Prison Labor: The Price of Prisons and the Lasting Effects of Incarceration

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Rising incarceration rates around the world have reignited debates around prison labor

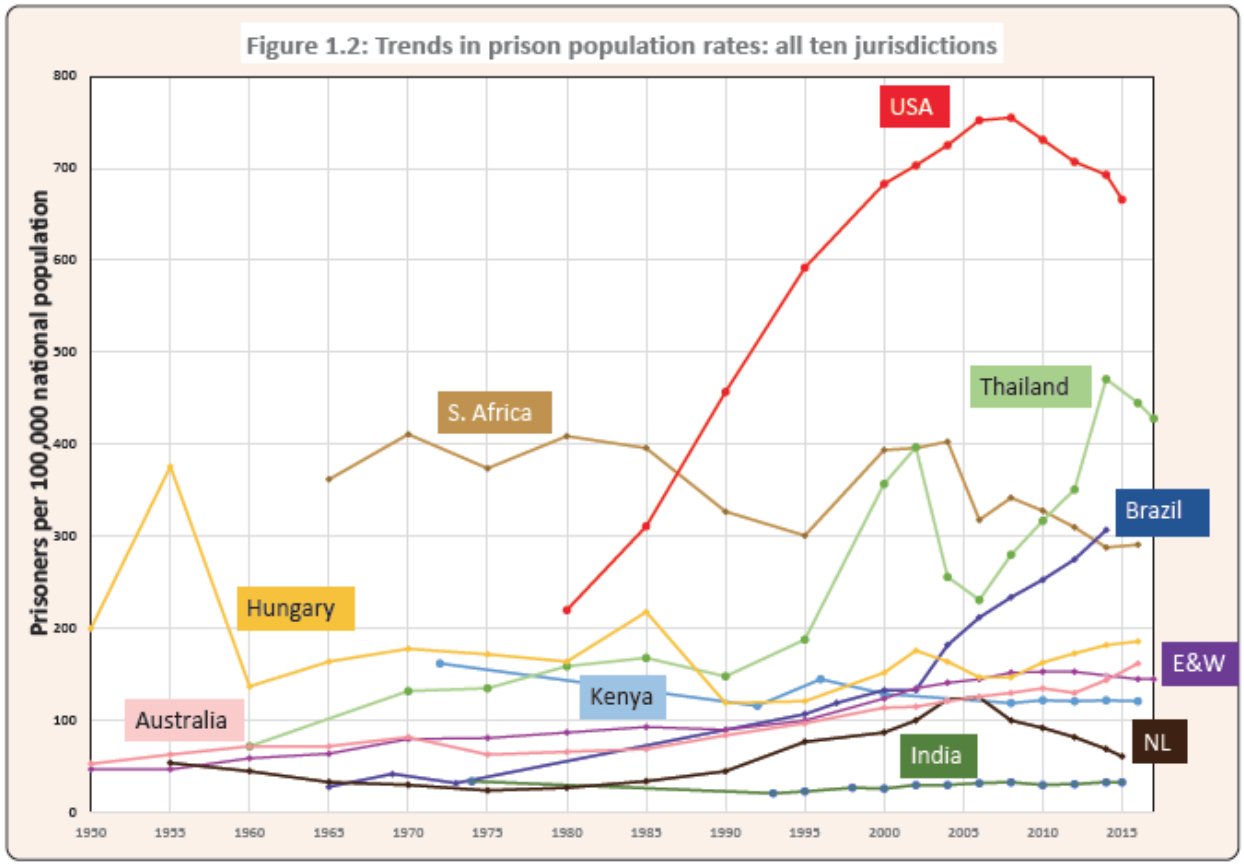

Figure: Incarceration rates globally, 1950-2015. Source: Institute for Criminal Policy Research

What are the effects on incarceration when prisoners are viewed and used as a source of labor to serve economic interests?

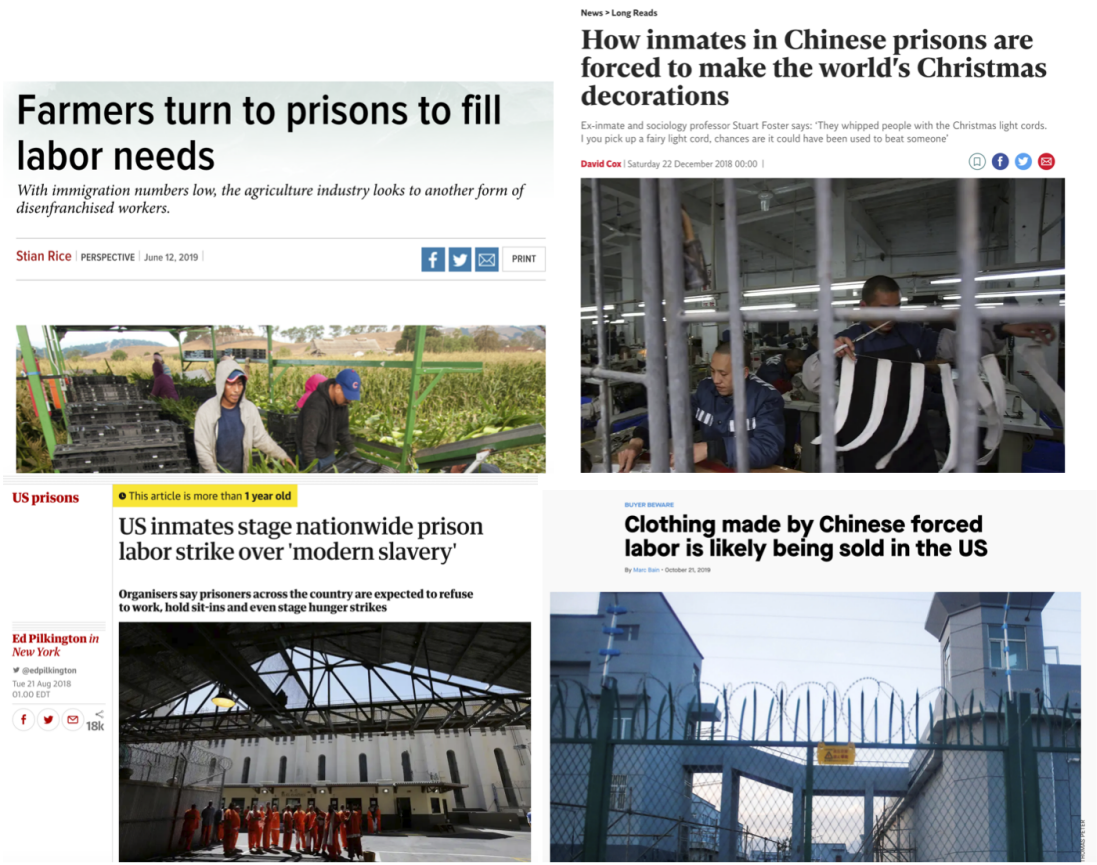

Figure: The US and China are 2 of the largest consumers of prison labor

And what are the potential implications for views of state legitimacy when an institution of state justice, like prisons, is used to serve economic/extrajudicial interests?

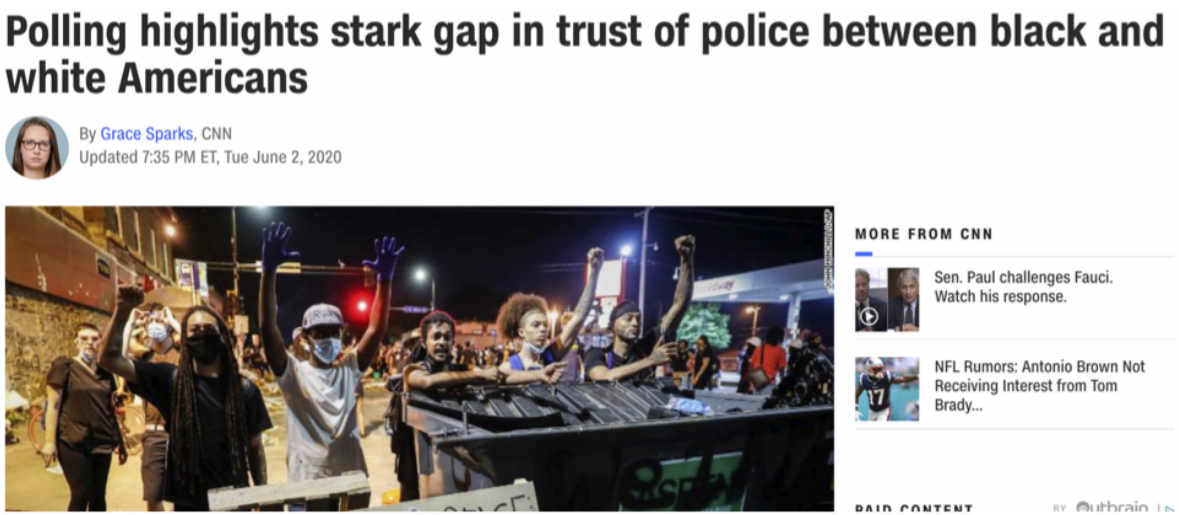

Figure: Racial gap in trust in police in US and protests against police brutality around the world

Key Questions: Evidence from prisons in colonial and postcolonial Nigeria

- Answer questions using evidence from colonial Nigeria (1920-1959) where prison labor was a feature of state policy and finance (first estimates)
- We examine the dynamics of incarceration, how it responded to economic shocks, and some long-term consequences (65 years of archival data on prisons)
- We answer 3 specific questions:
  - Q1: How important was prison labor for colonial public finance/public works construction and maintenance?

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  - Q2: How did incarceration rates respond to economic shocks when prison labor was an important part of state public finance?
    - Q2a: Falsification test: do we see the same relationship when prisoners are not being viewed and used as source of labor (evidence from postcolonial (post 1960) Nigeria, 1971-1995)

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  - Q3: What are there long-term effects of this prison labor system on perceptions of state legitimacy? Trust in legal institutions like police? When institutions of justice are used to serve economic or extrajudicial interests?

Why is colonial Nigeria an informative region to study these questions? 3 main reasons

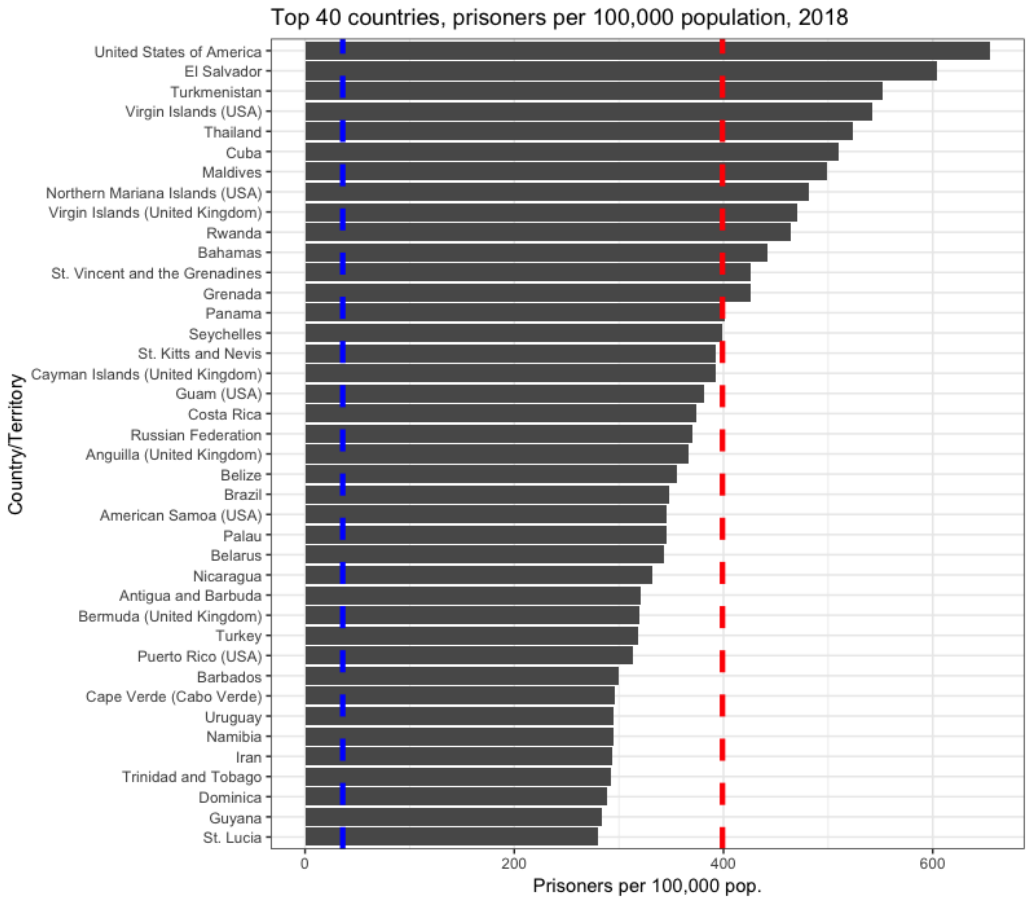

Figure: Top 40 countries/territories for incarceration rates, 2018 with Nigeria incarceration rates in red (year 1940) and blue (year 2018). Source: WPB

Preview of Results

- Q1: Prison labor is economically valuable to colonial regime. All able-bodied sentenced prisoners must work, unpaid labor:
  - Gross value of prison labor $>>$ 0 between 1920-1959 . Net value (all maintenance costs) $>>$ 0 $\approx$ 60% years
  - Significant share of colonial public works expenditures- 40-249% gross (mean 101%). Net: average 5%, max 42%. Govt departments like Public Works, railroad significantly use prison labor

Figure: African laborers on a railroad c. 1930, Source: Alexander Keese, CEAUP, Porto

Preview of Results

- Q2: Incarceration rates are procyclical during colonial period. Effect is reversed in postcolonial period:
  - Positive economic shocks increase incarceration rates and the use of prison labor in colonial era
  - Positive effect specific to short-term (ST) ($<$ 6mos) incarceration only. No effect for long-term (LT) ($>$ 2yr) incarceration.
  - Moderate positive rainfall shock that inc. agric. prod. increase ST rates by 12% (mean is 135)
  - Effect is reversed in postcolonial period: extreme negative rainfall shocks, like droughts, inc. incarceration (21% rel. to mean of 105)
  - 1% inc in export prices for major cash crop in producing regions $->$ 2% increase in ST incarceration rel. to mean
  - Inc. demand for unpaid labor for construction and maintenance of public works $->$ intensify exports of agric. comm. during pos. shocks
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- Q3: Respondents from areas with high rates of colonial imprisonment report lower trust in legal institutions like police today, no effect on interpersonal trust

A History of Forced Labor

- Prison labor was a small part of a larger regime of domestic forced labor in colonial Africa
- European colonial revenue imperative and labor shortage question
- Answer: Construct public works infrastructure using coercive labor regimes. Examples:
  - Labor ordinances, labor taxes, Masters and Servants Ordinances, vagrancy laws, labor registration, pass laws, Native Authority Ordinances, etc
  - E.g. Road ordinance of 1894, "Chiefs' Bye-Laws and Road Maintenance" 1912
  - Consequences of not participating: fines, prison

Prison labor in British colonial Nigeria

- Nigeria colony from 1914-1960. Colonial prisons (and Native Admin. prisons)
- Colonial prisons: Mostly short-term prisoners: Convict prisons/LT- $> 2yrs$; Provincial/MT ($2 > y > .5$); Divisional/ST ($y <= .5$/ or 6 months)
- Goals- punish crimes/control African pop., cheap labor
- Similar crimes $\neq$ similar punishment

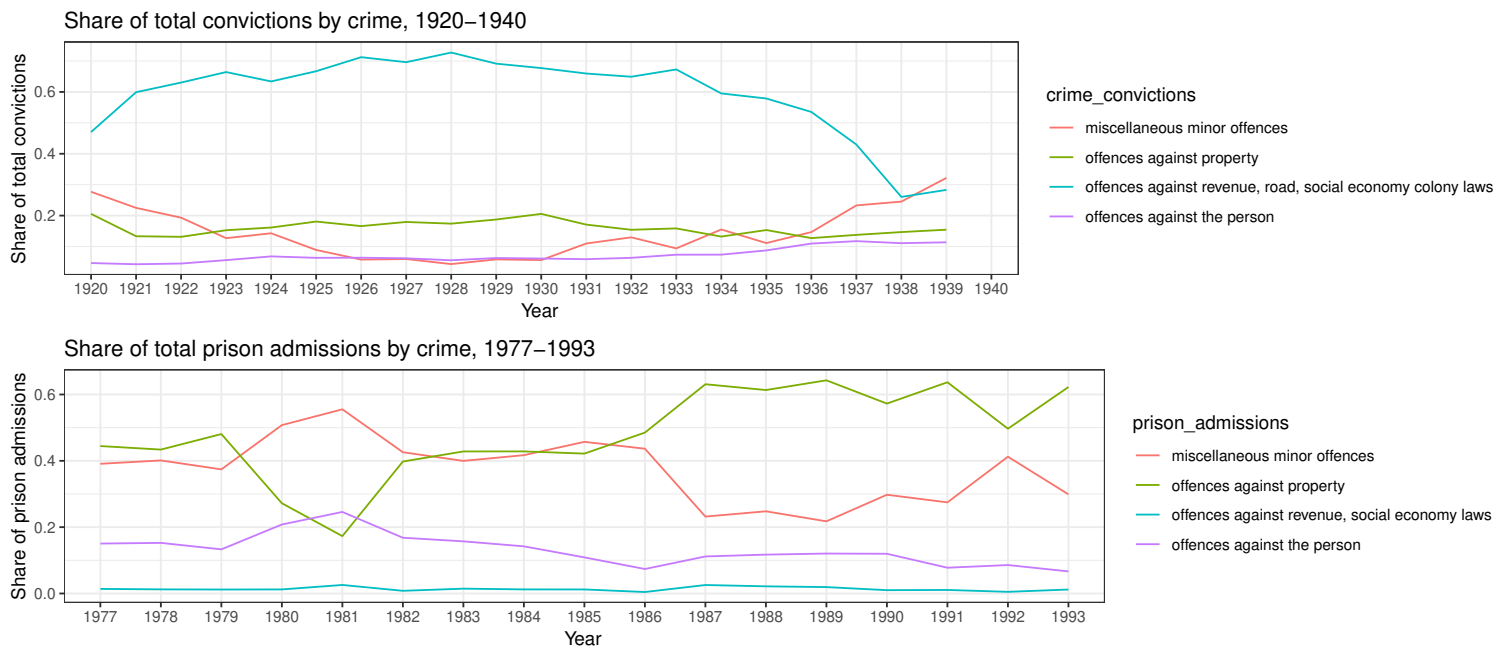


Figure: Share of total convictions in colonial courts and share of total prison admissions in postcolonial period by crime in Nigeria, 1920-1993.

Prison labor in British colonial Nigeria

- North/South differences in Native Admin (>North) vs colonial (>South) Prisons
- Unpaid prison labor hired out to govt. depts only- public works department (PWD), Railways and Harbors, Police, Public Health, Education top consumers. Types HL and LL (73-91% in South):
  - Unskilled hard labor (HL): "coaling ship, grass-cutting, painting and refuse disposal" etc
  - Skilled hard labor: "basket-weaving, brick-making, carpentry, clerical work, cooking, laundering, mat-making, masonry and tailoring" etc
  - Light labor (LL): cell-cleaning, lamp-trimming, sweeping" etc
- In Nigeria- quarries in Abeokuta province, coalfields in Enugu, industries in Lagos, Eastern railway from Port-Harcourt in Enugu province all use large gangs of prison labor etc- much of coal mining and railroad construction in SE Nigeria
- LT prisoners- trade like carpentry, basket making (uniforms etc) for cash returns
- Change in tax structure of postcolonial economy $->$ prison labor no longer a major feature of state public finance

Change in composition of tax revenue in Nigeria, 1930-1980

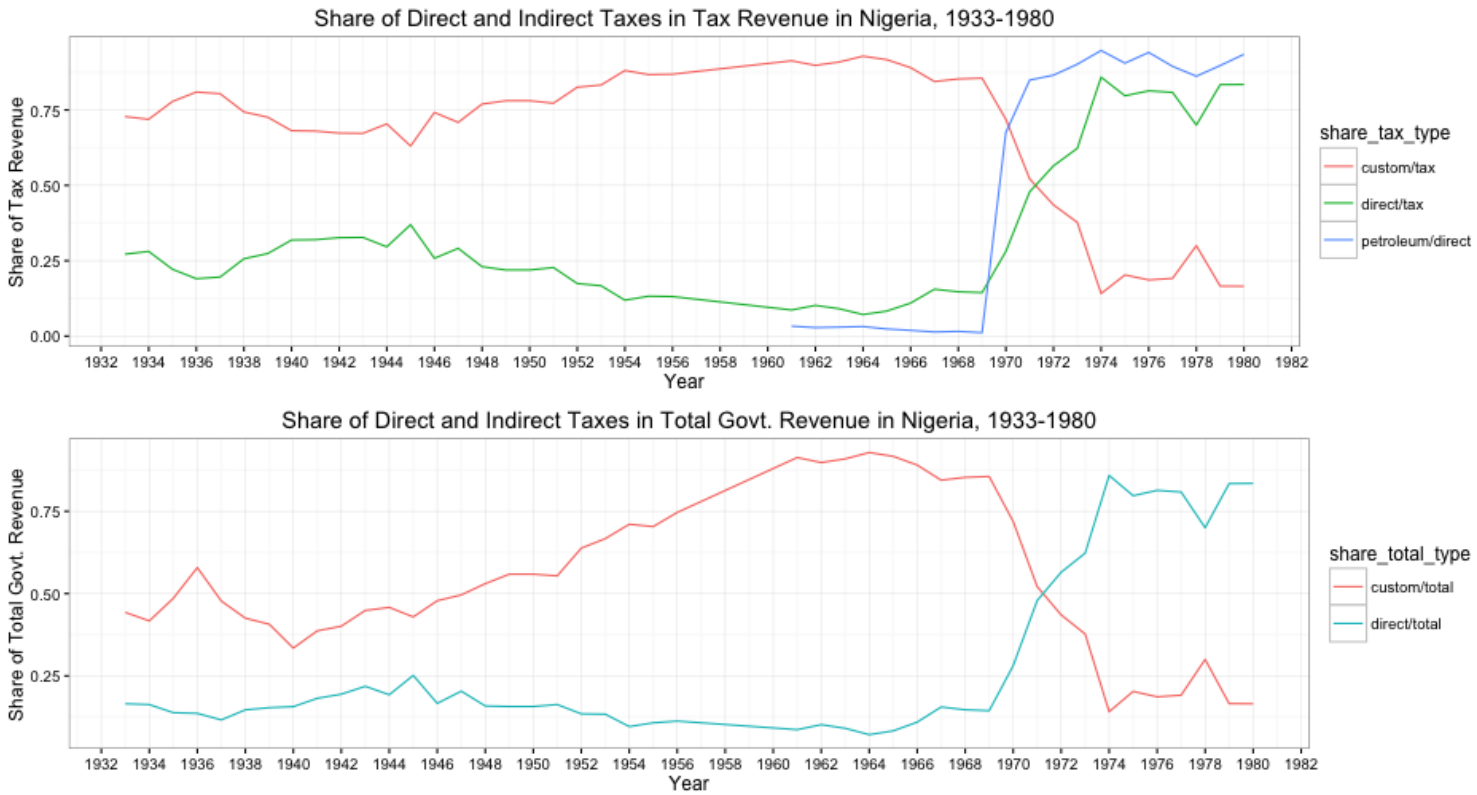


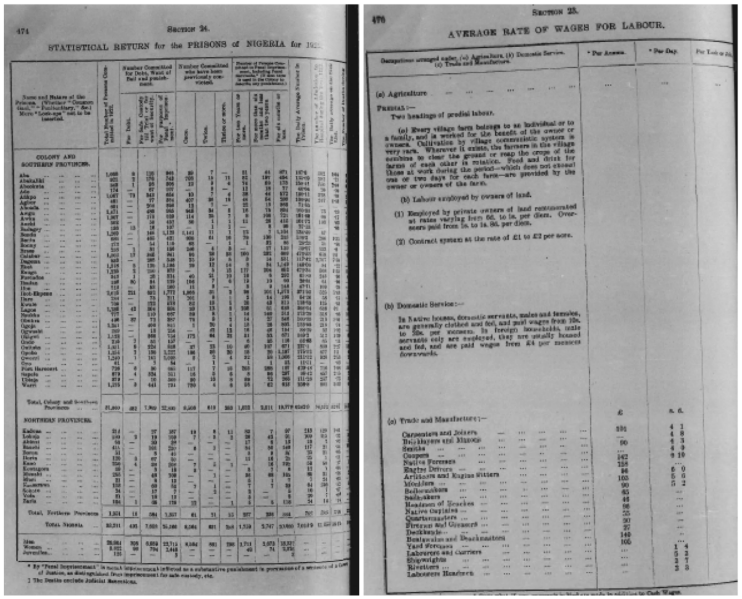
Figure: Composition of Tax Revenue in Nigeria, 1930-1980

Qualitative accounts: Addressing labor shortages with prison labor in British colonial Nigeria

- E.g.: 1920s "many of the inmates in Owerri prison in South-Eastern Nigeria were young men who had resisted compulsory labor, only to be imprisoned and employed in chains as prison labor" (Ekechi, 1989)
- Similar to US convict labor use over industrial period, e.g. Western North Carolina Railroad from 1855 to 1894 in the US (Fogel, 1995; Browne, 2007; Ayers, 1984; Myers, 1991)
- 1911 Gov of NN: "The value (calculated at 2/3 of the market rate) of prisoners' labor in connection with public works, which would otherwise have had to be paid for in cash was 3,878 pounds. If calculated at the ordinary market rates the value of the prisoners' useful labor would have exceeded the entire cost of the Prison Department" (Abiodun, 2017; Salau, 2015)
- Sometimes explicit: response to 1923 wage labor request of British sanitary inspector: 'the officials asked the prison department to find ways to either increase the prison population or recruit convicts from outstation prisons to complete the tasks." (NAI, CSO 26/2 09591 Vol.1 'Lieutenant Governor Southern Province to Resident Calabar Province: Memorandum on Prison labor' 23rd April 1923)
- Beverley in the 1916 Annual Report on Prisons lists 2 main reasons for creating categories of prisons according to prison sentence as (a) to place 'special prisons' in "townships which are on good lines of communication and afford the most suitable description of penal labour." and (b) "the ensuring, as far as possible, of an automatic and constant supply of prisoners to each class of prisons. At the end of the year, the system appeared to be working well; the prison population was evenly distributed, and nowhere was there shortage of convict labour."

Q1: Historical Data

- British colonial Blue Books and Annual Report on Prisons, Nigeria, 1920-1959, District/Province level
  - Prison data
  - Wages
  - Public works expenditure
  - Railroad (colonial only)
- A note on Native Administration prisons: Lower bound estimates

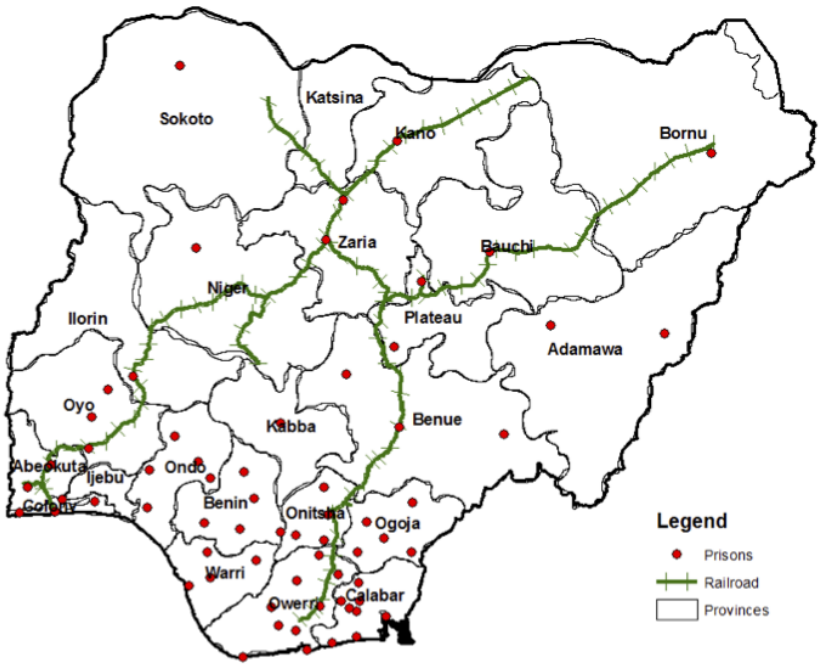


STATISTICAL RETURN for the PRISONS of NIGERIA for 192

AVERAGE RATE OF WAGES FOR LABOUR.

Figure: Example of archival data on prisons and wages from the British Blue Books (1922)

Colonial prisons, regions and railroad network in Nigeria



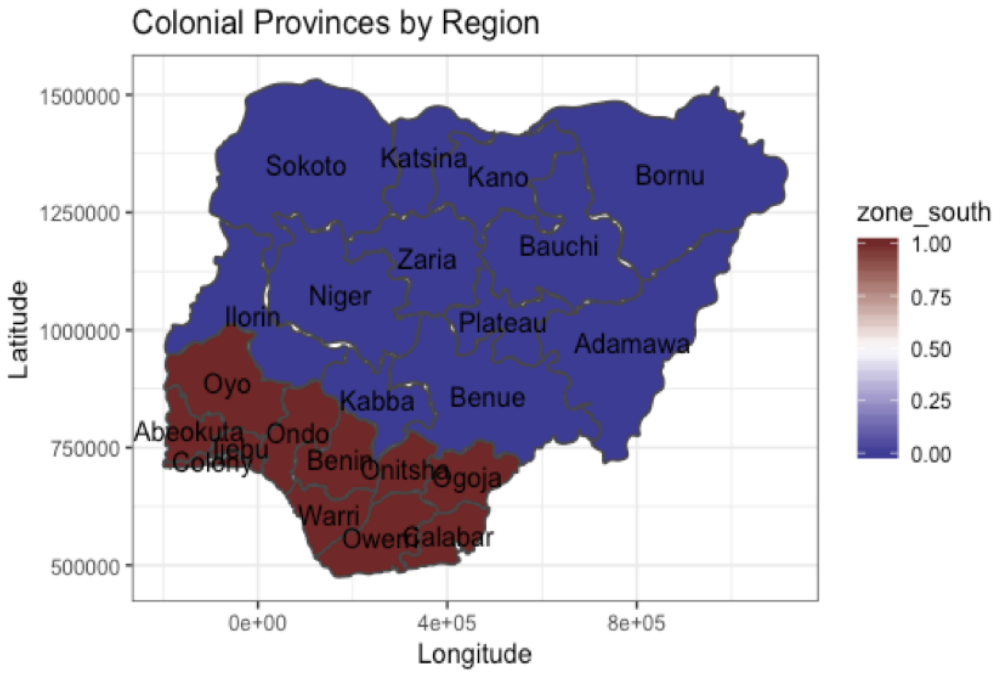


Figure: Nigeria provinces with colonial prison locations and railroad network shown (left) and regions (right)

Q1: How important was prison labor for colonial public finance/public works construction and maintenance?

$$\text{Value of prison labor}_t = \text{Annual wages}_t \times \sum_{n=1}^{N} \text{Prisoners}_{nt} \quad (1)$$

- $Prisoners_{nt}$ is the daily average number of people in prisons over n days in the year from archival records
- Implied labor costs = Value of prison labor [lower bound estimate]
- Gross value of prison labor and net value of prison labor (less food (35%) and total prison maintenance costs (most expansive))
- Relative value of prison labor = Value of prison labor / Public works expenditure
- Robustness checks: Compare with colonial estimates of value of prison labor

Wages, prisoner costs and daily average number in prisons in colonial Nigeria, 1920-1959

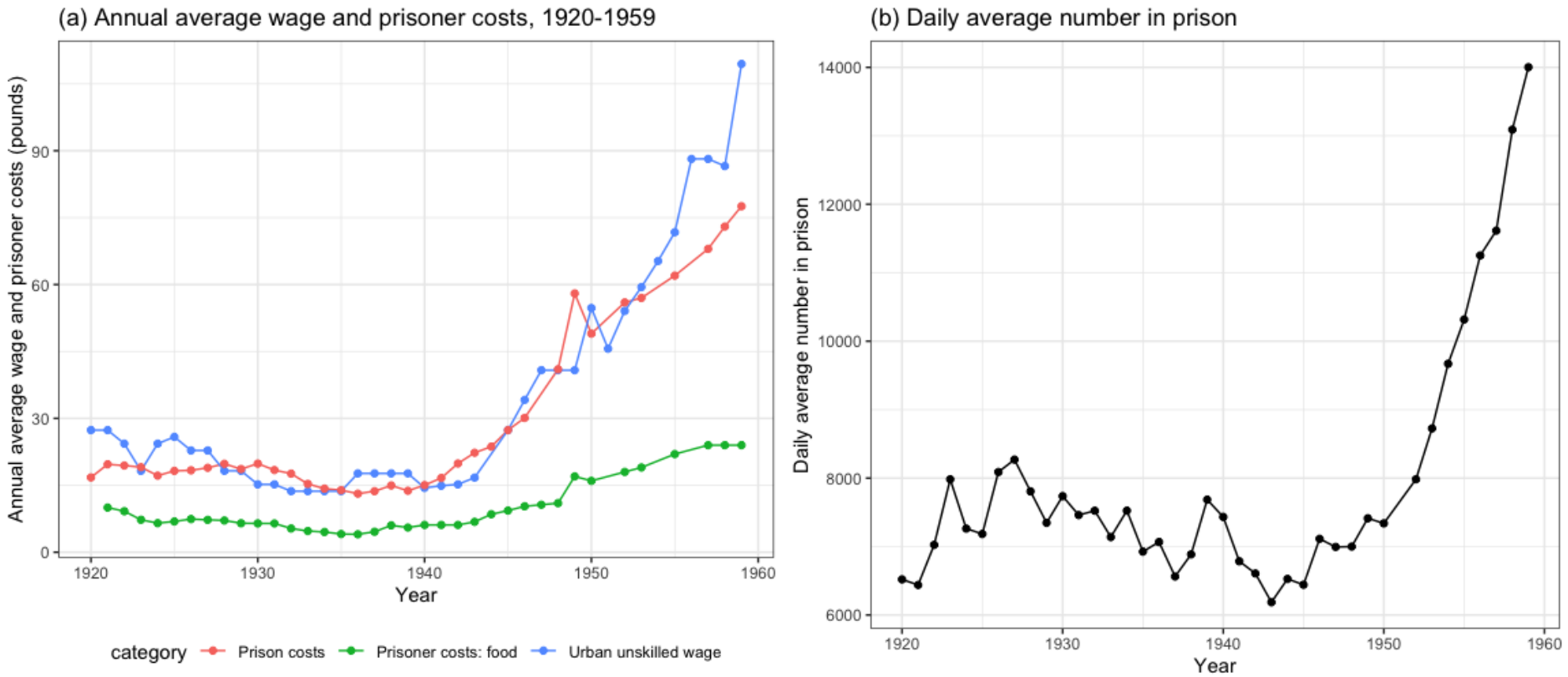
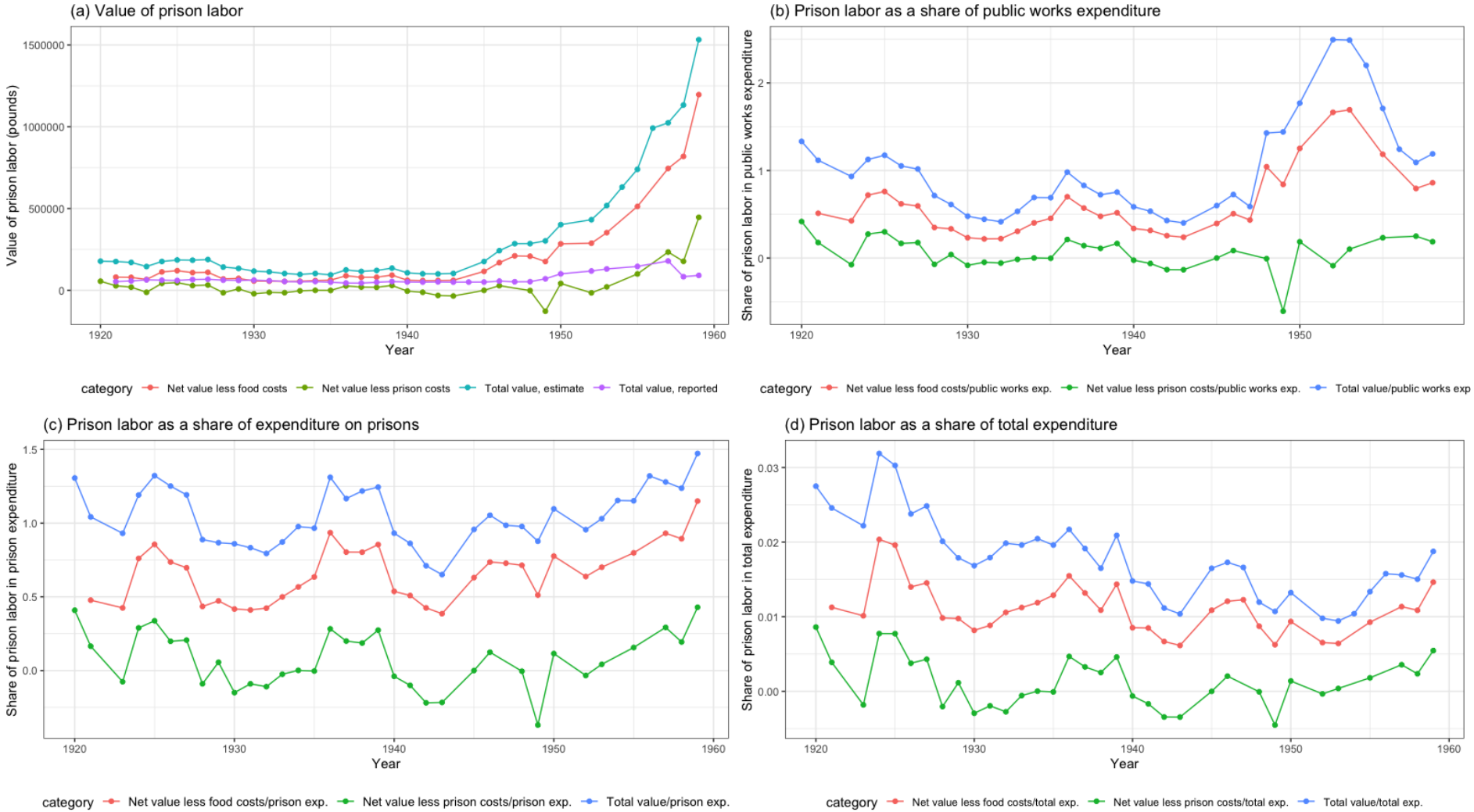


Figure: Wages, prisoner costs and daily average number in prisons in colonial Nigeria, 1920-1959

Relative value of prison labor (imputed vs colonial reported estimate), 1920-1959



Value of wages for different skill categories in prison and market sectors, 1919-1925

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Summary of results on value of prison labor in colonial Nigeria

- Prison labor is economically valuable to colonial regime. Significant share public works expenditure- gross value is 40-249% (mean 101%) of public works expenditure in colonial Nigeria [lower bound]
- Net value, accounting for most expansive costs of prisoner upkeep up to 42% (mean 5%), $>> 0 \approx 60\%$ years
- Colonial estimates: Prisoners' labor valued bet 60-80% below market rate over 1919-1925 (confirms historical lit trends). Underestimate value of prison labor to keep costs of administration for their peer departments low while attempting to balance their budgets

Q2: Data on Incarceration Rates and Economic Shocks

- Incarceration data:
  - British colonial Blue Books- Nigeria, 1920-1938, District/Province level:
  - Prison data: number of newly admitted prisoners per 100,000 pop., ST, LT (Falsification tests on sentence)
  - Nigeria Annual Abstract of Statistics, 1971-1995, District/State level:
  - Prison data: prisoners per 100,000 pop.
- Economic shocks data:
  - Rainfall z-scores, weather stations, Blue Books, 1920-1938
  - Rainfall z-scores, NASA MERRA-2, 1980-1995
  - Export price on major cash crop exports (cocoa, palm oil and groundnuts), Wageningen University African Commodity Trade Database (ACTD)
  - Land suitability and colonial crop production data from the Global Agro-Ecological Zones (GAEZ) and Blue Books

Average incarceration rate falls by ≈ 40% Between the colonial (1920-1938) and postcolonial (1971-1995) periods

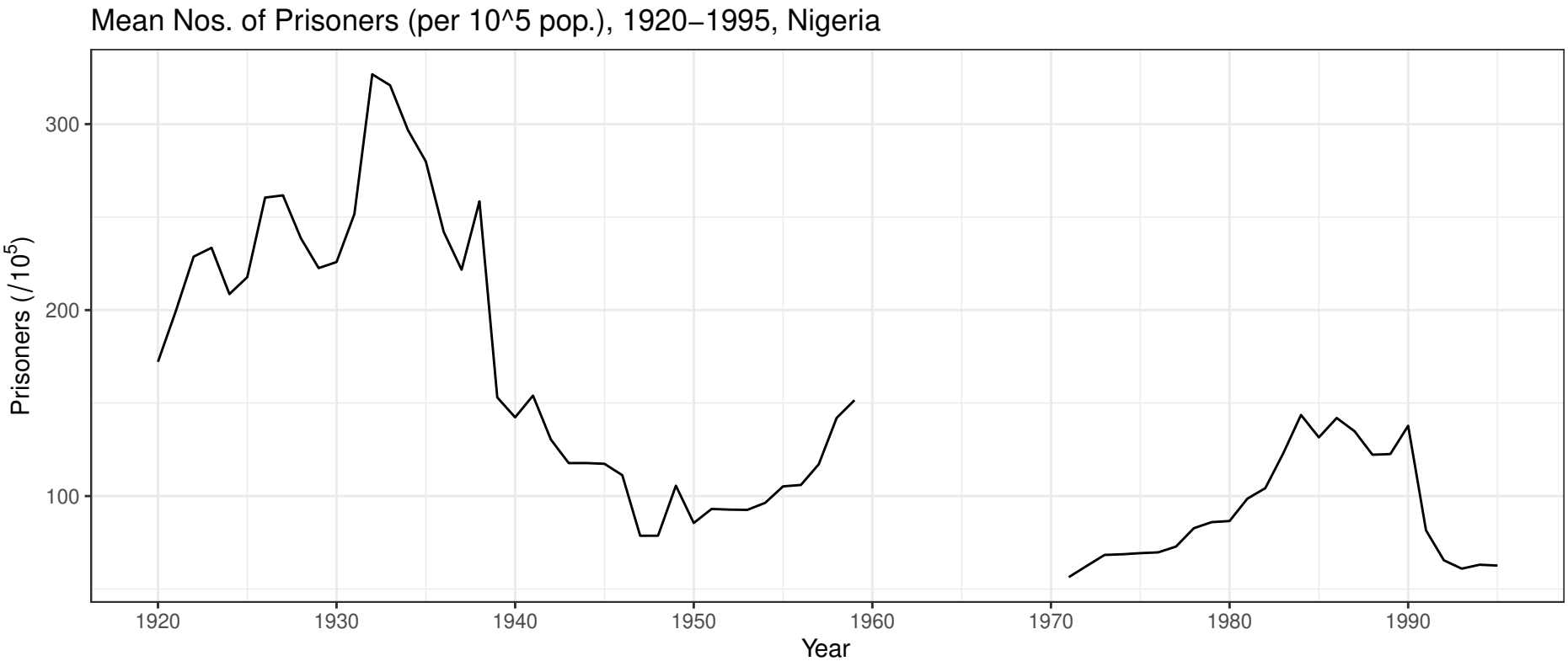


Figure: Mean number of prisoners per 100,000 population, 1920-1995

Spatial distribution of incarceration rates in colonial and postcolonial Nigeria

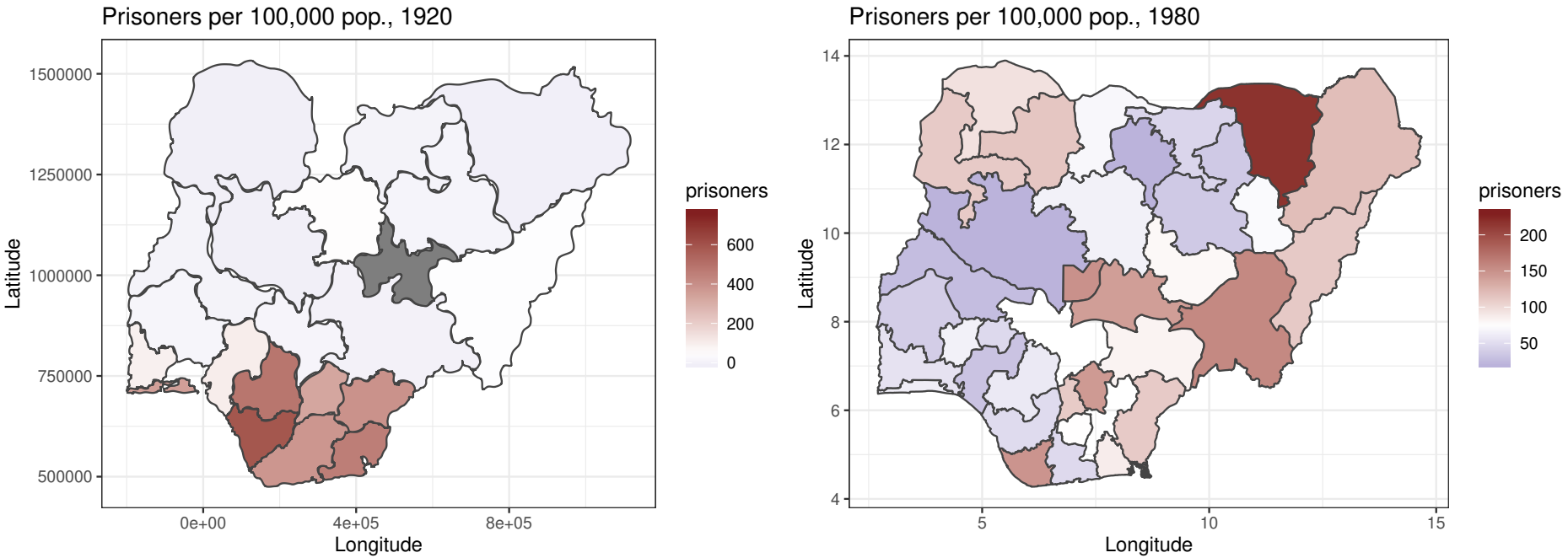


Figure: Prison populations in colonial (1920) and postcolonial (1980) Nigeria

Spatial distribution of cash crop production in colonial Nigeria (North vs South)

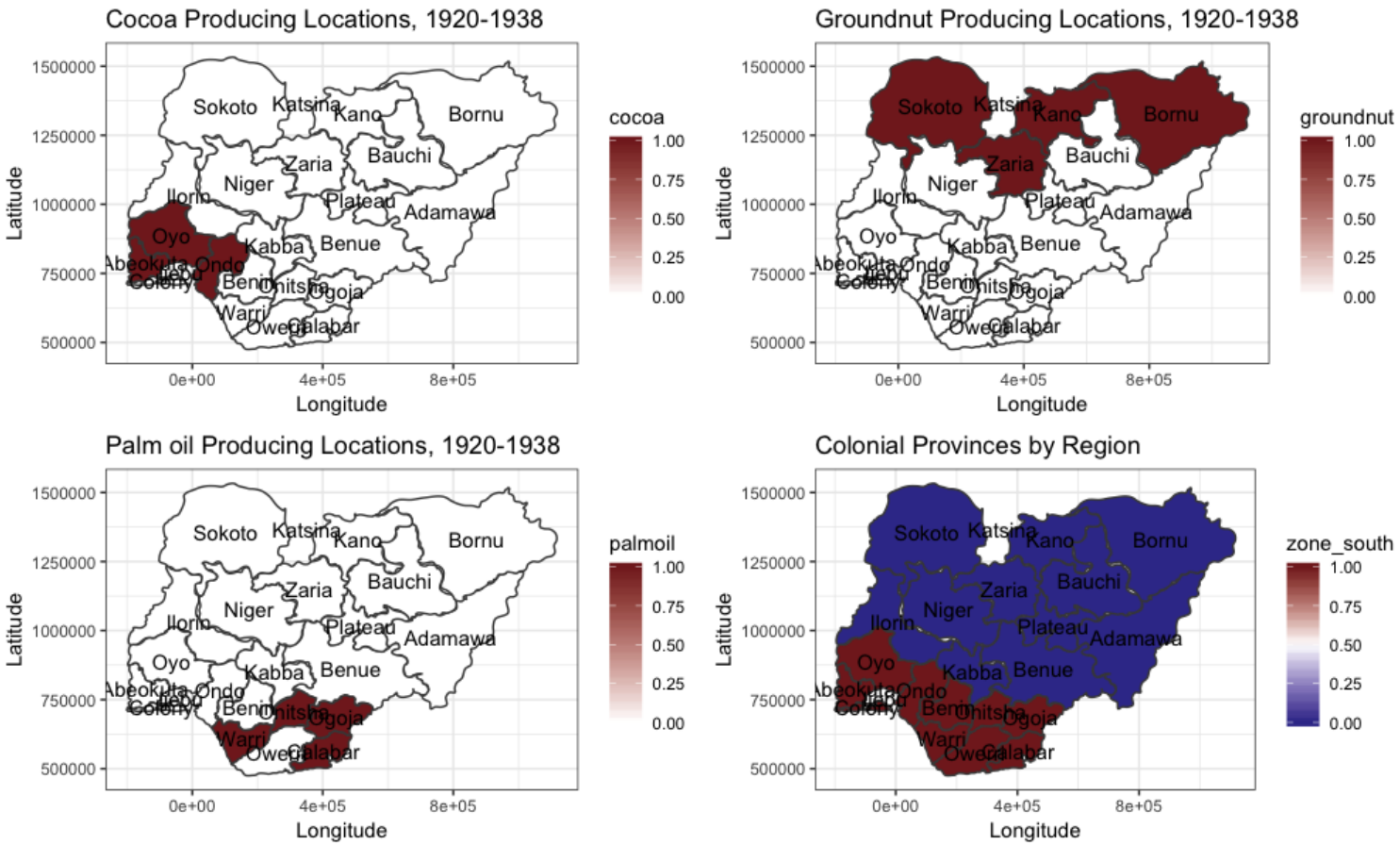
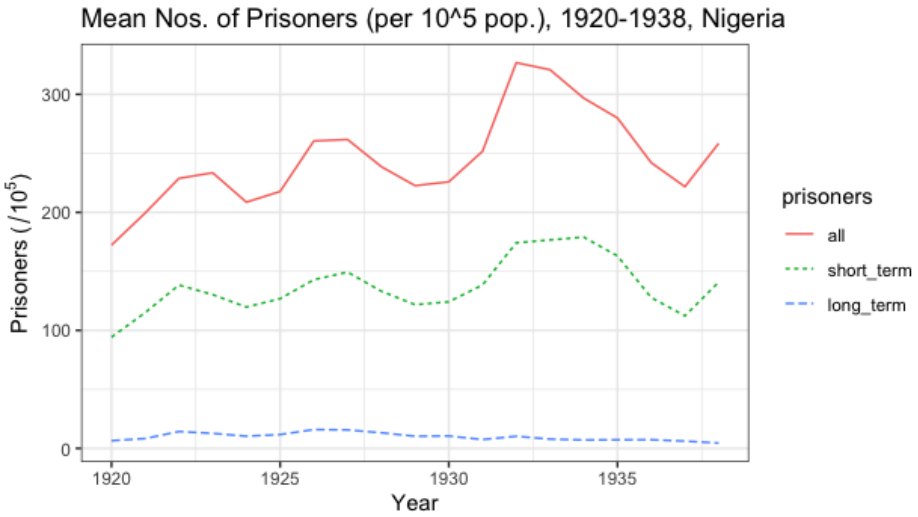
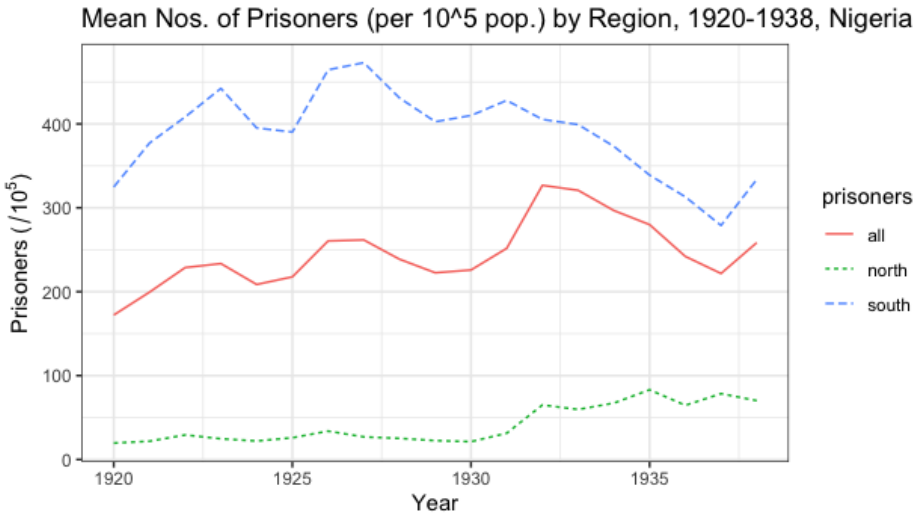
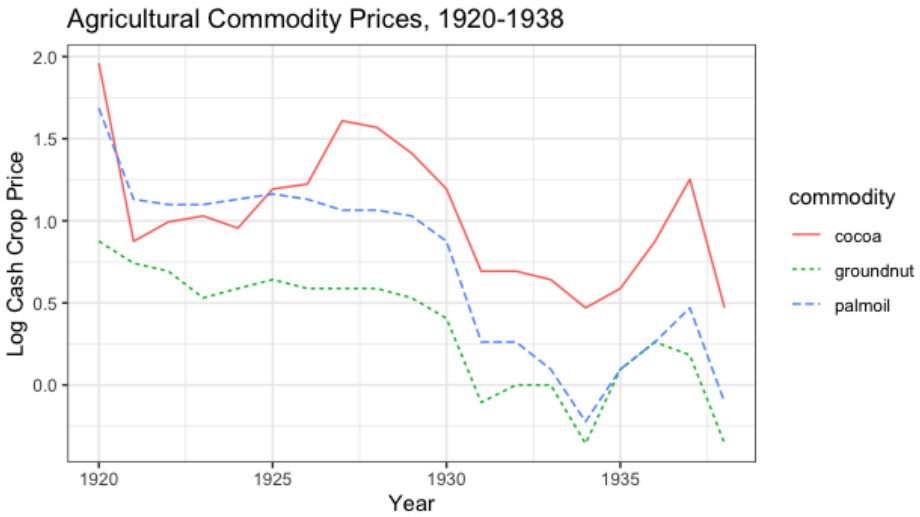


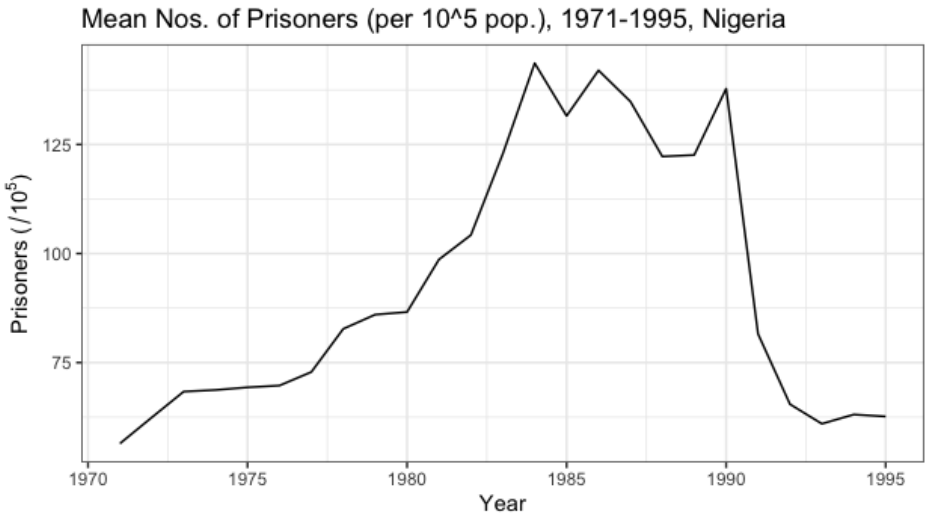
Figure: Agricultural commodity production in colonial Nigeria

Prisoners and agricultural commodity prices in Nigeria, 1920-1995









Q2: How do incarceration rates respond to economic shocks when prison labor is an important part of state public finance?

- 3 models:
  1. Nonlinear effects of economic shocks on incarceration rates: inverted-u (colonial) vs u-shaped (postcolonial)

$$\text{Prisoners}_{it} = \beta_1 \text{RainfallDev}_{it} + \beta_2 \text{RainfallDev}_{it}^2 + \mu_i + \delta_t + \epsilon_{it} \quad (2)$$

  2. Distinguishing + and − shocks, a) Positive shock (M)=1 if $0 < \textit{RainfallDev}_{it} < 0.75$ (b) Positive shock (E)= 1 if $\textit{RainfallDev}_{it} > 0.75$, floods (c) Negative shock (E)= 1 if $\textit{RainfallDev}_{it} < -0.5$, droughts

$$\text{Prisoners}_{it} = \alpha \text{Positive shock (M)}_{it} + \mu_i + \delta_t + \epsilon_{it} \quad (3)$$

  3. Effects of export cash crop price shocks

$$\text{Prisoners}_{it} = \sum_{c=1}^{3} \gamma_c \text{Cash Crop}_{ci} \times \text{Cash Crop Price}_{ct} + \mu_i + \delta_t + \epsilon_{it} \quad (4)$$

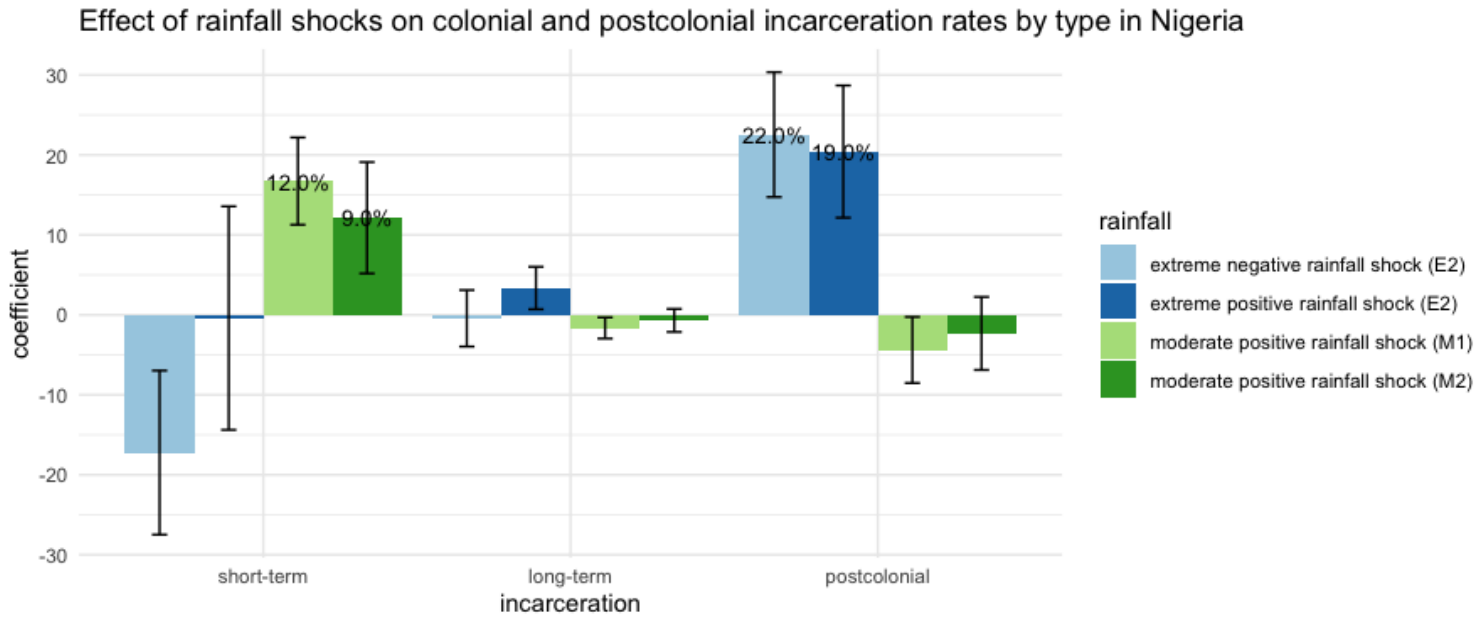
- Heterogeneity by North-South region, Falsification tests with sentences, postcolonial incarceration rates

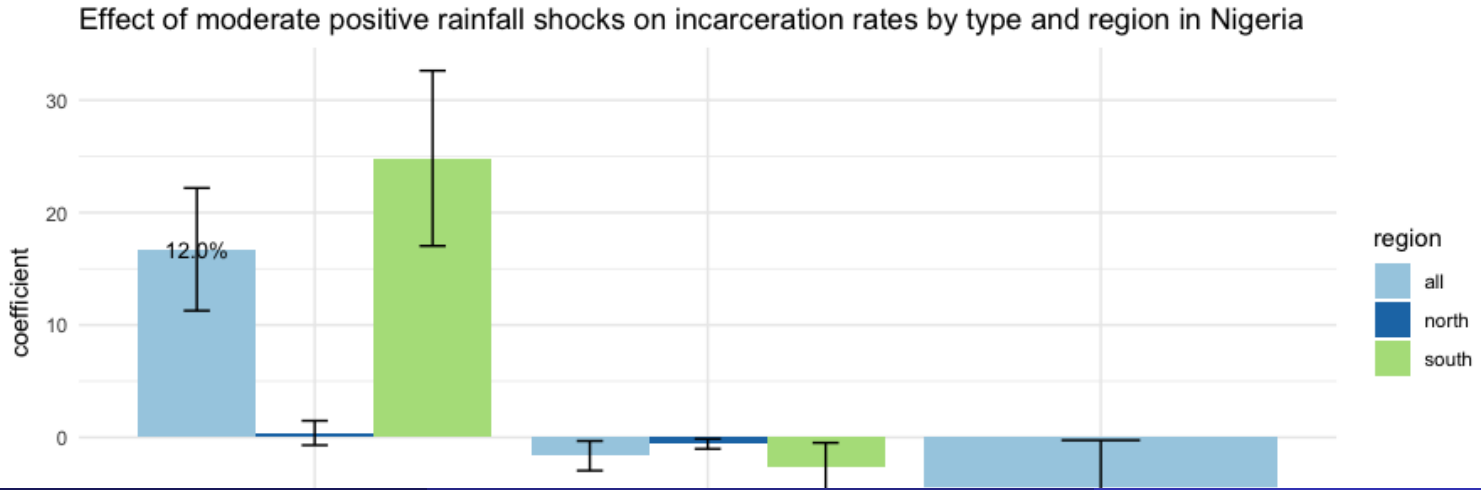
Model 1: Nonlinear effects of rainfall shocks on colonial and postcolonial incarceration rates

	All Penal	Short-Term	Medium-Term	Long-Term	All 1971-95
	(1)	(2)	(3)	(4)	(5)
Rainfall Dev	14.147**	11.995*	1.796	0.759	−6.237
	(6.041)	(6.433)	(1.276)	(1.227)	(8.570)
	[0.038]	[0.065]	[0.212]	[0.655]	[0.454]
Rainfall Dev Sq	−3.569	−4.884*	0.205	0.752	34.275***
	(2.479)	(2.816)	(0.387)	(0.739)	(9.692)
	[0.246]	[0.068]	[0.629]	[0.494]	[<.001]
Mean of outcome	162.032	134.659	16.556	10.175	104.802
District FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Observations	324	324	324	324	556
Clusters	21	21	21	21	36

Notes: Regressions estimated by OLS. Robust standard errors in parentheses clustered by district, where district is colonial province for colonial data, and postcolonial state for postcolonial data. Wild cluster bootstrap (by district) p-values are in brackets. Observations are provinces. Dependent variables in (1)-(5) are prisoners per 100,000 population (1939 pop.) by province in Nigeria broken down by all prisoners, penal imprisonment, custody/awaiting trial, short-term (less than 6 months) sentence and medium-term (between 6 months to 2 years) sentence and long-term (greater than 2 years) sentence over 1920-1938. Dependent variable in (6) is prisoners per 100,000 population (1990 pop.) by state in Nigeria. Results remain unchanged when we replace the denominator for the incarceration rates with the adult population of the province only. Rainfall deviation as defined in text. District FE are colonial province fixed effects in (1)-(5), and postcolonial state fixed effects in (6). ***Significant at the 1 percent level, **Significant at the 5 percent level, *Significant at the 10 percent level based on clustered standard errors in parentheses.

Model 2: Moderate positive rainfall shocks increase ST colonial incarceration rates



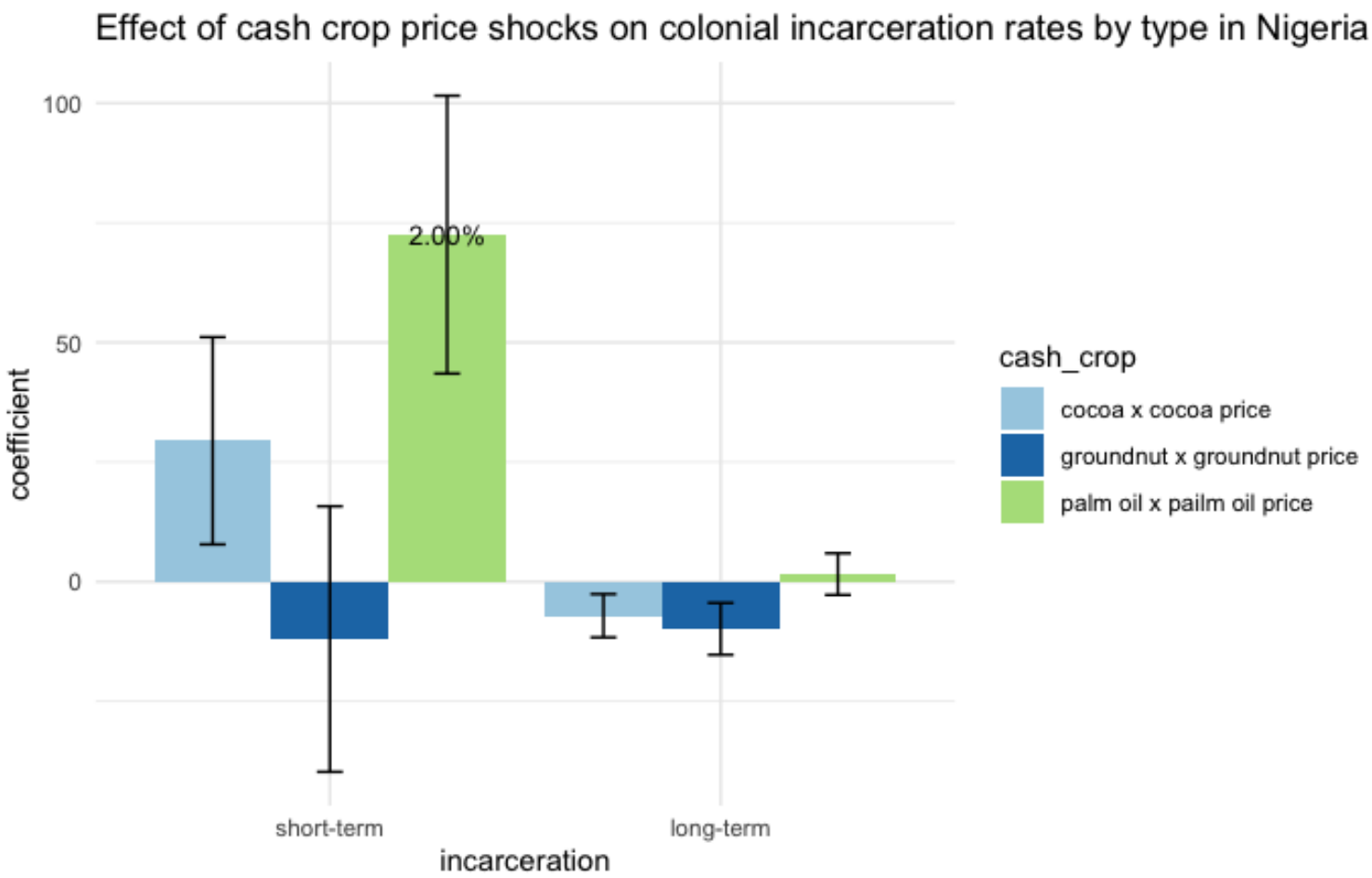


Model 2: Identifying the effects of positive rainfall shocks on incarceration rates results

	Short-Term			Long-Term			All 1971-95		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Positive rainfall shock (M)	16.727***		12.142*	−1.638		−0.695	−4.387		−2.320
	(5.456)		(6.964)	(1.319)		(1.437)	(4.132)		(4.564)
	[0.016]		[0.093]	[0.336]		[0.683]	[0.320]		[0.620]
Negative rainfall shock (E)		−20.290**	−17.225*		−1.060	−0.429		22.722***	22.545***
		(9.484)	(10.259)		(2.894)	(3.530)		(7.814)	(7.807)
		[0.057]	[0.139]		[0.762]	[0.886]		[0.016]	[0.012]
Positive rainfall shock (E)			−0.404			3.358			20.423**
			(13.973)			(2.654)			(8.268)
			[0.977]			[0.293]			[0.046]
Mean of outcome	134.659	134.659	134.659	10.175	10.175	10.175	104.802	104.802	104.802
District FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	324	324	324	324	324	324	556	556	556
Clusters	21	21	21	21	21	21	36	36	36

Notes: Regressions estimated by OLS. Robust standard errors in parentheses clustered by district, where district is colonial province for colonial data, and postcolonial state for postcolonial data. Wild cluster bootstrap (by district) p-values are in brackets. Observations are districts. Dependent variables in (1)-(6) are prisoners per 100,000 population (1939 pop.) by province in Nigeria broken down by short-term (less than 6 months) sentence((1)-(3))and long-term (greater than 2 years) sentence((4)-(6)) over 1920-1938. Dependent variable in (7)-(9) is prisoners per 100,000 population (1990 pop.) by state in Nigeria. Positive rainfall shock (M) where (M) is moderate, and (E) is extreme as defined in text. District FE are colonial province fixed effects in (1)-(6), and postcolonial state fixed effects in (7)-(9). ***Significant at the 1 percent level, **Significant at the 5 percent level, *Significant at the 10 percent level based on clustered standard errors in parentheses.

Model 3: Increases in prices of relatively higher valued southern crops like palm oil increase ST incarceration rates

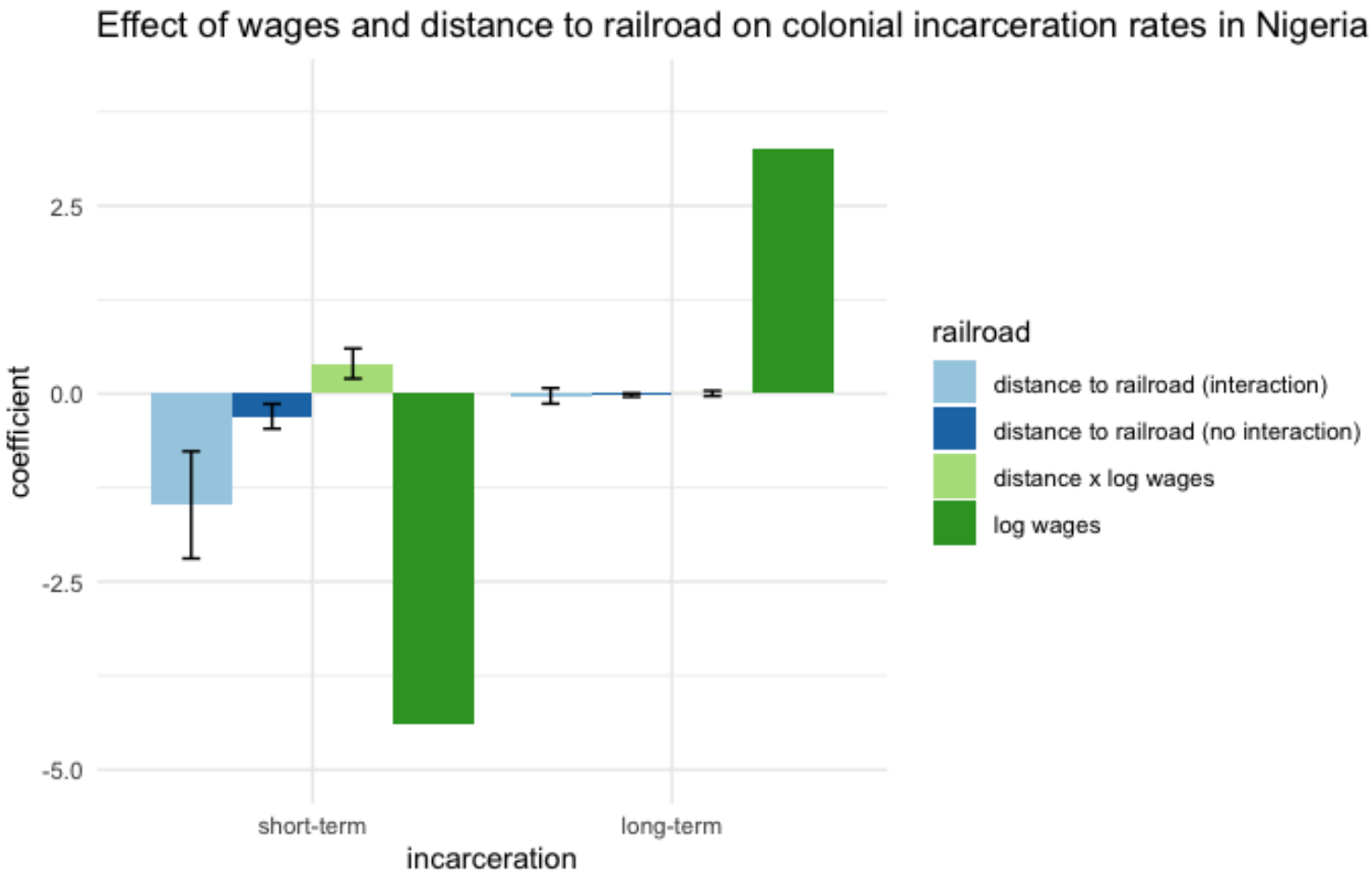


Model 3: Effects of cash crop price shocks on colonial incarceration rates results

	Short-Term				Long-Term			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Palm Oil	213.481***	193.727***			12.583***	6.707**		
	(19.240)	(18.204)			(2.468)	(2.444)		
	[0.016]	[0.012]			[0.052])	[0.083]		
Palm Oil Price	76.228	−14.926			2.874	2.562		
	(45.982)	(10.848)			(5.314)	(1.753)		
	[0.112]	[0.167]			[0.554]	[0.1271]		
Palm Oil x Palm Oil Price	72.530**	68.649**			1.588	4.151		
	(29.037)	(25.441)			(4.355)	(3.416)		
	[0.065]	[0.049]			[0.724]	[0.271]		
Cocoa	−8.002		−38.358*		11.415***		0.347	
	(19.462)		(18.619)		(3.973)		(2.822)	
	[0.718]		[0.190]		[0.061]		[0.929]	
Cocoa Price	−103.894*		3.114		−2.300		5.608***	
	(51.324)		(11.865)		(5.266)		(1.839)	
	[0.055]		[0.781]		[0.664]		[0.010]	
Cocoa x Cocoa Price	29.450		4.146		−7.111		−6.535**	
	(21.660)		(17.959)		(4.520)		(2.722)	
	[0.219]		[0.824]		[0.166]		[0.086]	
Groundnut	60.686***			50.839***	13.839***			9.547***
	(6.220)			(9.245)	(1.127)			(1.198)
	[0.233]			[0.238]	[0.146]			[0.098]
Groundnut Price	−13.026			12.731	6.516			6.816***
	(12.409)			(14.857)	(4.263)			(2.204)
	[0.269]			[0.407]	[0.075]			[<.001]
Groundnut x Groundnut Price	−11.989			−49.111*	−9.858*			−9.130**
	(27.752)			(27.060)	(5.419)			(3.505)
	[0.694]			[0.245]	[0.145]			[0.119]
Mean of outcome	134.659	134.659	134.659	134.659	10.175	10.175	10.175	10.175
District FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	324	324	324	324	324	324	324	324
Clusters	21	21	21	21	21	21	21	21

Notes: Regressions estimated by OLS. Robust standard errors in parentheses clustered by district, where district is colonial province for colonial data. Wild cluster bootstrap (by district) p-values are in brackets. Observations are provinces. Dependent variables are prisoners per 100,000 population (1939 pop.) by province in Nigeria broken down by short-term (less than 6 months) sentence and long-term (greater than 2 years) sentence over 1920-1938. Prices are in logs. District FE are colonial province fixed effects. ***Significant at the 1 percent level, **Significant at the 5 percent level, *Significant at the 10 percent level.

Prisons closer to the railroad have higher ST incarceration rates. Higher wages increase incarceration rates in prisons further away from the railroad



Q3: Data on Contemporary Trust

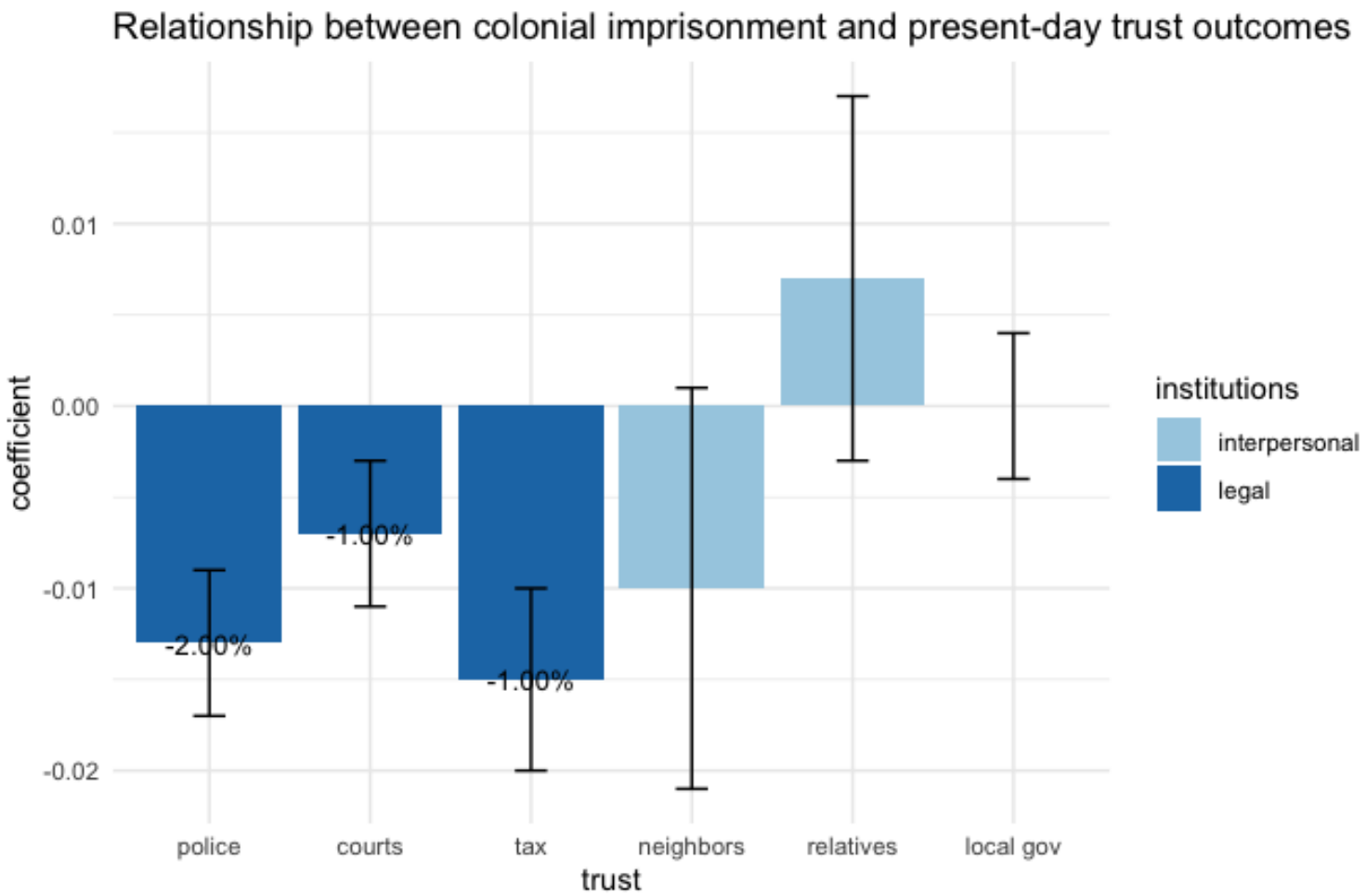
- Geocoded data on trust from Afrobarometer surveys
- Over 5 rounds, 2003-2014
- Trust in historical legal institutions: trust in courts, police, and trust in tax administration
- Falsification test: Interpersonal trust: trust in neighbors, trust in relatives, trust in local governing council member
- Population density, individual controls, geographic controls, disease controls and controls for precolonial and colonial institutions

Q3:What are there long-term effects of colonial prison labor system on perceptions of state legitimacy? Trust in legal institutions like police?

$$\text{Trust}_{aigst} = \beta \text{Prisoners}_i + \mathbf{X}'_{aigst}\theta + \mathbf{X}'_g\phi + \mu_s + \delta_t + \epsilon_{aigst} \quad (5)$$

- Hypothesis: Long-term exposure to colonial imprisonment centered around prison labor reduces views of state legitimacy through lowered trust in legal institutions like police today
- Falsification test: No effect on interpersonal trust, postcolonial imprisonment
- Evidence from robust OLS correlations and qualitative historical accounts
- Evidence from IV strategy- instrument long-term colonial imprisonment with "soil suitability for palm oil x colonial palm oil production indicator" following previous results

OLS Estimates: Respondents from areas with higher colonial imprisonment report lower trust in legal institutions like police



OLS Estimates: Relationship between colonial imprisonment and present-day trust in historical legal Institutions versus interpersonal trust

	Trust in Historical Legal Institutions			Interpersonal Trust		
	Police	Courts	Tax	Neighbors	Relatives	Local Gov
	(1)	(2)	(3)	(4)	(5)	(6)
Prisoners per 100,000 pop.	−0.013***	−0.007*	−0.015***	−0.010	0.007	−0.000
	(0.004)	(0.004)	(0.005)	(0.011)	(0.010)	(0.004)
	[0.003]	[0.080]	[0.063]	[0.442]	[0.604]	[0.954]
Mean of outcome	0.630	1.107	1.308	0.849	1.896	0.855
Population Density	Yes	Yes	Yes	Yes	Yes	Yes
Individual Controls	Yes	Yes	Yes	Yes	Yes	Yes
Geographic Controls	Yes	Yes	Yes	Yes	Yes	Yes
Disease Controls	Yes	Yes	Yes	Yes	Yes	Yes
Precolonial and Colonial Controls	Yes	Yes	Yes	Yes	Yes	Yes
District FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	8,349	8,256	3,063	3,415	3,261	6,578
Clusters	21	21	21	21	21	21

Notes: Regressions estimated by OLS. Robust standard errors in parentheses clustered by colonial province. Wild cluster bootstrap (by district) p-values are in brackets. The unit of observation is an individual. Prisoners per 100,000 pop. are averages of long-term (>2 years sentence) prisoners per 100,000 population (1939 pop.) over 1920 to 1938. Trust variables are from the Afrobarometer samples over 2003 to 2016 and as defined in the main text. Trust outcomes are reported trust levels on a scale of 0-3, where "Not at all"= "0", "Just a little"="1", "Somewhat"="2", "A lot"="3". All regressions use district fixed effects at the current state level in Nigeria, year fixed effects, educational attainment fixed effects and controls for sub-district or local government area population density in 2006. Individual controls include age, age squared and gender. Geographic controls at the sub-district level include, ruggedness, indicators for petroleum, seacoast and mean land suitability for agriculture and mean elevation in alternate specifications. Disease controls at the sub-district level include malaria suitability and

IV Estimates: Effect of colonial imprisonment on present-day trust in police

	Panel B: Second-Stage 2SLS Estimates			
	Trust in Police		Trust in Relatives	
	(1)	(2)	(3)	(4)
Prisoners per 100,000 pop.	−0.021***	−0.022***	0.016	0.005
	(0.005)	(0.005)	(0.024)	(0.035)
	Panel A: First-Stage Estimates			
Soil Suitability for Palm Oil x Colonial Palm Oil Production	0.191***	0.187***	0.214***	0.227***
	(0.023)	(0.040)	(0.053)	(0.045)
F-Stat of Excluded Instrument	14.80	21.65	16.13	25.21
Population Density	Yes	Yes	Yes	Yes
Individual Controls	Yes	Yes	Yes	Yes
Geographic Controls	No	Yes	No	Yes
Disease Controls	No	Yes	No	Yes
Precolonial and Colonial Controls	No	Yes	No	Yes
District FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	10,693	8,349	4,355	3,415
Clusters	21	21	21	21

Notes: Regressions estimated by OLS. Robust standard errors in parentheses clustered by colonial province. The unit of observation is an individual. Prisoners per 100,000 pop. are averages of long-term (>2 years sentence) prisoners per 100,000 population (1939 pop.) over 1920 to 1938. Trust variables are from the Afrobarometer samples over 2003 to 2016 and as defined in the main text. Trust outcomes are reported trust levels on a scale of 0-3, where "Not at all"= "0", "Just a little"="1", "Somewhat"="2", "A lot"="3". All regressions use district fixed effects at the current state level in Nigeria, year fixed effects, educational attainment fixed effects and controls for sub-district or local government area population density in 2006. Individual controls include age, age squared and gender. Geographic controls at the sub-district level include ruggedness, indicators for petroleum, seacoast and mean elevation in alternate specifications. Disease controls at the sub-district level include malaria suitability and tse tse fly suitability in alternate specifications with results unchanged. Precolonial and colonial controls at the ethnicity-level include the level of precolonial centralization and total exports of slaves from the region during the Atlantic slave trade. ***Significant at the 1 percent level, **Significant at the 5 percent level, *Significant at the 10 percent level.

Conclusion

1. Prison labor economically valuable to colonial regime. Significant share of public works expenditures. Strictly positive net value in most of colonial period
2. Incarceration rates are procyclical during colonial period. Positive economic shocks inc. colonial incarceration $->$ labor demand, shortages and tight labor markets
3. Result is reversed in the postcolonial period where prison labor is not a major feature of state policy and public finance
4. Areas with high rates of colonial imprisonment have lower trust in legal institutions like police today, no effect on interpersonal trust
5. First estimates on value of prison labor, effects on incarceration and long-term trust in police; lessons for long-run colonial development studies
6. Policy implications for the use of prison labor today

Q2: Summary Statistics

Statistic	N	Mean	St. Dev.	Min	Max
			Prisoners, 1920-1938		
All Prisoners Total	324	1,811.76	2,286.76	3.00	10,231.00
Penal Imprisonment Total	324	1,251.83	1,626.78	2.00	7,010.00
Custody Total	324	509.59	635.57	0.00	3,039.00
Short-Term (<= 6 Months) Total	324	1,051.05	1,409.20	2.00	6,377.00
Medium-Term (6Mo-2Y) Total	324	127.15	171.34	0.00	882.00
Long-Term (>=2yr) Total	324	68.93	84.10	0.00	417.00
1 Previous Total	324	285.26	503.19	0.00	2,967.00
2 Previous Total	324	49.51	73.51	0.00	503.00
3 Previous Total	324	31.80	48.07	0.00	321.00
All Prisoners /100,000	324	240.73	254.56	0.26	1,123.30
Penal Imprisonment /100,000	324	162.03	169.55	0.26	759.99
Custody /100,000	324	71.73	83.47	0.00	333.66
Short-Term /100,000	324	134.66	144.95	0.16	649.43
Medium-Term /100,000	324	16.56	18.26	0.00	80.45
Long-Term /100,000	324	10.18	12.88	0.00	83.45
Share w/ 1 Previous	324	0.11	0.15	0.00	0.90
Share w/ 2 Previous	324	0.02	0.03	0.00	0.32
Share w/ 3 Previous	324	0.02	0.03	0.00	0.18
			Agricultural Commodities and Rainfall Deviation, 1920-1938		
Cocoa Producing	393	0.15	0.35	0.00	1.00
Groundnut Producing	393	0.18	0.39	0.00	1.00
Palm Oil Producing	393	0.19	0.39	0.00	1.00
Log Cocoa Price	393	1.04	0.40	0.47	1.96
Log Groundnut Price	393	0.35	0.36	−0.36	0.88
Log Palm Oil Price	393	0.72	0.53	−0.22	1.69
Rainfall Dev.	393	−0.00	0.97	−2.21	4.08
Rainfall Dev. Sq.	393	0.95	1.83	0.00	16.67
Positive Rainfall Shock (M)	393	0.17	0.38	0.00	1.00
Negative Rainfall Shock (E)	393	0.30	0.46	0.00	1.00
Positive Rainfall Shock (E)	393	0.21	0.41	0.00	1.00
			Prisoners and Rainfall Deviation, 1971-1995		
All Prisoners Total	871	2,005.81	1,210.56	104.00	7,092.00
All Prisoners /100,000	871	92.48	60.43	9.91	361.99
Share w/ 1 Previous*	6	0.21	0.02	0.18	0.23
Share w/ 2 Previous*	6	0.12	0.02	0.10	0.16
Share w/ 3 Previous*	6	0.13	0.04	0.05	0.18
Rainfall Dev.	560	0.01	0.30	−0.62	1.06
Rainfall Dev. Sq.	560	0.09	0.12	0.00	1.11
Positive Rainfall Shock (M)	560	0.49	0.50	0.00	1.00
Negative Rainfall Shock (E)	560	0.04	0.19	0.00	1.00
Positive Rainfall Shock (E)	560	0.01	0.11	0.00	1.00

Notes: See text and online appendix for details. *denotes that data is based on available time series information from 1975-1980.

Native Administration prisons (1940)

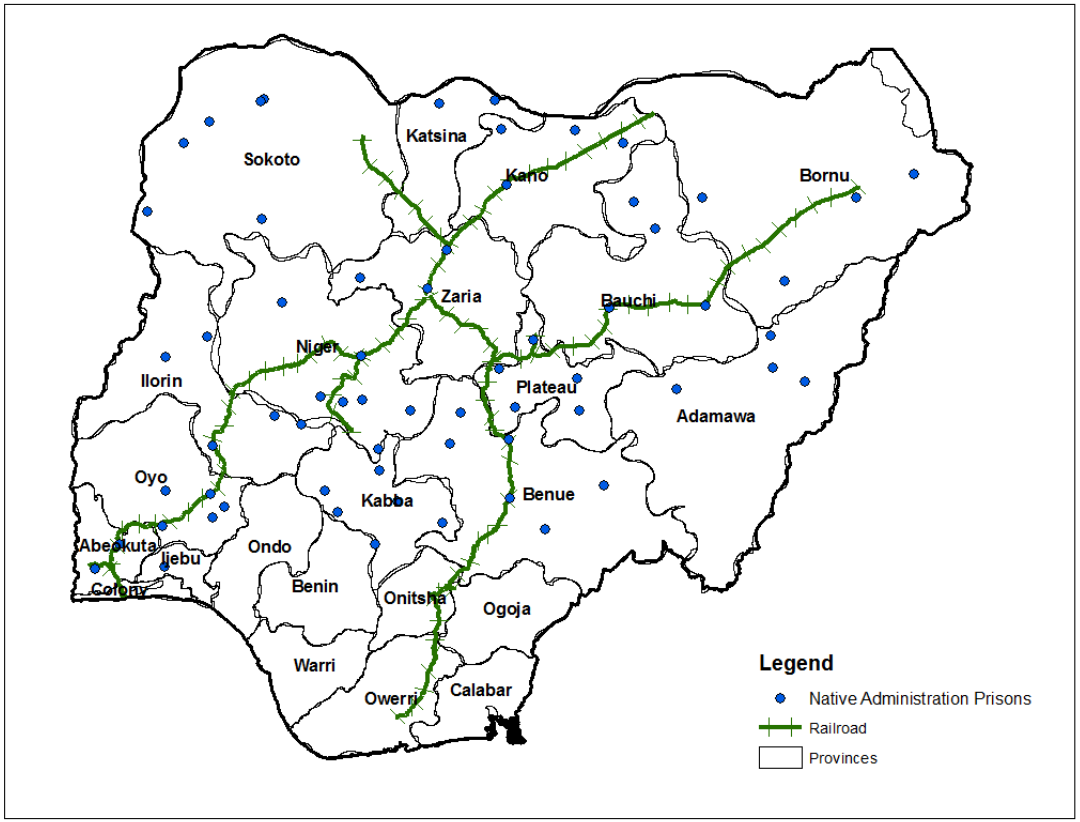


Figure: Native administration prisons, 1940

Native prison incarceration rates, 1940 and 1945

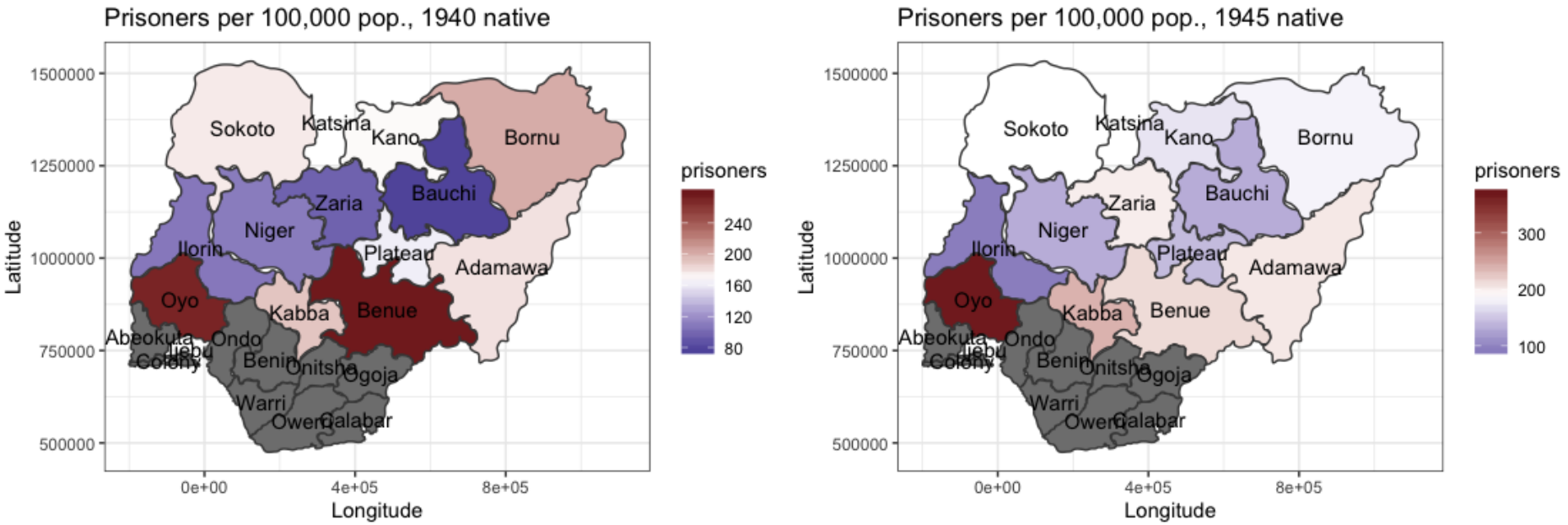


Figure: Native prison incarceration rates, 1940 and 1945

Model 1: Nonlinear effects of rainfall shocks on colonial and postcolonial incarceration rates breakdown by region

	Short-Term			Long-Term			All 1971-95
	All	South	North	All	South	North	All
Rainfall Dev	11.995*	18.884*	1.978	0.759	−0.071	0.236	−6.237
	(6.433)	(11.046)	(1.234)	(1.227)	(2.201)	(0.338)	(8.570)
	[0.065]	[0.142]	[0.205]	[0.655]	[0.989]	[0.544]	[0.454]
Rainfall Dev Sq	−4.884*	−8.686**	0.860***	0.752	1.381	0.062	34.275***
	(2.816)	(4.235)	(0.309)	(0.739)	(1.346)	(0.098)	(9.692)
	[0.068]	[0.046]	[<.001]	[0.494]	[0.541]	[0.675]	[<.001]
Mean of outcome	134.659	217.517	18.657	10.175	14.743	3.781	104.802
District FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	324	189	135	324	189	135	556
Clusters	21	10	11	21	10	11	36

Notes: Regressions estimated by OLS. Robust standard errors in parentheses clustered by district, where district is colonial province for colonial data, and postcolonial state for postcolonial data. Wild cluster bootstrap (by district) p-values are in brackets. Dependent variables are prisoners per 100,000 population (1939 pop.) by province in Nigeria broken down by short-term (less than 6 months) sentence and long-term (greater than 2 years) sentence over 1920-1938, for all provinces and Southern and Northern Provinces separately; and prisoners per 100,000 population (1990 pop.) in the postcolonial era from 1971-1995 by state in Nigeria in the last column. District FE are colonial province fixed effects for colonial data, and and postcolonial state fixed effects for postcolonial data. ***Significant at the 1 percent level, **Significant at the 5 percent level, *Significant at the 10 percent level based on clustered standard errors in parentheses.

Model 2: Identifying the effects of positive rainfall shocks on incarceration rates results breakdown by region

	Short-Term			Long-Term			All 1971-95
	All	South	North	All	South	North	All
Positive rainfall shock (M)	16.727***	24.826***	0.392	−1.638	−2.609	−0.573	−4.387
	(5.456)	(7.795)	(1.086)	(1.319)	(2.127)	(0.446)	(4.132)
	[0.016]	[0.009]	[0.729]	[0.336]	[0.408]	[0.174]	[0.320]
Mean of outcome	134.659	217.517	18.657	10.175	14.743	3.781	104.802
District FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	324	189	135	324	189	135	556
Clusters	21	21	21	21	21	21	36

Notes: Regressions estimated by OLS. Robust standard errors in parentheses clustered by district, where district is colonial province for colonial data, and postcolonial state for postcolonial data. Wild cluster bootstrap (by district) p-values are in brackets. Observations are provinces. Dependent variables in (1)-(6) are prisoners per 100,000 population (1939 pop.) by province in Nigeria broken down by short-term (less than 6 months) sentence((1)-(3))and long-term (greater than 2 years) sentence((4)-(6)) over 1920-1938. Dependent variable in (7) is prisoners per 100,000 population (1990 pop.) by state in Nigeria. Positive rainfall shock (M) where (M) is moderate as defined in text. District FE are colonial province fixed effects in (1)-(6), and postcolonial state fixed effects in (7). ***Significant at the 1 percent level, **Significant at the 5 percent level, *Significant at the 10 percent level based on clustered standard errors in parentheses.

Suggestive evidence of sentence switching (custody to ST) in response to shocks

	Custody		Short-Term		Custody − Short-Term	
	(1)	(2)	(3)	(4)	(5)	(6)
Positive rainfall shock (M)	5.623**	1.774	16.727***	12.142*	−11.104**	−10.368
	(2.201)	(2.795)	(5.456)	(6.964)	(4.554)	(6.475)
	[0.014]	[0.558]	[0.016]	[0.093]	[0.040]	[0.154]
Negative rainfall shock (E)		−6.703		−17.225*		10.523
		(6.396)		(10.259)		(8.004)
		[0.371]		[0.139]		[0.241]
Positive rainfall shock (E)		−6.734*		−0.404		−6.331
		(4.044)		(13.973)		(13.161)
		[0.093]		[0.977]		[0.615]
Mean of outcome	71.727	71.727	134.659	134.659	−62.932	−62.932
District FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	324	324	324	324	324	324
Clusters	21	21	21	21	21	21

Notes: Regressions estimated by OLS. Robust standard errors in parentheses clustered by district, where district is colonial province for colonial data, and postcolonial state for postcolonial data. Wild cluster bootstrap (by district) p-values are in brackets. Observations are provinces. Dependent variables in (1)-(2) and (3)-(4) are prisoners awaiting custody or trial per 100,000 population (1939 pop.) and short-term prisoners with less than 6 months sentences respectively. Outcome in (5)-(6) is the difference between the custody/awaiting trial incarceration rate and the short-term, less than 6 months sentence incarceration rate. Positive rainfall shock (M) where (M) is moderate, and (E) is extreme as defined in text. District FE are colonial province fixed effects in (1)-(6). ***Significant at the 1 percent level, **Significant at the 5 percent level, *Significant at the 10 percent level based on clustered standard errors in parentheses.

Effect of wages and distance to railroad on colonial incarceration rates

	Short-Term			Long-Term
	(1)	(2)	(3)	(4)
Distance to railroad	−0.301*	−1.479*	−0.018	−0.029
	(0.165)	(0.713)	(0.023)	(0.104)
	[0.005]	[0.010]	[0.440]	[0.807]
Log wages		−4.390		3.254
		(10.376)		(2.744)
		[0.655]		[0.215]
Distance x Log wages		0.401*		0.004
		(0.200)		(0.035)
		[0.038]		[0.927]
Mean of outcome	46.198	46.198	3.990	3.990
District FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	938	938	822	822
Clusters	21	21	21	21

Notes: Regressions estimated by OLS. Robust standard errors in parentheses clustered by district, where district is colonial province for colonial data. Wild cluster bootstrap (by district) p-values are in brackets. Observations are individual prisons. Dependent variables in (1)-(4) are prisoners in each prison per 100,000 population of the province broken down by short-term (less than 6 months) sentence and long-term (greater than 2 years) sentence over 1920-1938. Covariates are distance to railroad in km and log urban unskilled wages. District FE are colonial province fixed effects in (1)-(4). ***Significant at the 1 percent level, **Significant at the 5 percent level, *Significant at the 10 percent level based on clustered standard errors in parentheses.

Summary Statistics: Afrobarometer Results

Statistic	N	Mean	St. Dev.	Min	Max
		Trust and Crime Outcomes			
Trust in Courts	11,354	1.21	0.92	0.00	3.00
Trust in Police	11,486	0.69	0.87	0.00	3.00
Trust in Tax Admin.	4,480	1.01	0.85	0.00	3.00
Trust Relatives	4,596	1.97	1.03	0.00	3.00
Trust Neighbors	4,682	1.37	1.00	0.00	3.00
Trust Local Gov.	8,961	0.93	0.87	0.00	3.00
Fear Crime	11,584	0.59	1.00	0.00	4.00
Bribery (HHS)	8,082	0.27	0.68	0.00	3.00
Bribery (Doc)	7,987	0.29	0.66	0.00	3.00
		Individual Controls and Fixed Effects			
Age	11,603	31.94	12.05	18.00	95.00
Age Squared	11,603	1,165.29	987.34	324.00	9,025.00
Female	11,654	0.50	0.50	0	1
Education	11,629	3.27	1.92	0.00	7.00
		Geographic and Disease Controls			
Population Density 2006	11,526	450.97	693.01	41.04	2,694.63
Agricultural Land Suitability	8,453	4.71	0.76	1.80	6.00
Malaria	9,095	1.00	0.02	0.79	1.00
Ruggedness	9,095	0.26	0.22	0.03	2.28
Mean Elevation	8,332	248.09	234.70	−0.25	1,284.11
Sea Coast	9,095	0.29	0.45	0.00	1.00
Petrol	9,095	0.34	0.47	0.00	1.00
Tsetse Suitability	7,147	0.91	0.46	−0.78	1.45
		Precolonial and Colonial Controls			
Precolonial Centralization	9,095	1.66	0.78	0.00	3.00
Slave Exports	9,095	150,841.30	206,271.70	0.00	665,966.00
		Instrument			
Soil Suitability for Palm Oil x Colonial Palm Oil Production	11,025	3.09	7.95	0.00	32.34

Notes: See text and online appendix for details.

Falsification Test: OLS Estimates of relationship between postcolonial imprisonment and present-day trust in historical legal Institutions versus interpersonal trust

	Trust in Historical Legal Institutions			Interpersonal Trust		
	Police	Courts	Tax	Neighbors	Relatives	Local Gov
	(1)	(2)	(3)	(4)	(5)	(6)
Prisoners per 100,000 pop.	0.000	0.001	0.000	0.003**	−0.000	−0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
	[0.419]	[0.410]	[0.734]	[0.123]	[0.881]	[0.620]
Mean of outcome	0.649	1.121	0.938	1.345	1.918	0.875
Population Density	Yes	Yes	Yes	Yes	Yes	Yes
Individual Controls	Yes	Yes	Yes	Yes	Yes	Yes
Geographic Controls	Yes	Yes	Yes	Yes	Yes	Yes
Disease Controls	Yes	Yes	Yes	Yes	Yes	Yes
Precolonial and Colonial Controls	Yes	Yes	Yes	Yes	Yes	Yes
District FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	8,792	8,691	3,243	3,601	3,438	6,933
Clusters	36	36	36	35	36	36

Notes: Regressions estimated by OLS. Robust standard errors in parentheses clustered by current state. Wild cluster bootstrap (by district) p-values are in brackets. The unit of observation is an individual. Prisoners per 100,000 pop. are current state level averages of prisoners per 100,000 population (1990 pop.) over 1971 to 1995. Trust variables are from the Afrobarometer samples over 2003 to 2016 and as defined in the main text. Trust outcomes are reported trust levels on a scale of 0-3, where "Not at all"= "0", "Just a little"="1", "Somewhat"="2", "A lot"="3". All regressions use district fixed effects at the geopolitical zone level in Nigeria, year fixed effects, educational attainment fixed effects and controls for sub-district or local government area population density in 2006. Individual controls include age, age squared and gender. Geographic controls at the sub-district level include ruggedness, indicators for petroleum, seacoast and mean land suitability for agriculture and mean elevation in alternate specifications. Disease controls at the sub-district level include malaria suitability and tse tse

OLS Estimates: Relationship between colonial vs postcolonial imprisonment and present-day crime outcomes

	Colonial Imprisonment		Postcolonial Imprisonment	
	Bribery Doc	Fear Crime	Bribery Doc	Fear Crime
	(1)	(2)	(3)	(4)
Prisoners per 100,000 pop.	−0.001	−0.002	0.001**	0.001
	(0.003)	(0.005)	(0.000)	(0.001)
	[0.644]	[0.781]	[0.057]	[0.123]
Mean of outcome	0.225	0.229	0.571	0.225
Population Density	Yes	Yes	Yes	Yes
Individual Controls	Yes	Yes	Yes	Yes
Geographic Controls	Yes	Yes	Yes	Yes
Disease Controls	Yes	Yes	Yes	Yes
Precolonial and Colonial Controls	Yes	Yes	Yes	Yes
District FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	5,876	8,420	6,204	8,875
Clusters	21	21	36	36

Notes: Regressions estimated by OLS. Robust standard errors in parentheses clustered by colonial province. Wild cluster bootstrap (by district) p-values are in brackets. The unit of observation is an individual. Prisoners per 100,000 pop. are colonial province level averages of long-term (>2 years sentence) prisoners per 100,000 population (1939 pop.) over 1920 to 1938 in columns (1) to (3), and current state level averages of prisoners per 100,000 population (1990 pop.) over 1971 to 1995 in (4) to (6). Outcome variables are from the Afrobarometer samples over 2003 to 2016 and as defined in the main text. Bribery Doc and Bribery HHS is reported frequency of respondent bribery of government official for document and household services respectively where "Never"="0", "Once or Twice"="1", "A Few Times "="2", "Often"="3". Fear Crime is how often respondent or family has feared crime in their home where "Never"="0", "Just once or twice"="1", "Several times"="2", "Many times"="3", "Always"="4". Regressions in columns (1) to (3) use district fixed effects at the state level in Nigeria, and in columns (4) to (6) use geopolitical zone fixed effects. All regressions include year fixed effects, educational attainment fixed effects and controls for sub-district or local government area population density in 2006. Individual controls include age, age squared and gender. Geographic controls at the sub-district level include mean land suitability for agriculture, ruggedness, indicators for petroleum, seacoast and mean elevation in alternate specifications. Disease controls at the sub-district level include malaria suitability and tse tse fly suitability in alternate specifications with results unchanged. Precolonial and colonial controls at the ethnicity-level include the level of precolonial centralization and total exports of slaves from the region during the Atlantic slave trade. ***Significant at the 1 percent level, **Significant at the 5 percent level, *Significant at the 10 percent level.

IV Estimates: Effect of relationship between colonial imprisonment and present-day trust in historical legal Institutions versus interpersonal trust

	Panel B: Second-Stage 2SLS Estimates			
	Trust in Historical Legal Institutions		Interpersonal Trust	
	Courts	Tax	Neighbors	Loc. Gov
	(1)	(2)	(3)	(4)
Prisoners per 100,000 pop.	0.013	0.003	0.010	0.000
	(0.016)	(0.010)	(0.054)	(0.012)
	Panel A: First-Stage Estimates			
Soil Suitability for Palm Oil				
x Colonial Palm Oil Production	0.187***	0.228***	0.237***	0.178***
	(0.039)	(0.038)	(0.056)	(0.037)
F-Stat of Excluded Instrument	22.90	35.29	17.97	23.70
Population Density	Yes	Yes	Yes	Yes
Individual Controls	Yes	Yes	Yes	Yes
Geographic Controls	Yes	Yes	Yes	Yes
Disease Controls	Yes	Yes	Yes	Yes
Precolonial and Colonial Controls	Yes	Yes	Yes	Yes
District FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Observations	8,256	3,063	3,415	6,578
Clusters	21	21	21	21

Notes: Regressions estimated by OLS. Robust standard errors in parentheses clustered by colonial province. The unit of observation is an individual. Prisoners per 100,000 pop. are averages of long-term (>2 years sentence) prisoners per 100,000 population (1939 pop.) over 1920 to 1938. Trust variables are from the Afrobarometer samples over 2003 to 2016 and as defined in the main text. Trust outcomes are reported trust levels on a scale of 0-3, where "Not at all"= "0", "Just a little"="1", "Somewhat"="2", "A lot"="3". All regressions use district fixed effects at the current state level in Nigeria, year fixed effects, educational attainment fixed effects and controls for sub-district or local government area population density in 2006. Individual controls include age, age squared and gender. Geographic controls at the

Qualitative Evidence

- Newspapers 1940s and 1950s and protest against 'human rights and unjust practices perpetrated by penal officials'
- Garrick Braide movement