

The Persistent Effects of Peru's Mining Mita

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Roadmap of Talk

Motivation

Research question

Methodology

Data

Identification Strategy

Results and discussion

Conclusion and further research

Motivation: Long-term Impacts of Institutions

- ▶ Recent work in economic history leverages a **big data approach**, focusing on **sub-national differences** in institutions to understand their long-term impacts.
- ▶ This approach allows researchers to **trace back historical events**, analyzing how institutions, even centuries ago, shape modern-day economic outcomes.
- ▶ By comparing similar regions with varying historical institutional exposure, we can uncover persistent economic effects that would otherwise be difficult to measure.

Motivation: The role of persistence

- ▶ **Empirical Gap:** Existing evidence provides little clarity on which mechanisms drive the long-term impacts of historical institutions.
- ▶ **Potential Mechanisms Explored:**
 - ▶ Property rights enforcement
 - ▶ Inequality
 - ▶ Ethnic fractionalization
 - ▶ Barriers to entry
 - ▶ Public goods provision
- ▶ **Research Focus:** Dell uses variation in the Mining Mita system to identify **land tenure** (property rights) and **public goods** as the primary channels through which these effects persist.

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What is the research question, why is this important?

- ▶ What are the long-term economic impacts of the Mining Mita system on institutional development and economic outcomes in Peru?

Institutional setting: The Mining Mita System (1573–1812)

- ▶ The **Mining Mita** was a forced labor system implemented by the Spanish colonial government in Peru from **1573 to 1812**.
- ▶ Communities near the largest mines, such as Potosí and Huancavelica, were required to send **1/7th of their adult male population** annually to work in these mines.
- ▶ This system was intended to **ensure a steady labor supply for the Spanish silver mining industry**, essential for colonial economic interests.



Institutional setting: Impact of Property Rights and Public Goods Provision

► **Property Rights:**

- Non-Mita areas developed clear systems of land ownership and property rights, which persist to this day.
- In Mita areas, no clear property rights system emerged after the Mita's end, leaving institutions weaker.

► **Public Goods Provision:**

- Large rural estates in non-Mita areas created employment opportunities and likely advocated for public goods (roads, education).
- Dell shows that public goods provision, such as road density, is significantly higher outside Mita boundaries.

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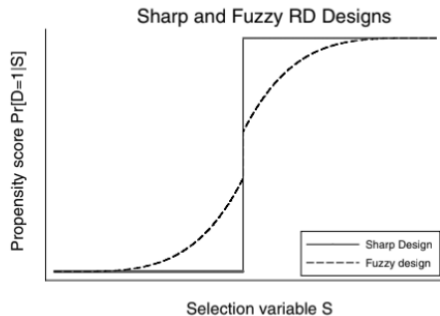
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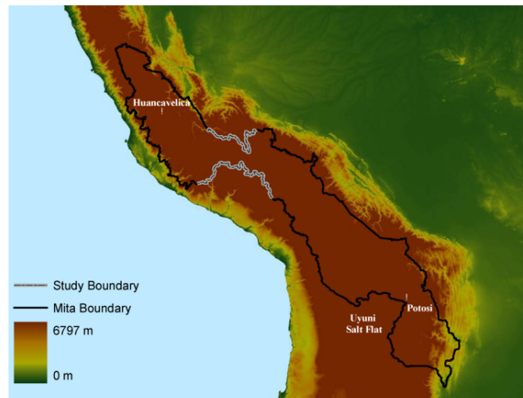
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What is the methodology? What is novel about this?

The Spanish government drew a boundary around the mines to limit commuting distances for workers. Only communities **within this boundary** were required to participate in the Mita labor draft.



(a) Classic RD



(b) Spatial RD

Be careful! Geographic Considerations in Analysis

- ▶ Geographic differences – such as elevation – can create distinct economies within and outside the analysis boundary.
- ▶ Such differences may confound regression discontinuity results, as they introduce other variables affecting economic outcomes beyond the treatment effect.

Addressing Geographic and Economic Challenges

- ▶ **Focus on Comparable Areas:** Dell selects regions with similar economic conditions before the Mita system to control for pre-existing differences.
- ▶ **Data from District Capitals:** She collects data from district capitals inside and outside the Mita region to standardize comparisons and reduce geographic variability.
- ▶ **Children's Heights as an Indicator:** Dell uses children's heights to assess economic outcomes, providing a tangible measure of health and well-being linked to economic conditions.
- ▶ **Exclusion of Cusco:** Because part of its relative prosperity today likely relates to its pre-mita heritage as the Inca capital (impact is larger when maintained).

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What is the data used?

- ▶ **Household Consumption Data:**

- ▶ From the 2001 Peruvian National Household Survey (ENAH0), collected by the National Institute of Statistics (INEI).
- ▶ Household consumption is adjusted by subtracting transfers and normalizing prices to Lima metropolitan levels.

- ▶ **Children's Heights Data:**

- ▶ Microcensus data from the Ministry of Education, measuring the heights of 6- to 9-year-old school children in the region.
- ▶ Used as a proxy for long-term living standards and health outcomes.

Both datasets georeferenced to the district.

- ▶ **Stunning:** Following international standards, children whose heights are more than 2 standard deviations below their age-specific median are classified as stunted (note: medians and sd calculated by the WHO from an international reference population)
- ▶ **Mean Area Weighted Elevation:** Finally, to obtain controls for exogenous geographic characteristics, of each district by overlaying a map of Peruvian districts on 30 arc second (1 km) resolution elevation data produced by NASA's Shuttle Radar Topography Mission (SRTM).

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- ▶ $f(\text{geographic location}_d)$ is the RD polynomial
- ▶ ϕ_b is a set of boundary segment fixed effects that denote which of four equal length segments of the boundary is the closest to the observation's district capital.

Treatment variable at the cutoff

Need to check for equal means for elevation, terrain ruggedness, soil fertility, rainfall, ethnicity, preexisting settlement patterns, local 1572 tribute (tax) rates, and allocation of 1572 tribute revenues.

TABLE I
SUMMARY STATISTICS^a

	Sample Falls Within											
	<100 km of <i>Mita</i> Boundary			<75 km of <i>Mita</i> Boundary			<50 km of <i>Mita</i> Boundary			<25 km of <i>Mita</i> Boundary		
	Inside	Outside	s.e.	Inside	Outside	s.e.	Inside	Outside	s.e.	Inside	Outside	s.e.
GIS Measures												
Elevation	4042	4018	[188.77] (85.54)	4085	4103	[166.92] (82.75)	4117	4096	[169.45] (89.61)	4135	4060	[146.16] (115.15)
Slope	5.54	7.21	[0.88]* (0.49)***	5.75	7.02	[0.86] (0.52)**	5.87	6.95	[0.95] (0.58)*	5.77	7.21	[0.90] (0.79)*
Observations	177	95		144	86		104	73		48	52	
% Indigenous	63.59	58.84	[11.19] (9.76)	71.00	64.55	[8.04] (8.14)	71.01	64.54	[8.42] (8.43)	74.47	63.35	[10.87] (10.52)
Observations	1112	366		831	330		683	330		329	251	
Log 1572 tribute rate	1.57	1.60	[0.04] (0.03)	1.57	1.60	[0.04] (0.03)	1.58	1.61	[0.05] (0.04)	1.65	1.61	[0.02]* (0.03)

(Continues)

Treatment variable at the cutoff 1

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(Continues)

Treatment variable at the cutoff 2

TABLE I—*Continued*

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	<100 km of <i>Mita</i> Boundary			<75 km of <i>Mita</i> Boundary			<50 km of <i>Mita</i> Boundary			<25 km of <i>Mita</i> Boundary		
	Inside	Outside	s.e.	Inside	Outside	s.e.	Inside	Outside	s.e.	Inside	Outside	s.e.
% 1572 tribute to Spanish Nobility	59.80	63.82	[1.39]*** (1.36)***	59.98	63.69	[1.56]** (1.53)**	62.01	63.07	[1.12] (1.34)	61.01	63.17	[1.58] (2.21)
Spanish Priests	21.05	19.10	[0.90]** (0.94)**	21.90	19.45	[1.02]** (1.02)**	20.59	19.93	[0.76] (0.92)	21.45	19.98	[1.01] (1.33)
Spanish Justices	13.36	12.58	[0.53] (0.48)*	13.31	12.46	[0.65] (0.60)	12.81	12.48	[0.43] (0.55)	13.06	12.37	[0.56] (0.79)
Indigenous Mayors	5.67	4.40	[0.78] (0.85)	4.55	4.29	[0.26] (0.29)	4.42	4.47	[0.34] (0.33)	4.48	4.42	[0.29] (0.39)
Observations	63	41		47	37		35	30		18	24	

^aThe unit of observation is 20 × 20 km grid cells for the geospatial measures, the household for % indigenous, and the district for the 1572 tribute data. Conley standard errors for the difference in means between *mita* and non-*mita* observations are in brackets. Robust standard errors for the difference in means are in parentheses. For % indigenous, the robust standard errors are corrected for clustering at the district level. The geospatial measures are calculated using elevation data at 30 arc second (1 km) resolution (SRTM (2000)). The unit of measure for elevation is 1000 meters and for slope is degrees. A household is indigenous if its members primarily speak an indigenous language in the home (ENAH0 (2001)). The tribute data are taken from Miranda (1583). In the first three columns, the sample includes only observations located less than 100 km from the *mita* boundary, and this threshold is reduced to 75, 50, and finally 25 km in the succeeding columns. Coefficients that are significantly different from zero are denoted by the following system: *10%, **5%, and ***1%.

Treatment variable at the cutoff 2

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TABLE II
LIVING STANDARDS*

Sample Within:	Dependent Variable						
	Log Equiv. Household Consumption (2001)			Stunted Growth, Children 6–9 (2005)			
	<100 km of Bound. (1)	<75 km of Bound. (2)	<50 km of Bound. (3)	<100 km of Bound. (4)	<75 km of Bound. (5)	<50 km of Bound. (6)	Border District (7)
Panel A. Cubic Polynomial in Latitude and Longitude							
<i>Mita</i>	−0.284 (0.198)	−0.216 (0.207)	−0.331 (0.219)	0.070 (0.043)	0.084* (0.046)	0.087* (0.048)	0.114** (0.049)
R^2	0.060	0.060	0.069	0.051	0.020	0.017	0.050
Panel B. Cubic Polynomial in Distance to Potosí							
<i>Mita</i>	−0.337*** (0.087)	−0.307*** (0.101)	−0.329*** (0.096)	0.080*** (0.021)	0.078*** (0.022)	0.078*** (0.024)	0.063* (0.032)
R^2	0.046	0.036	0.047	0.049	0.017	0.013	0.047
Panel C. Cubic Polynomial in Distance to <i>Mita</i> Boundary							
<i>Mita</i>	−0.277*** (0.078)	−0.230** (0.089)	−0.224** (0.092)	0.073*** (0.023)	0.061*** (0.022)	0.064*** (0.023)	0.055* (0.030)
R^2	0.044	0.042	0.040	0.040	0.015	0.013	0.043
Geo. controls	yes	yes	yes	yes	yes	yes	yes
Boundary F.E.s	yes	yes	yes	yes	yes	yes	yes
Clusters	71	60	52	289	239	185	63
Observations	1478	1161	1013	158,848	115,761	100,446	37,421

Figure: Dell (2010)

Results

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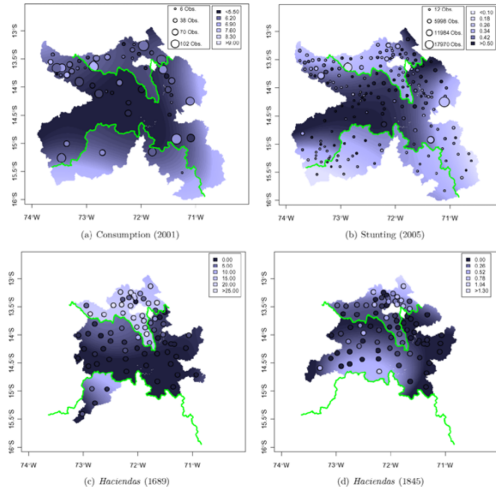


Figure: Plots of various outcomes against longitude and latitude

Results

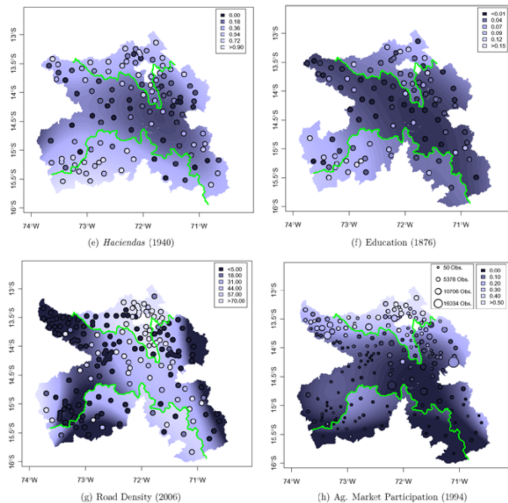


Figure: Plots of various outcomes against longitude and latitude

Discussion: Three-Step Process Leading to Institutional Change

1. Impact on Property Rights and Land Ownership:

- ▶ The Mita system weakened property rights in affected areas.
- ▶ Non-Mita areas developed large estates with formalized ownership, while Mita areas did not.

2. Impact on Public Goods Provision:

- ▶ Large landowners in non-Mita areas advocated for public goods like roads.
- ▶ Evidence shows roads were built near large farms, reflecting landowner influence.

3. Long-Term Economic Impacts:

- ▶ Disparities in public goods provision altered market structures and productivity.
- ▶ Mita areas, lacking infrastructure, are still characterized by subsistence farming.

Persistence

LAND TENURE AND LABOR SYSTEMS^a

	Dependent Variable				
	<i>Haciendas per District in 1689</i> (1)	<i>Haciendas per 1000 District Residents in 1689</i> (2)	Percent of Rural Tributary Population in <i>Haciendas</i> in ca. 1845 (3)	Percent of Rural Population in <i>Haciendas</i> in 1940 (4)	Land Gini in 1994 (5)
Panel A. Cubic Polynomial in Latitude and Longitude					
<i>Mita</i>	-12.683*** (3.221)	-6.453** (2.490)	-0.127* (0.067)	-0.066 (0.086)	0.078 (0.053)
R^2	0.538	0.582	0.410	0.421	0.245
Panel B. Cubic Polynomial in Distance to Potosí					
<i>Mita</i>	-10.316*** (2.057)	-7.570*** (1.478)	-0.204** (0.082)	-0.143*** (0.051)	0.107*** (0.036)
R^2	0.494	0.514	0.308	0.346	0.194
Panel C. Cubic Polynomial in Distance to <i>Mita</i> Boundary					
<i>Mita</i>	-11.336*** (2.074)	-8.516*** (1.665)	-0.212*** (0.060)	-0.120*** (0.045)	0.124*** (0.033)
R^2	0.494	0.497	0.316	0.336	0.226
Geo. controls	yes	yes	yes	yes	yes
Boundary F.E.s	yes	yes	yes	yes	yes
Mean dep. var.	6.500	5.336	0.135	0.263	0.783
Observations	74	74	81	119	181

Figure: Land tenure and Labor systems

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Conclusion 1

- ▶ Outside the mita, owners of “haciendas” – or big farming estates – used their political clout to have roads built to carry their produce to market.
- ▶ Within the mita, there were fewer haciendas, because the Spanish colonial administration didn't want competition for labor, and so there were fewer roads.

Conclusions 2

- ▶ **Role of Large Landowners:**

- ▶ Large landowners played a dual role: they did not promote broad economic prosperity, but they shielded individuals from an exploitative state and ensured public goods provision.

- ▶ **State Constraints and Economic Interactions:**

- ▶ The study highlights that constraints on how the state shapes economic interactions (e.g., coercion of labor, protection of property) are more critical than land inequality for understanding Latin America's long-term growth.

- ▶ **Future Research Directions:**

- ▶ Future work should focus on the development of general models of institutional evolution and investigate how these constraints are influenced by forces of change.