Industrial and Corporate Change, Volume 11, Number 2, pp. 355–389

The institutional environment for infrastructure investment

Witold J. Henisz

The empirical evidence that links political institutions to economic outcomes has grown dramatically in recent years. However, virtually all of this analysis is undertaken using data from the past three decades. This paper extends this empirical framework by performing a two-century long historical analysis of the determinants of infrastructure investment in a panel of over 100 countries. The results demonstrate that political environments that limit the feasibility of policy change are an important determinant of investment in infrastructure.

1. Introduction

The empirical evidence that links the structure of a nation's political institutions, and the distribution of the preferences of the actors that inhabit them, to economic outcomes such as an improved policy environment, investment behavior and economic growth has grown dramatically in recent years. However, due to data limitations, virtually all of this analysis is undertaken using data from the past three decades. The relatively small number of years available for analysis presents serious limitations for the interpretation of the results of these studies. Specifically, it is often difficult to separate the effect of unobserved country characteristics, which may be correlated with or cause cross-national variation in political institutions, from the effect of the institutions themselves.

While some progress has been made in addressing this concern using a generalized method of moment estimator (Caselli *et al.*, 1996), this article adopts a second path. It extends the empirical framework backward in time and performs a more than century-long historical analysis of the determinants of infrastructure investment in a panel of over 100 countries. The results demonstrate that political environments that limit the feasibility of policy change are an important determinant of cross-national variation in investment in vital economic infrastructure (the number of telephone handsets and megawatts of electrical generation)[1] not only in recent years but also at the inception of these technologies in the 19th century. The effect of cross-national and intertemporal variation in political institutions is shown to be independent of un-

[1]While main telephone lines and megawatts of generating capacity would be preferable dependent variables in the latter cases, they are unavailable for a wide sample of countries prior to the middle of the 20th century.

observed country-level and/or temporal variation as well as country-specific economic conditions.

Adopting an historical approach offers sufficient time series duration to separately identify this effect at the cost of sacrificing the richness of data available in studies that examine more recent, shorter and/or less diverse samples. However, in conjunction with related work that finds similar effects within more limited samples of countries, regions, industries and time periods (Mansfield, 1994; Campos and Nugent, 1998; Markusen, 1998; Dawson, 1999; Rose-Ackerman and Rodden, 1999), this article provides additional evidence that the ability of a nation to credibly commit to a given policy environment is an important component in explaining investment levels within that country.

These results have important ramifications for the expected diffusion rates of both the vital components of an economy's infrastructure, examined here, as well as the diffusion of more recent innovations, including digital communications networks. Regardless of the relevant socioeconomic, demographic or policy-related factors that may be thought to lead to rapid diffusion of these or other new technologies, countries lacking a credible policy regime will be at an extreme disadvantage when competing against other countries for infrastructure investment. From the perspective of the investor, analysis of the opportunity posed by a given country for private infrastructure investment that neglects a sophisticated analysis of the institutional environment will confound countries offering substantial returns on investment with those offering substantial probabilities of government expropriation.

2. Theory[2]

2.1 Infrastructure stock and returns to capital

Although the main emphasis of this paper is on the manner in which political institutions affect the level of investment in telecommunications and electrical infrastructure in a given country, the analysis of political factors must also take into account the initial level of infrastructure stock already in place in that country. The current analysis thus shares with the macroeconomic growth literature [rooted in the models of Solow (1956) and Koopmans (1965)] the insight that a country's existing level of capital stock—or in this case, infrastructure penetration—determines the level of marginal returns available from additional capital deployment and thereby influences the growth rate of the stock (see Barro, 1992).

Analogous to the arguments made in the growth literature, diminishing marginal returns to capital are likely to be observed in panel data on infrastructure investment such as employed in this study. Within a single country, over time, investment is likely to take place first in the highest return geographical areas (urban population centers) and then slowly spread to the remainder of the country. At a moment in time across a

[2]Much of the discussion in this section is drawn from Henisz and Zelner (2001, 2002).

sample of countries, those countries at the frontier of infrastructure penetration must experiment with new technologies and invest not just in the deployment of infrastructure but also in the development of new mechanisms for infrastructure supply and new products that may lead to additional demand. Laggard countries may, to some extent, 'free-ride' on the investment and experience of the countries that have preceded them.

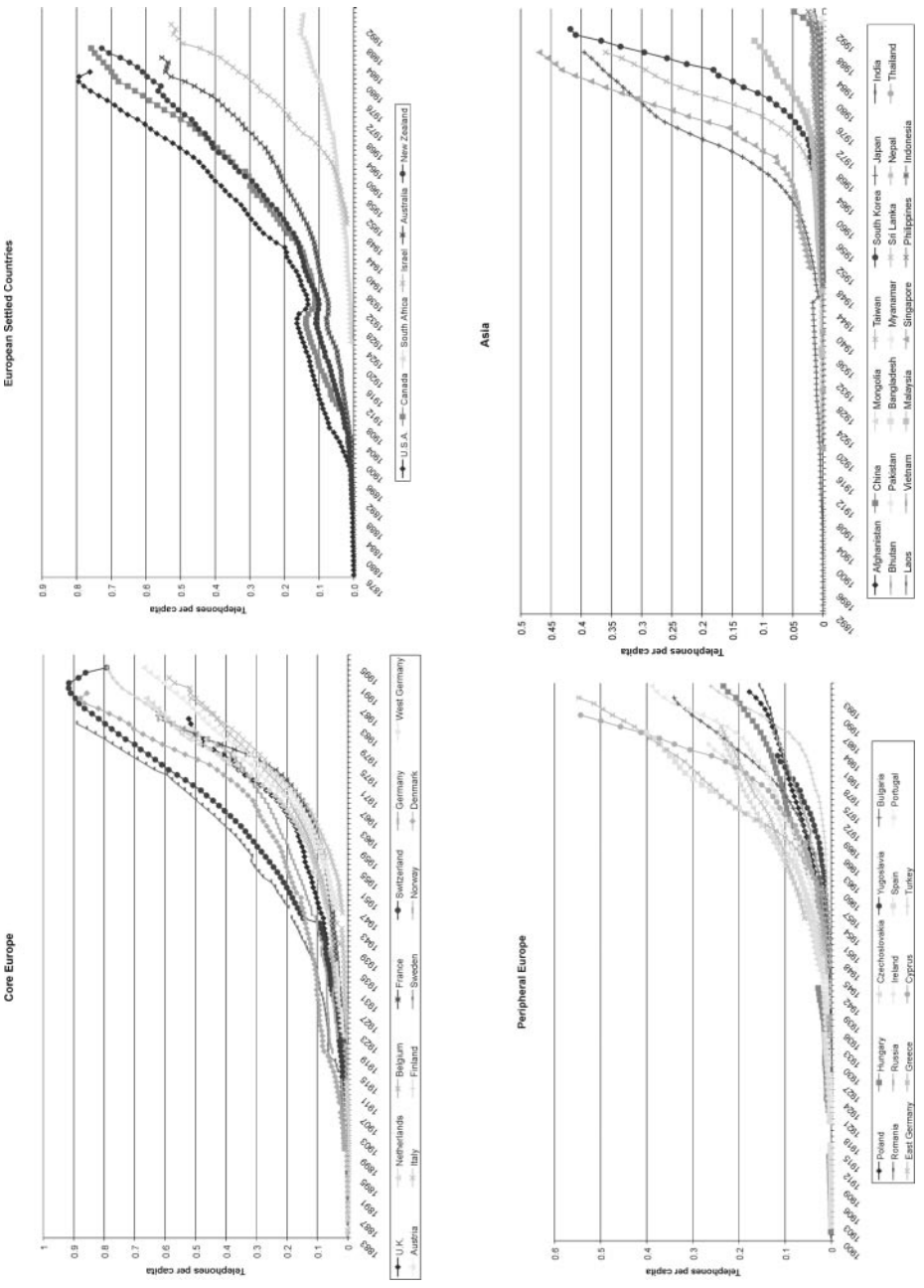
The link between the assumption of diminishing marginal returns to capital and the proposition of an inverse relationship between infrastructure stock and infrastructure growth is the concept of transitional disequilibrium: countries cannot instantaneously attain their desired infrastructure stock-levels given changes to the political or economic environment. Therefore, when these environmental conditions change over time, or vary across countries, those countries further ahead on the diffusion curve will experience less rapid growth than 'laggard' countries.

Another prominent technological driver of cross-national variation in infrastructure investment is the effect of the passage of time. Infrastructure growth-rates, like patterns of growth and diffusion of many other products and technologies (Romeo, 1975; Benvignati, 1982; Gort and Klepper, 1982; Oster, 1982; Quirmbach, 1986; Levin *et al.*, 1987; Rose and Joskow, 1990; Pennings and Harianto, 1992; Abrahamson and Rosenkopf, 1993; Jovanovic and MacDonald, 1994; Thomas, 1999), likely display age dependence. Examining patterns of historical diffusion (see Figures 1 and 2) one observes relatively low to moderate growth rates in the initial decades after the initial penetration of infrastructure services followed—in some countries—by a rapid acceleration of growth and—in a handful of countries—a downward trend in penetration beginning in just the past few years.

While some of this pattern may correspond to variation over time in the environmental variables described below, the similarity to patterns of diffusion of other technologies points to a role for technology as well. Specifically, it may take some time after the availability of new infrastructure prior to widescale adoption and reorganization of economic organization to take advantage of the ubiquitous supply of these producers (David, 1989). Later, growth rates may stabilize or even become negative as demand is saturated, more efficient consumption is realized and/or alternative products (e.g. cellular handsets) arrive in the marketplace.

2.2 Political institutions and investment

The relationship between the stock of a country's infrastructure and the growth rate of that infrastructure will be conditional on a set of country characteristics. Chief among these will be the country's ability to provide a credible policy environment for investors. Theoretical support for the economic impact of political institutions has expanded dramatically in the quarter century since (North and Thomas, 1973) first outlined a 'transaction cost view of economic history.' The crucial economic role played by socio-political factors which reduce the costs of bargaining, contracting, monitoring and enforcement has achieved the status of conventional wisdom in economic history


European Settled Countries
Telephones per capita
U.S.A. Canada South Africa Israel Australia New Zealand
Core Europe
Telephones per capita
U.K. Netherlands Belgium France Switzerland Germany West Germany
Austria Italy Finland Sweden Norway Denmark
Asia
Telephones per capita
Afghanistan China Mongolia Taiwan South Korea Japan India
Bhutan Pakistan Bangladesh Myanmar Sri Lanka Nepal Thailand
Laos Vietnam Malaysia Singapore Philippines Indonesia
Peripheral Europe
Telephones per capita
Poland Hungary Czechoslovakia Yugoslavia Bulgaria
Romania Russia Ireland Spain Portugal
East Germany Greece Cyprus Turkey

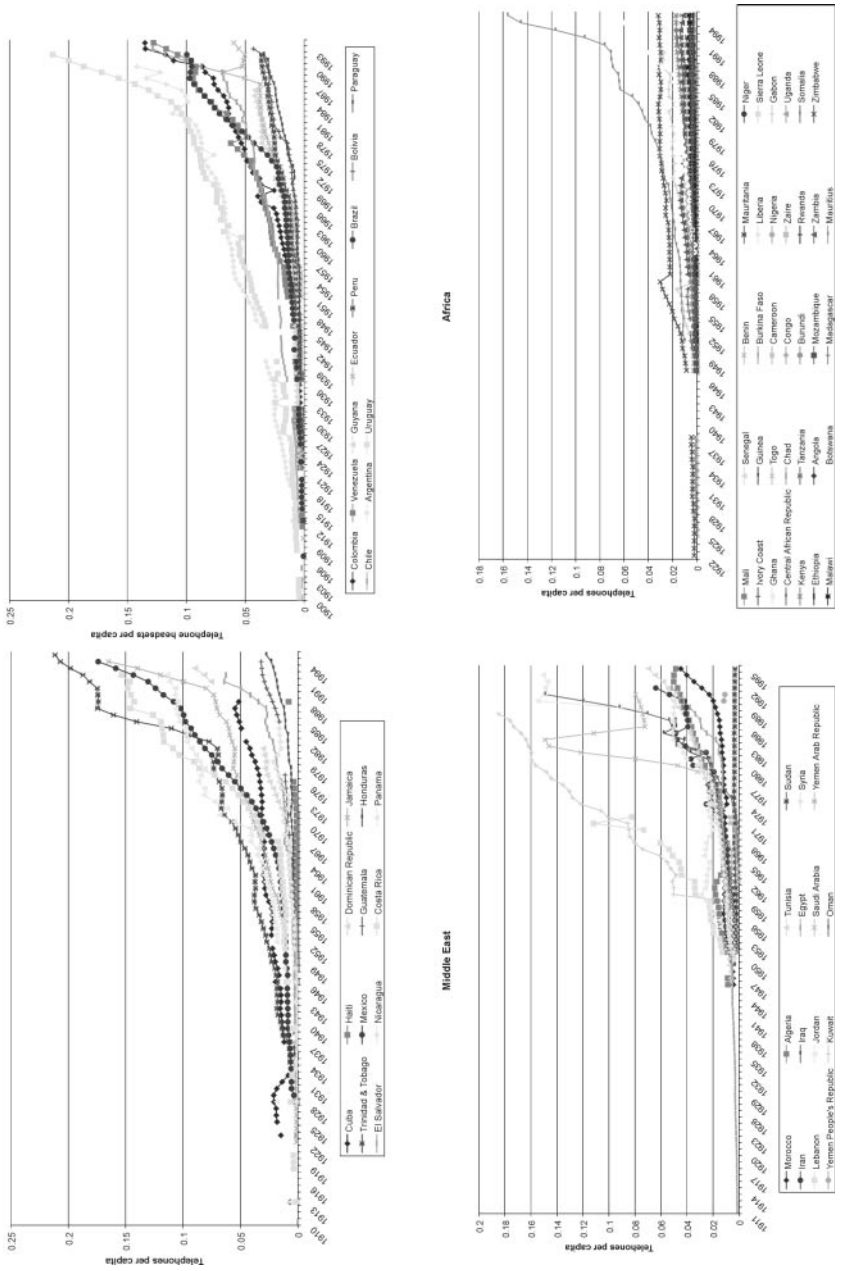
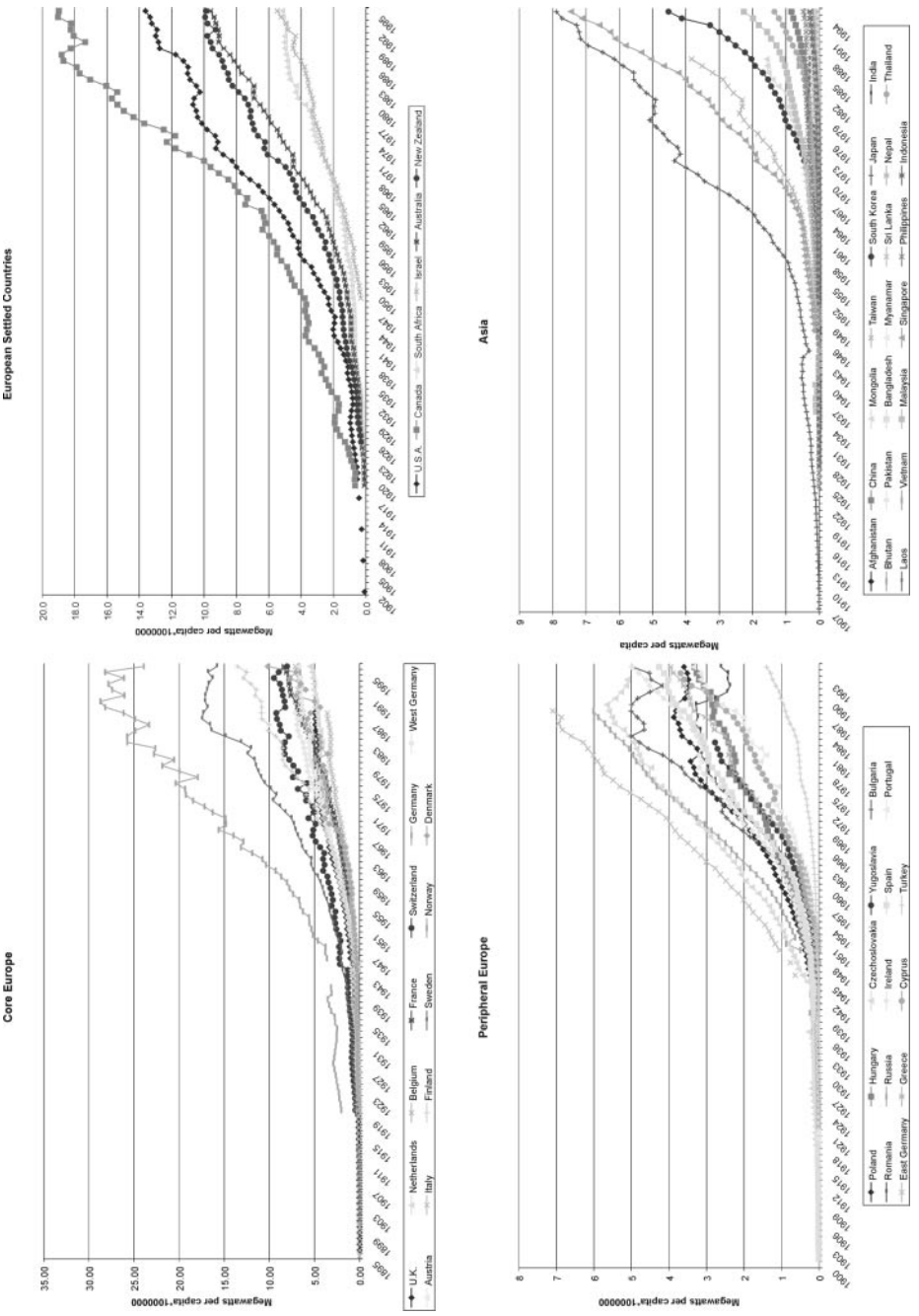


Figure 1 Diffusion of telecommunications infrastructure.


European Settled Countries
Megawatts per capita*1000000
U.S.A.
Canada
South Africa
Israel
Australia
New Zealand
Core Europe
Megawatts per capita*1000000
U.K.
Netherlands
Belgium
France
Switzerland
Germany
West Germany
Austria
Italy
Finland
Sweden
Norway
Denmark
Asia
Megawatts per capita
Afghanistan
China
Mongolia
Taiwan
South Korea
Japan
India
Bhutan
Pakistan
Bangladesh
Myanmar
Sri Lanka
Nepal
Thailand
Laos
Vietnam
Malaysia
Singapore
Philippines
Indonesia
Peripheral Europe
Megawatts per capita*1000000
Poland
Hungary
Czechoslovakia
Yugoslavia
Bulgaria
Romania
Russia
Ireland
Spain
Portugal
East Germany
Greece
Cyprus
Turkey

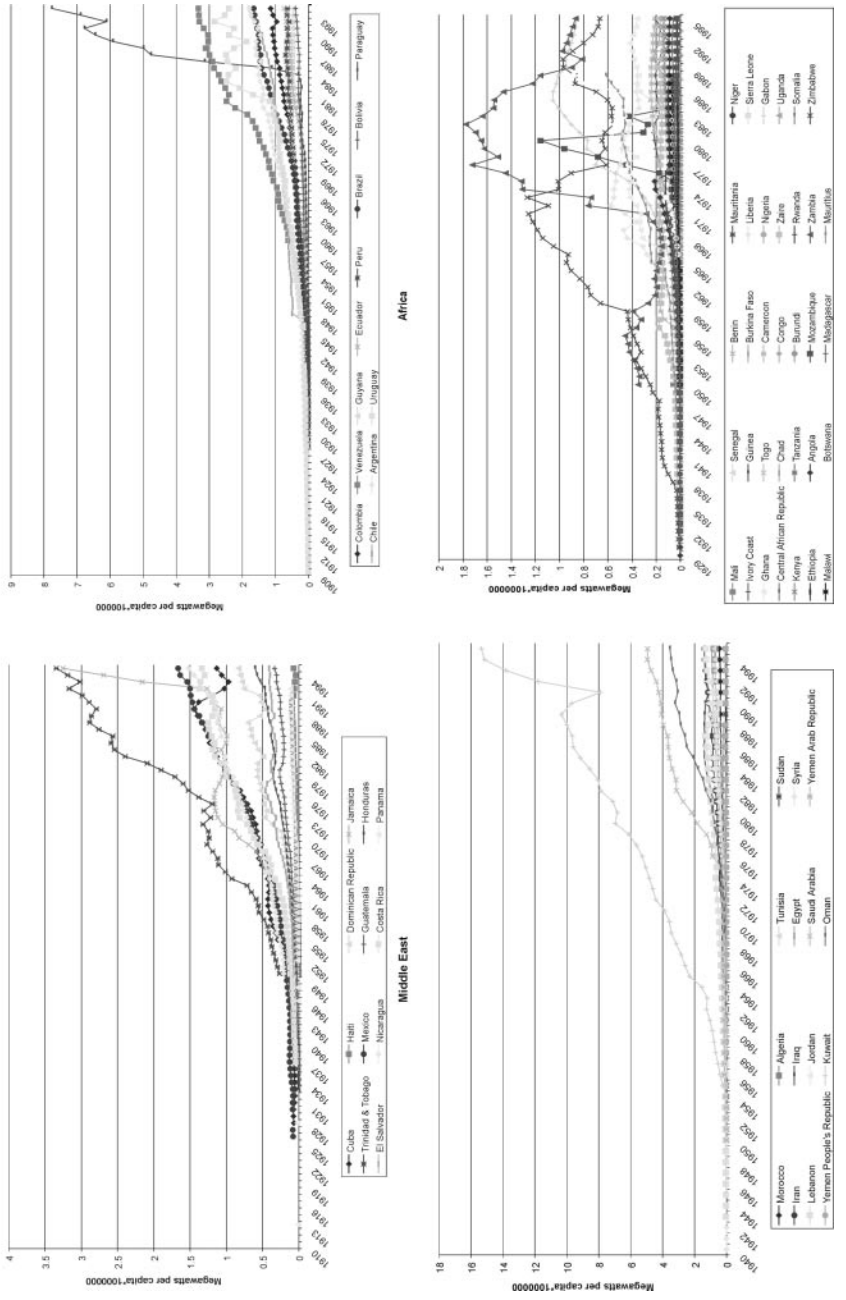


Figure 2 Diffusion of electrical infrastructure.

(North and Weingast, 1989; Root, 1989; North, 1990; De Long and Shleifer, 1993; Mokyr, 1993; Landes, 1998) and development (Nelson, 1989, 1990; North, 1990; Bates and Krueger, 1993; Campos and Lien, 1994; Brunetti and Weder, 1995; Haggard and Kaufman, 1995; Knack and Keefer, 1995; Sachs and Werner, 1995; World Bank, 1995; Olson, 1996; World Bank, 1996, 1997). Scholars in both these domains agree that a government's ability to credibly commit to not interfere with private-property rights is instrumental in obtaining the long-term capital investments required for countries to experience rapid economic growth.

While these arguments are most transparent and likely strongest when considering private investors, so long as public sector managers with control over investment also engage in subgoal pursuit, in particular the maximization of discretionary income streams, it is still reasonable to expect that the institutional environment will affect the incentives that managers of public sector organizations face to deploy capital. Like private sector managers, public sector managers face mechanisms that limit the extent to which they can pursue their subgoals at the expense of their political and financial principals. However, these mechanisms are relatively weak and leave public sector managers with substantial latitude to pursue subgoals. Specifically, both oversight (monitoring) and incentive-based measures that are operative in the private sector are less binding on public sector managers (Cameron and Duignan, 1984; Vining and Boardman, 1989; Scott *et al.*, 1990).

Because of the long time horizon, economies of scale and scope and highly political nature of the investment, infrastructure investment will be especially sensitive to a country's institutional environment (Williamson, 1976; Spiller, 1993; Levy and Spiller, 1994; Spiller and Vogelsang, 1996; Savedoff and Spiller, 1997). Empirical work provides strong support for this hypothesis (Grandy, 1989; Daniels and Trebilcock, 1994; Crain and Oakley, 1995; Levy and Spiller, 1996; Ramamurti, 1996; Savedoff and Spiller, 1997; Bergara Duque *et al.*, 1998; Caballero and Hammour, 1998; Dailami and Leipziger, 1998) including two examples delving into economic history by examining the construction of the Spanish (Keefer, 1996) and New Jersey (Grandy, 1989) railways. Two recent efforts to extend this logic to panel datasets in telecommunications (Henisz and Zelner, 2001) and electricity (Henisz and Zelner, 2002) have also found strong support for the hypothesis that political institutions that fail to constrain arbitrary behavior by political actors dampen the incentive for infrastructure providers to deploy capital and, *ceteris paribus*, yield lower levels of per capita infrastructure investment.[3]

2.3 Economic characteristics.

In addition to the political forces described above, economic conditions are also likely to play an important role in the pattern of infrastructure investment across countries and over time. Data limitations of the century-long panel prohibit the inclusion of vari-

[3]In the case of electricity, the positive effect of political constraints on infrastructure investment is shown to be operative only in the presence of substantial interest group competition from industrial users of electricity (Henisz and Zelner, 2002).

ables such as the composition of production of the economy, the cost of construction and the demographic characteristics of the population. However, some of these factors may be captured by examining cross-national variation in the level of income as well as other available macroeconomic statistics.

3. Measurement and data

3.1 Political constraints

The measure of political constraints employed in this paper estimates the feasibility of policy change (the extent to which a change in the preferences of any one actor may lead to a change in government policy) using the following methodology. First, extracting data from political science databases, it identifies the number of independent branches of government (executive, lower and upper legislative chambers)[4] with veto power over policy change in up to 160 countries in every year from 1800 to the present. The preferences of each of these branches and the status quo policy are then assumed to be independently and identically drawn from a uniform, unidimensional policy space. This assumption allows for the derivation of a quantitative measure of institutional hazards using a simple spatial model of political interaction.

This initial measure is then modified to take into account the extent of alignment across branches of government using data on the party composition of the executive and legislative branches. Such alignment increases the feasibility of policy change. The measure is then further modified to capture the extent of preference heterogeneity within each legislative branch which increases (decreases) decision costs of overturning policy for aligned (opposed) executive branches.

The main results of the calculations detailed in the Appendix (along with a pair of sample calculations and values of the final index for each country in each decade) are that (i) each additional veto point (a branch of government that is both constitutionally effective and controlled by a party different from other branches) provides a positive but diminishing effect on the total level of constraints on policy change and (ii) homogeneity (heterogeneity) of party preferences within an opposition (aligned) branch of government is positively correlated with constraints on policy change. These results echo those produced in similar work by Tsebelis (1995, 1999) and Butler and Hammond (1996, 1997).

3.2 Other independent variables

Data on infrastructure and other non-political factors that may be thought to influence infrastructure investment including real per capita income, population levels and

[4]Previous derivations of the political constraint index described here have included an independent judiciary and sub-federal political entities for a total of five potential veto points. Data limitations preclude their inclusion here. The effect of their omission will be to diminish the variance among countries with relatively high levels of political constraints thereby dampening the magnitude of the observed effect.

macroeconomic aggregates are taken from Mitchell (1992, 1993, 1995) and updated using *The World Development Indicators, 1998* (World Bank, 1998).

4. Initial investment

What are the determinants of the timing of a country's initial investment in infrastructure? Once the technology to transmit voice messages over copper wire had been demonstrated by Alexander Graham Bell in 1876, or to centrally generate electric power for transmission by Thomas Edison in 1882, many countries quickly adopted these technologies. However, outside of the United States and a core set of European countries, adoption times lagged into the decades, and infrastructure growth rates after adoption are noticeably slower. While the level of economic development and the relationship between a country and the core set of industrialized nations clearly play a role, the theoretical arguments developed above also point to an important relationship between political constraints and time to adoption.

4.1 Specification

In order to test this hypothesis, a discrete time logit model is employed to examine the determinants of the transition from having no infrastructure investment to having some positive quantity (Beck *et al.*, 1998).

Let $H(t)$ equal the probability of adoption for a country at time t. According to our hypotheses there exist a set of country-level independent variables (w) that determine $H(t)$.

$$H(t) = \lambda w(t) \tag{1}$$

So as to insure that $H(t)$ (the probability of adoption) is bounded by 0 and 1 in the empirical results, one commonly takes a logistic transformation:

$$\log\{H(t)/[1 - H(t)]\} = \lambda w(t) \tag{2}$$

Next, a separate observation record is created for every unit of time. Thus, if a country does not have its first telephone handset until 1883, that country has a record in each year after 1877 (the year after adoption by the United States) with a dependent variable equal to zero (no adoption) in each year until 1883 whereafter the dependent variable equals one (adoption). The full sample (including multiple observations for the same entry) is then estimated using a using a maximum likelihood estimator for the traditional logit specification. This technique addresses both the problems of censoring and time-varying explanatory variables.

Of the 6901 observed country-years with zero infrastructure penetration in telecommunications, and the 5754 in electricity, fewer than 300 cases possess data on the macroeconomic conditions. Unfortunately, this limited sample precludes independent testing of economic and political effects in the analysis of adoption. Economic characteristics will be included in the analysis of infrastructure growth presented in Section 5. The independent variables included in the vector $w(t)$ are, however, limited to:

POLCON	Political Constraint Index described in Section 3.1 and in Appendix 1.
COLONY	A vector of colony dummies equal to one if the country was a colony of Great Britain, Spain, France, Belgium, Portugal or another colonial power in year *t* (not a colony is the excluded category).
REGDUM	A vector of regional dummies (European settled nations, Central America & the Caribbean, South America, the Middle East, Africa and Asia with Western Europe as the excluded category).
TIMEDUM	A vector of time dummies.[5]

4.2 Results

Table 1 displays the estimation results. With the exception of isolated colony and regional dummies, all coefficient estimates are individually significant at a *P*-value of 0.01 or less. Additionally, an *F*-test confirms that the regional, colonial heritage and temporal dummies, as individual groups, are each jointly significant at a *P*-value of 0.01. The inclusion of the political constraint index offers a substantial improvement upon the specification in which dummy variables enter alone.[6] In the case of telecommunications, the full model correctly predicts 93.8% of non-adopting years and 93.4% of adopting years (93.6% overall) for an 87.1% improvement over a constant probability assumption. Similarly, in the case of electricity, the full model correctly predicts 89.1% of non-adopting years and 93.0% of adopting years (90.9% overall) for a 77.7% improvement over a constant probability assumption.

Table 2 displays the actual and predicted (both with and without the political constraint index) year of adoption of telecommunications and electrical generation infrastructure for each country in the sample. The improvement in the latter case is marked. Specifically, the average error in the predicted year of initial adoption declines from 8.6 years to 5.2 years in the case of telecommunications and from 8.1 to 7.0 years in the case of electricity.

Countries whose political structures offered relatively better protection for international investors than other countries in the same geographic region and with the same colonial heritage demonstrate marked gains in the predicted time of adoption. For example, the United States had political constraint index scores of 0.39 and 0.42 in the years in which they adopted telecommunications (1876) and electricity (1902) that far surpassed the average for European settled countries in these years of 0.06, 0.17 and 0.21. The original prediction for adoption of telecommunications (1911) and electricity (1923) based upon geography and time alone (the United States was not a colony at the time of adoption) were significantly improved based upon incorporation of this vital

[5]The hypothesis of linear or quadratic time dependence was examined but rejected in each sector.

[6]The *F*-statistics of 980 in the case of telecommunications and 380 in the case of electricity and log-likelihood ratios of 359 and 216 respectively reject the null hypothesis of the redundancy of the political constraint index with a *P*-value of less than 0.0001.

Table 1 Estimation results for initial investment in infrastructure[a]

Variable	Telecommunications		Electricity	
C	–2.63	–4.95	5.14	3.93
	(0.01)	(0.00)	(0.00)	(0.00)
POLCON		6.07		3.42
		(0.00)		(0.00)
Colony of UK	–1.29	–0.75	–1.76	–1.43
	(0.00)	(0.00)	(0.00)	(0.00)
Colony of France	–2.05	–1.68	–1.90	–1.70
	(0.00)	(0.00)	(0.14)	(0.00)
Colony of Belgium	–2.07	–1.69	–0.53	–0.30
	(0.00)	(0.00)	(0.05)	(0.26)
Colony of Portugal	–0.42	–0.02	0.91	1.17
	(0.15)	(0.00)	(0.00)	(0.00)
Colony of other	–2.55	–2.18	–1.18	–0.94
	(0.00)	(0.00)	(0.00)	(0.00)
European settled	–0.96	–0.97	–1.41	–1.35
	(0.00)	(0.00)	(0.00)	(0.00)
Eastern Europe	–2.91	–1.57	–3.41	–2.49
	(0.00)	(0.00)	(0.00)	(0.00)
Latin America	–1.44	0.09	–3.04	–2.25
	(0.00)	(0.63)	(0.00)	(0.00)
South America	–1.01	0.29	–2.47	–1.82
	(0.00)	(0.17)	(0.00)	(0.00)
Middle East	–4.81	–3.68	–3.44	–2.55
	(0.00)	(0.00)	(0.00)	(0.00)
Asia	–4.33	–3.18	–3.64	–2.79
	(0.00)	(0.00)	(0.00)	(0.00)
Africa	–5.45	–4.22	–4.26	–2.55
	(0.00)	(0.00)	(0.00)	(0.00)
N	12 633	12 633	12 552	12 552
Log likelihood	–2377	–2198	–2962	–2853
McFadden R^2	0.73	0.75	0.65	0.66
% Dep = 1	50.4	50.4	59.3	59.3
Correctly predicted (%)	93.0	93.6	90.9	90.9
% gain	85.8	87.1	77.6	77.7

P-values are given in parentheses.

[a]Coefficients on annual time dummies plotted in Figure 3.

Table 2 Actual and predicted years of initial investment in infrastructureboth omitting (1) and including (2) the index of political constraints

Country	Telecommunications			Electricity		
	Actual	Predicted		Actual	Predicted	
		(1)	(2)		(1)	(2)
Afghanistan	1951	1951	1951	1951	1948	1948
Algeria	1946	1960	1960	1946	1953	1953
Angola	1947	1950	1950	1929	1930	1930
Argentina	1913	1911	1913	1927	1929	1927
Australia	1901	1911	1901	1919	1923	1920
Austria	1884	1900	1884	1920	1919	1920
Bangladesh	1972	1951	1951	1951	1950	1950
Belgium	1896	1900	1896	1920	1919	1902
Benin	1959	1959	1959	1949	1950	1950
Bhutan	1972	1947	1972	1973	1941	1973
Bolivia	1913	1911	1899	1937	1929	1928
Botswana	1963	1951	1951	1966	1950	1950
Brazil	1907	1911	1907	1928	1929	1936
Bulgaria	1902	1922	1902	1924	1938	1941
Burkina Faso	1959	1959	1959	1947	1950	1950
Burma	1951	1948	1951	1951	1948	1951
Burundi	1963	1959	1959	1965	1950	1949
Cambodia				1950	1949	1949
Cameroon	1950	1959	1959	1950	1950	1949
Canada	1904	1911	1903	1919	1923	1923
Central African Rep.	1959	1959	1959	1954	1950	1950
Chad	1959	1959	1959	1953	1950	1950
Chile	1900	1911	1900	1923	1929	1923
China, PR	1949	1947	1948	1941	1941	1946
Colombia	1913	1911	1913	1933	1929	1928
Congo	1959	1959	1959	1957	1950	1950
Costa Rica	1913	1913	1913	1950	1937	1930
Côte d'Ivoire	1950	1959	1959	1950	1950	1950
Cuba	1913	1913	1913	1928	1937	1938
Cyprus	1936	1920	1926	1948	1937	1946
Czechoslovakia	1920	1922		1919	1938	1941
Denmark	1900	1900	1900	1920	1919	1912
Dominican Rep.	1913	1913	1913	1936	1937	1928
Ecuador	1903	1911	1903	1948	1929	1936
Egypt	1911	1951	1951	1950	1948	1948
El Salvador	1905	1913	1905	1950	1937	1938
Ethiopia	1951	1949	1950	1950	1942	1942
Finland	1920	1918	1917	1923	1919	1919
France	1889	1900	1894	1901	1919	1902
Gabon	1952	1959	1959	1952	1950	1950
Germany	1888	1900	1913	1900	1919	1923
Ghana	1931	1951	1951	1948	1950	1950

Table 2 *Continued*

Country	Telecommunications			Electricity		
	Actual	Predicted		Actual	Predicted	
		(1)	(2)		(1)	(2)
Greece	1935	1900	1922	1922	1919	1923
Guatemala	1913	1913	1913	1937	1937	1938
Guinea	1958	1958	1958	1950	1950	1950
Guyana	1913	1920	1913	1951	1948	1948
Haiti	1928	1913	1934	1950	1937	1950
Honduras	1906	1913	1913	1950	1937	1929
Hungary	1901	1922	1925	1923	1938	1941
India	1921	1948	1948	1939	1948	1948
Indonesia	1948	1947	1948	1928	1945	1946
Iran	1952	1951	1952	1954	1948	1952
Iraq	1949	1951	1951	1941	1948	1948
Ireland	1924	1913	1920	1929	1922	1922
Israel	1950	1911	1926	1949	1937	1946
Italy	1883	1900	1883	1895	1919	1914
Jamaica	1922	1922	1921	1937	1950	1950
Japan	1892	1947	1892	1907	1941	1907
Jordan	1955	1951	1955	1956	1948	1948
Kenya	1925	1951	1951	1938	1950	1950
Kuwait	1955	1959	1955	1955	1953	1951
Laos	1955	1950	1950	1951	1950	1950
Lebanon	1951	1951	1951	1943	1948	1948
Liberia	1955	1949	1950	1950	1939	1946
Libya				1953	1951	1951
Madagascar	1947	1958	1958	1931	1950	1950
Malawi	1951	1951	1951	1950	1950	1950
Malaysia	1936	1951	1951	1936	1950	1950
Mali	1960	1959	1959	1949	1950	1950
Mauritania	1959	1959	1959	1963	1950	1950
Mauritius	1951	1951	1951	1946	1950	1950
Mexico	1913	1913	1913	1926	1937	1938
Mongolia	1960	1947	1948	1957	1941	1946
Morocco	1946	1956	1956	1946	1953	1953
Mozambique	1947	1950	1950	1932	1930	1930
Nepal	1961	1947	1948	1953	1941	1946
Netherlands	1900	1900	1894	1919	1919	1902
New Zealand	1890	1911	1890	1926	1923	1920
Nicaragua	1913	1913	1913	1948	1937	1931
Niger	1959	1959	1959	1950	1950	1950
Nigeria	1951	1951	1951	1948	1950	1950
Norway	1900	1906	1906	1920	1919	1912
Oman	1965	1951	1951	1969	1948	1948
Pakistan	1951	1947	1951	1951	1947	1951
Panama	1913	1913	1913	1937	1937	1929
Paraguay	1913	1911	1912	1941	1929	1928

Table 2 *Continued*

Country	Telecommunications			Electricity		
	Actual	Predicted		Actual	Predicted	
		(1)	(2)		(1)	(2)
Peru	1913	1911	1913	1931	1929	1936
Philippines	1950	1947	1950	1925	1946	1935
Poland	1921	1922	1921	1923	1938	1923
Portugal	1922	1900	1922	1920	1919	1920
Romania	1900	1922	1900	1923	1938	1941
Rwanda	1962	1959	1959	1948	1947	1946
Saudi Arabia	1951	1951	1951	1958	1948	1948
Senegal	1959	1959	1959	1950	1950	1950
Sierra Leone	1955	1951	1951	1950	1950	1950
Singapore	1951	1951	1951	1948	1950	1950
Somalia	1968	1951	1951	1954	1950	1950
South Africa	1925	1911	1910	1924	1923	1920
Spain	1902	1900	1913	1901	1919	1923
Sri Lanka	1922	1948	1948	1935	1948	1948
Sudan	1951	1951	1951	1950	1950	1950
Sweden	1885	1900	1885	1901	1919	1912
Switzerland	1900	1900	1887	1920	1919	1901
Syria	1950	1951	1951	1940	1948	1944
Tanzania	1953	1951	1951	1938	1950	1950
Thailand	1920	1947	1936	1934	1941	1936
Togo	1949	1959	1959	1948	1950	1950
Trinidad & Tobago	1934	1922	1921	1933	1950	1950
Tunisia	1947	1957	1957	1946	1953	1953
Turkey	1947	1951	1931	1930	1948	1931
Uganda	1952	1951	1951	1948	1950	1950
United Kingdom	1894	1900	1894	1896	1919	1912
Uruguay	1900	1911	1900	1909	1929	1909
USA	1876	1911	1876	1902	1923	1919
Venezuela	1912	1911	1912	1938	1929	1936
Vietnam	1950	1954	1953	1950	1950	1950
Yugoslavia	1924	1922	1921	1929	1938	1941
Zaire	1947	1959	1959	1930	1947	1946
Zambia	1951	1951	1951	1950	1950	1950
Zimbabwe	1922	1951	1923	1930	1950	1930

distinction between the United States and other European settled countries. The new estimated adoption years of 1876 and 1919 represented reductions in error of 35 and 4 years respectively.

Another manner in which to assess the importance of the inclusion of political

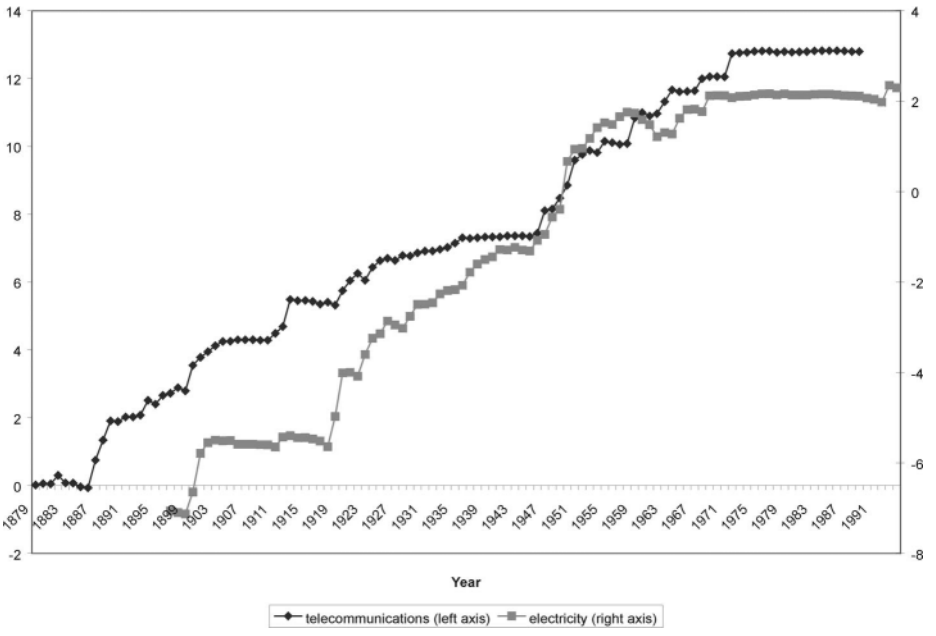


Figure 3 Value of time dummies from adoption equation.

constraints is to examine the predicted impact on the year of initial investment in infrastructure of an improvement in (or variation in) the level of political constraints within a country over time (or between two otherwise identical countries at a moment in time). *Ceteris paribus*, ten years after the initial adoption by any country, an African country that is not a colony, with political constraints, one standard deviation above the mean, is more than three times as likely (0.47 vs. 0.13%) to engage in their initial investment in telecommunications infrastructure. The difference remains of a similar magnitude twenty-five years after the initial adoption (4.1 vs. 1.2%) and fifty years after the initial adoption (38.3 vs. 14.9%). Similar effects are observed in other continents and for infrastructure investment in electrical generating capacity. While other unobserved country characteristics that are correlated with political constraints may be driving these results, this initial test at least lends preliminary support to the notion that the credibility of a government's policymaking apparatus plays an important role in the diffusion process of infrastructure.

5. Subsequent investment

In order to attempt to take this alternate hypothesis into account, this section exploits post-adoption variation in the data to examine the determinants of cross-national and intertemporal variation in infrastructure growth rates. The unbalanced panel data sets contain up to 129 countries for as many as 119 years.

5.1 Specification

The core econometric specification employed is:

$$\Delta\, INFPC_{i,t} + \mathbf{COUNTRYDUMS}\beta_{0,i} + \beta_1 \ln INFPC_{i,t-1} + \beta_2 \mathrm{POLCON}_{i,t-1} + \beta_3(YEAR - YEAR\_INIT\_INF_i) + \beta_4(YEAR - YEAR\_INIT\_INF_i)^2 + \beta_5 \ln RGNPPC_{i,t-1} + \beta_6 COLONY_{i,t-1} + \mathbf{TIMEDUMS}\beta_{8,t} + \varepsilon_{i,t} \quad (3)$$

where subscripts i and t are cross-sectional (country) and time period indices and ln signifies the natural logarithm. Variable definitions follow from Section 4 with the addition of:[7]

$INFPC_{i,t}$	Per capita infrastructure in country i in year t. The same model is estimated using telephone headsets and megawatts of electricity generated as measures of *INFPC*.
YEAR	Calendar year.
$YEAR\_INIT\_INF_i$	Calendar year of initial investment in infrastructure in country i.
$RGNPPC_{i,t}$	Real per capita income of country i in year t expressed in 1990 US dollars.
$COLONY_{i,t}$	Dummy variable equal to one if country i was a colony of any country in year t.
TIMEDUMS	Annual time dummies.
COUNTRYDUMS	Country dummies.

5.2 Estimation

I have pooled across time periods and countries with the exception of (i) the country dummies, which are necessarily pooled across time periods only and (ii) the annual time period dummies, which are necessarily pooled across countries only.

Two econometric issues arise in estimating this equation. First, as the sample is a panel consisting of repeated observations on a broad cross-section of countries, the error term exhibits within-group serial correlation. Second, the sample exhibits group-wise heteroskedasticity. Following Henisz and Zelner (2001, 2002), I

> estimate the standard errors using a robust covariance matrix estimator based on that developed by Newey and West (Newey and West, 1987; Greene, 1997: 503–506). This covariance matrix estimator is consistent in the presence of within-unit serial correlation up to a specified lag and heteroskedasticity of unknown form. Compared with the alternative procedure of estimating one or more AR(n) terms, the use of the robust

[7]Once again, potential nonlinearities in the effect of income and infrastructure stock including the potential for nonlinearities that are dependent on the level of political constraints were explored but one can not reject the null assumption of a linear relationship in each case.

> covariance matrix estimator has several advantages. First, it is computationally simpler. Not only does it easily accommodate autocorrelation that is of higher order than one, but it also simplifies estimation of models that are nonlinear in the parameters. . . . Second, the robust covariance matrix estimator does not rely on an assumption that the different cross-sectional units share common autocorrelation parameters. Failure to make this assumption in the estimation of AR(n) models creates a need to estimate many additional parameters, which reduces the efficiency of the point estimator. Third, it is not necessary to drop observations from one or more time periods when using the robust covariance matrix estimator. The estimator differs from the original Newey–West version in that it is constructed for use in a panel setting rather than a conventional time-series setting (see Driscoll and Kraay (1998) and Froot (1989)). (Henisz and Zelner, 2002)

A lag window of five was employed though results were robust to the use of a two and ten year lag window.[8]

5.3 Results

Tables 3 and 4 report the estimation results for telecommunications and electrical generation capacity infrastructure respectively. The core specification described above is reported in column 1 of each table while columns 2–5 add other economic variables that might be thought to impact the demand for infrastructure. However, in each case the coefficient estimates on these variables are statistically insignificant suggesting that the country fixed effects are sufficiently capturing structural differences in the sample. Columns 6–8 repeat the core specification but omit observations in the top or bottom decile of one independent variable. As the results of primary interest are robust across each of the nine specifications, I restrict my discussion to the core specification for each category of infrastructure (column 1).

With the exception of the quadratic time trend in the case of telecommunications (significant at a *P*-value of 0.10), the dummy for colonies in the case of electricity, and the Political Constraint Index (*POLCON*) in the case of electricity (significant at a *P*-value of 0.09) each variable is correctly signed and individually significant at a *P*-value of 0.02 or less. Additionally, F-tests confirm that the coefficients on the time- and country-specific fixed effects are both, as a group, jointly significant at a *P*-value of 0.01 or less. The adjusted R^2 figure is 0.108 in the case of telecommunications and 0.090 in the case of electricity.

The magnitude of the economic effect of the political constraint index is moderate in size. One standard deviation in the political constraint index (0.25) leads to a predicted increase in infrastructure penetration growth of 0.8 percentage points per

[8]The code to perform this computation on Eviews 3.1 was generously provided by Bennet Zelner.

Table 3 Estimation results for growth in telecommunications infrastructure stock

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
C	–1.016	–1.020	–1.020	–1.027	–1.055	–0.747	–1.15	–1.035
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Ln($INFPC_{tel,i,t}$)	–0.068	–0.072	–0.072	–0.069	–0.071	–0.065	–0.073	–0.070
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
POLCON	0.033	0.034	0.034	0.033	0.033	0.028	0.056	0.029
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.10)	(0.00)	(0.00)
COLONY	0.039	0.045	0.045	0.040	0.039	0.037	0.041	0.040
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.02)	(0.03)
AT WAR?	–0.031	–0.053	–0.052	–0.042	–0.041	–0.033	–0.037	–0.029
	(0.03)	(0.00)	(0.00)	(0.00)	(0.00)	(0.04)	(0.03)	(0.05)
Time trend × 1000	4.529	5.365	5.396	4.516	4.655	2.221	4.958	4.377
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)
$(\text{Time trend})^2 \times 1000$	–0.006	–0.008	–0.008	–0.006	–0.006	–0.001	–0.004	–0.003
	(0.10)	(0.06)	(0.07)	(0.16)	(0.12)	(0.74)	(0.34)	(0.49)
Ln($GDPPC_{t-1}$)	0.020	0.012	0.012	0.021	0.021	0.021	0.025	0.021
	(0.01)	(0.18)	(0.19)	(0.01)	(0.01)	(0.01)	(0.00)	(0.01)
Budget deficit		–0.02						
		(0.68)						
Government spending/GDP			–.03					
			(0.42)					
Current account deficit/GDP				–0.01				
				(0.85)				
Openness (exports + imports)/GDP					0.02			
					(0.20)			
Variable with outliers removed						(i)	(ii)	(iii)
Year dummies	yes	yes	yes	yes	yes	yes	yes	yes
Fixed effects	yes	yes	yes	yes	yes	yes	yes	yes
N	4341	3753	3753	4284	4284	3913	3664	4097
Log-likelihood	2676	2470	2470	2636	2637	2621	2017	2529
Adjusted R^2	0.108	0.131	0.131	0.109	0.109	0.094	0.116	0.113

P-values are given in parentheses. (i) Initial infrastructure stock; (ii) political constraints and (iii) real per capita GDP.

annum in the case of telecommunications and 0.5 percentage points per annum in the case of electricity. While given compounding even these differences can lead to dramatic differences across countries over a span of a few decades, recall that these annual growth rate estimates exclude time-period specific, country-specific effects and the effects of income levels and income growth rates with the latter estimated separately for each country. Previous research has demonstrated that political constraints are likely an important determinant of economic growth and, therefore, over the century-long period under examination here, income levels. The magnitude of the direct economic effect computed here should therefore be considered a lower bound on the total economic effect of political constraints on infrastructure growth.

Table 4 Estimation results for growth in electricity generating infrastructure

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
C	–1.084	–0.660	–0.660	–1.071	–1.072	–1.318	–1.208	–1.180
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Ln($INFPC_{tel,i,t}$)	–0.100	–0.064	–0.064	–0.099	–0.099	–0.118	–0.107	–0.106
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
POLCON	0.022	0.019	0.019	0.021	0.021	0.022	0.048	0.017
	(0.09)	(0.08)	(0.08)	(0.12)	(0.13)	(0.10)	(0.01)	(0.19)
COLONY	0.001	0.006	0.007	–.007	–.006	–0.002	0.005	–0.003
	(0.97)	(0.69)	(0.66)	(0.71)	(0.71)	(0.93)	(0.75)	(0.86)
AT WAR?	–0.017	–0.022	–0.023	–0.017	–0.016	–0.015	–0.023	–0.020
	(0.13)	(0.06)	(0.06)	(0.18)	(0.20)	(0.18)	(0.06)	(0.09)
Time trend × 1000	6.157	3.554	3.514	6.027	6.106	6.591	6.775	5.890
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
$(\text{Time trend})^2 \times 1000$	–0.017	–0.012	–0.012	–0.017	–0.018	–0.008	–0.024	–0.009
	(0.02)	(0.04)	(0.04)	(0.02)	(0.02)	(0.25)	(0.01)	(0.30)
Ln($GDPPC_{t-1}$)	0.024	0.017	0.017	0.025	0.024	0.034	0.034	0.031
	(0.01)	(0.02)	(0.02)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Budget deficit		–0.054						
		(0.27)						
Government spending/GDP			–0.006					
			(0.91)					
Current account deficit/GDP				–0.022				
				(0.72)				
Openness (exports + imports)/GDP					0.007			
					(0.85)			
Variable with outliers removed						(i)	(ii)	(iii)
Year dummies	yes	yes	yes	yes	yes	yes	yes	yes
Fixed effects	yes	yes	yes	yes	yes	yes	yes	yes
N	4816	4113	4112	4716	4716	4419	4041	4413
Log-likelihood	1182	2686	2684	1125	1124	1396	697	997
Adjusted R^2	0.092	0.120	0.119	0.089	0.088	0.099	0.084	0.093

P-values are given in parentheses. (i) Initial infrastructure stock; (ii) political constraints and (iii) real per capita GDP.

6. Conclusion

By demonstrating that a sophisticated incorporation of the institutional environment improves the power of models that predict both the initial year of infrastructure adoption by a country and the subsequent rate of growth of that infrastructure from its inception to the present day, this paper attempt to address the critiques that unobserved country-level heterogeneity may be driving much of the reported correlation between the structure of a nation's political institutions and a broad set of economic outcomes. Since initial adoption decisions cannot, by definition, be influenced by the existing level of infrastructure stock, concerns regarding the role of initial conditions, combined with

path dependency in explaining observed outcomes, are somewhat alleviated by the adoption results reported here. Similarly, the reported results showing a statistically and economically significant link between political institutions and infrastructure growth rates, even in a specification that includes data back to the initial adoption of the infrastructure in a given country, as well as country- and time-specific effects, should alleviate concerns regarding unobserved country-level heterogeneity. Furthermore, the lack of significance of some plausible variables capturing structural differences in these economies over time reinforces this conclusion.

Of course, these results are unable to account for a host of alternate economic explanations that may play an important role. However, in conjunction with other studies that consider a shorter time period and are therefore able to control for these effects, the evidence arguing for a sophisticated treatment of political institutions in the study of cross-national variation in economic outcomes appears increasingly strong.

Policymakers seeking to attract investment in vital infrastructure sectors should pay careful attention to the structure of the political institutions in their country and, if necessary, design mechanisms to compensate for institutional shortcomings. Analogously, investors should analyze not just the demand for new infrastructure but also the credibility of any and all explicit and implicit government pledges necessary to receive a fair rate of return on the investment in that infrastructure.

Acknowledgements

Thanks to Bennet A. Zelner for comments on a prior draft and Danielle Demianczyk and David Morales for superb research assistance.

Address for correspondence

The Wharton School, 2021 Steinberg Hall–Dietrich Hall, University of Pennsylvania, USA; henisz@wharton.upenn.edu.

References

Abrahamson, E. and L. Rosenkopf (1993), 'Institutional and competitive bandwagons: using mathematical modeling as a tool to explore innovation diffusion,' *Academy of Management Review*, **18**, 487–517.

Barro, R. and X. Sala-i-Martin (1992), 'Convergence', *Journal of Political Economy*, **100**, 223–251.

Bates, R. H. and A. O. Krueger (eds) (1993), *Political and Economic Interactions in Economic Policy Reform: Evidence from Eight Countries*. Blackwell: Cambridge, MA.

Beck, N., J. N. Katz and R. Tucker (1998), 'Taking time seriously: time-series-cross-section analysis with a binary dependent variable,' *American Journal of Political Science*, **42**, 1260–1288.

Benvignati, A. M. (1982), 'Interfirm adoption of capital-goods innovations,' *Review of Economics and Statistics*, **64**, 330–335.

Bergara D., M. E., W. J. Henisz and P. T. Spiller (1998), 'Political institutions and electric utility investment: a cross-nation analysis,' *California Management Review*, **40**, 18–35.

Brunetti, A. and B. Weder (1995), 'Political sources of growth: a critical note on measurement,' *Public Choice*, **82**, 125–134.

Butler, C. K. and T. H. Hammond (1997), 'Expected modes of policy change in comparative institutional settings,' Political Institutions and Public Choice Working Paper (Michigan State University's Institute for Public Policy and Social Research), 97.

Caballero, R. J. and M. L. Hammour (1998), 'The macroeconomics of specificity,' *Journal of Political Economy*, **106**, 724–768.

Cameron, R. L. and P. J. Duignan (1984), 'Government owned enterprises: theory, performance and efficiency,' presented at New Zealand Association of Economists' Conference, Wellington, 8 February 1984.

Campos, J. E. and D. Lien (1994), 'Institutions and the East Asian miracle: asymmetric information, rent-seeking and the deliberation council,' World Bank Policy Research Paper 1321.

Campos, N. F. and J. B. Nugent (1998), 'Investment and instability,' mimeo.

Caselli, F., G. Esquivel and F. Lefort (1996), 'Reopening the convergence debate: a new look at cross-country growth empirics,' *Journal of Economic Growth*, **1**, 363–390.

Crain, W. M. and L. K. Oakley (1995), 'The politics of infrastructure,' *Journal of Law and Economics*, **38**, 1–17.

Dailami, M. and D. Leipziger (1998), 'Infrastructure project finance and capital flows: a new perspective,' *World Development*, **26**, 1283–1298.

Daniels, R. and M. J. Trebilcock (1994), 'Private provision of public infrastructure: the next privatization frontier?,' mimeo.

David, P. A. (1989), 'Computer and dynamo: the modern productivity paradox in the not-too-distant mirror,' CEPR Working Paper, Stanford University, 1–67.

Dawson, J. W. (1999), 'Institutions, investment and growth: new cross-country and panel data evidence,' *Economic Inquiry*, **36**, 603–619.

De Long, J. B. and A. Shleifer (1993), 'Princes and merchants: European city growth before the industrial revolution,' *Journal of Law and Economics*, **36**, 671–702.

Derbyshire, J. D. and I. Derbyshire (1996), *Political Systems of the World*. St Martin's Press: New York.

Driscoll, J. C. and A. C. Kraay (1998), 'Consistent covariance matrix estimation with spatially-dependent panel data,' *Review of Economic and Statistics*, **80**, 549–560.

Froot, K. A. (1989), 'Consistent covariance matrix estimation with cross-sectional dependence and heteroskedasticity in financial data,' *Journal of Financial and Quantitative Analysis*, **24**, 333–355.

Gort, M. and S. Klepper (1982), 'Time paths in the diffusion of product innovations,' *Economic Journal*, **92**, 630–653.

Grandy, C. (1989), 'Can the government be trusted to keep its part of a social contract? New Jersey and the railways, 1825–1888,' *Journal of Law, Economics and Organization*, **5**, 249–269.

Greene, W. H. (1997), *Econometric Analysis*. Prentice Hall: Englewood Cliffs, NJ.

Gurr, T. R. (1990), 'Polity II: political structures and regime change, 1800–1986 [computer file],' Boulder, CO: Center for Comparative Politics [producer], Inter-University Consortium for Political and Social Research [distributor].

Haggard, S. and R. Kaufman (1995), *The Political Economy of Democratic Transitions*. Princeton University Press: Princeton, NJ.

Hammond, T. H. and C. K. Butler (1996), 'Some complex answers to the simple question, "do institutions matter?": aggregation rules, preference profiles, and policy equilibria in presidential and parliamentary systems,' Political Institutions and Public Choice Working Paper (Michigan State University's Institute for Public Policy and Social Research), 96.

Henisz, W. J. (2000), 'The institutional environment for economic growth,' *Economics and Politics*, **12**, 1–31.

Henisz, W. J. and B. A. Zelner (2001), 'The institutional environment for telecommunications investment,' *Journal of Economics & Management Strategy*, **10**, 123–148.

Henisz, W. J. and B. A. Zelner (2002), 'Interest groups, political institutions and electricity investment,' mimeo.

Jovanovic, B. and G. M. MacDonald (1994), 'Competitive diffusion,' *Journal of Political Economy*, **102**, 24–52.

Keefer, P. (1996), 'Protection against a capricious state: French investment and Spanish railroads, 1845–1875,' *Journal of Economic History*, **56**, 170–192.

Knack, S. and P. Keefer (1995), 'Institutions and economic performance: cross-country tests using alternative institutional measures,' *Economic and Politics*, **7**, 207–227.

Koopmans, T. C. (1965), 'On the concept of optimal growth,' in T. C. Koopmans (ed.), *Econometric Approach to Development Planning*. North Holland: Amsterdam.

Landes, D. S. (1998), *The Wealth and Poverty of Nations*. W. W. Norton: New York.

Levin, S. G., S. L. Levin and J. B. Meisel (1987), 'A dynamic analysis of the adoption of a new technology,' *Review of Economics and Statistics*, **69**, 12–17.

Levy, B. and P. Spiller (1996), *Regulations, Institutions and Commitment*. Cambridge University Press: Cambridge.

Levy, B. and P. T. Spiller (1994), 'The institutional foundations of regulatory commitment: a comparative analysis of telecommunications regulation,' *Journal of Law, Economics and Organization*, **10**, 201–246.

Mansfield, E. (1994), 'Intellectual property protection, foreign direct investment and technology transfer,' International Finance Corporation Discussion Paper.

Markusen, J. R. (1998), 'Contracts, intellectual property rights and multinational investments in developing countries,' NBER Working Paper 6448.

Mitchell, B. R. (1992), *International Historical Statistics: Europe 1750–1988*. Stockton Press: New York.

Mitchell, B. R. (1993), *International Historical Statistics: The Americas 1750–1988*. Stockton Press: New York.

Mitchell, B.R. (1995), *International Historical Statistics: Africa, Asia & Oceania 1750–1988*. Stockton Press: New York.

Mokyr, J. (1993), *British Industrial Revolution: An Economic Perspective*. Westview Press: London.

Nelson, J. (1989), 'The political economy of stabilization: commitment, capacity and public response,' in J. Nelson (ed.), *Toward a Political Economy of Development: A Rational Choice Perspective*. University of California Press: Berkeley.

Nelson, J. (ed.) (1990), *Economic Crisis and Policy Choice: The Politics of Adjustment in the Third World*. Princeton University Press: Princeton, NJ.

Newey, W. K. and K. D. West (1987), 'A simple, positive semi-definite, heteroskedasticity and autocorrelation consistent covariance matrix,' *Econometrica*, **55**, 703–708.

North, D. (1990), *Institutions, Institutional Change, and Economic Performance*. Cambridge University Press: New York.

North, D. C. and R. P. Thomas (1973), *The Rise of the Western World: A New Economic History*. Cambridge University Press: Cambridge.

North, D. C. and B. R. Weingast (1989), 'Constitutions and commitment: the evolution of institutions governing public choice in seventeenth century England,' *Journal of Economic History*, **49**, 803–832.

Olson, M. (1996), 'Big bills left on the sidewalk: why some nations are rich and others poor,' *Journal of Economic Perspectives*, **10**, 3–24.

Oster, S. (1982), 'The diffusion of innovation among steel firms: the basic oxygen furnace,' *Bell Journal of Economics*, **13**, 45–56.

Pennings, J. M. and F. Harianto (1992), 'The diffusion of technological innovation in the commercial banking industry,' *Strategic Management Journal*, **13**, 29–46.

Quirmbach, H. C. (1986), 'The diffusion of new technology and the market for an innovation,' *RAND Journal of Economics*, **17**, 33–47.

Rae, D. W. and M. Taylor (1970), *The analysis of political cleavages*. Yale University Press: New Haven, CT.

Ramamurti, R. (ed.) (1996), *Privatizing Monopolies: Lessons from the Telecommunications and Transport Sectors in Latin America*. Johns Hopkins University Press: Baltimore, MD.

Rice, J. A. (1995), *Mathematical Statistics and Data Analysis*. Duxbury Press: Belmont, CA.

Romeo, A. A. (1975), 'Interindustry and interfirm differences in the rate of diffusion of an innovation,' *Review of Economics and Statistics*, **57**, 311–319.

Root, H. (1989), 'Tying the king's hands: credible commitment and royal fiscal policy during the old regime,' *Rationality and Society*, **1**, 240–258.

Rose, N. L. and P. L. Joskow (1990), 'The diffusion of new technologies: evidence from the electric utility industry,' *RAND Journal of Economics*, **21**, 354–374.

Rose-Ackerman, S. and J. Rodden (1999), 'Contracting in politically risky environments: international business and the reform of the state,' mimeo.

Sachs, J. and A. Werner (1995), 'Economic convergence and economic policies,' National Bureau for Economic Research Working Paper 5039.

Savedoff, W. and P. Spiller (1997), 'Commitment and governance in infrastructure sectors,'

manuscript prepared for an IDB Conference on Private Investment, Infrastructure Reform and Governance in Latin America and the Caribbean, 15–16 September 1997.

Schwartz, E. P., P. T. Spiller and S. Urbiztondo (1994), 'A positive theory of legislative intent,' *Law and Contemporary Problems*, **57**, 51–74.

Scott, G., P. Bushnell and N. Sallee (1990), 'Reform of the core public sector: New Zealand experience,' *Governance*, **3**, 138–167.

Solow, R. (1956), 'A contribution to the theory of economic growth,' *Quarterly Journal of Economics*, **70**.

Spiller, P. (1992), 'Agency discretion under judicial review,' *Mathematical Computer Modeling*, **16**, 185–200.

Spiller, P. T. (1993), 'Institutions and regulatory commitment in utilities' privatization,' *Industrial and Corporate Change*, **2**, 387–450.

Spiller, P. T. and E. H. Tiller (1997), 'Decision costs and strategic design of administrative process and judicial review,' *Journal of Legal Studies*, **26**, 347–370.

Spiller, P. T. and I. Vogelsang (1996), 'The institutional foundations of regulatory commitment in the UK (with special emphasis on telecommunication),' in P. T. Spiller, T. Pablo and I. Vogelsang (eds), *Regulations, Institutions and Commitment*. Cambridge University Press: Cambridge.

Thomas, L. (1999), 'Adoption order of new technologies in evolving markets,' *Journal of Economic Behavior and Organization*, **38**, 453–482.

Tsebelis, G. (1995), 'Decision-making in political systems: veto players in presidentialism, parliamentarism, multicameralism and multipartyism,' *British Journal of Political Science*, **25**, 289–325.

Tsebelis, G. (1999), 'Veto players and law production in parliamentary democracies: an empirical analysis,' *American Political Science Review*, **93**, 591–608.

Vining, A. R. and A. E. Boardman (1989), 'Ownership and performance in competitive environments: a comparison of the performance of private, mixed and state-owned enterprises,' *Journal of Law & Economics*, **32**, 1–33.

Williamson, O. E. (1976), 'Franchise bidding with respect to CATV and in general,' *Bell Journal of Economics*, 73–104.

World Bank (1995), *Bureaucrats in Business: The economics and politics of government ownership*. Oxford University Press: New York.

World Bank (1996), *From Plan to Market*. Oxford University Press: New York.

World Bank (1997), *The State in a Changing World*. Oxford University Press: New York.

World Bank (1998), 'World development indicators on CD-ROM,' Development Data Group, The World Bank: Washington, DC.

Appendix: deriving and constructing the political constraints index[9]

Deriving the measure of political constraints

In order to construct a structurally derived, internationally comparable measure of political constraints, the structure of political systems must be simplified in a manner which allows for cross-national comparisons over a wide range of countries while retaining the elements of that structure which have a strong bearing on the feasibility of policy change. Here, I will focus on two such elements: the number of independent veto points over policy outcomes and the distribution of preferences of the actors that inhabit them. Without minimizing their importance, I set aside questions of agenda setting power, decision costs (Spiller, 1992; Schwartz *et al.*, 1994; Spiller and Tiller, 1997) and the relative political authority held by various institutions for subsequent extensions of the admittedly simplistic modeling framework presented here.

Political actors will be denoted by E (for executive), L1 (for lower house of legislature), L2 (for upper house of legislature).[10] Each political actor has a preference, denoted by X_I where $I \in [E, L1, L2]$. Assume, for the time being, that the status quo policy (X_0) and the preferences of all actors are independently and identically drawn from a uniformly distributed unidimensional policy space [0,1]. Data on actual preference distributions of political actors will subsequently be incorporated into the analysis loosening this assumption. The utility of political actor I from a policy outcome X is assumed equal to $-|X - X_I|$ and thus ranges from a maximum of 0 (when $X = X_I$) to a minimum of -1 (when $X = 0$ and $X_I = 1$ or vice versa). Further assume that each actor has veto power over final policy decisions. While these are, admittedly, strong assumptions, the incorporation of more refined and realistic game structures and preference distributions presents severe complications for analytic tractability. It is hoped that, mirroring the development of the domestic positive political theory literature, the strength of the results obtained using the simple framework presented here will provide an impetus for future research.

The variable of interest to investors in this model is the extent to which a given political actor[11] is constrained in his or her choice of future policies. This variable is calculated as (1 – the level of political discretion). Discretion is operationalized as the expected range of policies for which all political actors with veto power can agree upon

[9]This section draws heavily from Henisz (2000).

[10]Data limitations of the panel preclude the inclusion of other veto points such as an independent judiciary, sub-federal units of power, administrative agencies, and the like.

[11]Without loss of generality, the remainder of the paper refers to changes in executive preferences. Note that since the preferences of all actors and the status quo policy are drawn identically from the same distribution, each actor, including the executive, faces the same constraints in changing policy. Allowance for the likelihood of multiple actors changing preferences simultaneously is made by incorporating information on alignment of preferences across the various branches of government later in the analysis.

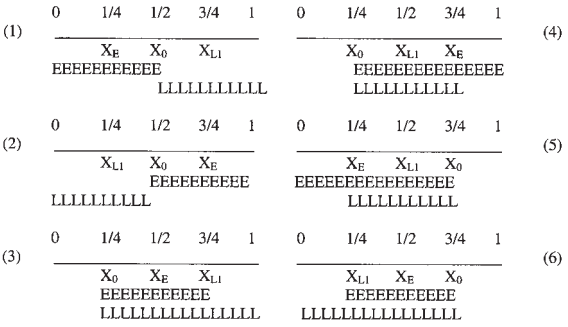


Figure A1 The six possible preference ordering of the game $\{X_E, X_{L1}\}$.

a change in the status quo. For example, regardless of the status quo policy, an unchecked executive can always obtain policy X_E and is guaranteed their maximum possible utility of 0. Investors face a high degree of uncertainty since the executive's preferences may change or the executive may be replaced by another executive with vastly different preferences. Therefore this is categorized as a polar case in which political discretion = 1 and political constraints equals 0 (1 – 1).

As the number of actors with independent veto power increases, the level of political constraints increases. For example, in a country with an effective unicameral legislature (L1), the executive must obtain the approval of a majority of the legislature in order to implement policy changes. The executive is no longer guaranteed the policy X_E as the legislature may veto a change from the status quo policy. The executive can, at best, achieve the outcomes closest to X_E that is preferred by the legislature to the status quo. Without additional information on the preferences of the executive and the legislature it is impossible to compute the exact outcome of the game. Nor is the expected magnitude of the effect on political discretion of adding this additional veto point immediately clear. However, one of the virtues of the simple spatial model outlined above is that it provides a more objective insight into the quantitative significance of adding an additional veto point.

Given the assumption that preferences are drawn independently and identically from a uniform distribution, the expected difference between the preferences of any two actors can be expressed as $1/(n + 2)$[12] where n is the number of actors. Assuming that there exist two political institutions with veto power [the executive (E) and a unicameral legislature (L1)], the initial preference draw yields an expected preference difference equal to 1/(2 + 2) = 1/4. There are six possible preference orderings in this game (see Figure A1) that we will assume are equally likely to occur in practice.[13]

[12]See Rice (1995: 155). The intuition for this result is that the expectation of any single draw is equal to 1/2 but there exists variation across draws. Given a uniform distribution, the expected distance between any two adjacent positions declines proportionally to the number of additional draws. The exact formula is 1/(# of draws + 1).

[13]For expositional convenience, I center each of the preference distributions on the unit line. As long as

In ordering (1), no change in executive preferences which retains the initial ordering of preferences yields a change in policy. The executive ($X_E = 1/4$) prefers all policies between $1/2 - \varepsilon$ and $0 + \varepsilon$ to the status quo ($X_0 = 1/2$) while the legislature ($X_{L1} = 3/4$) prefers all policies between $1/2 + \varepsilon$ and $1 - \varepsilon$ to X_0. As the executive and the legislature cannot agree on a change in policy, political discretion (the feasibility of policy change) equals 0 and political constraints equal 1. The same argument is true by symmetry for ordering (2). In the remaining orderings, both the executive and legislature agree on a direction in which policy should move relative to the status quo X_0. These cases have closed form solutions other than the status quo policy. Their exact values depend on the assumption as to who moves first (or last) and the relative costs of review by each party.

However, in the absence of knowledge on the rules of the game in each country, the range of outcomes over which both parties can agree to change the status quo is used as a measure of political discretion. As this range expands, there exists a larger set of policy changes preferred by both political actors with veto power. The existence of such a set reduces the credibility of any given policy and therefore decreases the level of political constraints. In ordering (3), the executive ($X_E = 1/2$) prefers policies between $1/4 + \varepsilon$ and $3/4 - \varepsilon$ to the status quo ($X_0 = 1/4$) while the legislature ($X_{L1} = 3/4$) prefers all policies greater than $1/4 + \varepsilon$. There exists a range of policies approximately equal to 1/2 (between $1/4 + \varepsilon$ and $3/4 - \varepsilon$), which both actors agree are superior to the status quo. The political discretion measure for this ordering therefore equals 1/2 yielding a political constraints measure equal to 1/2. The same is true in orderings (4), (5) and (6). The expected level of political constraints for the game $\{X_E, X_{L1}\}$ based on the number of veto points alone is the average of the political constraint measures across the six possible preference orderings: $(1 + 1 + 1/2 + 1/2 + 1/2 + 1/2)/6 = 2/3$.

Note that this initial measure of political constraints is based solely on the number of *de jure* veto points in a given polity maintaining the strong and unrealistic assumption of uniformly distributed preferences. However, neither the constitutional existence of veto power nor its prior exercise provide a *de facto* veto threat in the current period. Specifically, loosening the assumption of uniformly distributed preferences by allowing for preference alignment (i.e. majority control of the executive and the legislature by the same party) would be expected to expand the range of political discretion and thereby decrease the level of political constraints. In order to allow for this effect, the purely institutional measure of political constraints described above is supplemented with information on the preferences of various actors and their possible alignments. For example, if the legislature were completely aligned with the executive, the game would revert back to our simple unitary actor discussed above with a constraint measure of 0. The same exercise of determining constraints given the assumption of either com-

the expected difference between any two preferred points remains 1/4, the quantitative results are insensitive to the absolute location of these points. For example, were the leftmost (rightmost) point in each distribution to be placed at 0 (1) rather than 1/4 (3/4), the quantitative results would be unchanged.

Table A1 Political constraints with complete independence/alignment

Independent political actors	Entities completely aligned with executive		
	None	(L1 or L2)	L1 and L2
E	0		
E, L1	2/3	0	
E, L1, L2	4/5	2/3	0

E, executive; L1, lower legislature; L2, upper legislature.

pletely independent or completely aligned actors was conducted for all observed institutional structures yielding the values for political constraints displayed in Table A1.

Further modifications are required when other political actors are neither completely aligned with nor completely independent from the executive. In these cases, the party composition of the other branches of government are also relevant to the level of constraints. For example, if the party controlling the executive enjoys a majority in the legislature, the level of constraints is negatively correlated with the concentration of that majority. Aligned legislatures with large majorities are less costly to manage and control than aligned legislatures that are highly polarized.

By contrast, when the executive is faced with an opposition legislature, the level of constraints is positively correlated with the concentration of the legislative majority. A heavily fractionalized opposition may provide the executive with more discretion due to the difficulty in forming a cohesive legislative opposition bloc to any given policy. Information on the partisan alignment of different government branches and on the difficulty of forming a majority coalition within them can therefore provide valuable information as to the extent of political constraints.

Suppose, for example, that the party controlling the executive completely controls the other branch(es) of government (100%[14] of legislative seats). In this case, the values displayed in the appropriate right-hand column of Table A1 are utilized. However, as the executive's need for coalition building and maintenance increases (his or her majority diminishes), and under the assumption that the same party controls both branches, the values converge to the levels displayed in the left-most column. For the case in which the branches are controlled by different parties, the results are reversed. Now, complete concentration by the opposition (100% legislative seats) leads to the assignment of the values in the left-most column. As the opposition's difficulty of forming coalitions increases, the values converge to the levels displayed in the appropriate right-hand column. Following an extensive body of literature in political

[14]I assume that as the majority diminishes from this absolute level the difficulty in satisfying the preferences of all coalition or faction members increases thus increasing the level of political constraints.

science on the costs of forming and maintaining coalitions, the rate of convergence is based upon the extent of legislative fractionalization (Rae and Taylor, 1970).

The fractionalization of the legislature is equal to the probability that two random draws from the legislature are from different parties. The exact formula is:

$$1-\sum_{i=1}^{n}\left[\frac{(n_i-1)\frac{n_i}{N}}{N-1}\right] \tag{4}$$

where n = the number of parties, n_i = seats held by nth party and N = total seats.

The final value of political constraints for cases in which the executive is aligned with the legislature(s) is thus equal to the value derived under complete alignment plus the fractionalization index multiplied by the difference between the independent and completely aligned values calculated above. For cases in which the executive's party is in the minority in the legislature(s), the modified constraint measure equals the value derived under complete alignment plus (one minus the fractionalization index) multiplied by the difference between the completely independent and dependent values calculated above. In cases of mixed alignment, a weighted (equally) sum of the relevant adjustments is used.

For example, in the case described above the constraint measure equaled 0 if the legislature was completely aligned and 2/3 if it was completely independent. However, if the same party controls the executive and the legislative chamber and the probability of two random draws from the legislature belonging to different parties equals 1/4 (the executive has a large majority in parliament) then the modified constraint measure equals $0 + 1/4 \times (2/3 - 0) = 1/6$. By contrast, if the executive relied on a heavily fractionalized coalition in which the probability that any two random draws were from different parties was 75%, the modified constraint measure would equal $0 + 3/4 \times (2/3 - 0) = 1/2$. In the case where the opposition controls the legislature the values would be reversed. A heavily concentrated majority by the opposition would lead to a value of $0 + (1 - 1/4) \times (2/3 - 0) = 1/2$ while a fractionalized legislature would receive a score of $0 + (1 - 3/4) \times (2/3) = 1/6$.

This measure of political constraints has one important virtue that also yields several weaknesses. The strength of the measure is that it is structurally derived from a simple spatial model of political interaction which incorporates data on the number of independent political institutions with veto power in a given polity and data on the alignment and heterogeneity of the political actors that inhabit those institutions. The first weakness of the measure is that its validity is based upon the validity of the assumptions imposed upon the spatial model in order to generate quantitative results. Another weakness is that many features of interest are left out of the model including agenda setting rights, decision costs, other relevant procedural issues, the political role of the military and/or church, cultural/racial tensions, and other informal institutions which impact economic outcomes.

Constructing the measure of political constraints

Construction of a measure of political constraints based on the above methodology requires three types of data. First, information regarding the number of institutional players in a given polity; second, data on partisan alignments (including coalitions) across institutions; and, finally, data on the party composition of legislatures. All countries were assumed to have an executive. Data on the existence of other political actors (unicameral or bicameral legislatures[15]) with substantive veto power was taken from the Polity database and Derbyshire and Derbyshire (1996).

The above data sources were then supplemented by various issues of *The Political Handbook of the World* and *The Statesman's Yearbook* to note the party distribution of the legislature(s): specifically, whether the executive enjoys a majority in one (or both) legislature(s) and how many seats in each legislature were controlled by each party. Based on this information, the values of institutional constraints were modified to form a measure of political constraints using the methodology described in the previous section.

Sample calculation

Like the hypothetical example above, in 1990 Guyana had two veto points (an independent executive and a single legislative chamber). However, the same party (the People's National Congress) controlled the presidency and held 42 of the 53 legislative seats, with the remaining seats distributed among three other parties. The probability that two random draws from the legislature would be from different parties (the fractionalization index) was 35.4%. As a result, the initial constraint measure of 2/3 was scaled downwards to 0.237 to take into account the (imperfect) alignment of the legislative chamber with the executive branch. [Specifically, the final measure of 0.237 is 35.4% of the distance between the measure with no veto points or perfect alignment (0.000) and the value of the measure with one veto point and perfect opposition (2/3).]

In 1993, Guyana held an election in which the People's Progress Party won the Presidency and the majority in the legislature. The new distribution of seats was 35 for the People's Progress and 27 for the People's National Party, with the remaining parties' seat totals unchanged. In this case, the probability that two random draws from the legislature would belong to different parties increased to 54.5%, making it relatively more difficult for the new governing party to steamroll the legislature in comparison to their immediate predecessor (i.e. their majority was slightly more tenuous). The political constraint measure thus rose from 0.237 to 0.365 (or 54.5% of the distance between the value with no veto points or perfect alignment and the value with one veto point and perfect opposition). Table A2 reports the decade average of the result of the analogous calculation for each country where the necessary data exist. Figure A2 plots the regional averages by year.

[15]Effective legislatures possess 'significant governmental autonomy . . . including, typically, substantial authority with regard to taxation and disbursement, and the power to override vetoes of legislation.' A classification of partially effective is assigned when 'the effective executive's power substantially outweighs but does not completely dominate that of the legislature.' (Gurr, 1990: 51)

Table A2 Decade averages for political constraint index[a]

Country	1880–89	1890–99	1900–09	1910–19	1920–29	1930–39	1940–49	1950–59	1960–69	1970–79	1980–89	1990–98
Afghanistan	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Albania				0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.22
Algeria	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Angola	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.08
Argentina					0.47	0.44	0.57	0.08	0.00	0.00	0.22	0.57
Armenia												0.29
Australia	0.00	0.00	0.41	0.34	0.45	0.46	0.43	0.44	0.52	0.47	0.48	0.47
Austria		0.06	0.06	0.13	0.43	0.13	0.15	0.46	0.42	0.42	0.43	0.43
Azerbaijan												0.00
Bahrain										0.00	0.00	0.00
Bangladesh	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.01	0.00	0.38
Belarus												0.00
Belgium	0.38	0.37	0.47	0.48	0.52	0.48	0.54	0.49	0.48	0.55	0.69	0.70
Benin	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06
Bhutan	0.00	0.00	0.00						0.00	0.00	0.00	0.00
Bolivia		0.29	0.39		0.71	0.00	0.16	0.07	0.05	0.00	0.29	0.40
Bosnia												0.00
Botswana	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.23	0.15	0.27
Brazil	0.00	0.00			0.06	0.00	0.00	0.55	0.18	0.00	0.35	0.13
Bulgaria	0.00				0.20	0.08	0.00	0.00	0.00	0.00	0.00	0.36
Burkina Faso	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Burma	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00
Burundi	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.00	0.00
Cambodia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09
Cameroon	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.27
Canada	0.30	0.33	0.32	0.32	0.39	0.41	0.43	0.38	0.42	0.39	0.40	0.45
Central African Rep.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.30
Chad	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Chile					0.00	0.23		0.69	0.31	0.10	0.00	0.57
China	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Colombia	0.00	0.00	0.00		0.37	0.45	0.40	0.19	0.41	0.37	0.41	0.45
Comoros										0.00	0.00	0.00
Congo	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.28
Costa Rica	0.00	0.00			0.25	0.31	0.35	0.35	0.32	0.40	0.38	0.38
Cuba	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cyprus	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.20	0.35
Czech Republic												0.58
Czechoslovakia	0.00	0.00	0.00	0.00	0.27	0.65	0.00	0.00	0.00	0.00	0.00	0.34
Denmark	0.42	0.27	0.39	0.43	0.51	0.45	0.29	0.53	0.49	0.53	0.54	0.53
Dominican Rep.	0.00	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.09	0.26	0.42	0.58
Ecuador	0.00	0.00	0.00		0.00	0.00			0.00	0.00	0.27	0.14
Egypt	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
El Salvador	0.00	0.00	0.00			0.00	0.00		0.09	0.27	0.24	0.45
Equatorial Guinea									0.00	0.00	0.00	0.00
Eritrea												0.00
Estonia												0.55
Ethiopia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Finland	0.00	0.00	0.00	0.14	0.52	0.50	0.50	0.53	0.54	0.55	0.54	0.54
France	0.26	0.42	0.51	0.55	0.50	0.45	0.49	0.53	0.70	0.55	0.49	0.44
Gabon	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Gambia, The									0.26	0.19	0.21	0.09
Georgia												0.17
East Germany							0.00	0.00	0.00	0.00	0.00	
Germany	0.11	0.10	0.09	0.15	0.56	0.13						0.43
West Germany							0.47	0.44	0.39	0.39	0.40	
Ghana	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.04	0.00
Greece					0.21	0.22	0.00	0.38	0.26	0.16	0.36	0.38
Guatemala		0.00	0.00	0.00		0.00	0.07	0.07	0.00	0.00	0.16	0.32

Table A2 *Continued*

Country	1880–89	1890–99	1900–09	1910–19	1920–29	1930–39	1940–49	1950–59	1960–69	1970–79	1980–89	1990–98
Guinea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12
Guinea-Bissau										0.00	0.00	0.17
Guyana	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.40	0.33	0.00	0.27
Haiti	0.00			0.00	0.00	0.00		0.09	0.00	0.00	0.00	0.12
Honduras	0.00	0.00	0.00	0.00	0.28	0.10	0.00	0.04	0.23	0.07	0.21	0.34
Hungary	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.41
Iceland					0.52	0.47	0.46	0.43	0.48	0.49	0.51	0.51
India	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.34	0.39	0.42	0.52
Indonesia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00
Iran	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Iraq	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ireland	0.00	0.00	0.00	0.00	0.39	0.44	0.42	0.45	0.42	0.40	0.41	0.46
Israel	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.55	0.54	0.48	0.49	0.53
Italy		0.50	0.45	0.33	0.07	0.00	0.10	0.57	0.48	0.47	0.49	0.50
Ivory Coast	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09
Jamaica	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.39	0.37	0.24	0.26
Japan	0.00				0.71	0.71	0.00	0.42	0.46	0.52	0.52	0.56
Jordan	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Kazakhstan												0.00
Kenya	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.29
Kuwait	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Kyrgyz Republic												0.05
Laos	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.00
Latvia												0.35
Lebanon	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.12	0.04	0.08
Lesotho									0.24	0.00	0.00	0.00
Liberia							0.00	0.00	0.00	0.00	0.00	0.00
Libya	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lithuania												0.34
Luxembourg					0.22	0.20	0.31	0.22	0.46	0.50	0.47	0.36
Macedonia												0.27
Madagascar	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.01	0.00	0.26
Malawi	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.19
Malaysia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.38	0.38	0.48	0.31
Mali	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26
Mauritania	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mauritius	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.44	0.43	0.37	0.30
Mexico	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.07	0.12	0.19	0.37
Moldova												0.09
Mongolia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10
Morocco	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15
Mozambique	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.00	0.16
Namibia												0.37
Nepal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.37
Netherlands	0.41	0.42	0.52	0.55	0.58	0.66	0.60	0.42	0.62	0.52	0.49	0.51
New Zealand		0.35	0.32	0.38	0.41	0.38	0.34	0.34	0.33	0.32	0.34	0.35
Nicaragua		0.00	0.00	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.37
Niger	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13
Nigeria	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.05	0.00
North Korea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
North Yemen	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Norway	0.32	0.38	0.37	0.45	0.52	0.48	0.46	0.44	0.46	0.48	0.45	0.51
Oman	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pakistan	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.07	0.46

Table A2 *Continued*

Country	1880–89	1890–99	1900–09	1910–19	1920–29	1930–39	1940–49	1950–59	1960–69	1970–79	1980–89	1990–98
Panama	0.00	0.00	0.00		0.27	0.34	0.21	0.20	0.22	0.00	0.00	0.23
Papua New Guinea										0.34	0.50	0.36
Paraguay	0.00	0.00	0.00	0.00	0.30	0.04	0.00	0.00	0.00	0.00	0.00	0.19
Peru	0.00			0.00	0.00	0.00	0.00	0.12	0.17	0.00	0.15	0.06
Philippines	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.33	0.46	0.07	0.09	0.62
Poland	0.00	0.00	0.00	0.01	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.39
Portugal			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.21	0.43	0.39
Qatar										0.00	0.00	0.00
Romania					0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.46
Russia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06
Rwanda	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Saudi Arabia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Senegal	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Serbia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00				0.46
Sierra Leone	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.31	0.14	0.06	0.00
Singapore	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.00	0.02	0.05
Slovakia												0.50
Slovenia												0.56
Somalia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.00	0.00
South Africa	0.00	0.00	0.00	0.42	0.42	0.32	0.47	0.41	0.28	0.32	0.20	0.35
South Korea	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.04	0.22
South Vietnam	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
South Yemen	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Spain	0.00	0.00	0.00	0.00	0.00	0.26	0.00	0.00	0.00	0.12	0.46	0.49
Sri Lanka	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.50	0.38	0.20	0.40
Sudan	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.19	0.00	0.00	0.00
Swaziland									0.00	0.00	0.00	0.00
Sweden	0.32	0.39	0.38	0.45	0.51	0.56	0.52	0.53	0.45	0.47	0.47	0.49
Switzerland	0.30	0.29	0.35	0.35	0.28	0.55	0.70	0.70	0.70	0.70	0.70	0.46
Syria	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Taiwan	0.00	0.00	0.00	0.00	0.00	0.00	0.00		0.00	0.11	0.19	0.34
Tajikistan												0.00
Tanzania	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08
Thailand	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.63	0.29
Togo	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.18
Trinidad & Tobago	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26	0.34	0.40	0.40
Tunisia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Turkey	0.00	0.00	0.00	0.00	0.00	0.57	0.55	0.20	0.35	0.23	0.23	0.37
Turkmenistan												0.00
Uganda	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.21	0.00	0.00	0.07
Ukraine												0.11
United Arab Emirates										0.00	0.00	0.00
United Kingdom	0.40	0.44	0.42	0.46	0.36	0.33	0.37	0.37	0.34	0.36	0.35	0.36
Uruguay					0.73	0.52	0.44	0.57	0.44	0.10	0.21	0.54
USA	0.40	0.43	0.39	0.40	0.39	0.35	0.46	0.40	0.38	0.40	0.60	0.47
Uzbekistan												0.00
Venezuela	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.54	0.34	0.39	0.31
Vietnam	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Yemen												0.00
Yugoslavia	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Zaire	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Zambia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Zimbabwe	0.00	0.00	0.00	0.00	0.00				0.00	0.00	0.08	0.00

[a]Annual data for each country are available at http://www-management.wharton.upenn.edu/henisz/.

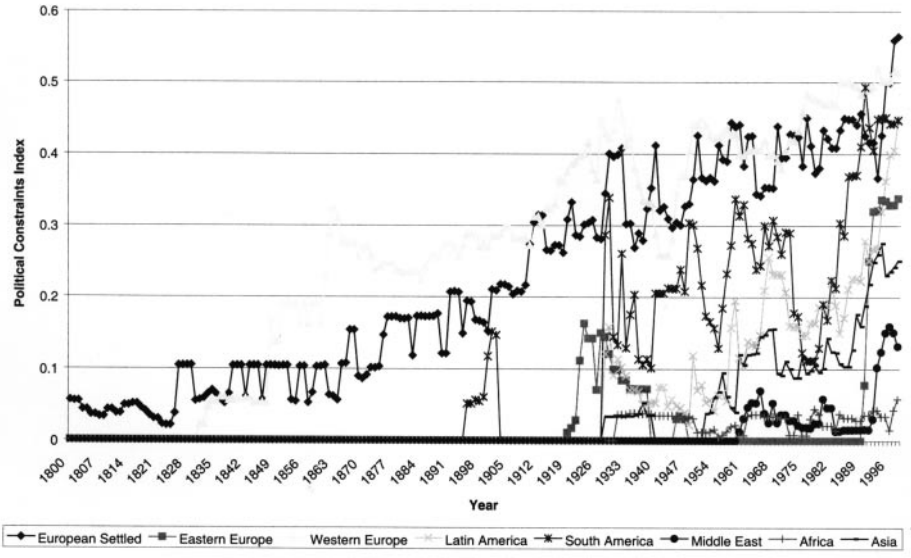


Figure A2 Political constraints by region.