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Mobile phones, the Internet and the institutional environment

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Abstract

This paper empirically investigates the determinants of the Internet and cellular phone penetration levels in a cross-country setting. It offers a framework to explain differences in the use of information and communication technologies in terms of differences in the institutional environment and the resulting investment climate. Using three measures of the quality of the investment climate, Internet access is shown to depend strongly on the country's institutional setting because fixed-line Internet investment is characterized by a high risk of state expropriation, given its considerable asset specificity. Mobile phone networks, on the other hand, are built on less site-specific, re-deployable modules, which make this technology less dependent on institutional characteristics. It is speculated that the existence of telecommunications technology that is less sensitive to the parameters of the institutional environment and, in particular, to poor investment protection provides an opportunity for better understanding of the constraints and prospects for economic development.

Keywords: Internet; Cellular; Institutional; Investment

1. Introduction

Telecommunications, as a mechanism for reducing information asymmetry, are argued to be a major determinant of market development and economic growth, and empirical research has confirmed this relationship (Garbade & Silber, 1978; DuBoff, 1980; Hardy, 1980; Nathaniel, 1984; Norton, 1992). However, other factors, many of which are institutionally determined, should be present if investment in telecommunications is to lead to growth. Since telecommunications technology related to the Internet and mobile telephony is fast becoming the foundation of the knowledge economy, a reassessment of the relationship between telecommunications, growth and institutions is needed.

This paper re-examines the relationship between information and communications technologies (ICT), institutions and growth in the light of the changing technological parameters of present-day communications. It suggests that the difference in ICT use between rich and poor nations is largely a product of the institutional divide, of which the digital divide is only a symptom. The central hypothesis is that wireless telephony is less dependent on institutional parameters, among them investor protection, and can therefore diminish

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cross-country differences in ICT use and may even change institutions. Mobile telecommunications are seen here as a paradigm for a viable business model in an environment of relatively poor investor protection.

The paper begins with a brief discussion of the digital divide and an exploration of its determinants. Next, it introduces two hypotheses describing the relationship between ICT and the institutional environment. In a cross-country setting, Internet access is shown to be significantly conditioned by the quality of the institutional environment, particularly by the degree of investor protection. Wireless telephony, in contrast, due to lower initial investments and re-deployable assets, is less institutionally dependent. Finally, prospects for economic growth and endogenous institutional change are discussed and policy recommendations are offered.

2. The digital divide and its determinants

The digital divide is defined as the difference between those with permanent, effective access to new ICT and those with none (Powell, 2001; Wilson III, 2001). According to this definition, the digital divide can occur both at national level, between different social groups (Hoffman, Novak, & Schlosser, 2000; Rice & Katz, 2003), and internationally, between different countries. Concerns about the international digital divide have given rise to numerous studies, whose goal is to facilitate the use of new information and communications technology and help bridge the gap (Kenny, 2001; Roycroft & Anantho, 2003; Wilson III & Wong, 2003). Such research has pointed to the socio-cultural and economic forces behind the digital divide, such as differences in education level and infrastructure, but only occasionally has it raised the question of why these exist in the first place.

One possible reason for investment differences in ICT is that the positive effect they may have is not easily recognized and the positive externalities are not immediately evident. This time lag may make the short-term benefits of investments unclear. For example, for many years economists failed to find a relationship between investments in information technology and productivity, calling this phenomenon a "productivity paradox" (Berndt & Morrison, 1995). Recently, this relationship has been empirically confirmed (Bassu, Fernald, Oulton, & Srinivasan 2003; Brynjolfsson & Hitt, 1995, 1996; Dunne, Foster, Haltiwanger, & Troske, 1999) and non-linearities in it have become evident.

Another reason for the existence of the digital divide is that, whenever governments are directly involved in investments, they have limited resources and end up allocating them to competing projects. If governments differ in their priorities for improving information and telecommunications facilities, their investment decisions may contribute to cross-country differences. Moreover, if governments are concerned about maintaining an oppressive and non-democratic status quo, they might intentionally limit ICT dissemination (Buchner, 1988).

A third explanation for the existence of the digital divide is that, when the institutional environment guarantees private investment security, it reduces the temptation of governments to expropriate private investors (Henisz & Zelner, 2001; Levy & Spiller, 1996). According to this argument, differences in the provision of utilities in general, and of telecommunication services in particular, stem from institutional parameters that condition the size of investments. So, credible and effective governments provide the institutional environment and property rights' protection needed for the development of new information and telecommunications technologies, while nations cursed with unbalanced, corrupt, unstable or unpredictable governments inevitably fall behind, because they are not able to provide the required institutional safeguards for private investors. Thus, the argument suggests that institutional differences resulting from historic, geographic and ad hoc factors determine the fortune of nations and their opportunities in the social and economic transformation triggered by the new information technologies. Although most evidence supports the existence of such institutional determinism, new mobile forms of technology have the potential to make the future less pessimistic for nations on the wrong side of the divide.

Mobile and wireless telephony in general, along with the Internet, are both novel communication venues and major demand drivers for telecommunications services. Although they share some features, they differ greatly in the requirements they pose for the receptive institutional environment. It is further argued that present-day Internet connectivity and wireless telephony rely on assets involving different degrees 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, such as fixed-line telecommunications,

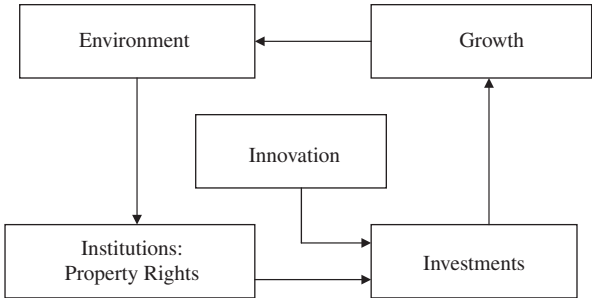

Fig. 1. Path-dependent model of development and innovation.

which currently provide the basis for Internet connectivity.[1] According to this argument, the idea that business opportunities in ICT in institutionally underdeveloped countries are a huge risk because of possible expropriation by the government might prove exaggerated. It may fail to take into account the current state of technology, disregarding the limited institutional requirements characterizing wireless telephony.

3. Telecommunications and the institutional environment

A growing line of research has highlighted the relationship between geographic conditions, historical accidents, ad hoc factors and institutions (Acemoglu, Johnson, & Robinson, 2002; Arruñada, 2003; Barro & MacCleary, 2003; Engerman & Sokoloff, 2002). In addition, a set of comparative studies empirically establishes a positive relationship between institutional environment, investment protection (La Porta, Lopez-de-Silanes, Shleifer, & Vishny, 1998) and infrastructure development (Henisz & Zelner, 2001). These factors are generally believed to affect development and growth. Feedback between general economic development and institutional parameters is also suggested, which magnifies the effects on growth of the initial conditions. This path-dependent model of economic development is presented in Fig. 1. Its prediction about the future of the digital divide is that, if it is in fact institutionally determined, it will persist because a market-supporting, investor-friendly institutional environment can only develop over a considerable time span and is difficult to influence.

Comparative statistical analysis together with field research on the influence of the institutional environment over the development of fixed-line telecommunications have identified the risk of investment expropriation or "hold-up" as being the single most important institutional parameter (Henisz & Zelner, 2001; Levy & Spiller, 1996). Henisz and Zelner 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, [and this] 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" (2001, p. 127). In this analysis, investments in basic telecommunications infrastructure are a classic example of investments which have a high potential for a hold-up problem so are very sensitive to a market-oriented set-up that is respectful of private property rights. Thus, the development of basic telecommunication services appears to be conditioned by path-dependent institutional parameters and from this perspective the digital divide seems unavoidable. Technologies relying on mobile assets, however, may interrupt the path-dependency loop and lessen the impact of the institutional environment.

Wireless telephony, for example, can give access to information and telecommunications services in previously isolated and institutionally underdeveloped regions. It is built on cheaper, easily re-deployable infrastructure, and may achieve a high degree of connectivity in hostile institutional environments, as exemplified by the satellite link Internet service which can achieve mobile connectivity in 90 days, and by the use of high-speed wireless modems, which can halve the cost of telecommunications while doubling the bandwidth (Wilson III & Wong, 2003). This technology needs less investment than fixed lines, although the

[1]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).

latter constitute the most common way of providing Internet access in homes today. In addition, mobile networks can be constructed faster than fixed-line networks, they need fewer subscribers to reach a minimally efficient scale, and their modules are mobile and easily transportable.[2] To sum up, the difference between fixed-line and wireless telecommunications networks from an institutional perspective lies in the size of the sunk costs, the asset mobility and the associated investment risk. This difference in the technological parameters gives rise to two testable hypotheses:

Hypothesis 1. An investment-friendly institutional environment, characterized by lower investor risks, correlates positively with the diffusion of information and communications technology.

Hypothesis 2a. An investment-friendly institutional environment, characterized by lower investor risks, correlates more strongly with the diffusion of those information and communication technologies which rely most heavily on site-specific assets and require larger up-front investments.

Hypothesis 2b. In contrast, an investment-friendly institutional environment, characterized by lower investor risks, correlates less strongly with the diffusion of those information and communication technologies which rely more heavily on easily transportable, re-deployable modules.

From these hypotheses it follows that the institutional environment associated with lower investor risks will have a stronger, positive correlation with the number of Internet users than with the number of mobile phone subscribers. This is because present-day Internet connectivity is built on more expensive, site-specific assets, while mobile telephony is based on easily transportable, re-deployable modules.

4. Description of variables

In order to test the above hypotheses, several reduced-form equations for ICT adoption rates are estimated, where the dependent variables are (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 ICTs which rely heavily on site-specific assets and require larger up-front investments, such as the deployment of basic infrastructure and the provision of Internet connectivity, will show a stronger correlation with proxies of the institutional environment than technologies such as cellular telephony, which are built on mobile, re-deployable modules.

4.1. Dependent variables

Main Lines represent per capita telephone lines connecting the subscriber's terminal equipment (telephone set) to a public, switched network having a dedicated part in the telephone exchange equipment (ITU Internet Reports, 2002).

Internet Hosts represents per capita computers in the 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 Reports, 2002).

Internet Users represents 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 & Fairlie, 2004).

Cellular Phone Subscribers represents per capita users of portable telephones subscribing to an automatic, public, mobile telephone service, which provides access to the public switched telephone network (PSTN) using cellular technology. This may include analog and digital cellular systems. Subscribers to fixed wireless, public, mobile data services, or radio-paging services are not included (ITU Internet Reports, 2002). Although, optimally, *wireless* telephone subscribers should have been used for testing the hypotheses, *Cellular Phone Subscribers* is the chosen proxy because of data availability. However, it should be kept in mind that the

[2]For example, after the 1998 earthquake in Honduras, mobile base stations were deployed in a matter of days (The Economist, 1999).

proxy variable might in some cases provide a considerably understated figure of the real penetration of wireless telephony (Chinn & Fairlie, 2004). 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.

4.2. Control variables

To guarantee the robustness of the results, three control variables measuring the quality of the institutional environment and thus the degree of investor protection are used: *POLCON*, *Political Rights* and *Civil Liberties*.

POLCON expresses 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 the *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 is 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 5-year periods between 1960 and 2002 and is a measure of how securely investors' interests are protected by a given polity, taking into account the checks and balances in the political system together with the homogeneity of preferences of the political actors.

In addition, *Political Rights* and *Civil Liberties* variables are used to check the robustness of the hypothesized relationship between the quality of the institutional environment and the ICT penetration rates. Both *Political Rights* and *Civil Rights* can be used as proxies for investment protection and, more generally, quality of the institutional environment, but the different methodology by which these two indices are created, when compared to *POLCON*, makes them suitable for checking robustness.

Political Rights and *Civil Liberties* are measures of political freedom and civil liberties, respectively, and represent the country scores provided by Annual Freedom in the World for 2000–2001. They reflect survey results obtained by 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 taking the inverse of the original measures, so that a higher value of *Political Rights* and *Civil Liberties* should be interpreted as an indication for a greater degree of political freedom and civil liberties. The empirical test using *Political Rights* and *Civil Liberties* is presented in the Appendix A to the paper (Tables 5–8).

In addition, the literature has offered mixed evidence about the importance of competitive markets as well as other variables affecting the demand for telecommunications services (Busse, 2000; Doyle & Smith, 1998; Guillén & Suárez, 2001), and many of these are included as control variables in the empirical tests.

First, an extensive list of price variables forms part of the regression equations. The price variables can be broadly divided into two groups: those that measure the price of telephony access (*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, in this cross-sectional setting, neither access prices nor prices of use have any robust statistical affect on the diffusion rates of information technologies. This result is not surprising as several other large-scale, cross-sectional studies fail to report a statistically significant effect of telecom prices on Internet use (Chinn & Fairlie, 2004). Nevertheless, several smaller-scale analyses have argued that telecommunications prices affect Internet diffusion (Kiiski & Pohjola, 2002; Mann, Eckert, & Knight, 2000).

Secondly, the *Illiteracy* variable represents the percentage of people aged 15 or above who cannot read with understanding and write a short, simple statement about their everyday life. This proxy for human capital is important because the degree of knowledge and training needed for proper use of technology affects its adoption rate. In a study on Internet penetration, Anthony Wilhelm (2000) reported that education is a stronger determinant of Internet connectivity than any other traditional, socio-economic indicator. A number of studies have found a positive effect of human capital on the ICT penetration rate, but researchers have not

Table 1
Variable names, definitions and sources

Variable	Variable description	Source
Business charge	Business telephone connection charge (US$)	ITU, 2002
Business subscription	Business telephone monthly subscription (US$)	ITU, 2002
Cellular charge	Cellular connection charge (US$)	ITU, 2002
Cellular subscription	Cellular monthly subscription (US$)	ITU, 2002
Cellular phone subscribers	Cellular mobile telephone subscribers divided by population.	ITU, 2002
Cellular phone subscribers(Res)	Variance of *Cellular Phone Subscribers* unexplained by *GDP per capita(Res)*, *Illiteracy(Res)*, *POLCON*, *Urban Population(Res)*.	
Civil liberties	The inverse of the score on Civil Liberties originally ranging from 1 to 7.	Freedom House, 2001
Cost of a 3 min call	Cost of a local 3 min call (peak rate) (US$)	ITU, 2002
GDP per capita	Gross domestic product divided by midyear population in constant 1995 US$.	World Development Indicators (2002)
GDP per capita(Res)	Variance of *GDP per capita* unexplained by *POLCON*.	
Illiteracy	Illiterate people aged 15 and above as a percentage of total population aged 15 and above.	WDI, 2002
Illiteracy(Res)	Variance of *Illiteracy* unexplained by *GDP per capita(Res)*, *POLCON* and *Urban Population(Res)*.	
Internet hosts	Number of computers in an economy that are directly linked to the worldwide internet network divided by population.	ITU, 2002
Internet hosts(Res)	Variance of *Internet Hosts* unexplained by *Cellular Phone Subscribers(Res)*, *GDP per capita(Res)*, *Illiteracy(Res)*, *Main Lines(Res)*, *POLCON* and *Urban Population(Res)*.	
Internet users	Estimated number of Internet users divided by population.	ITU, 2002
Main lines	Main telephone lines in operation divided by population.	ITU, 2002
Main lines(Res)	Variance of *Main Lines* unexplained by *Cellular Phone Subscribers(Res)*, *GDP per capita(Res)*, *POLCON*, *Urban Population(Res)*, *Illiteracy(Res)*.	
POLCON	*POLCON* 2002	*POLCON* data set
POLCON 94	*POLCON* 1994	*POLCON* data set
Δ*POLCON*	(*POLCON* 2002–*POLCON* 1994)	
Political rights	The inverse of the score on Political Rights originally ranging from 1 to 7.	Freedom House, 2001
Residential charge	Residential telephone connection charge (US$).	ITU, 2002
Residential subscription	Residential monthly telephone subscription (US$).	ITU, 2002
Urban population	Urban population as a percentage of total population.	WDI, 2002
Urban population (Res)	Variance of *Urban Population* unexplained by *GDP per capita(Res)* and *POLCON*.	

agreed on the best way to measure human capital (years of schooling or illiteracy rate, for example). As in the majority of studies, it is confirmed here that the measure of human capital is a strong predictor of information technology adoption.

Thirdly, given that differences in urbanization might be related to differences in infrastructure development, the *Urban Population* variable is used to measure the percentage of total urban population (Table 1).[3]

[3]A control for the English-language network effect with a dummy variable, which takes the value of 1 if a country has English as its national or official language, and 0 otherwise (www.ethnologue.com), was also tried. 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 Internet development. The coefficient of this variable was not statistically significant at conventional levels in any of the regression equations, thus failing to show the persistence of any English-language network effect.

5. Empirical test and results

Using ordinary least-squares hierarchical regression, the effect of the institutional environment on the equilibrium level of ICT diffusion is estimated. A hierarchical regression of the following type is used to residualize the influence of variables on data with multicollinearity problems:

(1) $\text{Log(GDP per capita)} = \alpha_1 + \beta_1 POLCON + \varepsilon_1$,
where $\varepsilon_1 = GDP$ per capita(Res)
(2) $\text{Log(Urban Population)} = \alpha_2 + \beta_2 POLCON + \beta_3\varepsilon_1 + \varepsilon_2$,
where $\varepsilon_2 =$ Urban Population(Res)
(3) $\text{Log(illiteracy)} = \alpha_3 + \beta_4 POLCON + \beta_5\varepsilon_1 + \beta_6\varepsilon_2 + \varepsilon_3$,
where $\varepsilon_3 =$ Illiteracy(Res)
(4) $\text{Log(Cellular Phone Subscribers)} = \alpha_4 + \beta_7 POLCON + \beta_8\varepsilon_1 + \beta_9\varepsilon_2 + \beta_{10}\varepsilon_3 + \varepsilon_4$,
where $\varepsilon_4 =$ Cellular Phone Subscribers(Res)
(5) $\text{Log(Main Lines)} = \alpha_5 + \beta_{11} POLCON + \beta_{12}\varepsilon_1 + \beta_{13}\varepsilon_2 + \beta_{14}\varepsilon_3 + \beta_{15}\varepsilon_4 + \varepsilon_5$,
where $\varepsilon_5 =$ Main Lines(Res)
(6) $\text{Log(Internet Hosts)} = \alpha_6 + \beta_{16}\log(\text{Latitude}) + \beta_{17}\varepsilon_1 + \beta_{18}\varepsilon_2 + \beta_{19}\varepsilon_3 + \beta_{20}\varepsilon_4 + \beta_{21}\varepsilon_5 + \varepsilon_6$,
where $\varepsilon_6 =$ Internet Hosts(Res)

The results show that there is a strong and statistically significant correlation between the institutional environment proxy (*POLCON*) and the penetration levels of basic telephone infrastructure, Internet usage, and cellular telephony subscription (Table 2). This evidence supports the hypothesis that the institutional environment, associated with lower investment risks and better property rights protection, is positively correlated with the adoption rate of information technology (Hypothesis 1). Additional evidence about the robustness of this relationship is provided in the Appendix A, where two alternative measures of institutional development (*Political Rights* and *Civil Liberties*) are used. Relying on the Wald test of difference between coefficients, the differential impact of a better institutional environment is tested, the hypothesis being that better investor protection correlates more strongly with communication technologies using more site-specific assets (fixed-line telephony and present-day Internet) than with communication technologies relying on less specific assets (wireless and, in this case, cellular telephony). After estimating a system of regression equations, the Wald test of difference between the coefficients of the *POLCON* variables is used. 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 all twelve different model specifications, the measure of the institutional environment (*POLCON* or *Political Rights* or *Civil Liberties*) has a stronger and statistically significant impact on the number of *Internet hosts* than on the number of *Internet users* or *Cellular Phone Subscribers*, while in eleven of these specifications the coefficient of the institutional variable for *Internet Users* is indistinguishable from the coefficient of *Cellular Phone Subscribers*. In general, this evidence suggests that a better institutional environment correlates more strongly with Internet technology penetration through the *Internet hosts* variable than with cellular telephony. Unexpectedly, however, a distinct effect of the institutional environment on the number of cellular and Internet users is not confirmed, although these technologies rely on assets having different degrees of specificity. Nevertheless, there is some evidence that Internet and cellular telephony diffusion correlate to a different degree with the quality of the institutional environment, although the relationship is subtler. Table 3 contains the results of a hierarchical regression, where the effect of the institutional quality (*POLCON*) and its improvement ($\Delta POLCON$) are estimated separately (Table 4).

The results show that the adoption levels of both Internet and cellular telephony are conditioned to a similar extent by the initial quality of the institutional environment (for *Internet Users*, $POLCON = 3.726$; for *Cellular Phone Subscribers*, $POLCON = 4.408$; Wald test for difference between coefficients is $p = 0.159$). However, for the standard levels of statistical significance, *improvements* in the institutional environment ($\Delta POLCON$) do not affect the adoption level of cellular telephony, while they do affect that of Internet

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)
Cellular charge		0.000 (0.001)		−0.007* (0.002)		−0.005 (0.001)		−0.003 (0.001)
Cellular phone subscribers	0.109 (0.080)	0.025 (0.146)						
Cellular subscription		0.001 (0.014)		−0.002 (0.031)		0.005 (0.015)		−0.002 (0.017)
Cost of a 3 min call		−3.932 (2.718)		5.333 (5.994)		−1.056 (3.081)		0.340 (3.486)
GDP per capita(Res)	0.914* (0.053)	0.879* (0.077)	1.351* (0.141)	1.293* (0.165)	0.927* (0.065)	0.948* (0.084)	1.111* (0.077)	1.119* (0.096)
Illiteracy(Res)	−0.365* (0.054)	−0.404* (0.090)	−0.810* (0.141)	−0.44** (0.19)	−0.323* (0.065)	−0.276* (0.103)	−0.207* (0.078)	−0.157 (0.112)
Internet hosts(Res)					0.155* (0.059)	0.054 (0.087)		
Main lines(Res)			0.168 (0.303)	0.345 (0.387)	0.285** (0.143)	0.475* (0.198)	0.001 (0.168)	−0.129 (0.225)
$POLCON^{a,b}$	3.129* (0.231)	3.053* (0.369)	6.944* (0.607)	6.368* (0.785)	3.779* (0.279)	3.507* (0.400)	4.568* (0.336)	4.295* (0.456)
Urban population(Res)	0.958* (0.185)	0.878* (0.309)	0.366 (0.500)	0.496 (0.628)	0.653* (0.231)	0.700** (0.319)	0.019 (0.268)	0.677** (0.365)
Intercept	−3.759* (0.116)	−3.508* (0.284)	−10.85* (0.306)	−10.23* (0.605)	−5.533* (0.140)	−4.982 (0.310)	−4.854* (0.168)	−4.511* (0.352)
Adj. R^2 (N)	0.866 (80)	0.842 (39)	0.729 (78)	0.775 (39)	0.825 (77)	0.856 (39)	0.801 (80)	0.849 (39)

Notes: *significant at 1% level; **significant at 5% level.

[a]Wald test of difference between coefficients: $POLCON_{(1)} = POLCON_{(3)}$, $p = 0.000$; $POLCON_{(1)} = POLCON_{(5)}$, $p = 0.073$; $POLCON_{(1)} = POLCON_{(7)}$, $p = 0.000$; $POLCON_{(3)} = POLCON_{(5)}$, $p = 0.000$; $POLCON_{(3)} = POLCON_{(7)}$, $p = 0.000$; $POLCON_{(5)} = POLCON_{(7)}$, $p = 0.0071$.

[b]Wald test of difference between coefficients: $POLCON_{(2)} = POLCON_{(4)}$, $p = 0.000$; $POLCON_{(2)} = POLCON_{(6)}$, $p = 0.404$; $POLCON_{(2)} = POLCON_{(8)}$, $p = 0.034$; $POLCON_{(4)} = POLCON_{(6)}$, $p = 0.001$; $POLCON_{(4)} = POLCON_{(8)}$, $p = 0.022$; $POLCON_{(6)} = POLCON_{(8)}$, $p = 0.195$.

Table 3
The differential impact of the institutional environment on internet users and cellular telephony

Independent variables	Dependent variables	
	Internet users	Cellular phone subscribers
GDP per capita(Res)	0.929* (0.069)	1.139* (0.083)
Illiteracy(Res)	−0.337* (0.070)	−0.208* (0.085)
Main lines(Res)	0.283** (0.146)	0.001* (0.173)
$\Delta POLCON$	0.161* (0.062)	0.393 (0.519)
$POLCON$[a]	3.726* (0.284)	4.408* (0.394)
Urban population(Res)	0.671* (0.234)	0.027* (0.274)
Intercept	−5.528* (0.143)	−4.822* (0.173)
Adj. R^2 (N)	0.865 (78)	0.798 (78)

Notes: *significant at 1% level; **significant at 5% level.
[a]Wald test of difference between coefficients: $POLCON_{(1)} = POLCON_{(2)}$, $p = 0.159$.

technology. This indicates that cellular telephony is less dependent on *improvements* of the institutional environment than Internet technology, 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 1.5% in per capita Internet users, while its correlation with cellular telephony is statistically indistinguishable from zero. This evidence supports the idea that institutional *improvements* associated with lower investment risks and better property rights protection correlate less strongly with the adoption level of technologies relying on mobile and re-deployable modules (Hypothesis 2b) than with that of technologies built on site-specific assets (Hypothesis 2a).

In addition, the degree of economic development (*GDP per capita(Res)*) correlates positively with the adoption level of all kinds of information technologies. In contrast, a control variable that impacts basic infrastructure and cellular telephony differently is the percentage of urban population (*Urban Population(Res)*). Higher urban concentration facilitates the development of fixed-line technologies more than cellular telephony. This result supports anecdotal evidence that many distant rural areas first obtained a reliable connection to the rest of the world by using wireless technology, for which deployment costs are less affected by network density.

Unsurprisingly, the percentage of the illiterate population (*Illiteracy(Res)*) as a measure of the stock of human capital shows a strong negative correlation with the diffusion of telecommunications technologies. In general, this correlation is stronger for the adoption of Internet, which requires reading and writing skills, than for the adoption of telephony. In addition, the adoption of Internet technology depends on the development of basic telephone infrastructures. These complementary features between fixed-line infrastructure and Internet use are not surprising given that present-day Internet connectivity is largely dependent on the existence of fixed-line networks. Naturally, the results also indicate that the number of Internet users is positively related to the number of computers connected to the World Wide Web (*Internet Hosts(Res)*).

As already discussed with regard to price levels, in this large-scale, cross-section setting, there are no robust, significant price effects either on the number of cellular phone subscribers or on the number of Internet users.

6. Discussion and policy implications

This analysis, first, shows that many of the differences observed in the use of information technologies, frequently called the digital divide, stem from deeper differences in what might be called the institutional divide. Consequently, narrowing the gap between the technological haves and have-nots requires changing this environment. This, however, might be a very difficult task as it frequently involves a transformation of the fundamental political and social rules of a society.

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)
Business charge	−0.000 (0.000)		−0.003 (0.002)		−0.002* (0.001)		−0.000 (0.001)	
Business subscription	−0.044* (0.012)		−0.017 (0.033)		0.007 (0.016)		0.002 (0.019)	
Cellular phone subscribers	0.025 (0.084)	0.029 (0.077)						
GDP per capita(Res)	0.968* (0.055)	0.985* (0.049)	1.323* (0.142)	1.282* (0.142)	0.972* (0.071)	0.951* (0.074)	1.093* (0.085)	1.102* (0.085)
Illiteracy(Res)	−0.315* (0.053)	−0.306* (0.048)	−0.634* (0.138)	−0.659* (0.139)	−0.351* (0.069)	−0.369* (0.073)	−0.19** (0.082)	−0.18** (0.082)
Internet hosts(Res)					0.206* (0.069)	0.215* (0.072)		
Main lines(Res)			−0.178 (0.337)	−0.073 (0.371)	0.243 (0.169)	0.304 (0.192)	−0.202 (0.202)	−0.229 (0.221)
POLCON[a,b]	3.325* (0.241)	3.596* (0.233)	7.032* (0.619)	6.882* (0.677)	3.739* (0.308)	3.689* (0.350)	4.591* (0.375)	4.647* (0.409)
Urban population(Res)	1.194* (0.189)	1.084* (0.168)	0.227 (0.492)	0.076 (0.474)	0.753* (0.246)	0.699* (0.247)	0.300 (0.296)	0.313 (0.285)
Residential charge		−0.01** (0.000)		−0.003 (0.001)		−0.002** (0.000)		0.000 (0.001)
Residential subscription		−0.103* (0.019)		0.015 (0.067)		0.029 (0.035)		−0.006 (0.040)
Intercept	−3.408* (0.163)	−3.292* (0.146)	−10.32* (0.432)	−10.53* (0.445)	−5.293* (0.219)	−5.511* (0.231)	−4.898* (0.263)	−4.885* (0.269)
Adj. R^2 (N)	0.888 (66)	0.907 (66)	0.773 (65)	0.773 (65)	0.857 (65)	0.845 (65)	0.823 (66)	0.823 (66)

Notes: *significant at 1% level; **significant at 5% level.

[a]Wald test of difference between coefficients: $POLCON_{(1)} = POLCON_{(3)}$, $p = 0.000$; $POLCON_{(1)} = POLCON_{(5)}$, $p = 0.290$; $POLCON_{(1)} = POLCON_{(7)}$, $p = 0.005$; $POLCON_{(3)} = POLCON_{(5)}$, $p = 0.000$; $POLCON_{(3)} = POLCON_{(7)}$, $p = 0.001$; $POLCON_{(5)} = POLCON_{(7)}$, $p = 0.079$.

[b]Wald test of difference between coefficients: $POLCON_{(2)} = POLCON_{(4)}$, $p = 0.000$; $POLCON_{(2)} = POLCON_{(6)}$, $p = 0.824$; $POLCON_{(2)} = POLCON_{(8)}$, $p = 0.026$; $POLCON_{(4)} = POLCON_{(6)}$, $p = 0.000$; $POLCON_{(4)} = POLCON_{(8)}$, $p = 0.005$;$POLCON_{(6)} = POLCON_{(8)}$, $p = 0.075$.

Secondly, human capital and the degree of urbanization happen to be important determinants of information technology diffusion. These factors are independent of the impact of institutional quality on ICT adoption levels. Governments may consider influencing these aspects if narrowing the digital divide is their priority although it has been more or less explicitly argued that efforts of this nature are not needed as in *relative terms* developing countries show faster rates of growth in network development than developed countries (Fink & Kenny, 2003). However, even though developing countries might be catching up in terms of telephone infrastructure and Internet use per dollar of GDP, this does not prove that the digital divide is going to disappear. First, ICT are characterized by network economies, where *absolute* numbers matter, and secondly, the *proper* use of these technologies depends on complementary factors such as 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.

Several important limitations of this analysis should be kept in mind. First, it does not account for differences both in telecommunications infrastructure and quality of institutions across regions within the same country. The difficulty of performing a large-scale analysis on a regional level rather than on a national level is twofold: there is no readily available, reliable data on regional ICT diffusion; in addition, internationally comparable indices of the quality of the institutional environment are drawn up on a national level, even though political scientists recognize some degree of institutional heterogeneity within a country. The cross-sectional nature of the analysis might also limit the validity of the conclusions to a specific time. A panel data estimation could overcome this limitation and demonstrate the general applicability of the results.

Finally, it can be speculated that this analysis could serve as a starting point to ponder on 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 introducing technologies which are less sensitive to institutional underdevelopment and which, in turn, through market dynamics, will endogenously change institutions. As has recently been shown, modular and mobile technologies relying on low initial investments are a viable business opportunity in institutionally underdeveloped countries (Hart & Christensen, 2002). Moreover, it can be hypothesized that these technologies have the potential to change the attractiveness of the institutional environment. More-balanced international development and narrower cross-country differences may be a byproduct of firms' quests for profit, whenever there are technologies and business models that are viable in institutionally underdeveloped environments. This speculation, however, remains to be proven and it should not be understood as implying that efforts to directly influence institutions are useless and that market-supporting institutions develop on their own. Probably, the most successful strategy to narrow the gap in international development would be a combination of institutional reforms backed with technological know-how that supports change and is largely immune to hostile business environments. However, further work is needed to verify the validity of this speculation.

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Appendix A

The empirical test using *Political Rights* and *Civil Liberties* is presented in Tables 5–8.

Table 5
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)
Cellular charge		0.000 (0.000)		−0.007* (0.002)		−0.005* (0.000)		−0.003* (0.001)
Cellular subscription		0.010 (0.012)		−0.007 (0.032)		0.009 (0.014)		0.006 (0.017)
Cellular phone subscribers	0.114 (0.074)	0.037 (0.123)						
Civil liberties [a,b]	4.135* (0.348)	4.433* (0.417)	9.443* (0.989)	6.944* (1.057)	5.263* (0.415)	4.612* (0.483)	5.390* (0.530)	4.626* (0.564)
Cost of a 3 min call		−5.31** (2.426)		5.590 (6.694)		−1.922 (2.941)		−0.223 (3.572)
GDP per capita(Res)	0.934* (0.051)	0.834* (0.068)	1.397* (0.148)	1.377* (0.183)	0.935* (0.062)	0.933* (0.079)	1.142* (0.077)	1.129* (0.097)
Illiteracy(Res)	−0.349* (0.054)	−0.351* (0.081)	−0.781* (0.154)	−0.529* (0.208)	−0.295* (0.064)	−0.278* (0.092)	−0.212* (0.082)	−0.196 (0.111)
Internet hosts(Res)					0.118* (0.052)	0.064 (0.073)		
Main lines(Res)			0.244 (0.321)	0.210 (0.440)	0.273* (0.138)	0.393** (0.192)	0.000 (0.171)	−0.147 (0.235)
Urban population(Res)	1.019* (0.177)	1.061* (0.273)	0.334 (0.522)	0.415 (0.685)	0.825* (0.219)	0.731** (0.298)	0.220 (0.270)	0.745** (0.366)
Intercept	−3.958* (0.133)	−3.909* (0.259)	−11.22* (0.381)	−9.999* (0.656)	−5.842* (0.161)	−5.218* (0.294)	−4.918* (0.203)	−4.508* (0.350)
Adj. R^2 (N)	0.865 (85)	0.862 (43)	0.687 (83)	0.778 (43)	0.827 (82)	0.866 (43)	0.778 (85)	0.835 (43)

Notes: *significant at 1% level; **significant at 5% level.

[a]Wald test of difference between coefficients: $Civil\ Liberties_{(1)} = Civil\ Liberties_{(3)}$, $p = 0.000$; $Civil\ Liberties_{(1)} = Civil\ Liberties_{(5)}$, $p = 0.037$; $Civil\ Liberties_{(1)} = Civil\ Liberties_{(7)}$, $p = 0.048$; $Civil\ Liberties_{(3)} = Civil\ Liberties_{(5)}$, $p = 0.000$; $Civil\ Liberties_{(3)} = Civil\ Liberties_{(7)}$, $p = 0.000$; $Civil\ Liberties_{(5)} = Civil\ Liberties_{(7)}$, $p = 0.851$.

[b]Wald test of difference between coefficients: $Civil\ Liberties_{(2)} = Civil\ Liberties_{(4)}$, $p = 0.027$; $Civil\ Liberties_{(2)} = Civil\ Liberties_{(6)}$, $p = 0.779$; $Civil\ Liberties_{(2)} = Civil\ Liberties_{(8)}$, $p = 0.784$; $Civil\ Liberties_{(4)} = Civil\ Liberties_{(6)}$, $p = 0.045$; $Civil\ Liberties_{(4)} = Civil\ Liberties_{(8)}$, $p = 0.053$; $Civil\ Liberties_{(6)} = Civil\ Liberties_{(8)}$, $p = 0.985$.

Table 6
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)
Business charge	−0.001 (0.000)		−0.01** (0.002)		−0.002* (0.000)		−0.000 (0.000)	
Business subscription	−0.044* (0.011)		0.006 (0.036)		0.008 (0.015)		0.008 (0.021)	
Cellular phone subscribers	0.053 (0.076)	0.081 (0.071)						
Civil liberties[a,b]	4.169* (0.326)	4.378* (0.305)	8.371* (0.162)	8.152* (0.935)	5.232* (0.412)	5.268* (0.437)	5.295* (0.541)	5.246* (0.548)
GDP per capita(Res)	1.008* (0.055)	1.019* (0.050)	1.369* (0.162)	1.272 (0.157)	0.957* (0.071)	0.932* (0.072)	1.113* (0.093)	1.097* (0.092)
Illiteracy(Res)	−0.307* (0.051)	−0.306* (0.047)	−0.687* (0.151)	−0.717* (0.148)	−0.319* (0.066)	−0.329 (0.068)	−0.21** (0.305)	−0.214* (0.085)
Internet hosts(Res)					0.181* (0.061)	0.184* (0.064)		
Main lines(Res)			−0.086 (0.368)	0.176 (0.393)	0.246 (0.161)	0.303 (0.181)	−0.169 (0.209)	−0.106 (0.227)
Urban population(Res)	1.269* (0.182)	1.162* (0.165)	0.377 (0.534)	0.228 (0.509)	0.802* (0.233)	0.759* (0.235)	0.451 (0.305)	0.446 (0.299)
Residential charge		−0.01** (0.000)		−0.003 (0.002)		−0.002** (0.001)		−0.000 (0.001)
Residential subscription		−0.097 (0.018)		0.096 (0.068)		0.031 (0.032)		0.030 (0.039)
Intercept	−3.532* (0.174)	−3.410* (0.158)	−10.43* (0.523)	−10.93* (0.532)	−5.621* (0.233)	−5.849* (0.245)	−4.908* (0.302)	−5.027* (0.309)
Adj. R^2 (N)	0.889 (70)	0.905 (70)	0.722 (69)	0.731 (69)	0.863 (69)	0.852 (69)	0.797 (70)	0.798 (70)

Notes: *significant at 1% level; **significant at 5% level.

[a]Wald test of difference between coefficients: $Civil\ Liberties_{(1)} = Civil\ Liberties_{(3)}$, $p = 0.000$; $Civil\ Liberties_{(1)} = Civil\ Liberties_{(5)}$, $p = 0.043$; $Civil\ Liberties_{(1)} = Civil\ Liberties_{(7)}$, $p = 0.074$; $Civil\ Liberties_{(3)} = Civil\ Liberties_{(5)}$, $p = 0.002$; $Civil\ Liberties_{(3)} = Civil\ Liberties_{(7)}$, $p = 0.004$; $Civil\ Liberties_{(5)} = Civil\ Liberties_{(7)}$, $p = 0.926$.

[b]Wald test of difference between coefficients: $Civil\ Liberties_{(2)} = Civil\ Liberties_{(4)}$, $p = 0.000$; $Civil\ Liberties_{(2)} = Civil\ Liberties_{(6)}$, $p = 0.095$; $Civil\ Liberties_{(2)} = Civil\ Liberties_{(8)}$, $p = 0.166$; $Civil\ Liberties_{(4)} = Civil\ Liberties_{(6)}$, $p = 0.005$; $Civil\ Liberties_{(4)} = Civil\ Liberties_{(8)}$, $p = 0.007$; $Civil\ Liberties_{(6)} = Civil\ Liberties_{(8)}$, $p = 0.975$.

Table 7
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)
Cellular charge		0.000 (0.001)		−0.007* (0.002)		−0.005* (0.001)		−0.003* (0.001)
Cellular phone subscribers	0.115 (0.075)	0.015 (0.128)						
Cellular subscription		0.007 (0.012)		−0.009 (0.032)		0.007 (0.014)		0.005 (0.016)
Cost of a 3 min call		−4.58** (2.437)		5.804 (6.404)		−1.427 (2.852)		−0.473 (3.389)
GDP per capita(Res)	0.896* (0.052)	0.824* (0.067)	1.323* (0.151)	1.348* (0.172)	0.905* (0.063)	0.924* (0.076)	1.101* (0.078)	1.101* (0.091)
Illiteracy(Res)	−0.340* (0.057)	−0.332* (0.085)	−0.694* (0.165)	−0.48** (0.214)	−0.259* (0.069)	−0.262* (0.095)	−0.16** (0.086)	−0.167 (0.113)
Internet hosts(Res)					0.128** (0.051)	0.067 (0.074)		
Main lines(Res)			0.275 (0.321)	0.206 (0.425)	0.294** (0.138)	0.422** (0.187)	−0.000 (0.168)	−0.176 (0.225)
Political rights[a,b]	3.085* (0.214)	3.319* (0.312)	6.709* (0.609)	5.384* (0.776)	3.679* (0.257)	3.394* (0.351)	4.056* (0.321)	3.652* (0.411)
Urban population(Res)	1.009* (0.177)	0.983* (0.277)	0.281 (0.522)	0.330 (0.675)	0.795* (0.221)	0.675** (0.297)	0.212 (0.265)	0.709** (0.357)
Intercept	−3.922* (0.115)	−3.886* (0.260)	−11.00* (0.329)	−10.03* (0.642)	−5.693* (0.140)	−5.164* (0.288)	−4.882* (0.172)	−4.541* (0.339)
Adj. R^2 (N)	0.864 (85)	0.855 (42)	0.685 (83)	0.729 (43)	0.824 (82)	0.865 (43)	0.784 (85)	0.840 (43)

Notes: *significant at 1% level; **significant at 5% level.

[a]Wald test of difference between coefficients: $Political\ Rights_{(1)} = Political\ Rights_{(3)}$, $p = 0.000$; $Political\ Rights_{(1)} = Political\ Rights_{(5)}$, $p = 0.076$; $Political\ Rights_{(1)} = Political\ Rights_{(7)}$, $p = 0.011$; $Political\ Rights_{(3)} = Political\ Rights_{(5)}$, $p = 0.000$; $Political\ Rights_{(3)} = Political\ Rights_{(7)}$,, $p = 0.000$; $Political\ Rights_{(5)} = Political\ Rights_{(7)}$, $p = 0.361$.

[b]Wald test of difference between coefficients: $Political\ Rights_{(2)} = Political\ Rights_{(4)}$, $p = 0.013$; $Political\ Rights_{(2)} = Political\ Rights_{(6)}$, $p = 0.873$; $Political\ Rights_{(2)} = Political\ Rights_{(8)}$, $p = 0.518$; $Political\ Rights_{(4)} = Political\ Rights_{(6)}$, $p = 0.019$; $Political\ Rights_{(4)} = Political\ Rights_{(8)}$, $p = 0.048$; $Political\ Rights_{(6)} = Political\ Rights_{(8)}$, $p = 0.632$.

Table 8
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)
Business charge	−0.001 (0.001)		−0.003** (0.002)		−0.003* (0.000)		−0.000 (0.000)	
Business subscription	−0.045* (0.011)		−0.000 (0.036)		0.006 (0.016)		0.005 (0.020)	
Cellular phone subscribers	0.046 (0.077)	0.078 (0.072)						
GDP per capita(Res)	0.966* (0.054)	0.981* (0.050)	1.309* (0.159)	1.204* (0.156)	0.934* (0.070)	0.906* (0.073)	1.082* (0.091)	1.062* (0.090)
Illiteracy(Res)	−0.292* (0.055)	−0.291* (0.051)	−0.592* (0.162)	−0.629* (0.159)	−0.288* (0.072)	−0.299* (0.075)	−0.154 (0.091)	−0.162 (0.090)
Internet hosts(Res)					0.188* (0.062)	0.192* (0.065)		
Main lines(Res)			−0.109 (0.366)	0.178 (0.389)	0.256 (0.163)	0.326 (0.182)	−0.184 (0.206)	−0.115 (0.222)
Political rights[a,b]	3.174* (0.205)	3.277* (0.193)	6.169* (0.585)	5.967* (0.586)	3.695* (0.261)	3.692* (0.277)	3.966* (0.336)	3.926* (0.340)
Urban population(Res)	1.268* (0.182)	1.154* (0.165)	0.381 (0.529)	0.201 (0.505)	0.783* (0.235)	0.727* (0.236)	0.453 (0.300)	0.437 (0.290)
Residential charge		−0.01** (0.000)		−0.003 (0.002)		−0.002** (0.001)		−0.000 (0.001)
Residential subscription		−0.098 (0.018)		0.094 (0.067)		0.031 (0.032)		0.028 (0.039)
Intercept	−3.519* (0.157)	−3.375* (0.148)	−10.29* (0.472)	−10.82* (0.499)	−5.466* (0.213)	−5.705* (0.233)	−4.848* (0.269)	−4.983* (0.287)
Adj. R^2 (N)	0.889 (70)	0.905 (70)	0.727 (69)	0.734 (69)	0.861 (69)	0.849 (69)	0.804 (70)	0.805 (70)

Notes: *significant at 1% level; **significant at 5% level.

[a]Wald test of difference between coefficients: $Political\ Rights_{(1)} = Political\ Rights_{(3)}$, $p = 0.000$; $Political\ Rights_{(1)} = Political\ Rights_{(5)}$, $p = 0.116$; $Political\ Rights_{(1)} = Political\ Rights_{(7)}$, $p = 0.044$; $Political\ Rights_{(3)} = Political\ Rights_{(5)}$, $p = 0.000$; $Political\ Rights_{(3)} = Political\ Rights_{(7)}$, $p = 0.001$; $Political\ Rights_{(5)} = Political\ Rights_{(7)}$, $p = 0.525$.

[b]Wald test of difference between coefficients: $Political\ Rights_{(2)} = Political\ Rights_{(4)}$, $p = 0.000$; $Political\ Rights_{(2)} = Political\ Rights_{(6)}$, $p = 0.219$; $Political\ Rights_{(2)} = Political\ Rights_{(8)}$, $p = 0.097$; $Political\ Rights_{(4)} = Political\ Rights_{(6)}$, $p = 0.000$; $Political\ Rights_{(4)} = Political\ Rights_{(8)}$, $p = 0.003$; $Political\ Rights_{(6)} = Political\ Rights_{(8)}$, $p = 0.593$.

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