What Underlies Weak States?

The Role of Terrain Ruggedness*

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Abstract

This article documents terrain ruggedness as an underlying cause of state fragility. The paper contends that rugged geography poses significant obstacles to establish cooperation in collective action among constituent groups within the state. This problem then translates into an inability to commit to policies and under-provision of public goods, leading to outcomes such as macroeconomic instability, poor protection of rule of law, limited tax revenue, civil violence, and ultimately, a weak state apparatus. Accordingly, the paper first establishes the theoretical connection between terrain ruggedness and the mentioned collective inaction outcomes, and then econometrically tests its argument using a latent variable model with a sample of 190 independent countries. Robust and clear evidence is found in favor of the reasoning. The impact of terrain ruggedness on state capacity is explained by two mechanisms; hindered checks and balances, and delayed urbanization.

Keywords: terrain ruggedness, collective action, early urbanization, checks and balances,

weak states

JEL: H11, H20, O11, O50

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1. Introduction

There is a resurgent and growing debate in the literature on the role of the state machinery in promoting economic development (Besley & Persson 2011a). However, in contrast to earlier debates regarding the appropriate level of government intervention, current discussion focuses on the questions of what constitutes an effective state apparatus and why inefficient states emerge and persist (Acemoglu et al. 2011). This paper concentrates on the underlying foundations for the formation of effective states, and asks: what are the impediments to the development of state capacity? The paper argues that obstacles for collective action are important hurdles to state formation and progression. In particular, rough topography, as a barrier to cooperation, is a fundamental factor in the early development of effective states and is, in turn, an important predictor of state capacity today.

The role of the state in economic development as well as in the distribution of welfare among citizens has received much attention in both political science and economics fields. Earlier literature addressing the formation of the state recognizes that a state is formed by a group of citizens sharing common interests aiming to satisfy their particular needs. In this sense, the state is an outcome of collective action (Olson 1971; Levi 1989). Agents form coalitions to overcome a common enemy or a problem when the benefits of creating such a group are larger than the benefits of acting alone. Cooperation among the state's constituents is needed, not only for forming the state, but also to increase its capacity over time (Blanton & Fargher 2008).

While common interests and objectives underlie the formation of the state, the key to its survival is its effectiveness. The recent view of the state in economics literature highlights effective taxation, improved provision of public goods, and successful redistribution to the poor as central to the state's capacity (Besley 2011). According to Acemoglu (2005), a role model state is one that is able to levy taxes sufficient to deliver growth-enhancing public

goods, while a weak state cannot fulfill its minimum obligations. Political science literature places more emphasis on the state being the provider of the rule of law and the host of political institutions. Arguably, the rule of law demands (i) supremacy of the law over discretion, (ii) equality before the law, and (iii) the enforcement of the law by the courts (Dicey 1885). Both the political science and economics fields hold the common view that all the economic and political functions of the state are tightly connected, and society's inability to invest in them will result in lost tax revenue, reduced provision of public goods, diminished rule of law, weak political institutions and, hence, fragile states.

If state capacity is vital, then what determines its initiation, evolution and persistence? Instead of focusing on the achievement of a capable state apparatus in its completeness, this study revisits the formative origins of the literature and goes further than the organizational tier of analysis. We re-focus attention on the underlying factors behind the collective action problem in the first place.[1] The core argument of this paper is that impediments to collective action, and the extent to which they can be addressed, will determine where a state falls in the state capacity 'spectrum', and can predict the efficacy of the state machinery today.[2]

Accordingly, the paper empirically investigates the role of terrain ruggedness, a core factor that features as major obstacle for collective action, in state capacity. The argument is that because ruggedness of the terrain historically increases the costs of cooperation—through raising the transaction costs—and reduces the benefits of collective action, the more

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[1] How a weak state can be transformed into a competent state so as to deliver development is also a valid question. We do not focus on that issue in this paper.

[2] We do not argue that collective action is *the* only factor underlying state formation, since, for instance, a society can begin with elite domination of the political scene and citizens can be only inactive players (Acemoglu et al. 2010).

prevalent this characteristic is within a country, the weaker the state apparatus is likely to be. Terrain ruggedness presents considerable challenges in the provision of public goods, not only by constituting a physical obstacle to infrastructure development, but also by restricting congregation, communication, and interaction. The latter are key to collective action agreement, and shape the capacity and effectiveness of early institutions. See Dell (2010), Stasavage (2010), Berkowitz and Clay (2011), and Nunn and Puga (2012), as well as Sokoloff and Engerman (2000), and Easterly and Levine (2003), who have illustrated that geographical conditions crucially affect the quality of initial institutions and the availability of future policy options.

Our terrain ruggedness measure, originally constructed by Riley, DeGloria and Elliot (1999) and later improved by Nunn and Puga (2012), quantifies small topographic irregularities in a country's land area. It is based on elevation data from GTOPO30, a global data set developed through international collaboration led by the US Geological Survey's Center. Elevation observations in GTOPO30 are regularly spaced at 30 arc-seconds across the entire surface of the Earth, and therefore, the sea-level distance between two neighboring grid points on a surface along a meridian is 926 metres (Nunn and Puga 2012). This degree of precision for the terrain structure facilitates capturing the proximate conditions that affect collective behavior among different human groups and the costs of cooperation arising from geographic constraints. That is, only fine grids of the Earth's surface can allow quantifying the collusion costs of, for instance, a number of settlements around the world that lie on different sides of the hills or in different altitudes in short span. Simple distance variables like as-the-crow-flies, or indicators reflecting larger scale irregularities such as the percentage of

mountains in a country's surface area, are too crude to capture this type of settlement dispersion, and the associated costs of inter-group cooperation.[3]

Our focus on terrain ruggedness also parallels Nunn and Puga (2012) due to outcomes of interest, as they show, somewhat surprisingly, that rugged topography reduced the severe effects of the slave trade in Africa, given the difficulties associated with "recruiting" slaves in such terrain. Our argument is predicated on a similar, but contrasting (from the outcomes point of view), logic; rugged terrain makes it more difficult for different groups to cooperate. An implied competing hypothesis, nonetheless, is that terrain ruggedness can result in geographical compactness, and people in such areas can cooperate more. Focusing on European state formation for the period 1250 to 1750, Stasavage (2010) shows that geographically-compact polities were able to sustain much stronger political representation because of their ability to meet frequently to monitor state expenditures. The net effect of terrain ruggedness under these circumstances is an empirical question.

Another distinctive contribution of this paper is methodological: treatment of state capacity as a latent variable. Despite the broad agreement on the state as a crucial platform upon which to build and implement welfare-enhancing policies, there is little consensus as to how to measure its effectiveness and compare its performance across countries. Besley and Persson (2009) argue that the empirics of state capacity are complex, as states perform a myriad of functions. The main estimation problem is that the level of state capacity is not observable: researchers observe only its outcomes. Therefore, we utilize the latent variable model, which, from a statistical point of view, captures perfectly the state capacity concept described above. Specifically, the index function underlying the latent variable model

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[3] Topographic heterogenetiy may significantly underlie the spatial choice of early settlements, but this does not change the thrust of our main argument.

moderates the probability of a state being weak or strong in the 'spectrum' of states, given the explanatory variables, where the relevant outcome is observed once a threshold is exceeded.

Our outcome variables to measure state capacity are inflation, rule of law, share of tax revenue in GDP, and presence of civil war. It must be stressed that these outcomes are not some simple measures of economic or political performance. They are tightly linked to cooperation in collective action, and thus, strongly indicate a state's ability to commit to policies and to provide public goods.

Given this background, we exploit a sizeable variation in topographic features and state performance exhibited by countries around the globe, which permits a useful empirical leverage to assess the hypothesized relationship. After demonstrating the direct predictive power of terrain ruggedness on state capacity, we explore two specific channels through which the related force may matter: checks and balances (C&B), and early urbanization. The central reasoning here is that rough physio-geography may shape the devices or platforms that facilitate the building of the state. C&B, reflecting the extent of cohesiveness of political institutions, underpins the state capacity. On the other hand, urbanized societies are more likely to have solved their tax collection problem earlier, and have better infrastructure and connectivity. In this setting, terrain ruggedness may hinder C&B and delay urbanization.

To summarize our findings, terrain ruggedness robustly predicts state capacity today, both directly and through the hypothesized channels, with meaningful and consistent marginal effects across an array of models. Further, we find that its effect on state capacity works in an inverted-U fashion, suggesting that countries may try to overcome its negativities, but after a point, ruggedness becomes inhibiting. Our results are robust to accounting for alternative mechanisms that might explain state formation, and to controlling for possible 'spatial spillovers' of state fragility among neighboring countries.

2. The State and the Collective Action Problem

In his seminal book, Olson (1971) theorizes that the state is formed by a group of citizens sharing common interests aiming to satisfy their particular needs. Hence, the origin of the state is explained by cooperation in collective action.[4] Levi (1989) posits that agents form groups or coalitions to overcome a common enemy or problem when the benefits of creating such a group are larger than the benefits for acting alone.[5] Thus, the maintenance of the state requires that the benefits of and incentives for cooperation are preserved over time. Accordingly, an organizational structure that deters the formation of internal factions (e.g., through a 'Weberian monopoly of violence') and distributes the benefits of collective action is integral to the maintenance of the state. The size of the coalition can also affect state capacity because incentives to cooperate are reduced as the coalition increases in size due to the free-rider problem (Olson 1971). Collective action theory thus highlights common interests and incentives for cooperation as key to state formation and persistence.

2.1. What is State Capacity?

State capacity is perhaps best defined by its antithesis. Political science literature refers to 'fragile states' or 'weak states' as those that are unable to provide basic public goods, effectively exert control over their territory, commit to a policy, or enforce the rule of law. In economics, the concept is more commonly related to tax raising capacity. Acemoglu

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[4] There are many other theories about state formation, such as those derived from Hobbes, Rousseau and Marx, among others, which are common in political science, sociology, and anthropology literatures.

[5] Using archaeological data, Blanton and Fargher (2008) find evidence that even rulers in pre-modern states provided public goods in exchange for different types of income from taxpayers in complex societies such as Egypt, the Aztecs, China, and Athens.

(2005) defines weak states as those that cannot tax and regulate the economy or deal efficiently with non-state actors. Conversely, strong states are those where taxes are high but provision of public goods is low. Role model states or 'consensually strong states' are countries where taxes and the provision of public goods are both high and rulers are held accountable for their actions (e.g., current OECD countries).

State capacity is different from political regime. A state with a democratic regime might be weak, while a more dictatorial regime may have a stronger state.[6] Moreover, the lack of state capacity is not a characteristic of poor or developing countries. For instance, Oman or the United Arab Emirates perform badly in areas like legitimization of the state or observance of human rights. The recent explosion of social violence in Bahrain, a country with one of the highest incomes per capita in the Gulf, is an example where high income and social unrest can co-exist. Further, the extent to which differences in political systems explain different levels of state capacity is not clear. Both consolidated democracies and non-democratic states face problems related to legitimization of the state. For instance, fierce political confrontation between fractionalized elites is at the heart of the Belgian disintegration debate. In summary, despite the interactions between political regimes and state capacity, they are distinct phenomena.[7]

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[6] See Hariri (2012) on how early statehood resulted in autocratic regimes in non-European countries through prevention of "effective" colonization.

[7] Fragile states are also different from failed states. The latter is countries where neither security nor justice is delivered by the state, such as Somalia or Sudan. A fragile state could become a failed state (Collier 2009).

The consequences of fragile states are diverse and multidimensional, ranging from low income to civil disorder, corruption, political instability and violence. Moreover, weak states are often a liability for other states, rendering them a global concern.

2.2. Impediments to Cooperation in Collective Action

The simplest framework to illustrate a collective action problem is a static game, where the predicted Nash equilibrium generates a socially inefficient outcome. This result can be reached if players do not cooperate.[8] Theoretical models mostly rely on social norms, reciprocity and trust to explain how the socially efficient equilibrium can emerge.

In this strand of research, an important predictor of cooperation within a group is transaction costs. North (1991) emphasizes that higher transaction costs can offset the gains from cooperation, even in settings where all individuals want to cooperate. North describes situations where societies facing higher transaction costs are more likely to remain idle or even to decline, while those facing lower transaction costs will progress over time. Olson (1971, pp. 46—47) argues that, "Any group that must organize to obtain a collective good, will find that it has a certain minimum organization cost that must be met ... The organizational costs include the costs of communication among group members, the costs of any bargaining among them, and the costs of creating, staffing, and maintaining any formal group organization." The question is: what determines transaction costs?

Physio-geography is clearly a non-trivial source of transaction costs. Early societies, in particular, confronted substantial constraints and prohibitive costs due to geographical

[8] Examples of such games are the Tragedy of the Commons and the Stage Hunt game (Binmore 2007).

phenomena.[9] Nunn and Puga (2012) explain that terrain ruggedness makes transportation and construction costly, reduces profits for agriculture, and is negatively related to income per capita. The provision of rule of law also requires not only enacting laws and codes, but also monitoring them and, for that, the state needs to establish courts and maintain their operation. Organizational costs of such operations are higher in settings characterized by tough topography.

Along these lines, several World Bank reports for Latin America argue that rugged terrain imposes serious constraints on the region due to difficulties associated with the delivery of infrastructure and basic services.[10] Also, Dell (2010) documents the persistent negative effects of past institutions, designed on the basis of the terrain ruggedness, on current levels of consumption in Peru. The *mita*, an institution characterized by a forced labor system working in silver mines, was imposed by the Spaniard colonizers only in places surrounded by mountains, so that the native population could not escape. Dell demonstrates that current consumption is 25 per cent lower in areas where *mita* was in place. She illustrates how physio-geography can have persistent effects on the current levels of development. Extending this reasoning to state capacity, rugged terrain can increase the transaction costs, deterring cooperation for the provision of public goods.

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[9] Stasavage (2010, p. 628) cites several sources on how tough geography led to absenteeism in assembly meetings, or resulted in complaints by the assembly members about prohibitive travel costs in early European polities.

[10] Ulubasoglu and Cardak (2007) find that landlocked countries, which are generally mountainous, exhibit higher inequality between rural and urban educational attainment due to difficulties associated with public service delivery to rural areas.

Another strand in the literature highlights the role of terrain ruggedness in civil conflicts. It is well-known that mountainous topography increases the likelihood or duration of civil war by providing rebels with advantage, and negatively affecting military operations (Fearon & Laitin 2003; Buhaug et al. 2009). Examples related to Colombia, Algeria, Peru, Cuba and Afghanistan are well documented (Arreguín-Toft 2001; Acemoglu et al. 2010).[11]

2.3. Inability to Commit

Another dimension of a state's strength is its ability to commit. This commitment is often required for implementing policies that concern a broad cross-section of the public. This first requires a broad agreement on the part of the constituents about the policy, and second, cooperation for the implementation and maintenance of the policy. Inability to commit is a particularly observable, but not directly measurable, symptom of a weak state.

North et al. (2009) argue that fragile states, or, in their definition, the natural state, "has a limited ability to make commitments about the future." By contrast, modern states have a complete set of rules and constraints that allow them to make credible long-term commitments. In the theory of conflicts, credibility is embedded in pacts. Usually, pacts in modern states last for long, because associated laws, institutions, separation of powers, and C&B make the pacts credible. For example, Uganda has experienced more than six civil internal wars in the last 40 years. After each dispute is settled a new one emerges because parties involved in the conflict cannot make credible commitments, and break the 'pacts'.[12]

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[11] Similarly, Herbst (2000) argues that colonizers conquered territories to the extent that benefits from expansion did not offset the costs.

[12] Acemoglu (2005) states that, in consensually strong states, it is the credibility of the state's commitment to redistribution policy that allows for higher taxation.

An obvious sphere in which to observe the inability to commit is unstable monetary and fiscal policies that lead to inflationary pressures. It is generally agreed that rulers have strong incentives to increase short-term employment by fuelling the economy with money. This, in turn, influences future expectations about inflation, creating a dynamic inconsistency problem. To avoid such a dilemma, policies must generate correct incentives to governments and central bankers to adopt credible policies (Blinder et al. 2008). Thus, a state that is able to commit to a sustained monetary policy would produce a low inflation rate over time. Inability to commit to policies expands also into areas such as fiscal policy, debt management, and deterrence.

3. Data and Methodology

As noted earlier, the concept of state capacity transcends income, political systems, colonialism and geographic location. Given the multidimensionality and complexity of the topic, it is difficult to separate the causes and consequences of state fragility. Besley and Persson (2010) state that some indexes used to measure state fragility mix causes and symptoms and, therefore, using such indexes to derive statistical inferences attracts strong reservations. Since state capacity cannot be observed directly, it is not advisable to use traditional statistical tools to make inferences. However, researchers *can* observe its outcomes, such as civil conflict, inflation and the size of the underground economy. Thus, state capacity fits the definition of a latent variable and, so, can be analyzed using a latent variable model. One can infer the strength of a state through an index function with appropriate manifest variables, where, with suitable indicators of state fragility, the index function would be $\beta_0 + \beta_1 \text{TERRAIN}$, moderating the probability of a weak state occurring if the threshold 0.5 is exceeded. Therefore, the index function captures, usefully, the underlying mechanism that leads to the observed outcome. A clear alternative is the continuous treatment of state capacity indicators and, hence, a linear estimation. Despite the shortcomings of this

treatment, we check for the implications of our choice in Appendix A2.[13] An additional econometric difficulty is the inability to observe collective action itself. While its determinants and outcomes are known, it is difficult to summarize collective action in a variable. Consequently, our latent variable model takes a reduced form.

Formally,

$$Y_i^* = \alpha + \beta X_i + \varepsilon_i \ (1)$$

where Y_i^* is the latent variable representing state capacity, X_i the manifest variables, and ε_i is the error term. Y_i^* is defined as follows:

$$Y_i = \begin{cases} 1, if\ Y_i^* > \overline{Y^*} \\ 0, otherwise \end{cases} \ (2)$$

where Y has the following probability:

$$\Pr(Y_i = 1|X_i) = \ \Phi(\beta X_i) \ (3)$$

which we estimate with a logit model.[14]

To test our principal hypothesis that terrain ruggedness impedes cooperation in collective action and reduces state capacity, we estimate the following index function:

$$Y_i^* = f(terrain\ ruggedness_i\ (TRI), Z_i) \ (4)$$

where Y_i^* captures state capacity for country i, and Z is a vector of controls as discussed below. This paper utilizes four indicators to measure Y_i^*: (i) the average inflation rate over the period 1960 to 2009, (ii) the rule of law averaged over the period 1996 to 2010,

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[13] As an example, an extra mountain contributing to state performance by X per cent is a difficult inference to make. Rather, we are interested in the *probability* of observing strong (or weak) state capacity *through capturing the underlying relationship*.

[14] We present only the average marginal effects (AME). Logit estimates are available upon request.

(iii) tax revenue/gross domestic product (GDP) averaged over the period 1990 to 2009, and (iv) the presence of civil war over the period 1975 to 2010.

Specifically, if average inflation over the 50-year period exceeds a certain threshold, it represents the state's inability to commit to policies. The benefit of using inflation as a proxy for state capacity is three-fold. First, it is a good proxy for the commitment to stable monetary and fiscal policy. North et al. (2009) argue that many weak states have experienced periods of high inflation due to self-imbalances that have not been addressed properly. Second, weak states frequently resort to inflation tax (Levi 1989, Tilly 1992 and Besley and Persson 2009; 2010). Third, it reflects a public good. When inflation is low, relative prices are more stable so that individuals and firms face less uncertainty.

We use a 10 per cent inflation rate as the threshold to construct the latent variable indicator. While this threshold is played with to check robustness, 10 per cent appears to represent a well-accepted figure.[15] Essentially, while moderate inflation may be acceptable over growth periods, no country with stable monetary and fiscal policy would score an average inflation rate higher than 10 per cent over a 50-year period.

The second state capacity indicator is the rule of law, and is obtained from Kaufmann et al. (2010). North et al. (2009) posit that the rule of law is characterized by credible commitments between all members of a society, including rulers and citizens. The concept has two main components: (i) the state provides protection to its citizens from the abuse of other citizens, and (ii) the state prevents itself from behaving in a predatory manner towards

[15] Fischer (1996) emphasizes that double-digit figures of inflation are unfavourable for growth. Khan and Ssnhadji (2001) find that an inflation rate above 11 per cent is harmful to growth in developing countries.

its constituents. Thus, the rule of law is a public good. Given the way this index is constructed, the mean value, 0, is adopted as the threshold for the latent variable.

The third indicator is tax revenue/GDP, following the reasoning of Levi (1989) and Tilly (1992). Tax collection is a broader measure of state capacity, indicating the extent to which the state can extract revenue from its constituents and enforce tax legislation and tax compliance. This indicator also signals the scope of the state; minimalistic states would prefer to have lower taxes than interventionist states. Note though, that minimalistic states should not be confused with weak states.[16] We use a threshold level of 15 per cent, a figure close to the mean observed in the sample with 17 per cent also used to check robustness.

The last indicator is the presence of civil war, taken from the UCDP/PRIO Armed Conflict Dataset. This variable captures the inability to peacefully resolve disputes among a state's constituents. A civil war reflects a lack of social contract, a characteristic of weak states[17]. Our latent variable equals 1 if there has been one or more incidents of civil war in that country over 1975 - 2010, and 0 otherwise.

The main control variable included in Z is the ethnic fractionalization index (EF) developed by Alesina et al. (2003). The role of ethnic fractionalization in state capacity is well-established (Alesina et al. 1999; Besley and Persson 2009). Consequently, we include this index in all models. Other control variables are described in the results discussion below. The main sample consists of 190 independent countries around the world. Definitions and sources of the data are provided in Appendix A2.

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[16] Our measure does not include contributions to social security as part of the tax revenue, so it more accurately reflects the real strength capacity of states to collect taxes.

[17] On wealth inequalities between politically relevant ethnic groups and ethnic conflict, see Cederman et al. (2011).

4. Empirical Results

Summary statistics for the latent indicators and main independent variables are shown in Appendix A2. Figures 1a to 1d in Appendix A1 display the nonparametric relationships between the latent and independent variables. Some observations appear to be influential. Since logit regression uses numerical methods to approximate the solution, influential observations could seriously distort the behavior of the maximum likelihood estimator (Bondell 2005). Visual inspection of Figures 1a, b, c, and d shows a potentially non-linear relationship between the latent variables and TRI. Accordingly, influential observations are trimmed.

4.1. Inflation

Estimation results of equation (3), using inflation as the latent variable are presented in Table 1. The linear effect of TRI is investigated first. Column (1) suggests that this choice performs poorly for the entire sample. In column (2), a non-linear effect of TRI is estimated to be statistically significant,[18] although influential analysis indicates that Tajikistan might be an outlier.[19] Column (3) presents the results without this observation, where all estimated coefficients are statistically significant. Effectively, one standard deviation increase in terrain ruggedness increases the likelihood of being a weak state by 13 per cent. To investigate whether these results are driven by a specific region, countries in Africa, Asia, Europe, and Latin America are eliminated one at a time. Columns (4) to (7) report that the results hold for

[18] This non-linear effect suggests that countries attempt to overcome the negative effects of ruggedness up to a point, but after that point, the geographical characteristic becomes inhibiting.

[19] Figure 2a shows the Pregibon delta beta influence statistic for each observation. The Pregibon delta beta influence statistic is the counterpart of Cook's distance for binary models.

all regions but Asia. This is not surprising given that many countries located in this part of the world are weak and rugged.[20] In column (10), our core factor is tested for its ability to predict state capacity within developing countries and former colonies, or when excluding small countries. Our predictor remains highly robust after these exercises.

Another concern is the potential concentration of weak states in some regions, such as Africa, resulting in standard errors being artificially lowered. Statistically speaking, this problem could result in spatial correlation of the residuals. Clustering standard errors by regions, column (11) shows that the estimates remain significant (we will re-visit this issue in sub-section 5.1). Columns (12) to (14) add additional controls such as colonial origins,[21] legal origins, and latitude to control for particular institutions arising historically that affect a state's strength. Our main variable remains robust.

Overall, the findings highlight clearly that TRI is a significant predictor of inflation performance, suggesting that rugged topography deters coordination, resulting in an inability to commit and thus giving rise to high levels of inflation, reflecting a weak state.

4.2. Rule of Law

Table 2 presents a diverse set of results using rule of law as the outcome variable. Column (1) shows a regression with a linear predictor; estimates are not significant. The next specification, column (2), adds a quadratic term for terrain ruggedness. The main predictor is statistically significant, and the sign anticipated. Influential analysis was performed to verify

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[20] A within-Africa or -Asia regression is not carried out due to smaller sample size than needed for our method.

[21] The year of independence is also included to control for different waves of decolonization. Acemoglu et al. (2008) use this variable to distinguish extractive from settlement colonies and Olsson (2009) uses it to differentiate the two main waves of colonization.

whether some observations were driving the results. A visual inspection of Figure 2b suggests that Andorra, Lesotho, and Monaco might potentially affect the estimation. Column (3) finds that removing these observations improves the results. The estimates in Table 2 suggest that a one-standard deviation increase in TRI increases the likelihood of being a weak state by 11 per cent. Since rule of law is also a public good that needs to be constantly funded, its provision is highly affected by ongoing transaction costs. Thus, the results show that more rugged countries are less prone to sustaining law and order, all else constant.

As in the previous sub-section, countries in Africa, Asia, Europe and Latin America are eliminated one at a time to check whether the results are driven by specific geographic characteristics. The estimates, reported in columns (4) to (7), are highly significant. Columns (8) to (10) utilize only developing countries, only former colonies, and exclude small countries, respectively, and the results remain robust. Column (11) presents the estimates with clustered standard errors by regions. Columns (12) to (15) add additional controls to the baseline regression and all results indicate the strong and robust predictive power of rugged physio-geography for state capacity as proxied by the rule of law.

As Olsson and Hansson (2011) argue that the maintenance of the rule of law depends on the size of the country -since it is more difficult to broadcast power from the capital to other regions-the size of the country was added as an additional control in the baseline regression. Results show that TRI remains statistically significant, and that the predictive power of the model actually increases.[22]

4.3. Tax Revenue/GDP

Table 3 displays the results using tax revenue/GDP as the outcome variable proxying the tax collection performance of the state. Column (1) reports a regression with linear

[22] No interaction effects between country size and TRI were found.

predictors; estimates are significant, although TRI is significant only at 10 per cent. The next specification adds a quadratic term of terrain ruggedness to check whether there is a non-linear relationship. As the results are not statistically significant, the linear specification is preferred. Beginning with column (3), initial government expenses[23] are controlled for, since the scope of tax collection ultimately depends on government size. Controlling for this variable, the results are statistically significant. The test of influential observations reveals no country that may be of concern. Results eliminating Africa, Asia and Latin America one at a time are displayed in columns (4) to (7), all of which are statistically significant, except, as above, when Asia is removed. Columns (8) to (10) utilize only developing countries, only former colonies, and exclude small countries, respectively. The results remain robust, except for only former colonies.[24] Column (11) presents the estimates when using clustered standard errors by regions. Columns (12) to (15) add additional controls to the baseline regression. All results remain robust after these exercises. Marginal effects are highly consistent across the columns, suggesting that a one-standard deviation rise in TRI increases the likelihood of being a weak state by 6 per cent. In posterior robustness checks, the cut-off point that defines a state as weak was increased to 17 per cent; however, TRI is not significant.[25] The differing strength of TRI in this circumstance may indicate that tax collection performance in a country is driven by other factors in addition to TRI.

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[23] Initial government size corresponds to the average of government expenditure/GDP between 1985 and 1989. Incorporating further years into the regression can lead to endogeneity.

[24] Again, the lost in significance could be could be caused for a reduction in sample size.

[25] Results are available upon request.

4.4. Presence of Civil War

Results using the presence of civil war as the latent indicator of state fragility are displayed in Table 4. Column (1) shows marginal effects using a linear model in predictors. A quadratic term for TRI is added in column (2), providing even more significant estimates. Figure 2b suggests that Tajikistan might be an influential observation. Removing this observation in column (3) does not drastically change the estimates. Results eliminating Africa, Asia and Latin America one at a time are displayed in columns (4) to (7), respectively, all of which are statistically significant. Columns (8) to (10) show that relationships are significant within developing countries, former colonies and when excluding small countries. Column (11) presents the estimates when using clustered standard errors by regions. Columns (12) to (15) add additional controls to the baseline regression. All results remain robustly significant after these exercises. Marginal effects are highly consistent across the columns, suggesting that a one-standard deviation rise in TRI increases the likelihood of being a weak state by 20 per cent.

4.5. Two Mechanisms: Checks and Balances and Early Urbanization

So far we have focused on the direct predictive power of TRI on state capacity in a reduced form framework. However, it might also be the case that physio-geography affects the very devices or platforms that facilitate the building of state capacity, and the maintenance of its operations. While there might be several such channels, we focus on two: C&B and early urbanization (i.e., urbanization in 1900). The central reasoning here is that terrain ruggedness may hinder C&B and delay the urbanization process, with the latter two forming the 'bridges' for TRI to effect state capacity.

4.5.1. Checks and balances

Besley and Persson (2011a) determine that the degree of cohesiveness of political institutions is a key element underpinning state capacity. They argue that incumbents are

willing to invest in fiscal capacity when there are enough C&B, since, in this case, incumbents know that public funds would be used to finance public goods. However, building a fair system of C&B is not a trivial process, because it requires constant effort and political participation from the public (Collier & Hoeffler 2009). Even democracies can fail to build a fair system of C&B. Chavez (2003) claims that incumbents might find it useful to institute a solid system of checks of balances, mainly through an independent judiciary system, if a threat of a new elite appears. In fact, C&B is the collective arrangement made by the constituents to control those in power. Finally, Keefer and Stasavage (2003) demonstrate that C&B are an important determinant of inflation, using a sample of 66 countries ranging over the period 1960 to 1989. This is not surprising because a ruler whose interest is to be re-elected in a democracy with low levels of C&B might find it easy to raise revenue without increasing the levels of accountability (Collier & Hoeffler 2009) through an inflation tax rather than an income tax.

Our hypothesis is that C&B—an essential device through which the delivery of public goods, taxation, redistribution, and a fair system of rule of law are maintained—is formed via collective action. More specifically, transaction costs, bargaining outcomes, coalition formation, as well as the future of pacts, can be rooted in the topography surrounding the state's constituents. In this way, the implied cohesion in the society, trust and cooperation, and rational handling (as opposed to handling by force) of issues eventually appear in state-capacity enhancing institutions like C&B (Besley & Persson 2011a). To test whether C&B constitute a channel for TRI's effect on state capacity, we take two steps. First, least squares estimation is used to explore whether TRI can explain C&B.[26] Second, C&B are introduced

[26] The C&B variable is obtained by averaging the 'checks' variable over the period 1975 to 2010 from Beck et al. 2001, and measures the number of formal veto players that can block

as another predictor in equation (1) Results are shown in Table 5. Column (1) documents a statistically significant negative effect of the two core factors on C&B. These effects survive even in column (2) after adding the standard set of controls. Columns (3) and (4) present the estimation results for equation (1) using inflation (proxying ability to commit) as the measure of state capacity. Column (3) shows that better C&B is negatively related to the probability of high inflation, as in Keefer and Stasavage (2003). However, in column (4), the effect of TRI is negligible when C&B is included in equation (1) (this will be explained further on). Column (5) shows that C&B are positively related to the rule of law. Adding TRI to the model in column (6), with a somewhat reduced coefficient, shows C&B remain as good predictors of the latent variable, as before. Thus, TRI has two effects in place: a direct effect on the rule of law, and an indirect effect working through C&B. Columns (7) and (8) indicate that the share of tax revenue in GDP is the measure of state capacity. Importantly, C&B lose their predictive power when TRI is included in the model in column (8), suggesting that they host TRI's effect, and so should be acting as a platform for a state's tax collection performance. Last, columns (9) and (10) use civil war presence as the state capacity outcome, and document exactly the same evidence found for taxation.

In all these exercises, TRI remains statistically significant, except in the case of inflation. This suggests, given the significance of C&B in that model, that there might be other intervening factors in the determination of inflation. This finding is not entirely surprising because factors parallel to, but outside of, the collective action theory, such as

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legislation, taking into account all the political system and not only the executive branch. However, one drawback is that the data availability permits only a contemporary account of the relationship. Yet, the well-known reality that institutions persist over time implies that we should be able to capture the underlying relationship.

regime type, economic history, international factors, and credibility of the ruler, can also affect inflation. Given that an economy's inflation performance also rests on credibility, the credibility explanation might be more relevant than the deeper collective action explanation (Keefer & Stasavage 2003).[27]

4.5.2 Early urbanization

The effect of the initial pattern of urbanization on state formation in Europe has been subject to numerous scholarly works (Stasavage 2010). The novelty in our approach is to generalize this argument to a large group of countries and test it empirically as an explicit mechanism between TRI and several state capacity measures. There are two possible dimensions of early urbanization that may facilitate stronger states today. First, building up cities (i.e., urbanization) *per se* requires that citizens choose to stay in a specific urban area and not to exit. Urbanized societies are more likely to have solved their tax collection problem, and have better infrastructure and connectivity. This is because minimal organizational costs, for which the cost of the first unit of collective good will be exceedingly high in relation to the cost of the subsequent units, are more likely to be borne in an urban setting (Olson 1971). It is also well documented that urban centers typically do not exhibit self-sufficient production patterns and, therefore, need to exchange and cooperate with other polities in order to endure. Economic gains from trade, specialization, and agglomeration determine this ability for urban centers. In addition, in various parts of the world, urban settlements were granted some degree of autonomy to self-manage their laws, rules, and even taxes. Thus, cities (i.e., those with a 'sizeable' population) are considered a cooperation success (Glaeser 2011). Urbanization is also likely to yield stronger political organization

[27] Exploring other outcome variables proxying the ability to commit can be promising for future research.

through labor unions, churches, universities, and professional associations. In general, organizational capital, which is needed to build and sustain a state, is likely to emerge in an urbanized society.

The second effect is related to the 'earliness' of this phenomenon. That is, for early urbanized societies, the timeframe considered becomes larger such that there is a longer period over which organizational capital can emerge, and in stronger terms. Therefore, our hypothesis from this discussion is that all else being equal, terrain ruggedness and ethnic fractionalization delay the urbanization process and such societies are less likely to have strong states today.

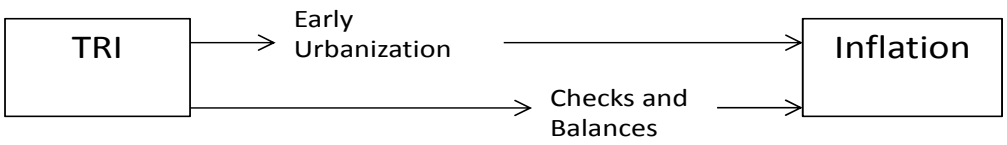
In light of this, we first test whether TRI can explain early urbanization, and whether early urbanization can, in turn, predict the measures capturing state capacity.[28] Results are displayed in Table 6. Columns (1) and (2), using least squares estimation, document strongly that terrain ruggedness are negatively related to urbanization in 1900, even after several controls. That is, the more rugged the country, the less urbanized it was in 1900. This is a critical finding, since early urbanization may also be related to initial institutions. Therefore, this result can shed some light on the importance of physio-geography for initial institutions that matter for current outcomes (Stasavage 2010). The next question is whether the extent of early urbanization represents a country's ability to act collectively today. Columns (3) to (4)

[28] Data for urbanization in 1900 are obtained from Chandler (1987). The data, available for 107 countries, are for settlements with populations above 40,000. If a country has no such settlement, then the urbanization rate of that country was assumed to be 0. This assumption is addressed in the regressions by controlling for those observations with a dummy. Data for countries' total population to calculate the urbanization rate have been obtained from McEvedy and Jones (1978).

show that such a channel effect does not exist when inflation is considered as the state capacity outcome. Given the insignificance of TRI and early urbanization (note that it was significant above), it is possible to suggest that this independent predictor is highly collinear with early urbanization.

However, columns (5) to (6), presenting the predicted probabilities for the rule of law, show that early urbanization and TRI remain good predictors of the latent variable, as before. This means that TRI has two effects in place: a direct effect on the rule of law, and an indirect effect working through early urbanization. Column (7) documents a positive effect of early urbanization on the current tax collection performance after several controls, being significant at 10 per cent. However, this effect becomes insignificant when TRI is introduced in the regression (see column [8]), implying that early urbanization subsumes their effect and, thus, acts as a channel on state capacity. Last, controlling for several variables, early urbanization has the predicted negative effect on the presence of civil war, with a z-statistic of -1.34. When TRI is included in the model, this effect is almost completely washed out, meaning that there is at least some effect from working through our suggested channel.

It is also striking that the results almost mimic each other exactly for both C&B and early urbanization for the effect of TRI on state capacity. The slight variation in the inflation case is normal, and might usefully indicate where C&B and early urbanization lie in the spectrum between TRI and state performance. The results suggest the following diagram:



5. Robustness Checks

5.1. Statistical Independence and Spatial Spillovers in State Capacity

If bordering countries share similar terrain characteristics, then each country may not necessarily constitute a statistically independent observation. For instance, the whole of Africa may very well be considered as a few independent data points based on physio-geography (i.e., many countries share the Sahara desert). This suggests that spatial spillovers may exist in state capacity between neighboring countries based on geographical characteristics.[29]

To test for a global spatial autocorrelation of state fragility, Moran's I test for terrain ruggedness was performed using a contiguity matrix, whose entries are 1 for countries sharing a common land border, and 0 otherwise.[30] The Moran's I statistic for the sample is equal to 0.274, with a z-score of 5.019 and a p-value of 0.00, suggesting global spatial autocorrelation. We address this problem by incorporating such spatial dimension in the estimation. Thus, equation (1) becomes:

$$Y_i^* = f\left(TRI_i, EF_i, WQ_j, Z_i\right) \qquad (5)$$

where W is a spatial weight matrix. To obtain W, we use a contiguity matrix weighted by neighbor's surface area. Q_j are neighbors' terrain. A significant estimate for φ would show that there are likely to be spatial spillovers across bordering countries. The average marginal effects of equation (5) using neighbors' ruggedness are shown in Table 7. In general, no evidence is found on neighbors' ruggedness affecting country outcomes directly. Even with the inclusion of neighbors' ruggedness, the main predictors maintain their

[29] See also Ades and Chua (1997) and Murdoch and Sandler (2004) for negative consequences of social unrest and civil wars that spread spatially across countries.

[30] Data are obtained from Mayer and Zignago (2005).

explanatory power. Thus, our confidence in the statistically significant estimates in Tables 1 to 4 is increased.

5.2. Other possible mechanisms

The main idea behind this paper is to use the collective action theory to explain the formation of a state. However, a state may be formed in other ways too. For instance, a society may start out with an elite dominance of the political scene and citizens may simply be inactive players (Acemoglu & Robinson 2008). To isolate the collective action channel as much as possible, we include in the regressions land gini at independence. Despite being an imperfect measure of the power of elites,[31] this variable's inclusion in equation (1) does not greatly alter the standard errors of TRI (Panel [A] in Table 8).

Another possible mechanism is related to artificial states. Although we have controlled for colonial legacy as the main factor behind this phenomenon, artificial political boundaries which do not coincide with 'natural' ethnic divisions on the field may blur our collective action story; see Alesina et al. (2011) for a systematic and innovative treatment of these states. We incorporate Alesina et al.'s fractal measure of artificial states into our main equation, but this does not change the thrust of our results (Panel [B] in Table 8).[32]

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[31] Admittedly, the empirics of such a channel can be more complex given interaction effects that may exist. For instance, initial political inequality could shape the initial set of institutions, coalitions, bureaucracy and military, and so affect the current state capacity. A more elaborate analysis needs to consider the interactions between political regime, elite strength, mass formation, and the like.

[32] The fractal measure is estimated to be insignificant in three cases, thus, it is justifiable to remove it from those equations. The reduction in the standard error of TRI when the fractal

Regime type might also blur the "mapping" from collective action to state capacity. For instance, lack of collective action might lead to an autocrat taking over the reign of the country, who might, in turn, establish a strong state. We test whether TRI explains constraints on the executive at independence, with the latter being a measure of the regime type, but find no significant link to initiate the concerned mechanism (Panel [C] in Table 8).

6. Conclusions

Traditionally, the state has been conceived as an organization that is able to implement any type of policy. However, constraints related to its own capacity have generally been disregarded. Accordingly, a recent research agenda has begun investigating the main determinants of state capacity (Acemoglu 2005; Besley & Persson 2009; 2010; 2011a; 2011b). Considering that the success of the state depends on cooperation, ability to commit, and provision of public goods, this paper indicates an exogenous feature that can affect cooperation in collective action: physio-geography. This study's analysis provides robust and clear evidence that terrain ruggedness, representing physio-geography, plays critical role in a state's capacity. Exploiting sizeable variations in topography of countries around the world, we document, using a latent variable model, that this factor strongly predicts state capacity outcomes today, such as inflation, rule of law, tax collection, and presence of civil war. This evidence is robust across other estimation approaches and consistent with the collection action theory, whereby transaction costs generated by terrain ruggedness constitute major setbacks to act collectively.

The paper next demonstrated that checks and balances and early urbanization, being intermediate outcomes of collective action, form two significant mechanisms for the observed

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measure is included in the rule of law equation is contributed by the shrinkage in the sample size.

relationship between terrain ruggedness and state capacity. More specifically, countries with more effective devices in place to check and balance their decision-makers, and those that urbanized in the relatively distant past so as to develop the necessary infrastructures and organizations to live together in large settlements, can maintain a stronger state apparatus that can provide improved public goods provision. While there may be other possible mechanisms involved, such as social trust, and land distribution, their effects are likely to be more nuanced in that they may interact with other variables, such as the power of the elites, history, and other initial conditions. These mechanisms, together with other underlying factors, can be a fruitful research avenue for the empirics of state capacity.

Our results also provide some insights into policy matters. The analysis indicates that increased cohesiveness in political institutions might decrease the organizational costs and enhance a state's capabilities. Other possible avenues involve the enhancement of civil institutions that lower the transaction cost of information sharing. However, the questions that remain for further research are how those political institutions might be enhanced and, more importantly, how to make those improvements persist over time.

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Table 1

Average Marginal Effects; Dependent Variable: Y =1 if Inflation>10%; 0 Otherwise

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Variables	Linear	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline with clustered std. errors	Baseline controlling for colonial origins	Baseline controlling for legal origins	Baseline controlling for latitude	Baseline with all controls
TRI	0.00555	0.0951**	0.0983**	0.0806*	0.0729	0.122**	0.111**	0.0832*	0.144**	0.101**	0.0983**	0.0748*	0.0862**	0.0989**	0.0540
	(0.210)	(2.358)	(2.372)	(1.878)	(1.372)	(2.536)	(2.491)	(1.680)	(2.435)	(1.984)	(2.433)	(1.764)	(1.982)	(2.379)	(1.333)
EF	0.262**	0.352***	0.346***	0.267	0.395***	0.385**	0.363**	0.307*	0.530***	0.254	0.346***	0.384***	0.489***	0.359**	0.434***
	(1.974)	(2.634)	(2.594)	(1.432)	(2.885)	(2.418)	(2.565)	(1.937)	(3.050)	(1.618)	(3.680)	(2.847)	(3.464)	(2.549)	(3.139)
Ind. Year												0.00140**			0.000875
												(2.425)			(1.462)
Colony: SPA												0.130			0.0642
												(1.019)			(0.433)
Colony: GBR												-0.313***			-0.162
												(-4.353)			(-1.536)
Colony: FRA												-0.339***			-0.321***
												(-2.836)			(-2.747)
Legal: GBR													-0.404***		-0.468***
													(-5.222)		(-3.724)
Legal: FRA													-0.287***		-0.330***
													(-3.424)		(-3.113)
Latitude														0.000523	-0.0047***
														(0.309)	(-2.634)
Observations	182	182	181	129	139	141	148	147	116	152	181	181	180	181	180
Sample	All	All	All excluding influential obs.	All excluding influential obs.& Africa	All excluding influential obs.& Asia	All excluding influential obs.& Europe	All excluding influential obs.& Latin America/ Caribbean	Developing countries	Former colonies	All excluding small countries	All excluding influential obs.	All excluding influential obs.	All excluding influential obs.	All excluding influential obs.	All excluding influential obs.

Robust z-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

a) Column (1) presents the linear prediction of TRI and EF on the dependent variable. Column (2) introduces the square of TRI as a predictor. Column (3) is the baseline specification. Column (4) eliminates African countries from the sample. Column (5) eliminates Asian countries from the sample. Column (6) eliminates European countries from the sample. Column (7) eliminates Latin America and Caribbean countries from the sample. Column (8) uses a sample consisting of developing countries—those countries that are not part of the OECD. Column (9) uses a sample consisting of former colonies categorized as such by Olsson (2009). Column (10) shows estimates for the baseline specification using standard errors corrected by clusters. Clusters correspond to the following regions: Asia, Europe, Europe, North America, South America, and Oceania. Column (12) controls for colonial origins and independence year using Olsson (2009) and Acemoglu et al. (2008). Column (13) controls for legal origins using La Porta et al. (2008). East Timor legal origin is coded as French. Legal origin for Palau is not specified. Column (14) controls for latitude. Column (15) uses all controls.

b) Columns (3) to (16) eliminate Tajikistan since it is an influential observation.

Table 2

Average Marginal Effects; Dependent Variable: Y =1 if Rule of Law >0; 0 Otherwise

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Variables	Linear	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline with clustered standard errors	Baseline controlling for colonial origins	Baseline controlling for legal origins	Baseline controlling for latitude	Baseline with all controls
TRI	-0.00354	-0.0835**	-0.0921**	-0.124***	-0.0743*	-0.0844*	-0.0905**	-0.118***	-0.0997*	-0.0950**	-0.0921**	-0.0789**	-0.0660	-0.0906**	-0.0634*
	(-0.115)	(-2.243)	(-2.395)	(-3.063)	(-1.683)	(-1.864)	(-2.083)	(-2.620)	(-1.779)	(-2.256)	(-1.977)	(-2.186)	(-1.617)	(-2.433)	(-1.818)
EF	-0.710***	-0.790***	-0.820***	-0.688***	-0.879***	-0.663***	-0.784***	-0.601***	-0.643***	-0.798***	-0.820***	-0.683***	-0.823***	-0.783***	-0.686***
	(-7.464)	(-8.390)	(-9.005)	(-4.258)	(-12.50)	(-5.519)	(-7.851)	(-4.805)	(-4.947)	(-8.286)	(-5.676)	(-6.665)	(-8.139)	(-7.908)	(-6.150)
Ind. Year												-0.0015***			-0.00103**
												(-3.354)			(-2.042)
Colony: SPA												-0.363***			-0.280***
												(-3.474)			(-2.736)
Colony: GBR												0.190***			0.159
												(3.008)			(1.288)
Colony: FRA												-0.421***			-0.445***
												(-2.794)			(-3.149)
Legal: GBR													0.264***		0.220
													(3.373)		(1.586)
Legal: FRA													0.0174		0.206**
													(0.225)		(2.171)
Latitude														0.00183	0.00353**
														(1.248)	(2.079)
Observations	187	187	184	133	140	144	151	150	117	155	184	184	183	184	183
Sample	All	All	All excluding influential obs.	All excluding influential obs.& Africa	All excluding influential obs.& Asia	All excluding influential obs.& Europe	All excluding influential obs.& Latin America/ Caribbean	Developing countries	Former colonies	All excluding small countries	All excluding influential obs.	All excluding influential obs.	All excluding influential obs.	All excluding influential obs.	All excluding influential obs.

Robust z-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1

a) Same as Notes a) in Table 2

b) Columns (3) to (16) eliminate Andorra, Lesotho, and Monaco since they are influential observations.

Table 3

Average Marginal Effects; Dependent Variable: Y =1 if Tax/GDP >15%; 0 Otherwise

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Variables	Linear	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline with clustered std. errors	Baseline controlling for colonial origins	Baseline controlling for legal origins	Baseline controlling for latitude	Baseline with all controls
TRI	-0.0523*	-0.0537	-0.0499**	-0.0665**	-0.0159	-0.0488*	-0.0508**	-0.0524*	-0.0218	-0.0603**	-0.0499**	-0.0452*	-0.0450*	-0.0504*	-0.0486*
	(-1.731)	(-1.102)	(-2.051)	(-2.102)	(-0.462)	(-1.719)	(-2.009)	(-1.862)	(-0.598)	(-2.335)	(-2.514)	(-1.823)	(-1.681)	(-1.845)	(-1.722)
EF	-0.66***	-0.66***	-0.538***	-0.544***	-0.531***	-0.484***	-0.574***	-0.472***	-0.626***	-0.524***	-0.538***	-0.587***	-0.683***	-0.638***	-0.737***
	(-4.905)	(-4.616)	(-4.221)	(-2.823)	(-3.740)	(-3.102)	(-4.376)	(-2.986)	(-3.983)	(-3.980)	(-7.174)	(-4.194)	(-5.401)	(-5.341)	(-5.236)
Init. gov. size			0.0277***	0.0232***	0.0358***	0.0284***	0.0234***	0.0295***	0.0360***	0.0276***	0.0277***	0.0224***	0.0250***	0.0311***	0.0267***
			(4.623)	(3.237)	(6.147)	(4.250)	(3.340)	(4.253)	(4.949)	(4.642)	(3.936)	(3.114)	(3.749)	(4.601)	(3.676)
Ind. Year												7.68e-05			0.000292
												(0.0895)			(0.365)
Colony: SPA												0.00474			-0.180
												(0.0367)			(-1.237)
Colony: GBR												0.199*			-0.131
												(1.783)			(-0.698)
Colony: FRA												0.0266			-0.103
												(0.195)			(-0.702)
Legal: GBR													0.399***		0.405**
													(3.768)		(2.059)
Legal: FRA													0.232**		0.238*
													(2.214)		(1.884)
Latitude														-0.0041***	-0.00289
														(-2.840)	(-1.549)
Observations	127	127	127	90	97	100	101	96	82	113	127	127	127	127	127
Sample	All	All	All excluding influential obs.	All excluding influential obs.& Africa	All excluding influential obs.& Asia	All excluding influential obs.& Europe	All excluding influential obs.& LAC	Developing countries	Former colonies	All excluding small countries	All excluding influential obs.	All excluding influential obs.	All excluding influential obs.	All excluding influential obs.	All excluding influential obs.

Robust z-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1

a) Same as Notes a) in Table 2. .

b) Columns (3) to (15) control for initial government size.

Table 4

Average Marginal Effects; Dependent variable: Y =1 if Presence of Civil War; 0 Otherwise

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Variables	Linear	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline with clustered std. errors	Baseline controlling for colonial origins	Baseline controlling for legal origins	Baseline controlling for latitude	Baseline with all controls
TRI	0.0649**	0.149***	0.152***	0.128***	0.159***	0.166***	0.155***	0.179***	0.191***	0.156***	0.152***	0.142***	0.152***	0.150***	0.145***
	(2.134)	(4.293)	(4.329)	(4.180)	(3.373)	(3.588)	(4.103)	(4.079)	(3.280)	(4.222)	(7.685)	(3.961)	(4.292)	(4.288)	(3.960)
EF	0.476***	0.585***	0.578***	0.489***	0.583***	0.509***	0.614***	0.507***	0.335	0.573***	0.578***	0.605***	0.527***	0.551***	0.532***
	(3.747)	(4.351)	(4.303)	(3.234)	(3.609)	(2.864)	(4.467)	(2.850)	(1.538)	(4.075)	(7.501)	(4.333)	(3.806)	(3.897)	(3.855)
Ind. Year												-0.000320			-7.16e-05
												(-0.590)			(-0.112)
Colony: SPA												0.0222			-0.00986
												(0.202)			(-0.0840)
Colony: GBR												-0.0416			-0.140
												(-0.510)			(-1.121)
Colony: FRA												-0.0198			-0.0587
												(-0.169)			(-0.469)
Legal: GBR													0.0917		0.180
													(0.924)		(1.130)
Legal: FRA													0.118		0.121
													(1.242)		(0.926)
Latitude														-0.0009	-0.0003
														(-0.640)	(-0.180)
Observations	161	161	160	110	118	126	133	128	100	148	160	160	160	160	160
Sample	All	All	All excluding influential obs.	All excluding influential obs.& Africa	All excluding influential obs.& Asia	All excluding influential obs.& Europe	All excluding influential obs.& Latin America/ Caribbean	Developing countries	Former colonies	All excluding small countries	All excluding influential obs.	All excluding influential obs.	All excluding influential obs.	All excluding influential obs.	All excluding influential obs.

Robust z-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1

a) Same as Notes a) in Table 2.

b) Columns (3) to (16) eliminate Tajikistan since it is an influential observation.

Table 5

Mechanism 1: Checks and Balances

	OLS: C&B		AME: Inflation		AME: Rule of law		AME: Tax		AME: Civil war	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Variables	Baseline	Baseline and controls	Baseline	Baseline, C&B, and controls	Baseline	Baseline, C&B, and controls	Baseline	Baseline, C&B, and controls	Baseline	Baseline, C&B, and controls
C&B			-0.0986***	-0.0875**	0.102***	0.0646**	0.102*	0.0391	-0.0807*	-0.0455
			(-2.659)	(-2.135)	(3.086)	(2.016)	(1.951)	(0.795)	(-1.756)	(-1.128)
TRI	-0.196***	-0.232***		0.0738		-0.101**		-0.0618*		0.166***
	(-3.219)	(-4.137)		(1.533)		(-2.536)		(-1.804)		(4.354)
EF	-1.925***	-1.317***		0.144		-0.419**		-0.598***		0.322*
	(-5.831)	(-3.008)		(0.742)		(-2.329)		(-3.127)		(1.866)
Ind. year		-0.00813***	0.00166**	0.00169**	-	-	-0.000267	-9.04e-05	0.000234	0.000707
					0.00176***	0.00172***				
		(-4.369)	(2.165)	(2.193)	(-3.407)	(-3.237)	(-0.279)	(-0.0988)	(0.305)	(0.968)
Colony SPA		-0.371	0.180	0.172	-0.343***	-0.345***	-0.0374	-0.0298	-0.00335	0.0297
		(-1.434)	(1.222)	(1.176)	(-3.536)	(-3.626)	(-0.242)	(-0.205)	(-0.0288)	(0.258)
Colony GBR		-0.239	-0.210*	-0.201	0.176*	0.115	0.0425	-0.0665	-0.166	-0.151
		(-0.617)	(-1.660)	(-1.581)	(1.655)	(1.083)	(0.197)	(-0.337)	(-1.232)	(-1.188)
Colony FRA		-0.471**	-0.425***	-0.400***	-0.249	-0.280*	0.0679	0.0669	-0.175	-0.112
		(-2.315)	(-3.511)	(-3.398)	(-1.414)	(-1.785)	(0.437)	(0.421)	(-1.323)	(-0.875)
Legal: GBR		0.825*	-0.116	-0.119	-0.151	-0.0393	0.215	0.437**	0.295*	0.269*
		(1.863)	(-0.821)	(-0.739)	(-1.233)	(-0.278)	(1.055)	(2.131)	(1.913)	(1.814)
Legal: FRA		-0.00201	-0.103	-0.118	-0.0619	0.0103	0.133	0.192	0.229*	0.200*
		(-0.00834)	(-0.914)	(-0.946)	(-0.844)	(0.120)	(0.995)	(1.531)	(1.926)	(1.734)
Log Area		-0.0374	0.0487*	0.0481*	-0.0506***	-0.0476**	-0.0598**	-0.0435*	0.0550**	0.0663**
		(-0.609)	(1.935)	(1.838)	(-2.704)	(-2.347)	(-2.435)	(-1.800)	(2.282)	(2.538)
Initial gov. size							0.0255***	0.0238***		
							(3.842)	(3.449)		
Constant	3.572***	19.26***								
	(14.62)	(4.903)								
Observations	170	170	153	153	155	155	113	113	149	149

z-statistics in parentheses. ***p<0.01, **p<0.05, *p<0.1.

Note. Columns (1) and (2) estimate C&B using OLS. Columns (3) to (14) present average marginal effects.

Table 6

Mechanism 2: Early Urbanization

	OLS: Urbanization in 1900		AME: Inflation		AME: Rule of law		AME: Tax		AME: Civil war	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Variables	Baseline	Baseline and controls	Baseline	Baseline and controls	Baseline	Baseline and controls	Baseline	Baseline and controls	Baseline	Baseline and controls
Urban_1900			-0.827	-0.408	2.168***	1.614***	1.082	0.686	-1.073*	-0.347
			(-0.824)	(-0.401)	(4.415)	(4.463)	(1.496)	(1.134)	(-1.857)	(-0.765)
TRI	-0.0108**	-0.0154***		0.0791		-0.0682*		-0.0672**		0.162***
	(-2.310)	(-2.980)		(1.381)		(-1.903)		(-2.146)		(4.442)
EF	-0.107***	-0.0807***		0.254		-0.437***		-0.614***		0.356***
	(-3.995)	(-2.798)		(1.239)		(-4.741)		(-2.977)		(4.148)
Ind. year		-0.000515***	0.00240***	0.00241***	-0.00199***	-0.00164***	-0.000233	0.000103	0.000808**	0.00112**
		(-4.163)	(4.105)	(4.317)	(-7.254)	(-4.077)	(-0.212)	(0.0939)	(2.053)	(1.998)
Colony SPA		-0.0428*	0.189	0.198	-0.358***	-0.356***	0.00264	-0.0204	-0.0108	0.0326
		(-1.713)	(1.199)	(1.210)	(-3.606)	(-4.393)	(0.0140)	(-0.0985)	(-0.0715)	(0.240)
Colony GBR		-0.00425	-0.173**	-0.169**	0.131*	0.0792	-0.0288	-0.122	-0.149	-0.142
		(-0.171)	(-2.028)	(-2.268)	(1.759)	(1.075)	(-0.0846)	(-0.368)	(-0.686)	(-0.618)
Colony FRA		-0.0239	-0.380*	-0.366**	-0.302	-0.316	-0.00554	0.0189	-0.142	-0.0910
		(-1.284)	(-1.958)	(-1.969)	(-1.187)	(-1.373)	(-0.0403)	(0.0876)	(-0.536)	(-0.386)
Legal: GBR		-0.0171	-0.164	-0.186	-0.0205	0.0814	0.336	0.512**	0.274	0.252
		(-0.548)	(-0.746)	(-0.985)	(-0.205)	(1.159)	(1.156)	(2.105)	(1.287)	(1.369)
Legal: FRA		-0.0214	-0.0528	-0.0906	-0.0711	0.0185	0.142	0.209	0.271**	0.225**
		(-1.026)	(-0.549)	(-0.772)	(-0.759)	(0.190)	(1.356)	(1.411)	(2.257)	(2.294)
Log. Area		0.00323	0.0412*	0.0418*	-0.0531***	-0.0450**	-0.0530	-0.0394	0.0440**	0.0578**
		(1.053)	(1.658)	(1.879)	(-2.730)	(-1.964)	(-1.529)	(-1.088)	(2.008)	(2.565)
Initial govt. size							0.0265***	0.0236***		
							(3.217)	(5.231)		
Constant	0.128***	1.107***								
	(6.378)	(4.514)								
Observations	187	186	153	153	156	156	113	113	149	149
R-squared	0.091	0.241								

z-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Note. Columns (1) to (2) estimate urbanization using OLS. Columns (3) to (10) present average marginal effects using clustered standard errors.

Regressions in columns (3) to (10) include a dummy variable to control for the assumption that countries with no settlements greater than 40,000 in 1900 had 0 urbanization rate.

Table 7

Ruggedness and Spatial Correlation; Dependent Variable: State Capacity

	Latent inflation			Latent rule of law			Latent tax/GDP			Latent presence of civil war		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Variables	Baseline	Baseline controlling for colonial origins	Baseline controlling for legal origins	Baseline	Baseline controlling for colonial origins	Baseline controlling for legal origins	Baseline	Baseline controlling for colonial origins	Baseline controlling for legal origins	Baseline	Baseline controlling for colonial origins	Baseline controlling for legal origins
TRI	0.0855*	0.0833*	0.0975*	-0.104**	-0.0812**	-0.0901*	-0.0495*	-0.0450	-0.0488*	0.138***	0.133***	0.135***
	(1.805)	(1.865)	(1.852)	(-2.359)	(-2.114)	(-1.891)	(-1.773)	(-1.632)	(-1.670)	(3.095)	(2.903)	(3.038)
Neighbors' TRI	0.0372	0.00709	-0.0104	0.0813	0.0151	0.0820	0.0117	0.00374	0.0242	0.0407	0.0404	0.0595
	(0.509)	(0.101)	(-0.136)	(1.299)	(0.267)	(1.326)	(0.153)	(0.0495)	(0.319)	(0.533)	(0.506)	(0.809)
EF	0.214	0.198	0.378**	-0.625***	-0.489***	-0.680***	-0.441***	-0.488***	-0.586***	0.563***	0.578***	0.511***
	(1.399)	(1.281)	(2.382)	(-5.736)	(-3.807)	(-5.846)	(-3.286)	(-3.388)	(-4.410)	(4.120)	(4.039)	(3.637)
Islands	-0.420***	-0.439***	-0.368**	0.381***	0.272***	0.286**	0.290**	0.225	0.218	-0.161	-0.148	-0.155
	(-2.708)	(-2.780)	(-2.280)	(3.783)	(2.603)	(2.526)	(2.237)	(1.566)	(1.608)	(-0.944)	(-0.867)	(-0.916)
Initial gov. size							0.0267***	0.0232***	0.0252***			
							(4.573)	(3.495)	(3.865)			
Ind. Year		0.00204***			-0.00177***			-0.000203			-0.00005	
		(3.888)			(-4.380)			(-0.241)			(-0.1000)	
Colony SPA		0.184			-0.377***			-0.00268			0.0534	
		(1.619)			(-3.998)			(-0.0208)			(0.466)	
Colony GBR		-0.237***			0.107			0.155			-0.0233	
		(-3.207)			(1.547)			(1.417)			(-0.282)	
Colony FRA		-0.321***			-0.388***			0.0387			-0.00772	
		(-2.979)			(-2.624)			(0.301)			(-0.0642)	
Legal: GBR			-0.319***			0.195**			0.345***			0.115
			(-3.559)			(2.170)			(3.110)			(1.185)
Legal: FRA			-0.273***			0.0364			0.221**			0.129
			(-3.233)			(0.457)			(2.089)			(1.385)
Observations	180	180	179	185	185	184	127	127	127	161	161	161

z-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Notes: Columns (1) to (3) use Y*=1 if inflation >10%, 0 otherwise.

Islands are controlled for in all specifications as entries for those countries in the contiguity matrix W are 0.

Table 8
Robustness Checks

Panel A – Results controlling for initial land inequality.

Average Marginal Effects

VARIABLES	(1) Inflation	(2) Inflation with controls(ǂ)	(3) Rule of law	(4) Rule of law with controls (ǂ)	(5) Tax/GDP	(6) Tax/GDP with controls (ǂ)	(7) Civil war	(8) Civil war with controls (ǂ)
Initial Land Gini(?)		0.00334		-0.00209		0.00337**		-0.00171
		(1.265)		(-0.661)		(2.417)		(-0.800)
TRI	0.0869	0.0902*	-0.0805	-0.0867	-0.0669	-0.0609	0.189***	0.185***
	(1.612)	(1.923)	(-1.225)	(-1.356)	(-0.790)	(-0.907)	(2.867)	(2.683)
EF	0.318*	0.336*	-0.800***	-0.864***	-0.683***	-0.697***	0.367**	0.341**
	(1.954)	(1.872)	(-6.075)	(-3.899)	(-2.751)	(-3.027)	(2.505)	(2.507)
Initial Gov. size					0.0305***	0.0286***		
					(3.073)	(3.689)		
Area	0.0675***	0.0657***	-0.0301**	-0.0267	-0.0434	-0.0385	0.0421*	0.0432*
	(3.810)	(3.986)	(-2.131)	(-1.354)	(-1.260)	(-1.512)	(1.682)	(1.930)
Observations	81	81	82	82	72	72	76	76

Panel B – Results controlling for Artificial States

Average Marginal Effects

VARIABLES	(1) Inflation (ǂ)	(2) Rule of Law (ǂ)	(3) Tax/GDP (ǂ)	(4) Civil War (ǂ)
Artificial State	-0.00245**	-0.000953	0.00269	3.08e-05
	(-2.145)	(-0.930)	(1.230)	(0.0271)
TRI	0.0636	-0.0749	-0.0597*	0.198***
	(0.836)	(-0.977)	(-1.839)	(4.136)
EF	0.429***	-0.806***	-0.820***	0.470***
	(3.164)	(-9.322)	(-10.77)	(4.394)
Initial Gov. size			0.0238***	
			(3.194)	
Observations	128	129	91	123

Panel C – Regime Type

OLS

VARIABLES	(1) Constraints on Executive at Independence	(2) Constraints on Executive at Independence (ǂ)
TRI	-0.241	0.172
	(-0.597)	(0.342)
TRI sq	0.0296	-0.0602
	(0.339)	(-0.581)
EF	-0.0804	-0.349
	(-0.168)	(-0.923)
Constant	3.883***	-11.95
	(7.566)	(-1.522)
Observations	157	157
R-squared	0.004	0.319

Robust t-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1

(ǂ) Controls used in the regressions are legal origins, colonial origins and independence year.

(?) Initial land gini is the gini coefficient of land tenure closest to independence year.

Figure 1a. Non Parametric Regression

Inflation

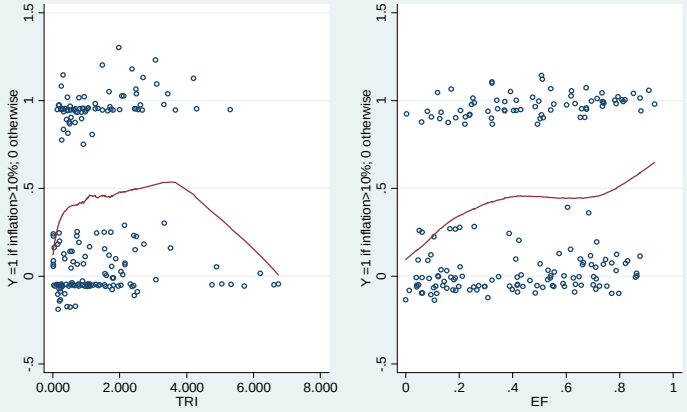


Figure 1b. Non Parametric Regression

Rule of Law

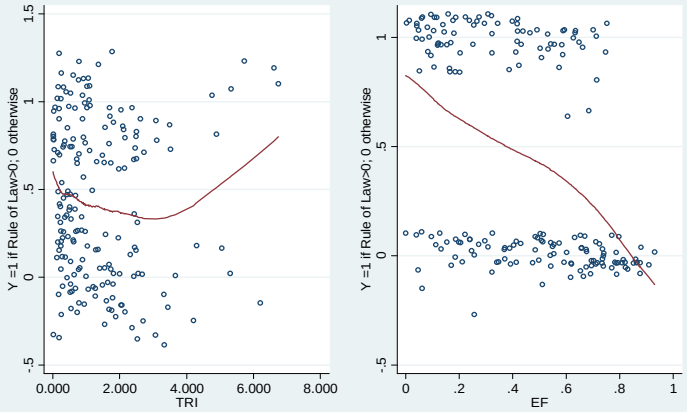


Figure 1c. Non Parametric Regression

Tax Revenue

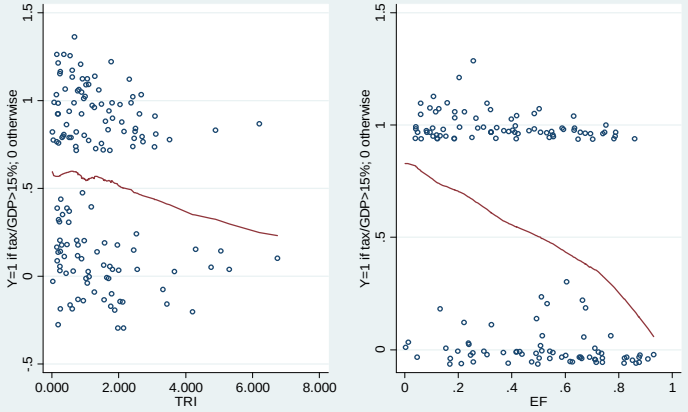
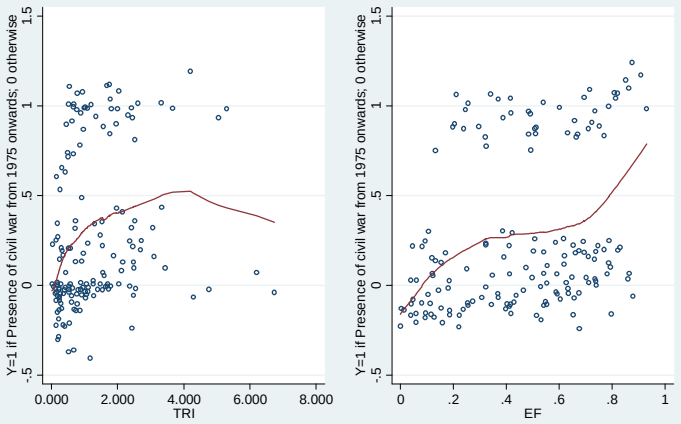


Figure 1d. Non Parametric Regression

Presence of civil war



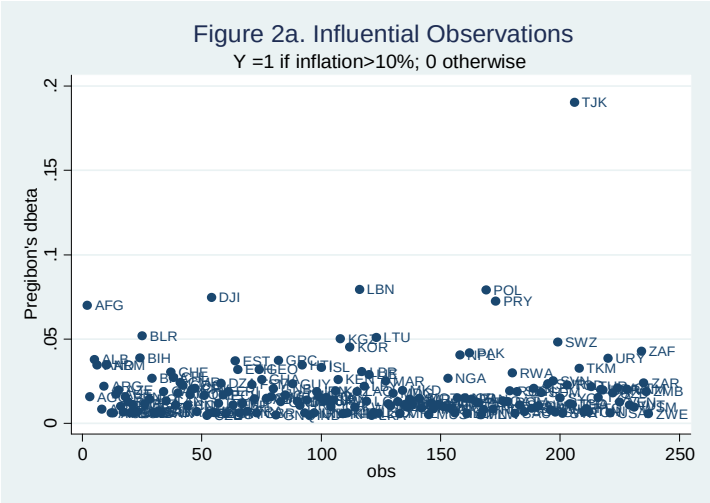


Figure 2a. Influential Observations
Y =1 if inflation>10%; 0 otherwise
Pregibon's dbeta
obs
TJK
DJI
LBN
POL
PRY
AFG
BLR
KGZ
LTU
KOR
SWZ
ZAF
URY
TKM
RWA
NGA
ZWE

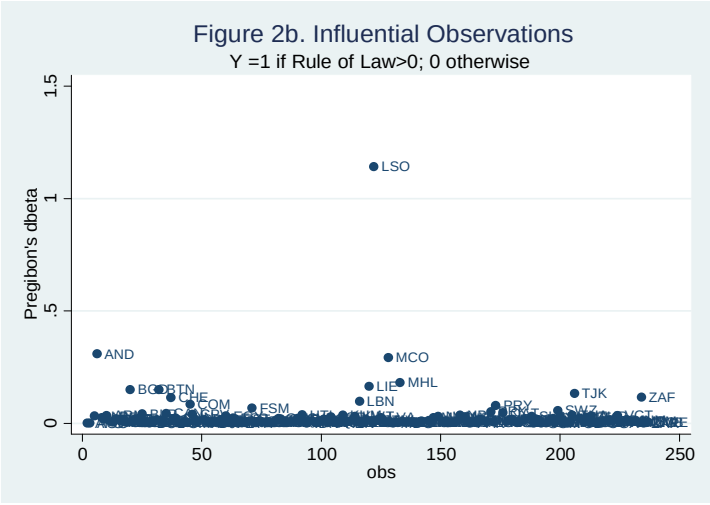


Figure 2b. Influential Observations
Y =1 if Rule of Law>0; 0 otherwise
Pregibon's dbeta
obs
LSO
AND
MCO
MHL
LIE
LBN
TJK
ZAF
FSM

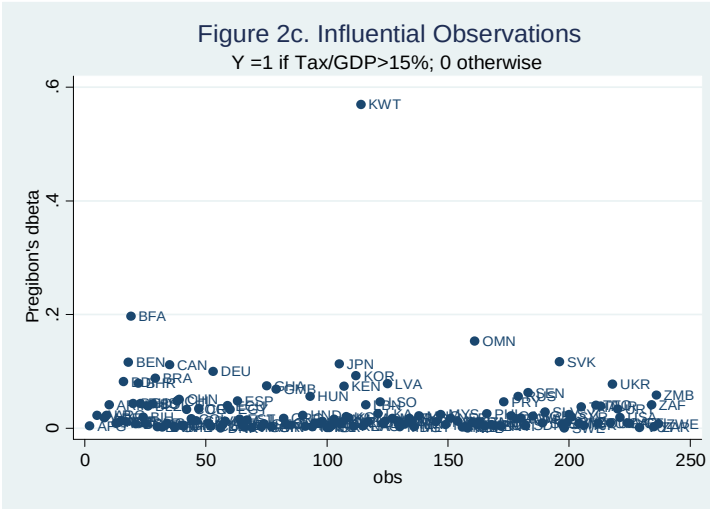


Figure 2c. Influential Observations
Y =1 if Tax/GDP>15%; 0 otherwise
Pregibon's dbeta
obs
KWT
BFA
OMN
SVK
UKR
ZMB
ZAF
JPN
DEU
KOR
LVA
HUN

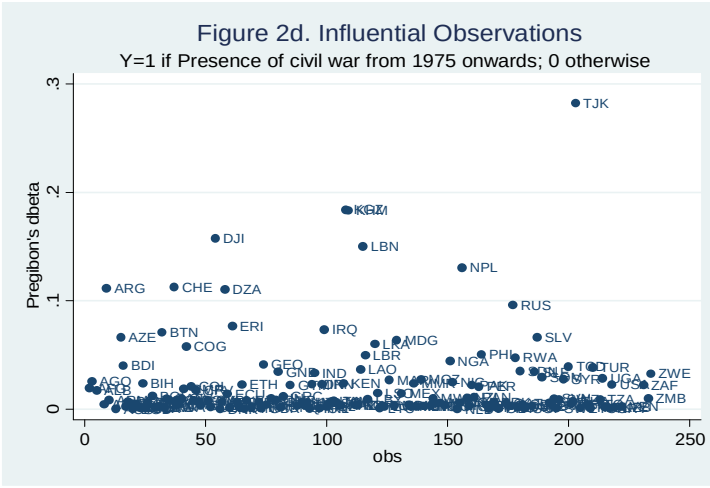


Figure 2d. Influential Observations
Y=1 if Presence of civil war from 1975 onwards; 0 otherwise
Pregibon's dbeta
obs
TJK
DJI
LBN
NPL
ARG
CHE
DZA
RUS
ERI
IRQ
AZE
BTN
COG
SLV
LBR
BDI
NGA
PHL
RWA
ZWE
ZAF
ZMB

Appendix A2: Not Intended for Publication

Table A1 provides data sources and descriptions and Table A2 presents the summary statistics for latent variables.

A2.1. The Relationship between Terrain Ruggedness and Ethnic Fractionalization

In our study, we have controlled our latent models using ethnic fractionalization as a main control, following the literature. However, Michalopoulos (2012) establishes that variations in soil quality and elevation can explain ethnic diversity today, except for its component that was determined after 1500 AD. We investigate the implications of this intuitive finding on our results in a few ways. First, we test whether EF is explained by TRI in our sample. Table A3 shows that the answer is in the affirmative when TRI enters the equation non-linearly with our usual controls. Accordingly, we remove TRI appropriately from our main equations, and find that the AMEs of EF are reduced by an average of 6% across all four dependent variables (compared to AMEs reported in columns (15) in Tables 2-5). This drop, however, does not seem to be huge. Second, checking the simple correlation between TRI and EF, we find it to be -0.14 and statistically insignificant. Third, in unreported regressions, we interact TRI and EF in our main equations and find these terms to be insignificantly estimated. Thus, it appears that the component of ethnic fragmentation that was shaped post-1500 AD is an important predictor for today's state capacity, such that our choice of pursuing ethnic fractionalization rather than soil quality as a more immediate platform for collective action does not seem to ignore considerable information.

A2.2. Other possible channels

The reduced form model may also not capture all processes leading a society to cooperate. For instance, trust and social capital have largely been seen as key ingredients for cooperation in role model states. Accordingly, correlations between trust-related cross-country measures and TRI (unreported) have been checked for, but no significant relationships were observed, nor any change

in TRI coefficients when the former were included in equation (1).[1] Instead of ruling out this mechanism completely, it is our conjecture that trust may affect a state's foundations through their associations with other interactive factors, such as history, wars, and climate. For instance, in a recent study, Nunn and Wantchekon (2011) show that the transatlantic and Indian Ocean slave trade that Africa was subjected to more than 400 years ago strongly explains the mistrust within African society today. One would probably need to model some interactions to capture such linkages.

A2.3. Estimation method

One concern with a latent variable model is that relevant information may be left out when constructing the latent indicators. To see whether a continuous treatment of the state capacity would make a difference, a least squares estimation was adopted. Results, shown in Table A4 below, indicate that TRI is statistically significant in explaining rule of law and persistence of civil war, but not for inflation and taxation.[2] It is conceivable that an extra unit of terrain ruggedness may not be able to explain an extra unit of inflation or an extra percentage of tax proceeds; rather, it could explain the *probability* of high inflation or better tax collection performance, as moderated by the collective action channel. We also use the State Fragility Index 2009 of Marshall and Cole (2011) as the dependent variable, despite the reservations about such indices. Results indicate that TRI strongly predicts this continuous variable in the anticipated direction.

[1] These trust indicators are commonly-used social cohesion, solidarity and dialogue measures from the World Values Survey and the Institutional Profiles Database.
[2] The result regarding years of civil war presence is robust to tobit estimation.

Table A1 *Data Sources and Descriptions*

Variable	**Source**	**Description**	**Link**
Inflation	World Development Indicators database	GDP deflator (annual %)	http://databank.worldbank.org
Rule of law	Worldwide Governance Indicators database		http://info.worldbank.org/governance/wgi/index.asp
Tax revenue /GDP	World Development Indicators database	Tax revenue (% of GDP)	http://databank.worldbank.org
Constraints on the executive	Polity IV Project; Marshall et al. (2010)		http://www.systemicpeace.org/inscr/p4v2010.xls
Terrain ruggedness index	Nunn and Puga (2012)		http://diegopuga.org/data/rugged/
Ethnic fractionalization	Alesina et al. (2003)		http://www.anderson.ucla.edu/faculty_pages/romain.wacziarg/downloads/fractionalization.xls
Government size	World Development Indicators database	Expense (% of GDP)	http://databank.worldbank.org
Colonial origins and independence years	Acemoglu et al. (2008) and Olsson (2009)		http://economics.mit.edu/faculty/acemoglu/data/ajry2008
Legal origins	La Porta et al. (2008)		http://www.economics.harvard.edu/faculty/shleifer/files/JEL_%20web.xls
Latitude, area	Nunn and Puga (2012)		http://diegopuga.org/data/rugged/
C&B	Beck et al. (2001)	Checks	http://siteresources.worldbank.org/INTRES/Resources/469232—1107449512766/DPI2010_stata9.zip
Security legitimacy index	Marshall and Cole (2011)	Secleg	http://www.systemicpeace.org/inscr/SFIv2010a.xls
Contiguity matrix			http://www.cepii.fr/anglaisgraph/bdd/distances.htm

Table A2 *Descriptive Statistics for Latent Variables*

	(1)	(2)	(3)	(4)
Variables	Inflation	Rule of law	Tax revenue/GDP	Years in civil war
Mean	44.19	-0.07	16.47	0.26
Standard deviation	107.61	0.97	7.5	0.79
Percentiles %				
10	3.72	-1.27	8.14	0
25	5.22	-0.85	11.4	0
50	8.49	-0.24	15.23	0
75	18.57	0.61	21.03	0
90	124.11	1.38	25.35	1.01
Obs.	186	191	148	160

Table A3

The relationship between ethnic fractionalization and terrain ruggedness

	OLS Dependent variable: Ethnic Fractionalization			AVERAGE MARGINAL EFFECTS Dependent variables: Latent Variables			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
VARIABLES	EF (ǂ)	EF	EF (ǂ)	Inflation (ǂ)	Rule of Law (ǂ)	Tax/GDP (ǂ)	Civil war (ǂ)
EF				0.415**	-0.654***	-0.665***	0.410***
				(2.027)	(-5.752)	(-7.341)	(3.554)
TRI	0.00657	-0.148***	-0.114***				
	(0.426)	(-4.189)	(-3.207)				
TRI sq		0.0265***	0.0240***				
		(4.118)	(3.278)				
Initial Gov. Size						0.0251***	
						(6.960)	
Log. Area	0.0303***	0.0260***	0.0345***				
	(3.646)	(4.059)	(4.601)				
Constant	-2.075***	0.311***	-2.092***				
	(-3.318)	(4.651)	(-3.663)				
Observations	186	187	186	180	183	127	160
R-squared	0.224	0.141	0.284				

z-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

(ǂ) Controls used in the regressions are legal origins, colonial origins and independence year.

Table A4

Robustness Checks: Estimation Method; Continuous Dependent Variables

Panel A – Results using continuous variables. OLS										
VARIABLES	(1) Inflation	(2) Inflation with controls(ǂ)	(3) Rule of law	(4) Rule of law with controls (ǂ)	(5) Tax/GDP	(6) Tax/GDP with controls (ǂ)	(7) Years in civil war	(8) Years in civil war with controls (ǂ)	(9) State Fragility Index (SFI)	(10) SFI with controls (ǂ)
TRI	5.185	-8.234	-0.336***	-0.328**	0.165*	0.277	0.146***	0.130**	0.468***	0.621***
	(0.569)	(-1.250)	(-2.631)	(-3.625)	(0.27)	(0.406)	(3.742)	(3.556)	(4.700)	(6.433)
TRI sq.	-1.626*	0.756	0.0614**	0.0528**			-0.0242***	-0.0212**		
	(-2.046)	(1.653)	(2.404)	(3.113)			(-3.809)	(-3.928)		
EF	53.68***	72.14***	-1.881***	-1.511***	-11.46***	-14.39***	0.279***	0.273**	14.55***	10.59***
	(4.122)	(4.217)	(-7.418)	(-5.668)	(-4.91)	(-7.643)	(3.432)	(3.907)	(4.325)	(6.673)
Initial Gov. size					0.384***	0.349**				
					(3.54)	(3.721)				
Constant	19.54	-693.5*	0.992***	11.80***	15.26***	-11.60	-0.105**	0.0597	1.515	-41.04**
	(1.893)	(-2.369)	(5.195)	(7.379)	(5.95)	(-0.512)	(-2.005)	(0.213)	(0.644)	(-3.137)
Observations	181	180	184	183	127	127	160	160	157	157
R-squared	0.018	0.201	0.228	0.408	0.286	0.347	0.095	0.116	0.323	0.435

Robust t-statistics in parentheses. *** p<0.01, ** p<0.05, * p<0.1

(ǂ) Controls used in the regressions are legal origins, colonial origins and independence year.

(ʔ) Initial land gini is the gini coefficient of land tenure closest to independence year.