

Income Taxation and State Capacities in Chile: measuring institutional development using historical earthquake data

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Abstract

I argue that higher levels of sectoral competition increased state-capacities overtime. The paper explains how the emergence of industrial elites posed credible threats to the landowning elites, pushing both groups to reach political agreements. I identify one such agreement, the income tax law. Borrowing from the fiscal sociology paradigm I explain how this institution was important for state-making. Exploiting the exogeneity of earthquake shocks, I leverage a novel hand-collected intertemporal dataset on Chilean earthquake death tolls and a Bayesian multilevel Poisson model to estimate levels of state capacities between 1900 and 2010. My identification strategy contends that the capacity of enforcing and monitoring building codes throughout the territory is a reflection of a state's overall capacities. What my empirical analyses show are twofolds. Death-tolls decrease, that is, state capacities increase, (1) when levels of sectoral contestation increase, and (2) once the income tax law is implemented. To explore the causal mechanisms at work more deeply I discuss the Chilean case.

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Latin Americanists have several theories to explain the causes and consequences of state capacities. Scholars also have countless alternatives to measure state capacities. However, there exists a huge deficit. Most state formation theories (just to name a few) are situated during precolonial,¹ early² or late³ independent Latin America. Yet, we lack of a measurement that corresponds *temporally* to the theories we have. While most explanations of state-making are *historical* in nature, in practice, available measurements capture *contemporary* levels of *stateness*. In this paper I try to bridge this gap by providing an additional explanation on the origins of state capacities in Latin America and a corresponding indicator able to capture levels of state capacities *overtime*. This paper then seeks to contribute to the state formation literature in general, both from a theoretical and methodological perspectives.

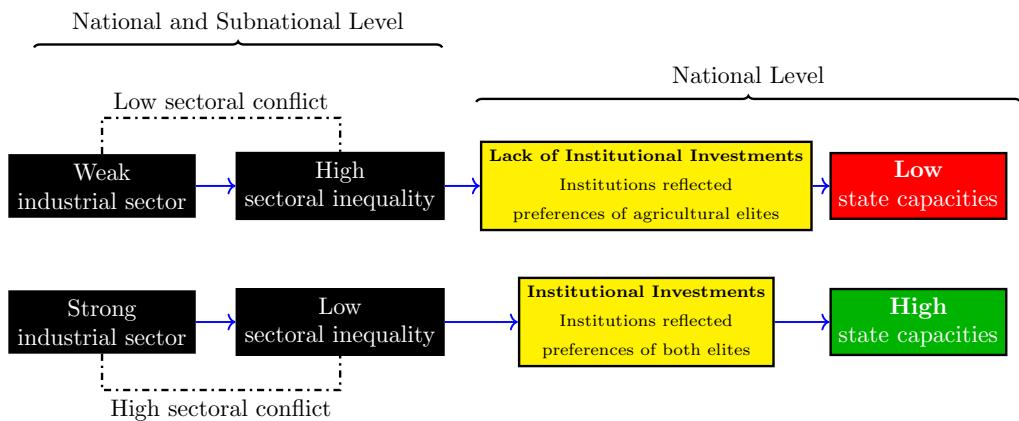


Figure 1: Causal Mechanism

I argue that higher levels of sectoral contestation characterized by the emergence of a strong industrial sector promoted state-capacities. Particularly, the paper explains how higher levels of sectoral contestation promoted the implementation of the income tax, an institution that - according to the fiscal sociology approach - produced positive externalities for state-making. Exploiting the exogeneity of earthquake shocks, I leverage a novel hand-collected dataset on Chilean earthquake death tolls between 1900 and 2010. In conjunction with Bayesian multilevel Poisson models with year fixed-effects I am able to estimate Chilean state capacities overtime. I find that death-tolls decreased (*state capacities increased*) when (1) levels of national/subnational sectoral contestation were high, and (2) after the income tax law was implemented.

Under reasonable assumptions, the capacity the state has of enforcing and monitoring building codes throughout the territory is a *reflection* of Chile's *overall* state capacities. Earthquakes are

¹Mahoney [2010].

²See Kurtz [2013] and Soifer [2015].

³Bahamonde [2017b].

time-invariant, and importantly, orthogonal to economic development and regime type. Consequently, death-toll differentials should be associated with state-capacities only. The proposed measurement goes in line with other attempts to capture state capacities overtime. While most strategies have focused on the capacity to enforce private contracts,⁴ unfortunately, these measurements correlate strongly with property rights protection, distorting the resemblance between concept and measurement.

The theory incorporates important subnational dynamics as well. The ability of the central level of enforcing these (and other) institutions depends on whether subnational elites are willing to cooperate with the central level. The paper contends that industrial elites challenged agricultural elites, moving forward investments in state-*making* institutions - the income tax law.⁵ The tax did not only increased national revenues, but also helped to form bureaucratic structures at the subnational level. As the Chilean case illustrates, industrial elites were willing to impose a national income tax on themselves in exchange of public goods delivered at the subnational level, and incorporation into the national project. Compliance depended on sustained national-subnational coordination, boosting state centralization.

The rest of the paper proceeds as follows. In section I I explain the argument, paying special attention to how the implementation of the income tax expanded state-capacities. Second, in section II I illustrate the causal mechanisms at work, presenting some historical context about the Chilean case. In ?? I introduce the proposed measurement and explain how it maps onto state capacities. Then, in section IV, I present a number of econometric tests. In section V I provide final comments. In section VI (online appendix) I show some convergence diagnostics.

I. SECTORAL CONFLICT, COOPERATION, AND THE CASE OF THE INCOME TAX

The crux of the argument is that sectoral conflicts triggered state development. Analytically, the paper considers that the sectoral conflict approach offers also a theory of state consolidation. Particularly, elites whose assets are allocated in different sectors of the economy have different preferences over state centralization and direct taxation. Consequently, sectoral economic expansion not only (re)shaped the economic landscape; given that both sectors had their corresponding political arms, the *political* conflict over state centralization was rooted in a broader *economic* conflict.⁶ This line of argumentation goes in line with others, in that “state formation will be most likely to the degree that powerful individual actors form two groups on the basis of divergent economic and

⁴See for an example Besley and Persson [2010, 1].

⁵Besley et al. [2013, 208] also consider implementing the income tax a strong sign of fiscal capacities, including Chile.

⁶See Ansell and Samuels [2014].

political interests.”⁷

The capacity of enforcing and monitoring building codes depends on both *national* and *subnational* sources of cooperation, and hence, state incorporation. O'Donnell [1993, 1359] famously distinguished different levels of state penetration *in the same country*. The subnational approach goes in line with Snyder [2001, 103], Ziblatt [2008, 286] and particularly, Soifer [2008]. Following these important contributions, I implement an identification strategy that not only accounts for temporal but also for geographical - i.e. subnational - sources of sectoral contestation and state-capacities. Importantly, this paper then advances “a small literature on within-country variation in state capacity.”⁸ Substantively, the paper claims that higher levels of subnational sectoral contestation translated into more credible threats coming from the provinces. Should these subnational sources of contestation *not* be translated into sectoral agreements, the country risked being torn apart, or alternatively, see the emergence of local *caudillos* or other regional ‘bosses.’ For example, historian Barros [1970, 500] explains that before the civil war, *salitreras* (nitrate towns) in northern Chile were locally so important that they were considered ‘a state within the state.’⁹ Local bosses had to approve on whether public employees could be fired, whether public works could be developed, and on whether politicians could give public speeches. Moreover, they coined their own currency and had their own particular local laws. The paper sketches a theory that explains how these national-subnational tensions fostered institutional investments that promoted state capacities overtime.

Elite incorporation was possible contingent on the capacity outsiders had of challenging the institutional order that permitted hegemonic groups to rule without opposition. The landed Latin American elites were an economic hegemonic group protected by norms and institutions originated during colonial times. By extension, the landowning class controlled most of the politics too.¹⁰ However, when the *structural transformation* (that is, the “secular decline of agriculture and substantial expansion of manufacturing”)¹¹ took place, this process imposed tight constraints on the way politics was run by the incumbent landowning class.¹² Given the initial advantage of the landed elites, the secular emergence of the industrial sector translated into lower levels of inter-sectoral inequality, generating political, economic and military threats to the landed elites.¹³ The higher the threats, the more likely the inter-sectoral compromises (yellow box in [Figure 1](#)). One particular

⁷Hechter and Brustein [1980, 1085]. Unlike Besley et al. [2013, 206], I find that conflict ('political frictions') is not 'exogenous,' but rather endogenous to the implementation of the tax itself.

⁸Acemoglu et al. [2015, 2368]. See for an exception Foa and Nemirovskaya [2016].

⁹My translation.

¹⁰See for the Chilean case Zeitlin [1984, 13], Bauer [2008, 45], Baland and Robinson [2008, 1748] and Best [1976, 56], Rippy [1971], Marichal [1989].

¹¹Johnston and Mellor [1961, 567].

¹²Bahamonde [2017b].

¹³Boix [2015]. For example, elites could use a faction of the existing army or hire private militias.

compromise is identified - the implementation of the income tax - and especial attention is paid to how this institution expanded state-capacities overtime.

Since state centralization affects landowners and industrialists in different ways, both sectors have different preferences towards taxation and state centralization.¹⁴ On the one hand, land fixity increases the risk premium of the landed elite's main asset,¹⁵ so they systematically resist taxation. In turn, as capital can be reinvested in nontaxable sectors,¹⁶ industrialists' preferences toward taxation are more elastic. These cross-sectoral tensions are most likely to resolve in favor of inter-sectoral cooperation - particularly, implementing the income tax law - when income inequality among the elites is low.¹⁷ In Latin America, the post-colonial institutional and economical orders were designed to give an unfair advantage to the agricultural sector.¹⁸ However, the emergence of a strong industrial class put heavier pressures for higher levels of state centralization and investment in public goods at the local level. I find elsewhere that the emergence of the industrial sector *accelerated* the implementation of the income tax in a number of Latin American states.¹⁹ In fact, not only sustained industrial expansion depended on the implementation of the income tax. Beramendi et al. [2016, 18] explain that as industrialists depended more on infrastructure implemented at the local level such as roads, railroads and bridges, they “[preferred] to shoulder a higher tax burden through progressive direct taxation.” But also, lower levels of inter-elite economic inequality implied similar degrees of military capabilities.²⁰ Under these circumstances, war was most likely to exhaust all existent assets without producing positive outcomes for either sector,²¹ putting heavier pressures to reach agreements instead of engaging in armed conflicts.

The tax was not only important because of the new revenue it collected, however. While Humud (1969, p. 154) explains that the income tax generated considerable resources for the Chilean treasury,²² following the fiscal sociology paradigm, the tax was important for state-making as well. Musgrave [1992, 99] argues that since taxation (especially on incomes) requires such a high degree of state penetration, public finances offer the key for a theory of state-building. Indirect taxes are easier to levy, and hence this kind of revenue is generally considered “unearned income”²³ or “easy-to-collect source of revenues.”²⁴ Given the relatively lower costs states have to incur to collect

¹⁴See Acemoglu and Robinson [2009, 289] and Best [1976, 50].

¹⁵Robinson [2006, 512].

¹⁶Hirschman [1970]. See Ronald Rogowski in Drake and McCubbins [1998, ch. 4]. However, see Bates and Lien [1985, 15].

¹⁷Tani [1966, 157] explains that the absence of “wealth groups” makes passing an income tax law easier.

¹⁸Bahamonde [2017a].

¹⁹Bahamonde [2017b].

²⁰Boix [2015].

²¹Richard Salvucci in Uribe-Uran [2001, 48].

²²Bowman and Wallerstein [1982, 451-452].

²³Moore [2004b, 304].

²⁴Coatsworth and Williamson [2002, 10].

them, indirect taxes have a very low impact on state-building.²⁵ For example Krasner [1985, 46] explains that “tariffs and export taxes are easier to obtain than direct taxes, which require high levels of bureaucratic skill and voluntary compliance.” In fact, when early Latin American states depended heavily on trade taxes, the state apparatus tended to be less developed.²⁶ Since customs administrations have always been concentrated in a few critical locations, especially ports, tariffs and customs duties did not require an elaborate fiscal structure.²⁷

The very implementation of the income tax produced a secular accumulation of know-how, particularly, of better technologies able to monitor individual incomes. Unlike ‘regular’ institutions, income taxation infiltrates the state’s coercive sovereignty unto the individual itself. Not only observing individual economies, but transforming them into public property is what fostered state expansion.²⁸ This argument goes in line with Besley et al. [2013] who explain that implementing the income tax law is “associated with investments in public administrative structures that support tax collection” in a number of countries, including Chile. I contend that the knowledge and expertise the state accumulated were transferred to other state institutions via spillovers, augmenting the overall levels of *stateness*. For instance, it was necessary to send official emissaries to check on accounting books of the refinery in the north, the winery in the central valley and the *hacienda* in the south. Eventually, these delegations became more complex, increasing the density of state presence in the territory. For instance, Strayer [2005] explains how official state delegations traveled the territory dispensing judicial decisions, fostering state centralization. Also, Dincecco [2015] explains that states became effective organisms upon centralizing a system of direct taxation and implementing some kind of checks-and-balances system. As I explain in section II, the Chilean case met these two conditions. Others find that the *introduction* of the income tax is associated with state expansion too. For instance, Dincecco and Troiano [2015, 3] find “a positive and significant relationship between the introduction of the income tax and (1) per capita total expenditures, (2) per capita education expenditures, and (3) per capita health expenditures.” Analytically, the *effectiveness* of income taxation on fiscal *capacities* increased due to the nature of the implementation of the income tax. Aghion et al. [2004, 566] explain how optimal institutional choices result from political settings where all involved actors “had a voice in the choice of institutions,” essentially contributing to an equilibrium of quasi-voluntary compliance.²⁹ In line with this literature, I find in section II that *both* elites agreed on imposing the tax on themselves.

²⁵Moore [2004a, 14].

²⁶Campbell [1993, 177].

²⁷Bertola and Ocampo [2012, 132].

²⁸Musgrave [1992, 98] and Moore [2004b, 298]. While Kurtz [2009, 2013], Soifer [2015] situate the relevant state-building critical juncture at the end of the colonial period, before the class compromises I identify in this paper, I argue that the implementation of the income tax was an important building block in this process.

²⁹Levi [1989].

Finally, income taxation not only triggered other state capacities. Via a process of assimilation, it also helped constructing the figure of the *citizen* centered around the concept of the *taxpayer*. Regardless of an individual's race, religion, culture or any other kind of status, the state classifies its subjects according to their incomes and oblige them to pay, punishing whoever refuses to do so. From a sociological standpoint, this "generality makes taxation a crucial element in the development of the 'imagined community'³⁰ of the modern nation-state [...] Taxation enmeshes us in the web of generalized reciprocity that constitutes modern society."³¹

II. HISTORICAL BACKGROUND

Historians still debate whether agriculturalists and industrialists comprised two *different* elites. Some claim that this dualism is incorrect.³² They argue that since landowners also invested in industry,³³ there was a blurry class division between the mining, banking and agricultural sectors.³⁴ Perhaps the most cited reference regarding this issue is *Veliz* [1963, 231-247]. I contend that there are a series of stylized facts that strongly suggest that there was indeed a structural economic cleavage which led to the consolidation of two separate sectors. First of all, there were certain practices that mask the existence of a sectoral dualism. For example, it was common that industrialists invested in real state. However, in many instances they did so *just* to obtain credit. *Kirsch* [1977, 59] explains that "in a *rural society* land offered one of the best guarantees for loans [since] loans could not be secured by equipment, machinery, or inventory. Only real estate was acceptable collateral."³⁵ In fact, this practice shows how the credit system was oriented to give unfair advantage to the landed elites. Similarly, *Zeitlin* [1984, 174] finds 'the combined ownership of capital and landed property was a distinctive quality of *certain* [elites] actors,'³⁶ not something that was generalizable to *the* elites. There were also other instances where miners invested in banking. Yet, *Segall* [1953] argues that Chilean bankers, after the crisis of the mining sector around the 1870s, had acquired a number of mineral deposits given as collateral years before. Similarly, but for the Argentinean case, *Hora* [2002, 609] explains that 'the image of an entrepreneurial elite with assets *scattered throughout several spheres of investment* does not appear entirely correct.'³⁷ I contend that the nature of the main

³⁰*Anderson* [2006].

³¹Martin et al. (in *Martin et al.* [2009, 3]).

³²See for example *Mamalakis* [1976, 125].

³³*Kirsch* [1977, 57, 95] who cites *Bauer* [2008]. See also *Coatsworth and Williamson* [2002, 23] argue that "[t]he only landowners that mattered in 19th century Latin American politics were those for whom land represented but one asset in a much broader portfolio." In the same vein, *Bauer* [2008, 180] argues that "[m]iners and merchants bought haciendas but landowners in turn invested in banks, insurance companies, commercial firms and the incipient industrial sector."

³⁴*Bauer* [2008, 30, 44, 94, 108].

³⁵Emphases are mine.

³⁶Emphasis is mine.

³⁷Emphasis is mine.

factors of production of agriculturalists and industrialists (land v. capital), in addition to their preferences over fiscal policy, produced a strong sectoral cleavage. In fact, borrowing from the Lewis model of economic growth, I explain elsewhere that the agricultural sector's role in the economy is to supply labor to the industrial sector, limiting agriculture's expansion relative to industry's growth,³⁸ evidencing the lack of incentives of crossed investments.

In all Latin American economies during and after the colonial period, agriculture was the most important sector.³⁹ Thus, by extension, agricultural political elites were the most powerful group.⁴⁰ Collier and Collier [2002, 106] explain that the “national government was dominated by the central part of the country, with owners of large agricultural holdings playing a predominant role.”⁴¹ There existed an important asymmetry, however. While both the agricultural and industrial sectors were growing at the same pace (see Figure 2, top panel), the latter were kept from participating in politics under fair conditions.⁴² Initially, this asymmetry led these two ‘antagonistic elites’⁴³ to two bloody civil wars. Zeitlin [1984, 23] argues that the civil wars challenged a “large landed property [elite against a] productive capital[ist] [elite].” Due to low levels of inequality (and similar military capacities) war was not sustainable overtime. For instance, while *Balmacedistas* managed to secure the support of the army, *congresistas* (the anti-Balmaceda group) gathered support from the navy. Similarly, in the subsequent years of the civil war, there were a number of *aborted* coups in 1907, 1912, 1915 and 1919,⁴⁴ suggesting an equilibrium where no elite was the leading elite. In 1924, industrial elites accepted to be income taxed by agriculturalist incumbents in exchange of having more *state services* and being included in state politics. As others have explained, the non-agricultural sector “accepted taxation, while demanding state services and expecting to influence how tax revenues were spent [...] Consultation and cooperation were relatively institutionalised between the two sides.”⁴⁵ As explained above, income taxation not only increased the treasuries' budget. Importantly, these sectoral compromises increased the complexity of the state, expanding its dominion beyond Santiago. Also, it allowed previously-excluded (industrial) elites to influence on public spendings. *Did sectoral contestation increase state capacities? Did implementing the income tax increase state capacities overtime?*

³⁸Bahamonde [2017a].

³⁹Keller [1931, 13].

⁴⁰Wright [1975, 45-46].

⁴¹Similarly, McBride [1936, 15] explains that “Chile’s people live on the soil. Her life is agricultural to the core. *Her government has always been of farm owners. Her Congress is made up chiefly of rich landlords.* Social life is dominated by families whose proudest possession is the ancestral estate.” Emphases are mine.

⁴²For instance, Bahamonde [2017b] explains that President Balmaceda’s agenda on “industrial” infrastructure (mainly roads and railroads) benefited mostly agricultural areas, and that his attitude towards the banking sector (closely linked to the mining sector) was mostly confiscatory. See especially Zeitlin [1984].

⁴³Keller [1931, 37-38].

⁴⁴Collier and Collier [2002, 109].

⁴⁵Carmenza Gallo, in Brautigam et al. [2008, 165]. Emphases are mine.

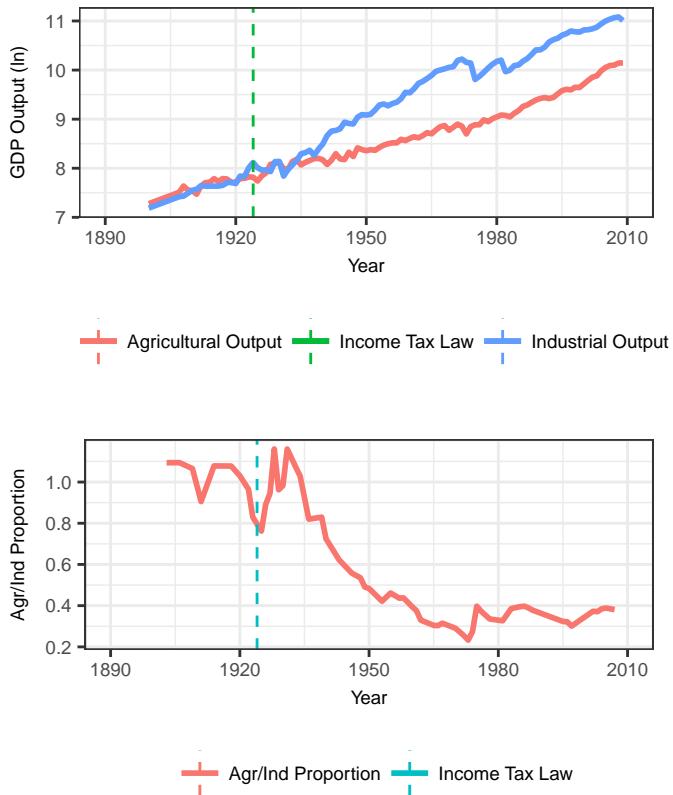


Figure 2: Industrial and Agricultural Outputs, and The Passage of the Income Tax Law in Chile

do so.”⁵⁶

This paper identifies a third limitation. Beyond conceptual and analytical problems, most available measurements are unable to capture temporal sources of variation of state capacities. Since most explanations of state-making have a strong historical component, the lack of an indicator able to ‘travel in time’ represents a huge deficit in the literature. Just to name a few examples, Soifer [2012, 585] “builds a new measure of state capacity for [...] contemporary Latin America [combining] multiple dimensions (extraction, security, and the administration of basic services).” Kurtz and Schrank [2012, 618–619] propose an experimental design based on list-experiments to study (in an unbiased way) bureaucrat’s opinions, while Soifer and Luna [2016] employ a survey-based design to measure subnational state capacities. While these measurements overcome the conceptual and analytical problems mentioned above, they do not help us studying state capacities in a historical setup. Economic historians and other students of political development offer other alternatives.

⁵⁶Kiser and Tong [1992, 301].

Some examples are levels of investments in public goods like infrastructure, roads,⁵⁷ electrification (measured as light intensity per pixel),⁵⁸ and railroads.⁵⁹ However, many of these measurement are debatable. For instance, Soifer [2012, 593] explains that “railroads were often constructed by private actors.”⁶⁰ The same problem applies to other types of infrastructures. There are others more appropriated strategies such as the opening of postal offices,⁶¹ the administration of national censuses⁶² and vaccination.⁶³ While these measurements do capture historical variations of state capacities, some other problems arise. Censuses for example provide a *non-continuous temporal measurement* of state capacities. For instance, censuses are applied in Chile every ten years. Having just a few snapshots of state-capacity should compromise any statistical analysis. In turn, vaccines are usually targeted to primary and high school students. In practice, vaccines are administered by the schools themselves, both public and private. Private schools might be more efficient in doing so, inflating the *average* level of state-capacity.

To solve some of these limitations, the paper proposes considering earthquake death tolls as an alternative to measure state capacities overtime. Unlike censuses - *unfortunately* - earthquakes happen very often. While “[e]arthquakes alone claim thousands of lives a year,”⁶⁴ they are not well studied in the discipline.⁶⁵ Building on Mann [1984, 113], the proposed measurement intends to capture the state’s ‘infrastructural’ power.⁶⁶ “Natural hazards can be seen as a function of a specific natural process and human [...] activity.”⁶⁷ Given that earthquakes happen at random and are exogenous to the affected locality,⁶⁸ the only part that is left unexplained is the systematic human component, which is what the proposed measurement captures. Earthquakes are orthogonal to levels of state capacity and economic development.⁶⁹ Thus, keeping earthquake magnitudes constant at their means, (population-weighted) death counts should be attributed to the (*in*)capacity of the

⁵⁷See for example Mann [1984, 2008], Acemoglu [2005], Saylor [2012], Thies [2009], Besley and Persson [2010].

⁵⁸Huntington and Wibbels [2014].

⁵⁹Saylor [2012, 302] and Coatsworth [1974].

⁶⁰Footnote #11.

⁶¹See for example Acemoglu et al. [2016].

⁶²See for example Soifer [2013] and Centeno [2002]. This technique is borrowed from demographers. It compares the age structure (incorrectly) captured in the census with an assumed ‘correct’ theoretical age distribution. Low-capacity states should inaccurately round ages or inflate certain intervals, producing error. The error is usually computed using the Whipple’s index which serves as a proxy for state capacities.

⁶³Soifer [2012].

⁶⁴Anbarci et al. [2005, 1908].

⁶⁵Brancati [2007, 719] explains that “[d]isasters are not as well studied [...] in the field of political science.”

⁶⁶He defines infrastructural power as “the capacity of the state [to] actually [...] penetrate civil society, and to implement logically political decisions throughout the realm.”

⁶⁷Raschky [2008, 627].

⁶⁸Brancati [2007, 728] explains that “earthquakes constitute a natural experiment.” Gignoux and Menéndez [2016, 27] also point out “that the occurrence of earthquakes can be viewed as random [allowing the analyses of] these events as a set of repeated social experiments.” Caruso [2017, 32, unpublished] for instance “[exploits] the exogenous variation in the location and timing of natural disasters.”

⁶⁹Kahn [2005, 271] and Brancati [2007].

states to invest in preparedness and earthquake-mitigation institutions.⁷⁰ I focus on earthquakes and not on other natural disasters such as ‘extreme temperature events, floods, landslides, and windstorms’⁷¹ because earthquakes cannot be foreseen, and such, they put to a test the capacity of the states of having their preventive institutions *already* in place and in good shape.⁷² State capacities consist of sustained *proactive* efforts of enforcing institutions in the territory, and hence short-term *reactive* actions should *not* be considered state-making.

Under reasonable assumptions, the capacity states have of deploying inspectors to enforce quake-sensitive zoning and building codes should be a reflection of the overall levels of state capacity. Since “[e]arthquake-resistant construction depends on responsible governance,”⁷³ state capacities act as a scope condition, particularly, undermining (or facilitating) the implementation of these norms. For example, *Bilham* [2013, 169] explains that “although engineering codes may *exist* [,] mechanisms to *implement* these codes are largely unavailable”⁷⁴ in low-capacity states. For example, *Anbarci et al.* [2005, 1910] explain that “while Iran has building codes [...] comparable to those existing in the United States, they tend to be enforced only in the country’s larger cities,” failing to monitor the countryside, which was where most casualties occurred in the 6.4 earthquake in Changureh in 2002.⁷⁵ Importantly, the proposed measurement bridges this gap by incorporating and modeling the capacity of enforcing these codes at the subnational level.

Only high-capacity states overcome their own limitations, not only implementing but also enforcing quake-sensitive regulations. The Chilean government started its efforts to ameliorate the impact of earthquakes after the great quake of 1928 in Talca. A first effort happened in 1929 when *Ley number 4563* was implemented. The law was among the first attempts to prohibit “construction, reconstruction or any other repairing or transformations [...] without a permit from the authorities.” Importantly, the law required that all blueprints had to be signed by an expert before the construction started. By 1930, *Decreto number 4882* was adopted, but this time the rule made a number of technical prescriptions,⁷⁶ determining what kinds of construction materials ought to be used, among other requirements. Critically, while the central government had retained

⁷⁰To make sure, while “earthquakes may not be preventable, it is possible to prevent the disasters they cause” (*Escaleras et al.* [2007, 209]). Similarly, *Anbarci et al.* [2005, 1911] explain that “the potentially devastating effects of major earthquakes are, if not preventable, at least subject to significant mitigation.” For a similar approach, see *Noji* [1996, 130].

⁷¹*Kahn* [2005, 280].

⁷²In fact, *Brancati* [2007, 716] explains that “[e]arthquakes may provoke conflict more than any other type of natural disaster *because* they have rapid onsets [and] are not predictable.” Emphasis is mine.

⁷³*Ambraseys and Bilham* [2011, 153]. Similarly, *Raschky* [2008, 628] argue that “the effects of natural hazards [do] not solely depend on a region’s topographic or climatic exposure to natural processes [...] but [on] the region’s *institutional* vulnerability.” Emphasis is mine.

⁷⁴Emphases are mine.

⁷⁵Similarly, *Bardhan* [2016, 865] explains that “unlike in the case of some macroeconomic policies, [...] the effectiveness of the state varies enormously across localities and administrative levels within the same country.”

⁷⁶See especially article 151.

the control of the supervision of the code since the promulgation of the *ley*, the *decreto* explicitly created the figure of the *inspector* to supervise, enforce and monitor these measures at the local level. Furthermore, *artículo* 414 of the Chilean *Decreto* 4882 granted *inspectores* ‘free access to the building’ at any time during the construction process. The proposed measurement picks up whether these good intentions written in paper actually scored lower death tolls.

Earthquake damage poses a major threat to commerce, official and residential buildings, potentially triggering higher levels of looting and social unrest. Consequently, enforcing quake-sensitive building codes also embodies the most basic form of social contract that exists between the state and its subjects. Any kind of political leader should be interested in preventing looting and social unrest. Leaders not only care about their survival (*electoral or not*) but also about the legitimacy of ‘the state.’ In the event of heavy social unrest, not only the essential social Hobbesian-like contract is broken but also the expectations for social peace are questioned.⁷⁷ The physical presence of the state literally *crumbles* when institutions of social coercion and discipline such as state schools, prisons and police stations, collapse. For example, when the 7.0 earthquake hit Hati in 2010, the *Prison Civile de Port-au-Prince* had a population of 4,500 inmates. During the quake, five inmates died. As a prison guard describes it, *everyone escaped. Everyone. Except the dead.* This natural disaster exacerbated the already existent chaos, freeing “gang bosses, kidnappers, gunmen,” among others,⁷⁸ reducing the legitimacy of the state to zero.

The proposed measurement has a number of advantages. Unlike non-experimental survey-based or purely policy-based measures, earthquake death tolls are an *objective* measurement of earthquake preparedness,⁷⁹ an activity that *any* state *must* perform.⁸⁰ Importantly, Soifer [2008, 235-236] divides the state infrastructural power in three layers, ‘national capabilities’,⁸¹ the ‘weight of the state’⁸² and a ‘subnational’ component which tracks “the ability of the state to exercise control within its territory.” The proposed measurement strategy maps well in all three components.

The measurement has a number of drawbacks, however. Obviously, the country needs to have earthquakes, possibly limiting the number of potential cases. However, most “earthquakes occur at the various borders of the Pacific plate, the Western border of the Latin American plate, and

⁷⁷Carlin et al. [2014, 419] study how earthquakes damage interpersonal trust. They argue that “state capacity plays a decisive role in determining natural disasters’ consequences for social capital.”

⁷⁸Reed [2011]. See also Laursen [2010].

⁷⁹That is, “it does not rely on an effort to measure the beliefs of citizens about the nature of the state, the legitimacy of its leaders or the institutional procedures that selected them, or even perceptions of the efficiency of public bureaucracies” (Kurtz and Schrank [2012, 616]).

⁸⁰Kurtz [2013, 58] for example explains that “the best measures [of state capacities] would be of the sorts of activities that all (or nearly all) states consider to be of primary importance.” Similarly, Carlin et al. [2014, 422] explain that “a basket of ‘minimal’ state functions [typically includes] primary education, public health, rule of law, public finance management, and disaster relief.”

⁸¹This layer ‘sees state infrastructural power as a characteristic of the central state’.

⁸²This relates to ‘how the exercise of state power shapes the society it controls.’

the boundaries between the African, the Arabic and the Indian plates and the Eurasian plate,” allowing potential cross-country comparisons within most of the developing world.⁸³ Moreover, there are countries, like India or the United States, where earthquakes happen in certain regions only. Presumably, mitigation policies in these places would need to be targeted to specific areas, possibly undermining the assumption that these kinds of policies should penetrate the ‘entire’ territory.⁸⁴ Another potential concern is that the ability of counting the death-toll might be a function of state capacities itself.⁸⁵ However, in most cases, civic organizations, the Catholic Church, and particularly, the press (national and local) have been the main entities who (willingly or not) have carried out the task of enumerating the deaths. Another potential issue is the measurement of the magnitudes. Before the instrumental period, magnitudes were obtained in an estimative way. And while there are methods to approximate historically-felt magnitudes to instrumental-like intensities,⁸⁶ this strategy unfortunately adds more than one layer of complexity. All in all, this measurement offers a rough approximation of levels of state capacities overtime.

IV. MULTILEVEL ANALYSES

I constructed a hand-collected novel dataset using the *Significant Earthquake Database* compiled by the National Centers for Environmental Information (NOAA) as a starting point.⁸⁷ The dataset ‘contains information on destructive earthquakes from 2150 B.C. to the present,’ and records the number of deaths,⁸⁸ the magnitude, date, the latitude and longitude of every quake, among other variables. Using archival census data from 1907 to 2012,⁸⁹ I complemented the NOAA dataset with local population at the municipal level where the quake hit. I use local population to weight the death toll.⁹⁰ Using archival census data as well, I considered the main economic activity of

⁸³Keefer et al. [2011, 1534]. From a population size perspective, this measurement is also convenient. A “quarter of the world’s population inhabits [...] the northern edge of the Arabian and Indian Plates that are colliding with the southern margin of the Eurasian Plate” (Billham and Gaur [2013, 618]). Other measurements are also context-specific. For example, Soifer [2012, 593] proposes a measurement of administrative capacities focusing on how states are able to enforce voter registration ‘where voting is mandatory.’

⁸⁴Dunbar et al. [2003, 164] explains that the Indian state implements targeted policies (that might not necessarily correspond to the administrative areas) based on isoseismal maps that define different zones of seismic hazard.

⁸⁵I thank Paul Poast for this comment.

⁸⁶Szeliga et al. [2010].

⁸⁷ [NGDC/WDS].

⁸⁸Importantly, the NOAA distinguishes earthquake deaths from total deaths (which includes tsunami casualties). I use the former.

⁸⁹Particularly, censuses of 1907, 1920, 1930, 1940, 1952, 1960, 1970, 1982, 1992, 2002 and 2012. Some of them were kept at the *Biblioteca Nacional* and others at the *National Statistic Institute* historical library.

⁹⁰While in most occasions I was able to recover the actual local population, in some instances that was not possible. In these cases, I recovered the population of the most concentrated area nearby. Consequently, I adopted a more general approach and used population as a control, not as a variable to construct a dependent variable in proportion-like form.

the affected municipality,⁹¹ and also whether the municipality was urban or rural.⁹² The death tolls and magnitudes proportionated by the NOAA dataset were contrasted case by case with historical press archival information.⁹³ Magnitudes in particular were also compared with the International Seismological Centre. All these are subnational-level variables. Next, I included national-level indicators that aim to proxy levels of sectoral conflict. Following Bahamonde [2017b,a] I measured the degree in which the industrial elites challenged incumbent landowners by calculating the proportion of agricultural growth relative to industrial growth as presented in the MOxLAD data (see Figure 2, bottom panel).⁹⁴ According to Astorga et al. [2005, 790], these data provide extended comparable sectoral value-added series in constant purchasing power parity prices. Even when pre-1900 earthquakes are recorded in both the NOAA data and my own dataset (Figure 3), the economic data provided by MOxLAD limits the scope of this paper from 1903 to 2007 (Figure 2).

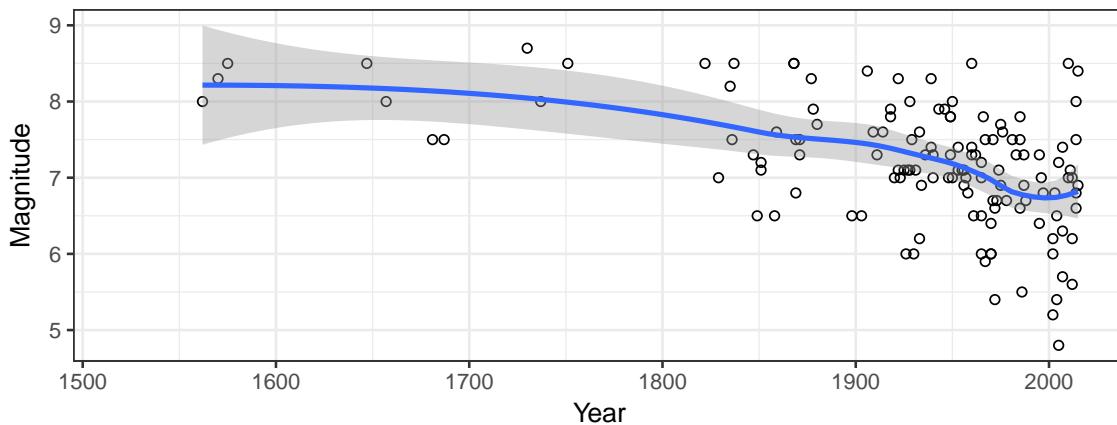


Figure 3: Earthquakes in Chile: 1500-2010

Figure 3 plots the earthquakes, the years and the magnitudes, while Figure 4 plots the geographical distribution and magnitudes of the quakes.⁹⁵ Both figures suggest that Chile is a good case to study infrastructural state-capacities using the proposed earthquake framework since it has considerable variance regarding quake magnitudes and locations. The northern part of Chile has historically

⁹¹Agriculture (n=27), Industry (n=51), Mixed (n=13).

⁹²Urban=74, rural=17. If more than 50% of the population lives in an urban setting, I assigned a 1 to that municipality, 0 otherwise. Urban concentrations are most likely to have vertical constructions rather than one-story buildings, increasing the potential number of casualties. Consequently, it is important to control for this source of variation. I thank Daniel Kelemen for this suggestion.

⁹³*El Mercurio* and *La Nación* newspapers, both kept at the Archivo of the Biblioteca Nacional de Chile.

⁹⁴These data build on the studies and statistical abstracts of the Economic Commission for Latin America, but also rely on Mitchell's International Historical Statistics, International Monetary Fund's International Financial Statistics, the World Bank's World Development Indicators and a variety of national sources." I used the *agriculture value-added* and *manufacturing value-added* variables. The former measures "the output of the sector net of intermediate inputs and includes the cultivation of crops, livestock production, hunting, forestry and fishing." The later "[r]eports the output of the sector net of intermediate inputs." Both of them are expressed in local currency at 1970 constant prices.

⁹⁵For illustrative purposes, both plots consider the full sample starting in 1520 and ending in 2015.

been an industrial region, while the southern part of Chile has traditionally been an agricultural region. Relatedly, both regions vary according to their climate. Also, distance from Santiago, which is located near latitude 33° , might impose some degree of difficulty for the central government to reach out the farthest northern/southern parts of the territory.⁹⁶ There is also variance considering longitude. Closeness to the Andean mountains (around longitude 70°) determines the ruggedness of the terrain, presumably making it harder for the state to penetrate these areas.⁹⁷ All considered, earthquakes have affected the territory from coast to mountain,⁹⁸ solving potential concerns about geographical sectoral self-selection.

The unit of analysis is the earthquake.⁹⁹ As an event, each earthquake has associated to it a death toll, a subnational location (latitude and longitude), a magnitude, the main economic activity of the locality where the quake hit, a local population, and an urban/rural setting. All these factors are subnational. At the national level, I consider sectoral outputs (as a proportion), population and year. Specifically, using a Bayesian Poisson regression,¹⁰⁰ I test the effect of both national and subnational sources of sectoral contestation on death-tolls overtime. In a second model, I test the effect of implementing the income tax law on death-tolls overtime. In the first model the main variable of interest is the national proportion of agriculture output relative to national industrial output with different slopes for agricultural, industrial or mixed localities. In the second model, the main quantity of interest is a binary variable which denotes whether the income tax is implemented or not. Both models consider year fixed-effects to account for time-varying confounding factors and for unmeasured sources of variation.¹⁰¹ For instance, fiscal development is also a function of country-specific prior state-capacities. Additionally, technological changes (advances in construction, for example) should diminish death-tolls.¹⁰² Fixed-effects should be able to account for these and other unmeasured yearly factors such as the evolution of the political system, demographic, climate and cultural changes as well as economic shocks. I also included latitude to control for the proximity to the Andean mountains, aiming to control for a built-in tectonic earthquake predisposition. Longitude seeks to control for climate and other unmeasured conditions that make agricultural development

⁹⁶Foa and Nemirovskaya [2016, 418].

⁹⁷Moreover, Brancati [2007, 729] explains that “[e]arthquakes often occur in mountainous areas.”

⁹⁸Since “most of the damage in major earthquakes occurs within 30 km of the epicenter,” (Dunbar et al. [2003, 172]) I don’t necessarily drop quakes that didn’t happen on land. While the epicenter might have happened a few miles away from the shore, the consequences certainly reached the land.

⁹⁹Kahn [2005, 273] also considers that “the unit of analysis is [the] disaster.”

¹⁰⁰Anbarci et al. [2005, 1907] use “a Negative Binomial estimation strategy with both random and fixed estimators” to estimate death tolls, Kahn [2005, 276] estimates a Zero Inflated Negative Binomial model, Brancati [2007, 729] uses “a negative binomial model with robust standard errors clustered by country,” and Escaleras et al. [2007] use “a Negative Binomial specification.” Yet, no study tests for over dispersion. I do not find evidence of over dispersion in my dataset, hence I employ a Poisson model.

¹⁰¹Brancati [2007, 729] also includes in his analyses “year-fixed effects to control for trends over time.”

¹⁰²I thank Hillel Soifer for this suggestion.

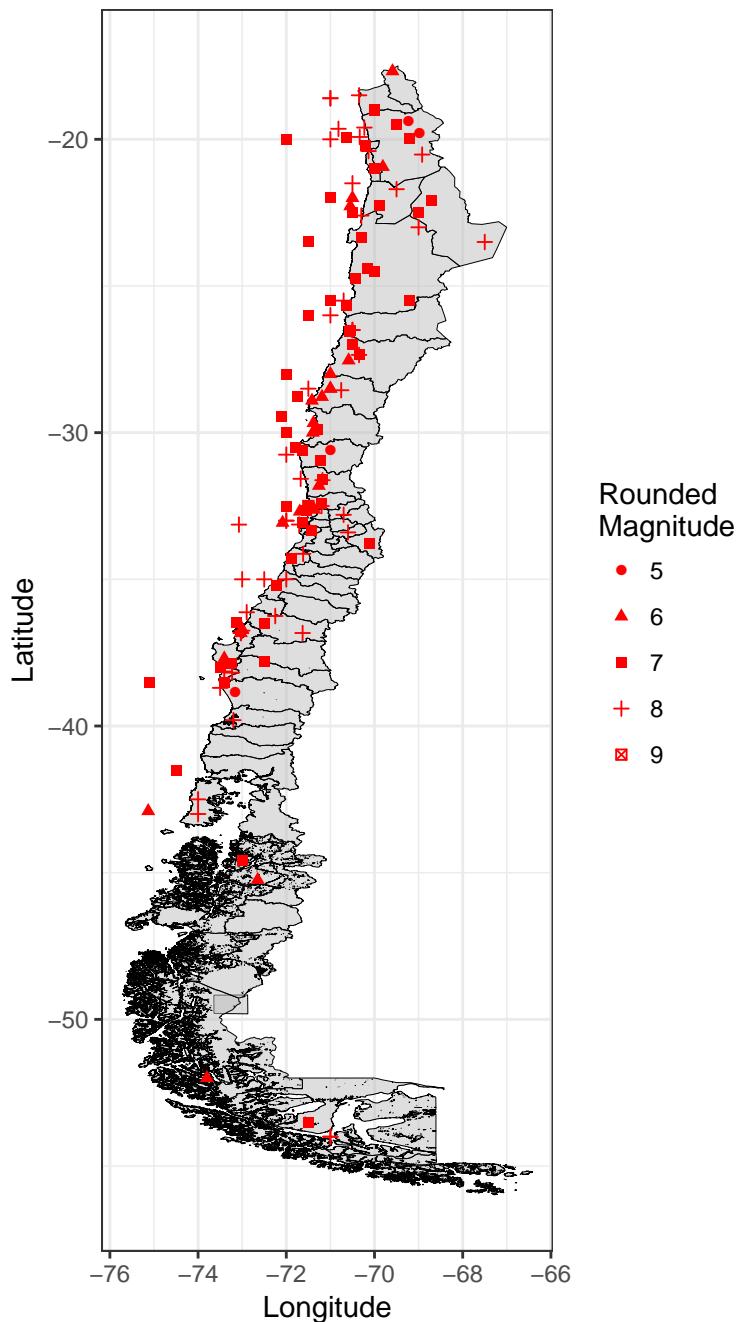


Figure 4: Geographical Distribution of Earthquakes in Chile 1500-2015

more difficult. In turn, both measurements serve as good proxies of terrain ruggedness and the difficulties the state faces in reaching these areas.¹⁰³ Finally, some areas should be wealthier than others. Increased wealth should allow private investment in earthquake proofing.¹⁰⁴ While data on subnational levels of income inequality is lacking, I model the effect of earthquake magnitudes on earthquake death-tolls by the type of *comuna* - industrial or agricultural - aiming to proxy subnational levels of income inequality.¹⁰⁵ More formally, I fit the next equation,

$$\text{Deaths} \sim \text{Poisson}(\lambda_i)$$

$$\begin{aligned} \log(\lambda_i) = & \mu + \beta_{1j} \text{Proportion}_i + \beta_{2j} \text{Magnitude}_i^2 + \beta_3 \text{Latitude}_i + \beta_4 \text{Longitude}_i + \\ & \beta_5 \text{Population}_i + \beta_6 \text{Urban}_i + \beta_7 \text{Year}_i \end{aligned} \quad (1)$$

where,

$$i_{1,\dots,I} \text{ and } I = 91$$

$$j_{1,\dots,J} \text{ and } J = 3$$

$$t_{1,\dots,T} \text{ and } T = 59;$$

the i subscript denotes the unit of analysis (i.e. earthquake),¹⁰⁶ the j index expresses the type of subnational economic composition of the affected municipality - agricultural, industrial, mixed - and the t subscripts denotes the year when earthquake i happened. Since earthquakes can happen more than once per year, $I > T$.¹⁰⁷ Finally, μ is the intercept.

I implement a multilevel setup to model the effect of national-subnational sources of sectoral contestation on state capacities overtime. Substantively, sectoral contestation is high in circumstances where the leading sector at the national level is *not* the same that leads the subnational level,

¹⁰³Undoubtedly, there are many more factors that might increase death tolls. [Ambraseys and Bilham \[2011, 154\]](#) for example explain that the “number of fatalities depends on whether an earthquake happens at night or during the day, in the winter or in the summer, in a mountainous region or in a valley, after strong and protracted fore-shocks and with or without warning.” While in my model some of these factors are accounted for, I do not have complete hourly data. However, [Lomnitz \[1970, 1309\]](#) explains that “some of the larger Chilean earthquakes which have caused deaths” between the 1900’s and the 1960’s have been afternoon quakes. See especially Table 1 in p. 1310. Other factors such as “the speed of tectonic movements [and] the degree to which the lower plate bends the upper plate” and the focal depth ([Keefer et al. \[2011, 1534\]](#)) could not be included due to the lack of complete data overtime.

¹⁰⁴I thank Hillel Soifer for this comment.

¹⁰⁵[Figure 2](#) (top panel) shows that for most years, the industrial sector contributed more to the economy, suggesting that industrial areas were wealthier than agricultural zones.

¹⁰⁶[Kahn \[2005, 278\]](#) follows the same strategy.

¹⁰⁷For the years in which there is just one earthquake, the ‘group’ variable has only one observation. This does not endangers the robustness of the model. [Gelman and Hill \[2006, 276\]](#) explain that it “is even acceptable to have one observation in many of the groups.”

suggesting an overall situation of sectoral indeterminacy. For instance, sectoral contestation is low when the agricultural sector leads both the national and subnational level. Econometrically, the multilevel component of [Equation 1](#) allows the slope of the national proportion of agriculture relative to industry (β_{1_j}) to vary by the j th dominant subnational economic sector. Due to space constraints, I exclude mixed subnational units from my theoretical analyses. Additionally, to rule out the possibility that sectors self-select into less earthquake-prone geographical locations, I modeled the effect of magnitudes considering different slopes too (β_{2_j}).¹⁰⁸ The results strongly suggest that there is not a self-selection mechanism in the data generating process.¹⁰⁹ Finally, the estimated parameters β_k have noninformative normally distributed priors,¹¹⁰ while precisions τ_p of β_{1_j} , β_{2_j} and β_{7_t} have noninformative Gamma priors.

More formally, I considered the following:

$$\beta_{k,\dots,K} \sim \mathcal{N}(0, 0.01) \text{ where } K = 8$$

$$\tau_{p,\dots,P} \sim \mathcal{G}(0.5, 0.001) \text{ where } P = 3.$$

Do higher levels of sectoral contestation translate into state development? [Table 1](#) shows the posterior predictive distributions of the multi-level Bayesian Poisson regression, particularly, the predicted death counts conditional on observed covariates. The main quantity of interest is β_{1_j} . The results strongly suggest that the average earthquake causes 13 *more* deaths when the average subnational locality is agricultural under circumstances where the main national economic sector is *also* agricultural. I contend that agricultural economic hegemony left the political order uncontested, reinforcing the advantaged position landowners had since colonial times. However, the same average earthquake causes 16 *less* casualties when the average subnational locality is industrial under circumstances where the main national economic sector is agricultural. In these contexts of inter-sectoral challenge, industrial political elites at the subnational level had more leverage to push for the implementation of the income tax, fostering state development in the long-run. To ease interpretation of these results, [Figure 5](#) shows that as the proportion of the agricultural sector increases, the death toll decreases by a 4-19 range when the average affected locality is industrial, but it increases by a 3-15 range when the average affected locality is *also* agricultural.

¹⁰⁸According to the NOAA, an “increase of one in magnitude represents a tenfold increase in the recorded wave amplitude.” Consequently the effect of this variable should not be linear. Consequently, both in [Equation 1](#) and [Equation 2](#) I consider the square term of magnitude.

¹⁰⁹Nearly-zero posteriors indicate that the three types of subnational localities are affected in the same way, and that casualties are independent of the subnational predominant sector.

¹¹⁰“Noninformative prior distributions are intended to allow Bayesian inference for parameters about which not much is known beyond the data included in the analysis at hand” ([Gelman \[2006, 520\]](#)).

	Mean	SD	Lower	Upper	Pr.
Agr/Ind [Agr]	12.68	7.21	3.73	22.65	0.98
Agr/Ind [Ind]	-16.26	5.30	-23.17	-9.62	1.00
Agr/Ind [Mixed]	-30.73	21.74	-63.78	-4.89	0.95
Magnitude [Agr]	0.04	0.02	0.01	0.06	0.95
Magnitude [Ind]	0.24	0.07	0.16	0.32	1.00
Magnitude [Mixed]	0.37	0.14	0.17	0.55	1.00
Latitude	-0.01	0.03	-0.05	0.02	0.69
Longitude	-0.16	0.14	-0.34	0.03	0.85
Population	-0.01	0.00	-0.02	-0.01	1.00
Urban	-1.54	2.01	-4.22	1.00	0.76

Note: 200000 iterations with a burn-in period of n = 5000 iterations discarded.

80% credible intervals (upper/lower bounds). All R-Hat statistics below critical levels.

Standard convergence diagnostics suggest good mixing and convergence.

Year fixed effects were omitted in the table.

A total of 4 chains were run. Detailed diagnostic plots available [here](#).

Table 1: *Sectoral Competition Model: Simulated Posterior Predictions (Poisson Regression)*

In sum, the overall results strongly suggest that the Chilean state was better able to enforce building codes when the main national economic sector did not rule the average subnational locality. I attribute these increments in subnational state-capacities to the incorporation of industrial elites into the same national project. Historical evidence suggests that the implementation of the income tax contributed towards the incorporation of industrial elites. Importantly for state-making, the tax reflected the preferences of both elites, fostering the implementation of stronger local bureaucracies and better monitoring technologies. Following the fiscal sociology paradigm, there were complementarities between income taxation and expanding/improving other state capacities. In sum, these results find empirical support for the *average* positive relationship between higher levels of sectoral contestation and higher levels of state-capacities. However, they do not tell us how these sectoral dynamics impacted state-capacities *overtime*, which is what I do next.

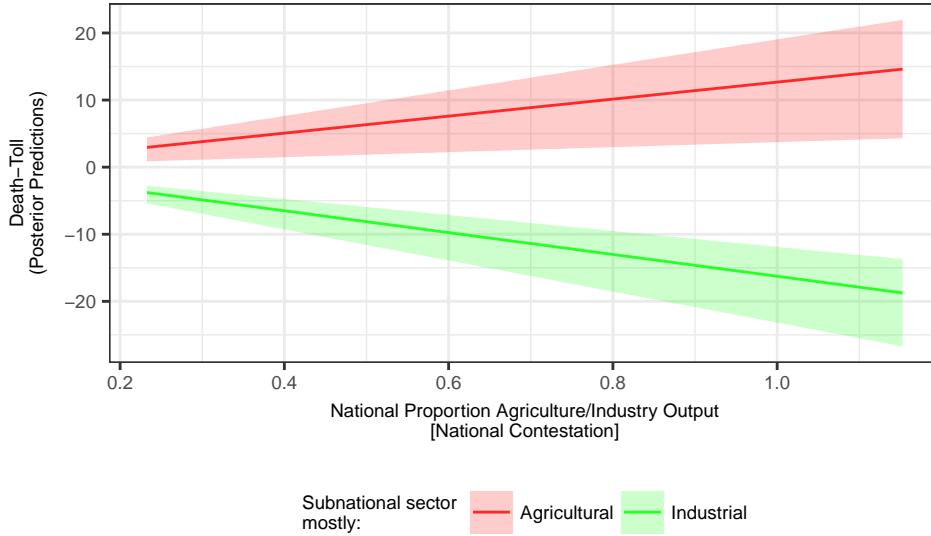


Figure 5: Death-Toll by National and Subnational Sources of Sectoral Contestation

Did taxation improve state capacities overtime? Following the same setup, I fit a simpler one-dimensional Poisson model. The only complexity kept were the year fixed-effects. The main difference is the inclusion of an indicator variable that denotes whether by year t the income tax is implemented, and whose estimated parameter (β_1) is the main quantity of interest.

More formally, I fitted the next equation:

$$\text{Deaths} \sim \text{Poisson}(\lambda_i)$$

$$\begin{aligned} \log(\lambda_i) = & \mu + \beta_1 \text{Income Tax}_i + \beta_2 \text{Magnitude}_i^2 + \beta_3 \text{Latitude}_i + \beta_4 \text{Longitude}_i + \\ & \beta_5 \text{Population}_i + \beta_6 \text{Urban}_i + \beta_7 \text{Year}_i \end{aligned} \quad (2)$$

Table 2 also shows posterior predictive distributions. The results show that implementing the income tax *decreases* the death-toll by an estimated average of 3. **Figure 6** shows the overtime effect, and how death-tolls (state capacities) *decrease* (increase) overtime. Before the income tax law was implemented, death-tolls were relatively stable, averaging 28 casualties approximately per earthquake. However, once the income tax law was implemented, the death-toll decreased from 28 to 22, approximately.

	Mean	SD	Lower	Upper	Pr.
Income Tax	-3.01	3.55	-7.55	1.41	0.81
Magnitude	0.06	0.01	0.04	0.07	1.00
Latitude	0.06	0.01	0.04	0.08	1.00
Longitude	-0.49	0.07	-0.58	-0.39	1.00
Population	-0.02	0.00	-0.02	-0.02	1.00
Urban	-5.22	0.73	-6.19	-4.35	1.00

Note: 200000 iterations with a burn-in period of n = 5000 iterations discarded.

80% credible intervals (upper/lower bounds). All R-Hat statistics below critical levels.

Standard convergence diagnostics suggest good mixing and convergence.

Year fixed effects were omitted in the table.

A total of 4 chains were run. Detailed diagnostic plots available [here](#).

Table 2: Income Tax Adoption Model: Simulated Posterior Predictions (Poisson Regression)

The fiscal sociology has longly claimed that the capacity of taxing individuals' incomes transfers to other state institutions, improving overall state-capacities. Here I find support for this claim. Historical evidence suggests that the treasury did increase the Chilean fiscal coffers after the implementation of the income tax law, suggesting a denser (and better) state presence at the local level. My analyses suggest that the act of *sending* bureaucrats to collect the income tax had positive externalities on other state activities. Here I identify one such activity, the enforcement of national quake-sensitive norms. The data analyses show (statistically) that, *ceteris paribus*, state capacities increase overtime after the implementation of the income tax law.

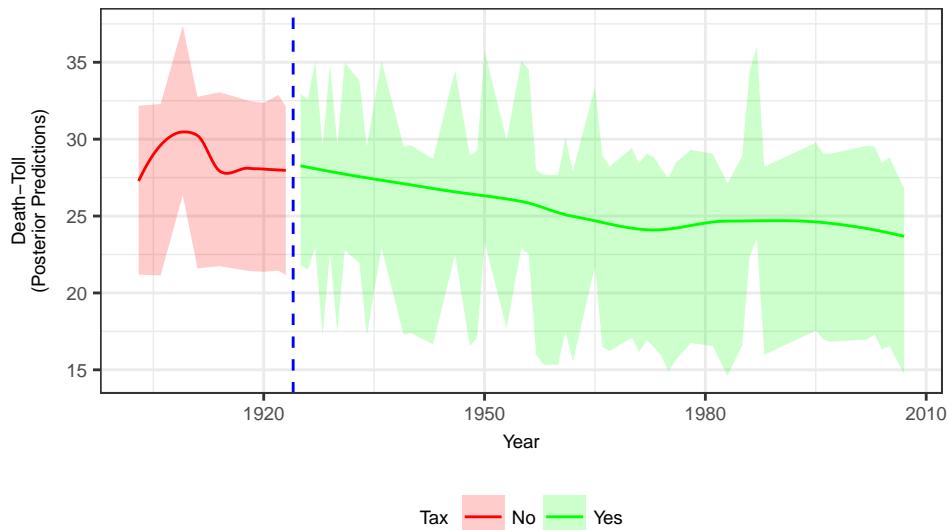


Figure 6: Death-Tolls Over Time: Before and After the Implementation of the Income Tax

V. FINAL COMMENTS

The crux of the argument was that higher levels of sectoral contestation increased state-capacities overtime. Specifically, I explained how the emergence of industrial elites lowered levels of inter-sectoral inequality, pushing agricultural and industrial elites to reach out agreements that materialized in investments in state-making institutions (income tax law), fostering higher levels of state-capacities overtime. My empirical analyses show the following. First, death-tolls decrease (state capacities increase) when levels of national/subnational sectoral contestation increase. Second, death-tolls decrease (state capacities increase) after the income tax law is implemented. This last finding finds support in favor of the idea that income taxation produces positive effects via spillovers on overall state capacities (fiscal sociology paradigm).

The causal mechanism focuses on how higher levels of sectoral contestation translated into more credible threats, advancing sectoral alliances at the national level. I identified one such compromise, the implementation of the income tax, and how this crucial institution for state-making included the preferences of both elites. Importantly, I explain how the industrial sector before these big compromises was excluded from participating in politics, and how industrial expansion required the implementation of the income tax law (to pay for local public goods). Analytically, these conditions were met once the emergence of the industrial elites posed credible-enough threats to the landowning incumbent elites. The paper also introduced a novel framework that leveraged the exogeneity of earthquake. Under reasonable assumptions, this approach is well-suited to capture how the Chilean state has been able to enforce a number of regulations that sought to norm the construction and infrastructure sectors.

VI. ONLINE APPENDIX

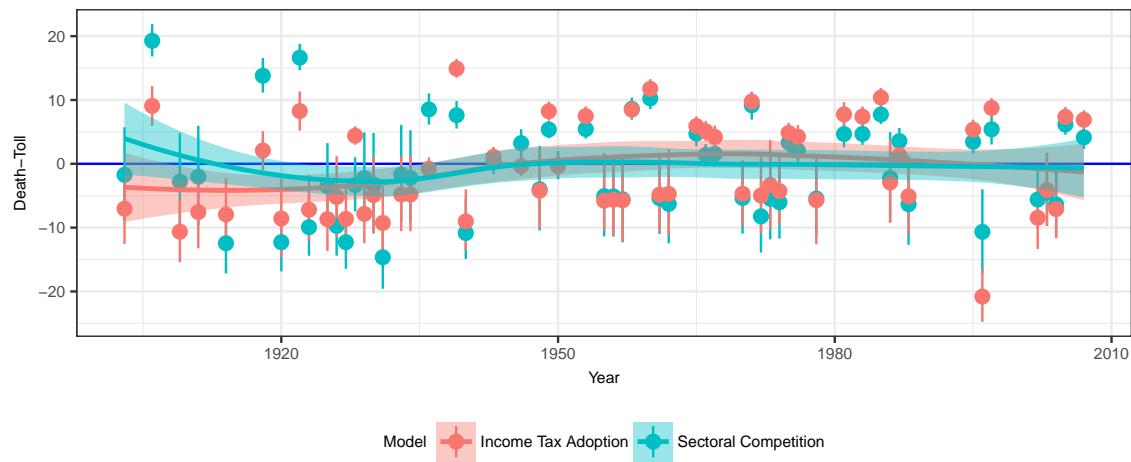


Figure OA1: *Year Fixed Effects*

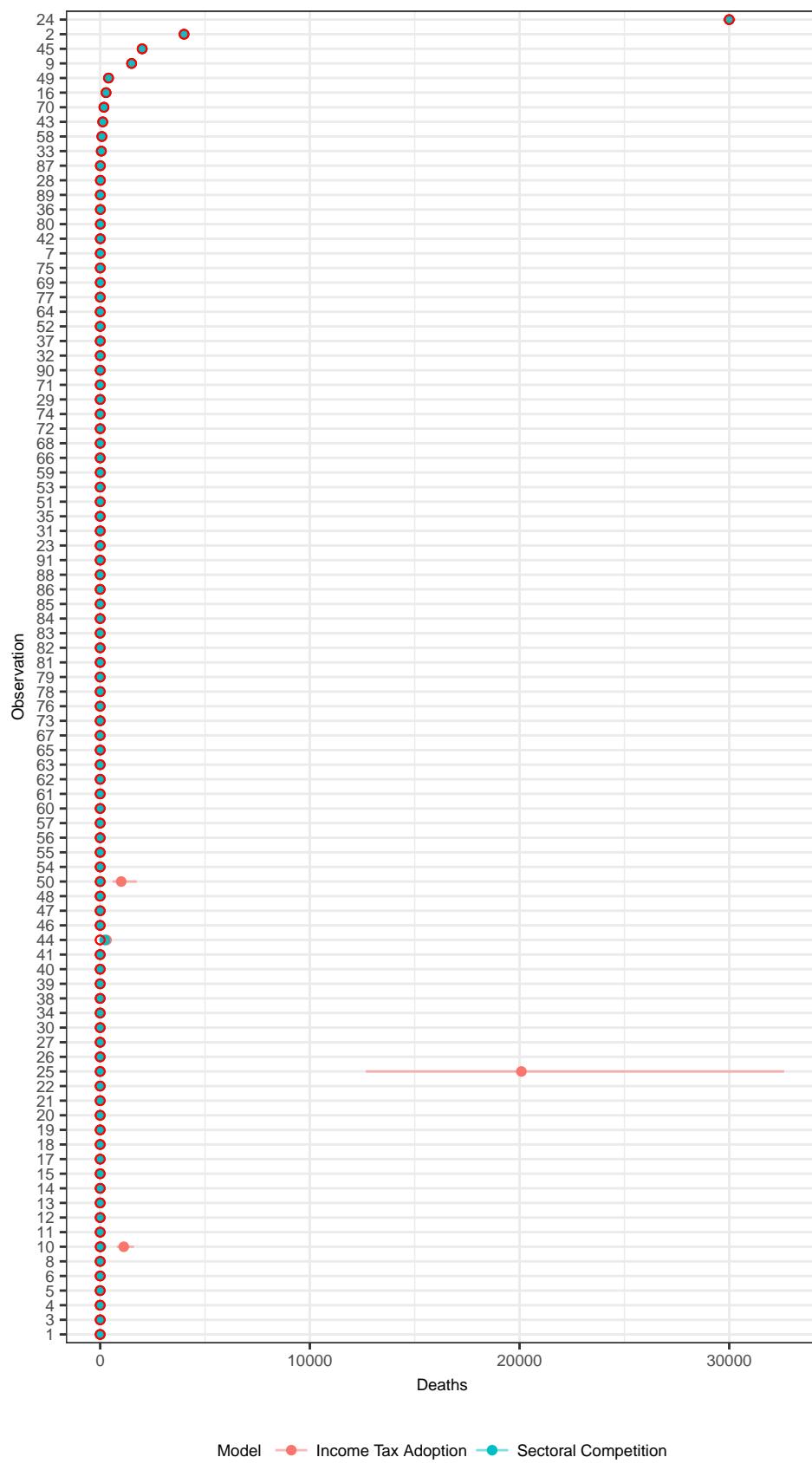


Figure OA2: Assessing Model Fit

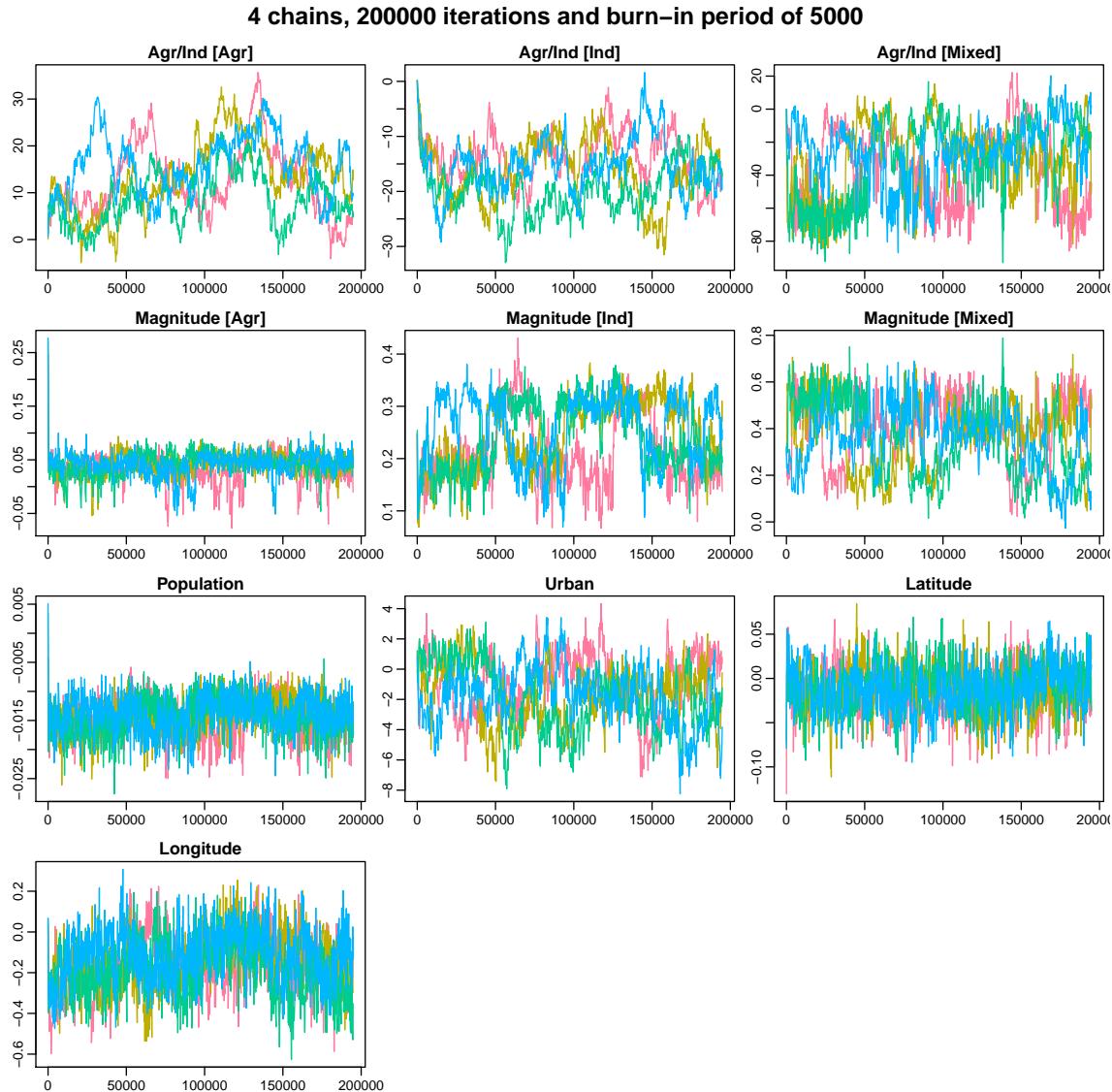


Figure OA3: Trace Plots: Sectoral Conflicts Model

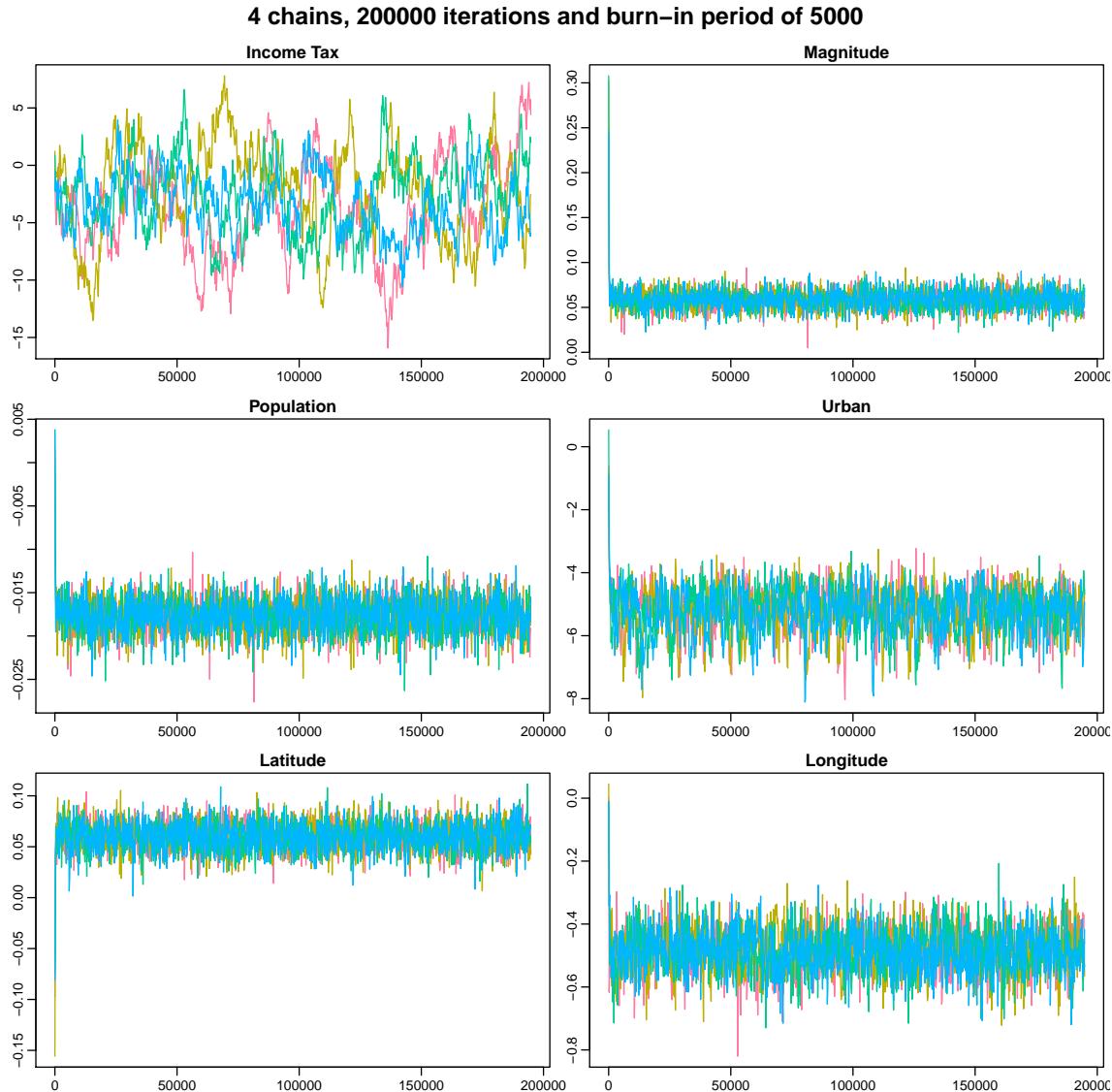


Figure OA4: Trace Plots: Income Tax Adoption Model

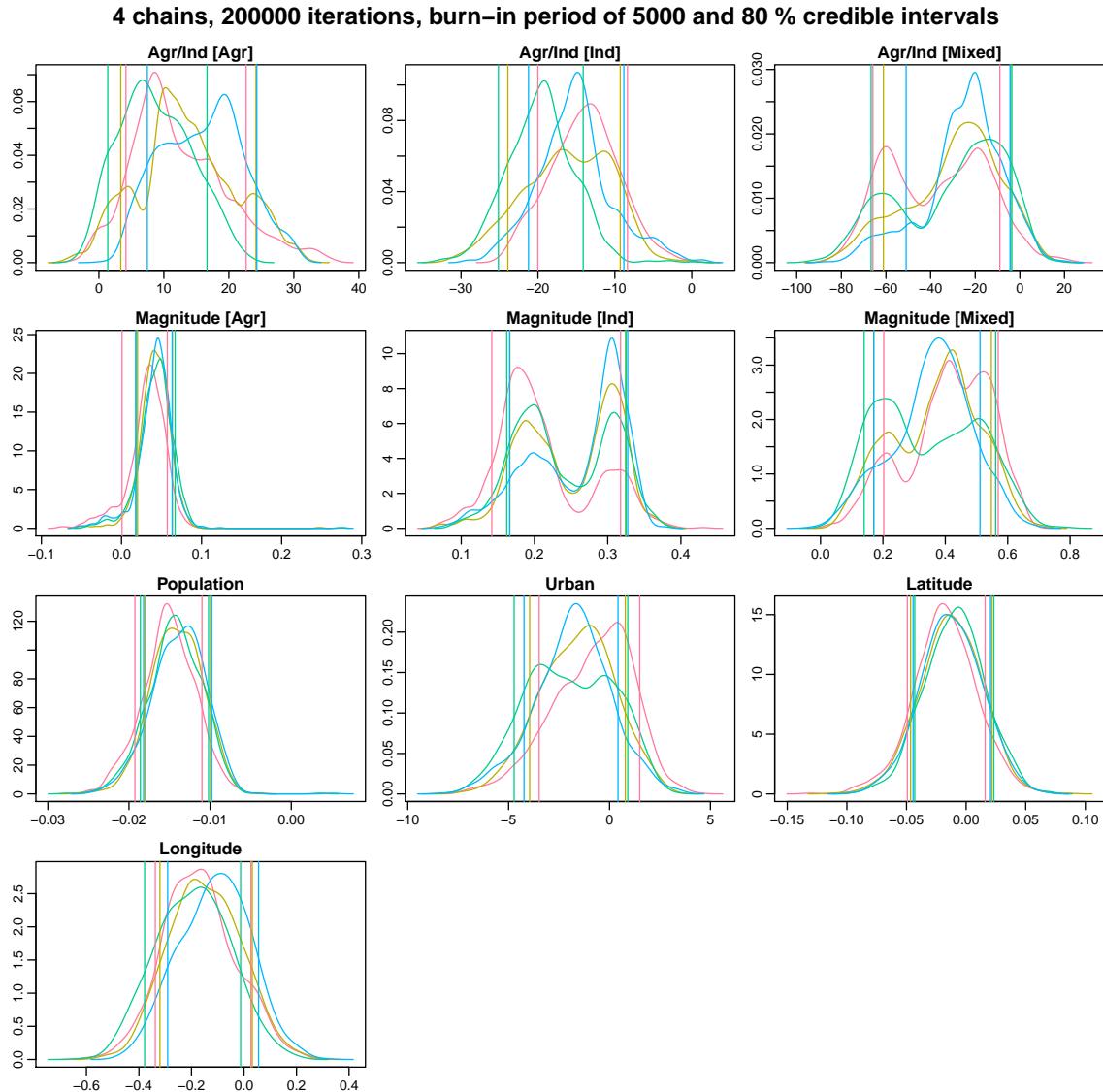


Figure OA5: Density Plots: Sectoral Conflicts Model

4 chains, 200000 iterations, burn-in period of 5000 and 80 % credible intervals

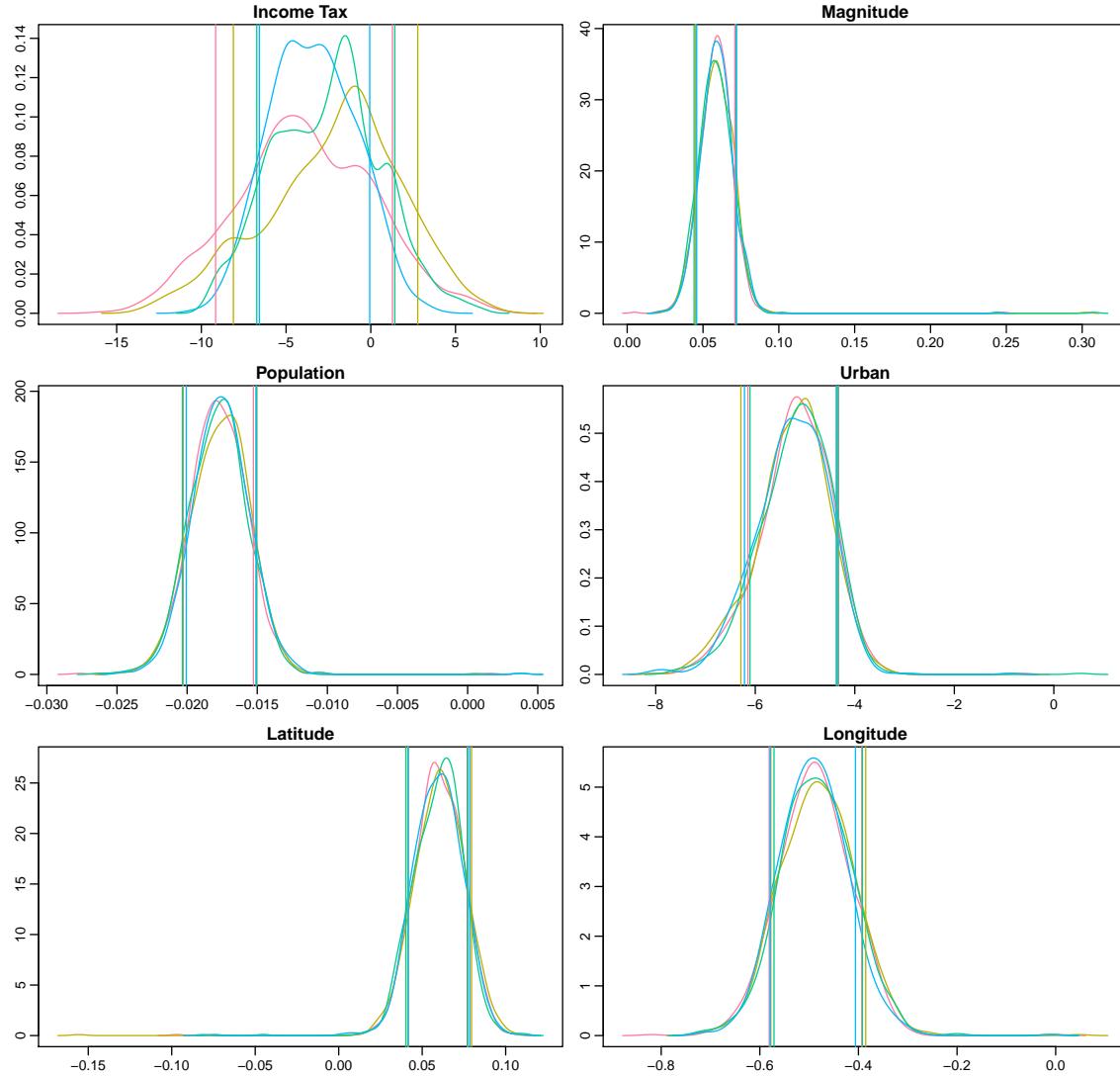


Figure OA6: Density Plots: Income Tax Adoption Model

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