**Transaction Costs and Economic Growth under Common Legal System: State-Level Evidence from Mexico**

Mitja Kovac and Rok Spruk

Faculty of Economics University of Ljubljana

e-mails: [Mitja.kovac@ef.uni-lj.si](mailto:Mitja.kovac@ef.uni-lj.si) ; [rok.spruk@ef.uni-lj.si](mailto:rok.spruk@ef.uni-lj.si)

**Abstract**

*This paper examines the contribution of administrative and procedural transaction costs to economic growth under common legal system. We show that administrative and procedural costs vary quite a lot even within the institutional environment sharing the common legal system. States with low-cost business registration, low-cost access to property rights and greater judicial efficiency tend to have consistently higher growth. The established effects are robust to alternative model specifications, heterogeneity bias, and to a variety of control variables that might confound the effects of transaction costs on growth. Such differences in transaction costs are far from being trivial as we show that these within-system differences might be instrumental in influencing economic growth. Lower transaction costs induce growth by increasing investment rate, lowering unemployment rate, encouraging labor supply and improving TFP. In the counterfactual scenario, the transition from high-cost to low-cost regime is associated with substantial growth and development gains over time. By exploiting the variation in historical presence of US troops in 1848, disease environment, ethnic fractionalization and historical urbanization, we show that the negative effect of rising transaction costs on growth and development appears to be causal.*

***JEL classification***: C23, C26, C51, K42, O43

***Keywords*:** economic growth, transaction costs, legal institutions

**1. Introduction**

The notion that legal institutional framework matters for long-run growth and development can be hardly overstated (North 1989, Knack and Keefer 1995, Acemoglu et. al. 2005, Rodríguez-Pose 2013). The conventional wisdom says that broad-based inclusive property rights and low-cost contracting institutions encourage growth. Societies without a robust rule law, secure property rights and low transaction costs can seldom flourish in the long run. How much the legal institutions really matter for growth and development, and which layers are the most important ones for economic growth has been largely unanswered. Most of the studies examine the impact of legal institutions on growth and development at the country level. Such studies are prone to the statistical identification issues and hardly shade any light on the relationship between legal institutions and economic development (Leamer 1983, Angrist and Pischke 2010, Klick 2010, Helland and Klick 2011, Klerman et. al. 2011, Helland 2016)

The fundamental issue stems from omitted variable bias inherent in cross-country studies. Aggregate correlations between various measures of legal institutions and economic growth can thus hardly provide any evidence on the impact of legal institutions on growth and development (Sobel and Coyne 2011). Such comparisons compare different legal systems and histories and merely indicate that factors other than legal institutions are related to economic development (Olson 2010). On the other hand, sub-national variation in legal institutions holds out more hope to identify the effects on growth and development by holding an array of other factors constant, and partially overcome the identification bias inherent in cross-country setup (Armour et. al. 2009).

In this paper, we exploit within-country variation in state-level legal institutions in a panel of Mexican states. We construct several indicators of administrative and procedural transaction costs, which allow us to capture time-varying differences in the legal institutions across Mexican states, and examine their impact on growth and development. In spite of the common political framework and shared national history and culture, large per capita income differences exist across Mexican states. In the North, the state of Nuevo León is characterized by a dynamic industrialized economy with a relatively affluent population and income level comparable with Portugal and Slovenia. In the South, the state of Oaxaca has a relatively underproductive and agricultural economy, and a per capita income level similar to that of Uzbekistan. Both states share the same set of political institutions, culture and common history since the promulgation of Mexican Federation in 1824. The most obvious question to ask is why Nuevo Leon prospers and why Oaxaca fell behind in spite of few idiosyncrasies between them.

A large and growing strand of literature recognized the importance of institutions for divergent paths of development while not everyone agrees that institutions are the root cause of sub-national income differences. Several scholars emphasize the fundamental importance of geography (Diamond 1997, Gallup et. al. 1999, Sachs and Malaney 2002, Sachs 2003, Nordhaus 2006, Dell et. al. 2009, 2012), and human capital (Genniaoli et. al. 2012, 2014) in the determination of sub-national income levels. A different stream of literature argues that the quality of institutional framework is the key to growth and development (Torstensson 1994, Mauro 1995, Levine 1998, Clague et. al. 1999, Hall and Jones 1999, Aron 2000, Rodrik 2000, Haber et. al. 2003, Rodrik et. al. 2004, Acemoglu and Johnson 2005, Beck and Levine 2005, Easterly et. al. 2006). This particular stream of literature does not deny the importance of geography but suggests that both geography and factor endowments (Sokoloff and Engerman 2000) matter for long-run development but only insofar as they affect the institutional framework (Acemoglu et. al. 2001, 2002, Easterly and Levine 2003). Acemoglu et. al. (2014) present within-country evidence on the dominance of institutions over human capital in explaining sub-national growth and development. Exploiting the municipality-level variation in the proximity to paved roads across 11 countries in the Americas, Acemoglu and Dell (2010) show that a large fraction of within-country differences cannot be explained by observed human capital. Michalopoulous and Papaioannou (2013a, 2013b) suggest ethnic institutions are the root cause of regional development, Bruhn and Gallego (2012) show that the type of colonial economic activities matters for within-country long-run development whereas Mitton (2016) shows that stronger subnational institutions are generally not associated with higher incomes.

We capture the differences in legal institutions across Mexican states by quantifying the sub-national administrative and procedural transaction costs. Such costs are one of the few more or less reliable proxies capturing the observable differences in legal institutions across and within Mexican states (Bruhn 2011), and allow us to overcome time invariance of institutional indicators traditionally used in sub-national or cross-country growth regressions (Glaeser et. al. 2004). Our definition of transaction costs emphasizes the costs of economic exchange generated by legal institutions (Coase 1937). We specifically distinguish between the administrative and procedural transaction costs. The former involve the costs of dealing with the administrative authorities such as business incorporation and dealing with various licenses. The latter capture the procedural costs of securing (and enforcing) property rights and contract enforcement. Matthews (1986), Allen (1999) and Williamson (1985, 1998) emphasize the vital importance of transaction costs for long-term relationships which implies that they matter for long-term economic outcomes (Kovac and Spruk 2016), and that the effect of procedural transaction costs on long-run outcomes should prevail due to their role in addressing moral hazard, short-run opportunism and other sources of asymmetric information. Nevertheless, the effect of transaction costs on different sources of growth remains subject to the empirical debate. Our study provides additional support for Coase (1998), North (1990) and Williamson (1996) arguments that in the world of positive transaction costs, the legal system might be the crucial source of institutional variation in efficiency and growth. However, several caveats should be stated. The availability of data represents an inherent limitation on the scope of our results. Since it is impossible to acquire data on the entire spectrum of transaction costs, we focus solely on administrative and procedural costs and their components. This article also employs data that is readily available although far from ideal and its validity has in recent years also triggered an extensive scholarly discussion (Djankov et. al. 2002; Arruñada and Garoupa 2005; Djankov et. al. 2006, Arruñada 2007, Klick, 2010; Spamann 2010).

Our results highlight a persistent negative effect of rising administrative and procedural transaction costs on per capita income both across and within Mexican states. The effects of rising administrative costs on growth appear to be weak although the duration of business registration is of substantial importance for subnational growth differences. Rising procedural costs tend to have a suppressive effect on economic growth. In particular, our findings suggest that more complex and lengthier property registration procedures and low-quality judicial process consistently depress the path of economic growth. The most likely source of transmission mechanism for rising costs of business registration is the capital intensity and factor productivity while rising procedural costs translate into sub-national growth differences through the labor supply, infant mortality, and policy reform channels. The established effects are not susceptible to the reverse causation in which the richer states could afford better institutional environment and lower transaction costs. Employing a variety of instrumental variables capturing the historical disease environment, historical presence of US troops in 1848, historical ethnic fractionalization and historical urbanization, we isolate the effects of administrative and procedural transaction costs from the potential growth confounders and show that the effect of those costs on growth and development of Mexican states is likely to be causal. We build a series of counterfactual scenarios and show that income gains from lower administrative and procedural transaction costs are large while the losses from higher costs are moderate. Moreover, we also show that the 1550 drought only affect growth through administrative costs and the 1650 drought only affect growth through procedural costs. Namely, introduced property rights and contract enforcement following 1570 drought that facilitated the formation of “haciendas” economically speaking lowered the administrative costs of acquiring land from indigenous population and from small-holders and enabled extraction of higher benefits from controlling local labor markets. Hence, the 1570 drought only affected growth through administrative costs related to formation and enforcement of property rights and related contractual provisions. The 1650 drought has caused second major population scarcity that has further reduced the costs of acquiring land from smallholders (Sellars and Alix-Garcia 2018). Many members of the new landowner class elite than used their power to take advantage of the changing economic circumstances and developed institutions – procedures in related rules – to control labor, restrict internal migration, and force the population onto large estates, preventing survivors from leveraging their bargaining power in the labor market (Gibson 1964; Florescano 1987; Knight 2002). These institutions and related procedural costs (needed for enforcement of this rules) and preexisting political structure were then instrumental in determine the political and economic effects of sudden population scarcity in 1650.

The rest of the paper is organized as follows. Section II reviews the Mexican legal institutions in comparative perspective and relates them to transaction costs, Section III offers theoretical framework linking transactions costs resulting from administrative procedures on the different sources of economic growth, Section IV presents the identification strategy. Section V discusses the data and construction of key variables. Section VI presents the results, robustness checks and the counterfactual scenario. Section VII concludes.

**II.Mexican Legal Institutions and Transaction Costs**

Mexican legal system and legal institutions are a complex historical, anthropological, political, sociological and intellectual strand that defies a simplified analysis. Since an exhaustive study of Mexican legal institutions is far beyond the scope of this work, and may be found elsewhere (Clagett et. al. 1973, Herget and Camil 1978, Clagett 1979, Floris Margadant 1983), our focus is merely on Mexican contract, property, administrative, and procedural law.

The Spanish conquest of the Aztec and other territories in the New World resulted in the emergence of a highly developed colonial bureaucracy intended to satisfy the demands for resources by the Spanish Crown, which left Mexico subservient to the mother country. The imposition of the Spanish law was bolstered by the rapid military conquest as well as by religious authority of the Catholic Church. At the outset, Spanish colonial law consisted of the transplantation of Castillian law to the newly conquered territories although the Spanish Crown added numerous laws and regulations designed specifically for the colonies. At the beginning of the 16th century, the Crown began to create institutions to govern and administer the colonial territories. These institutions were characterized as haphazard, highly detailed, adapted to local conditions, unsystematic, contradictory and even confusing. Colonial legal regime in Mexico was highly stratified, and was not a uniform system of laws applied equally to everyone. For instance, Spanish colonial law created more than twenty special courts and judicial procedures for particular social groups, which resulted in a heavily preferential treatment depending on the status in the society. At the top of the pyramid was a European minority (born in Spain and elsewhere) followed by a large mestizo population, and a sizeable population of indigenous ancestry at the bottom of the socioeconomic pyramid. In property law, the colonial administration maintained the existence of communal properties. Expropriation rights were granted at large to religious orders set to found settlements and convert Indian population to Catholic faith. By lacking full legal capacity, the Indians were not free to buy and sell lands in spite of holding land titles. The Mexican independence from Spain in 1812 was carried out as a coup d’etat to isolate Mexico from the liberalizing current in the mother country, which set a new stage in the development of legal institutions. The legacy of the Spanish colonial rule for Mexican law and legal institutions is both profound and long-lasting. It includes a strong centralized control of government, particularly in economic matters, and a lack of solid foundation for the separation of powers between the executive, legislative and judicial branches. Most importantly, the major imprint of Spanish colonial rule on Mexican law is institutionally weak judicial branch of government, and the subsequent limitation on the ability of judges to create legal precedent.

In spite of the independence from Spain, underdeveloped legal institutions persisted down to the present day. In the early years of independence, Mexico faced numerous constraints on the ability to build a modern economic structure on top a feudal agricultural base that left the majority of Mexicans disenfranchised and impoverished. The Constitution of 1824 was influenced by the US Constitution and the 1812 Constitution of Cadíz with the bicameral legislature and a de jure system of checks and balances between executive, legislative and judicial branch of government. The institutional modernization efforts were curtailed by rampant political instability leading to the failure to build growth-supporting legal institutions. The drafters of 1824 Constitution reacted against the centralism of Spanish colonialism by a severe limitation on the power of the central government. The net result was the domination of local political powerholders, and the lack of taxing power and reduced ability to provide public goods by the central government. In addition, individual states further hampered trade and commerce with burdensome regulations and special tariffs. The French intervention in 1864 failed to put into effect the set of modernizing legal institutions. Some modernization of legal institutions evolved under the Díaz dictatorship but the regime collapsed under the weight of widespread social and economic inequalities. In spite of the bold institutional reforms after the 1917 Revolution and the subsequent rise of the one-party state under PRI domination, low-cost enforcement of contracts and property rights, and administrative entry barriers failed to reach the frontier level of the US or European civil-law countries.

Mexico’s legal system stems from the European Civil Law tradition. This tradition manifests itself in all four Mexican codes, which were, like most Latin American codes, borrowed greatly from the European codes of the late 19th century. Other important historical contributors to the Mexican legal system were Roman law, canon law, and medieval commercial law (Mirow 2004, Avalos 2013). In post-independence period, the adherence to Spanish precepts of private law was gradually abandoned. Instead, Mexican legal institutions followed the ideas espoused by the French civil and commercial codes (Zamora et. al. 2004). For example, the Mexican Federal Civil Code, promulgated in 1884, relied exclusively on the French Code Napoleon. The civil tradition is partly responsible for the persistence of high transaction costs. It eschews judge-made law, deemphasizes the role of judges, and instructs them to refrain from policy decisions while applying the codified legal norms adopted by the lawmaker. Mexico’s de jure formal hierarchy of law is not very much different from that of the United States (Farnsworth 1996). However, Mexican judiciary is substantially less independent, underdeveloped, less prestigious and de facto much less powerful than their US counterpart (Fiss 1993).

Mexican civil and administrative legal procedure is characterized by the absence of juries and judges seeking truth. It lacks concentrated public trails since trails are sporadic over a period of months, or even years. It has a complicated system of six main stages of civil procedure (and several sub-stages), and lacks contingency fees (Ovalle Favela 1996, Arellano Garcia 1998, Merryman and Pérez Perdomo 1985, López-Ayllón et. al. 2015). Table 1 outlines the Mexican legal institutions and places them in a comparative framework together with the United States and two civil-law countries (France and Spain). The comparison of law and legal institutions between Mexico and benchmark countries highlights the external validity of our analysis, and shows the extent to which our study can be generalized and applicable to other countries with a comparable degree of subnational variation in transaction costs in a common legal system.

**Table 1**: Mexican Law and Legal Institutions in Comparative Framework

|  |  |  |  |
| --- | --- | --- | --- |
| *Feature* | **Mexican Law** | **Spanish and French Law** | **US Law** |
| **Main Source of Law** | Statues and codes | Statues and codes | Case law |
| **Legal Process** | inquisitorial | Inquisitorial | adversarial |
| **Development of Law** | scholars play a more important role than judges | scholars play a more important role than judges | Judges play a more important role than legal scholars |
| **Judicial Decisions** | Not binding on 3rd parties; however, administrative and constitutional court decisions on laws and regulations binding on all. | Not binding on 3rd parties; however, administrative and constitutional court decisions on laws and regulations binding on all. | binding |
| **Court System** | Separated administrative, labor, criminal and civil courts | Separated administrative, labor, criminal and civil courts | no separate court systems for administrative, labor, criminal, civil or constitutional matters |
| **Published and Argued Judicial Opinion** | General, undetailed and ill-reasoned | Terse, general employment or archaic language | Detailed and well-reasoned |
| **Legal Foundation and Justification** | Codes and doctrinal jurisprudence | Codes and doctrinal jurisprudence | Case law |
| **Writings of Legal Scholars** | Significant influence | Significant influence | modest influence |
| **Public Property Register** | Yes, but manual record keeping | Yes, electronic record keeping | Electronic land registers governed by individual federal states |
| **Dogmatic Distinction Between Property and Possession** | yes | Yes | no |
| **Mortgage Market** | undeveloped | Developed | sophisticated |
| **Juries** | no | No | yes |
| **Contingency Fees** | no | No | yes |
| **Civil Litigation** | Written only | Oral and written | Oral and written |
| **Civil Procedure** | Complicated 6-stage procedure with several sub stages | Unified procedure | Unified procedure |
| **Public Trial** | Sporadic over a period of months or years | Sporadic over a period of months | concentrated |
| **Evidence** | Sporadic evaluation and gathering | Sporadic evaluation and gathering | Ex ante gathering and evaluation (before the trial) |
| **Appellate Courts Review Competence** | Review of errors in law, of factual determinations and capacity to alter factual determinations | Review of errors in law | Review of errors in law |
| **Types of Appeal** | 3 different types | Unified | unified |
| **Organizing Evidence** | Clerks and judges | Clerks and judges | attorneys |

The major question arising from the comparative framework of Mexican legal institutions against reference countries is to how do legal institutions at the national level affect the incentive structure created by the variation in transaction costs at the local level. Not all transaction costs are created equal. Higher administrative transaction costs may set up formal entry barriers such as incorporation fees or time constraints and number of procedures to comply with, which may affect firm entry and exit rates in a given sector. Costly incorporation fees, complex procedures and lengthy duration of incorporation procedures may discourage the firm entry, which may also discourage capital formation and investment-based strategies, especially when the economies are below the world technology frontier (Aghion et. al. 2006). If the costs of obtaining licenses and construction permits are prohibitively expensive, or if the quality of building regulation is poor, firm entry in capital-intensive and knowledge-intensive sectors may be discouraged while investment rates of existing firms may decrease in response to more burdensome administrative costs.

The incentive structure created by the procedural transaction costs dealing with contract enforcement and property rights is more complex. The legal institutions and laws at the national level tend to shape access to property rights. High transaction costs can easily preclude or even deny access to property rights. When the access to property rights is difficult or costly, the net effect are strong incentives for informality (De Soto 2003, Galiani and Weinschelbaum 2011), especially for small firms unable to overcome initial transaction cost constraints. By contrast, low-cost and broad-based access to property rights tends to encourage the labor market participation, savings and investment rates in response to the legal structure of property and availability of the collateral. Low-cost property rights that facilitate a broad-based access also encourage investment through lower risk of expropriation. In response, incentives to invest in tangible and intangible sectors with high rates of return tend to strengthen. The availability of centralized land register where transactions can be easily tracked and recorded tends to incentivize parties to use land as a collateral in long-term investments by partially solving the principal agent problem inherent in such transactions, since claims and land titles can be clearly defined.

The institutional framework for contract enforcement may produce numerous positive or negative incentives, which bear directly on economic performance. Costly and lengthy enforcement of contracts may produce judicial delays, and pervasive uncertainty about economic transactions. The net effect of costly enforcement of contracts is widespread litigation, which directly reduces investment rate by increasing the transaction costs, which firms have to bear in the litigation process to secure their claims. The combined effect of judicial delays and costly litigation are most likely weak incentives to participate in productive economic activities with high rate of return. Prolonged judicial delays can therefore drastically lower the incentives to undertake long-term investments where low uncertainty is one of the necessary upfront conditions. Judicial delays and costly litigation may also invoke hold-up problems in negotiations with external parties, which may lead to the emergence of less complex economic activities requiring low skills (Hidalgo and Hausmann 2009). In response, TFP drops, the acquisition of human capital skills becomes more costly, and long-term investment decisions become more difficult, which has strong implications for long-run economic growth. The incentives generated by the local variation in transaction are too important to neglect, which should be reflected in subnational long-run growth differences.

**III. Theoretical Mechanism at Work**

In this section we explore in detail the theoretical framework linking transactions costs resulting from administrative procedures on the different sources of economic growth. Particularly, we, while refining the theory, assess the intriguing questions of why does the 1570 drought only affect growth through administrative costs and the 1665 drought only affect growth through procedural costs?

Economists have generally constructed their growth models on the gains from trade and highlighted the role of specialization, division of labor, capital accumulation, human capital, entrepreneurship and technology as key factors in long-run development patterns. However, in constructing such models, they have ignored the costs of transacting and their potential impact on economic growth (North, 2005). Yet, as Coase (1960), North, (1990), Acemoglu et. al. (2005) and many other scholars have stressed out such levels of physical, human capital and technology of societies should be regarded as endogenously determined by differences in institutional incentive streams. The importance and origin of such institutions might be embodied by their transaction costs generating capacity.

The welfare of a human society depends on the flow of goods and services, which in turn depends on the productivity of the economic system (Coase, 1998). The productivity depends on specialization which is only possible if there is an exchange of goods and services. Such a voluntary transaction is beneficial to both parties, but transaction costs tend to reduce the value of an exchange and both contracting parties will want to minimize them. The amount of that exchanges which spur allocative efficiency depends, as Coase (1988) and North (1990) argues, also upon the costs of exchange[[1]](#footnote-1) – the lower they are the more specialization there will be and the greater the productivity of the system. Coase (1961) made clear that only in the absence of transaction costs did the neoclassical paradigm yield the implied allocative results and in the world of positive transaction costs, resource allocations are altered by property and contract rights structures.

Analytically, transaction costs slow the movement of scarce resources to their most valuable uses and should be minimized in order to spur allocative efficiency. Without the concept of transaction costs it might be impossible to understand the working of the economic system, to analyze many of its problems and to identify the key factors, and mechanisms of economic growth. In a world of zero transaction costs parties would always produce economically efficient results without the need of legal intervention. In such a world, transaction cost would indeed be completely irrelevant for any investigation on the mechanisms of economic growth. Since in the real world transaction costs are imposed daily, intervention becomes necessary and the legal rules by reducing transaction costs imposed upon an exchange can either improve or worsen allocative efficiency and thus maximize social welfare. In the world of positive transaction costs the law (i.e. the costs of the legal system) should play a crucial role in determining how resources are used (Coase, 1988) and consequently should have also a significant impact upon long-term economic growth. Moreover, information processing by the market actors as a result of such costliness of transacting underlies the formation of institutions (North, 1990).

From the normative perspective, efficiency- and welfare-minded policy maker should economize on transaction costs generated by different legal institutions to spur economic growth. North (2005) also argues that “the costliness of information is the key to the costs of transacting, which consist of the costs of measuring the valuable attributes of what is being exchanged and the costs of protecting rights and policing and enforcing agreements.” He also adds that precisely those transaction costs (i.e. costs of measurement and enforcement) are the sources of social, political, and economic institutions.

Far more interesting from our perspective are, however, administrative transaction costs created by different administrative procedures. Administrative procedure is a set or system of rules that govern the procedures of public bodies for managing organizing bureaucratic actions inside bureaucracies and in their interactions with private parties (Kovac, 2017). These procedures are generally meant to establish efficiency, consistency, responsibility, and accountability (Kovac, 2017). Although perplexing problems and issues of administrative procedures and related costs have triggered some attention of law and economics scholars (e.g. Weigel, 2003; Ogus, 2004; Rose-Ackerman, 1995; Schuck, 1994; Johnson and Libcap, 1994; Rose-Ackerman and Lindseth, 2010; Lewish and Parker 2017) and despite its great expansion to nonmarket fields the proper interpretation of administrative procedures has received relatively little law and economics analysis in recent years.

Classical law and economics literature conceives legal procedure as an institution designed to minimize the sum of "error costs" (the social costs generated when a judicial system fails to carry out the allocative or other social functions assigned to it), and "direct costs" (such as lawyers', judges', and litigants' time) of operating legal dispute-resolution machinery (Posner 1973). According to this classical law and economics framework the rules and other features of any procedural system can be analyzed as efforts to maximize efficiency (Posner 1973). In line with this observation Posner (1973) actually already, as part of his case studies, addresses the deterrence issues of administrative sanctions, argues against any judicial-review of agency fact-finding and suggests that the characteristic combination of prosecution and adjudication in the same agency may be a source of inefficiency.

Rose-Ackerman (1988) suggest that if administrative procedures lower the transaction cost of access to information about administrative decisions, then interested parties will be more likely to be able to find out about an upcoming decision. The more time an interested party has to mobilize financial and political resources against a particular decision, the more likely it will be able to force the administrative decision-maker, through his or her more politically accountable superiors, to influence that decision. The impact on substantive policy comes from the greater benefit to less organized interest groups of lowering this cost of access to information (Rose-Ackerman, 1988). Another stream of law and economics research focuses on the importance and on the impact of administrative procedural law on trade policy. Rosenbaum (1998) for example argues that administrative procedures that lower the cost of obtaining information about and notice of agency decision-making, and that therefore increase the amount of time between an interest group's learning of a potential decision and the final administrative decision, shift the balance of power between more and less organized groups.

The first theoretical mechanism linking transaction costs resulting from administrative procedures on the different sources of economic growth that calls for elaborated treatment is the drought severity in 1570. This climatic shock generated a pandemic burst of cocolitzi bacteria which than reduced indigenous population by between 70 and 90 percent. This epidemic is believed to have been caused by a rodent-transmitted pathogen that emerged after several years of drought (Acuna Soto, Calderon Romero and Maguire, 2000). This population collapse caused the complete disappearance of initial institution of “enconmienda” (extractive institution) instead of which Spanish crown adopted a series of legal institutions (property rights and corresponding contract law) aimed at controlling land and labor in the context of severe population scarcity (Gibson 1964; Hassig 1985; Knight 2002). Generated labor scarcity led to development of perverse political and economic institutions (Borah 1951; Gibson 1964; Knight 2002), which than resulted in specific landholding patterns (Sellars and Alix-Garcia, 2018).

Namely, demographic collapse placed a heavy burden on the colonial elites, no longer being able to life off the surplus produced by indigenous villages and laborers who were unable to economically support themselves and these extractive elites. In the areas depopulated by “cocolitzi” settlers were, via set of newly introduced property rights and corresponding contract law enforcement (needed for establishment, transfer and enforcement of such property rights) able to amass, while incurring administrative costs, large quantities of land from indigenous villages. Large estates known as “haciendas” have been formed and majority of the rural population consequently lived on those large estates (Sellars and Alix-Garcia 2018). Hacienda is associated with the following institutions: a) control of labor; b) restriction of internal migration; c) force population to stay on large estates; and d) preventing survivors from leveraging the bargaining power in the local labor market. In other words, this coercive institutional restructuring enabled tribute extraction, harnessing land and labor for agriculture production and commercialization. In this respect, we highlight two legal institutions that enabled effectively this institutional restructuring – property rights and related contract enforcement. Namely, formation of property rights and related contract enforcement were mechanisms that actually legally safeguarded persistence of power balance between elites and non-elites (indigenous population). Introduced property rights and contract enforcement that facilitated the formation of “haciendas” economically speaking lowered the administrative costs of acquiring land from indigenous population and from small-holders and enabled extraction of higher benefits from controlling local labor markets. Hence, the 1570 drought only affected growth through administrative costs related to formation and enforcement of property rights and related contractual provisions.

The mechanism linking transaction costs resulting from procedural costs on the different sources of economic growth is the drought severity in 1650. This second extreme drought severity in 1650 caused the nadir of the indigenous population and enabled further land concentration by elites (Sellars and Alix-Garcia, 2018). It has caused second major population scarcity that has further reduced the costs of acquiring land from smallholders and has increased the benefits of controlling local labor markets once initial land concentration (generated by the 1570 drought severity) has been established (Sellars and Alix-Garcia 2018). Many members of the new landowner class elite used their power to take advantage of the changing economic circumstances (Lockhart 1969; Knight 2002). They developed institutions – procedures in related rules – to control labor, restrict internal migration, and force the population onto large estates, preventing survivors from leveraging their bargaining power in the labor market (Gibson 1964; Florescano 1987; Knight 2002). These institutions and related procedural costs (needed for enforcement of this rules) and preexisting political structure were then instrumental in determine the political and economic effects of sudden population scarcity in 1650. Hence, these procedural costs and political institutions were then a major mechanism affecting growth in 1665.

Moreover, Spanish crown now have to control, administer vast territory controlled by the owners of haciendas (Garcia Martinez 2011). Spanish crown has seen this emerging power as a threat to the Crown and has by 1700 installed numerous provisions (i.e. procedural costs) eroding the power of the land owners and established corregimientos (public offices by royal officials collecting taxes for the Crown). Spain acted as an agent of centralization and via administrative procedures also dissolved private fiefs of early encommendero, strengthened the political control of the territory and improved state capacity (Knight 2002, Gibson 1964, Zavala 1973).

However, this transition was not universal. Some areas had a rapid transition to direct rule, especially the areas with a strong control of landholding (i.e. areas of Central Mexico, Mexico City which served as a center of royal control). Other areas retained indirect rule (e.g. in Yucatan encomienda survives into the 18th century due to high population density and surviving structure of the Mayan Empire) which was due to the complicated effort to establish political dominance, combined with poor factor endowments and long distance from trade routes (Sellars and Alix-Garcia 2018). Encomienda in Yucatan has actually served as a low-cost method of colonial administration (Garcia Bernal 1979, Gerhard 1993, Knight 2002). Similar pattern could be identified in Nueva Galicia (Knight 2002).

Another mechanism worth exploring is the proportion of the mestizo population in 1921. This powerful social group aimed for top ranks of colonial and post-colonial administration (always subordinated to peninsulares). Their persistent rent extraction combined with weak state capacity to provide public goods might be another source of administrative transaction cost today.

Furthermore, ethnic fractionalization in 1921 illustrates cost of control over economic resources (e.g. indigenous labor) and may be regarded as a source of administrative transaction costs. However, this mechanism was present only until Mexican revolution when “ejido” was introduced (Yates 1981; Larreguy 2013; Albertus et al. 2015).

**IV. Identification Strategy**

Our aim is to examine the contribution of transaction costs to subnational economic growth consistently. Our goal is to simultaneously address the unobserved state-level heterogeneity and common technology shocks that might confound the effect of transaction costs on growth, and control for the standard set of previously identified growth determinants to net out the conditional effect of transaction costs on subnational growth. Following Barro (1991), Barro and Sala-i-Martin (1992), Mankiw et. al. (1992), De La Fuente and Vives (1995), Chen and Fleisher (1996), Sala-i-Martin (1996), Garofalo and Yamarik (2002), and Brock and German-Soto (2013), we assume a standard Cobb-Douglass production function with constant returns to scales, and with physical and human capital accumulation. To this end, for a panel of 32 Mexican states in the period 2006-2015, we estimate the basic within-state growth model with region-fixed effects and time-fixed effects of the following form:

 (1)

where y is the level of per capita output in state *i* at time *t*, *A* is the level of technology common to all states, **  and denote the level of administrative and procedural transaction costs, **X** is the vector of state-level growth covariates,  captures the full set of state-fixed effects unobserved by the econometrician,  is the set of technology shocks common to all states, and *u* denotes the random error term in state *i* at time *t*.

The key coefficients of interest are  and , which denote the response of per capita output to the change in administrative and procedural transaction costs. In spite of controlling for the full set of state-fixed effects and time-fixed effects, valid inference on  and  can be undermined if the random error term is correlated across and within states, which renders the estimated transaction cost parameters inconsistent. The failure to control for non-zero within-state random error correlation is likely to yield underestimated standard errors and the over-rejection of the null hypothesis by invoking the Moulton bias (Moulton 1986, 1990) regardless of whether the set of fixed effects is switched on (Davis 2002, Pepper 2002, Bertrand et. al. 2004, Kezdi 2004). We address the multiple random error term correlation using a non-nested multiway clustering scheme from Cameron et. al. (2011) at state-, regional, and year level. In doing so, we deploy a multiway error component model under i.i.d random error distribution assumption. Compared to the standard robust OLS variance-covariance matrix estimator (Huber 1967, White 1980), the nested multiway clustering scheme facilitates a valid inference on key parameters even in the presence of non-zero within-cluster random error correlation (Pfefferman and Nathan 1981, Liang and Zeger 1986, Arellano 1987, Wooldridge 2003, Hansen 2007).

The key threat to the consistency of the effect of transaction costs on economic growth arises from the potential endogeneity of transaction costs. Does slower growth cause the deterioration of institutional quality and thereby higher transaction costs? Conversely, if richer states can afford better institutions, higher rates of growth could induce lower transaction costs, and render the fixed-effects cost coefficients in Eq. (1) invalid. Hence, in the absence of instrumental variables producing a plausibly exogenous source of growth variation, the estimated effect of transaction costs on growth is plagued by the reverse causation. In the presence of endogeneity, the underlying effects of costs on growth are co-influenced by the omitted factors, which pose the reverse causality between costs and growth,

, and , which leads to biased fixed-effects coefficients since  and

 imply that  and .

Our approach to address the endogeneity of administrative and procedural transaction costs is to exploit the cross-state variation in the occupation by US troops in Mexican-American war in 1848, historical urbanization levels, historical disease environment and historical ethnic fractionalization as plausibly exogenous sources of variation in long-run growth. This allows us to isolate and identify the effect of administrative and procedural transaction costs independently of other confounding variables. Suppose *Z* denotes the instrumental variable (IV) to address the endogeneity of transaction costs. For the full set of IVs, we impose zero covariance restriction on their relationship with the structural random error term in Eq. (1), , which allows us to consistently estimate the effect of costs on growth using plausibly exogenous sources of growth variation. In addition, our set of IVs satisfy the relevance criteria to ensure a non-zero covariance with respect to administrative and procedural costs, , and . The bias of fixed-effects estimator, triggered by omitted variables, is proportional to:

 (2)

 (3)

which implies that IV estimator roughly approximates the true effect of administrative and procedural costs on growth,  and , as long as the IVs produce a plausibly exogenous source of state-level growth variation, i.e. . Our set of IVs consists of (i) the presence of US troops during the Mexican-American war in 1848 (as a measure of external institutional shock), (ii) drought severity during the Spanish colonial rule, (iii) urbanization rate prior to Mexican revolution (as a measure of historical development), and (iv) ethnic fractionalization variables for they years 1793 and 1921 (as a measure of historical ethnic divisions). To satisfy the exclusion restriction, we use different sets of IVs for administrative and procedural transaction costs. Hence, we estimate the following first-stage OLS relationship between administrative and procedural transaction costs and the cost-specific set of IVs:

 (4)

 (5)

where  is the index of drought severity in the year 1550,  is the ethnic fractionalization index for the year 1921, and  denotes the share of Mestizo population in the year 1921. This specific set of IVs is used to address the endogeneity of administrative transaction costs. In addition,  is the index of drought severity in the year 1645,  is a dummy variable that takes the value of 1 if US troops were present in the year 1848 in *i*-th state, and 0 otherwise,  is urbanization rate in the year 1910,  is the ethnic fractionalization index for the year 1793, and **** denotes the share of European-born population in the year 1793 for *i*-th state. By splitting the set of IVs into two specific sets for administrative and procedural transaction costs, we ensure that the exclusion restriction is not violated for each model specification.

Our key identifying assumption is that historical disease environment, historical ethnic fractionalization and urbanization rate, and the 1848 occupation by US troops do not influence long-run growth beyond their impact on modern-day transaction costs. To satisfy the relevance and exogeneity conditions on the full set of IVs, we construct the following covariance restrictions,, ,  , , , , and respectively.

Several caveats about the instrumental variables should be stated. An ideal set of instruments (IVs) for transaction costs would be the set of time-varying instrumental variables plausibly exogenous with respect to per capita income level to identify the effect of transaction costs to per capita income differences across states. Our instrumental variables do not fully meet these characteristics, which is a limitation per se with respect to our identification strategy. Yet, in spite of potentially strong identification properties in the presence of plausibly exogenous sources of variation, time-varying IVs could be correlated with contemporary economic outcomes, which may violate the exclusion restriction, and thus render the effects of transaction costs on per capita income inconsistent. The fundamental problem is the one of statistical identification (Helland 2016). Since transaction costs appear to be persistent and tend to change very slowly over time, there are significant reasons to believe that potentially time-varying instruments predicting the level of transaction costs reflect many other growth-confounding changes beyond the legal rules (Helland and Klick 2011). Many instrumental variables used to address the endogeneity of institutional variables do not provide time-varying year-to-year changes such as colonial settler mortality rates (Acemoglu et. al. 2001), population density in the year 1500 (Acemoglu et. al. 2002), ethnic fractionalization (Mauro 1995), factor and resource endowments (Easterly and Levine 2003), the presence of historical gold mines (Acemoglu et. al. 2012), the prevalence of toxoplasma gondii (Maseland 2013), the presence of colonial state (Acemoglu et. al. 2015), and pre-colonial genetic diversity (Faria et. al. 2016) among several others. Our instrumental variables follow a similar logic. They do not provide year-to-year source of variation in transaction costs, but are based on historical levels of urbanization, drought severity and ethnic fractionalization, which largely excludes the possibility of direct effect on current-day economic outcomes, and we believe it does not invalidate our exclusion restriction.

**V. Data**

*IV.A. The Dependent Variable*

Our dependent variable is state-level real GDP per capita at 1990 constant prices adjusted for purchasing power parity. The data on state-level real GDP per capita is at TL2 territorial level and if from OECD Regional Statistics. We also use the state GDP level, state GDP without PPP conversion, and state GDP per worker to revalidate our results with a different set of growth measures.

*IV.B. Measuring Transaction Costs*

The data on state-level transaction costs is from the series of sub-national Doing Business reports for Mexican states for the period 2006-2015 (World Bank 2006, 2007, 2009, 2012, 2014, 2016). The measures of administrative and procedural transaction costs are captured by the costs of business registration, cost of construction permits, cost of property registration and cost of contract enforcement. Business registration and permit costs are used to proxy administrative transaction costs while property registration and contract enforcement costs are used to proxy procedural transaction costs. We compute a standardized transaction cost variable for each underlying indicator using the Gaussian transformation:

 (6)

where  is a standardized indicator of transaction costs in state *i* at time *t*,  is the untransformed original indicator of transaction costs,  is the mean value of -th indicator across *i*-th state at time *t*, and  is its standard deviation.

*IV.B.1. Cost of Business Registration*

The costs of business registration comprise (i) the number of incorporation procedures to legally start and formally operate the company, including pre-registration, registration, and post-registration procedures, (ii) time required to complete each procedure denoted in calendar days, (iii) and costs required to complete all procedures recorded in terms of percentage of state-level per capita income.

*IV.B.2. Cost of Construction Permits*

The costs of dealing with construction permits comprise the number of procedures to legally build a warehouse, time required to complete each procedure, the cost required to complete the full set of procedures, and the latent index of state-level building quality. The number of procedures include the submission of all relevant documents and obtaining all necessary clearances, licenses, permits, and certifications, submission of all required notifications and receiving all necessary inspections, obtaining utility connections for water and sewerage, and the registration of the warehouse after completion. The time required to complete procedures does not include the time spent on gathering information, and each procedure is considered complete once the final document is received assuming no prior contact with the officials. The cost required to complete each procedure is denoted in terms of percentage of warehouse value.

Quality of building index consists of six sub-indices and reflects the quality control and safety mechanisms in the construction regulatory system. The six sub-indices include (i) quality of building regulations (accessibility and clarity of requirements, 2 points), quality control before construction (whether licensed or technical experts approve the plan, 1 point), quality control during construction (types of inspections, de facto implementation of legally mandated inspections, 3 points), quality control after construction (whether the final inspection is legally mandated after construction and whether the legally mandated inspections are de facto implemented, 3 points), liability and insurance regimes (whether parties are held liable for structural flaws, and whether parties are legally mandated to obtain insurance cover structural flaws, 2 points), and professional certifications index (whether qualification requirements for the approval of building plans exist, and whether the qualification requirements for inspections and construction supervision exist, 4 points). The building quality control is the sum of six sub-indices with the maximum of 15 points.

*IV.B.3. Cost of Property Registration*

The costs of property registration comprise (i) the number of procedures legally required to register a property, (ii) the total number of days required to register property indicated by as the median duration that property lawyers, notaries or registry officials indicate is necessary to complete the procedures, (iii) the cost of completing property registration procedures recorded in terms of percentage of property values, and (iv) the index of the quality of land administration. The procedures to legally transfer title on the immovable property includes pre-registration procedures (such as checking of liens, notarizing sales agreement, and paying property transfer taxes), registration procedures, and post-registration procedures such as filing with the municipality. The time required to complete each procedure does not include the time spent on gathering information. The cost of completing the procedures takes into account official costs only such as administrative fees, stamp duties, transfer taxes, and any other payment to the property registry, notaries, public agencies, and lawyers.

The quality of land administration index consists of five sub-indices: (i) reliability of property infrastructure (8 points), (ii) transparency of information (6 points), (iii) geographic coverage (8 points), (iv) land dispute resolution (8 points), (v) equal access to property rights. Reliability of property infrastructure captures the type of system for archiving information on land ownership, availability of e-database to check for encumbrances, types of system for archiving maps, availability of geographic information system, and the link between property ownership registry, and mapping system. The transparency of information index consists of the accessibility of information on land ownership, accessibility of maps of land plots, publication of fee schedules, lists of registration documents, service standards, availability of specific and separate complaint mechanisms, and the publication of statistics about the number of property transactions. Geographic coverage index reflects the coverage of land registry at the level of the largest business city in the state, and coverage of mapping agency at the level of the largest business city in the state. Land dispute resolution index reflects the quality of the legal framework for immovable property registration, and mechanisms to prevent and resolve land disputes. The quality of land administration index is a simple sum of the six sub-indices.

*IV.B.4. Cost of Contract Enforcement*

The assessment of the costs of contract enforcement is based on the standardized commercial case dispute through a local first-instance court. The data is collected through the study of codes of civil procedure other court regulations as well as questionnaires completed by local litigation lawyers and judges. The cost measures include (i) the number of procedures necessary to resolve the dispute, (ii) time required to enforce a contract through the court recorded in calendar days, and (iii) cost required to enforce a contract through the court as a fraction of the claim value. The costs comprise the attorney fee, court fee, and enforcement fee. We also include the quality of the judicial process index, which consists of the four major indices and 17 sub-indices measuring the degree of state-level judicial efficiency. In the Appendix A1, Table A1 summarizes the pointwise construction of the index of the quality of judicial process. Higher values indicate a better and more efficient judicial process. In Table 2, we present the key descriptive statistics of the untransformed transaction cost indicators for the full state-level sample. In Appendix A2, the aggregate state-level trends and patterns of administrative and procedural transaction costs are shown over time by taking year-level means of administrative and procedural cost indicators.

**Table 2**: Descriptive Statistics of Transaction Costs Across Mexican States, 2006-2015

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Obs | Mean | StD |  |  | Min | Max |
|  |  |  | Overall | Between | Within |  |  |
| *Panel A: Administrative Transaction Costs* | | | | | | | |
| # Business registration procedures | 320 | 7.61 | .980 | .440 | .878 | 5 | 10 |
| # Days to register business | 320 | 19.44 | 12.19 | 7.67 | 9.56 | 5.5 | 69 |
| Cost of business registration (% state-level per capita income) | 320 | 13.64 | 2.20 | 4.98 | 5.24 | 4.6 | 65.79 |
| # Procedures to deal with construction permits | 320 | 12.57 | 2.20 | 1.78 | 1.33 | 6 | 17 |
| # Days to deal with construction permits | 320 | 73.64 | 32.17 | 27.02 | 18.29 | 9.7 | 238 |
| Cost of dealing with construction permits (% warehouse value) | 320 | 68.13 | 58.14 | 42.77 | 39.97 | 1.5 | 353.1 |
| *Panel B: Procedural Transaction Costs* | | | | | | | |
| # Property registration procedures | 320 | 6.43 | 1.62 | 1.52 | 0.64 | 3 | 10 |
| # Days to complete property registration | 320 | 33.58 | 20.33 | 16.30 | 12.42 | 2 | 154 |
| Cost of property registration (% property value) | 320 | 3.53 | 1.03 | 0.94 | 0.44 | .84 | 6.98 |
| Quality of land administration | 320 | 13.57 | 3.63 | 3.68 | 0 | 5.5 | 21 |
| # Contract enforcement procedures | 320 | 37.63 | 0.39 | 0.40 | 0 | 37 | 38 |
| # Days to enforce a contract | 320 | 343.82 | 80.83 | 67.81 | 45.30 | 160 | 581 |
| Cost of contract enforcement (% claim) | 320 | 25.87 | 4.38 | 3.75 | 2.33 | 14 | 36.3 |
| Quality of the judicial process | 320 | 9.79 | 1.82 | 1.84 | 0 | 6 | 13 |

Our transaction costs variable are constructed from the survey of respondents for the period 2006-2015 reporting on the four dimensions of costs. Compared to the traditional surveys, the respondents include public and private professionals, and business people reporting their experience with the laws and business regulations as the sources of transaction costs. The survey respondents do not include business people only but many legal professionals and public sector officials as well. The private professionals in the survey comprise local lawyers, litigation experts, notaries, brokerage firms, architects and engineers. Public respondents comprises municipal officials, public registers and attorney generals reporting on their cases and experience with the administrative and procedural transaction costs. These responses do not capture the lived business experience by firms only but also reflect the experience of legal professionals such as local attorneys and litigation experts in the field, and the records of public officials in the business registration, dealing with licenses, property registration and contract enforcement. With the exception of Mexico City, the size of the sample is fairly even across states. Figure 1 plots the number of respondents for 2015 as a reference year, and breaks them down into private and public respondents by state. Concurrently, Figure 2 plots the relative shares of public vs. private respondents by state for the same reference year and shows that in about half of the states, private professionals outnumber the public professionals. The opposite holds for the other half of the states. In two cases (Sinaloa and Quintana Roo), either only private, or only public respondents reported the input scores used to build state-level indicators.

**Figure 1**: State-Level Survey Sample Size and Composition in 2015

|  |  |
| --- | --- |
|  |  |

*IV.C. Covariates and Transmission Mechanism Variables*

Table 3 reports the key descriptive statistics for the set of outcomes, covariates and transmission mechanisms. The set of covariates comprises population growth, population size, the size of the working-age population, capital city-level distance from the US border, life expectancy, population density and latitude. The proposed transmission mechanism variables in the relationship between transaction costs and economic growth comprise the investment share of GDP, state-level total factor productivity (TFP), unemployment rate, average years of education, infant mortality, index of economic reforms, and labor force participation rate. Since these variables are directly affected by the changes in institutional quality, changes in transaction costs are very likely to be transmitted into growth through these channels.

**Table 3**: Descriptive Statistics for Outcomes and Covariates

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Obs | Mean | StD |  |  | Min | Max | Source |
|  |  |  | Overall | Between | Within |  |  |  |
| Panel A: Outcomes | | | | | | | | |
| Real GDP Per Capita (1990 Geary-Khamis, PPP) | 320 | 17031 | 16759 | 16515 | 3977 | 5855 | 131034 | OECD Regional Statistics |
| Real GDP Per Capita (Constant Prices, peso) | 320 | 130594 | 128507 | 126635 | 30497 | 44892 | 1004740 | OECD Regional Statistics |
| State GDP (millions, current prices, peso) | 320 | 422946 | 441135 | 435163 | 102838 | 55533 | 2866250 | OECD Regional Statistics |
| State GDP (millions, constant prices, peso | 320 | 412729 | 421579 | 425375 | 43472 | 66777 | 2404040 | OECD Regional Statistics |
| Panel B: Covariates and Transmission Mechanism Variables | | | | | | | | |
| Average Years of Schooling | 320 | 7.76 | 0.94 | 0.91 | 0.28 | 5.19 | 10.18 | Genniaolli et. al. (2014) |
| Investment Share of GDP | 320 | 0.030 | 0.018 | .014 | 0.11 | 0.003 | 0.205 | INEGI |
| Unemployment Rate | 320 | 4.40 | 1.62 | 1.22 | 1.09 | 1.1 | 8.7 | OECD Regional Statistics |
| Log TFP | 320 | -.054 | .329 | .300 | .144 | -1.448 | 1.202 | Own calculation |
| Infant Mortality | 320 | 13.27 | 2.45 | 1.85 | 1.63 | 7.14 | 21.6 | INEGI |
| Government Size | 320 | 12.93 | 5.15 | 5.01 | 1.44 | 1.82 | 33.26 | INEGI |
| Index of Economic Reforms | 320 | 6.23 | 0.31 | 0.248 | 0.198 | 5.4 | 7.4 | Stansel et. al. (2017) |
| Labor Force Participation Rate | 320 | 63.90 | 3.50 | 3.21 | 1.49 | 55.9 | 75.2 | OECD Regional Statistics |
| Population Growth | 320 | 1.39 | 0.65 | 0.65 | 0.12 | -0.23 | 3.57 | INEGI |
| Log Population Size | 320 | 14.70 | 0.76 | 0.78 | 0.08 | 13.16 | 16.47 | INEGI |
| Log Working-Age Population | 320 | 13.91 | 0.740 | 0.74 | 0.06 | 12.397 | 15.777 | INEGI |
| Log Distance to US Border | 320 | 6.35 | 0.96 | 0.98 | 0 | 1.791 | 7.134 | Own calculation |
| Life Expectancy | 320 | 74.35 | 1.15 | 1.09 | 0.42 | 68.7 | 76.1 | INEGI |
| Log Population Density | 320 | 4.27 | 1.30 | 1.32 | 0.04 | 2.03 | 8.70 | INEGI |
| Latitude | 320 | 21.66 | 3.68 | 3.73 | 0 | 16.04 | 32.22 | Own elaboration |

*IV.D. Instrumental Variables*

The set of instrumental variables used to address the potential reverse causation between transaction costs and economic growth comprise (i) the presence of the US troops during the Mexican-American war in 1848, (ii) urbanization rate in 1910, (iii) proxies for historical disease environment, and (iv) historical ethnic fractionalization.

*IV.D.1. Presence of US Troops in 1848*

The Mexican-American War had a tremendous impact on the institutional development of Mexico. Besides thousands of military and civilian deaths, the war caused a severe disruption of internal and external trade with a substantial economic ruin (Sicotte and Vizcara 2009). The war also provided a long-lasting institutional shock to the Mexican political economy (Tenenbaum 1986). After gaining independence from Spain in 1821, Mexico adopted the federal constitution in 1824. The constitution retained some of the pre-independence privileges to the military and the church. The central government levied high tariffs on imports as it relied heavily on customs revenue. The 1824 constitution also retained significant elements of Spanish law, mainly commercial law based on the *Ordenanzas de Bilbao* from 1737 (Carmagnani and Marichal 2001). By mid-1830s, the constitutional order collapsed in the light of the attempt to expropriate church holdings of the land. The conservative regime that followed in late 1830s adopted strongly centralist measures to downgrade the autonomy of the states which precipitated numerous rebellions such as the 1835 Texas Rebellion. The Mexican-American War in 1846 came when Mexico was in the state of institutional chaos (Santoni 1996, Vazquez 1997). The disruption caused by the war encouraged a period of substantial institutional change which resulted in the liberal victory in 1855. The US intervention had a substantial influence on Mexican institutional development. It encouraged the abolition of military and clerical courts (*fueros*) over the civil matters. It had a strong impact on the new federal constitution based on liberal principles, and fostered liberal institutional building which resulted in a new civil code in 1871, a new commercial code in 1884 (Knowlton 1967, Ducey 1997, Negretto and Aguilar-Rivera 2000) . While the war caused a severe disruption to trade and commerce, it also encouraged liberal institutional changes, and thus had prolonged and long-lasting implications for the path of Mexican institutional development. We exploit state-level spatial variation in the presence of US troops during the Mexican-American war in the period 1846-1848 as a plausibly exogenous source of variation in long-run growth rates of Mexican states. Since the US presence in 1848 held long-lasting implications for Mexican institutional development, its impact should be reflected in the levels of transaction costs of Mexican states down to the present day as the previously established institutional framework has a tendency to persist for a long period of time (Acemoglu and Robinson 2006).

We classify the US military forces’ presence in the Mexican states depending on whether the US military defeated the Mexican army in each military campaign, and conquered the major cities in the state. To this end, we review a large strand of historical bibliography on the US occupation of Mexico, primarily relying on Carney (2006), and code the presence of US troops in 1848 across the full set of US military campaigns. In doing so, we match the state-level transaction costs with the presence of US troops in 1848. The value of the underlying US troops variables take 1 for the states Baja California, Baja California Sur, Chihuahua, Coahuila de Zaragoza, México, Mexico City, Nuevo Leon, Puebla, Sinaloa, Tamaulipas, Veracruz, and 0 for the states without the US presence in 1848.

*IV.D.2 Urbanization Rate in 1910*

It can be easily taken for granted that the set of institutions that supports low transaction costs requires the existence of constituent groups, which demand broad-based low-cost enforcement of contracts and property rights, that do not prolong the status quo under high transaction costs (Rajan 2009). Yet, the present-day existence of constituent groups supporting low transaction costs may be the result of either high or slow rates of growth. Our approach is to exploit the differences in historical urbanization rate prior to 1917 Mexican revolution to consistently estimate the contribution of procedural and administrative transaction costs to economic growth. There are numerous reasons to believe that historical urbanization rate is a sufficient measure for historical levels of income and affluence. Kuznets (1968) notes that sustained increases in per capita income are most often accompanied by the structural changes in the distribution of population between the countryside and the cities. De Vries (1976), Bairoch (1988) and De Long and Shleifer (1998) further argue that large urban centers have been the nodes of information, industry and exchange where the economic specialization and agricultural productivity had advanced far enough to support them, and that large urban centers could not existing without a good trade network and high-productivity agriculture. Hence, historical urbanization rates is both a sufficient and reasonably proxy both for historical development levels, and for the presence of constituent groups demanding low transaction costs to support sustained economic growth.

In Mexico, the civil war in the period 1910-1920 led to fundamental changes in the political and economic institutions (Cockcroft 1976, Knight 1990). The war broke out in the midst of the political crisis after 35-year Díaz dictatorship. His rule had been characterized by the repeated attempts to rapidly modernize the country through the promotion of industry and infrastructural development as well as foreign direct investment. The onset of the industrialization resulted in the rise of urban classes, which further attracted the foreign capital from the United States and Great Britain. The 1917 Constitution, which formally ended the armed conflict, brought numerous economic and social reforms, which held long-lasting implications for Mexican political economy and institutional development.

Following Acemoglu et. al. (2002), we exploit historical urbanization rate to consistently estimate the contribution of transaction costs to economic growth. To this end, we construct state-level urbanization rates for the year 1910 from *III Censo de Población y Vivienda*. Urbanization rate is constructed as the ratio of the state-level urban population relative to the total population using modern administrative boundaries. Since we use the urbanization rate in 1910 to isolate the impact of transaction costs on growth from other channels, it is unlikely that historical urbanization rate would violate our exclusion restriction.

*IV.D.4. Historical Disease Environment*

Upon the colonization of Mexico, the Spanish encountered large, urbanized and relatively advanced societies. The size of the indigenous population is estimated at around 20 million people (Gibson 1964, Hassing 1985, Maddison 2007). After the conquest of Mexico, by mid-16th century, the Spanish instituted *encomienda* to extract tribute from the indigenous population. The existing empirical evidence suggests that *encomienda* is one of the major contributing factors to Mexico’s long-term underdevelopment relative to the U.S. Simultaneously with encomienda, the myriad of disease, drought and famine led to the demographic collapse of the indigenous population. Some estimates arguably suggest 90 percent indigenous population loss from the collapse (Newson 1993). The demographic collapse facilitate an easy and low-cost acquisition of land by the Spanish colonial elites. Sellars and Alix-Garcia (2016) highlight the policies of colonial government aimed at fostering land acquisition such as acquisition incentives in population-scarce areas, forced indigenous resettlement in disease-impacted areas, and legal protections for those who acquired the land (Knight 2002), which expanded the de facto political and economic power of the colonial elites with long-lasting implications for the evolution of transaction costs as a form of contracting institutions. The disease environment laid the seeds of the demographic collapse is thus one of the more reliable plausibly exogenous source of variation in long-run development. The data on the historical disease environment is from Cook and Krusic (2004).

Following Garfias and Sellars (2017), we exploit the variation in the historical disease environment. Our focus is on the outbreak of the “cocolitzi” bacteria, a climate-related pathogen transmitted by rodents. The bacteria arises in the periods of disproportionate rainfall after the period of severe drought. Disease-related rodents transmit into water and food resources spreading the pathogen among the rodent population. When climatic conditions improve, the rodents dissipate into agricultural fields and homes, which causes the infection among the people by inhaling the rodents’ feces. Similar to Garfias and Sellars (2017), we use the drought severity index from Cook and Krusic (2004) for the years 1550 and 1645 as the two cutoffs of the “cocolitzi” epidemics as advocated by Acuña Soto et. al. (2002). The drought severity measures the soil moisture at the given location relative to the normal moisture. We construct the set of disease environment-related IVs from the tree rings of North American Drought Atlas. We extract the grid points from the tree rings and match them with the latitude/longitude coordinates. The matched grid points are overlapped with the modern administrative boundaries to convert tree ring-level drought severity measures into its modern state-level counterparts. We also use the long-term Palmer Drought Severity Index, and Palmer hydrological drought index to cross-validated our sources of variation in long-run growth. In addition, we also use the station-level Palmer drought severity index for the period 1920-2008 to re-assess our first-stage variation in transaction costs against alternative historical drought intensity measures.

We code the weather stations by extracting the latitude and longitude information and overlaying it on the modern state-level administrative division. Since single states have multiple weather states, we compute the mean value using the full set of weather stations for each state. The resulting measures yield the sizeable variation in the historical drought intensity and allow us to examine its impact on the state-level institutional development. Garfias and Sellars (2017) suggest that greater historical drought-rain gap in the early colonial period is associated with a markedly greater demographic collapse, which in turns led to a more rapid political transition from indirect to direct political rule. We further examine whether the historical drought severity associated with the outbreak of the “cocolitzi” bacteria has long-lasting implications for administrative and procedural transaction costs. Since this particular sub-set of IVs captures the historical variation in the disease envioronment, it is unlikely that the exogeneity-based exclusion restriction might fail in isolating the effects of transaction costs on long-run growth.

*IV.D.5. Historical Ethnic Fractionalization*

A growing number of studies suggest that differences in institutional quality and economic performance are rooted in the ethnic conflict and fractionalization (Easterly and Levine 1997, La Porta et. al. 1999, Collier 2000, Garcia-Montalvo and Reynal-Querol 2005). Societies with greater ethnic divisions may be less likely to foster mutual trust and cooperation with the members outside their respective group. High ethnic divisions are significantly more likely to discourage economic exchange, and simultaneously encourage rent-seeking, which should be reflected in the level of transaction costs. Canning and Fay (1993) show that ethnic heterogeneity is exogenous to the existing economic and polity structure, and is unrelated to economic outcomes beyond its impact on institutional efficiency. Many scholars believe that ethnic fractionalization is to blame for poor quality of institutions, political instability and badly designed economic policies, and poor economic performance (Mauro 1995, Alesina et. al. 2003, Alesina and Ferrara 2005, Putterman and Weil 2010, Campos et. al. 2011). Hence, ethnic fractionalization should be a valid instrument for present-day transaction costs while the lags of transaction cost variables might not be a valid instrument because lagged endogenous variables are highly autocorrelated.

Following Mauro (1995) and Alesina et. al. (2003), we use the variation in ethnic fractionalization across Mexican states to estimate the effect of transaction costs on economic growth, and to address the endogeneity of transaction costs. Our measures of ethnic fractionalization are constructed from the first official census for the Viceroyalty of New Spain in 1793 known as *1er Censo de Poblacion de la Nueva España, Censo de Revillagigedo* (Lerner 1968), and from 1921 census (Alba 1976, Anaya 1996). We extract district-year ethnic group shares for three major ethnic groups: (i) European population, (ii) indigenous population, and (iii) mestizo population from the 1793 census, and match them with the current state-level administrative division.[[2]](#footnote-2) Following Taylor and Hudson (1972), we construct an index of historical ethnic fractionalization for *i*-th state as:

 (7)

where  is the census cohort for both benchmark years,  denotes the size of *j*-th ethnic group, *J* denotes the number of ethnic groups, and  is the total population in the census. As Mauro (1995), we assume that the extent to which the states are fractionalized along ethnic lines is exogenous to the long-run growth variable and as it affects it only through its effect on transaction costs as a proxy for institutional efficiency. Apart from the ethnic fractionalization indices from Eq. (7), we also use the share of European population in 1793 and the share of Mestizo population in 1921 as separate IVs to further unravel the endogeneity of transaction costs through the fractionalization channel.

Figure 2 presents the spatial distribution of IVs across Mexican states. State-level pairwise comparisons reveal a strong and persistent correlation between transaction costs and of IVs. Figure 3 presents state-level correlations between the selected set of IVs and the indices of transaction costs. States with greater ethnic fractionalization in 1921 have substantially higher costs of business registration, while states with higher share of European population in 1793 tend to have significantly better quality of the judicial process with a high correlation coefficient (ρ = 0.45) at 1% significance level. Higher urbanization rate in the year 1910 is associated with markedly better present-day quality of land administration (ρ = 0.45), where the correlation appears to be statistically significant at 1%. In addition, states with the presence of US troops in 1848 during the Mexican-American war have lower procedural complexity in business registration (ρ = -0.21 at 1%), better quality of building regulation (ρ = 0.10 at 5%), and no better quality of the judicial process (ρ = 0.09 at 10%) than non-occupied states. States with a more pervasive disease environment in 1645 have higher costs of contract enforcement (ρ = 0.21 at 1%), and higher costs of property registration (ρ = 0.10 at 5%). States with higher urbanization rate in the year 1910 tend to have lower procedural complexity in the business registration process (ρ = -0.16 at 1%). The aggregate cross-state correlations of transaction costs and the IVs confirm the relevance or disease environment, presence of US troops in 1848, and urbanization rate in 1910 and historical ethnic fractionalization in accounting for the differences in transaction costs across states.

**Figure 2**: Presence of US Troops, Disease Environment and Historical Ethnic Fractionalization Across Mexican States

|  |  |  |
| --- | --- | --- |
| (a) Presence of US Troops in 1848 | (b) Drought Severity in 1550 | (c) Drought Severity in 1645 |
|  |  |  |
| (d) Palmer Z-Index (1920-2007) | (e) Urbanization Rate in 1910 | (f) Ethnic Fractionalization in 1793 |
|  |  |  |
| (g) European Population in 1793 (in %) | (h) Ethnic Fractionalization in 1921 | (i) Mestizo Population in 1921 (in %) |
|  |  |  |

**Figure 3**: The Aggregate Relationship Instrumental Variables and Transaction Costs Across Mexican States

|  |  |
| --- | --- |
|  |  |
|  |  |

**VI. Results**

*V.A. Weighted OLS and Fixed-Effects Estimates*

Table 4 presents the baseline OLS and fixed-effects estimated of the long-run sub-national growth model with transaction costs. The evidence largely suggests that transaction costs matter for long-run growth substantially. The parameter estimates clearly indicate a negative effect of rising transaction costs on growth and development in the presence of the unobserved state-fixed effects and technology shocks common to all states. The effects of transaction costs on per capita output across and within states remain robust the number of structural covariates that either confound the cost-growth relationship or influence long-run growth independently.

Columns (1) through (4) report the effect of business registration costs on state-level per capita GDP. The parameter estimates suggest that the effect of the registration cost relative to per capita income prevails over the effect of business registration days and number of registration procedures. Our pointwise fixed-effect estimate suggest that 1 standard deviation increase in the cost of business registration relative to per capita income drops state-level per capita output by 0.03 standard deviation. In columns (3) and (4), the coefficient estimate with multi-way clustered standard errors raises to -0.051 and -0.071, and is statistically significant at 5%, even when we exclude Mexico City as a potential outlying set of observations. Columns (5) through (8) exhibit the effects of the costs of construction permits on per capita output across states. We find no discernible effects of dealing with permits on growth either when the full set of unobserved effects is switched on, or even when we adjust the standard errors for spatial and temporal aggregate uncertainty using the multi-way clustering scheme. By contrast, columns (9) through (12) examine the effects of property registration costs. The estimates suggest arguably large effects of property registration costs on sub-national growth. In column (9), weighted OLS estimate suggests that 1 standard deviation increase in the number of property registration procedures is associated with 7.5 percent drop in the long-run growth holding other factors constant. Column (10) adds the full set of state-fixed effects and time-fixed effects to the model specification. This results in a notable drop of the coefficient to a more plausible estimate, i.e. from -.075 to -.024, suggesting 2.4% long-run growth drop in response to the equivalent 1 standard deviation increase in property registration complexity. Given the aggregate uncertainty about the estimate, columns (11) and (12) simultaneously adjust the standard errors for temporal and spatial correlation of the error term, and suggest the effect is arguably larger than the fixed-effects estimate in column (10), in the range between -.083 and -.092 and is statistically significant at 5% and 10%, respectively. Across the full set of long-run growth model specifications, the effect of property registration procedures prevails over the effect of property registration costs, and its duration. Columns (13) through (16) examine the effects of contract enforcement costs on per capita output across and within states. The evidence suggests that among the full set of cost measures, the quality of the judicial process prevails, and appears to be the most relevant contract enforcement variable explaining between-state and within-state growth patterns. Pointwise, the coefficient with state/year/region clustered S.E in column (15) suggests that 1 standard deviation improvement in the quality of the judicial process is associated with 18.9 percent drop in long-run per capita output at 5% significance holding the effect of other confounders constant. The negative effect of poor quality judicial process remains intact once the Mexico City is excluded as a potentially influential observation. A potential caveat arising from the estimated long-run growth responses in Table 3 is posted by the likely interaction effect between administrative and procedural transaction costs. We thoroughly examine multiple interaction effects between the full set of indicators and find no interaction effect, which advocates an independent effect of transaction costs on long-run growth.

Another caveat of the estimated effects of transaction costs on long-run growth using fixed-effects and multi-way clustered specifications in Table 4 arises from the choice of the dependent variable. Lower transaction costs inside the national market with common institutional framework likely affect the extensive growth by facilitating labor and capital into the more efficient regions until the returns to production factors are equalized. We address these caveats by replicating the estimated effects in Table 4 using state GDP, GDP per capita at constant prices without PPP adjustment, and output per worker as the alternative dependent variables. We use the long-run growth model specification with the full set of state-fixed effects and time-fixed effects to net out the heterogeneity bias, and state/year-clustered S.E. to contain the aggregate uncertainty about the parameter estimates within reasonable bounds. The evidence in Table 5 confirms the negative impact of rising transaction costs on the full set of alternative dependent variables. The effect is particularly powerful and pervasive for the costs of business registration and property registration.

**Table 4**: Effects of Transaction Costs on Economic Growth Across Mexican States, 2006-2015

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Administrative Transaction Costs | | | | | | | | Procedural Transaction Costs | | | | | | | |
|  | Business Registration | | | | Construction Permits | | | | Property Registration and Land Administration | | | | Contract Enforcement and Judicial Quality | | | |
|  | Full Sample | | | Excluding Mexico City | Full Sample | | | Excluding Mexico City | Full Sample | | | Excluding Mexico City | Full Sample | | | Excluding Mexico City |
|  | Weighted OLS | Fixed-Effects | Multi-Way Clustered S.E. | Multi-Way Clustered S.E. | Weighted OLS | Fixed-Effects | Multi-Way Clustered S.E. | Multi-Way Clustered S.E. | Weighted OLS | Fixed-Effects | Multi-Way Clustered S.E. | Multi-Way Clustered S.E. | Weighted OLS | Fixed-Effects | Multi-Way Clustered S.E. | Multi-Way Clustered S.E. |
|  | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) |
| # Business Registration procedures | .034  (.029) | -.004  (.014) | .022  (.033) | .006  (.033) |  |  |  |  |  |  |  |  |  |  |  |  |
| # Days to register | .034\*  (.020) | .013  (.015) | .019  (.017) | .013  (.024) |  |  |  |  |  |  |  |  |  |  |  |  |
| Cost of business registration | -.044  (.031) | -.031\*\*  (.012) | -.051\*\*  (.025) | -.071\*\*\*  (.024) |  |  |  |  |  |  |  |  |  |  |  |  |
| # Construction permit procedures |  |  |  |  | -.038  (.033) | -.015  (.012) | -.056\*  (.030) | -.027  (.027) |  |  |  |  |  |  |  |  |
| # Days to obtain construction permits |  |  |  |  | .054\*  (.029) | -.001  (.008) | .061\*\*  (.026) | .042  (.027) |  |  |  |  |  |  |  |  |
| Cost of obtaining permits  (% warehouse value) |  |  |  |  | .031  (.040) | .004  (.006) | .031  (.034) | -.011  (.027) |  |  |  |  |  |  |  |  |
| Quality of building regulation |  |  |  |  | -.027  (.029) | omitted | -.034  (.023) | -.023  (.026) |  |  |  |  |  |  |  |  |
| # Property registration procedures |  |  |  |  |  |  |  |  | -.075\*  (.048) | -.024\*  (.014) | -.083\*  (.051) | -.092\*\*  (.045) |  |  |  |  |
| # Days to register property |  |  |  |  |  |  |  |  | .088\*\*\*  (.032) | .002  (.010) | .075\*\*  (.030) | .021  (.031) |  |  |  |  |
| Cost of property registration (% property value) |  |  |  |  |  |  |  |  | -.0005  (.028) | -.011  (.013) | .004  (.023) | -.002  (.025) |  |  |  |  |
| Quality of land administration |  |  |  |  |  |  |  |  | -.049  (.046) | Omitted | -.045  (.051) | -.028  (.037) |  |  |  |  |
| # Contract enforcement procedures |  |  |  |  |  |  |  |  |  |  |  |  | .012\*  (.054) | .291  (.269) | .098\*\*  (.048) | .106\*\*\*  (.041) |
| # Days to enforce the contract |  |  |  |  |  |  |  |  |  |  |  |  | .049  (.050) | .013  (.020) | .060\*\*\*  (.020) | .025  (.019) |
| Cost of contract enforcement (% claim) |  |  |  |  |  |  |  |  |  |  |  |  | .016  (.037) | .014  (.012) | -.009  (.033) | -.017  (.023) |
| Quality of the judicial process |  |  |  |  |  |  |  |  |  |  |  |  | .173\*\*  (.089) | omitted | .189\*\*  (.082) | .167\*\*\*  (.065) |
| Observations | 319 | 319 | 319 | 309 | 319 | 319 | 319 | 309 | 319 | 319 | 319 | 309 | 319 | 319 | 319 | 309 |
| Structural Covariates | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| # State Clusters | 32 | 32 | 32 | 31 | 32 | 32 | 32 | 31 | 32 | 32 | 32 | 31 | 32 | 32 | 32 | 31 |
| #Year Clusters |  |  | 10 | 10 |  |  | 10 | 10 |  |  | 10 |  |  |  | 10 | 10 |
| # Regional Clusters |  |  | 8 | 8 |  |  |  |  |  |  | 8 | 10 |  |  | 8 | 8 |
| # Latitude Clusters |  |  | 31 | 30 |  |  | 31 | 30 |  |  | 31 | 30 |  |  | 31 | 30 |
| R2 | 0.77 | 0.02 | 0.77 | 0.78 | 0.77 | 0.04 | 0.77 | 0.79 | 0.80 | 0.03 | 0.79 | 0.81 | 0.78 | 0.02 | 0.79 | 0.80 |
| Within R2 |  | 0.35 |  |  |  | 0.32 |  |  |  | 0.33 |  |  |  | 0.32 |  |  |
| Between R2 |  | 0.02 |  |  |  | 0.04 |  |  |  | 0.03 |  |  |  | 0.02 |  |  |
| Wald Full Covariate F-Test  p-value) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.00 | 0.000 | 0.000 | 0.000 |
| Joint Significance of Transaction Costs  (p-value) | 0.036 | 0.050 | 0.028 | 0.014 | 0.188 | 0.658 | 0.027 | 0.429 | 0.065 | 0.182 | 0.061 | 0.125 | 0.204 | 0.607 | 0.000 | 0.089 |
| Notes: the table presents the estimated effects of transaction costs on per capita output of 32 Mexican states for the period 2006-2015. The dependent variable is the log of PPP-adjusted GDP per capita (2005 constant prices). Standard errors are adjusted for within-state serially correlated disturbances and heteroskedastic distribution of random error variance into state-level, region-level, year-level, and latitude-level clusters to tackle multiple sources of uncertainty in the aggregate estimates, using Cameron et. al. (2011) non-nested multiway clustering scheme for finite-sample adjustment of the empirical distribution function, and cluster-robust inference on transaction cost parameters to remove the inconsistencies arising from biased OLS variance-covariance matrix estimators with serially correlated stochastic disturbances. Multi-way cluster-robust standard errors are denoted in the parentheses for each empirical specification. Asterisks denote statistically significant coefficients at 10% (\*), 5% (\*\*), and 1% (\*\*\*), respectively. | | | | | | | | | | | | | | | | |

Columns (1) through (3) tackle the effect of business registration costs on sub-national growth. For instance, 1 standard deviation increase in the cost of business registration relative to state-level per capita income is associated with 3.8 percent drop in state GDP, and with 4 percent drop in output per worker, ceteris paribus. We also find that some transaction costs may be beneficial for state-level productivity growth as a screening device. For instance, 1 standard deviation rise in the duration of business registration, according to our specification in column (3), facilitates 2.7 percent improvement in long-run output per worker as a result of improved screening and ex-ante tackle-up of the rent-seeking behavior. Columns (7) through (9) re-examine the contribution of property registration costs to sub-national economic growth. The evidence is consistent with the prior estimates in Table (3). In particular, 1 standard deviation increase in the number of property registration procedures tends to depress state GDP by 2.4 percent and output per worker by 2.5 percent, respectively. Both parameter estimates are statistically significant at 10%. The replicated results largely suggest that the choice of the dependent variable is unlikely to backlash the established effects of transaction costs on sub-national growth.

*V.B. Transmission Mechanisms*

The next question pertaining to our results are the transmission mechanism variables shaping the relationship between transaction costs and economic growth. Most transmission variables such as human capital, investment rate, TFP and unemployment rate are affected by the postulated changes in transaction costs and institutional quality and are the key to explain the transmission of changing transaction costs to the state-level economic growth. Our growth transmission mechanism variables follow the framework proposed by Acemoglu et. al. (2015) and include state-level investment/GDP ratio, human capital, infant mortality, and index of economic reforms (Stansel et. al. 2017). We also add state-level unemployment rate and labor supply, proxied by the labor force participation rate, and government size as a share of GDP, to the battery of growth transmission variables. The growth transmission framework allows us to distinguish empirically between direct and indirect effects of transaction costs on economic growth. Such framework also allows us to disentangle almost full network of interrelationships between sub-national growth and the variables directly affected by the postulated changes in transaction costs. For each of the four types of transaction costs considered, we build and test the fully saturated long-run growth specification with the full set of type-specific transaction costs to be able to observe which effect prevails.

**Table 5**: Effects of Transaction Costs on Economic Growth Across Mexican States Using Alternative Outcomes, 2006-2015

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Administrative Transaction Costs | | | | | | Procedural Transaction Costs | | | | | |
|  | Business Registration | | | Construction Permits | | | Property Registration | | | Contract Enforcement | | |
|  | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
|  | State GDP | GDP Per Capita (constant prices only) | Output per Worker | State GDP | GDP Per Capita (constant prices only) | Output per Worker | State GDP | GDP Per Capita (constant prices only) | Output per Worker | State GDP | GDP Per Capita (constant prices only) | Output per Worker |
| # Business Registration procedures | -.008  (.014) | -.008  (.014) | -.008  (.013) |  |  |  |  |  |  |  |  |  |
| # Days to register | .026  (.016) | .026  (.016) | .027\*  (.016) |  |  |  |  |  |  |  |  |  |
| Cost of business registration | -.038\*\*\*  (.013) | -.038\*\*\*  (.013) | -.040\*\*\*  (.013) |  |  |  |  |  |  |  |  |  |
| # Construction permit procedures |  |  |  | -.010  (.011) | -.012  (.013) | -.007  (.011) |  |  |  |  |  |  |
| # Days to obtain construction permits |  |  |  | -.0005  (.009) | -.001  (.010) | .005  (.008) |  |  |  |  |  |  |
| Cost of obtaining permits  (% warehouse value) |  |  |  | -.002  (.006) | -.001  (.008) | -.004  (.007) |  |  |  |  |  |  |
| Quality of building regulation |  |  |  | -.012  (.035) | -.011  (.042) | -.003  (.011) |  |  |  |  |  |  |
| # Property registration procedures |  |  |  |  |  |  | -.024\*  (.014) | -.024\*  (.014) | -.025\*  (.015) |  |  |  |
| # Days to register property |  |  |  |  |  |  | -.001  (.010) | -.002  (.013) | -.001  (.009) |  |  |  |
| Cost of property registration (% property value) |  |  |  |  |  |  | -.021  (.022) | -.021  (.023) | -.013  (.014) |  |  |  |
| Quality of land administration |  |  |  |  |  |  | -.078\*  (.046) | -.093\*\*  (.046) | -.047  (.052) |  |  |  |
| # Contract enforcement procedures |  |  |  |  |  |  |  |  |  | 3.826  (2.757) | 3.648  (2.450) | 3.883  (4.221) |
| # Days to enforce the contract |  |  |  |  |  |  |  |  |  | .012  (.025) | .012  (.026) | .009  (.020) |
| Cost of contract enforcement (% claim) |  |  |  |  |  |  |  |  |  | .013  (.012) | .011  (.010) | .009  (.011) |
| Quality of the judicial process |  |  |  |  |  |  |  |  |  | .195\*  (.119) | .093  (.122) | .028  (.032) |
| Observations | 319 | 319 | 319 | 319 | 319 | 319 | 319 | 319 | 319 | 319 | 319 | 319 |
| Structural Covariates | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES | YES |
| State-Fixed Effects  (p-value) | YES  (0.000) | YES  (0.000) | YES  (0.000) | YES  (0.000) | YES  (0.000) | YES  (0.000) | YES  (0.000) | YES  (0.000) | YES  (0.000) | YES  (0.000) | YES  (0.000) | YES  (0.000) |
| Time-Fixed Effects (p-value) | YES  (0.000) | YES  (0.000) | YES  (0.000) | YES  (0.000) | YES  (0.000) | YES  (0.000) | YES  (0.000) | YES  (0.000) | YES  (0.000) | YES  (0.000) | YES  (0.000) | YES  (0.000) |
| # States | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 |
| # Years | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| R2 | 0.09 | 0.008 | 0.01 | 0.62 | 0.01 | 0.02 | 0.23 | 0.01 | 0.02 | 0.05 | 0.008 | 0.004 |
| Within R2 | 0.66 | 0.46 | 0.37 | 0.59 | 0.35 | 0.29 | 0.61 | 0.37 | 0.30 | 0.60 | 0.35 | 0.29 |
| Between R2 | 0.08 | 0.008 | 0.01 | 0.64 | 0.01 | 0.02 | 0.23 | 0.01 | 0.02 | 0.05 | 0.01 | 0.005 |
| Wald Full Covariate F-Test (p-value) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Joint Significance of Transaction Costs (p-value) | 0.005 | 0.005 | 0.004 | 0.528 | 0.516 | 0.562 | 0.072 | 0.035 | 0.295 | 0.502 | 0.415 | 0.791 |
| Notes: the table presents the estimated effects of transaction costs on per capita output of 32 Mexican states for the period 2006-2015 using alternative dependent variables. Standard errors are adjusted for within-state serially correlated disturbances and heteroskedastic distribution of random error variance into state-level and year-level clusters to tackle multiple sources of uncertainty in the aggregate estimates, using Cameron et. al. (2011) non-nested multiway clustering scheme for finite-sample adjustment of the empirical distribution function, and cluster-robust inference on transaction cost parameters to remove the inconsistencies arising from biased OLS variance-covariance matrix estimators with serially correlated stochastic disturbances. Two-way cluster-robust standard errors are denoted in the parentheses for each empirical specification. Asterisks denote statistically significant coefficients at 10% (\*), 5% (\*\*), and 1% (\*\*\*), respectively. | | | | | | | | | | | | |

**Table 6**: Effects of Transaction Costs on Potential Mechanisms

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Log Investment Share of GDP | Log of TFP | Unemployment  Rate | Average Years of Schooling | Log of Infant Mortality | Log of Government Size per GDP | Index of Economic Reforms | Labor Supply |
|  | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Panel A: Business Registration | | | | | | | | |
| # Business Registration procedures | .127\*\*  (.062) | .040  (.047) | -.019  (.214) | -.125  (.107) | .017  (.026) | -.449  (.643) | -.002  (.031) | -1.097\*\*\*  (.233) |
| # Days to register | -.084\*  (.051) | -.032\*\*\*  (.008) | -.134  (.232) | .030  (.149) | .004  (.006) | .997  (.795) | -.036  (.046) | 1.515\*\*\*  (.440) |
| Cost of business registration | -.062\*  (.040) | -.041  (.057) | .350\*\*\*  (.138) | .185\*\*  (.073) | .0001  (.0011) | .130  (.845) | .039  (.027) | -.194  (.378) |
| # Observations | 319 | 319 | 319 | 319 | 319 | 319 | 319 | 319 |
| Joint Significance of Transaction Costs  (p-value) | 0.17 | 0.00 | 0.00 | 0.01 | 0.63 | 0.36 | 0.02 | 0.00 |
| Panel B: Construction Permits | | | | | | | | |
| # Construction permit procedures | -.037  (.064) | -.034  (.039) | -.163  (.200) | -.140  (.107) | .046  (.029) | -.148  (.588) | .049  (.040) | -.332  (.359) |
| # Days to obtain construction permits | -.046  (.059) | .066\*\*\*  (.019) | -.163  (.210) | -.022  (.171) | -.009  (.028) | .172  (.645) | -.0004  (.051) | -.198  (.715) |
| Cost of obtaining permits  (% warehouse value) | .002  (.056) | .015  (.024) | .092  (.245) | .173  (.170) | -.013  (.018) | .142  (.560) | -.037  (.068) | .045  (.330) |
| Quality of building regulation | -.034  (.050) | -.029  (.038) | -.322\*  (.181) | -.114  (.175) | .034\*\*  (.017) | .470  (.919) | -.008  (.032) | .415  (.458) |
| # Observations | 319 | 319 | 319 | 319 | 319 | 319 | 319 | 319 |
| Joint Significance of Transaction Costs  (p-value) | 0.73 | 0.00 | 0.00 | 0.20 | 0.16 | 0.97 | 0.68 | 0.46 |
| Panel C: Property Registration | | | | | | | | |
| # Property registration procedures | -.120\*  (.075) | .016  (.045) | -.256\*  (.140) | -.060  (.081) | .005  (.023) | -.484  (.775) | .043  (.029) | .602  (.446) |
| # Days to register property | .020  (.060) | .004  (.016) | .119  (.222) | .191\*  (.102) | .011  (.012) | .373  (.419) | -.049\*  (.034) | 1.227\*\*\*  (.438) |
| Cost of property registration (% property value) | -.058  (.069) | -.024  (.022) | .345\*\*  (.171) | .310\*\*\*  (.088) | -.021\*\*  (.009) | .171  (.630) | .012  (.048) | -.161  (.309) |
| Quality of land administration | -.013  (.052) | .022  (.025) | .356\*  (.216) | .338\*  (.185) | -.017  (.022) | -2.116\*\*  (1.047) | .023\*  (.016) | .474  (.400) |
| # Observations | 319 | 319 | 319 | 319 | 319 | 319 | 319 | 319 |
| Joint Significance of Transaction Costs  (p-value) | 0.10 | 0.14 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 |
| Panel D: Contract Enforcement | | | | | | | | |
| # Contract enforcement procedures | -.024  (.036) | .014  (.047) | .074  (.118) | -.037  (.136) | .017  (.017) | -.334  (.803) | -.035  (.063) | -1.146\*  (.673) |
| # Days to enforce the contract | -.036  (.053) | -.012  (.037) | -.360\*\*  (.175) | .036  (.125) | .019  (.017) | -.297  (.576) | .019  (.013) | 1.429\*\*  (.606) |
| Cost of contract enforcement (% claim) | -.013  (.076) | -.056  (.067) | .334\*  (.179) | .247\*\*  (.125) | .013  (.022) | .689  (.532) | -.004  (.031) | .366  (.394) |
| Quality of the judicial process | .007  (.065) | .063  (.073) | .311  (.241) | .191  (.149) | -.045\*  (.030) | -1.979\*\*  (.958) | .044  (.043) | .720  (.578) |
| # Observations | 319 | 319 | 319 | 319 | 319 | 319 | 319 | 319 |
| Joint Significance of Transaction Costs  (p-value) | 0.80 | 0.62 | 0.00 | 0.00 | 0.00 | 0.08 | 0.42 | 0.00 |
| Notes: the table presents the estimated effects of transaction costs on potential mechanisms of subnational economic growth. The full set of potential transmission mechanisms comprises the set of dependent variables. Standard errors are adjusted for within-state serially correlated disturbances and heteroskedastic distribution of random error variance into state-level and year-level clusters to tackle multiple sources of uncertainty in the aggregate estimates, using Cameron et. al. (2011) non-nested multiway clustering scheme for finite-sample adjustment of the empirical distribution function, and cluster-robust inference on transaction cost parameters to remove the inconsistencies arising from biased OLS variance-covariance matrix estimators with serially correlated stochastic disturbances. Two-way cluster-robust standard errors are denoted in the parentheses for each empirical specification. Asterisks denote statistically significant coefficients at 10% (\*), 5% (\*\*), and 1% (\*\*\*), respectively. | | | | | | | | |

However, we refrain from using a fully saturated specification with all transaction cost covariates since this may invoke a heavy multi-collinearity between transaction cost variables. Table 5 examines the effects of transaction costs on the potential sub-national growth mechanisms. The evidence suggests a non-trivial importance and persistence of indirect effects of transaction costs on the growth mechanisms. Panel A exhibits the transmission mechanisms for the costs of business registration. The parameter estimates suggest that the negative effect of rising business registration costs most likely emanate through the capital intensity. Greater duration of business registration tend to drop investment share of GDP and TFP, higher cost of registration drops in the investment share of GDP, and raises the unemployment rate while an increase in business registration procedures strongly discourages labor supply. The combined impact corresponds to the negative effect of business registration costs on sub-national economic growth. In Panel B, the indirect effects of costs of construction permits on economic growth appear to be weak and indiscernible from zero. In Panel C, the evidence suggest that rising costs of property registration on growth most likely takes place via the effect on investment rate and TFP. In particular, in column (1), 1 standard deviation increase in the number of property registration procedure is associated with 12 percent drop in investment/GDP ratio leading to lower long-run growth. In column (3), 1 standard deviation increase in the cost of property registration (relative to the property value) tends to increase the state-level unemployment rate by 34 percent, respectively, thereby lowering growth. We also find that better quality of land administration is associated with a persistent drop in the government size relative to GDP, which fosters growth, and with the acceleration of economic reforms. This suggest that in spite of relatively weaker direct effect on growth, better quality of land administration clearly does not necessitate a large and potentially inefficient public sector bureaucracy and may present the reform incentives for the incumbent politicians which fosters growth compared to the states without efficient land administrations. Both transmission mechanism coefficients are statistically significant at 10% and clearly prevail over other property registration costs.

In Panel D, we estimate the responses of transmission mechanism variables to the costs of contract enforcement. Contrary to the cost of business registration and costs of property registration in Panel A and Panel B, the effects of contract enforcement cost do not seem to influence growth through capital intensity and TFP. Rising cost of contract enforcement is associated with 33 percent increase in the state-level unemployment rate. By contrast, the effect of judicial quality appears to be pervasive. We find that the improved quality of the judicial process exhibits a direct effect on long-run growth via infant mortality. The most pervasive transmission effect of improved judicial quality emanates from lower government size in the share of GDP. Similar to the effect of quality of land administration in Panel C, our evidence suggests that improved judicial quality appears to be a substitute for a large and inefficient public sector bureaucracy, and thus indirectly fosters long-run growth. In addition, more complex contract enforcement procedures tend to indirectly affect long-run growth through lower labor supply. Across the full set of transmission mechanism specifications, transaction costs jointly and significantly influence long-run growth channels. The Wald linearly restricted joint null hypothesis is consistently rejected across the whole set of specifications.

*V.C. Instrumental Variable Estimates*

Does the effect of transaction costs on sub-national growth appear to be causal? Table 7 presents the effects of transaction costs on growth using plausibly exogenous source of variation in the presence of US troops in 1848, disease environment, and historical ethnic fractionalization. The evidence largely suggest that higher transaction costs tend to produce a negative effect on subnational growth once the effect is isolated using plausibily exogenous channels of variation. Panel A exhibits the structural effects of costs on long-run growth while Panel B displays first-stage regressions for transaction costs. Each IV specification is estimated using state/region/year-level triple clustered standard errors to tackle the aggregate uncertainty of the parameter estimates. We present the IV estimated effects for transaction cost variables exhibiting either moderate or strong impact on long-run growth in OLS and fixed-effects setup from Table 4.

Columns (1) through (4) examine the effects of administrative transaction costs on per capita income using state-level variation in drought severity in 1550, and ethnic fractionalization in 1921 as plausibly exogenous sources of variation in long-run growth. In each specification, we separately control for the confounding effect of procedural transaction costs using the average of procedural cost indicators since the procedural costs co-influence state-level growth as well. The evidence suggests that higher administrative transaction costs tend to decrease per capita income although the effects appear to be rather weak. In column (1), we examine the effect of costs of business registration on per capita income levels. First-stage evidence suggests that higher share of Mestizo population in 1921 is associated with markedly higher administrative transaction costs. The first-stage coefficient on the 1921 Mestizo share appears to be statistically significant at 1%. However, in the second stage, higher costs of business registration do not produce lower per capita income. By contrast, the coefficient on procedural transaction costs appears to be both negative and statistically significant at 5%. In column (2), we further unravel the effects of administrative costs on per capita income by using the duration of business registration as the administrative cost variable. Contrary to column (1), the second-stage evidence in Panel A suggests that 1 standard deviation increase in duration of business registration tends to decrease state-level per capita income by 10.7 percent at 10% significance, respectively. In the first stage, colonial drought severity in 1550, greater ethnic fractionalization, and higher share of Mestizo population in 1921 are associated with significantly greater duration of business registration. Controlling for procedural transaction costs does not seem to render the effect of administrative costs insignificant although the negative effect of rising procedural costs clearly prevails over the negative effect of rising administrative costs on subnational growth. In column (3), we use procedural complexity of business registration as an administrative cost variable. The evidence suggests that although the first-stage evidence appears to be strong and consistent with column (2), higher number of procedures in business registration is associated with marginally lower per capita income, as the second-stage coefficient is statistically significant at 15% only. By contrast, in column (4), we find no evidence of the impact of building quality regulation on state-level per capita income differences.

The evidence from the first-stage regressions in Panel B suggests that the proposed IVs for administrative transaction costs are unlikely to suffer from weak identification properties. Weak identification arises when the excluded instruments are correlated with the endogenous variables. In this case, the IV estimator would perform poorly compared to the alternative estimators. In our case, the null hypothesis on excluded instruments in the first-stage using Angrist and Pischke (2009) test is consistently rejected at 5% significance level, except for the quality of building regulation variable. Based on Cragg and Donald (1993) Wald test statistics on weak identification, we compute Stock and Yogo (2005) critical values for the Wald weak identification test statistic. For the full set of IVs, the weak identification test statistic is within 5% (for business registration cost and duration variables) or 10% (for business registration procedures and quality of building regulation) bounds on maximal relative bias, which largely suggests that other IVs are unlikely to suffer from weak identification properties, and further advocates that our exclusion restriction is plausible. In addition, the IVs in Panel B explain between 43 percent and 60 percent of the variation in administrative transaction costs.

Columns (5) through (8) examine the effects of procedural transaction costs on per capita income differences across and within states. The evidence consistently suggests that costly property rights and high-cost enforcement of contracts systematically account for slower economic growth, even after the growth-confounding effects of administrative transaction costs and structural covariates are taken into account.

Column (5) examines the effects of the number of property registration procedures on state-level per capita income. Second-stage evidence suggests that more complex property registration tends to decrease per capita income considerably. In particular, 1 standard deviation increase in the number of property registration procedures tends to decrease per capita income, on average, by 28 percent, respectively, and appears to be statistically significant at 1%. The evidence from the first stage suggests that states with greater drought severity in 1645, greater share of European-born population in 1793, and higher urbanization rate in 1910 tend to have considerably less complex property registration procedures. In column (6), we use the property registration cost as a measure of procedural transaction costs. The first-stage parameters in Panel B suggest that the presence of US troops in 1848 is associated with 12.6 drop in the property registration cost relative to the value of the estate (p-value = 0.000). By contrast, states with greater drought severity during the second outbreak of “cocolitzi” bacteria in 1645 have considerably higher costs of property registration. Higher urbanization rate in 1910 and greater ethnic fractionalization in 1793 are associated with substantially lower costs of property registration. In the second stage, increasing the cost of property registration by 1 standard deviation tends to reduce per capita income by 19 percent, respectively, ceteris paribus. Once the endogeneity of procedural transaction costs is accounted for, the effect of administrative transaction costs does not seem to be statistically different from zero.

Column (7) considers the quality of land administration as a measure of procedural transaction costs, and estimates its impact on state-level per capita income. The evidence from the first stage suggests that states with the presence of US troops in 1848 tend to have 12.6 percent lower quality of land administration (p-value = 0.000) than the states without the US troops presence. On the other hand, states with higher urbanization rate in 1910 tend to have considerably better quality of land administration. In the second stage, 1 standard deviation improvement in the quality of land administration tends to increase per capita income by 15 percent, respectively. In column (8), we consider the effects of the quality of the judicial process on economic growth. First-stage OLS evidence shows that the presence of the US troops is associated with markedly lower quality of the judicial process relative to the control group. In addition, higher rate of urbanization in 1910 predicts a notable improvement in the current-day quality of the judicial process while states with a higher share of European-born population in 1793 tend to have considerably better quality of the judicial process down to the present day. In particular, our first-stage estimates show that a state with 10 percentage points higher share of European-born population in 1793 can expect an improvement in the quality of the judicial process index by 7.2 basis points, respectively.

**Table 7**: IV Estimated Effects of Transaction Costs on Economic Growth Across Mexican States, 2006-2015

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Administrative Transaction Costs | | | | Procedural Transaction Costs | | | |
|  | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Transaction costs as measured by: | Cost of Starting Business | Days to Complete Business Registration | # Procedures to Complete Business Registration | Quality of Building Regulation | # Property Registration Procedures | Property Registration Cost | Quality of Land Administration | Quality of Judicial Process |
| Panel A: Second-Stage Structural Estimates | | | | | | | | |
| Effect Size | -.048  (.074) | -.107\*  (.063) | -.122a  (.085) | .048  (.102) | -.287\*\*\*  (.087) | -.190\*\*  (.087) | .151\*  (.084) | .287\*\*\*  (.077) |
| Procedural Transaction Covariate (unweighted average) | -.213\*\*  (.111) | -.212\*\*  (.102) | -.158\*  (.096) | -.229\*\*  (.114) |  |  |  |  |
| Administrative Transaction Covariate (unweighted average) |  |  |  |  | .208\*\*  (.103) | -.043  (.094) | -.080  (.084) | -.063  (.061) |
| Panel B: First-Stage OLS Regressions for Transaction Cost Variables | | | | | | | | |
| Presence of US Troops in 1848 |  |  |  |  | -.747  (.595) | -.126\*\*\*  (.026) | -.115\*\*  (.044) | -.982\*\*\*  (.273) |
| Drought Severity in 1550 | -.009  (.022) | .103\*\*\*  (.019) | .076\*\*  (.031) | -.018  (.043) |  |  |  |  |
| Drought Severity in 1645 |  |  |  |  | -.941\*\*  (.374) | .598\*\*  (.237) | .199  (.415) | .625\*\*\*  (.179) |
| Palmer Drought Severity Index |  |  |  |  |  |  |  |  |
| Hydrological Palmer Drought Index |  |  |  |  |  |  |  |  |
| Station-Level Drought Index |  |  |  |  |  |  |  |  |
| Urbanization Rate in 1910 |  |  |  |  | -.391\*  (.198) | -.300\*\*  (.134) | .378\*\*  (.180) | .415\*\*\*  (.091) |
| Share of Europeans in 1793 |  |  |  |  | -.386a  (.259) | .240  (.172)  p-val = .19 | .186  (.246) | .729\*\*\*  (.107) |
| Ethnic Fractionalization in 1793 |  |  |  |  | .168  (.261) | -.231\*\*  (.091) | -.229  (.162) | -.055  (.102) |
| Ethnic Fractionalization in 1921 | .180  (.133) | .412\*\*\*  (.045) | .403\*\*\*  (.082) | .091  (.201) |  |  |  |  |
| Share of Mestizo Population in 1921 | .425\*\*\*  (.130) | .462\*\*\*  (.062) | .319\*\*\*  (.071) | -.108  (.192) |  |  |  |  |
| First-Stage R2 | 0.59 | 0.60 | 0.43 | 0.56 | 0.54 | 0.74 | 0.75 | 0.93 |
|  |  |  |  |  |  |  |  |  |
| # Observations | 319 | 319 | 319 | 319 | 299 | 299 | 299 | 299 |
| R2 | 0.86 | 0.86 | 0.82 | 0.86 | 0.86 | 0.83 | 0.81 | 0.87 |
| Baseline Controls  (p-value) | YES  (0.000) | YES  (0.000) | YES  (0.000) | YES  (0.000) | YES  (0.000) | YES  (0.000) | YES  (0.000) | YES  (0.000) |
| Region Fixed-Effects  (p-value) | YES  (0.009) | YES  (0.000) | YES  (0.019) | YES  (0.047) | YES  (0.047) | YES  (0.298) | YES  (0.361) | YES  (0.000) |
| Time-Fixed Effects  (p-value) | YES  (0.000) | YES  (0.000) | YES  (0.000) | YES  (0.000) | YES  (0.000) | YES  (0.002) | YES  (0.019) | YES  (0.007) |
|  |  |  |  |  |  |  |  |  |
| Cragg-Donald Weak Identification Test  (p-value) | 17.11 | 14.84 | 11.37 | 7.50 | 13.15 | 25.74 | 16.90 | 60.82 |
| Stock-Yogo 5% Critical Value  For maximal IV relative bias | 13.91 | 13.91 | 13.91 | 13.91 | 18.37 | 18.37 | 18.37 | 18.37 |
| Stock-Yogo 10% Critical Value maximal IV relative bias | 9.08 | 9.08 | 9.08 | 9.08 | 10.83 | 10.83 | 10.83 | 10.83 |
|  |  |  |  |  |  |  |  |  |
| Angrist-Pischke Test on Excluded Instruments  (p-value) | [0.031] | [0.002] | [0.000] | [0.362] | [0.231] | [0.003] | [0.033] | [0.001] |
| Hansen J-Test of Overidentifying Restrictions  (p-value) | [0.23] | [0.85] | [0.85] | [0.25] | [0.49] | [0.28] | [0.38] | [0.33] |
| Notes: the table presents the IV-2SLS estimated effects of administrative and procedural transaction costs on economic growth. The dependent variable is per capita GDP (2005 $G-K constant prices). Panel A exhibit second-stage estimates. Panel B presents first-stage OLS regressions for transaction cost variables. Standard errors are adjusted for within-state serially correlated disturbances and heteroskedastic distribution of random error variance into state-level, region-level, and year-level clusters to tackle multiple sources of uncertainty in the aggregate estimates using Cameron et. al. (2011) non-nested multiway clustering scheme for finite-sample adjustment of the empirical distribution function, and cluster-robust inference on transaction cost parameters to remove the inconsistencies arising from biased OLS variance-covariance matrix estimator in the presence of serially correlated stochastic disturbances. Multi-way cluster-robust standard errors are denoted in the parentheses for each empirical specification. Asterisks denote statistically significant coefficients at 10% (\*), 5% (\*\*), and 1% (\*\*\*), respectively. | | | | | | | | |

In addition, colonial drought severity in the year 1645 during the second outbreak of “cocolitzi” bacteria strongly predicts current-day quality of the judicial process. In the second stage, the improvement in the quality of the judicial process is associated with pervasive growth gains, where the effect appears to be causal. A one basis point improvement in the quality of the judicial process tends to increase per capita income by 28.7 percent, respectively, ceteris paribus. Controlling for the confounding effects of administrative transaction costs show that the effect of procedural costs is the dominant one while the effects of administrative costs do not appear to be significantly different from zero. The evidence also suggests that the share of European-born population in 1793, drought severity in the year 1645, and urbanization rate in 1910, are unlikely to suffer from weak identification properties. In particular, Cragg and Donald (1993) weak identification test statistics is both large and within Stock and Yogo (2005) 5% relative bias, which confirms the plausibility of the proposed IVs in isolating the effects of transaction costs on growth from other channels. Weak identification test of IVs also shows that the reverse causation between transaction costs and growth is very unlikely, and that our exclusion restriction is plausible. In addition, the null hypothesis on excluded instruments using Angrist and Pischke (2009) test is consistently rejected across our specifications. At the same time, we show that overidentifying restrictions remain stable, which further suggests that the proposed IVs provide a plausibly exogenous source of variation in long-run growth. Hence, the evidence invariably suggests that the effect of transaction costs on economic growth appears to be causal. In Appendix A3, we validate our IV estimates by using Palmer Drought Severity Index, and Palmer hydrological drought from Cook and Krusic (2004) as alternative measures of drought, and show that the results remain unaffected by the choice of drought severity-related IVs.

*V.D Counterfactual Scenario*

The most obvious question arising from the effects of transaction costs on sub-national economic growth under common legal system concerns the counterfactual scenario. Would Mexican states with high transaction costs perform better if they had low transaction costs? Such hypothetical scenario might be crucial in understanding the importance and policy relevance of transaction costs in shaping the paths of economic growth. Since the evidence clearly advocates the importance of transaction costs for long-run growth under the common legal system, we examine the counterfactual scenario in two-fold perspective. First, how much would high-cost states gain from lowering procedural and administrative transaction costs? And second, how much would low-cost states lose from increasing procedural and administrative transaction costs.

Recall the fixed-effects long-run growth specification in Eq. (1). Formally, our counterfactual scenario proceeds as follows:

 (8)

 (9)

where  denotes the level of transaction costs at high-cost threshold, and  denotes the level of transaction costs at low-cost threshold. We set the high-cost threshold cutoff at 75th percentile of the distribution for each indicator, and the low-cost cutoff at 25th percentile of the distribution. This allows us a quasi-experimental setup where we identify the quasi-treated states where the observed  in the range of the 25th and 75th percentile cutoffs, and estimate the hypothetical gains and losses of the transition from high-to-low cost and low-to-high cost conditional on the growth confounder. We estimate the long-run growth specification with state/region/year-clustered S.E., state-fixed effects, and common technology shocks and full set of growth covariates as in Table 4 using transaction costs from the IV specifications in Table 5: (i) cost of business registration, (ii) number of property registration procedures, (iii) quality of land administration, and (iv) quality of the judicial process. We refrain from using the synthetic control and difference-in-differences setup to estimate the missing counterfactual given the lack of the policy shock, which would allow us to establish post-treatment effects. Our counterfactual scenario is based on the long-run per capita output losses and gains in the hypothetical shift of transaction costs from 75th percentile of the aggregate distribution to the 25th percentile of the distribution and vice versa.

Figure 4 plots the hypothetical per capita output gains from lower transaction costs and the hypothetical losses from higher transaction costs for the set of quasi-treated states. Panel A exhibits the transition from high to low transaction costs while Panel B exhibits the transition from low to high transaction costs. The transition from high to low transaction costs is associated with widespread and notable long-run per capita output gains. For the cost of business registration, we use the state of Chiapas as a quasi-treatment state since its business registration costs are in the range of the 75th percentile of between-state distribution. The evidence suggests large per capita output gains from lower costs of business registration. In the long run, a drop in business registration costs would improve the long-run per capita output of Chiapas by 49 percent, holding other factors constant. For the same reason, the transition from low to high transaction costs exhibits a sizeable per capita output loss although the magnitude of the loss is smaller than the magnitude of the gain from lower business registration cost. For the quasi-treated state of Tabasco, the transition from 25th to the 75th percentile of the cost of business registration would drop its long-run per capita output by 11 percent, respectively. Our counterfactual scenario for the number of property registration procedures arguably highlights large gains and widespread long-term losses. Decreasing the number of property registration procedures by a reasonable amount (i.e. from the 75th to the 25th percentile) for the quasi-treated state of Sonora would, according to our scenario, boost its long-run per capita output by 30 percent, respectively. On the other hand, expanding the number of property registration procedures from 25th to 75th percentile threshold would drop per capita considerably. For instance, if the state of México would incur such a hypothetic increase in the number of property registration procedures, its long-run per capita output would be about 22 percent lower than the level without the increase in the number of procedures. Similarly, better quality of land administration yields similar long-run gains in per capita output. For the quasi-treated state of Chihuahua, the transition to the 75th percentile of the quality of land administration would raise its long-run per capita output by 58 percent, respectively. On the other hand, if the states with high quality of land administration such as the state of Durango, would worsen from the 75th percentile to the 25th percentile, our counterfactual estimates suggest per capita output would decrease roughly by a half relative to the counterfactual scenario. The counterfactual estimates for the property registration procedures critically highlight the importance of property rights for long-run growth and development.

Lastly, we examine the hypothetical long-run growth gains and losses associated with the judicial quality. Our estimates imply that improving the judicial quality within a common legal system would generate sizeable per capita output gains. In our case, quality of the judicial process at the 25th percentile corresponds to the state of Oaxaca. If Oaxaca improved the quality of the judicial process to the 75th percentile of the statewide distribution, our counterfactual estimates imply that its per capita output would increase by a factor of 2.6 which would move Oaxaca’s per capita income level which is similar that of Greece. In the long run, such a shift would move Oaxaca’s development level from lower-middle income to the high-income status. In a similar vein, the deterioration of the quality of judicial process from the 75th percentile to the 25th percentile would generate non-trivial economic losses. For the quasi-treated state of Nuevo Leon, such a deterioration of the quality of the judicial process would drop its per capita output by 22 percent, respectively. Our counterfactual estimates confirm the deep importance of the judicial efficiency for long-run growth and development.

**Figure 4**: Counterfactual Estimations

|  |  |  |  |
| --- | --- | --- | --- |
| (a) Business Registration / Start-Up Cost | (b) # Property Registration Procedures | (c) Quality of Land Administration | (d) Quality of the Judicial Process |
| Panel A: Transition from High-Cost to Low-Cost Equilibrium | | | |
|  |  |  |  |
| Panel B: Transition from Low-Cost to High-Cost Equilibrium | | | |
|  |  |  |  |

**VII. Conclusion**

This paper asks whether institutions matter for subnational economic growth within a common legal system. To this end, we examine the contribution of transaction costs to subnational economic growth drawing on a panel of 32 Mexican states for the period 2006-2015. We build a series of indicators measuring the level of administrative and procedural transaction costs from the surveys of local litigation experts, businesspeople, private professionals, and public officials, namely attorney generals, public land registers, and municipal officials. Compared to traditional surveys, this survey combines the direct costs generated by the legal system as well as the lived experience of businesspeople, and is thus prone to fewer subjective biases inherent in survey with lived experience only. Our measures of transaction costs broadly capture the costs of business registration, costs of dealing with construction permits, costs of property registration, and costs of contract enforcement. Focusing on the subnational variation in transaction costs, our approach allows us to hold the effect of cultural differences and common institutional framework constant, and focus only on the role of transaction costs in long-run growth. We show that the differences in transaction costs within the common legal system matter for growth and development, and are far from trivial. Our evidence based on the battery of fixed-effects specifications with multi-way clustered standard errors, reveals a persistent negative impact of rising transaction costs on long-run growth and development.

The negative effects of higher transaction costs on per capita income are driven by the costs of property rights and contract enforcement whereas the effects of administrative costs appear to be limited both in size and significance, except for the duration of administrative procedures. In particular, states with shorter duration of business registration, less complex property registration procedures, and greater judicial efficiency tend to growth consistently faster than the states without low transaction costs. The beneficial effects of lower transaction costs do not disappear once the broad set of growth-confounding variables is controlled for. On the other hand, costs of dealing with construction permits do not seem to matter much for growth and development. Lower transaction costs harness higher growth rate through a variety of transmission mechanisms such as higher rate of investment, improved TFP, lower unemployment rate, and higher rate of labor supply.

The effects of transaction costs on subnational growth are robust across a variety of model specification checks, and hold across alternative measures of long-run growth. Since richer states can possibly afford better institutions and lower transaction costs, we address the potential endogeneity of transaction costs by exploiting the presence of US troops during Mexican-American war in 1848, urbanization rate prior to Mexican Revolution, colonial drought severity and disease environment, and historical ethnic fractionalization. We show that our exclusion restrictions remain stable and do not fall across a series of falsification checks. In particular, states with the historical presence of US troops have lower property registration costs but significantly lower quality of land administration and lower quality of the judicial process. States with greater urbanization rate prior to Mexican revolution tend to have significantly lower transaction costs while states with greater historical ethnic fractionalization have significantly higher administrative transaction costs. In addition, historical disease environment associated with the “cocolitzi” epidemic in the years 1550 and 1645 successfully predict the level of transaction costs down to the present day. We show that these historical differences appear to be a plausibly exogenous source of variation in long-run growth, and tend to produce the negative impact of rising transaction costs on growth and development, which appears to be causal. More research on the impact of transaction costs under a common legal system with alternative identification strategies is needed to better understand the impact of transaction costs, the differences and similarities across countries with different legal cultures, to further grasp the relevance and policy implications of transaction costs for growth and development.

**References**

Acemoglu, D., Aghion, P., & Zilibotti, F. (2006). Distance to frontier, selection, and economic growth. *Journal of the European Economic Association* 4(1), 37-74.

Acemoglu, D., & Dell, M. (2010). Productivity differences between and within countries. *American Economic Journal: Macroeconomics*, 2(1), 169-88.

Acemoglu, D., Gallego, F. A., & Robinson, J. A. (2014). Institutions, human capital, and development. *Annual Review of Economics*, 6(1), 875-912.

Acemoglu, D., García-Jimeno, C., & Robinson, J. A. (2012). Finding Eldorado: Slavery and long-run development in Colombia. *Journal of Comparative Economics* 40(4), 534-564.

Acemoglu, D., Garcia-Jimeno, C., & Robinson, J. A. (2015). State capacity and economic development: A network approach. *American Economic Review* 105(8), 2364-2409.

Acemoglu, D., Johnson, S., & Robinson, J. A. (2001). The colonial origins of comparative development: An empirical investigation. *American Economic Review*, 91(5), 1369-1401.

Acemoglu, D., Johnson, S., & Robinson, J. A. (2002). Reversal of fortune: Geography and institutions in the making of the modern world income distribution. *Quarterly Journal of Economics*, 117(4), 1231-1294.

Acemoglu, D., Johnson, S., & Robinson, J. A. (2005). Institutions as a fundamental cause of long-run growth. In: Aghion, P, Durlauf, S.N. (eds.), Handbook of Economic Growth, 1, 385-472.

Acemoglu, D., & Johnson, S. (2005). Unbundling institutions. *Journal of Political Economy*, 113(5), 949-995.

Acemoglu, D., Naidu, S., Restrepo, P., & Robinson, J. A. (2015). Democracy does cause growth. Forthcoming in: *Journal of Political Economy*.

Acemoglu, D., & Robinson, J. A. (2006). De facto political power and institutional persistence. *American Economic Review*, 96(2), 325-330.

Acuña-Soto, R., Romero, L. C., & Maguire, J. H. (2000). Large epidemics of hemorrhagic fevers in Mexico 1545-1815. *The American Journal of Tropical Medicine and Hygiene*, 62(6), 733-739.

Alba, F. (1976). *La Población de México*. Mexico City: El Colegio de México.

Alesina, A., Devleeschauwer, A., Easterly, W., Kurlat, S., & Wacziarg, R. (2003). Fractionalization. *Journal of Economic Growth*, 8(2), 155-194.

Alesina, A., & Ferrara, E. L. (2005). Ethnic diversity and economic performance. *Journal of Economic Literature*, 43(3), 762-800.

Allen, D.W. (199). Transaction Costs. In Bouckaert, B., De Geest, G. (eds.). The Encyclopedia of Law and Economics, Vol. 1 (pp. 893-926).

Anaya, D. S. (1996*). La población extranjera en México, 1895-1995: un recuento con base en los censos generales de población*. Mexico City: Instituto Nacional de Antropología e Historia.

Angrist, J. D., & Pischke, J. S. (2010). The credibility revolution in empirical economics: How better research design is taking the con out of econometrics. *Journal of Economic Perspectives*, 24(2), 3-30.

Arellano, M. (1987). Computing Robust Standard Errors for Within‐Groups Estimators. *Oxford Bulletin of Economics and Statistics*, 49(4), 431-434.

Arellano Garcia, C. (1998). *Derecho Procesal Civil*. 5th ed., Mexico City: Porrua.

Armour, J., Deakin, S., Mollica, V., Siems, M. (2009). Law and financial development: what are we learning from time-series evidence. *Bringham Young University Law Review*, pp. 1435-1500.

Aron, J. (2000). Growth and institutions: a review of the evidence. *The World Bank Research Observer*, 15(1), 99-135.

Arruñada, B. (2007). Pitfalls to avoid when measuring institutions: Is Doing Business damaging business?. *Journal of Comparative Economics*, 35(4), 729-747.

Arruñada, B., & Garoupa, N. (2005). The choice of titling system in land. *The Journal of Law and Economics*, 48(2), 709-727.

Avalos, F. A. (2013). *The Mexican Legal System: A Comprehensive Research Guide*. 3rd Edition. Buffalo, NY: William S. Hein & Co.

Bairoch, P. (1988). *Cities and Economic Development: From the Dawn of History to the Present*. Chicago, IL: University of Chicago Press.

Barro, R. J. (1991). Economic growth in a cross section of countries. *Quarterly Journal of Economics*, 106(2), 407-443.

Barro, R. J., & Sala-i-Martin, X. (1992). Convergence. *Journal of Political Economy*, 100(2), 223-251.

Beck, T., & Levine, R. (2005). Legal institutions and financial development. In Shirley, M.M, Ménard C. (eds.), *Handbook of New Institutional Economics* (pp. 251-278). Springer, Boston, MA.

Bertrand, M., Duflo, E., & Mullainathan, S. (2004). How much should we trust differences-in-differences estimates?. *Quarterly Journal of Economics*, 119(1), 249-275.

Boettke, P. J., Coyne, C. J., & Leeson, P. T. (2008). Institutional stickiness and the new development economics. *American Journal of Economics and Sociology*, 67(2), 331-358.

Brock, G., & German-Soto, V. (2013). Regional industrial growth in Mexico: Do human capital and infrastructure matter?. *Journal of Policy Modeling*, 35(2), 228-242.

Bruhn, M. (2011). License to sell: the effect of business registration reform on entrepreneurial activity in Mexico. *The Review of Economics and Statistics*, 93(1), 382-386.

Bruhn, M., & Gallego, F. A. (2012). Good, bad, and ugly colonial activities: do they matter for economic development?. *Review of Economics and Statistics*, 94(2), 433-461.

Cameron, A. C., Gelbach, J. B., & Miller, D. L. (2011). Robust inference with multiway clustering. *Journal of Business and Economic Statistics*, 29(2), 238-249.

Campos, N. F., Saleh, A., & Kuzeyev, V. (2011). Dynamic ethnic fractionalization and economic growth. *The Journal of International Trade & Economic Development*, 20(2), 129-152.

Canning, D., Fay, M. (1993). The effect of transportation networks on economic growth. Discussion Paper No. 653, Columbia University.

Carmagnani, M., Marichal, C. (2001). Mexico: from colonial fiscal regime to liberal financial order, 1750-1912. In: M. Bordo & R. Cortés-Conde (eds.), *Transferring Wealth and Power from the Old to the New World: Monetary and Fiscal Institutions in the 17th Through the 19th Centuries* (pp. 284-326). New York, NY: Cambridge University Press.

Carney, S.A. (2006). *The Occupation of Mexico, May 1846-July 1848*. Washington DC: United States Army Center of Military History.

Chen, J., & Fleisher, B. M. (1996). Regional income inequality and economic growth in China. *Journal of Comparative Economics*, 22(2), 141-164.

Clague, C., Keefer, P., Knack, S., & Olson, M. (1999). Contract-intensive money: contract enforcement, property rights, and economic performance. *Journal of Economic Growth*, 4(2), 185-211.

Clagett, H. L., Valderrama, D. M., & Vance, J. T. (1973). *A Revised Guide to the Law & Legal Literature of Mexico*. Washington D.C.: Library of Congress.

Clagett, H.L. (1979). *Guide to the Law and Legal Literature of Mexican States*. Washington D.C., Library of Congress.

Coase, R. H. (1937). The nature of the firm. *Economica*, 4(16), 386-405.

Coase, R. (1998). The new institutional economics. *American Economic Review*, 88(2), 72-74.

Cockcroft, J. D. (1976). *Intellectual Precursors of the Mexican Revolution*, 1900-1913. Austin, TX: University of Texas Press.

Collier, P. (2000). Ethnicity, politics and economic performance. *Economics & Politics*, 12(3), 225-245.

Cook, E.R., & Krusic, P.J. (2004). *The North American Drought Atlas*. New York, NY: National Science Foundation.

Cragg, J. G., & Donald, S. G. (1993). Testing identifiability and specification in instrumental variable models. *Econometric Theory*, 9(2), 222-240.

Davis, P. (2002). Estimating multi-way error components models with unbalanced data structures. *Journal of Econometrics*, 106(1), 67-95.

De La Fuente, A., & Vives, X. (1995). Infrastructure and education as instruments of regional policy: evidence from Spain. *Economic Policy*, 10(20), 11-51

De Soto, H. (2000). *The Mystery of Capital: Why Capitalism Triumphs in the West and Fails Everywhere Else*. New York, NY: Basic Books

Dell, M., Jones, B. F., & Olken, B. A. (2009). Temperature and income: reconciling new cross-sectional and panel estimates. *American Economic Review*, 99(2), 198-204.

Dell, M., Jones, B. F., & Olken, B. A. (2012). Temperature shocks and economic growth: Evidence from the last half century. *American Economic Journal: Macroeconomics*, 4(3), 66-95.

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

De Vries, J. (1976). *The Economy of Europe in an Age of Crisis, 1600-1750*. Cambridge, UK: Cambridge University Press.

Diamond, J. (1997). *Guns, Germs and Steel: The Fates of Human Societies*. New York, NY: Vintage Press.

Djankov, S., La Porta, R., Lopez-de-Silanes, F., & Shleifer, A. (2002). The regulation of entry. *Quarterly Journal of Economics*, 117(1), 1-37.

Djankov, S., McLiesh, C., & Ramalho, R. M. (2006). Regulation and growth. *Economics Letters*, 92(3), 395-401.

Ducey, M. (1997). Liberal theory and peasant practice: land and power in northern Veracruz, Mexico, 1826-1900. In R. Jackson (ed.), *Liberals, the Church and Indian Peasants: Corporate Lands and the Challenge of Reform in 19th Century Spanish America* (pp. 65-94). Albuquerque, NM: University of New Mexico Press.

Easterly, W., & Levine, R. (1997). Africa's growth tragedy: policies and ethnic divisions. *Quarterly Journal of Economics*, 112(4), 1203-1250.

Easterly, W., & Levine, R. (2003). Tropics, germs, and crops: how endowments influence economic development. *Journal of Monetary Economics*, 50(1), 3-39.

Easterly, W., & Levine, R. (2016). The European origins of economic development. *Journal of Economic Growth*, 21(3), 225-257.

Easterly, W., Ritzen, J., & Woolcock, M. (2006). Social cohesion, institutions, and growth. *Economics & Politics*, 18(2), 103-120.

Faria, H. J., Montesinos-Yufa, H. M., Morales, D. R., & Navarro, C. E. (2016). Unbundling the roles of human capital and institutions in economic development. *European Journal of Political Economy* 45S, 108-128.

Farnsworth, E.A. (1996). *An Introduction to the Legal System of the United States*. 3rd Edition. New York, NY: Oceana Publishers.

Fiss, O. M. (1993). The limits of judicial independence*. The University of Miami Inter-American Law Review*, 57-76.

Floris Margadant, G.S. (1983). *An Introduction to the History of Mexican Law*. Mexico City: Libros Ocotepec.

Galiani, S., & Weinschelbaum, F. (2012). Modeling informality formally: households and firms. *Economic Inquiry* 50(3), 821-838.

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

Garfias, F. & Sellars, E. A. (2017). Elite conflict, demographic collapse, and the transition to direct rule: Evidence from colonial Mexico. Presented at: 21st Annual Conference of the Society for Institutional & Organizational Economics, Columbia University, New York.

Garofalo, G. A., & Yamarik, S. (2002). Regional convergence: Evidence from a new state-by-state capital stock series*. Review of Economics and Statistics*, 84(2), 316-323.

Gennaioli, N., La Porta, R., Lopez-de-Silanes, F., & Shleifer, A. (2012). Human capital and regional development. *The Quarterly Journal of Economics*, 128(1), 105-164.

Gennaioli, N., La Porta, R., De Silanes, F. L., & Shleifer, A. (2014). Growth in regions. *Journal of Economic Growth*, 19(3), 259-309.

Gibson, C. (1964). *The Aztecs under Spanish Rule: A History of the Indians of the Valley of Mexico, 1519-1810*. Stanford, CA: Stanford University Press.

Glaeser, E. L., La Porta, R., Lopez-de-Silanes, F., & Shleifer, A. (2004). Do institutions cause growth?. *Journal of Economic Growth*, 9(3), 271-303.

Haber, S., Maurer, N., & Razo, A. (2003). *The Politics of Property Rights: Political Instability, Credible Commitments, and Economic Growth in Mexico, 1876-1929*. Cambridge University Press.

Hall, R. E., & Jones, C. I. (1999). Why do some countries produce so much more output per worker than others?. *Quarterly Journal of Economics*, 114(1), 83-116.

Hansen, L. P. (1982). Large sample properties of generalized method of moments estimators. *Econometrica*, 50(4): 1029-1054.

Hansen, C. B. (2007). Asymptotic properties of a robust variance matrix estimator for panel data when T is large. *Journal of Econometrics*, 141(2), 597-620.

Hassig, R. (1985). *Trade, Tribute, and Transportation: The Sixteenth-Century Political Economy of the Valley of Mexico*. Norman, OK: University of Oklahoma Press.

Helland, E. (2016). Of instrumental variables and institutions. *Journal of Institutional and Theoretical Economics*, 172(1), 65-69.

Helland, E., & Klick, J. (2011). Legal origins and empirical credibility. In: Faure, M., Smits, J. (eds.), *Does Law Matter* (pp. 99-114), Antwerpen: Intersentia.

Herget, J.E., Camil, J. (1978). *An Introduction to the Mexican Legal System*. Buffalo, NY: W.S. Hein & Co.

Hidalgo, C. A., & Hausmann, R. (2009). The building blocks of economic complexity. *Proceedings of the National Academy of Sciences* 106(26), 10570-10575.

Huber, P. J. (1967). The behavior of maximum likelihood estimates under nonstandard conditions. In: *Proceedings of the Fifth Berkeley Symposium on Mathematical Statistics and Probability* (Vol. 1, No. 1, pp. 221-233).

Kezdi, G. (2003). Robust standard error estimation in fixed-effects panel models. *Hungarian Statistical Review*, Special Number 9, 95-115.

Knack, S., & Keefer, P. (1995). Institutions and economic performance: cross‐country tests using alternative institutional measures. *Economics & Politics*, 7(3), 207-227.

Klerman, D. M., Mahoney, P. G., Spamann, H., & Weinstein, M. I. (2011). Legal origin or colonial history?. *Journal of Legal Analysis*, 3(2), 379-409.

Klick, J. (2010). The perils of empirical work on institutions: comment. *Journal of Institutional and Theoretical Economics*,166(1): 166-170.

Knight, A. (1990). *The Mexican Revolution: Counter-Revolution and Reconstruction (Vol. 2)*. Lincoln, NE: University of Nebraska Press.

Knight, A. (2002). *Mexico: The Colonial Era*. New York, NY: Cambridge University Press.

Knowlton, R. (1976). *Church Property and the Mexican Reform, 1856-1910*. Dekalb, IL: Northern Illinois University Press.

Kovac, M., Spruk, R. (2016). Institutional development, transaction costs and economic growth: evidence from a cross-country investigation. *Journal of Institutional Economics*, 12(1), 129-159.

Kovac, M. (2017). Administrative procedure. in Marciano, Alain (ed.), Ramello, Giovanni B. (ed.). *Encyclopedia of law and economics*. Continuously updated ed. New York: Springer, 2017

Kuznets, S. (1968). *Modern Economic Growth: Rate Structure and Spread*. New Haven, CT: Yale University Press.

Lerner, V. (1968). Consideraciones sobre la población de la Nueva España (1793-1810): Según Humboldt y Navarro y Noriega. *Historia Mexicana*, 17(3), 327-348.

La Porta, R., Lopez-de-Silanes, F., Shleifer, A., & Vishny, R. (1999). The quality of government. *The Journal of Law, Economics, and Organization*, 15(1), 222-279.

Leamer, E. E. (1983). Let's take the con out of econometrics. *American Economic Review*, 73(1), 31-43.

Levine, R. (1998). The legal environment, banks, and long-run economic growth. *Journal of Money, Credit and Banking*, 30(3): 596-613.

Liang, K. Y., & Zeger, S. L. (1986). Longitudinal data analysis using generalized linear models. *Biometrika*, 73(1), 13-22.

López-Ayllón, S., García, A., & Fierro, A. E. (2015). A comparative-empirical analysis of administrative courts in Mexico. *Mexican Law Review*, 7(2), 3-35.

Maddison, A. (2007). *The World Economy. Volume 2: Historical Statistics*. Paris: Organization for Economic Cooperation and Development.

Mankiw, N. G., Romer, D., & Weil, D. N. (1992). A contribution to the empirics of economic growth. *Quarterly Journal of Economics*, 107(2), 407-437.

Maseland, R. (2013). Parasitical cultures? The cultural origins of institutions and development. *Journal of Economic Growth* 18(2), 109-136.

Matthews, R. C. (1986). The economics of institutions and the sources of growth. *The Economic Journal*, 96(384), 903-918.

Mauro, P. (1995). Corruption and growth. *The Quarterly Journal of Economics*, 110(3), 681-712.

Merryman, J. H., & Pérez-Perdomo, R. (1985). *The Civil Law Tradition: An Introduction to the Legal Systems of Europe and Latin America*. Stanford, CA: Stanford University Press.

Michalopoulos, S., & Papaioannou, E. (2013a). Pre‐colonial ethnic institutions and contemporary African development. *Econometrica*, 81(1), 113-152.

Michalopoulos, S., & Papaioannou, E. (2013b). National institutions and subnational development in Africa. *The Quarterly Journal of Economics*, 129(1), 151-213.

Mirow, M. C. (2004). *Latin American Law: A History of Private Law and Institutions in Spanish America*. Austin, TX: University of Texas Press.

Mitton, T. (2016). The wealth of subnations: Geography, institutions, and within-country development. *Journal of Development Economics*, 118, 88-111.

Montalvo, J. G., & Reynal-Querol, M. (2005). Ethnic diversity and economic development. *Journal of Development Economics*, 76(2), 293-323.

Moulton, B. R. (1986). Random group effects and the precision of regression estimates. Journal of Econometrics, 32(3), 385-397.

Moulton, B. R. (1990). An illustration of a pitfall in estimating the effects of aggregate variables on micro units. *The Review of Economics and Statistics*, 72(2): 334-338.

Negretto, G., Aguilar-Rivera, J.A. (2000). Rethinking the legacy of the liberal state in Latin America: the cases of Argentina (1853-1916) and Mexico (1857-1910), *Journal of Latin American Studies* 32(2): 361-397.

Newson, L. A. (1993). The demographic collapse of native peoples of the Americas, 1492-1650. In: *Proceedings of the British Academy* (Vol. 81, pp. 247-288). Oxford University Press.

Nordhaus, W. D. (2006). Geography and macroeconomics: New data and new findings. *Proceedings of the National Academy of Sciences of the United States of America*, 103(10), 3510-3517.

North, D. C. (1989). Institutions and economic growth: An historical introduction. *World Development*, 17(9), 1319-1332.

North, D.C. (1990). *Institutions, institutional change and economic performance*. New York, NY: Cambridge University Press.

Olson, M. (1984). *The Rise and Decline of Nations: Economic Growth, Stagflation, and Social Rigidites*. London: Yale University Press.

Ovalle Favela, J. (1996), *Teoria General del Proceso*. 4th ed. Mexico City: Harla.

Pepper, J. V. (2002). Robust inferences from random clustered samples: an application using data from the panel study of income dynamics. *Economics Letters*, 75(3), 341-345.

Pfeffermann, D., & Nathan, G. (1981). Regression analysis of data from a cluster sample. *Journal of the American Statistical Association*, 76(375), 681-689.

Putterman, L., & Weil, D. N. (2010). Post-1500 population flows and the long-run determinants of economic growth and inequality. *Quarterly Journal of Economics*, 125(4), 1627-1682.

Rajan, R. (2009). Rent preservation and the persistence of underdevelopment. *American Economic Journal: Macroeconomics*, 1(1): 178-218.

Rodrik, D. (2000). Institutions for high-quality growth: what they are and how to acquire them. *Studies in Comparative International Development*, 35(3), 3-31.

Rodrik, D. (2008). *One Economics, Many recipes: Globalization, Institutions, and Economic Growth*.

Rodrik, D., Subramanian, A., & Trebbi, F. (2004). Institutions rule: the primacy of institutions over geography and integration in economic development. *Journal of Economic Growth*, 9(2), 131-165.

Rodríguez-Pose, A. (2013). Do institutions matter for regional development?. *Regional Studies*, 47(7), 1034-1047.

Sachs, J.D. (2003). Institutions don't rule: direct effects of geograophy on per capita income. NBER Working Paper No. 9490, Cambridge, MA: National Bureau of Economic Research.

Sachs, J., & Malaney, P. (2002). The economic and social burden of malaria. *Nature*, 415(6872), 680.

Sala-i-Martin, X. X. (1996). Regional cohesion: evidence and theories of regional growth and convergence. *European Economic Review*, 40(6), 1325-1352.

Santoni, P. (1996). *Mexicans at Arms: Puro Federalists and the Politics of War, 1845-1848.* Forth Worth, TX: Texas Christian University Press.

Sellars, E. A., & Alix-Garcia, J. (2016). Labor Scarcity, Land Tenure, and Historical Legacy: Evidence from Mexico. Presented at: Annual Conference of the Society for Institutional and Organizational Economics, Sciences Po, Paris.

Sellars, Emily A. & Alix-Garcia, Jennifer, (2018). "[Labor scarcity, land tenure, and historical legacy: Evidence from Mexico](https://ideas.repec.org/a/eee/deveco/v135y2018icp504-516.html)," [Journal of Development Economics](https://ideas.repec.org/s/eee/deveco.html), 135(C), 504-516.

Sicotte, R., Vizcara, C. (2009). The Mexican-U.S war: a turning point in Mexican development? Working Paper, University of Vermont.

Sobel, R. S., & Coyne, C. J. (2011). Cointegrating institutions: the time-series properties of country institutional measures. *The Journal of Law and Economics*, 54(1), 111-134.

Sokoloff, K. L., & Engerman, S. L. (2000). Institutions, factor endowments, and paths of development in the new world. *Journal of Economic Perspectives*, 14(3), 217-232.

Spamann, H. (2010). Legal origin, civil procedure, and the quality of contract enforcement. *Journal of Institutional and Theoretical Economics*, 166(1), 149-165.

Stansel, D., Torra, J. & McMahon, F. (2017). *Economic Freedom of North America 2017.* Vancouver, BC: Fraser Institute.

Stock, J.H, Yogo, M. (2005). Testing for weak instruments in linear IV regression. In: D.W.K. Andrews & J.H. Stock (eds). *Identification and Inference for Econometric Models: Essays in Honor of Thomas Rothenberg* (pp. 80-108). New York, NY: Cambridge University Press.

Taylor, C.L. & Hudson, M.C. (1972). *World Handbook of Political and Social Indicators*. Ann Arbor, MI: ICPSR.

Tenenbaum, B. (1986). *The Politics of Penury: Debts and Taxes in Mexico, 1821-1856*. Albuquerque, NM: University of New Mexico Press.

Torstensson, J. (1994). Property rights and economic growth: an empirical study. *Kyklos*, 47(2), 231-247.

Vázquez, J.Z. (1997). *México y la guerra con Estados Unidos. In: J.Z. Vázquez (ed.), México al tiempo de su guerra con Estados Unidos (1846-1848)*. Mexico City: Fondo de Cultura Económica (pp. 17-46).

White, H. (1980). A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity. *Econometrica*, 48(4). 817-838.

Williamson, O.E. (1985). The Economic Institutions of Capitalism. New York, NY: Free Press.

Williamson, O.E. (1996). *The Mechanics of Governance*. New York, NY: Oxford University Press.

Williamson, O. E. (1998). Transaction cost economics: how it works; where it is headed. *De Economist,* 146(1), 23-58.

Wooldridge, J. M. (2003). Cluster-sample methods in applied econometrics. *American Economic Review*, 93(2), 133-138.

World Bank (2006). *Doing Business in Mexico in 2006*. Washington D.C.

World Bank (2007). *Doing Business in Mexico in 2007: Comparing Regulation in the 31 States and Mexico City*. Washington D.C.

World Bank (2009). *Doing Business en México 2009: Comparado La Regulación En 31 Estados, El Distrito Federal y 181 Economías* . Washington D.C.

World Bank (2012). *Doing Business en México 2012:* *Comparado La Regulación En 32 Entitades Federativas y 183 Economías*. Washington D.C.

World Bank (2014). *Doing Business en México 2014:Entendiendo Las Regulaciones Para Las Pequeñas y Medianas Empresas*. Washington D.C.

World Bank (2016). *Doing Business in Mexico 2016.* Washington D.C.

Zamora, S., Cossío, J. R., & Castro, L. P. (2004). *Mexican Law*. New York, NY: Oxford University Press.

**Appendix A1:** Construcing the Quality of the Judicial Process index

**Table A1**: Quality of the Judicial Process Index

|  |  |  |
| --- | --- | --- |
|  | **Presence** | **Absence** |
| **Panel A: Court Structure and Proceedings** | | |
| Availability of specialized commercial court | 1.5 points | 0 points |
| Availability of small claims court and/or simplified procedure for small claims | 1 point, additional 0.5 points assigned if parties can represent themselves before the court in the specific procedure | 0 points |
| Availability of pre-trail attachment for plaintiffs | 1 point | 0 points |
| Random assignment of cases to judges | 1 point | 0 points |
| **Panel B: Case Management** | | |
| Regulations setting time standards for service of process, first hearing, filing of the statement of defense, completion of evidence period, filing of testimony by expert, and submission of the final judgement | 1 point | 0 points |
| Regulations setting time standards on adjournments and continuances and whether these rules are respected in more than 50% of cases | 1 point, 0.5 point if only two out of three criteria are met | 0 points |
| Availability of performance measurement reports to monitor court performance | 1 point | 0 points |
| Availability of pretrial conference to discuss scheduling, case complexity, possibility of settlement through alternative dispute resolution, evidence, jurisdiction and other procedural issues, and narrowing down of contentious issues | 1 point | 0 points |
| Availability of electronic case management system for judges to access laws, regulations, and case law, to automatically generate a hearing schedule for all cases on their docket, to send notifications to lawyers, to track the status of the case on their docket, to view and manage case documents, to assist in writing judgements, to semi-automatically generate court order, and to view court orders and judgements in a particular case | 1 point | 0 points |
| Availability of electronic case management for lawyers to access laws, regulations, and case law, to track the status of the case, to view and manage case documents, to file briefs and documents with the court, and to view court orders and judgements in a particular case | 1 point | 0 points |
| **Panel C: Court Automation Index** | | |
| Ability to file initial complaint electronically through a dedicated platform | 1 point | 0 points |
| Ability to serve initial complaint electronically through a dedicated system | 1 point | 0 points |
| Ability to pay court fees electronically through a dedicated platform or online banking | 1 point | 0 points |
| Publication of judgements rendered by local courts to the general public in official gazettes, newspapers or on the internet | 1 point, 0.5 point if only judgements rendered at the appeal and supreme court level are made available to the general public | 0 points |
| **Panel D: Alternative Dispute Resolution** | | |
| Is domestic commercial arbitration governed by a consolidated law or consolidated chapter or section of the applicable code of civil procedure encompassing all its aspects | 0.5 point | 0 points |
| Are the commercial disputes other than those that deal with public order or public policy that cannot be submitted to arbitration? | 0.5 point | 0 points |
| Are valid arbitration clauses or agreements enforced by local courts in more than 50% of the cases | 0.5 point | 0 points |
| Are voluntary mediation, conciliation or both recognized ways of resolving commercial disputes | 0.5 point | 0 points |
| Are voluntary mediation, conciliation or both governed by a consolidated law or consolidated chapter or section of the applicable code of civil procedure encompassing all its aspects | 0.5 point | 0 points |
| Are there financial incentives for parties to attempt mediation or conciliation (such as refund of court filing fees) if it is successful? | 0.5 point | 0 points |
| **Quality of the Judicial Process** | 18 points | |

Source: World Bank (2016)

**Appendix A2: Administrative and Procedural Transaction Costs Across 32 Mexican States, 2006-2015**

**Figure A21:** Administrative Transaction Costs, 2006-2015

****

**Figure A22:** Procedural Transaction Costs, 2006-2015

****

**Appendix A3**: Robustness of Instrumental Variable Estimates to Alternative Drought Severity Measures

|  |
| --- |
|  |
|  |
|  |
|  |

1. The costs of exchange actually depend on the institutions of a country: its legal system, its political system, its social system, its educational system its culture and so on (Coase, 1998). [↑](#footnote-ref-1)
2. The administrative division in 1921 census is the same as the current administrative division [↑](#footnote-ref-2)