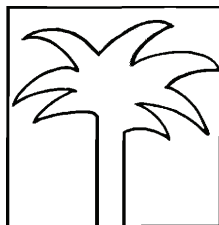# The WTO's telecommunications commitments and the credibility of telecommunications regulatory reforms in small island developing states

'Ofa, Siope Vakataki

Crawford School of Economics and Government, The Australian National University

2009

The WTO's telecommunications commitments and the credibility of telecommunications regulatory reforms in small island developing states

Siope V. 'Ofa

Telecommunications regulatory reform is a recent phenomenon in small island developing states, including in five Pacific island states in the past five years. Opportunities for regulatory capture exist when independent regulators are vulnerable to political pressure. There is therefore a case for external multilateral policy restraint to deter policymakers from reneging on policies. This study estimates the impact of the telecommunications commitments of the WTO on a panel data set of 160 developing countries (including 26 small island developing states) during the period 1995–2006. Preliminary evidence is that the credibility of telecommunications reform in small island developing states is enhanced via commitments to WTO telecommunications agreements that lock in domestic reforms. No evidence was found that signing on to bilateral investment treaties enhanced the credibility of telecommunications reform in small island developing states.

Siope V. 'Ofa is a PhD Scholar, Crawford School, The Australian National University

Do multilateral policy restraints enhance the credibility of telecommunications regulatory reforms in small island developing states? Telecommunications liberalisation is a complex and relatively new process for developing countries (Fink, Mattoo and Rathindran 2003:444). It is an even more recent policy initiative in small island developing states. Three Caribbean island states—Barbados, Jamaica and Trinidad and Tobago—began such reform in the early 2000s (Lodge and Stirton 2002). Five Pacific island countries have reformed their telecommunications sectors in the past five

years. While it is still early days to try to capture fully the outcomes of such reforms, it is important to account for the selection and implementation of key policies during the early stages of the regulatory reform process.

Telecommunications investment involves high sunk costs; therefore, reversing an investment decision is generally costly because the capital, once installed, is industry specific and cannot easily be put to productive use in a different activity (Serven and Solimano 1993:131). When investment is irreversible, theory suggests that firms will be reluctant to invest (Chirinko and Schaller 2009:390).

Pindyck (1988) found that increases in uncertainty lowered investment (Caballero, Engel and Haltiwanger 1995; Abel and Eberly 2002; Guiso and Parigi 1999; Bloom, Bond and van Reneen 2007). Low credibility[1] of announced telecommunications reforms can create uncertainty for investors. Evidence of frequent policy reversals during telecommunications reform was found in reforming Pacific island countries. In the early stages of the process of moving to a more competitive environment, governments attempt to balance the pressures from the incumbent operators and other vested interest groups and pressure from the public for better-quality services and lower prices. The result of these conflicting interests is that governments might announce a competition policy but over time renege on it, which is known in economics as the 'time inconsistency problem' (Kydland and Prescott 1977). Regulatory capture by vested interests can have the same effect as policy reversal (Bo 2006; Helm 2006; Levine and Forrence 1990).

A majority of the recent studies on telecommunications policy in developing countries have focused on three regulatory reform policy instruments: privatisation, competition and independent regulators (Flacher and Jennequin 2008; Fink, Mattoo and Rathindran 2003; Wallsten 2003, 2004; Li and Xu 2002; Ros 1997).

Scholars have undertaken national and cross-national studies on competition in the telecommunications sector (Keck and Djiofack-Zebaze 2009; Shiu and Lam 2008; Lam and Shiu 2008; Armstrong and Sappington 2006; Lee and Findlay 2005; Fink, Mattoo and Rathindran 2003; Wallsten 2001). The consensus is that there is a positive impact on the sector's performance, with higher infrastructure and technological investment leading to reductions in prices and improvements in the quality of services. The role of independent regulators in providing credibility and transparency in the regulation of telecommunications has also been well addressed (Levy and Spiller 1994; Ros 1997; Melody 1997; Noll 1999; Stern and Trillas 2003; Wallsten 2003; Lee and Levendis 2006; Bertelli and Whitford 2009). When independent from political pressures, these legal entities oversee economic and technical regulation of the telecommunications sector for the benefit of the public. The literature on institutions suggests that when regulatory frameworks restrain executive discretion, utility sectors tend to experience better performance (Lee and Levendis 2006; Wallsten 2001; Baudrier 2001; Levy and Spiller 1996).

Scholars and policymakers, however, continue to debate the effectiveness of independent regulators. Melody (1997:195) argued that 'the regulator either lost, or never had, the independence to make professional decisions on their merits because of undue influence either from politicians, politically driven Ministries, or the regulated monopolies'. The independence of the regulator can be compromised via financial or political means. Funding of some independent regulators is by budgetary appropriations passed by parliament. The regulator's board of directors can include

the prime minister or the minister responsible for telecommunications. The prime minister often appoints the commissioner (or head) of the independent regulator.

While the independence and autonomous decision-making of independent regulators are crucial for the credibility of policy reforms, regulatory capture can provide opportunities for governments to renege on previously announced policy commitments. Regulatory capture creates uncertainty. The outcome of such uncertainty for potential private investors is hesitation about investing. Rodrik (1991:230) suggests that rational behaviour on the part of the private sector calls for withholding investment until much of the uncertainty regarding the success of the reforms is eliminated. The uncertainty drives up the prices of services or the withholding of part of the physical investment[2] until the investor can be sure that a reform policy is irreversible (Aryeetey 1994:1,212).

A case can therefore be made for the role of external multilateral policy restraints in hindering opportunistic regulatory capture behaviour. The WTO's telecommunications commitment under the General Agreement on Trade in Services (GATS) provides a fixed rule that is relatively immune from domestic politics. Effectively, WTO telecommunications commitments provide a 'lock-in' mechanism to consolidate governments' unilateral reform initiatives. Buthe and Milner (2008:742) argue that 'unilateral domestic policy choices can often be easily changed; instead a government can make a more credible commitment regarding present and future economic policies by entering into international agreements that commit its country to the liberal economic policies that are seen as desirable for foreign investors'.

This article contributes to the literature on telecommunications reform with respect to two key issues. First, it provides insights into the impact of commitments to the WTO's telecommunications agreement (multilateral policy restraint) on the credibility of telecommunications reform. Second, it provides evidence of telecommunications regulatory reform in small island developing states, to which the existing literature on telecommunications reform gives little attention.

Based on a panel of 160 developing countries—including 26 small island developing states, and covering the period 1995–2006—multiple regression analysis is used to test the robustness of the impact of multilateral policy restraints on the credibility of telecommunications regulatory reforms. This study finds that controlling for telecommunications reform policy and socio-political, economic and technological factors, there is evidence of a positive relationship between multilateral policy restraint and the credibility of unilateral telecommunications regulatory reforms in small island developing states. The positive relationship is stronger and statistically significant for larger developing countries. Controlling for the effects of other key external policy restraints, there is no statistically significant evidence of positive effects for small island developing states of participating in bilateral investment treaties.[3]

Analytical framework

There are about 60 small island states. Due to a lack of the statistical data on telecommunications and regulatory variables required for this study, the sample of small island developing states is limited to 26. The total number of developing countries in the data set is 160. The use of a large number of developing countries is important to ensure the highest number of observations for the study and a good representation of the total population (Monroe 2000:68–9).

Two restraint policies (multilateral and domestic) are employed to proxy for the credibility of unilateral telecommunications reform. Restraint policies were tested on their own to account for their respective effects on the 160 developing countries. This approach crosschecks the research's findings against the literature. To ensure the best description of the island dummy, two approaches were adopted. First, a dummy variable for islands was included to proxy the 26 small island developing states. Second, the restraint policies were interacted with the island dummy to isolate any spurious effects the island dummy might have picked up due to other factors.

Relationships involving the two restraint policies were tested using ordinary least squares (OLS) and generalised least squares (GLS) methods. The use of simple OLS was to address outliers within the data set, given that economic, social, political and institutional characteristics of the developing countries within the data set were large. The use of GLS effectively controls for country-wise heteroscedasticity[4] (Fink, Mattoo and Rathindran 2003:453).

Fink, Mattoo and Rathindran (2003) argued that the presence of heteroscedasticity could be explained by differing government initiatives in liberalising the sector under different political regimes. The use of GLS to correct for heteroscedasticity makes the estimation far more efficient than ordinary fixed-effects panel estimation (Baltangi 1995, cited in Fink, Mattoo and Rathindran 2003:453).

Data collection and variable definition

Plagued by a lack of, out-of-date or conflicting data, studying small island developing states is a challenge for empirical research. In recent years, however, improvements in the availability of statistics have led to some progress—most notably, the World Bank's *World Development Indicators*, the International Telecommunications Union's *World's ICT Indicators 2007* and the World Bank's (online) *Good Governance Indicators* have made several useful policy and economic data sets available for time-series analysis.

Data collection

This study updated and revised an earlier panel data set on telecommunications policy and regulation compiled by the International Telecommunications Union (ITU) and the World Bank in 2003. Fink, Mattoo and Rathindran (2003) used the data set for analysis of 86 developing countries for the period 1985–99. The data set covered key indicators of telecommunications regulations, market structures and the presence of an independent regulator.

The data set was expanded for the period 1995–2006. Updates of key telecommunications variables were sourced from the ITU (2006, 2007) and World Bank (2006). Missing observations were sourced from government web sites, telecommunications operators and national telecommunications regulatory authorities. Other economic, institutional, technological, social and geographic variables were sourced online from the Asian Development Bank (ADB), the International Monetary Fund (IMF), the Commonwealth Secretariat, Freedom House, the United Nations Conference on Trade and Development (UNCTAD) and The Fraser Institute.[5]

Of the 26 small island developing states in the sample, 15 had established independent regulatory bodies to oversee the regulatory and implementation aspects of the telecommunications sector by 2007. Nine island states have signed telecommunications commitments under the WTO framework, while 16 have signed on to one or more bilateral investment treaties.

Twenty-one island states had introduced competition into the telecommunications sector as of 2008. The key policy characteristics of the 26 small island developing states are outlined (Table 1).

Variable definitions

This analysis used the following dependent, independent and control variables (Table 2).

Dependent variables

The credibility level of telecommunications regulatory reform is the dependent variable. The credibility level is roughly measured by telecommunications sector performance. If the regulatory reform process is credible, we should see better telecommunications sector performance and vice versa. The study adopts similar variables to those used in the earlier study by Fink, Mattoo and Rathindran (2003). Sector performance is proxied

---

Figure 1 **Residuals of performance variables** (examining heteroscedasticity)

Performance variable 1

Performance variable 2
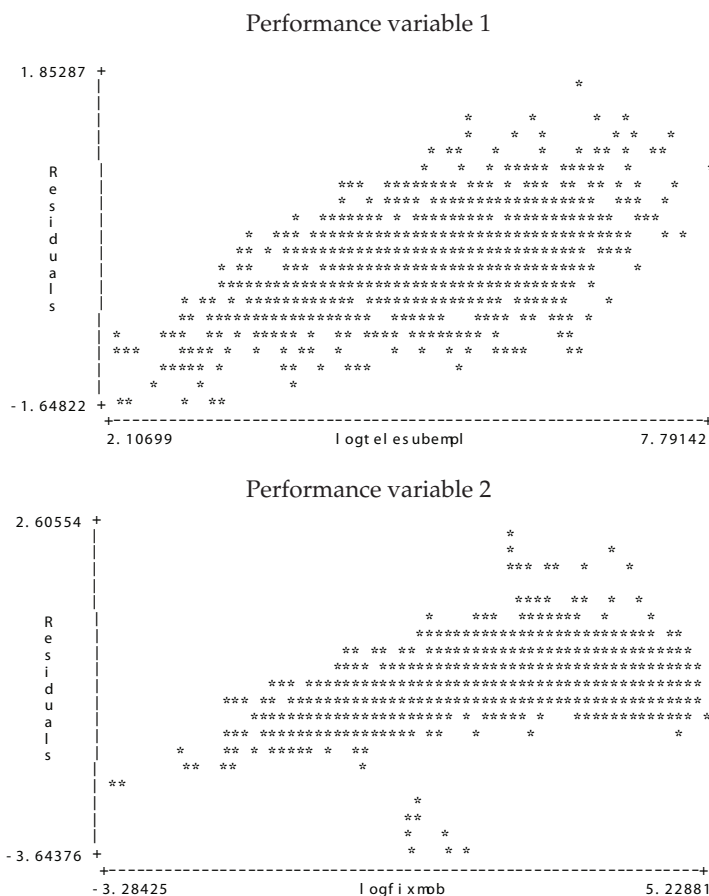
Source: Author's estimations.

Table 1 Selected key telecommunications regulatory and economic characteristics of small island developing states, 2008

Country	Region	Total population	Urban population (% of total)	Land area (sq km)	GDP per capita (US$ constant 2000)	WTO	Independent regulator	BIT	Competition
Bermuda	North Atlantic	64,000	100	50	..	NO	NO	YES	YES
Marshall Islands	Pacific	66,508	70.7	180	2,066	NO	NO	NO	NO
Dominica	Caribbean	72,793	73.6	750	4,775	YES	NO	YES	YES
Antigua and Barbuda	Caribbean	84,814	30.5	440	10,754	YES	NO	NO	YES
Seychelles	Indian Ocean	85,032	53.9	460	7,408	NO	NO	YES	YES
Tonga	Pacific	100,599	24.5	720	1,621	YES	NO	YES	YES
Kiribati	Pacific	101,860	43.8	810	552	NO	NO	NO	NO
Grenada	Caribbean	108,111	30.8	340	4,313	YES	YES	YES	YES
Federated States of Micronesia	Pacific	110,961	22.5	700	2,003	NO	NO	NO	NO
St Vincent and the Grenadines	Caribbean	120,325	46.7	390	3,734	NO	YES	NO	YES
St Lucia	Caribbean	167,975	27.8	610	4,759	NO	YES	YES	YES
Samoa	Pacific	186,759	22.8	2,830	1,607	NO	YES	NO	YES
Vanuatu	Pacific	225,898	24.3	12,190	1,275	NO	YES	YES	YES
Barbados	Caribbean	293,942	39.4		8,454[c]	YES	YES	YES	YES
Maldives	Indian Ocean	305,340	36.5	300	3,668	NO	YES	NO	YES
Bahamas	Caribbean	331,140	83.5	10,010	15,858[c]	NO	YES	NO	YES
Malta	Mediterranean	409,198	94	320	10,322[a]	NO	YES	YES	YES
Solomon Islands	Pacific	495,362	17.6	27,990	731	NO	NO	NO	NO
Cape Verde	Africa	530,269	58.9	4,030	1,447	NO	YES	YES	YES
Comoros	Africa	625,834	28	1,861	371	NO	NO	YES	NO
Bahrain	Middle East	752,789	88.5	710	14,776[b]	NO	YES	YES	YES
Fiji	Pacific	838,205	51.8	18,270	2,246	NO	NO	NO	YES
Mauritius	Indian Ocean	1,262,722	42.4	2,030	4,700	YES	YES	YES	YES
Trinidad and Tobago	Caribbean	1,333,050	12.9	5,130	10,974	YES	YES	YES	YES
Jamaica	Caribbean	2,677,170	53.1	10,830	3,400	YES	YES	YES	YES
Papua New Guinea	Pacific	6,324,097	12.6	452,860	656	YES	YES	YES	YES
Small island developing states		679,798[d]	46[d]	21,355[d]	2,810[d]				
Low income		21,216,891	31.7	1,295,736,911	415				
Middle income		74,923,175	48.1	4,259,969,264	1,997				
High income		33,504,521.15	77.5	1,056,334,218	28,777				
World		129,644,587.20	49.5	6,612,040,394	5,964				

.. not available   [a] most recent available data from 2006, [b] most recent available data from 2005, [c] most recent available data from 2002, [d] simple average estimate
Sources: World Bank, various years. *World Development Indicators*, The World Bank, Washington, DC. Regulatory variables sourced from ITU, World Bank and respective government sources (online).

via internal (productive) efficiency within operators and allocative efficiency across the whole sector.[6] Productive efficiency (Performance Variable 1) is proxied by the total number of subscribers per employee. This measure provides a limited indicator of the internal efficiency of rendering quality services to subscribers. We therefore expect that a higher number of subscribers per employee roughly indicates that efficiency is higher.

Allocative efficiency (Performance Variable 2) is measured by a crude, commonly used measure—namely, the total number of fixed and mobile subscribers per 100 people. This ratio roughly indicates the network allocations for expansion throughout a country. We would therefore expect that a higher ratio indicates a higher resource allocation to network expansion and investment. The use of this measure ensures that the majority of the telecommunications sector's activity is accurately reflected. Added-value services were not included due to the acute lack of up-to-date and consistent country data, particularly for small island developing states.

Obviously, these two performance variables have limitations, which Fink, Mattoo and Rathindran (2003:445) have touched on. Nevertheless, the two proxies are available as time series for a large number of countries. Fink, Mattoo and Rathindran (2003) used 86 developing countries for the period 1985–99, while this study included 160 developing countries for the period 1995–2006.

By no means do the two performance indicators mirror performance.[7] Pair-wise correlations between the two credible policies and the two performance variables indicate that Performance Variable 1 (0.41 for multilateral restraint and 0.34 for domestic restraint) denotes higher pair-wise correlations of the two variables.[8] The analyses therefore emphasise the OLS and GLS estimates for Performance Variable 1 while using Performance Variable 2 estimates to crosscheck the results.

Independent variables

The hypothesised explanation for the varied performance of the telecommunications sectors is the use of multilateral policy restraints. Multilateral policy restraints impose regulatory restraints that limit the policy discretion of policymakers, thereby establishing a credible policy environment for investment and performance. While independent regulators have been used to establish credible telecommunications reform, through the WTO's telecommunications commitments, governments can provide a more credible reform policy than the domestic regulator. Independent regulators are subject to domestic legislation, which can be amended by policymakers if there are sufficient incentives. A multilateral commitment that is legally binding is difficult to ignore. A variable indicating that the country has signed on to a bilateral investment treaty (BIT) is included as another control variable since it is also an international treaty obligation.

A commitment to the WTO's telecommunications agreement by member countries since 1997[9] is indicated by inclusion of a dummy variable for which 1 = country made a commitment and 0 = no commitment (Keck and Djiofack-Zebaze 2009:11; Buthe and Milner 2008:748). Countries that are not WTO members or are currently undergoing the accession process are marked with 'no commitment'. Information on years of commitment was sourced online from the WTO (http://www.wto. org/english/tratop_e/serv_e/telecom_e/ telecom_e.htm). When controlling for the effects of islands, multilateral restraint policy was interacted with the islands dummy (Multilateral Restraint*Islands).

To account for the effects of other influences, five categories of control variables

Table 2   Descriptive statistics for dependent and independent variables

Variable names	Variable description	Obs.	Mean	Standard deviation	Min.	Max.	Source
Dependent variables							
Performance variable 1	Total number of subscribers per employee (log)	1,520	4.8	1.09	1.90	7.79	World Bank online; ITU (2007)
Performance variable 2	Total number of fixed and mobile subscribers per 100 population (log)	1,832	2.30	1.74	−3.28	5.22	ITU (2007)
Independent variables							
Multilateral restraint	1 = WTO commitment on telecommunications sector; 0 = no commitment	1,920	0.36	0.48	0	1	WTO online source
Domestic restraint	1 = independent regulator; 0 = no independent regulator	1,878	0.50	0.50	0	1	Fink, Mattoo and Rathindran (2003); World Bank (online); ITU (2007)
Islands*multilateral restraint	1 = WTO commitment on telecommunications and islandness; 0 = otherwise	1,920	0.03	0.19	0	1	UNCTAD; WTO; Commonwealth Secretariat; World Bank
Islands*domestic restraint	1 = independent regulator and islandness; 0 = otherwise	1,878	0.04	0.21	0	1	UNCTAD; ITU; Commonwealth Secretariat; World Bank
Control variables							
Bilateral restraint	Total number of bilateral investment treaties (log)	1,573	2.03	1.12	0	4.45	UNCTAD online source
Islands*bilateral restraint	Total aggregate number of bilateral investment treaties (log) signed and islandness	1,573	0.13	0.47	0	3.40	UNCTAD; Commonwealth Secretariat; World Bank
Competition	1 = competition in mobile and/or local services; 0 = no competition (Fink, Mattoo and Rathindran 2003; World Bank)	1,915	0.46	0.49	0	1	Fink, Mattoo and Rathindran (2003); ITU (online); World Bank regulatory source (online)
Corruption free	Perception of corruption in business and government environments: 100 = most corrupted; 0 = free from corruption (log)	1,497	1.82	0.40	−0.51	2.30	Index of Economic Freedom (online source)
Interest group pressure	Percentage of total population in urban areas (square root)	1,920	6.84	1.74	2.68	10	World Bank (online)
Islands	Small island developing state	1,920	0.16	0.36	0	1	UNCTAD; Commonwealth Secretariat; World Bank
Geography	Absolute (latitude of capital)/90	1,920	0.24	0.16	0.01	0.66	CIA Factbook (online)
Population	Total population per year (log)	1,875	15.30	2.20	3.28	20.99	World Bank (online)
Time dummy (years)	Year (1995–2006)*Country	1,920	0.08	0.27	0	1	Fink, Mattoo and Rathindran (2003)
GDPPC	GDP per capita US$ constant 2000 (log)	1,768	7.16	1.34	4.03	10.44	World Bank (online)

were included—domestic telecommunications reform policy, bilateral policy restraints, socio-political development, economic and technological development, and geography.

Domestic policy restraint is a measure of the impact of domestic regulatory institutions on telecommunications sector performance. Domestic credibility is realised when governments create independent entities to regulate and implement telecommunications policies outside the government's policymaking boundaries. The dummy for the establishment of an independent regulator therefore has a value of 1, while the existence of a regulator that is not independent has a value of zero, as in Maiorano and Stern (2007:169). The variable is a proxy for 'strong country institutions (i.e. that could commit credibility level to a given policy)' (Maiorano and Stern 2007:168). Information on the independence of regulators was drawn from Fink, Mattoo and Rathindran (2003) and updated based on the ITU's online sources and the online sources of regulators. The results for domestic policy restraints are compared with those for multilateral policy restraints. To control for the effects of small island developing states, the domestic policy restraint variable is interacted with the islands dummy (Domestic Restraint*Islands).

The introduction of competition in the telecommunications sector is another important control variable for telecommunications regulatory reforms. The choice of this particular reform policy is based on the fact that it has consistently been found to influence strongly and positively the telecommunications sector's performance (Fink, Mattoo and Rathindran 2003:443–66; Maiorano and Stern 2007:165–81; Armstrong and Sappington 2006:325–66). The competition dummy is 1 = introduced competition in the telecommunications sector and 0 = otherwise. The competition variable reflects competition in mobile and/or fixed-line services. The objective is to control for any effects of introduced competition. While privatisation is an equally important reform measure, most developing countries have not fully reformed their incumbent operators through 100 per cent private ownership. Competition is therefore presently the most influential reform policy and therefore the most appropriate indicator for telecommunications regulatory reform in small island developing states. Further, the experience with telecommunications reform in the Pacific shows that the introduction of competition has been the major policy focus while privatisation seems to be less forthcoming.

To control for bilateral policy restraints on performance, the cumulative number of bilateral investment treaties (BITs) signed by a country at the end of a given year (Buthe and Milner 2008:748) was chosen as the control variable. The use of cumulative numbers reflects the signalling effect of bilateral investment treaties for a safe investment environment (Kim 2006; Tobin and Rose-Ackerman 2005; Neumayer and Spess 2005). The log of the total number of bilateral investment treaties signed was taken to normalise the data set. The information on bilateral investment treaties was sourced online from UNCTAD ('UNCTAD Investment Instruments Online', http://www.unctadxi.org/templates/DocSearch____779.aspx). When controlling for the effects of islands, the bilateral restraint policy variable is interacted with the islands dummy (Bilateral Restraint*Islands).

Two socio-political indicators were included—first, whether telecommunications sector performance was influenced by domestic interest group lobbying. The square root of urban population as a percentage of total population is used as a measure of interest group pressure on telecommunications infrastructure deploy-

ment. The more urbanised a country, the higher are the pressures from interest groups for telecommunications reform (Li, Qiang and Xu 2005:1,309; Henisz and Zelner 2006:266–8).

Second, the extent of corruption is taken as a proxy for institutional quality. It is well documented that corruption reduces foreign direct investment (Wei 2000; Cuervo-Cazurra 2006; Kaufmann 1997). Moreover, corruption results in the inefficient allocation of resources towards areas that are most prone to bribes (Mauro 1998, cited in Cuervo-Cazurra 2006:808). A 'freedom from corruption' indicator was sourced online from the Heritage Foundation's Index of Economic Freedom (http://www.heritage.org/Index/Default.aspx).[10] The Index of Economic Freedom is constructed from 10 'freedoms' including freedom from corruption. The freedom from corruption index is derived from Transparency International's Corruption Perceptions Index. The Corruption Perceptions Index is scaled so that a score of 10 indicates very little corruption and a score of 1 indicates a very corrupt government. The freedom from corruption index also adopts this scaling; however, the raw Corruption Perceptions Index data are multiplied by 10 to obtain the freedom from corruption score (Beach and Kane 2008:52). This study reverted to the original Corruption Perceptions Index score and, to avoid confusion on reading the regression coefficients, the corruption measure was recoded[11] such that a high corruption index number meant little corruption and vice versa.

Two economic control variables were included. First, the natural logarithm of GDP per capita (constant US$2000) was used as a measure of economic performance (as in Maiorano and Stern 2007; Cubbin and Stern 2006; Estache, Goicoechea and Manacorda 2006; Waverman, Meschi and Fuss 2005). Second, the natural logarithm of total population per country was included

to control for country size (Frankel and Romer 1999).

It is argued that 'geography' negatively affects the economic development of countries.[12] Nearly all countries geographically located 23 degrees north and south of the equator are poor, while almost all countries in the higher latitudes are rich (Gallup, Sachs and Mellinger 1999:180; Sachs 2001:1). The 'cursed' tropical regions are often disadvantaged by distance from major markets, scarcity of natural resources and high transportation costs due to populations being concentrated inland rather than on the coast (including landlocked countries). Sachs (2001:10–19) argues that geography negatively affects labour productivity through tropical infectious diseases, low soil fertility for farming (due to heavy precipitation), large numbers of tropical pests and diseases that affect farming systems and acute shortages of water for agriculture.

Almost all 26 small island developing states in the sample are located in the tropics. 'Geography' is quantified by the absolute latitudinal location of capital cities from the equator (Rodrik, Subramanian and Trebbi 2004). The technological nature of the telecommunications sector does, however, alleviate some of the geographic challenges of small island developing states, given that the regulatory policies ensure universal access throughout the islands.

In addition, an island dummy variable is included for small island developing states, with 1 = island and 0 = otherwise. This is a necessary control variable for 'islandness'. To isolate any spurious effects, the island dummy variable might pick up in the regressions on the data set for the 160 developing countries, an interaction variable between the islands dummy variable and the main predictor policy variable is also included.

Technological development is a key ingredient for the development and effec-

tiveness of telecommunications services. It is therefore crucial to control for technological development in the estimates. A time dummy is included to account for the effects of technological developments and diffusion in the telecommunications sector (as in Maiorano and Stern 2007; Fink, Mattoo and Rathindran 2003). It is expected that its effect will be positive and strong.

Empirical results

The relationships between multilateral and domestic restraint policies and telecommunications sector performance is first checked through the use of simple scatter plots/kernel density graphs. There are correlations between restraint policies and the two performance variables (Figure 1). The multilateral and domestic restraints are best depicted using kernel density graphs since both indicators are dummy variables. There is a noticeable difference between the means when the multilateral restraint policy (x) is not present (*mean* ($y | x = 0$)) compared with when it is present (*mean* ($y | x = 1$)).[13] The kernel density graph for domestic restraint policy shows similar positive correlations with the performance variables when domestic restraint policy is present.

One noticeable difference in the pair-wise correlations between the two sets of independent variables (multilateral and domestic policy restraints) and the two performance variables is that the two sets of independent variables are highly correlated with Performance Variable 1, as shown by the distinct difference of the two (dotted and solid) lines. On the other hand, the pair-wise correlations between the two sets of credibility policies and Performance Variable 2 are much weaker, as shown by the slight difference between the two lines. This suggests that Performance Variable 1 reflects sector performance better than Performance Variable 2.

The simple multiple OLS and GLS estimates for the two performance variables are shown (Table 3). Columns 1 and 2 show the regression estimates on Performance Variable 1, while Columns 3 and 4 show the regression results on Performance Variable 2.

The multilateral policy restraint coefficient is consistently positive and statistically significant across robust OLS and GLS estimates in Performance Variable 1 (0.17 and 0.17) and Performance Variable 2 (0.27 and 0.22). In comparison, the coefficients on the domestic restraint policy variable[14] are positive and significant but weaker (0.14 and 0.16 for Performance Variable 1; 0.19 and 0.15 for Performance Variable 2). As expected, the WTO's multilateral agreements, with their legal obligations, strengthen telecommunications reforms by locking in policies. The coefficient estimates for the domestic policy restraints suggest that although independent national regulatory bodies might be established, regulatory capture can compromise their effectiveness.

As expected, bilateral investment treaties positively influence the performance of telecommunications sectors in developing countries. This result is in line with the literature on the positive impact of bilateral investment treaties on foreign direct investment inflows. While the bilateral policy restraint variables have statistically significant regression coefficients for both performance variables, they are, however, lower than for the other two restraint variables (0.08 and 0.10 for Performance Variable 1; 0.16 and 0.18 for Performance Variable 2).

Examination of the main explanatory variables shows two important results. First, there is a strong positive relationship between the external policy restraints—WTO commitments and bilateral investment treaties adopted by developing countries—and

Table 3   **OLS and GLS regression results** (160 developing countries)

	Performance variable 1		Performance variable 2	
	(1)	(2)	(3)	(4)
	OLS	GLS	OLS	GLS
Multilateral restraint	0.17 ***	0.17 ***	0.27 ***	0.22 ***
	(0.04)	(6.61)	(0.04)	(8.60)
Domestic restraint	0.14 ***	0.16 ***	0.19 ***	0.15 ***
	(0.04)	(6.32)	(0.06)	(5.88)
Bilateral restraint	0.08**	0.10 ***	0.16 ***	0.18 ***
	(0.02)	(7.43)	(0.02)	(11.74)
Multilateral restraint*islands	0.19	0.13	0.56 ***	0.53 ***
	(0.12)	(1.53)	(0.18)	(4.90)
Domestic restraint*islands	0.11	0.03	–0.18	–0.22 **
	(0.13)	(0.37)	(0.20)	(–2.11)
Bilateral restraint*islands	–0.18 ***	–0.13 ***	–0.42 ***	–0.36 ***
	(0.05)	(–3.05)	(0.09)	(0.05)
Competition	0.25 ***	0.21 ***	0.05	0.04 *
	(0.04)	(7.83)	(0.05)	(1.77)
Corruption free	0.17 ***	0.16 ***	0.16 **	0.18 ***
	(0.05)	(5.52)	(0.06)	(4.92)
Interest group pressure	0.03 **	0.04 ***	0.15 ***	0.15 ***
	(0.01)	(4.57)	(0.02)	(13.33)
Population	0.06 ***	0.05 ***	–0.03 **	2.47 ***
	(0.00)	(9.31)	(0.01)	(0.27)
GDPPC	0.39 ***	0.37 ***	0.64 ***	0.49 ***
	(0.02)	(23.40)	(0.02)	(0.11)
Geography	–0.51 ***	–0.60 ***	1.95 ***	1.95 ***
	(0.12)	(–8.38)	(0.11)	(26.85)
Islands	0.05	0.03	1.24 ***	1.14 ***
	(0.10)	(0.39)	(0.17)	(11.95)
Constant	–0.23	–0.01	–3.08 ***	–4.45 ***
	(0.26)	(–0.09)	(0.31)	(–23.65)
Wald Chi-squared	n.a.	7,637.80	n.a.	18,278.26
Observations	1,051	1,051	1,223	1,223
Adjusted R-squared	0.72	..	0.81	..
VIF (mean)	2.84	..	2.49	..

* significant at 10 per cent, ** significant at 5 per cent, *** significant at 1 per cent
Notes: Time dummy is not reported. Robust standard errors in columns 1 and 3 in parentheses; GLS corrected z-statistics in columns 2 and 4 in parentheses.
Sources: Panel data set compiled from World Bank, 2003. *World Development Indicators*, The World Bank, Washington, DC; ITU online sources and respective governments data sources.

their telecommunications sector perform-ance under competition. Second, the impact of endogenous policy restraints (establishing an independent regulator) is diminished (as reflected by the regression coefficient 'r') when the two external policy restraints are added to the model. These results suggest that external policy restraints can play an important role in establishing credibility.

The estimated coefficients of the other control variables are fairly robust, as indicated by the statistical significance across the OLS and GLS estimates. The telecommunications reform policy indicator (competition) is positive (0.25 and 0.21 for Performance Variable 1; 0.05 and 0.04 for Performance Variable 2) and mostly statistically significant at the 1 per cent level. This result supports the idea that unilateral introduction of competition policy spurs the overall performance of the sector.

Socio-political variables (corruption free and interest group pressure) have positive relationships with performance. Freedom from corruption—an indicator of the integrity of governments—has positive and statistically significant coefficients in both sets of equations (0.17 and 0.16 for Performance Variable 1; 0.16 and 0.18 for Performance Variable 2). This result aligns with the literature on corruption and investment: lower corruption leads to higher foreign direct investment. Similarly, the interest group pressure variable had positive and statistically significant results (0.03 and 0.04 for Performance Variable 1; 0.15 and 0.15 for Performance Variable 2)—all statistically significant at the 5 per cent level. This result is in line with research on the impact of interest group pressure on telecommunications infrastructure deployment.

The economic control variable (GDPPC) is positive and statistically significant (0.39 and 0.37 for Performance Variable 1; 0.64 and 0.49 for Performance Variable 2). The high regression coefficients, compared with most other variables in the model, are understandable, as income and sustainable economic activities generally determine private telecommunications operators' investment strategies. Population (as a proxy for country size) is also positive and statistically significant (Performance Variable 1, 0.06 and 0.05), suggesting economies of scale. As expected, the proxy variable for technological development, the time dummy (1.36 and 1.25 for Performance Variable 1 and 0.25 and 0.18 for Performance Variable 2), is positive and statistically significant in GLS estimates for both of the performance variables.
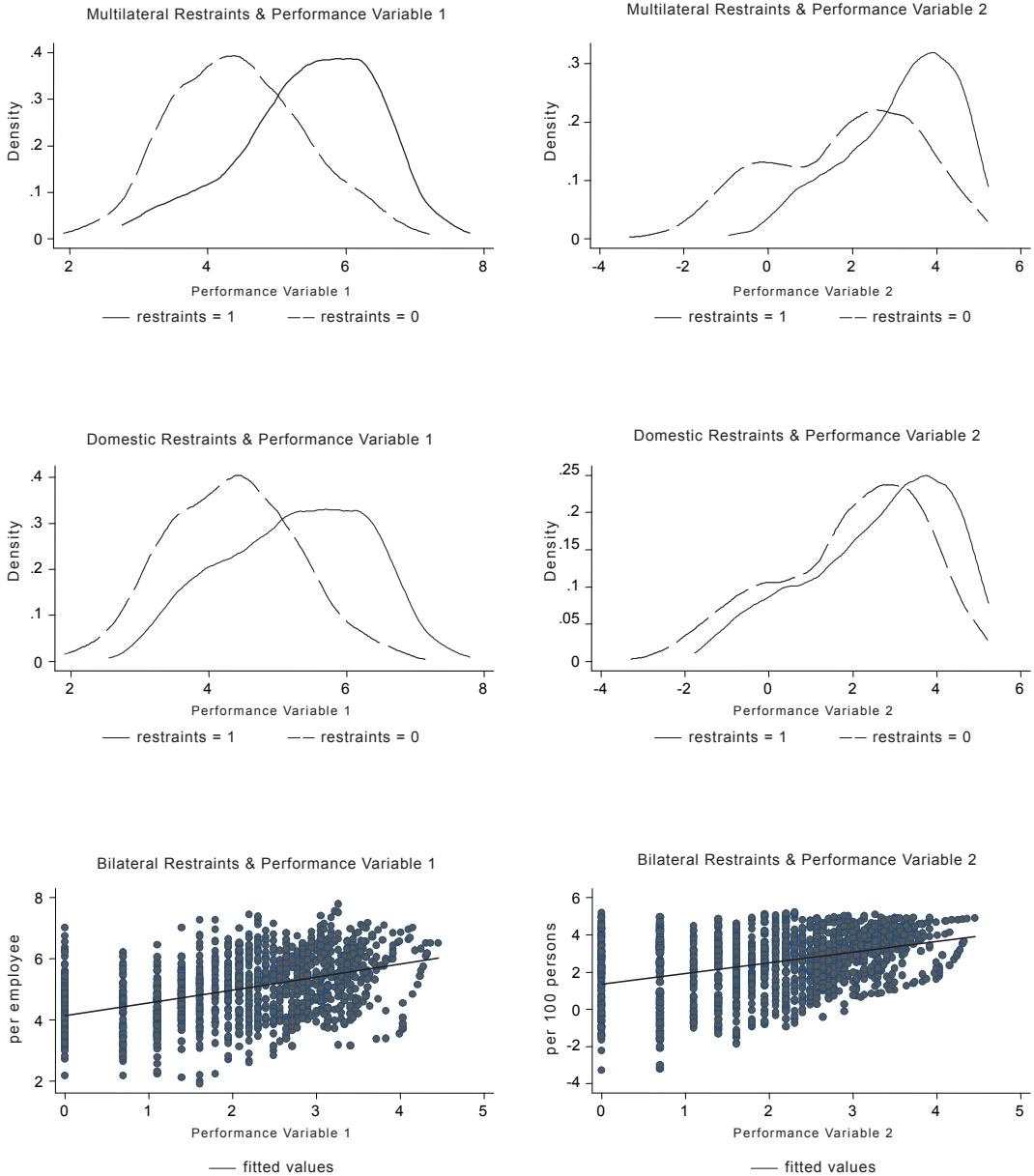
As expected, 'geography' has a negative relationship with performance (–0.51 and –0.60 for Performance Variable 1). Isolated, small islands with mountainous landscapes might not provide commercial incentives for private investment.

Given the natural challenges of small island states, one is always suspicious of regression results from studies including larger-scale developing countries. Many of these quantitative studies seldom do justice to the special circumstances of small island developing states and how they can affect the regression estimates. Understandably, the lack of data on small island developing states means that many are excluded from empirical studies. With the necessary data available to include 26 small island developing states in the database, it was possible to test the credibility of telecommunications policies in small island developing states via the interaction terms. The regression estimates show coefficients on islands interacted-policy variables.

The islands interacted policy variables show positive regression coefficients for the two performance variables (Performance Variable 1 = 0.19 and 0.13; Performance Variable 2 = 0.56 and 0.53). The coefficients are statistically significant at the 1 per cent level.

Figure 2   Bivariate correlations K-density/scatterplot graphs, 160 developing countries

Multilateral Restraints & Performance Variable 1

Multilateral Restraints & Performance Variable 2

Domestic Restraints & Performance Variable 1

Domestic Restraints & Performance Variable 2

Bilateral Restraints & Performance Variable 1

Bilateral Restraints & Performance Variable 2

Sources: Panel data set compiled from World Bank and ITU data sources.

The OLS and GLS coefficient estimates for the islands interacted with the multilateral restraint variable are higher than for the islands interacted by the domestic restraint variable (0.11 and 0.03 for Performance Variable 1; –0.18 and –0.22 for Performance Variable 2).

The coefficients on the islands inter-acted with the policy variables are roughly similar to the results for the policy restraint variables for the 160 developing countries. As expected, the results show positive rela-tionships between the multilateral policy restraints and the credibility of unilateral telecommunications reforms in small island developing states. In the case of domestic policy restraints, the islands interaction variables have positive but weak coefficients at best. Again, this reaffirms the limited credibility that domestic policy restraint can provide.

Robustness checks

With respect to the significance of the statisti-cal estimates, two issues are worthy of note. First, given the F-test results, we can reject the null hypothesis that the effects of the independent variables did not happen by chance. Also, OLS equations explain a high percentage of the variation of Performance Variable 1 (adjusted-R^2 = 0.72) and Perform-ance Variable 2 (adjusted-R^2 = 0.81). Second, multi-collinearity is of minimal concern, as shown by the low variance inflation factors (VIF) of the OLS estimates—from 1.27 to 4.08 (mean VIF = 2.46) for Performance Variable 1, and from 1.25 to 3.95 (mean VIF = 2.58) for Performance Variable 2. As a general rule, an individual VIF level of more than 10 requires attention (Der and Everitt 2002:85; Szmrec-sanyi 2006:215; Castillo 2007:146–7).

Controlling for 'islandness'—which effectively reduces the number of observa-tions in the sample from 160 to 29—comes with some statistical challenges. The total number of observations potentially avail-able for an empirical study of small island developing states is quite low (60 micro-states, half of which are non-sovereign states—either territories or colonies of industrialised economies). The relatively small number of island states within the data set can be considered as outliers. Further, only nine small island developing states of the 160 developing countries made commitments to the WTO, and 15 of the 160 established independent regulators. Therefore, the relative impact of such small numbers in the sample could be minute.

Conclusion

The findings of this study provide important policy implications for small island develop-ing states and international institutions. Investments in the telecommunications sector are sensitive to policy uncertainties due to their high sunk costs, the politically sensitive nature of the sector and the non-transferability of the assets. The credibility of the regulatory reform program is therefore of utmost importance. This article provides preliminary support for the idea that mul-tilateral policy restraint provides credibility to unilateral telecommunications reforms in small island developing states.

The coefficient estimates from the analy-sis of 160 developing countries, including 26 small island developing states, show that multilateral policy restraints provide higher credibility for telecommunications sector regulatory reform than domestic restraints and being a signatory to bilateral investment treaties. Commitment to the WTO agree-ment on telecommunications—as a proxy for multilateral policy restraints—appears to provide the credibility that investors require. The legally binding nature of the multilateral trading treaty signals a more predictable and transparent investment environment. Although bilateral investment

treaties contain similar legal provisions to WTO telecommunications commitments, their credibility impact is less pronounced—perhaps since the scope of legal coverage is far narrower and the costs for the governments of small island developing states are higher.

Notes

[1] The likelihood of policy reversal.

[2] The hesitation to invest in physical infrastructure by Indonesian mobile company Greencom, which was granted a mobile licence in Papua New Guinea, provides support to this argument.

[3] Being a signatory to a bilateral investment treaty did, however, have a positive and statistically significant impact on the credibility level of regulatory reform across the full sample of 160 developing countries.

[4] Testing of the two performance variables showed problems with heteroscedasticity.

[5] The countries defined as small island developing states were taken from UNCTAD's unofficial list of small island developing states and the Commonwealth Secretariat's categorisation of small states.

[6] See Flacher and Jennequin (2008) for a recent discussion of the efficiency concept in telecommunications.

[7] Refer to the bivariate linear k-density graphs (Figure 1) for a comparison of pair-wise correlations.

[8] Pair-wise correlations for Performance Variable 2 show 0.35 for multilateral restraint and 0.14 for domestic restraint.

[9] The first round of telecommunications sector negotiations was launched at the WTO in 1997.

[10] A US research institute founded in 1973 to undertake policy research on issues pertinent to American principals and values.

[11] See Wei (2000:3), in which similar methodology was adopted.

[12] See Easterly and Levine (2003) for discussion of the 'geography' hypothesis.

[13] Depicted by the solid line shifting to the right in the kernel density graph when the multilateral policy restraint is present.

[14] The regression coefficients for the main predictor, including the other two policy restraints, were standardised for easy comparison. The standardised beta weights (not reported) indicate that multilateral restraint consistently has the strongest contribution compared with the other two policy restraints.

References

Abel, A.B. and Eberly, J.C., 2002. *Investment and q With Fixed Costs: an empirical analysis*, Wharton School, University of Pennsylvania, Philadelphia.

Armstrong, M. and Sappington, D.E.M., 2006. 'Regulation, competition, and liberalization', *Journal of Economic Literature*, XLIV:325–66.

Aryeetey, E., 1994. 'Private investment under uncertainty in Ghana', *World Development*, 22:1,211–21.

Baudrier, A., 2001. Independent regulation and telecommunications performance in developing countries, Annual ISNIE Conference, Institutions and Governance, Berkeley, California. Available from http://www.isnie. org/ISNIE01/Papers01/baudrier.pdf (accessed on 21 June 2008).

Beach, W.W. and Kane, T., 2008. 'Methodology: measuring the 10 economic freedoms', *2008 Index of Economic Freedom*, The Heritage Foundation, Washington, DC. Available from http://www.heritage. org/Index/PDF/2008/Index2008_ Chap4.pdf (accessed 24 March 2009).

Bertelli, A.M. and Whitford, A.B., 2009. 'Perceiving credible commitments: how independent regulators shape elite perceptions of regulatory quality', *British Journal of Political Science*, 39(3):517–37.

Bloom, N., Bond, S.R. and van Reenen, J.M., 2007. 'Uncertainty and investment dynamics', *Review of Economic Studies*, 74(2):391–415.

Bo, E.D., 2006. 'Regulatory capture: a review', *Oxford Journal of Economic Policy*, 22(2):203–25.

Buthe, T. and Milner, H.V., 2008. 'The politics of foreign direct investment into developing countries: increasing FDI through international trade agreements', *American Journal of Political Science*, 52(4):741–62.

Caballero, R.J., Engel, E. and Haltiwanger, J.C., 1995. 'Plant-level adjustment and aggregate investment dynamics', *Brookings Papers on Economic Activity*, 1995(2):1–54.

Castillo, D.E., 2007. *Process Optimization: a statistical approach*, Springer, Arlington.

Chirinko, R.S. and Schaller, H., 2009. 'The irreversibility premium', *Journal of Monetary Economics*, 56:390–408.

Cubbin, J. and Stern, J., 2006. 'The impact of regulatory governance and privatization on electricity industry generation capacity in developing countries', *The World Economic Review*, 20(1):115–41.

Cuervo-Cazurra, A., 2006. 'Who cares about corruption?', *Journal of International Business Studies*, 37:803–22.

Der, G. and Everitt, B., 2002. *A Handbook of Statistical Analyses Using SAS*, Second edn, CRC Press, Boca Raton.

Easterly, W. and Levine, R., 2003. 'Tropics, germs, and crops: how endowments influence economic development', *Journal of Monetary Economics*, 50:3–39.

Estache, A., Goicoechea, A. and Manacorda, M., 2006. *Telecommunications performance, reforms, and governance*, World Bank Policy Research Working Paper Series 3822, The World Bank, Washington, DC.

Fink, C., Mattoo, A. and Rathindran, R., 2003. 'An assessment of telecommunications reform in developing countries', *Information Economics and Policy*, 15:443–66.

Flacher, D. and Jennequin, H., 2008. 'Is telecommunications regulation efficient? An international perspective', *Telecommunications Policy*, 32(5):364–77.

Frankel, J.A. and Romer, D., 1999. 'Does trade cause growth?', *The American Economic Review*, 89(3):379–99.

Gallup, J.L., Sachs, J.D. and Mellinger, A.D., 1999. 'Geography and economic development', *International Regional Science Review*, 22(2):179–232.

Guiso, L. and Parigi, G., 1999. 'Investment and demand uncertainty', *Quarterly Journal of Economics*, 114(1):185–227.

Helm, D., 2006. 'Regulatory reform, capture, and the regulatory burden', *Oxford Review of Economic Policy*, 22(2):169–85.

Henisz, W.J. and Zelner, B.A., 2006. 'Interest groups, veto points, and electricity infrastructure deployment', *International Organisation*, 60(1):263–86.

International Telecommunications Union (ITU), 2006. *Telecommunications Report 2006*, International Telecommunications Union, Geneva.

——, 2007. *World Telecommunications ICT Indicators 2007 Database*, International Telecommunications Union, Geneva.

Kaufmann, D., 1997. 'Corruption: the facts', *Foreign Policy*, (Summer):114–31.

Keck, A. and Djiofack-Zebaze, C., 2009. 'Telecommunications services in Africa: the impact of WTO commitments and unilateral reform on sector performance and economic growth', *World Development*, 37(5):919–40.

Kim, S., 2006. 'Bilateral investment treaties, political risk and foreign direct investment', *Asia Pacific Journal of Economics & Business*, 11(1):6–24.

Kydland, F. and Prescott, E.C., 1977. 'Rules rather than discretion: the inconsistency of optimal plans', *Journal of Political Economy*, 85(3):473–92.

Lam, P.L. and Shiu, A., 2008. 'Productivity analysis of the telecommunications sector in China', *Telecommunications Policy*, 32:559–71.

Lee, R.C. and Findlay, C., 2005. 'Telecommunications reform in Indonesia: achievements and challenges', *Bulletin of Indonesian Economic Studies*, 41(3):341–65.

Lee, S.H. and Levendis, J., 2006. 'Creation of a separate telecom regulatory agency: a duration analysis of its time pattern', *Contemporary Economic Policy*, 24(3):407–17.

Levine, M.E. and Forrence, J.L., 1990. 'Regulatory capture, public interest, and the public agenda: toward a synthesis', *Journal of Law, Economics, and Organization*, 6 (Special issue):167–98.

Levy, B. and Spiller, P., 1994. 'The institutional foundations of regulatory commitment: a comparative analysis of telecommunications regulation', *The Journal of Law, Economics & Organization*, 10(2):201–46.

——, 1996. 'A framework for resolving the regulatory problem', in B. Levy and P. Spiller (eds), *Regulations, Institutions and Commitment: comparative studies in regulation*, Cambridge University Press, Cambridge.

Li, W. and Xu, L.C., 2002. 'The political economy of privatization and competition: cross-country evidence from the telecommunications sector', *Journal of Comparative Economics*, 30:439–62.

Li, W., Qiang, C.Z.W. and Xu, L.C., 2005. 'Regulatory reforms in the telecommunications sector in developing countries: the role of democracy and private interests', *World Development*, 33(8):1,307–24.

Lodge, M. and Stirton, L., 2002. 'Embedding regulatory autonomy in Caribbean telecommunications', *Annals of Public and Cooperative Economics*, 73(4):667–93.

Maiorano, F. and Stern, J., 2007. 'Institutions and telecommunications infrastructure in low and middle-income countries: the case of mobile telephony', *Utilities Policy*, 15(3) (September):165–81.

Melody, W.H., 1997. 'Comment—on the meaning and importance of "independence" in telecom reform', *Telecommunications Policy*, 21(3):195–7.

Monroe, A.D., 2000. *Essentials of Political Research*, Westview Press, Colorado.

Neumayer, E. and Spess, L., 2005. 'Do bilateral investment treaties increase foreign direct investment to developing countries?', *World Development*, 33:1,567–85.

Noll, R.G., 1999. *Telecommunications reform in developing countries*, Working Paper 99-10, AEI-Brookings Joint Centre for Regulatory Studies, The Brookings Institution, Washington, DC.

Pindyck, R.S., 1988. 'Irreversible investment, capacity choice, and the value of the firm', *American Economic Review*, 78(5):969–85.

Rodrik, D., 1991. 'Policy uncertainty and private investment in developing countries', *Journal of Development Economics*, 36:229–42.

Rodrik, D., Subramanian, A. and Trebbi, F., 2004. 'Institutions rule: the primacy of institutions over geography and integration in economic development', *Journal of Economic Growth*, 9:131–65.

Ros, A.J., 1997. 'When, where and how? Implementing effective telecommunications competition and regulatory policy', *Journal of Project Finance*, 3(4):33–42.

Sachs, J.D., 2001. *Tropical underdevelopment*, NBER Working Paper 8119, National Bureau of Economic Research, Cambridge, Mass.

Serven, L. and Solimano, A., 1993. 'Debt crisis, adjustment policies and capital formation in developing countries: where do we stand?', *World Development*, 21(1):127–40.

Shiu, A. and Lam, P.L., 2008. 'Causal relationship between telecommunications and economic growth in China and its regions', *Regional Studies*, 42(5):705–18.

Stern, J. and Trillas, F., 2003. 'Independence and discretion in telecommunications regulation: lessons from independent central banks', *Utilities Policy*, 11(4):191–201.

Szmrecsanyi, B., 2006. *Morphosyntactic Persistence in Spoken English: a corpus study at the intersection of variationist sociolinguistics, psycholingui*, Walter de Gruyter Gmbh & Company, KG, Berlin.

Tobin, J. and Rose-Ackerman, S., 2005. *Foreign direct investment and the business environment in developing countries: the impact of bilateral investment treaties*, Yale Law and Economic Research Paper, no.293, New Haven, Conn.

Wallsten, S.J., 2001. 'An econometric analysis of telecom competition, privatization, and regulation in Africa and Latin America', *The Journal of Industrial Economics*, XLIX(1):1–19.

——, 2003. 'Of carts and horses: regulation and privatization in telecommunications reforms', *Policy Reform*, 6(4):217–31.

——, 2004. 'Privatizing monopolies in developing countries: the real effects of exclusivity periods in telecommunications', *Journal of Regulatory Economics*, 26(3):303–20.

Waverman, L., Meschi, M. and Fuss, M., 2005. *The impact of telecoms on economic growth in developing countries*, The Vodafone Policy Paper Series 2:10–23.

Wei, S.J., 2000. 'How taxing is corruption on international investors?', *The Review of Economics and Statistics*, 82(1):1–11.

World Bank, 2003. *World Development Indicators*, The World Bank, Washington, DC.

——, 2006. *Information and Communications for Development—global trends and policy*, The World Bank, Washington, DC.

——, various years. *World Development Indicators*, The World Bank, Washington, DC.

Acknowledgments