cannot be manipulated by the introduction of additional candidates and second, it gives incentives for honest instead of strategic voting. However, as far as pure proportional representation is modified by the application of some formulae, translating votes into parliamentary seats distorts the proportionality principle. For

example, both Webster-Sainte Lague and Hamilton-Hare formulae encourage fragmentation of political parties, because independent participation of the parties forming a coalition can result in more seats in the parliament than their joint participation. On the contrary, Jefferson-d'Hondt formula favors big parties and coalitions.

Higher district magnitude and consequently the number of seats to be distributed among parties can also affect the degree of proportionality. The higher the district magnitude, the smaller the distortion in the proportionality principle (Taagepera, 1998). In spite of these potential deviations from proportionality, the proportional rule tends to produce parliaments in which no single political party has the majority of seats. Thus, in the absence of one unquestionable winner, the parties have to engage in negotiations in order to form a cabinet.

There are several reasons to argue that elections performed by proportional rule create more consensus-oriented governance institutions than the ones resulting from majority rule voting. First, the proportional rule in contrast to the majority rule tends to produce more often coalition governments (Persson, 2004). This kind of governments can have different configurations within the same legislature. Various parties can consequently enter and exit the governing coalition. These political dynamics create an environment of negotiation and consensus building. In contrast, under the majority rule and especially under the plurality rule, a less representative, often one-party government is created. Second, governments elected by the majority rule tend to be less predictable and more durable, so the interests of an important part of the voters are excluded from political consideration for longer time periods. In addition, empirical studies of the composition of multiparty cabinets performed in countries with either proportional or majority rule general elections show that the composition of the cabinets approved by parliaments elected by proportional representation

are located closer to the position of the median voter (Huber and Bingham Powell, 1994). A study performed on 452 general and presidential election for the period 1945-2000 finds that the more inclusive the election rule, the closer the result to the position of the median voter. In particular, the rule that most often produces the outcome preferred by the median voter is proportional (91% of the cases) followed by absolute majority (73%) and relative majority (54%) rule (Colomer, 2001). The uncertainty about the winner and the exclusiveness of the majority rule make political parties fear about their interests in case they stay in opposition. In this way, the rules of political representation force political actors to seek a credible guarantee for their interests. As a result, I hypothesize that in regimes with majority voting, political actors have incentives to create a credible and visible mechanism of protection, and in particular property rights protection, to serve as a guarantee against expropriation.

Treating minority cabinets as always exclusive and assuming that they occur only in elections organized by the majority rule is misleading, however. It has been shown that “minority governments¹³ may represent the preferences of the voters equally well, although in different ways” and that they occur with frequency in countries with proportional representation. For example, the fact that between 1973 and 1982, 19 of 21 Scandinavian cabinets were undersized did not affect these societies in any meaningful way, as the economic performance of their minority governments was comparable to the performance of majority coalitions (Strom, 1990). The existence of decentralized committees, where the opposition has considerable influence, contributes to the achievement of a broad consensus on most issues. In these countries the cost of being in opposition is low because there exists

¹³ Strom (1990) uses the words government and cabinet interchangeably, while I use the word government in a broader sense than the word cabinet.

an implicit public agreement that decisions are taken with broad support.¹⁴ The pluralistic nature of the Scandinavian model is reflected also in the fact that most of these countries are parliamentary democracies with proportional representation. Although they frequently form minority cabinets, most important decisions are taken by broad consensus through a system of decentralized and highly influential committees.

Unlike the Scandinavian model of democracy, the Westminster model imposes a much higher cost on being in opposition. It is based on the plurality election rule and lacks the consultative spirit of the Scandinavian parliaments. In fact, stronger committees have been a frequently prescribed remedy for the weakness of the British House of Commons (Strom, 1990). This less consensus-orientated institutional arrangement is reflected in the “winner-takes-it-all” electoral format and, as argued here, in their strong reliance on and protection of the institution of property rights.

4.4. Horizontal government

As described above, the difference between one-party governments and broad coalitions can be partially attributed to the difference between the majority rule of exclusion and the proportional rule of consensus building. In addition, horizontal differentiation of powers among different governance actors—parliament, president and prime minister—also contributes to the balance of interests and it is an inseparable part of the institutional design of collective decision-making. Three major models of formal relationship among these three sources of power emerge.

¹⁴ In Norway, for example, most civil servants see their role not as that of judges, managers, or scientists but rather as negotiators or mediators.

4.4.1. PARLIAMENTARY REGIME

Under the parliamentary regime, the legislature elects a prime minister, who in turn appoints a cabinet. In general, when the parliament is elected with absolute majority rule, the winning party forms the government. When the parliament is elected with proportional rule, a coalition government is formed and the power is dispersed in the hands of the cabinet members. The cabinet in parliamentary regimes depends on majority support in the legislature in order to stay in office.

4.4.2. PRESIDENTIAL REGIME

In presidential regimes, the parliament and the president are elected separately and the president is the one to form a cabinet. He is a one-person executive, who concentrates substantial power and he is less dependent on the legislature than the prime minister in parliamentary systems. Presidential regimes can produce one-party or multi-party governments. In the first case, the same party wins general and presidential elections, while in the second case, different parties participate in government and more than one political party approves the legislative initiatives of the president.

4.4.3. SEMIPRESIDENTIAL REGIME

This regime is similar to the presidential, but in this case a prime minister chosen by the parliament forms a government. This system can be generally considered a parliamentary system, because the executive concentrates less power and needs broader support.

Using the previous descriptions of election rules and horizontal government formulae, democratic regimes are classified into four groups: parliamentary regimes established by majority rule; parliamentary regimes established by proportional rule; presidential and semipresidential regimes. A more or less consensual collective decision-making process characterizes each of these forms of democracy and, as a consequence, a different degree of

protection of property rights is expected to characterize each of them. The rationale behind this conjecture is presented formally below.

4.5. A simple model

Consider a political competition with N political parties representing conflicting economic interests.¹⁵ Let the post-electoral distribution be such that each party i has control over a share x_i of the common wealth, where $\sum_i^N x_i = 1$. Under each of two stylized mechanisms of collective decision-making—plurality rule and proportional rule—the parties decide over the degree of protection of property rights they want. This decision must be generally applicable, meaning that no coalition of parties that benefits at the detriment of another party is allowed. Let V_A be the probability of winning of party A in the next elections and let x_A be the share of the common wealth party A can dispose of. Parties are risk averse and $\alpha \in (0,1)$ represents the degree of risk aversion, where higher value of α means lower risk aversion. Parties maximize their objective function over both the current and the next post-electoral periods.

a) Plurality rule competition

Under plurality rule, the party that accumulates most votes is the absolute winner and can decide how much it will respect the losing parties' interests. That is, in the absence of some kind of limitations, the absolute winner can completely expropriate the losers. Let us

¹⁵ The assumption that political actions derive from economic interests has been widely used in the literature and its validity throughout history has been highlighted in the cases of seventeenth-century England (North and Weingast, 1989) and twentieth-century South Africa (Fedderke, De Kadt and Luiz, 2001).

assume that party A is the absolute winner. Then the maximization problem party A faces is:

$MaxU_A = x_A^s + V_A(x_A)^\alpha + (1 - V_A)(1 - x_A)^\alpha$, where x_A^s is the share of the common wealth that party A disposes of, given the status quo that is determined by previous legislative decisions and is not a decision variable for party A. The variable party A can influence is x_A . After solving for x_A , we get

$$\left(\frac{V_A}{1 - V_A} \right)^{\frac{1}{1 - \alpha}} = \frac{x_A}{1 - x_A}. \quad (1)$$

From equation (1) some comparative statics are derived implying that, first, the higher the probability of winning for party A in the next period, the less respected the loser's interests are going to be, $\frac{\partial x_A}{\partial V_A} > 0$. Second, the lower the risk aversion coefficient for party

A (higher α), the less respected the loser's interests are going to be, $\frac{\partial x_A}{\partial \alpha} > 0$.

Summing up, when parties are risk averse and when they are not confident about winning in the next period, they will agree to commit to the protection of the loser's interest. If parties are risk neutral or confident about winning the next elections they will tend to expropriate the loser.

b) Proportional rule competition

One trait of governments formed by the proportional rule, as opposed to the plurality rule, is the high incidence of coalitions (Persson, 2004). Let V_{AC} be the probability that party A belongs to the winning coalition in the next elections and let x_C be the share of the

common wealth the coalition can dispose of. Then the maximization problem party A faces is:

$MaxU_A = x_{AC}^s + V_{AC}(x_C)^\alpha + (1 - V_{AC})(1 - x_C)^\alpha$, where x_{AC}^s is the share of the common wealth that party A disposes of, given that it is part of the ruling coalition in the current period. The variable party A can influence is x_C , that is, how much of the common wealth would the next ruling coalition appropriate. After solving for x_C ,

$$\left(\frac{V_{AC}}{1 - V_{AC}} \right)^{\frac{1}{1-\alpha}} = \frac{x_C}{1 - x_C} \quad (2)$$

Equation (2) becomes identical to equation (1) when, given the proportional representation rule, one party expects to obtain more than 50 per cent of the votes and govern alone. In the case when no party expects such a landslide, a coalition should be formed. As a result, $V_{AC} > V_A$, that is, under the proportional representation rule, the probability to govern as part of a coalition is higher than the probability to form a one-party government.¹⁶ The difference in the expected probability for participation in government implies different commitments to the protection of interest of the political losers, as $x_C > x_A$. When a coalition is formed, different parties can join or exit it at any moment and, in addition, coalitions can be much larger than the minimum-winning requirement. This fact, combined with the possibility to actively participate in the decision-making process and protect one's own interests, limit the incentives of the majority coalition to explicitly commit to non-expropriation.

¹⁶ For analytical overview and empirical evidence, see Persson (2004).

According to the framework presented here, the majoritarian model of democracy is characterized with incentives to commit against expropriation, because the winner in this electoral format is, first, absolute, and second, very uncertain. As parties have imperfect information about the next absolute winner, all have incentives to guarantee the loser against abusive behavior, by creating a commitment mechanism. On the contrary, a parliamentary regime established by the proportional rule is usually more fragmented and coalitions are frequently formed. Decision-making is based on negotiations among several political actors and usually this form of democracy is more consensus-oriented and is characterized by mutual controls among coalition members.

Using this intuition, the types of democratic models described above— parliamentary regimes established by majority rule, parliamentary regimes established by proportional rule, presidential and semipresidential regimes — can be transposed to the majoritarian— consensual dichotomy in the following way: Parliamentary regimes elected by majority rule lie at the majoritarian end of the spectrum and parliamentary regimes elected by the proportional rule lie at the consensus-oriented end of the spectrum. In presidential and semipresidential regimes the mere fact that the choice is concentrated in one person (the president) makes the institutional design look less representative. However, dividing political powers and requiring some degree of coordination between them, convert these regimes into somewhat consensual. In fact, there is evidence that voters in presidential and semipresidential regimes tend to diversify their choice. A study of 507 elections in 40 democratic countries during the period 1945-2000 concludes that in 63% of the elections conducted in countries with presidential (62,69%) and semipresidential (67,75%) regimes, the party of the president does not have majority in the parliament (Colomer, 2001). In reality this diversification strategy generates a more consensus-oriented political practice.

However, the fact that in presidential regimes the power of the executive with respect to the collective body is greater than in semipresidential regimes, frequently imposes on presidential regimes weaker pressure to seek consensus-oriented decisions.

Summarizing, countries belonging to the majoritarian model of democracy—presidential and parliamentary regimes elected by the plurality rule— are expected to show stronger commitment to property rights protection than countries belonging to the consensus-oriented model of democracy—semipresidential regimes and parliamentary regimes elected by proportional rule. The reason is that the majoritarian model of democracy requires credible commitment against losers' expropriation if it is to provide stable democratic practice. The fragmented and consultative nature of the proportional model of democracy does not create as strong incentives for property rights protection. The conjectured political explanation of cross-country differences in the degree of property rights protection, however, has to be contrasted with the popular legal explanation, which sets the Anglo-American common law tradition against the continental civil law tradition.

4.6. Common versus civil law

Comparative legal scholars and institutional economists classify countries into two major groups depending on their legal and judicial tradition, namely common law and civil law (Watson, 1974). Often the main difference between the two categories is assumed to reside in the degree to which they use judicial precedents and statutory law.¹⁷ The economic importance of this difference has been recently outlined in a number of studies

¹⁷ For a detailed discussion of the role of judicial decision-making in the Western legal tradition, see Arruñada and Andonova (2004).

related to the development of financial markets (La Porta *et al.*, 1997, 1998). Researchers have focused on the level of legal protection that minority shareholders and investors enjoy in countries with different legal traditions and find that better protection of investors' interests is correlated, on the one hand, with better-developed financial markets and, on the other, with the common law legal tradition. In other words, the development of financial markets and the associated macroeconomic growth are argued to be related to the legal tradition—common law versus civil law—a country belongs to. Consequently, this line of research has been extended to include other institutional and economic indicators like level of regulation, efficiency of government, judicial independency and economic growth (La Porta *et al.*, 1999, 2000; Mahoney, 2001; Djankov *et al.*, 2002, 2003), with the same underlying conclusion that the common law is superior to the civil law tradition.

These recent empirical studies found their natural theoretical inspiration in the works of the American law and economics school, whose most prominent example is the pioneering work of Posner (1973). An important part of the paradigm defended by the American law and economics school is that the judge-made law characteristic for 18th century common law countries is superior to the statute law created by elected representatives typical for civil law countries. The validity of this belief, however, has been questioned recently and evidence has been provided, showing that current judicial practices are not as divergent across legal traditions as they probably were two centuries ago (Arruñada and Andonova, 2004; Manne, 1997; Zywicki, 2003). In addition, sources of efficiencies and inefficiencies have been found in both common law and civil law practice (Bork, 1990; Faure, 2001; Harnay, 2002; Mattei, 1997; Rubin, 1982; Wagner, 1998). In fact, researchers have observed convergence between the common law and the civil law legal traditions, and in particular, judicial practices, and have explained it with the rise of

the regulatory state (Glaeser and Shleifer, 2001; Manne, 1997; Sunstein, 1989). That is, in modern societies differences between the common law and the civil law are claimed to be overshadowed by the rise of the legislature as primary institution in the process of law creation. In fact, legislatures have acquired a privileged position in the law-making process even in traditional common law countries. This, however, was not the case some centuries ago, when medieval statutes started with a preamble justifying the need for the parliament to intervene in most cases using as an argument the controversial common law.¹⁸ As

Fletcher (1996) puts it:

“It is as though the community of citizens as well as the professional community of lawyers simply agreed to defer to elected officials as oracles of the Law. Occasionally one encounters the kind of irreverent reaction that Nozick dared: ‘Is there really someone who, searching for a group of wise and sensitive persons to regulate him for his own good, would choose that group of people who constitute the membership of both houses of Congress?’”

Although polemic, this statement points to the relevance that elected institutions have acquired in the process of law creation and questions the importance of setting judge-made law against the statute law tradition. In fact, non-corrupt judiciary is a required condition for a stable economic development. However, there are no reasons to believe that the present day judiciary practice varies across legal traditions for any other reason than the institutional balance of powers in the realm of the State. Moreover, the major families of legal systems were created as a consequence of debates about government structure, not merely about the rules that should govern particular transactions (Mahoney, 2001).

Building on this, I argue that what explains cross-country differences in the degree of property rights protection and the derived economic welfare is not the legal tradition itself, but the pattern of social organization that is reflected in the electoral rules and government

¹⁸ “[A]t least since the origins of parliamentary rule in Britain, the legislature was always recognized as having the authority and the power to change a rule of common law even one found by the highest appellate court [...]” (Manne, 1997).

formation formulae. Prior choices and beliefs that have shaped legal structures are also reflected in the institutions of collective decision-making, which are the major generator of legal rules in present day democracies. In this way, the determinant for a well-functioning legal and political process is the balance of power within the limits of the state, where the structure of political competition and the form of government determine the mechanism by which private property rights are protected. I hypothesize that in modern democracies the nature of the collective decision-making process is a better predictor of the degree of property rights protection than the legal tradition a country belongs to. The reason is that the structure of political institutions directly reflects prior choices about the role of the individual and the State, while belonging to a given legal tradition does so only remotely and indirectly. The validity of this hypothesis, however, has to be empirically investigated.

4.7. Data, variable description and empirical results

It is time now to empirically test the conjectured relationship between the form of democracy and the degree of property rights protection. In essence, I will confirm that the form of democratic government, and not the legal tradition to which a country belongs to, explains better the degree of property rights protection. Then I take a step further to explore the role of institutional interdependencies using a measure of social infrastructure.

4.7.1. PROPERTY RIGHTS AND POLITICAL CONSENSUS

The empirical test is performed on a sample of sixty-three, out of the sixty four, countries originally studied and classified as democracies by Colomer (2001).¹⁹ The countries in the sample comprise about 90 per cent of world's population, which currently lives in democracy. Table 1 contains the list of the countries according to their form of democratic government.

Dependent variable

Property rights (*PropertyRights*) represent one of the ten fields monitored in order to construct the Index of Economic Freedom for year 2000 provided by the Heritage Foundation²⁰. *PropertyRights* accounts for two broad areas—independence and efficiency of judicial system and legally granted and protected private property. The weaker the legal protection of property, the higher the score. The property rights index for the countries in the sample ranges from 1 to 4, meaning that the sample does not contain countries with the maximum score of 5, which indicates absence of secure property rights. Countries receiving score of 1 fit the following description: Private property is guaranteed by the government. The court system efficiently enforces contracts and justice punishes those, who unlawfully confiscate private property. Corruption is nearly nonexistent and expropriation is unlikely. Score 4, on the other hand, implies that property ownership is weakly protected, the court

¹⁹ Papua New Guinea is dropped out due to data availability.

²⁰ Economic freedom is defined as “*the absence of government coercion or constraint on the production, distribution, or consumption of goods and services beyond the extent necessary for citizens to protect and maintain liberty itself*” (Beach and O’ Driscoll Jr., 2002). The fields under evaluation are trade policy, fiscal burden of government, government intervention in the economy, monetary policy, capital flows and foreign investment, banking and finance, wages and prices, property rights, regulation and black market activity. Each of these fields is given equal importance in the evaluation of the degree of economic freedom in a country.

system is inefficient and corruption is present. Judiciary is influenced by other branches of government, which makes expropriation possible (Beach and O' Driscoll Jr., 2002).

Independent variables

The independent variables are dummy variables taking value of 1 if a country belongs to a specific model of democracy or legal tradition, and 0 otherwise. The classification of the countries according to their model of democracy is done following Colomer (2001) and according to the legal tradition— following La Porta *et al.* (1999).²¹

Table 1
Voting rules and form of government

Parliamentary with majority rule	Presidential and semipresidential regimes	Parliamentary with proportional rule
Australia	Argentina	Austria
Botswana	Bolivia	Slovenia
Canada	Brazil	Belgium
India	Chile	Spain
Jamaica	Colombia	Czech Rep.
Mauritius	Costa Rica	Sweden
Thailand	Dominican Rep.	Switzerland
Trinidad	Ecuador	Denmark
United Kingdom	El Salvador	Estonia
	Guatemala	Finland
	Honduras	Germany
	Israel	Greece
	Malawi	Hungary
	Mali	Ireland
	Mexico	Italy
	Namibia	Japan
	Nicaragua	Latvia
	Panama	Netherlands
		New Zealand
		Norway
		South Africa
		Slovakia

Source: Colomer 2001, table 5.3. *Democracies in 2000*

²¹ For two of the countries in the dataset, Israel and Italy, there is not a general agreement about their model of democracy. In order to check the robustness of the results, I have performed sensitivity tests with alternative classifications of these two countries. Coefficients change only marginally and their significance remains the same.

Table 2

Variable definitions, Means and Standard Deviations

Variable		Mean	Std Dev.
<i>PropertyRights</i>	Index of property rights protection ranging from 1 to 4.	2.11	0.90
<i>SocialInfrastructure</i>	Index of social infrastructure ranging from 0 to 1.	0.58	0.25
<i>Majoritarian</i>	Dummy variable taking value of 1 if a country belongs to the group of parliamentary regimes with majority rule, 0 otherwise.	0.15	0.37
<i>Presidential</i>	Dummy variable taking value of 1 if a country belongs to the group of presidential regimes, 0 otherwise.	0.38	0.49
<i>Proportional</i>	Dummy variable taking value of 1 if a country belongs to the group of parliamentary regimes with proportional rule, 0 otherwise.	0.34	0.48
<i>Semipresidential</i>	Dummy variable taking value of 1 if a country belongs to the group of semipresidential regimes, 0 otherwise.	0.13	0.33
<i>CommonLaw</i>	Dummy variable taking value of 1 if a country belongs to the group of Anglo-American legal tradition, 0 otherwise.	0.24	0.43
<i>FrenchOrigin</i>	Dummy variable taking value of 1 if a country belongs to the group of French civil law tradition, 0 otherwise.	0.43	0.50
<i>GermanOrigin</i>	Dummy variable taking value of 1 if a country belongs to the group of German civil law tradition, 0 otherwise.	0.09	0.29
<i>ScandiOrigin</i>	Dummy variable taking value of 1 if a country belongs to the group of Scandinavian civil law tradition, 0 otherwise.	0.06	0.25
<i>Socialist</i>	Dummy variable taking value of 1 if a country belongs to the group of socialist legal tradition, 0 otherwise.	0.17	0.38
<i>MajorityCommon</i>	Dummy variable taking value of 1 if a country has either presidential regime or parliamentary regime with majority voting and belongs to the common law tradition.	0.19	0.39
<i>MajorityCivil</i>	Dummy variable taking value of 1 if a country has either presidential regime or parliamentary regime with majority voting and belongs to the civil law tradition.	0.33	0.47
<i>ConsensusCommon</i>	Dummy variable taking value of 1 if a country has either semipresidential regime or parliamentary regime with proportional voting and belongs to the common law tradition.	0.05	0.21
<i>ConsensusCivil</i>	Dummy variable taking value of 1 if a country has either semipresidential regime or parliamentary regime with proportional voting and belongs to the civil law tradition.	0.25	0.44
<i>ConsensusSocialist</i>	Dummy variable taking value of 1 if a country has either semipresidential regime or parliamentary regime with proportional voting and belongs to the socialist legal tradition.	0.17	0.38
<i>logGDP</i>	Log GPD per capita.	3.67	0.61
<i>Africa</i>	Dummy variable taking value of 1 if a country is located in the African continent, 0 otherwise.	0.11	0.32
<i>LatinAmerica</i>	Dummy variable taking value of 1 if a country belongs to the group of Latin-American countries, 0 otherwise.	0.25	0.44

Control variables

Three control variables are used. *logGDP* represents a logarithmic transformation of the GDP per capita for year 2000. This variable controls for the overall economic development of a country as it is expected to affect the efficiency of property rights enforcement. In general, richer countries have better financed and controlled institutions, including property rights protection, and I expect this variable to explain a considerable share of the sample variance.²² Given the definition of the *PropertRights* variable, it is mandatory to use GDP per capita as a control if I am to isolate the effect of the forms of government on the incentives to create strong property rights protection.

In addition, two geographical dummy variables, one for Latin America (*LatinAmerica*) and one for Africa (*Africa*) are included in order to control for the geographical, social and historical idiosyncrasy of these regions. Extensive research in institutional analysis and macroeconomics has been done on the determinants of the specific behavior of African and Latin American countries. Among the arguments used to justify the special consideration given to these regions are “the weakness and misfortune” of the colonizers (Albert, 1983), the fragmentation of political power, the militarization of the society (Landes, 1998) and path-dependency.²³ Table 2 contains a detailed variable description.

Since the dependant variable represents rank categories with a minimum of 1 and a maximum of 4, the appropriate estimation method is an ordered dependent variable model. Given that OLS estimates are easier to interpret and do not rely for the significance of the coefficients on the large number of observations that the probit estimates imply, I present

²² More specifically, I expect that economic development affect democracy and its institutions and not the other way around (Huber *et al.*, 1993).

²³ For a detailed and comprehensive analysis of the determinants of persistent differences characterizing Latin American development, see Prados de la Escosura (2003).

both OLS and probit results. I proceed to estimate how the probability of obtaining a better (that is, lower) score on the index of property rights protection is affected by the form of democratic government. The results are presented in Table 3.

Model 1 to Model 4 are estimated using OLS, while Model 5 to Model 8 are estimated using ordered probit. The estimation of a model including all control variables is followed by an estimation including the independent variables only. Given the evidence in Model 1 and Model 5, I cannot reject the hypotheses that having a proportional parliamentary or semipresidential forms of government increases the probability of obtaining worse scores on the index of property rights, when controlling for geographical factors and economic development. Moreover, I cannot reject the hypothesis that majoritarian parliamentary and presidential systems contribute to better scores on the property rights protection measure, when controlling for the same factors (see Model 3 and Model 7). These results provide support to the conjectured negative relationship between the number of institutions of consensual decision-making and the degree of property rights protection. The size of this effect also deserves attention, as on average it amounts to half of the effect of the *logGDP* variable, which has the strongest influence on property rights protection. For example, a country with GDP per capita of 10 000 U.S. dollars, which has proportional parliamentary democratic system will obtain a score of 1.27, while ceteris paribus, a majoritarian parliamentary democracy will obtain a score closer to two (1.71).

In addition, the geographical control dummy for Latin America shows strong and robust positive effect on the index of property rights protection, implying weak respect for private property in that part of the world. More importantly, *logGDP* has the strongest negative effect on the dependent variable and explains most of the sample variance, supporting the conjecture that richer countries have better institution for private property

protection. Naturally, when I test the model without *logGDP* as a control variable, the hypothesized relationships seem not to hold and the explained sample variance is drastically reduced. Not holding wealth equal, however, prevents from isolating the effect of democratic forms of government on property rights protection and, as a result, coefficients should be interpreted with caution.

Next, I test the importance of the legal tradition for the degree of property rights protection. According to some recent comparative studies, belonging to the Anglo-American common law tradition creates an advantage for developing a market economy and market-supporting institutions, of which property rights protection is one example. I test the impact of the common law versus the civil law legal origin (French, German, Scandinavian or Socialist) on the property rights protection index and present the results in Table 4.

The main observation is that the claim about the superiority of common law for creating market-supporting institutions remains, to say the least, unproven. The results show that German and Scandinavian civil law provide *at least* as good protection for property rights as the common law does. I confirm the importance of the GDP per capita in explaining institutional development and the negative effect of the *LatinAmerica* dummy for private property protection.

Table 3

Property Rights and the Form of Democracy

Independent Variables	Dependent Variable: Property Rights							
	Model 1 OLS	Model 2 OLS	Model 3 OLS	Model 4 OLS	Model 5 Probit	Model 6 Probit	Model 7 Probit	Model 8 Probit
<i>Majoritarian</i>	0.026 (0.243)	-0.833* (0.308)	-0.423** (0.203)	0.030 (0.311)	0.011 (0.685)	-1.144* (0.448)	-1.244** (0.609)	0.057 (0.448)
<i>Presidential</i>			-0.449** (0.222)	0.864* (0.232)			-1.256** (0.635)	1.201* (0.345)
<i>Proportional</i>	0.449** (0.223)	-0.864* (0.232)			1.256** (0.635)	-1.201* (0.345)		
<i>Semipresidential</i>	0.797* (0.256)	0.250* (0.321)	0.348 (0.224)	1.114* (0.325)	2.058* (0.709)	0.332 (0.444)	0.803 (0.573)	1.533* (0.474)
Control Variables								
<i>Africa</i>	0.043 (0.243)		0.043 (0.243)		0.116 (0.604)		0.116 (0.604)	
<i>LatinAmerica</i>	0.842* (0.236)		0.843* (0.236)		2.087* (0.663)		2.087* (0.663)	
<i>logGDP</i>	-1.044* (0.138)		-1.044* (0.138)		-2.673* (0.500)		-2.672* (0.500)	
<i>Intercept</i>	5.477* (0.554)	2.500* (0.161)	5.926* (0.581)	1.636* (0.168)				
<i>Adj.RSq./Pseudo RSq</i>	0.727	0.234	0.727	0.234	0.485	0.122	0.485	0.122
<i>(N)</i>	(63)	(63)	(63)	(63)	(63)	(63)	(63)	(63)

* = Significant at 1% level; ** = Significant at 5% level; *** = Significant at 10% level.

Table 4

Property Rights and Legal Origins.

Independent Variables	Dependent Variable: Property Rights							
	Model 1 OLS	Model 2 OLS	Model 3 OLS	Model 4 OLS	Model 5 Probit	Model 6 Probit	Model 7 Probit	Model 8 Probit
<i>CommonLaw</i>	-0.184 (0.303)	0.483 (0.411)	-0.296 (0.203)	-0.748* (0.235)	-0.498 (0.824)	0.916 (0.732)	-0.763 (0.508)	-1.083* (0.372)
<i>FrenchOrigin</i>	0.112 (0.312)	1.231* (0.391)			0.265 (0.814)	1.998* (0.717)		
<i>GermanOrigin</i>	-0.368 (0.330)	-0.250 (0.472)	-0.479** (0.270)	-1.481* (0.329)	-9.085 (828)	-7.424 (379)	-9.673 (341)	-9.317 (249)
<i>ScandiOrigin</i>			-0.112 (0.312)	-1.231* (0.391)			-0.265 (0.814)	-1.998* (0.717)
<i>Socialist</i>	0.469 (0.344)	1.386* (0.426)	0.357 (0.249)	0.155 (0.261)	1.048 (0.914)	2.213 (0.765)	0.784 (0.622)	0.215 (0.388)
Control Variables								
<i>Africa</i>	0.134 (0.277)		0.134 (0.277)		0.291 (0.669)		0.291 (0.669)	
<i>LatinAmerica</i>	0.509** (0.235)		0.509** (0.235)		1.082** (0.585)		1.082** (0.585)	
<i>logGDP</i>	-0.848* (0.159)		-0.848* (0.159)		-2.061* (0.474)		-2.061* (0.474)	
<i>Intercept</i>	5.041* (0.758)	1.250* (0.365)	5.153* (0.723)	2.481* (0.141)				
<i>Adj.RSq/Pseudo RSq</i>	0.715	0.341	0.715	0.340	0.481	0.214	0.481	0.214
<i>(N)</i>	(63)	(63)	(63)	(63)	(63)	(63)	(63)	(63)

* = Significant at 1% level; ** = Significant at 5% level; *** = Significant at 10% level.

So far, I have presented evidence showing that better scores on property rights protection index are associated with less consensus-oriented democracy models. The data supports the conjecture that in political environments with majoritarian characteristics, creating clear rules for property rights protection works as a visible, and thus, credible commitments not to expropriate political losers. In addition, no convincing evidence is found on the superiority of the common law legal tradition with respect to property rights protection. On the contrary, in modern democracies legal protection of property rights is probably a consequence of the balance of powers between groups with different interests within the realm of the state, and in this sense endogenous, rather than an inherited institution like the legal origin.

The hypothesis presented here has its own limitations, however, the most important probably being that it assumes away institutional interdependencies. This shortcoming should be kept in mind, as the theory developed here seemingly advises more adversarial institutions of collective decision-making as a step towards a well-functioning market economy. The ideas presented here, however, do not have direct normative implications, since they focus on just one facet of the complex social interaction. Next, I highlight the limitations of the ideas presented thus far and explore the effect of institutional interdependencies.

4.7.2. INSTITUTIONAL INTERDEPENDENCIES

The objective of the analysis in this chapter is to study the extent to which a given polity protects private property rights and consequently facilitates a market-friendly institutional environment. Institutional interdependencies have been assumed away and a measure of private property rights protection has been treated as a proxy for social and

economic development. However, if institutional interdependencies are in place, the measure of property rights protection fails to reflect correctly the *overall* development of an economic system. In this case, we need a *global* measure of social infrastructure in order to isolate the effect (if any) that democratic forms of government have on the overall institutional and economic development, of which property rights protection is just one component.

For this purpose, I use the index of social infrastructure proposed by Hall and Jones (1999). Social infrastructure (*SocialInfrastructure*) encompasses the institutions and government policies that provide incentives for the individuals and firms either to get involved into productive activities or to engage in rent seeking, corruption and theft. The social infrastructure index ranges from 0 to 1 and is a combination of two indices: an index of government anti-diversion policies taken from Knack and Keefer (1995) and a measure of the extent to which a country is open to international trade. For the first part, three categories that relate to the government's role as a possible diverter are considered—corruption, risk of expropriation and government repudiation of contracts—and assigned equal weights. For the second part, an index compiled by Sachs and Warner (1995) is used as a measure of the openness of a country to trade. Policies toward international trade are argued to be a sensitive indicator of social infrastructure, as for example, tariffs, quotas, and other trade barriers divert resources to the government and create opportunities for further private diversion (Hall and Jones, 1999).

Consequently, I test the effect that different democratic forms of government have on this global measure of social infrastructure. The results are presented in Table 5. The main observation is that the democratic forms of collective decision making perform poorly as explanatory variables for the measure of social infrastructure, probably manifesting the

effect of institutional interdependencies. Again GDP per capita and the dummy variable for Latin America show statistically significant coefficients. The evidence suggests that parliamentary systems, instead of presidential or semipresidential systems, seem to contribute to a better social infrastructure. This result is in line with extensive research in political studies, which analyzes the unfulfilled expectations of the presidential democratic model (Linz and Valenzuela, 1994).

Table 5

Social Infrastructure and the Form of Democracy.

Independent Variables	Dependent Variable: Social Infrastructure			
	Model 1 OLS	Model 2 OLS	Model 3 OLS	Model 4 OLS
<i>Majoritarian</i>	0.185*** (0.265)	0.214** (0.308)	0.051 (0.092)	-0.131 (0.099)
<i>Presidential</i>			-0.134 (0.089)	-0.345* (0.070)
<i>Proportional</i>	0.134 (0.090)	0.345* (0.070)		
<i>Semipresidential</i>	0.084 (0.112)	0.158 (0.114)	-0.050 (0.101)	-0.187* (0.325)
Control Variables				
<i>Africa</i>	-0.006 (0.105)		-0.006 (0.105)	
<i>LatinAmerica</i>	-0.032* (0.095)		-0.032* (0.095)	
<i>logGDP</i>	0.245* (0.0.065)		0.235* (0.138)	
<i>Intercept</i>	-0.364* (0.265)	0.419** (0.047)	-0.230 (0.283)	0.764* (0.052)
<i>Adj. R Sq.(N)</i>	0.596 (46)	0.371 (46)	0.596 (43)	0.371 (46)

* = Significant at 1% level; ** = Significant at 5% level; *** = Significant at 10% level.

4.8. Concluding remarks and discussion

Property rights are regarded as one of the most important institutions of the market economy as they induce individuals to invest in assets and facilitate the exchange of goods.²⁴ The most recent attempts to understand the nature of property rights have pointed to the origin of the legal tradition and heralded the superiority of the Anglo-American common law. An increasing number of studies, however, are looking at the protection of property rights as something more than a legal issue. For example, Coffee (2001) argues that moral norms can probably explain the fact that, although Scandinavian countries do not have strong legal protection of investors' property, they do have well developed financial markets. Dyck and Zingales (2002) propose a related argument, suggesting that it is premature to recommend legal reforms as a necessary step for the development of markets, while Mark Roe (1995) accommodates three related concepts: chaos theory, path-dependence and modern evolutionary theory in an attempt to explain the dynamics behind several "successful" market-supporting institutions.

The theory developed and tested here belongs to this group of works, which look behind legal rules and into the broader institutional system in search of an explanation for the differences in the degree of property rights protection across countries. The proposed mechanism of cross-country variations in property rights protection is based on a model of collective decision-making. The legal rules protecting property rights are treated as endogenous to the political system and, as such, resistant to any attempts to transplant the

²⁴ The literature on property rights has been growing fast since the seminal Demsetz's (1967) article.

concepts of one legal system into another. While remaining skeptical about the effect of legal transplants, this study extends a bridge between social choice and comparative legal studies that could prove to be a fruitful path towards understanding institutional interdependencies. Further work is needed to detect and analyze the factors that determine the degree of consensus in collective decision-making and thus endogenize the institutions of democratic rule.

5. References

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