Income Taxation and State Capacities in Chile: Measuring Institutional Development Using Historical Earthquake Data

Hector Bahamonde • Postdoctoral Fellow • Tulane University

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Overview

[**Origins**] Most theories emphasize how important fiscal development is for state consolidation. However, the origins of fiscal development are less clear.

[**Measurement**] Most theories provide **historical** explanations for state consolidation, and yet, they lack of a **historical** measurement capable of capturing levels of state capacities overtime.

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- I find that these gaps represent important **theoretical** and **empirical** **deficits**.

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   The **capacity** of the state to **enforce** quake-sensitive **building codes** throughout the territory, is a **reflection** of its **overall** state-capacities.

Earthquake and States Capacities

2010 Haiti: 7M, 100,000 casualties

Government Palace

2010 Chile: 8.8M, 525 casualties

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Why did a weaker earthquake flatten Haiti? **Intuition**: Chile has better "state capacities" compared to Haiti.

The Importance of Building Codes

There exists a **popular** consensus on that **building codes** *do* reduce death tolls.

The New York Times

AMERICAS

Why Chile's Latest Big Earthquake Has a Smaller Death Toll

CNN World » Africa | Americas | Asia | Europe | Middle East Live TV U.S. Edition +

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[Ind] As capital can be reinvested in nontaxable sectors, industrialists' preferences toward taxation are more elastic.

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In simple, the same bureaucracies that were sent to collect taxes, used the acquired knowledge to perform other state tasks

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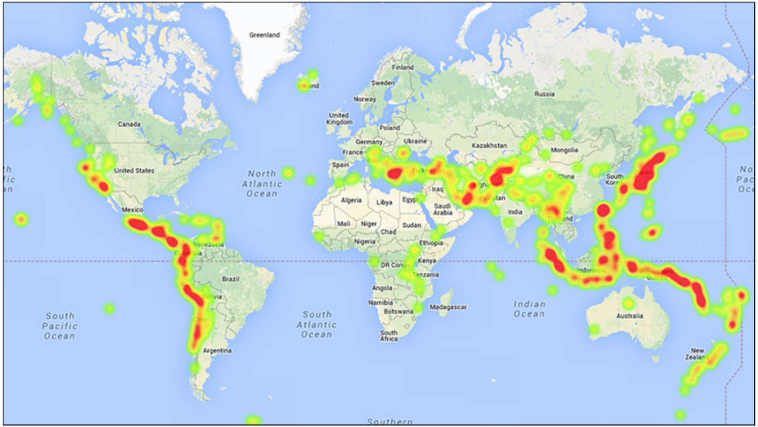
If so, how can those be measured?

Use a novel hand-collected longitudinal **dataset on earthquake death tolls** to proxy for the *capacity* of the state to enforce building codes

State capacities increase overtime upon the implementation of the income tax

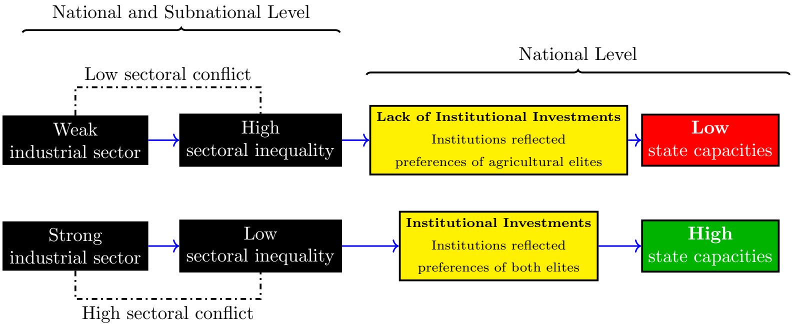
Why Earthquakes?

Earthquakes are **exogenous** to regime type, levels of political/economic development, and other sources of variation.



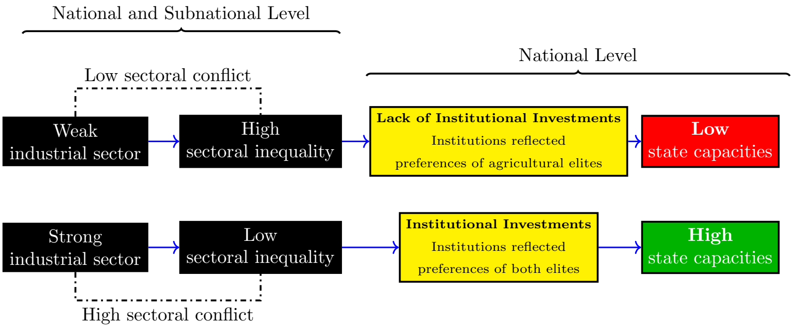
Thinking Subnationally

Since death tolls are a function of how well/bad building codes are enforced by the state throughout the **territory**, adopting a **subnational** approach seems more appropriate.



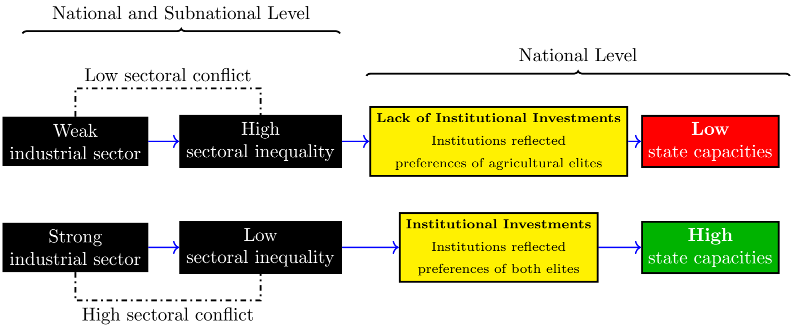
Argument

Higher levels of subnational and national **sectoral contestation** fostered state-capacities overtime.



Conceptualizing Contestation

Industrial expansion in the **regions**, challenged the hegemonic **agricultural** political economy.



Incorporation of Subnational Elites into the National State-Making Project

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- Contingent on the delivery of subnational public goods, industrial elites agreed to comply with the central level paying the **income tax**.
- Activities such as **deployment** of tax collectors to inspect accounting books and to supervise monetary transfers increased the density of state presence overtime.

The Theory Should Pass Two Tests

1. The state should have higher capacities (i.e. *lower death tolls*) when subnationally contested.
2. Implementation of the income tax should produce higher state-capacities (i.e. *lower death tolls*) overtime.

Analyses

Data Subnational and national data on Chile (1907 to 2012).

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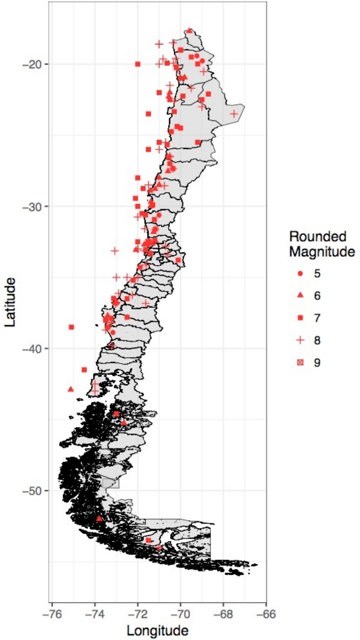
Model Bayesian Hierarchical Poisson model with year fixed-effects to account for the count of deaths. Jags Code



Rounded
Magnitude
5
6
7
8
9
Latitude
Longitude
−20
−30
−40
−50
−76
−74
−72
−70
−68
−66

Subnational Contestation and State Development

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

Distribution of Deaths

$$log(\lambda_i) = \mu + \beta_{1_j}\text{Proportion}\frac{\text{Agr}}{\text{Ind}}_i + \beta_{2_j}\text{Magnitude}_i^2 + \beta_3\text{Latitude}_i + \beta_4\text{Longitude}_i + \beta_5\text{Population}_i + \beta_6\text{Urban}_i + \beta_{7_t}\text{Year}_i$$

where,

$i_{1,\dots I}$ where I = 91 earthquakes

$j_{1,\dots J}$ where J = 3 sectors @ subnational level (agr, ind, mixed)

$t_{1,\dots T}$ where T = 59 years.

4 chains, 200K iterations, burn-in of 5000.

Densities | Trace plots | Model fit | Table | Download detailed diagnostics plots | Proportion

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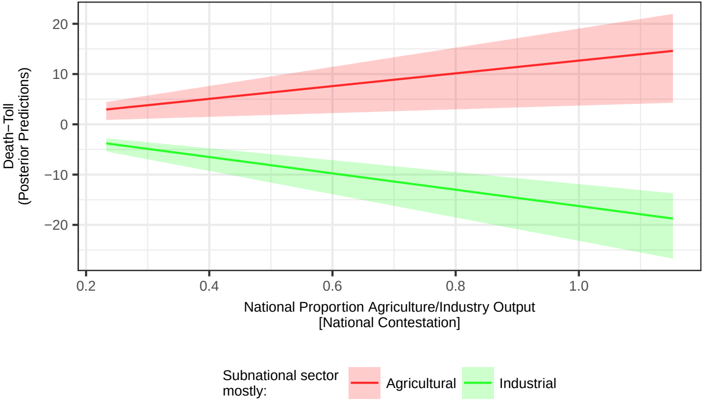
Subnational Contestation Increases State Capacities



Estimating Effects of Income Taxation on Death Tolls Overtime

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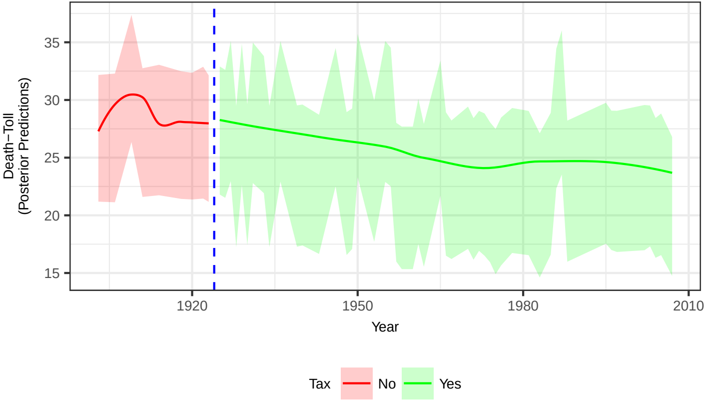

Conclusion

1. **Sectoral contestation**, between a strong national agriculture, and strong regional industrial clusters helped to foster state consolidation.
2. **Income taxation** increased state capacities overtime.
3. **Limitations**: this rationale only applies for cases where there are earthquakes.

What's ahead:

- More data should be collected, and the mechanism should be examined in other countries of the region.

Thank you

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Duration Models

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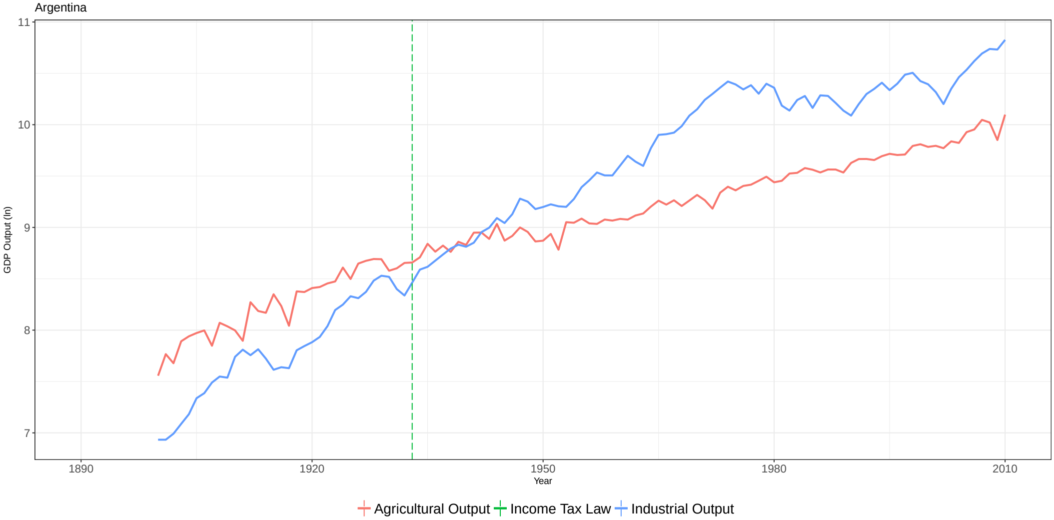
Argentina
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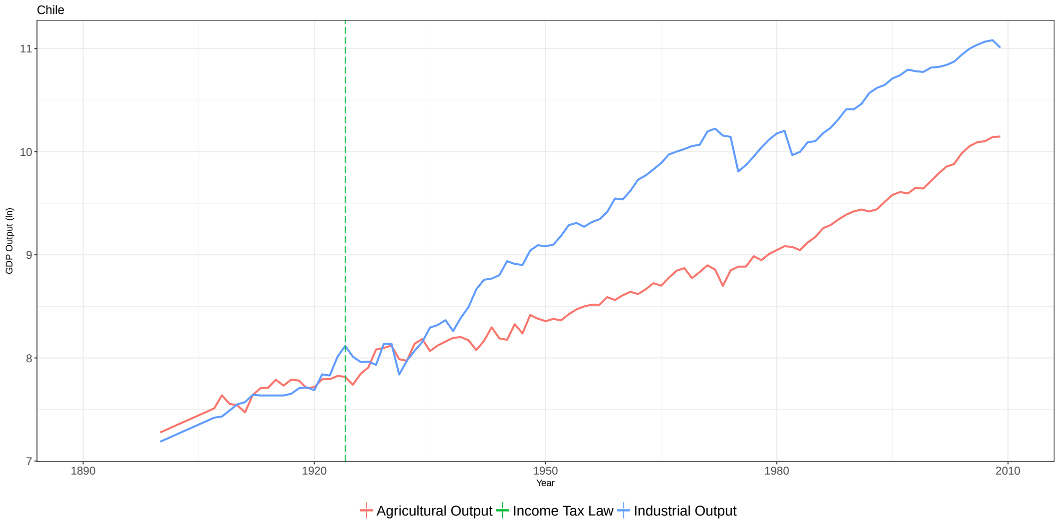
GDP Output (ln)
1890
1920
1950
1980
2010
Year
Agricultural Output
Income Tax Law
Industrial Output


Chile
GDP Output (ln)
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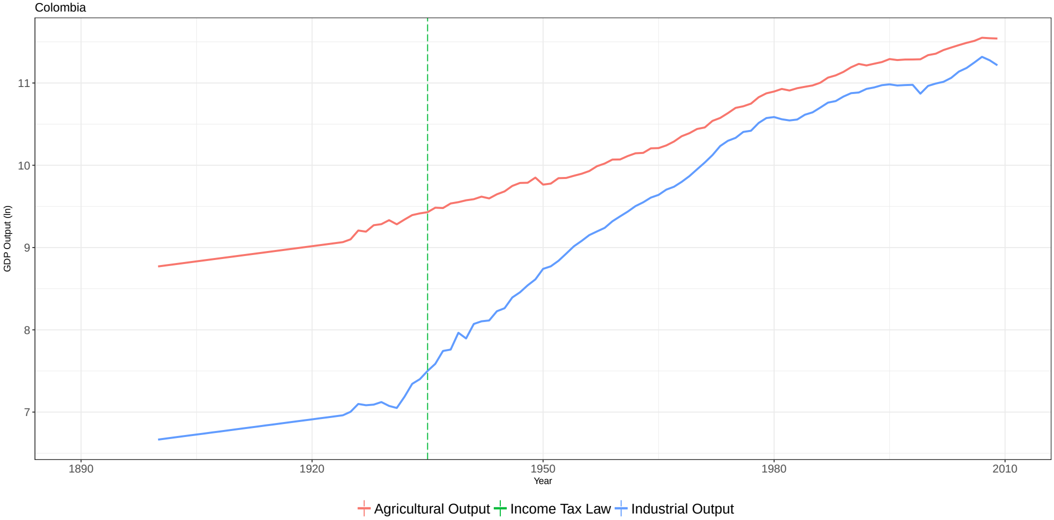

Colombia
GDP Output (ln)
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Year
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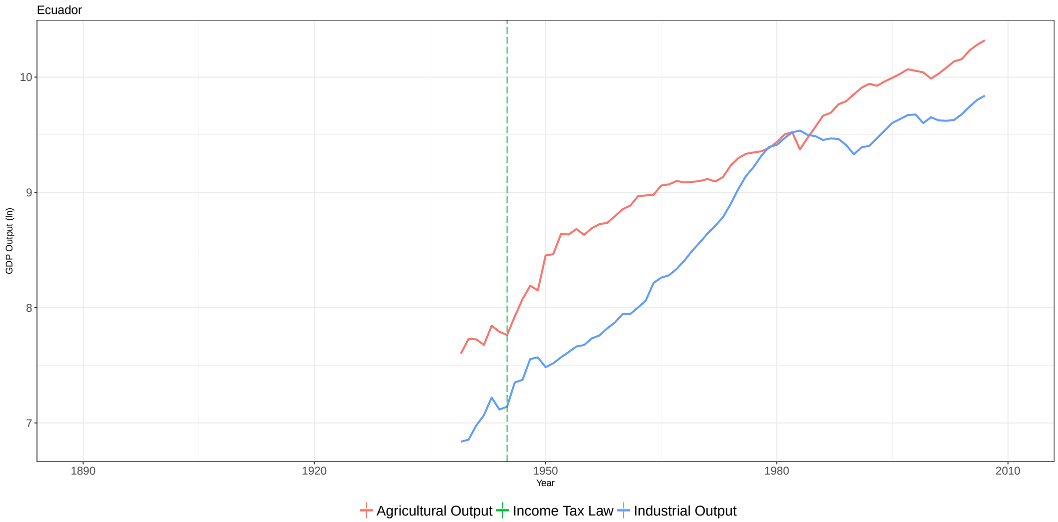
Ecuador
GDP Output (ln)
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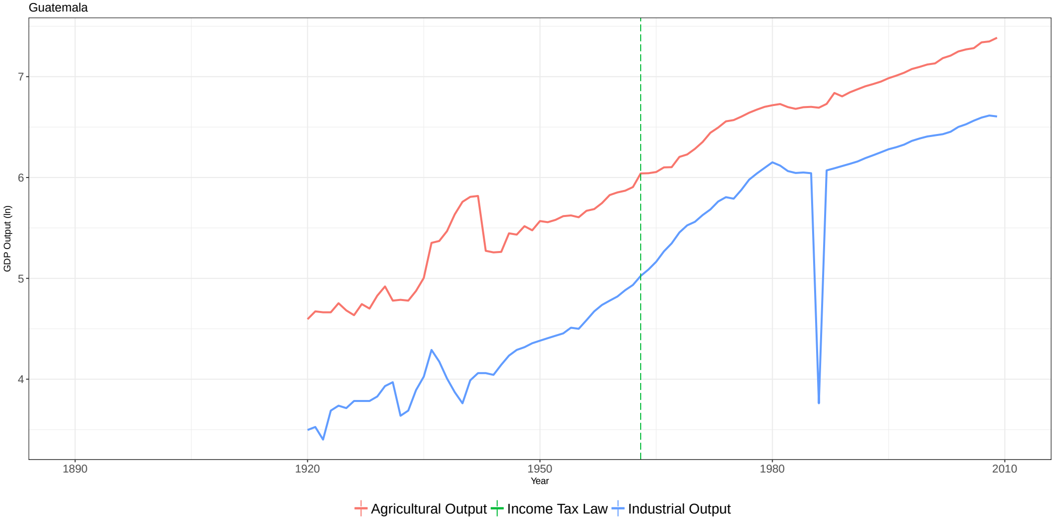
Guatemala
GDP Output (ln)
7
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Year
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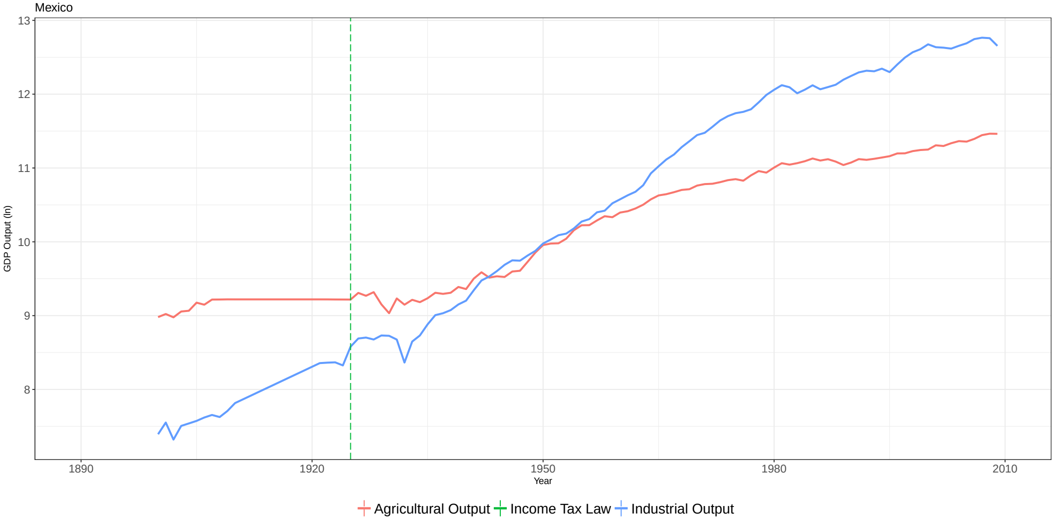
Mexico
13
12
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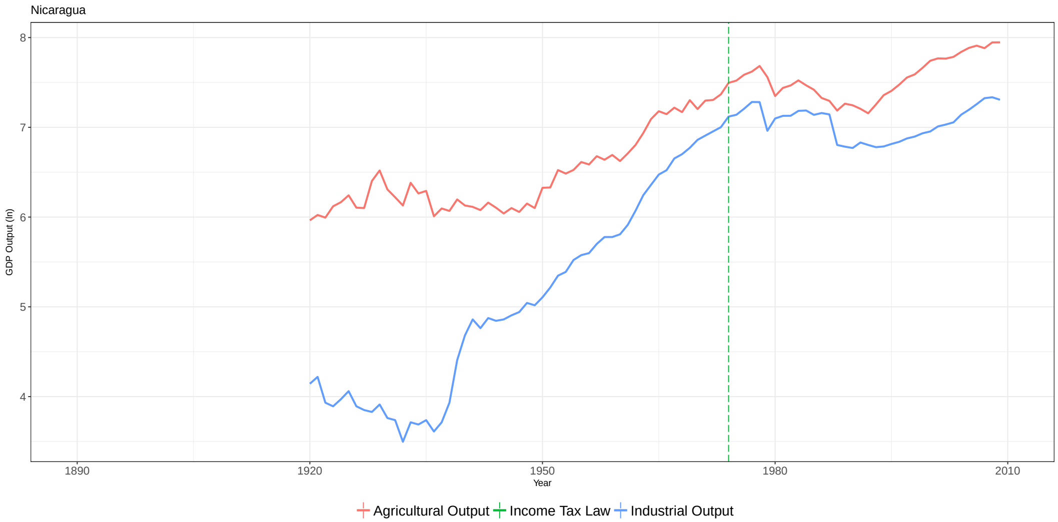
Nicaragua
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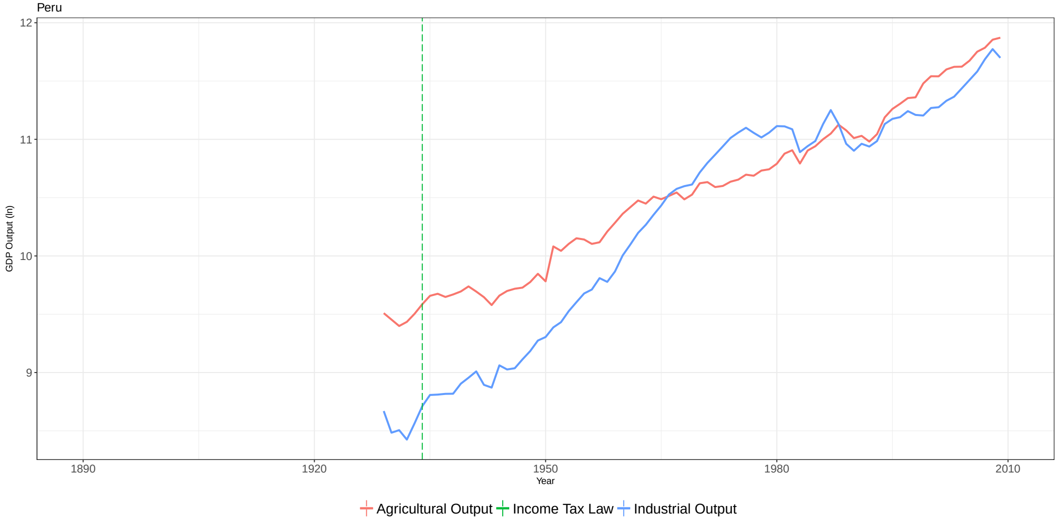

Peru
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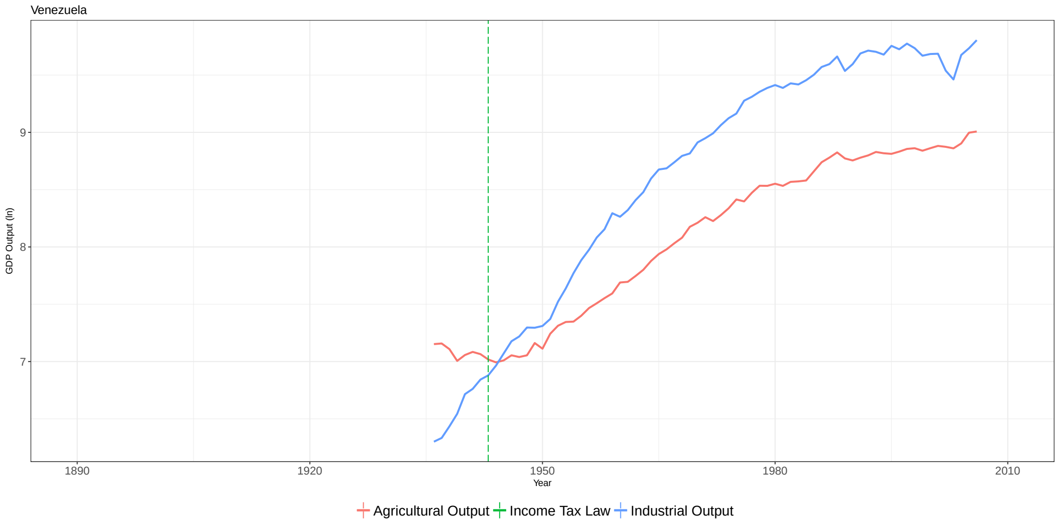

Venezuela
GDP Output (ln)
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	Cox (1 lag)	Cox (1 lag, ln)	Logit GEE	Conditional Logit (FE)	Spatial Dependence
Manufacture Output$_{t-1}$	4.923**				
	(1.851)				
Agricultural Output$_{t-1}$	-4.208*				
	(1.638)				
Total Population	0.000**				
	(0.000)				
Manufacture Output$_{t-1}$ (ln)		7.685*			
		(3.333)			
Agricultural Output$_{t-1}$ (ln)		-6.971*			
		(3.227)			
Total Population (ln)		5.059*	1.259	1.030**	4.676$^{\cdot}$
		(2.228)	(1.052)	(0.391)	(2.682)
Manufacture Output (ln)			1.924***	0.668***	7.148
			(0.514)	(0.143)	(4.815)
Agricultural Output (ln)			-1.596**	-0.941***	-6.465
			(0.603)	(0.281)	(4.636)
AIC	12.796	10.894		4505.538	11.056
R^2	0.059	0.068		0.341	0.065
Max. R^2	0.085	0.088		0.997	0.085
Num. events	9	9		610	9
Num. obs.	241	232	842	842	241
Missings	0	0		0	0
PH test	0.388	0.877			0.667
Num. clust.			9		

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Total Population (ln)		5.059*	1.259	1.030**	4.676·
		(2.228)	(1.052)	(0.391)	(2.682)
Manufacture Output (ln)			1.924***	0.668***	7.148
			(0.514)	(0.143)	(4.815)
Agricultural Output (ln)			-1.596**	-0.941***	-6.465
			(0.603)	(0.281)	(4.636)
AIC	12.796	10.894		4505.538	11.056
R^2	0.059	0.068		0.341	0.065
Max. R^2	0.085	0.088		0.997	0.085
Num. events	9	9		610	9
Num. obs.	241	232	842	842	241
Missings	0	0		0	0
PH test	0.388	0.877			0.667
Num. clust.			9		

$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$, $^{\cdot}p < 0.1$. Robust standard errors in all models

	Cox (1 lag)	Cox (1 lag, ln)	Logit GEE	Conditional Logit (FE)	Spatial Dependence
Manufacture Output$_{t-1}$	4.923**				
	(1.851)				
Agricultural Output$_{t-1}$	-4.208*				
	(1.638)				
Total Population	0.000**				
	(0.000)				
Manufacture Output$_{t-1}$ (ln)		7.685*			
		(3.333)			
Agricultural Output$_{t-1}$ (ln)		-6.971*			
		(3.227)			
Total Population (ln)		5.059*	1.259	1.030**	4.676·
		(2.228)	(1.052)	(0.391)	(2.682)
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PH test	0.388	0.877			0.667
Num. clust.			9		

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	(1.851)				
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	(0.000)				
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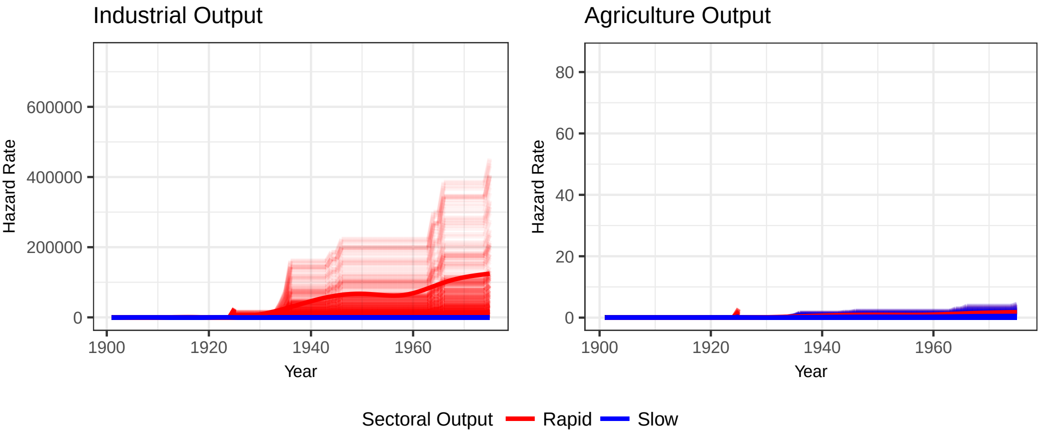
PH test	0.388	0.877			0.667
Num. clust.			9		

$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$, $^{\cdot}p < 0.1$. Robust standard errors in all models

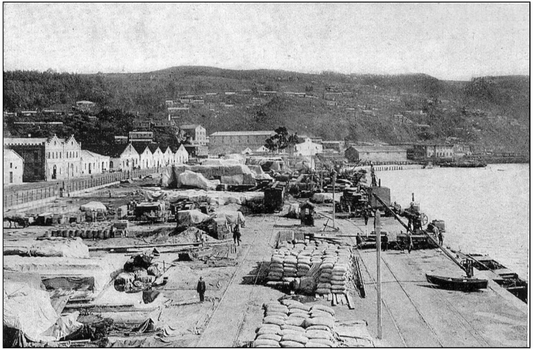
Simulated sectoral hazard rates of implementing the income tax law.
HR: probability that a case will fail at time t.



Why Not *In*direct Taxation

Indirect taxes (like import taxes) require less **state efforts** to capture revenue.

Staffing an office, **waiting** for the ships to come in and **count** the goods. **Sacks of wheat**, for ex.



Talcahuano Port, Chile 19th Century.

```
model.jags.sectoral <- function() {
for (i in 1:N){ # number of earthquakes

Deaths[i] ~ dpois(lambda[i]) log(lambda[i]) <-
            b.propagrmanu[Sector[i]]*propagrmanu[i] + # multi-level
            b.Magnitude[Sector[i]]*Magnitude[i] + #  multi-level
            b.p.Population*p.Population[i] +
            b.Urban*Urban[i] +
            b.year[yearID[i]] + # year fixed-effects
            b.r.long*r.long[i] +
            b.r.lat*r.lat[i] +
            mu ## intercept
}

## Non-Informative/Flat Priors
b.r.lat ~ dnorm(0, 0.01)
b.r.long ~ dnorm(0, 0.01)
mu  ~ dnorm(0, 0.01) ## intercept
b.p.Population ~ dnorm(0, 0.01)
b.Urban ~ dnorm(0, 0.01)

## Year Fixed-Effects
for (t in 1:yearN){
     b.year[t] ~ dnorm(m.b.year[t], tau.b.year[t])
     m.b.year[t] ~ dnorm(0, 0.01)
     tau.b.year[t] ~ dgamma(0.5, 0.001) # uninformative Gamma priors
}

## Varying Slopes for Magnitude (unmodeled)
for (k in 1:NSector){#
     b.Magnitude[k] ~ dnorm(m.Magnitude[k], tau.Magnitude[k])
     m.Magnitude[k] ~ dnorm(0, 0.01)
     tau.Magnitude[k] ~ dgamma(0.5, 0.001) # uninformative Gamma priors
     }

## Varying Slopes for Agr/Ind Proportion (unmodeled)
for (k in 1:NSector){#
     b.propagrmanu[k] ~ dnorm(m.b.propagrmanu[k], tau.b.propagrmanu[k])
     m.b.propagrmanu[k] ~ dnorm(0, 0.01)
     tau.b.propagrmanu[k] ~ dgamma(0.5, 0.001) # uninformative Gamma priors
     }

 }
```

Sectoral Competition and Taxation?

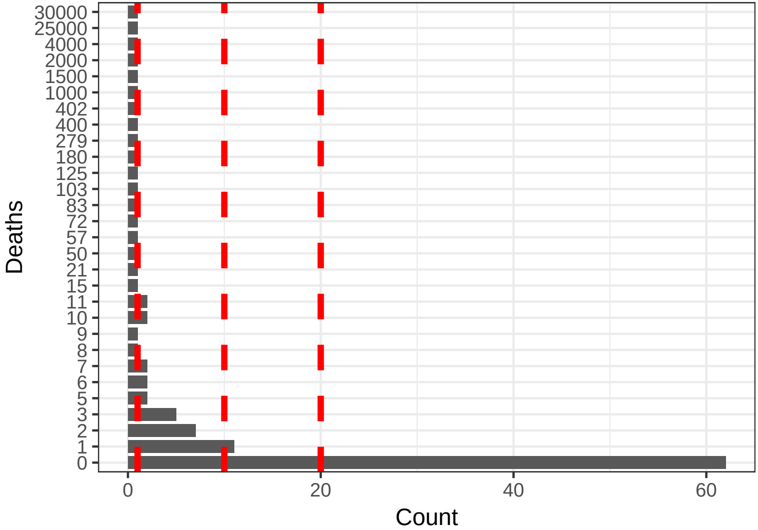
Agricultural production, as it needs mostly land, it does not rely on capital as much as the industrial sector does. Moreover, they oppose taxation because their main asset (land) is fixed, hence landowners not being able to move their asset, resist taxation. On the contrary, industrial elites rely on public goods that are beneficial for their business (railroads, bridges, etc.). And while industrialists would prefer imposing higher import taxes (NOT the income tax), that increases the price of importing industrial capital (for ex., machines). Consequently, their second best choice is imposing an income tax.

For these reasons, the emergence of the industrial sector (which implies higher levels of sectoral/elite contestation) leads to the implementation of the income tax.

Where does industry come from?

p. 20 of dissertation. Industry, as predicted by the dual sector model, came from agriculture:

- After the mining boom, mining elites shifted their focus to what is considered the first *true* industrial work which began under agricultural auspices: the cotton mills: "[t]he first power looms were brought [in Perú, Ecuador, and Venezuela] in the 1840s, 1850s; but in all three they were a failure, some of the early mills in Ecuador being destroyed by an earthquake. It was not until after 1890 that the textile industries of these nations began to operate with reasonable success. Guatemala's first cotton mill was established in 1882, and between that date and 1910 a few mills appeared in Chile, Argentina, Uruguay, and Colombia."
- The first industries were called *obrajes* and beyond textiles, early industrialists processed other agricultural goods. For example, animal grease and tallow, dried and cured meats, flour, bread, beer, wines and spirits, being most of them for domestic consumption. Sugar was used in the production of chocolate, candies and biscuits.
- The industrial sector was boosted by favorable international conditions, many times stimulating a positive complementarity between the two sectors. Industrial activities started very small, progressing "from the shop to the factory during the latter half of the nineteenth century."
- Importantly, modern industrialization did *not* begin with ISI, but around 1900. Others find that the "fact that manufacturing was alive and thriving in Latin America before the 1929 crash is now beyond question." And that the "development of large-scale, mechanized (and even "heavy") industry can be dated back to the 1890s." By the 1870's the carriage industry was on a firm basis.


Deaths
30000
25000
4000
2000
1500
1000
402
400
279
180
125
103
83
72
57
50
21
15
11
10
9
8
7
6
5
3
2
1
0
0
20
40
60
Count

But Where Does Industrialization Come From?!

The theory puts heavy emphasis on the role of industrialization on state development. However, *Where does industrialization come from?*

Haber 2005 explains that:

"The impetus for industrial development came from the expansion of foreign trade. Driving the growth of foreign trade were two factors. The first was that most Latin American countries were on the silver standard, and silver fell in value relative to gold in the last two decades of the nineteenth century. Most Latin American countries therefore saw their currencies depreciate in real terms relative to the gold-backed currencies of the economies of the North Atlantic. As international trade theory would predict, real exchange rate depreciation resulted in the expansion of the tradables (e.g. industrial goods) [...] Second, the late nineteenth century also saw a dramatic decline in the international costs of transport, as steel-hulled steamships came to replace wood and sail."

From Conflict to Cooperation

Why do lower levels of **sectoral inequality** (which implied **higher military threats**) lead to **sectoral cooperation**?
The rising of the industrial sector allowed industrial political elites to get access to military capacities that were as good as the agricultural elite's. The **threat** is what leads to **cooperation** rather than **conflict**. It makes no sense to engage in conflict when (1) both groups have the same 'fire power' and (2) when there is a cheaper exit (sectoral bargains).

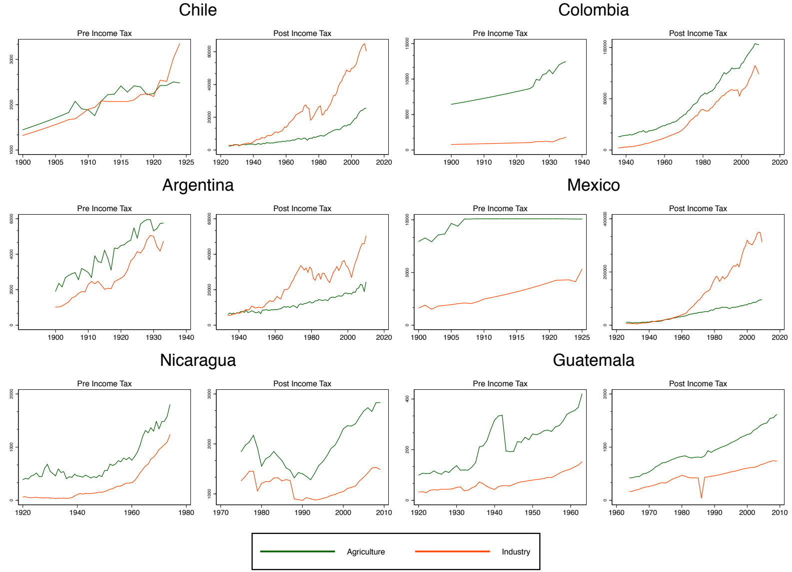
War was in 1891, but Income Tax in 1924?

- Civil wars of **1851-859** and **1891** between a "**large landed property** [**elite against a**] **productive capital** [**elite**]."
- President **Balmaceda's overthrowing in 1891** explains the sectoral nature of these conflicts.
- He was mainly supported by the landed elites, but later overthrown in 1891 by a mainly industrial/mining coalition:
  - His agenda on "industrial" infrastructure benefited mostly agricultural areas.
  - his attitude towards the banking sector (closely linked to the mining sector) confiscatory.
- At the same time, however, he failed to secure a coalition with his own sector.
  - Decline of wheat exports. Balmaceda's policies fostered sectoral dependence of agriculture on industrial production, forcing the "landed proprietors [to] become dependent to a considerable extent on the continuing prosperity of the major nitrate capitalists." (Zeitlin).
  - While it would be inaccurate to say that Balmaceda was *completely* supported by agriculturalists and *completely* opposed by industrialists, this example illustrates how (failed) inter-sectoral alliances and biased public goods provision against industrialists led these two groups to a military conflict in 1891.
  - The conflict left a permanent scar in the Chilean society. While the civil war lasted only nine months, it took 10,000 lives (out of a total population of 3 million people) and cost more than $ 100 million,a significant amount for a small country.
  - There was an intention to avoid more violence. For instance, while all "ministers, counselors of state, members of the constituent congress [,] municipal officials, provincial governors and intendants, members of the judiciary and even the lowest functionaries and ordinary employees of Balmaceda's government were investigated [or] brought to trial," there were a number of amnesties issued. Similarly, there were a number of *aborted* coups in 1907, 1912, 1915 and 1919. I identify a third additional factor. War was more likely to exhaust all existent assets without producing positive outcomes for either sector, putting pressures for a sectoral compromise.

Country	Time Frame	Sector	Augmented Dickey-Fuller	Phillips-Perron	KPSS	Conclusion
Chile	Pre	Agriculture	-1.185 (0.68)	-1.241 (0.66)	.107†	I(1)
		Industry	2.310 (0.99)	2.556 (0.99)	.113†	I(1)
	Post	Agriculture	4.557 (1.00)	5.40 (1.00)	.289	I(1)
		Industry	0.908 (0.99)	1.458 (0.99)	.249	I(1)
	All	Agriculture	5.521 (1.00)	6.722 (1.00)	.31	I(1)
		Industry	1.582 (0.99)	2.305 (0.99)	.314	I(1)
Colombia	Pre	Agriculture	2.709 (0.99)	2.414 (0.99)	.204	I(1)
		Industry	2.103 (0.99)	3.257 (1.00)	.183	I(1)
	Post	Agriculture	2.392 (0.99)	3.156 (1.00)	.282	I(1)
		Industry	0.520 (0.98)	1.044 (0.99)	.241	I(1)
	All	Agriculture	4.256 (1.00)	5.893 (1.00)	.372	I(1)
		Industry	1.674 (0.99)	2.707 (0.99)	.374	I(1)
Argentina	Pre	Agriculture	-0.849 (0.80)	-1.201 (0.67)	.0801†	I(1)
		Industry	-0.495 (0.89)	-0.378 (0.91)	.115†	I(1)
	Post	Agriculture	1.197 (0.99)	1.093 (0.99)	.277	I(1)
		Industry	0.228 (0.97)	0.381 (0.98)	.0901†	I(1)
	All	Agriculture	1.484 (0.99)	1.401 (0.99)	.332	I(1)
		Industry	1.007 (0.99)	1.237 (0.99)	.183	I(1)
Mexico	Pre	Agriculture	4.601 (1.00)	5.552 (1.00)	.288	I(1)
		Industry	5.803 (1.00)	10.776 (1.00)	.29	I(1)
	Post	Agriculture	0.599 (0.9876)	0.497 (0.99)	.109†	I(1)
		Industry	-1.255 (0.65)	-0.982 (0.76)	.113†	I(1)
	All	Agriculture	3.431 (1.00)	3.607 (1.00)	.341	I(1)
		Industry	0.672 (0.99)	2.020 (0.99)	.367	I(1)
Nicaragua	Pre	Agriculture	2.473 (0.99)	2.355 (0.99)	.25	I(1)
		Industry	4.958 (1.00)	9.100 (1.00)	.244	I(1)
	Post	Agriculture	-0.154 (0.94)	0.154 (0.97)	.2	I(1)
		Industry	-1.237 (0.6577)	-1.176 (0.68)	.189	I(1)
	All	Agriculture	0.636 (0.99)	0.759 (0.99)	.116†	I(1)
		Industry	-0.164 (0.94)	-0.090 (0.95)	.123	I(1)
Guatemala	Pre	Agriculture	-0.393 (0.91)	-0.343 (0.92)	.0639†	I(1)
		Industry	1.358 (0.99)	1.704 (0.99)	.199	I(1)
	Post	Agriculture	1.786 (0.99)	1.965 (0.99)	.162	I(1)
		Industry	-0.998 (0.75)	-1.352 (0.61)	.0915†	I(1)
	All	Agriculture	3.349 (1.00)	3.714 (1.00)	.321	I(1)
		Industry	0.413 (0.98)	0.017 (0.96)	.288	I(1)

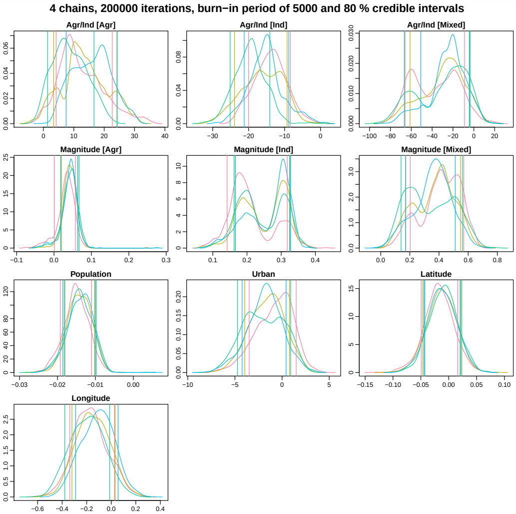
Country	**Number of Cointegrated Vectors (rank)**	Restrictions	**Lags**	**Log-Likelihood**	**Trace**
Chile	at least 1	Restricted Constant	5	-1665.9736	0.3799
Argentina	at least 1	Restricted Constant	3	-1802.292	4.7657
Colombia	at least 1	Restricted Trend	2	-1805.6773	10.0076
Mexico	at least 1	Restricted Constant	4	-1978.1322	1.0274
Nicaragua	0	Restricted Constant	2	-1020.221	11.5297
Guatemala	0	Trend	3	-859.2802	16.5493

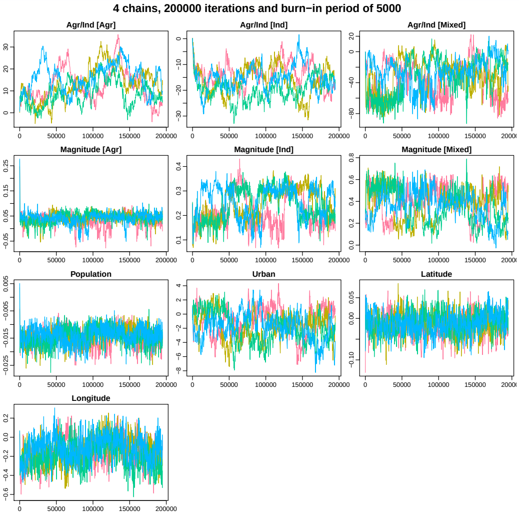
Country	Time Frame	Number of Lags	LM	Normally Tests			Stability Condition
				Jarque-Bera	*Skewness*	*Kurtosis*	
Chile	Pre	4	✓	✓	✓	✓	✓
	Post	2	✓	✓⁻	✓⁻	✓⁻	✓
Colombia	Pre	1	✓⁻	✗	✗	✗	✓
	Post	1	✓	✓⁻	✓⁻	✓⁻	✓
Argentina	Pre	2	✓	✓	✓	✓	✓
	Post	2	✓	✓⁻	✓	✓⁻	✓
Mexico	Pre	1	✓	✓⁻	✓⁻	✓⁻	✓
	Post	2	✓	✓	✓	✓	✓
Nicaragua	Pre	2	✓	✓⁻	✓⁻	✓⁻	✓
	Post	1	✓	✓⁻	✓⁻	✓⁻	✓
Guatemala	Pre	3	✓	✗	✓⁻	✓⁻	✓
	Post	1	✓⁻	✓⁻	✓⁻	✓⁻	✓

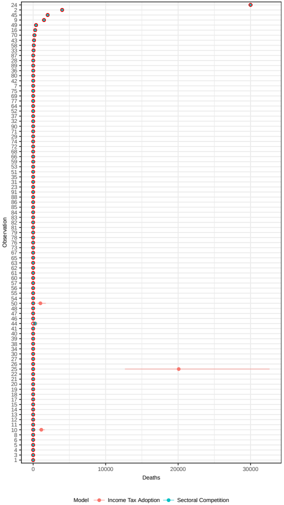


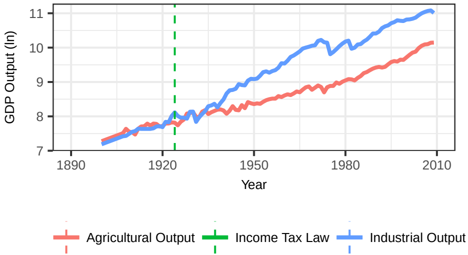
Chile
Pre Income Tax
Post Income Tax
Colombia
Pre Income Tax
Post Income Tax
Argentina
Pre Income Tax
Post Income Tax
Mexico
Pre Income Tax
Post Income Tax
Nicaragua
Pre Income Tax
Post Income Tax
Guatemala
Pre Income Tax
Post Income Tax
Agriculture
Industry

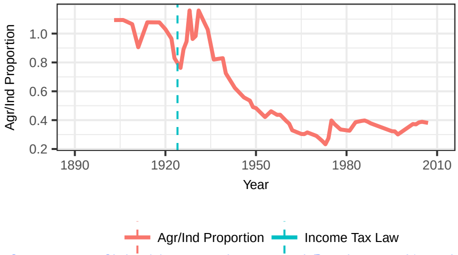
Country	Pre/Post Income Tax	Sample	Directionality	chi2	P-value
Chile	Pre	1905 - 1924	Agriculture → Industry	3.55	0.47
			Industry → Agriculture	12.13	0.02
	Post	1928 - 2009	Agriculture → Industry	11.92	0.00
			Industry → Agriculture	5.37	0.07
Colombia	Pre	1902 - 1935	Agriculture → Industry	4.96	0.03
			Industry → Agriculture	10.44	0.00
	Post	1938 - 2009	Agriculture → Industry	4.32	0.04
			Industry → Agriculture	1.63	0.20
Argentina	Pre	1903 - 1933	Agriculture → Industry	4.19	0.12
			Industry → Agriculture	.42	0.81
	Post	1937 - 2010	Agriculture → Industry	.18	0.91
			Industry → Agriculture	1.37	0.50
Mexico	Pre	1902 - 1965	Agriculture → Industry	.73	0.39
			Industry → Agriculture	11.57	0.00
	Post	1969 - 2009	Agriculture → Industry	5.56	0.06
			Industry → Agriculture	1.32	0.52
Nicaragua	Pre	1923 - 1974	Agriculture → Industry	.48	0.79
			Industry → Agriculture	6.83	0.03
	Post	1977 - 2009	Agriculture → Industry	.014	0.91
			Industry → Agriculture	4.96	0.03
Guatemala	Pre	1924 - 1963	Agriculture → Industry	2.18	0.54
			Industry → Agriculture	6.72	0.08
	Post	1966 - 2009	Agriculture → Industry	.58	0.45
			Industry → Agriculture	6.05	0.01


4 chains, 200000 iterations, burn−in period of 5000 and 80 % credible intervals
Agr/Ind [Agr]
Agr/Ind [Ind]
Agr/Ind [Mixed]
Magnitude [Agr]
Magnitude [Ind]
Magnitude [Mixed]
Population
Urban
Latitude
Longitude


4 chains, 200000 iterations and burn−in period of 5000
Agr/Ind [Agr]
Agr/Ind [Ind]
Agr/Ind [Mixed]
Magnitude [Agr]
Magnitude [Ind]
Magnitude [Mixed]
Population
Urban
Latitude
Longitude


Observation
0
10000
20000
30000
Deaths
Model
Income Tax Adoption
Sectoral Competition


GDP Output (ln)
11
10
9
8
7
1890
1920
1950
1980
2010
Year
Agricultural Output
Income Tax Law
Industrial Output


Agr/Ind Proportion
1.0
0.8
0.6
0.4
0.2
1890
1920
1950
1980
2010
Year
Agr/Ind Proportion
Income Tax Law

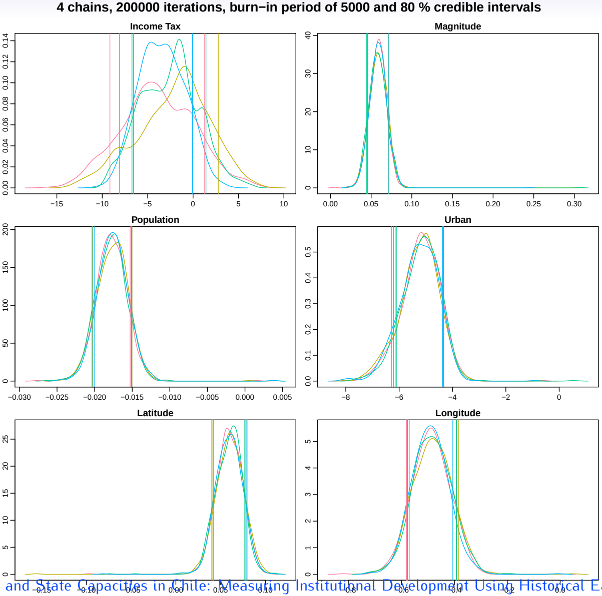
	Mean	SD	Lower	Upper	Pr.
Agr/Ind [Agr]	12.68	7.21	3.73	22.65	0.98
Agr/Ind [Ind]	-16.26	5.30	-23.17	-9.62	1.00
Agr/Ind [Mixed]	-30.73	21.74	-63.78	-4.89	0.95
Magnitude [Agr]	0.04	0.02	0.01	0.06	0.95
Magnitude [Ind]	0.24	0.07	0.16	0.32	1.00
Magnitude [Mixed]	0.37	0.14	0.17	0.55	1.00
Latitude	-0.01	0.03	-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

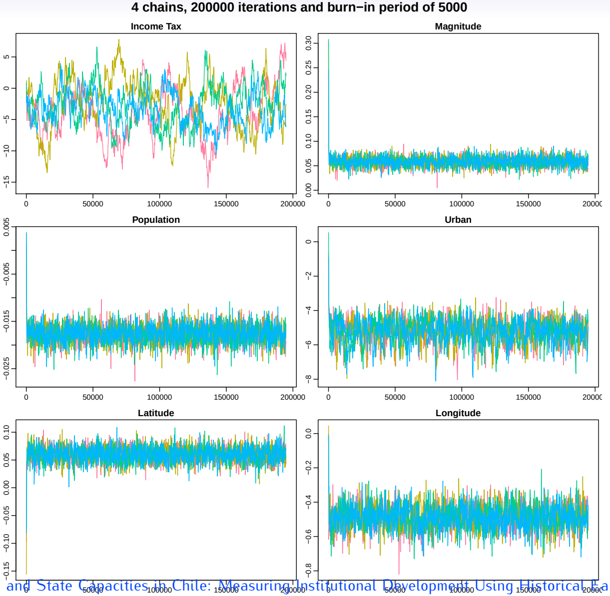
Note: 200000 iterations with a burn-in period of n = 5000 iterations discarded.

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.


4 chains, 200000 iterations, burn−in period of 5000 and 80 % credible intervals
Income Tax
Magnitude
Population
Urban
Latitude
Longitude


4 chains, 200000 iterations and burn−in period of 5000
Income Tax
Magnitude
Population
Urban
Latitude
Longitude

	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.

For example, the historian Barros (1970) 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." **Local bosses had to approve decisions 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.