

# Colonial Institutions, Marriage Markets, and HIV: Evidence from Mozambique

Jon Denton-Schneider (Michigan)

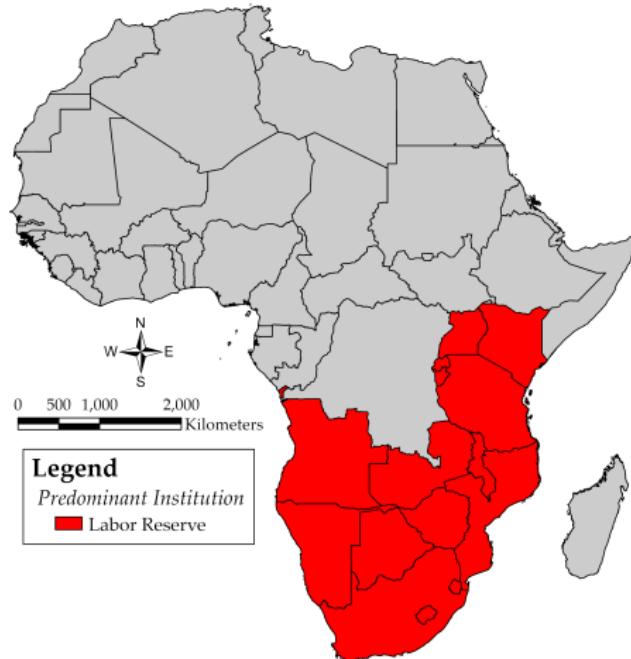
September 16, 2021

# Colonial Institutions in Sub-Saharan Africa



Vast literature on institutions, compares “inclusive” vs “extractive”  
**African context:** Extraction was universal, came in different forms

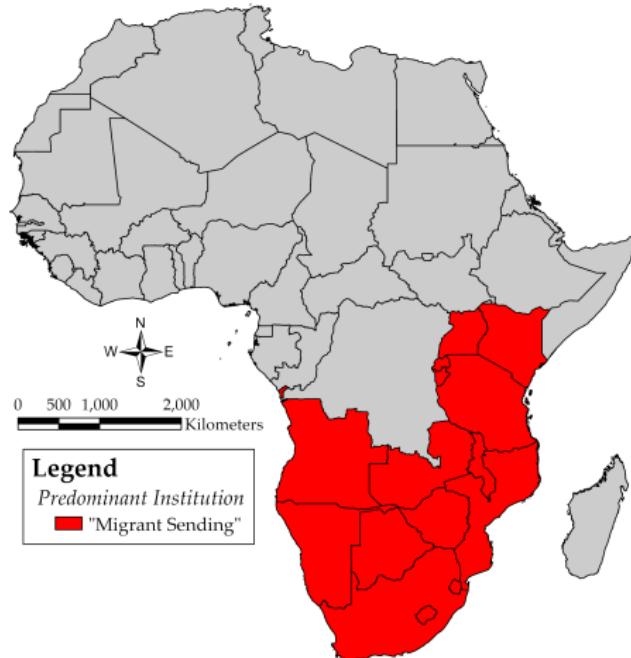
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Amin (1972) grouped colonies by predominant extractive institution

- ① **Labor reserve:** Pushed men into temporary labor migration

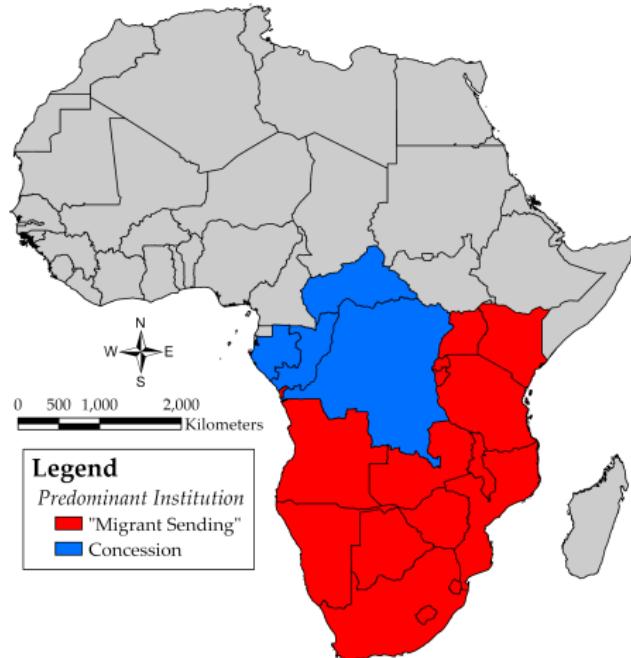
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- ① “**Migrant-sending**”: Pushed men into “circular” migration

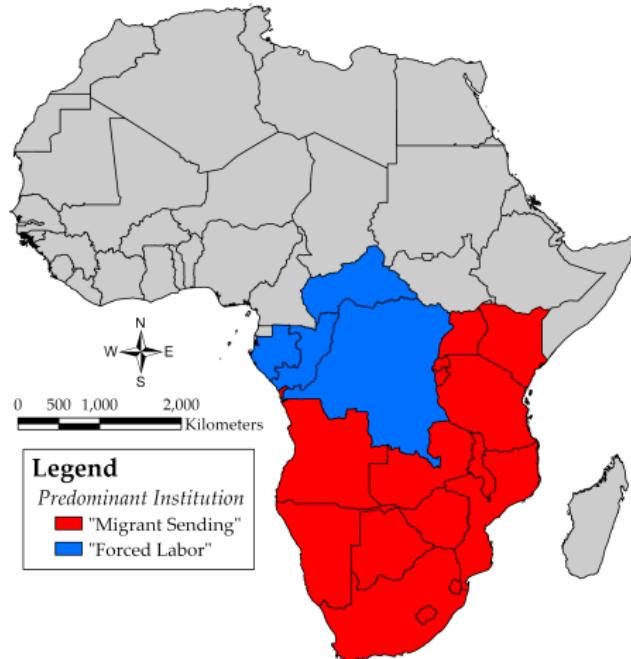
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- ② **Concession:** Grant of land (and people living on it) to company

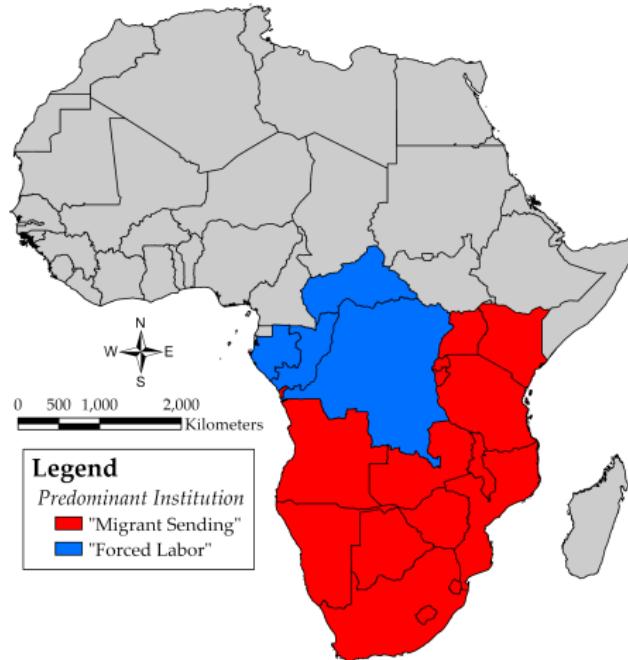
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Amin (1972) grouped colonies by predominant extractive institution

- ② “**Forced labor**”: Grant of land (and people living on it) to company

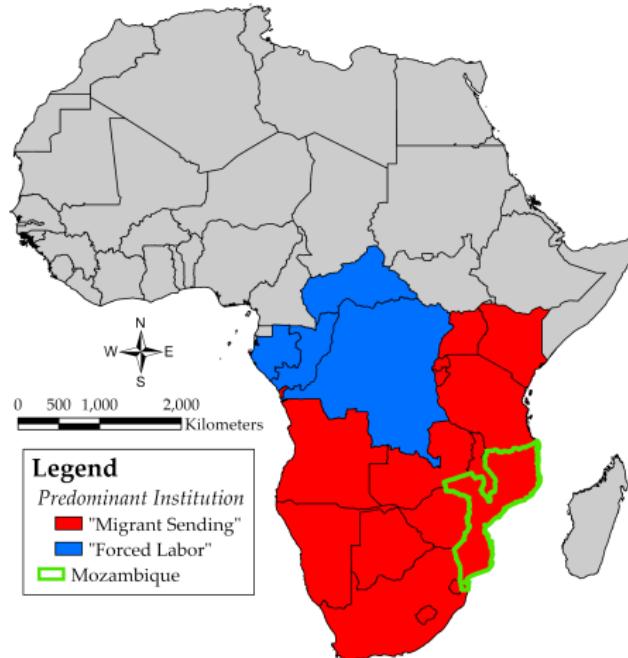
# Colonial Institutions in Sub-Saharan Africa



Organized economic and social life for decades (1890s-1970s)

**But no evidence yet on effect of assignment to one vs other**

# Colonial Institutions in Sub-Saharan Africa



This paper: Makes comparisons within rare colony that had both  
→ **Mozambique:** Institutions adjacent for 45 years (1897-42)

## Question and Empirical Strategy

**Motivation:** Mozambique is one of the world's poorest (\$3.55/day PPP) and highest HIV prevalence (11.3% of adults) countries

**Question:** How did a colonialist's choice of extractive institution shape these outcomes in Sub-Saharan Africa?

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- ① “First stage”: Colonial census summaries from 2 years before (1940), 18 years after (1960) abolition of forced labor institution

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- ① “First stage”: Colonial census summaries from 2 years before (1940), 18 years after (1960) abolition of forced labor institution
- ② Long run: Demographic and Health Surveys (DHS) data (up to 4 waves in 2009-18), IPUMS 2007 census 10% sample

## Summary of Results

- ① “First stage”: Lasting differences in marriage market outcomes, convergence in circular migration and human capital
  - ▶ Substantially more married young men in migrant-sending region for each married young women
  - ▶ Matches historical narratives: Bride price motivated young men to engage in circular migration
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- ▶ Historical shocks generate continuation of colonial-era patterns
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  - Lowers HIV risk from spousal, sex partner age disparities in former migrant-sending region
- ③ **Long run:** Matches predictions from colonial patterns
  - ▶ Much lower HIV prevalence in former migrant-sending region, but no differences in development
  - ▶ Channel: Smaller age disparities between partners

## Contributions

**Major historical shock:** Short- and (very) long-run effects

- ▶ Detailed data, simple theory to understand how and why their impacts continue (or not)
- ▶ Clear *a priori* reasons to expect the patterns found

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- ▶ Well-identified episode in which migration costs were lower in one region but not the other
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### **Marriage markets**, especially non-Western ones

- ▶ Novel channel for lasting effects to arise through
- ▶ Substantial share of world participates in markets with asset transfers at marriage

## Related Literatures

**Long-run effects of institutions** → Causal impacts of different forms of extraction

- ▶ Acemoglu, Johnson, & Robinson (2001); Banerjee & Iyer (2005); Dell (2010); Michalopoulos & Papaioannou (2014, 2016, 2020); Alexopoulos & Juif (2017); Dell & Olken (2020); Lowes & Montero (forthcoming); Méndez-Chacón & Van Patten (2021)

**Long-run effects of circular migration** → Evidence on “one of the most unique features of [Africa]’s development” (Stitcher, 1985)

- ▶ Yang (2008); Dinkelman & Mariotti (2016); Khanna, Theoharides, & Yang (2020)

**Marriage markets and human capital** → Health component

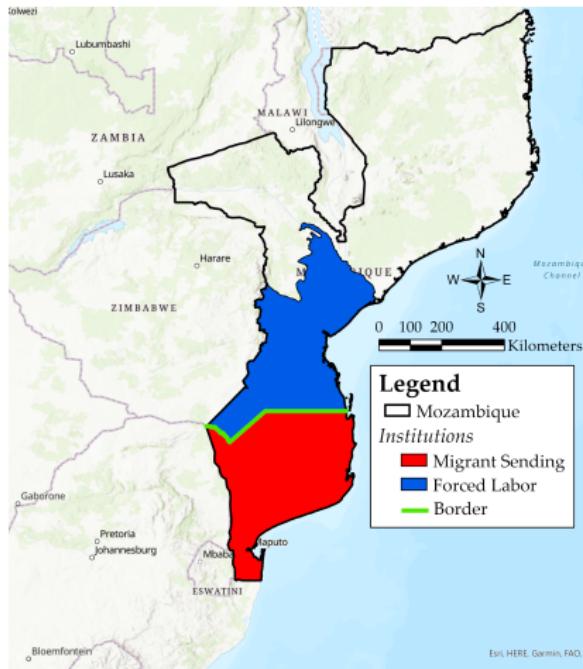
- ▶ Chiappori, Iyigun, & Weiss (2009); Anderson (2018)

**History as a determinant of health** → HIV’s spatial distribution

- ▶ Alsan & Wanamaker (2018); Bertocchi & Dimico (2019); Dwyer-Lindgren, Cork, Sligar, et al. (2019); Cagé & Rueda (2020); Lowes & Montero (2021)

## Historical Overview

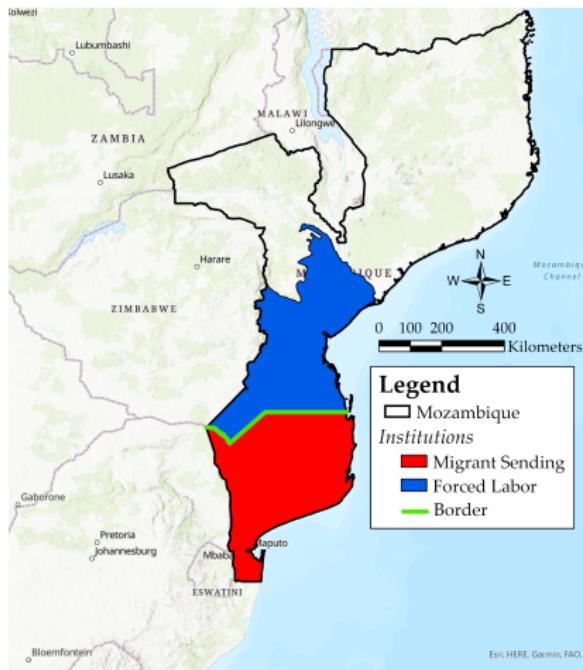
# Creation and Choice of Institutions



Berlin Conference (1884-85): “Effectively occupy” colony to keep it

→ **Solution:** Expand state out from port cities, lease areas farther away

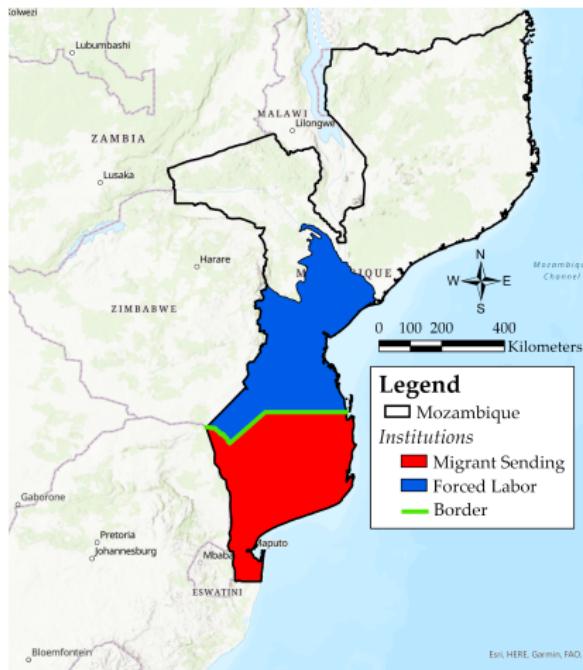
# Creation and Choice of Institutions



Portuguese split southern half of colony between 2 institutions

- ① **Migrant-sending:** Profit from preexisting migration with 1897 treaty

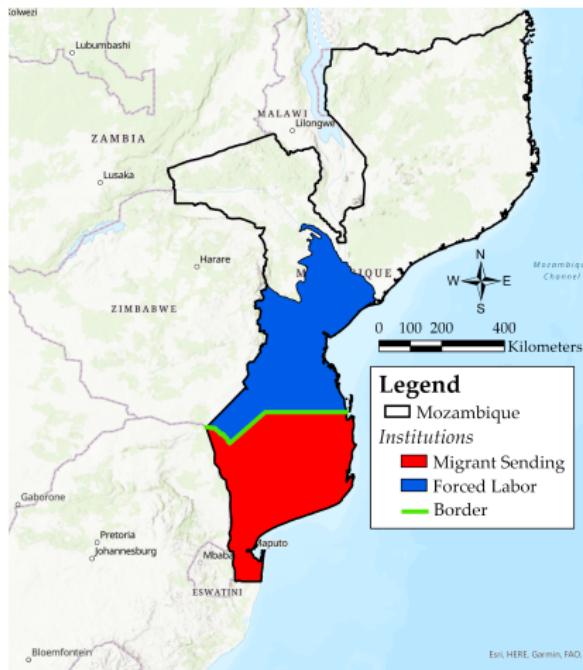
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- ① **Migrant-sending:** Also hoped labor flows would develop port city

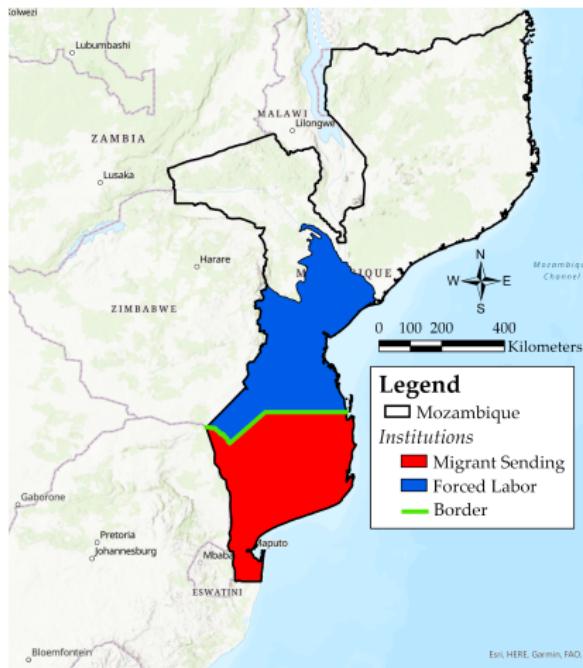
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Portuguese split southern half of colony between 2 institutions

- ② **Forced labor:** 50-year lease on unknown area btwn. rivers in 1891

# Creation and Choice of Institutions

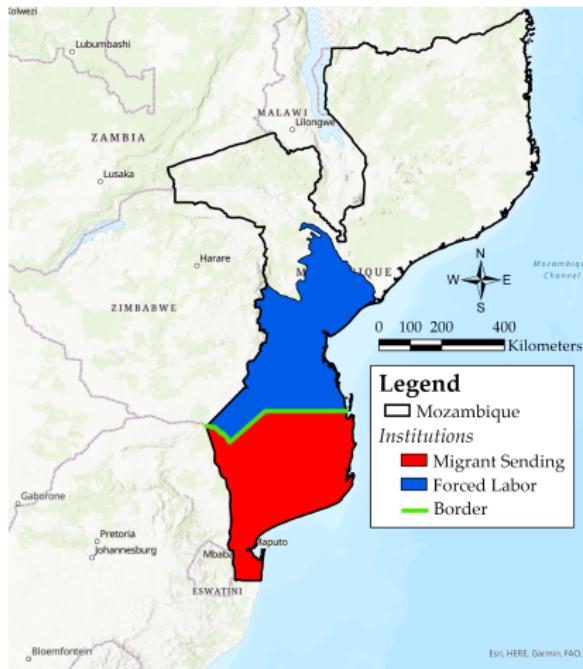


Portuguese split southern half of colony between 2 institutions

② **Forced labor:** Granted additional land to south in 1893

► Decree text

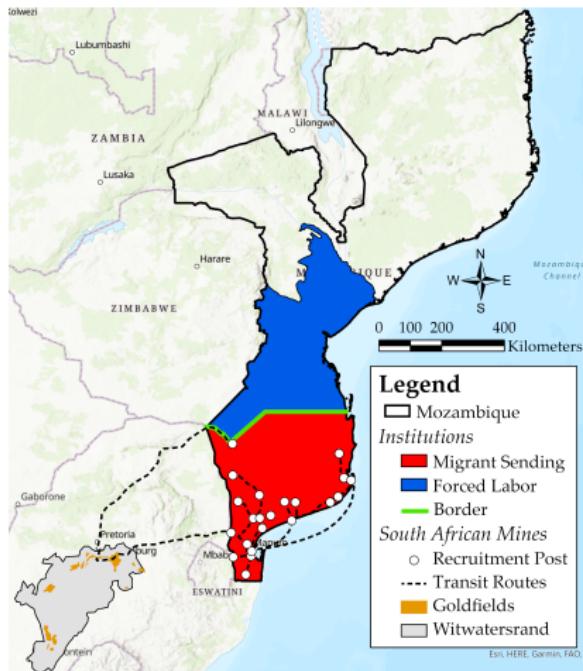
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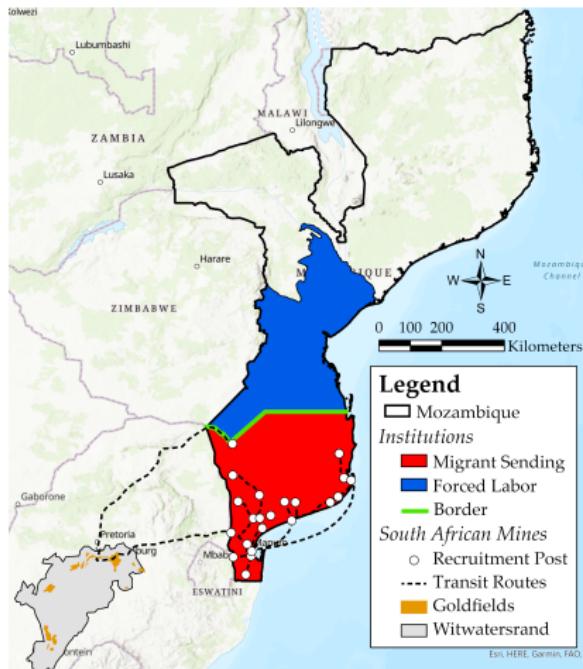
→ **Arbitrary border:** Straight lines on a map, did not reflect conditions

# Differences between Institutions



**Migrant-sending:** Recruiting, transportation networks for mines  
1-year contract, only men allowed, half of pay held in Mozambique

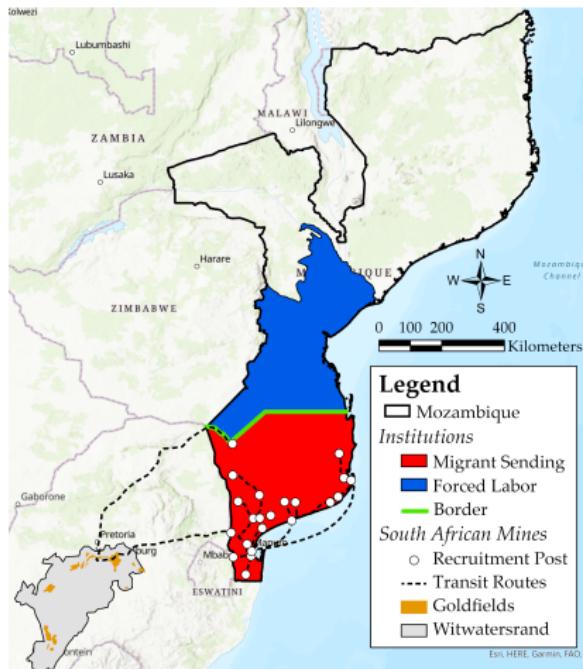
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→ 50K-100K circular migrants annually in colonial era [Graph](#)

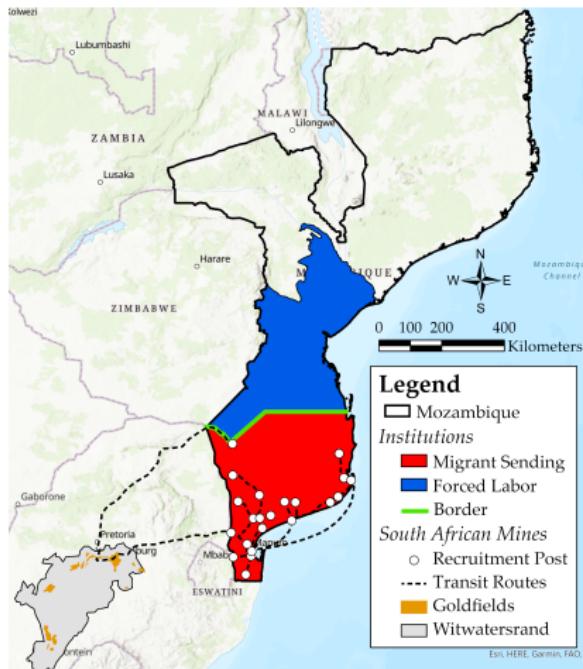
# Differences between Institutions



**Forced labor:** Banned migration to preserve low-cost labor pool  
Used police, violence, pass laws to enforce regime work

▶ Quotes

# Differences between Institutions



**Forced labor:** Banned migration to preserve low-cost labor pool

→ 1908: 84 days to work off hut tax vs 10 days in mines (Newitt, 1995)

# Narrative Evidence on Institutions' Impacts

## Governance: Equally extractive

- ▶ “The [migrant-sending area] was governed by the Portuguese colonial state no less exploitatively than [the forced labor region was] . . . and under the same labor code” (Allina, 2012, p. 94)

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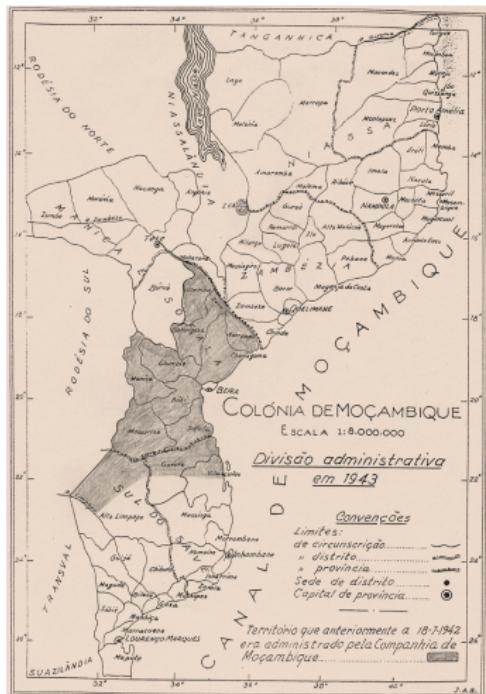
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## Human capital accumulation: Different providers of schooling

- ▶ Protestant missions provided schooling in migrant-sending region but expelled in 1930; Catholic missions did so in forced labor region, took over all schooling in 1940s and expanded provision (Helgesson, 1994)

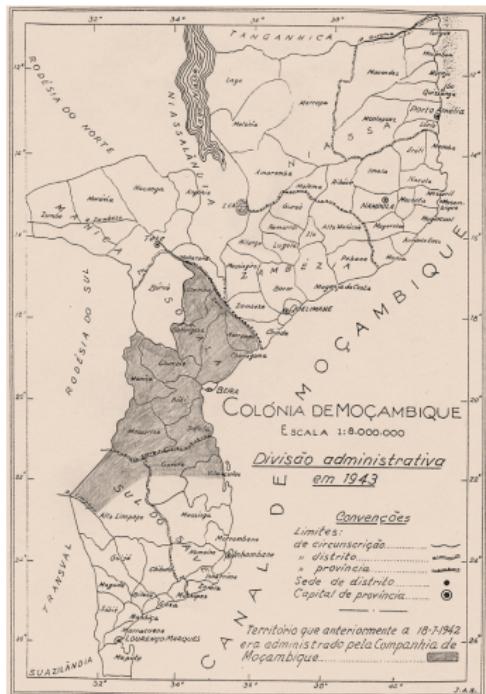
# End of the Forced Labor Institution



**Portuguese dictator Salazar:** Rose to power in 1928

Thought concessions eroded national sovereignty, let charter lapse

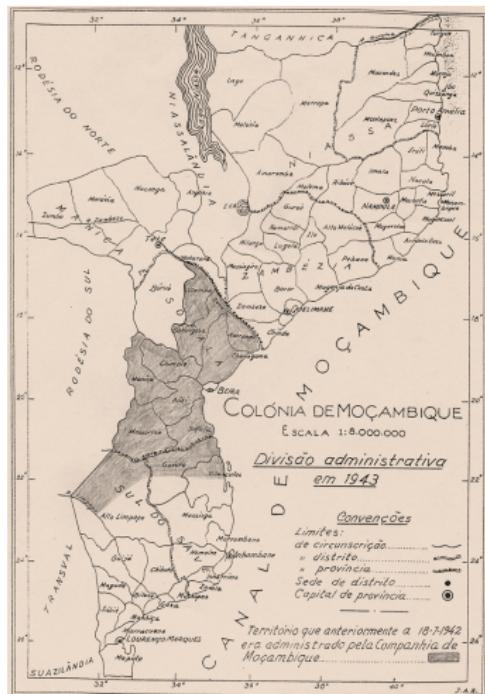
# End of the Forced Labor Institution



**Portuguese dictator Salazar:** Rose to power in 1928

→ End of forced labor regime not due to performance or other concerns

# End of the Forced Labor Institution



**Territorial reorganization in 1943:** Institutional border erased

→ Provincial, district borders moved north to Sabi River

# Independence and Civil War

## **End of Portuguese rule:**

- ▶ Extractive labor code abolished in 1961
- ▶ 10-year independence war began in 1964, mostly fought in north

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## Independent Mozambique:

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- ▶ Circular migration: Declines drastically [▶ Graph](#)
- ▶ Bride price institution: Also declines [▶ Graph](#)

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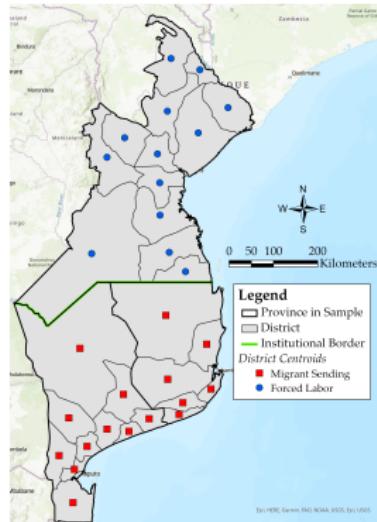
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## Civil war: 1977-92

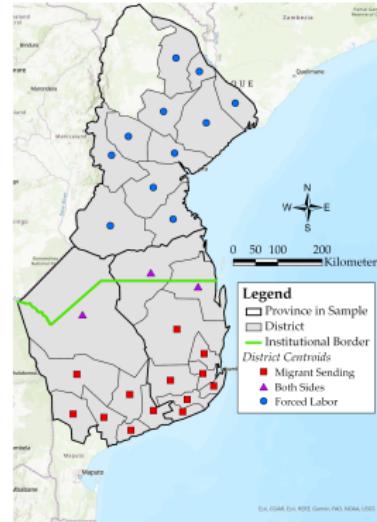
- ▶ Estimated 60,000 killed in violence and 1 million from famine, many displaced
- ▶ Violence worst in southern Mozambique (Weinstein, 2006)
- ▶ Illife (2006) argues it delayed arrival of HIV to Mozambique in 1990s

“First Stage”

# Data



2 Years before Forced Labor Institution Abolished (1940)



18 Years after Forced Labor Institution Abolished (1960)

**Colonial censuses:** Digitized, georeferenced district-level summaries  
Restrict sample to closest provinces on either side of the border

► 1940 example

► 1960 example

## Three Domains of Interest

- ① **Labor markets:** Did the forced labor institution restrict men's labor mobility? Did it spill over onto women's work?
  - ▶ Share of men ages 15-64 ("prime-age") engaged in circular migration
  - ▶ Share of prime-age women in agricultural occupations

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- ② **Marriage and fertility:** Did circular migration change marriage patterns? How did fertility respond to higher wages?
  - ▶ Ratio of ever-married men to ever-married women in age group
  - ▶ Ratio of children ages 0-4 to women ages 15-49 ("general fertility rate")

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- ③ **Human capital:** How did the interaction of circular migration and different missions responsible for education affect schooling?
  - ▶ Share of boys and girls ages 5-14 enrolled in school at enumeration

# Empirical Strategy

## RD design:

$$y_d = \alpha + \tau \text{MigrantSending}_d + f(\text{Dist}_d) + \text{Lon}_d + \epsilon_d \quad \text{for } d \in B$$

## Variables:

- ▶  $y_d$ : Outcome for district  $d$
- ▶  $\text{MigrantSending}_d$ : Indicator variable for  $d$ 's institution
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## Details:

- ▶ Local linear specification, triangular kernel (Cattaneo et al., 2019)
- ▶ Weight each district's outcome by relevant population
- ▶ 1960 districts with area on both sides of border → mask differences
- ▶ Robust and Conley (1999) SEs (100 km bandwidth, Bartlett kernel)
- ▶ Moran (1950) spatial autocorrelation measure and SD

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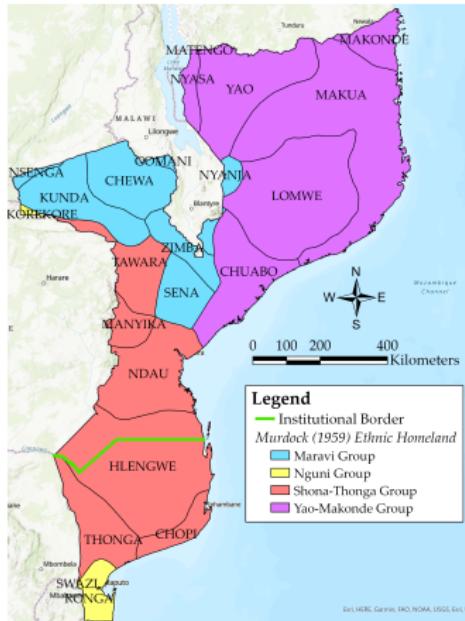
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**Interpretation:**  $\tau$  captures causal effect of assignment to migrant-sending region *relative to assignment to forced labor region*

# RD Validity



Ethnic Groups in Mozambique

**Necessary condition:** All other factors changed smoothly at border

- ✓ Border within single ethnic group, neighbors in same cultural group

# RD Validity

	Geographic Traits				Disease Suitability	
	Elevation	Rainfall	Slope	Soil Index	Malaria	TseTse
Migrant Sending	-1.798 (31.917) [23.254]	1.153 (6.533) [4.045]	0.014 (0.100) [0.054]	3.207 (3.887) [2.658]	-0.270 (0.368) [0.244]	-0.002 (0.009) [0.007]
Observations	167	105	144	115	139	173
Clusters	29	19	26	20	23	30
Bandwidth	131.5	79.4	120.6	94.3	107.0	144.3
Wild Cluster Bootstrap $p$	0.950	0.866	0.812	0.435	0.504	0.827
Spatial Autocorrelation	0.40	0.42	0.29	0.11	0.09	0.57
Spatial Autocorrel. SD	0.02	0.03	0.02	0.02	0.02	0.02
Forced Labor Mean	182.7	40.94	0.179	49.19	10.84	1.259

*Notes:* Observations are  $0.25 \times 0.25$  degree cells. Standard errors clustered by third-level administrative unit in parentheses, Conley (1999) standard errors with a 100 km window and Bartlett kernel in brackets. Regressions estimate a local linear RD specification on each side of the border with a triangular kernel and include longitude as a control. Bandwidths are MSE-optimal (Calonico, Cattaneo, & Titiunik, 2014). Wild cluster bootstrap  $p$ -values are calculated using 999 repetitions and a small-sample correction (Cameron, Gelbach, & Miller, 2008).

- Necessary condition:** All other factors changed smoothly at border
- ✓ No discontinuities in geographic traits, disease environments

# Results: 2 Years before Forced Labor Regime Ended (1940)

	Labor Markets		Marriage and Fertility			Human Capital	
	Men Circular Migrants (1)	Women in Agriculture (2)	Married M:F Ages 15-24 (3)	Married M:F Ages 25-34 (4)	General Fert. Rate (5)	Boys in School (6)	Girls in School (7)
Migrant Sending	0.207 (0.089) [0.085]	0.015 (0.018) [0.016]	0.269 (0.080) [0.061]	0.312 (0.113) [0.088]	0.175 (0.092) [0.086]	-0.028 (0.016) [0.015]	-0.001 (0.006) [0.006]
Observations	29	29	28	28	28	29	29
Bandwidth	-503, 401	-503, 401	-503, 401	-503, 401	-503, 401	-503, 401	-503, 401
Spatial Autocorrel.	-0.14	-0.10	0.26	0.14	-0.16	-0.03	-0.06
Spatial Autocor. SD	0.11	0.10	0.11	0.11	0.12	0.11	0.10
Forced Labor Mean	0.047	0.958	0.364	0.696	0.808	0.050	0.006

Notes: Observations are districts. Robust standard errors in parentheses, Conley (1999) standard errors with a 100 km window and Bartlett kernel in brackets. Left and right limits of the RD bandwidth are shown. Regressions estimate a local linear RD specification on each side of the border using a triangular kernel and include longitude as a control. Districts are weighted by the size of the relevant population. Columns (3), (4), and (5) exclude an extreme outlier near the border, likely due to data collection errors.

① **Labor markets:** ↑ 21 p.p. circular migration ▶ RD plot

4.5x mean in forced labor region

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Notes: Observations are districts. Robust standard errors in parentheses, Conley (1999) standard errors with a 100 km window and Bartlett kernel in brackets. Left and right limits of the RD bandwidth are shown. Regressions estimate a local linear RD specification on each side of the border using a triangular kernel and include longitude as a control. Districts are weighted by the size of the relevant population. Columns (3), (4), and (5) exclude an extreme outlier near the border, likely due to data collection errors.

## ① Labor markets: ↑ 21 p.p. circular migration ▶ RD plot

But no change in near-universal share of women in agriculture

# Results: 2 Years before Forced Labor Regime Ended (1940)

	Labor Markets		Marriage and Fertility			Human Capital	
	Men Migrants (1)	Circular Agriculture (2)	Married Ages 15-24 (3)	Married Ages 25-34 (4)	General Fert. Rate (5)	Boys in School (6)	Girls in School (7)
Migrant Sending	0.207 (0.089) [0.085]	0.015 (0.018) [0.016]	0.269 (0.080) [0.061]	0.312 (0.113) [0.088]	0.175 (0.092) [0.086]	-0.028 (0.016) [0.015]	-0.001 (0.006) [0.006]
Observations	29	29	28	28	28	29	29
Bandwidth	-503, 401	-503, 401	-503, 401	-503, 401	-503, 401	-503, 401	-503, 401
Spatial Autocorrel.	-0.14	-0.10	0.26	0.14	-0.16	-0.03	-0.06
Spatial Autocor. SD	0.11	0.10	0.11	0.11	0.12	0.11	0.10
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- ② Marriage and fertility: ↑ 27-31 married M for every 100 married F  
45-74% of mean in forced labor region

# Results: 2 Years before Forced Labor Regime Ended (1940)

	Labor Markets		Marriage and Fertility			Human Capital	
	Men Circular Migrants (1)	Women in Agriculture (2)	Married M:F Ages 15-24 (3)	Married M:F Ages 25-34 (4)	General Fert. Rate (5)	Boys in School (6)	Girls in School (7)
Migrant Sending	0.207 (0.089) [0.085]	0.015 (0.018) [0.016]	0.269 (0.080) [0.061]	0.312 (0.113) [0.088]	0.175 (0.092) [0.086]	-0.028 (0.016) [0.015]	-0.001 (0.006) [0.006]
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Bandwidth	-503, 401	-503, 401	-503, 401	-503, 401	-503, 401	-503, 401	-503, 401
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- ② Marriage and fertility: ↑ 27-31 married M for every 100 married F
- Major role for migration in allowing young men to marry

# Results: 2 Years before Forced Labor Regime Ended (1940)

	Labor Markets		Marriage and Fertility			Human Capital	
	Men Circular Migrants (1)	Women in Agriculture (2)	Married M:F Ages 15-24 (3)	Married M:F Ages 25-34 (4)	General Fert. Rate (5)	Boys in School (6)	Girls in School (7)
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Bandwidth	-503, 401	-503, 401	-503, 401	-503, 401	-503, 401	-503, 401	-503, 401
Spatial Autocorrel.	-0.14	-0.10	0.26	0.14	-0.16	-0.03	-0.06
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- ② Marriage and fertility: ↑ 27-31 married M for every 100 married F
- Couples closer in age? If men marry younger

# Results: 2 Years before Forced Labor Regime Ended (1940)

	Labor Markets		Marriage and Fertility			Human Capital	
	Men Migrants (1)	Circular Agriculture (2)	Married Ages 15-24 (3)	Married Ages 25-34 (4)	General Fert. Rate (5)	Boys in School (6)	Girls in School (7)
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Bandwidth	-503, 401	-503, 401	-503, 401	-503, 401	-503, 401	-503, 401	-503, 401
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- ② Marriage and fertility: ↑ 0.18 children 0-4 for every female 15-49
- 22% of value in forced labor region

# Results: 2 Years before Forced Labor Regime Ended (1940)

	Labor Markets		Marriage and Fertility			Human Capital	
	Men Circular Migrants (1)	Women in Agriculture (2)	Married M:F Ages 15-24 (3)	Married M:F Ages 25-34 (4)	General Fert. Rate (5)	Boys in School (6)	Girls in School (7)
Migrant Sending	0.207 (0.089) [0.085]	0.015 (0.018) [0.016]	0.269 (0.080) [0.061]	0.312 (0.113) [0.088]	0.175 (0.092) [0.086]	-0.028 (0.016) [0.015]	-0.001 (0.006) [0.006]
Observations	29	29	28	28	28	29	29
Bandwidth	-503, 401	-503, 401	-503, 401	-503, 401	-503, 401	-503, 401	-503, 401
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- ② Marriage and fertility: ↑ 0.18 children 0-4 for every female 15-49
- Circular migration and fertility positively related

# Results: 2 Years before Forced Labor Regime Ended (1940)

	Labor Markets		Marriage and Fertility			Human Capital	
	Men Migrants (1)	Circular Agriculture (2)	Married Ages 15-24 (3)	Married Ages 25-34 (4)	General Fert. Rate (5)	Boys in School (6)	Girls in School (7)
Migrant Sending	0.207 (0.089) [0.085]	0.015 (0.018) [0.016]	0.269 (0.080) [0.061]	0.312 (0.113) [0.088]	0.175 (0.092) [0.086]	-0.028 (0.016) [0.015]	-0.001 (0.006) [0.006]
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③ Human capital: ↓ 0.3 p.p. boys in school ► RD plot

56% of mean in forced labor region

# Results: 2 Years before Forced Labor Regime Ended (1940)

	Labor Markets		Marriage and Fertility			Human Capital		
	Men Migrants (1)	Circular Migrants (2)	Women in Agriculture (2)	Married Ages 15-24 (3)	Married Ages 25-34 (4)	General Fert. Rate (5)	Boys in School (6)	Girls in School (7)
Migrant Sending	0.207 (0.089) [0.085]	0.015 (0.018) [0.016]		0.269 (0.080) [0.061]	0.312 (0.113) [0.088]	0.175 (0.092) [0.086]	-0.028 (0.016) [0.015]	-0.001 (0.006) [0.006]
Observations	29	29	28	28	28	29	29	
Bandwidth	-503, 401	-503, 401	-503, 401	-503, 401	-503, 401	-503, 401	-503, 401	
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③ Human capital: ↓ 0.3 p.p. boys in school [RD plot](#)

Circular migration? Expulsion of Protestant missions in 1930?

# Results: 18 Years after Forced Labor Regime Ended (1960)

	Labor Markets		Marriage and Fertility			Human Capital	
	Men Circular Migrants (1)	Women in Agriculture (2)	Married Ages 15-24 (3)	Married M:F Ages 25-34 (4)	General Fert. Rate (5)	Boys in School (6)	Girls in School (7)
Migrant Sending	-0.025 (0.049) [0.050]	0.006 (0.004) [0.004]	0.102 (0.057) [0.053]	0.106 (0.147) [0.131]	0.058 (0.080) [0.075]	-0.014 (0.033) [0.029]	-0.026 (0.024) [0.021]
Observations	27	28	27	27	28	28	28
Bandwidth	-500, 294	-500, 294	-500, 294	-500, 294	-500, 294	-500, 294	-500, 294
Spatial Autocorrel.	-0.09	-0.02	-0.03	-0.15	0.04	0.44	0.24
Spatial Autocor. SD	0.12	0.11	0.12	0.10	0.12	0.12	0.13
Forced Labor Mean	0.163	0.997	0.267	0.635	0.743	0.089	0.041

Notes: Observations are districts. Robust standard errors in parentheses, Conley (1999) standard errors with a 100 km window and Bartlett kernel in brackets. Left and right limits of the RD bandwidth are shown. Regressions estimate a local linear RD specification on each side of the border using a triangular kernel and include longitude as a control. Districts are weighted by the size of the relevant population. Columns (1), (3), and (4) exclude an extreme outlier near the border, likely due to data collection errors.

## ① Labor markets: Convergence in circular migration

→ Importance of former forced labor regime's mobility restrictions

# Results: 18 Years after Forced Labor Regime Ended (1960)

	Labor Markets		Marriage and Fertility			Human Capital	
	Men Circular Migrants (1)	Women in Agriculture (2)	Married Ages 15-24 (3)	Married M:F Ages 25-34 (4)	General Fert. Rate (5)	Boys in School (6)	Girls in School (7)
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## ② Marriage and fertility: ↑ 10-11 married M for every 100 married F

Still 17-38% of forced labor value 

# Results: 18 Years after Forced Labor Regime Ended (1960)

	Labor Markets		Marriage and Fertility			Human Capital	
	Men Circular Migrants (1)	Women in Agriculture (2)	Married Ages 15-24 (3)	Married M:F Ages 25-34 (4)	General Fert. Rate (5)	Boys in School (6)	Girls in School (7)
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- ② Marriage and fertility: ↑ 10-11 married M for every 100 married F
- Some factor slows convergence in marriage markets

# Results: 18 Years after Forced Labor Regime Ended (1960)

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- ② **Marriage and fertility:** Approaching convergence in fertility  
8% of forced labor mean, but imprecise

# Results: 18 Years after Forced Labor Regime Ended (1960)

	Labor Markets		Marriage and Fertility			Human Capital	
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- ③ **Human capital:** Effective convergence in boys' schooling ▶ RD plot
- More demand (migration)? More supply (Catholic missions)?

## Summary of “First Stage” Results

- ① **Labor markets:** Forced labor institution mattered *while it existed*
  - ▶ Circular migration: Far higher rates in migrant-sending region before forced labor regime ended, convergence after
  - ▶ Women's work: No differences before or after

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- ② **Marriage and fertility:** Forced labor institution *still mattered*
  - ▶ Marriage: **Far higher rates for young men in migrant-sending region** before forced labor regime ended, smaller but continued gap after
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- ③ **Human capital:** Forced labor institution mattered while it existed but *unclear exactly why*
  - ▶ Enrollment: Lower rates for boys in migrant-sending region before forced labor regime ended, convergence after
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**Other differences ruled out:** Road network, health infrastructure

## Framework Linking Past and Present

## Hypothesis

If colonial-era patterns continue today, I expect:

- ▶ Similar levels of development: Migration, human capital equalized
- ▶ Differences in marriage and dating: Fewer age-disparate relationships in former migrant-sending region

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How the past shapes present-day marriage and dating markets in Southern Africa:

- ▶ “**Age-disparate relationships . . . have antecedents in older practices** that have long played a part in defining the nature of social life and the particular values and norms associated with sexuality. Many **culturally inscribed assumptions and expectations that once legitimized these practices still prevail at present**, and continue to influence the meanings that people attach to contemporary sexual relationships and the expectations that people have in relationships” (Leclerc-Madlala, 2008, pp. S22-S23)

# Theory

**Setup:** 2 overlapping generations (young, old), 2 sexes (M, F)

- ▶ Young males in own households, young females in parents' (or living parent's) household until joining husband's through marriage
- ▶ Young and old males are fecund, only young females are fecund
- ▶ Half of each household's children are male, half are female
- ▶ No borrowing or saving (note: borrowing constraint will be important)

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**In each period:**

- ① Work: Contribute to current household's budget
- ② Marriage market: If unmarried, enter frictionless marriage market with bride price paid out of husband's budget
- ③ Consumption and children: Consume from remaining budget and if wife is young, have children who survive at cost to her new household

## Baseline Case

- ① **Work:** Everyone works in household production
  - ▶ Young females produce more than young males (Corno et al., 2020)
  - ▶ Older males produce more than young females

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  - ▶ Young females are scarce due to declining fecundity (Siow, 1998)
  - ▶ Parental altruism / social stigma (random variable): Preference for daughters to have marriages with same husband-wife generation gap as their own—want daughters happy and/or in “proper” marriages (similar to Corno et al., 2020)

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- ③ **Children and consumption:** Children increase households’ future consumption and continue males’ lineages

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- ① **Work:** Everyone works in household production
    - ▶ Young females produce more than young males (Corno et al., 2020)
    - ▶ Older males produce more than young females
  - ② **Marriage market:** Decisions by unmarried males and parent(s) of unmarried females
    - ▶ Young females are scarce due to declining fecundity (Siow, 1998)
    - ▶ Parental altruism / social stigma (random variable): Preference for daughters to have marriages with same husband-wife generation gap as their own—want daughters happy and/or in “proper” marriages (similar to Corno et al., 2020)
  - ③ **Children and consumption:** Children increase households' future consumption and continue males' lineages
- **Prediction:** All old males marry all young females, young males priced out of marriage market because they cannot borrow

## Responses to Shocks

- ① **Labor market for young males:** Can work for wages exceeding value of old males' production
  - ▶ Example: Circular migration to Witwatersrand, which requires fitness and energy that only young males have

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- ② **Decline of circular migration and bride price** → Only parents' preferences for generation gaps in daughters' marriages determine who marries whom; fertility declines to previously affordable level

## Implications for Today

### **Age-disparate relationships and HIV:**

- ▶ de Oliveira et al. (2017): Older men transmit virus to younger women, who as they age transmit it to similarly-aged men

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### **Associated behavioral risk factors:**

- ▶ Earlier sexual debut for girls (Evans et al., 2019)
- ▶ Man has concurrent partners (Mabaso et al., 2021)
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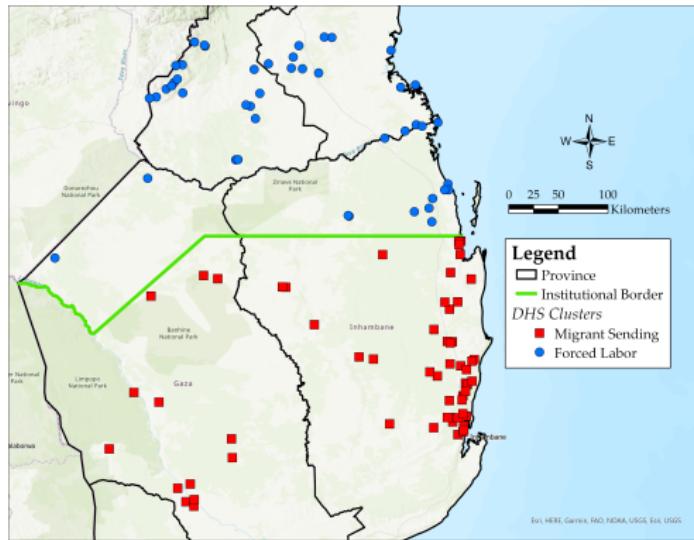
- ▶ Earlier sexual debut for girls (Evans et al., 2019)
- ▶ Man has concurrent partners (Mabaso et al., 2021)
- ▶ Lower condom use (Schaefer et al., 2017)

### **Implications of reducing age-disparate relationships:**

- Reduce between-generation transmission of virus
- Delay and dampen peak in age profile of HIV prevalence, especially for women

Long Run

# Data



DHS Clusters within 200 km of Border (2009, '11, '15, '18)

## DHS: Georeferenced survey clusters

- ① HIV: Blood test results
- ② Development: Asset index, childhood stunting, children in last 5 years, years of schooling

# Empirical Strategy

## RD design:

$$y_{i,c} = \alpha + \tau \text{MigrantSending}_c + f(\text{Dist}_c) + \text{Lon}_c + \mathbf{X}_i \beta + \delta_t + \epsilon_{i,c}$$

for  $c \in B_{\text{MSE}}^*$

## New features:

- ▶ Data for individual  $i$  in survey cluster  $c$
- ▶  $\mathbf{X}_i$ : Individual controls (age, age squared, female indicator)
- ▶  $\delta_t$ : Year FE
- ▶  $B_{\text{MSE}}^*$ : Set of clusters within Calonico, Cattaneo, & Titiunik (2014)  
MSE-optimal bandwidth

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## New details:

- ▶ Slight displacement of clusters to protect privacy → drop clusters potentially on wrong side of border, also classical measurement error
- ▶ Clustered and Conley (1999) SEs (100 km bandwidth, Bartlett kernel)
- ▶ Sometimes “too few” clusters in bandwidth → wild cluster bootstrap  $p$ -values (Cameron, Gelbach, & Miller, 2008)

# Results: HIV Prevalence

	Positive Blood Test		
	Pooled (1)	Women (2)	Men (3)
Migrant Sending	-0.103 (0.049) [0.037]	-0.089 (0.053) [0.041]	-0.097 (0.084) [0.093]
Observations	860	588	212
Clusters	21	22	14
Bandwidth	124.4	128.3	86.5
Wild Cluster Bootstrap <i>p</i>	0.073	0.137	0.458
Spatial Autocorrelation	0.07	-0.05	0.05
Spatial Autocorrelation SD	0.21	0.20	0.19
Forced Labor Mean	0.215	0.214	0.198

Notes: Clustered standard errors in parentheses, Conley (1999) standard errors with a 100 km window and Bartlett kernel in brackets. Regressions estimate a local linear RD specification on each side of the border with a triangular kernel and include age, age squared, a female indicator, and longitude as controls. Bandwidths are MSE-optimal (Calonico, Cattaneo, & Titiunik, 2014). Wild cluster bootstrap *p*-values are calculated using 999 repetitions and a small-sample correction (Cameron, Gelbach, & Miller, 2008).

↓ 10 p.p. in seroprevalence ▶ RD plots ▶ Refusals (Lowes & Montero, 2021)

48% of mean in former forced labor region

# Results: HIV Prevalence

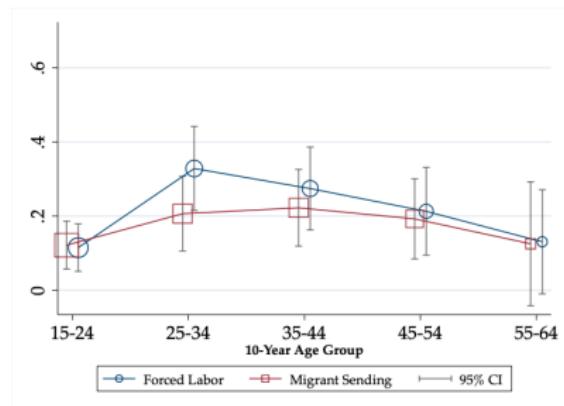
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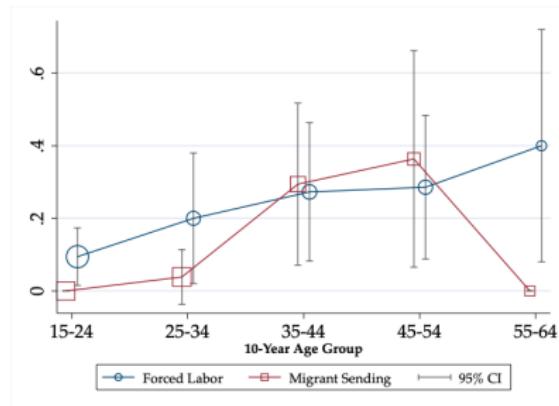
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Effects similar when separating sexes, though imprecise for men

# Age Profiles of HIV Prevalence



Women

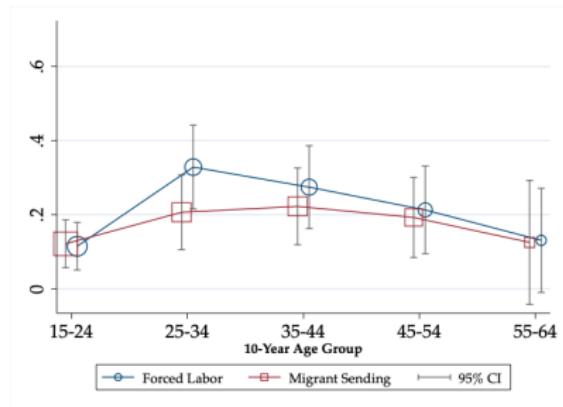


Men

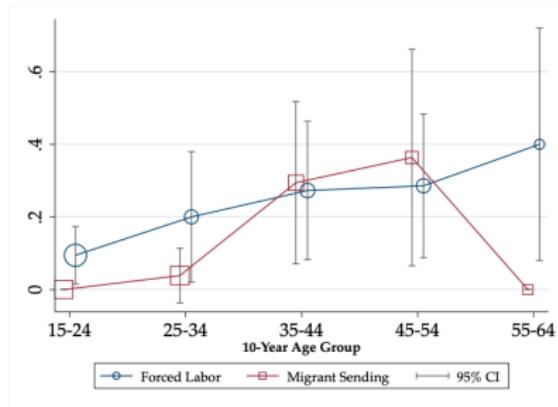
Compare mean HIV prevalence by 10-year age group within  $B_{MSE}^*$

- Large gaps between former **forced labor** and **migrant-sending** regions help rationalize large RD estimates

# Age Profiles of HIV Prevalence



Women



Men

Compare mean HIV prevalence by 10-year age group within  $B_{MSE}^*$

- Respective peaks consistent with implications of age disparities (de Oliveira et al., 2017)

# Results: Development

	<i>Assets</i>	<i>Stunting</i>	<i>Fertility</i>	<i>Years of Schooling</i>	
	Index (1)	Children (2)	Women (3)	Females (4)	Males (5)
<b>Migrant Sending</b>	0.067 (0.322) [0.414]	-0.055 (0.117) [0.132]	0.069 (0.114) [0.078]	0.377 (0.327) [0.281]	0.224 (0.782) [0.795]
Observations	2,513	258	301	883	815
Clusters	22	15	15	19	22
Bandwidth	59.6	108.0	68.7	64.8	71.5
Wild Cluster Bootstrap $p$	0.862	0.824	0.580	0.302	0.818
Spatial Autocorrelation	-0.19	-0.30	-0.14	-0.26	-0.16
Spatial Autocorrelation SD	0.15	0.25	0.16	0.16	0.15
Forced Labor Mean	3.375	0.376	0.730	2.498	3.443

*Notes:* Clustered standard errors in parentheses, Conley (1999) standard errors with a 100 km window and Bartlett kernel in brackets. Regressions estimate a local linear RD specification on each side of the border with a triangular kernel and include age, age squared, a female indicator, and longitude as controls. Bandwidths are MSE-optimal (Calonico, Cattaneo, & Titiunik, 2014). Wild cluster bootstrap  $p$ -values are calculated using 999 repetitions and a small-sample correction (Cameron, Gelbach, & Miller, 2008).

No substantive difference in outcomes along border

→ Consistent with implications of patterns at end of colonial era

## Explaining Differences in HIV Prevalence

# Age-Disparate Partnerships

	Census	DHS	
	Spouse	Last Sex Partner	
	Women (1)	Women (2)	Men (3)
Migrant Sending	-0.790 (0.289) [0.220]	-3.129 (1.492) [1.257]	-1.912 (0.828) [0.833]
Observations	9,307	204	300
Clusters	15	14	63
Bandwidth	138.3	56.4	179.0
Wild Cluster Bootstrap $p$	0.075	0.154	0.081
Spatial Autocorrelation	0.18	0.06	0.12
Spatial Autocorrelation SD	0.21	0.17	0.08
Forced Labor Mean	8.380	7.265	5.110

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## Age disparities: Man's age minus woman's age

- ▶ Linked spouses in IPUMS 10% sample of 2007 census
- ▶ Last reported sexual partner in DHS

Admin. post map

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**Age disparities:** Much smaller in former migrant-sending region

- ▶ Census spouses: ↓ 0.8 years (9% of forced labor mean) [▶ RD plot](#)
- ▶ DHS sexual partners: ↓ 1.9-3.1 years (37-45%) [▶ RD plot](#)

# Risk Factors Associated with Age-Disparate Partnerships

	<i>Age at First Sex</i>	<i>Has Partners Concurrently</i>	<i>Condom Used Last Sex</i>	
	Women (1)	Men (2)	Women (3)	Men (4)
Migrant Sending	0.813 (0.379) [0.403]	-0.157 (0.086) [0.081]	0.001 (0.045) [0.039]	0.065 (0.058) [0.061]
Observations	603	250	375	136
Clusters	26	54	28	26
Bandwidth	86.8	156.1	96.1	85.3
Wild Cluster Bootstrap <i>p</i>	0.169	0.153	0.986	0.448
Spatial Autocorrelation	0.01	0.07	-0.28	0.14
Spatial Autocorrelation SD	0.15	0.09	0.16	0.15
Forced Labor Mean	16.13	0.258	0.056	0.069

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Later sexual debuts for women, fewer concurrent partners for men  
Meaningful but imprecise estimates

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Later sexual debuts for women, fewer concurrent partners for men

→ Lower risk in former migrant-sending region

## Additional Factors Ruled Out

### **HIV risk factors unrelated to institutional differences:**

- ▶ Genital ulcers (effect points in opposite direction)
- ▶ Polygyny
- ▶ Forced and transactional sex
- ▶ Women's health decision making
- ▶ Men's medical circumcision (Maffioli, 2017)
- ▶ Public-sector health facilities (Maina et al., 2019)

### **Conflict:**

- ▶ Civil war violence (ACLED, PRIO, UCDP)
- ▶ Landmines (Halo Trust)

## Conclusion

## Summary of Results

- ① “First stage”: Lasting differences in marriage market outcomes, convergence in circular migration and human capital
  - ▶ Substantially more married young men in migrant-sending region for each married young women
  - Fewer age-disparate relationships if men only married younger women

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  - ▶ Shocks to young men's wages and decline of bride price generate continuation of colonial-era patterns above
  - Lowers HIV risk from spousal, sex partner age disparities in former migrant-sending region

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  - Lowers HIV risk from spousal, sex partner age disparities in former migrant-sending region
- ③ **Long run:** Matches predictions above
  - ▶ Much lower HIV prevalence in former migrant-sending region
  - ▶ Channel: Smaller age disparities between partners, fewer associated risk factors (women's age at first sex, men with concurrent partners)

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**Major historical shock:** Detailed data, simple theory to understand how and why their impacts continue (or not)

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**Marriage markets:** Novel channel for lasting effects to arise through

## Appendix Slides

# Appendix: Decree Expanding Leased Territory

*PORTUGUESE DECREE, extending the Concessions granted  
to the Mozambique Company.—Lisbon, December 22, 1893.\**

(Translation.)

In view of the representations made to me by the Mozambique Company asking that the Concessions referred to in the Decrees having the force of law of the 11th February† and of the 30th July,† 1891, may be amplified so that they may also comprise a portion of the region to the south of the River Save (or Sabi);

Whereas the Mozambique Company has at its disposal important means of action, and consequently it is highly expedient that the territories alluded to should be administered by that Company, so as to insure the proper development and defence of those territories;

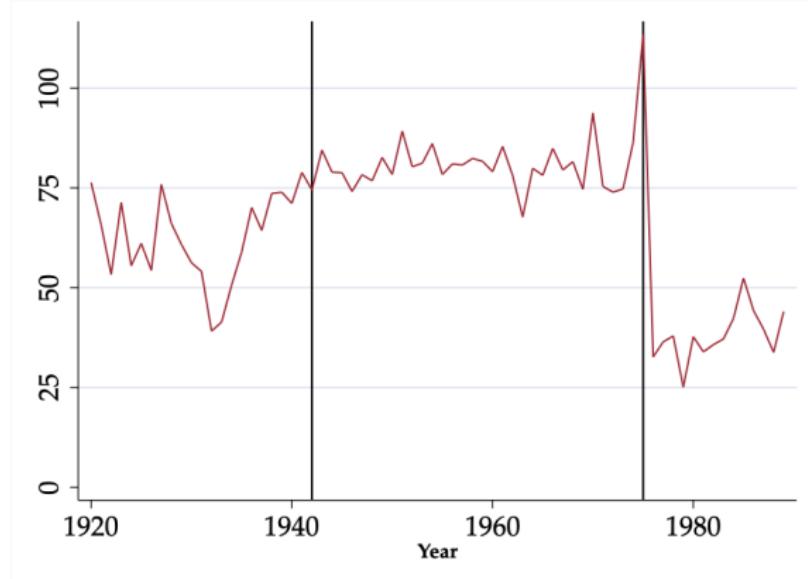
I hereby decree:—

Art. 1. The administration and "exploitation" of the territory bounded, on the north by the River Sabi from its mouth to its confluence with the Lundi, on the west by the frontier line as far as the Limpopo, and following the course of this river as far as the point where it is intersected by the 32nd meridian, near Chahalata,

on the south, by the direct line starting from the last-named point as far as that where the 32nd meridian intersects the 22nd parallel of latitude, and following the course of the said parallel of latitude as far as the sea, and, on the east, by the Ocean, is granted to the Mozambique Company, under the same conditions as are laid down in the Decrees, having the force of law, of the 11th February, and the 30th July, 1891.

Source: Great Britain Foreign Office (1901, pp. 601-602)

## Appendix: Intensity of Circular Migration



Miners from Mozambique Working in South Africa (000s)

Notes: The respective black lines denote the end of the forced labor institution (1942) and Mozambique's independence (1975), which immediately worsened relations with South Africa. Data from Crush, Jeeves, & Yudelman (1991).

## Appendix: Labor Coercion by the Company

### Police powers:

- ▶ Officials told chiefs “on such and such a date they had to supply a certain number of men to go to work; generally, . . . because [some] cannot manage to organize the number of workers requested, one or more police go to help the chiefs who fell short” (as cited in Allina, 2012, p. 50)

### Punishments for evasion:

- ▶ “Workers returning from abroad . . . [were conscripted] into forced labor almost immediately, such that they . . . could no go home for any length of time” (Allina, 2012, p. 58)
- ▶ Punish wives, mothers if men tried to flee system (Guthrie, 2018)

**League of Nations report:** “The [B]lacks [say] . . . that they are the slaves of the Mozambique Company” (Ross, 1925, p. 53)

### New system: Hut taxes and pass books

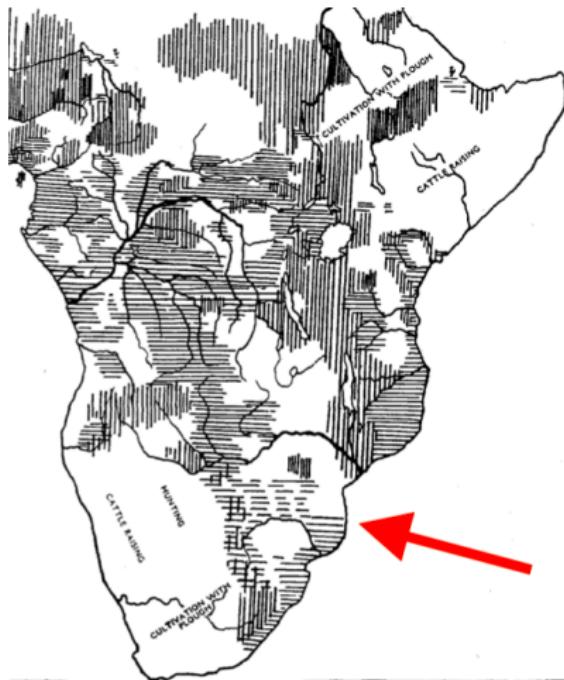
- ▶ 1927: Doubled annual hut tax (required wage labor), mandated all males over age 14 carry pass books with work history, anyone not carrying pass books punished with forced labor (Allina, 2012)

# Appendix: Agricultural Division of Labor

## AFRICA.

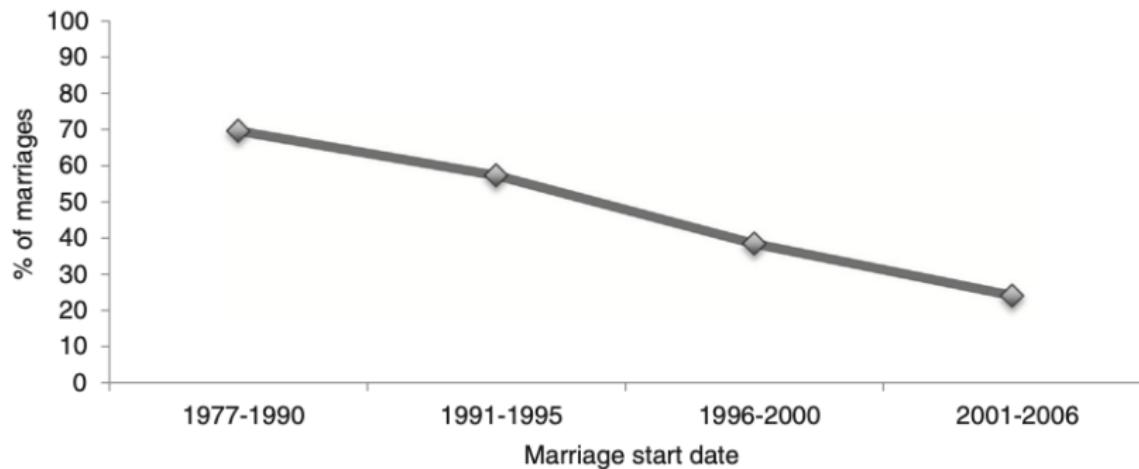
### DIVISION OF WORK IN HOE CULTURE.

-  Man takes part in actual hoe culture  
(prepares ground, hoes, sows, weeds, harvests alone or with women).  
(thicker shading indicates that man takes most part).
-  Man only prepares ground,  
women do all the other work.



Source: Baumann (1928, p. 303)

## Appendix: Intensity of Circular Migration



Prevalence of Bride Price Marriage, Rural Gaza Province

Note: Figure taken from Chae et al. (2021).

# Appendix: 1940 Census Summary Example

Grupos de Idades	Total geral	POPULAÇÃO INDÍGENA POR GRUPOS DE IDADES, SEGUNDO O SEXO E A OCUPAÇÃO											
		Total por sexos		Nas terras		Agricultura e pecuária		Pesa exploração de marinhais		Indústria		Exploração mineral e petróleo	
		Varões	Fêmeas	Varões	Fêmeas	Varões	Fêmeas	Varões	Fêmeas	Varões	Fêmeas	Varões	Fêmeas
Aveio.....	58.537	37.089	21.458	7.337	14.824	3	-	37	-	13	-	-	-
Até 1 ano.....	4.787	2.059	2.728	-	-	-	-	-	-	-	-	-	-
De 1 mês a 1 ano.....	5.986	4.722	3.064	-	-	-	-	-	-	-	-	-	-
De 1 a 5 anos.....	18.042	5.085	12.957	-	-	-	-	-	-	-	-	-	-
De 5 a 10 anos.....	10.100	3.720	6.380	-	-	-	-	-	-	-	-	-	-
De 10 a 15 anos.....	2.788	1.008	1.815	614	1.170	379	-	-	-	-	-	-	-
De 15 a 20 anos.....	1.979	793	1.189	574	615	374	-	-	-	-	-	-	-
De 20 a 25 anos.....	1.808	648	1.153	550	553	353	-	-	-	-	-	-	-
De 25 a 30 anos.....	4.127	1.950	2.641	1.031	1.938	774	-	-	-	-	-	-	-
De 30 a 35 anos.....	3.812	2.035	1.197	1.090	1.083	793	-	-	-	-	-	-	-
De 35 a 40 anos.....	3.494	1.861	1.632	825	803	803	-	-	-	-	-	-	-
De 40 a 45 anos.....	1.484	993	754	616	539	457	-	-	-	-	-	-	-
De 45 a 50 anos.....	1.031	623	605	353	353	353	-	-	-	-	-	-	-
De 50 a 55 anos.....	966	582	603	353	353	353	-	-	-	-	-	-	-
De 55 a 60 anos.....	1.031	447	904	391	599	599	-	-	-	-	-	-	-
De 60 a 65 anos.....	798	383	613	306	306	306	-	-	-	-	-	-	-
De 65 a 70 anos.....	631	254	366	-	-	-	-	-	-	-	-	-	-
De 70 a 75 anos.....	520	218	302	-	-	-	-	-	-	-	-	-	-
De 75 a 80 anos.....	343	130	213	-	-	-	-	-	-	-	-	-	-
De 80 a 85 anos.....	216	72	144	-	-	-	-	-	-	-	-	-	-
De 85 a 90 anos.....	43	19	44	-	-	-	-	-	-	-	-	-	-
De 90 a 95 anos.....	5	1	4	-	-	-	-	-	-	-	-	-	-
De 95 a 100 anos.....	-	-	-	-	-	-	-	-	-	-	-	-	-
De 100 a 110 anos.....	-	-	-	-	-	-	-	-	-	-	-	-	-
De 110 a 120 anos.....	-	-	-	-	-	-	-	-	-	-	-	-	-
De 120 a 130 anos.....	-	-	-	-	-	-	-	-	-	-	-	-	-
De 130 a 140 anos.....	-	-	-	-	-	-	-	-	-	-	-	-	-
De 140 a 150 anos.....	-	-	-	-	-	-	-	-	-	-	-	-	-
De 150 a 160 anos.....	-	-	-	-	-	-	-	-	-	-	-	-	-
De 160 a 170 anos.....	-	-	-	-	-	-	-	-	-	-	-	-	-
De 170 a 180 anos.....	-	-	-	-	-	-	-	-	-	-	-	-	-
De 180 a 190 anos.....	-	-	-	-	-	-	-	-	-	-	-	-	-
De 190 a 200 anos.....	-	-	-	-	-	-	-	-	-	-	-	-	-
Acima de 200 anos.....	-	-	-	-	-	-	-	-	-	-	-	-	-

Vilanculos District: Indigenous Population by Age Group, Sex, and Occupation

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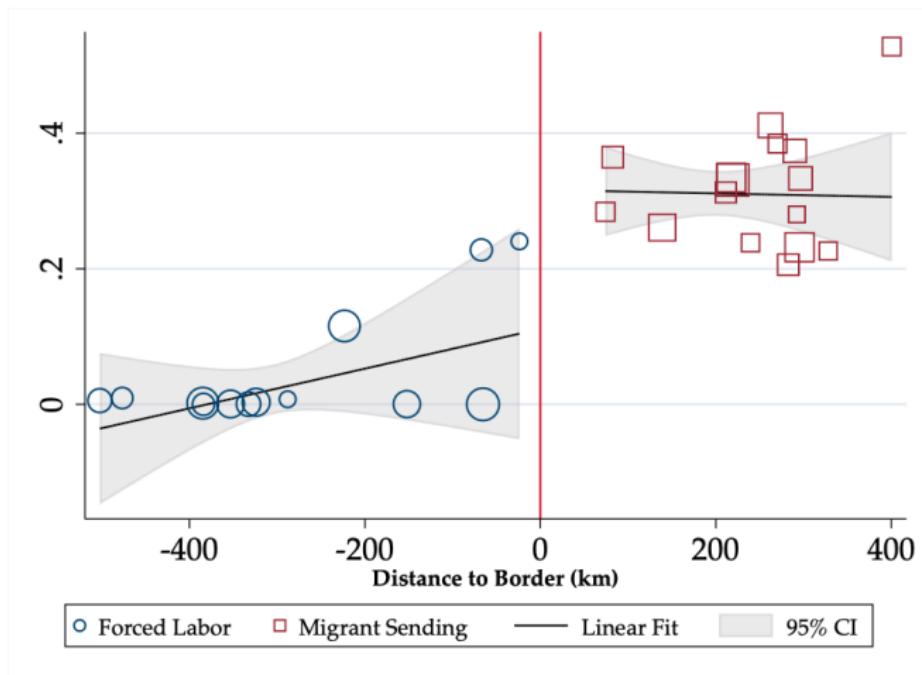
# Appendix: 1960 Census Summary Example

3. — População de residência habitual, segundo a instrução, o estado civil, a religião, a idade e o tipo somático, por concelhos e circunscrições (concl.).

Domicílio, concelhos e circunscrições Males	TOTAL	Instrução												religião, a idade e o tipo somático, por concelhos e circunscrições (concl.)																			
		Sobrinhos						Cônjuges						Estado civil						Religião													
		Analfabetos			Sabe ler			Solteiros			Casados			Vivos			Divorciados			Separados			Católicos			Outros cristãos			Não cristãos				
		H	M	H	M	H	M	H	M	H	H	M	H	H	M	H	H	M	H	H	M	H	H	H	H	H	H	H					
I		2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
CIRCUNSCRIÇÃO DE VILANCULOS	67 069	30 961	62 982	28 456	1 115	974	1 745	1 58	327	205	34 520	18 466	186	N	20 987	11 974	3 111	216	463	19	2 064	1 320	1 698	938	28	10	63 348	28 773					
De 1 a 10	4 108	2 070	4 108	2 070	—	—	—	—	—	—	4 119	2 021	—	N	—	—	—	—	—	—	—	46	26	47	21	2	4 108	1 976	—	—	—		
x 1 a 4	3 154	1 748	3 154	1 748	—	—	—	—	—	—	3 154	1 748	—	N	—	—	—	—	—	—	—	36	20	46	21	2	3 154	1 748	—	—	—		
x 5 a 9	2 648	1 323	2 648	1 323	—	—	—	—	—	—	2 648	1 323	—	N	—	—	—	—	—	—	—	36	20	46	21	2	2 648	1 323	—	—	—		
x 10 a 14	2 327	1 230	2 327	1 230	—	—	—	—	—	—	2 327	1 210	—	N	—	—	—	—	—	—	—	34	20	34	16	2	2 327	1 210	—	—	—		
x 15 a 19	2 027	1 014	2 027	1 014	—	—	—	—	—	—	2 027	1 014	—	N	—	—	—	—	—	—	—	34	20	34	16	2	2 027	1 014	—	—	—		
x 20 a 24	1 636	816	1 636	816	—	—	—	—	—	—	1 636	816	—	N	—	—	—	—	—	—	—	34	20	34	16	2	1 636	816	—	—	—		
x 25 a 29	1 341	670	1 341	670	—	—	—	—	—	—	1 341	670	—	N	—	—	—	—	—	—	—	34	20	34	16	2	1 341	670	—	—	—		
x 30 a 34	1 041	516	1 041	516	—	—	—	—	—	—	1 041	516	—	N	—	—	—	—	—	—	—	34	20	34	16	2	1 041	516	—	—	—		
x 35 a 39	751	380	751	380	—	—	—	—	—	—	751	380	—	N	—	—	—	—	—	—	—	34	20	34	16	2	751	380	—	—	—		
x 40 a 44	591	291	591	291	—	—	—	—	—	—	591	291	—	N	—	—	—	—	—	—	—	34	20	34	16	2	591	291	—	—	—		
x 45 a 49	483	223	483	223	—	—	—	—	—	—	483	223	—	N	—	—	—	—	—	—	—	34	20	34	16	2	483	223	—	—	—		
x 50 a 54	403	187	403	187	—	—	—	—	—	—	403	187	—	N	—	—	—	—	—	—	—	34	20	34	16	2	403	187	—	—	—		
x 55 a 59	343	161	343	161	—	—	—	—	—	—	343	161	—	N	—	—	—	—	—	—	—	34	20	34	16	2	343	161	—	—	—		
x 60 a 64	287	139	287	139	—	—	—	—	—	—	287	139	—	N	—	—	—	—	—	—	—	34	20	34	16	2	287	139	—	—	—		
x 65 a 69	237	119	237	119	—	—	—	—	—	—	237	119	—	N	—	—	—	—	—	—	—	34	20	34	16	2	237	119	—	—	—		
x 70 a 74	197	98	197	98	—	—	—	—	—	—	197	98	—	N	—	—	—	—	—	—	—	34	20	34	16	2	197	98	—	—	—		
x 75 a 79	157	76	157	76	—	—	—	—	—	—	157	76	—	N	—	—	—	—	—	—	—	34	20	34	16	2	157	76	—	—	—		
x 80 a 84	127	59	127	59	—	—	—	—	—	—	127	59	—	N	—	—	—	—	—	—	—	34	20	34	16	2	127	59	—	—	—		
x 85 a 89	102	49	102	49	—	—	—	—	—	—	102	49	—	N	—	—	—	—	—	—	—	34	20	34	16	2	102	49	—	—	—		
x 90 a 94	82	41	82	41	—	—	—	—	—	—	82	41	—	N	—	—	—	—	—	—	—	34	20	34	16	2	82	41	—	—	—		
x 95 a 99	62	31	62	31	—	—	—	—	—	—	62	31	—	N	—	—	—	—	—	—	—	34	20	34	16	2	62	31	—	—	—		
x 100 e mais	13	4	13	4	—	—	—	—	—	—	13	4	—	N	—	—	—	—	—	—	—	34	20	34	16	2	13	4	—	—	—		

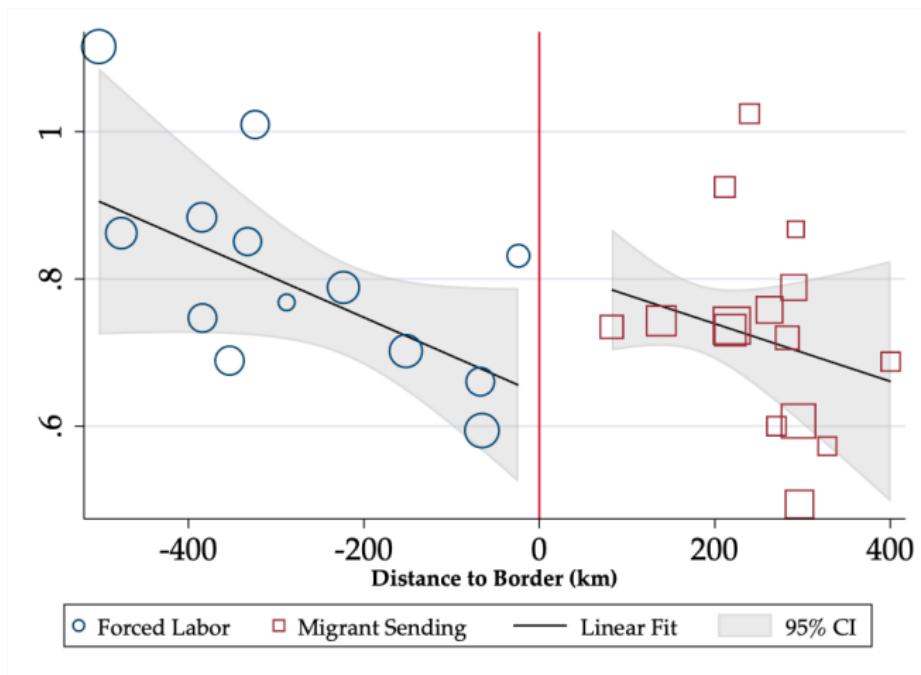
Vilanculos District: Black Resident Population by Education, Marital Status, Religion, Age, and Sex

## Appendix: RD Plot for Circular Migration (1940)



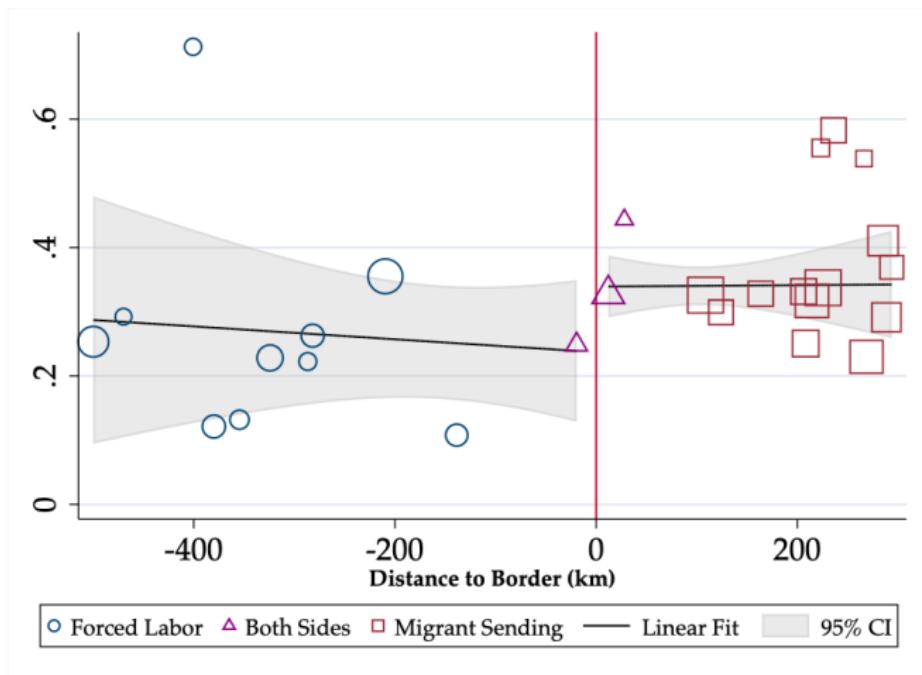
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## Appendix: RD Plot for Boys in School (1940)



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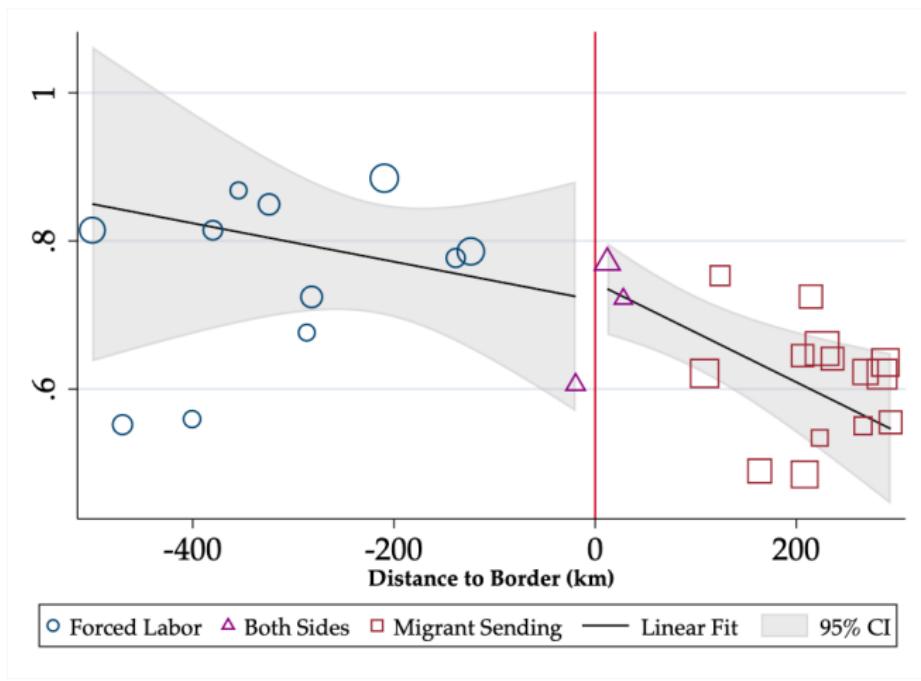
## Appendix: RD Plot for Married M : Married F (1960)



Ages 15-24

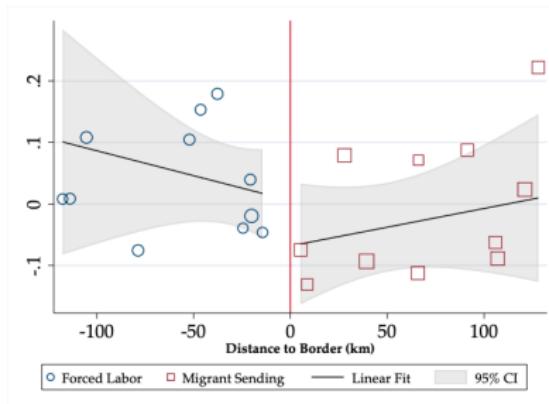
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## Appendix: RD Plot for Boys in School (1960)



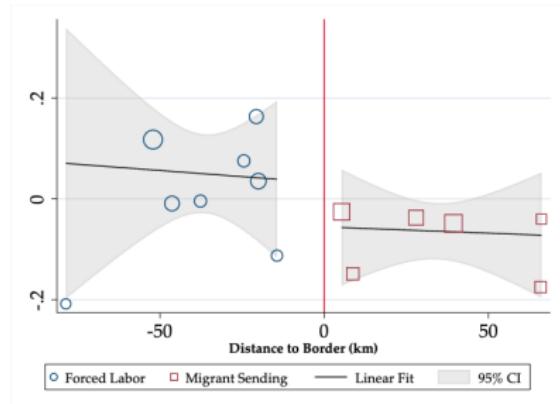
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# Appendix: RD Plots for HIV Prevalence



Women

Net of Age, Age Squared, Longitude, Year FE



Men

Net of Age, Age Squared, Longitude, Year FE

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## Appendix: Blood Test Refusals

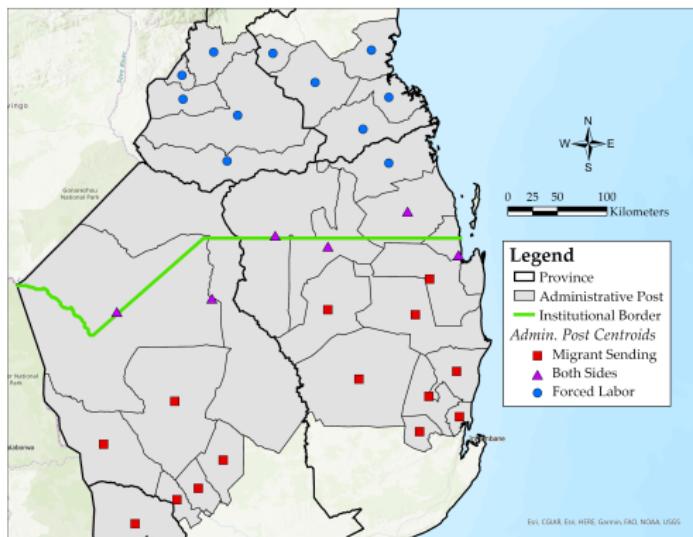
	Refused Blood Test		
	Pooled (1)	Women (2)	Men (3)
Migrant Sending	0.009 (0.006) [0.006]	0.010 (0.006) [0.006]	-0.006 (0.006) [0.007]
Observations	478	500	141
Clusters	13	20	12
Bandwidth	148.4	176.8	132.8
Wild Cluster Bootstrap $p$	0.428	0.195	0.432
Forced Labor Mean	0.009	0.004	0.000

*Notes:* Clustered standard errors in parentheses, Conley (1999) standard errors with a 100 km window and Bartlett kernel in brackets. Regressions estimate a local linear RD specification on each side of the border with a triangular kernel and include age, age squared, a female indicator, and longitude as controls. Bandwidths are MSE-optimal (Calonico, Cattaneo, & Titiunik, 2014). Wild cluster bootstrap  $p$ -values are calculated using 999 repetitions and a small-sample correction (Cameron, Gelbach, & Miller, 2008).

Negligible differences in very low refusal rates

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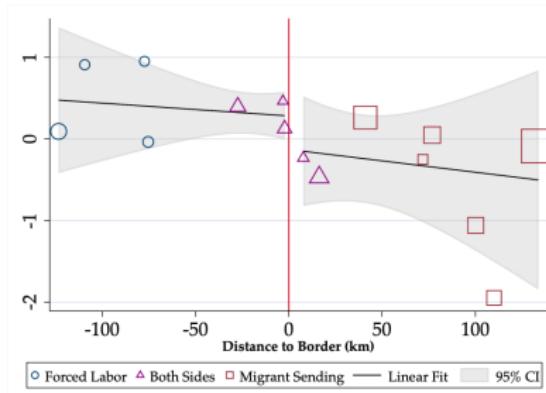
# Appendix: Georeferenced 2007 Census Data



Administrative Posts with Centroids within 200 km of Border

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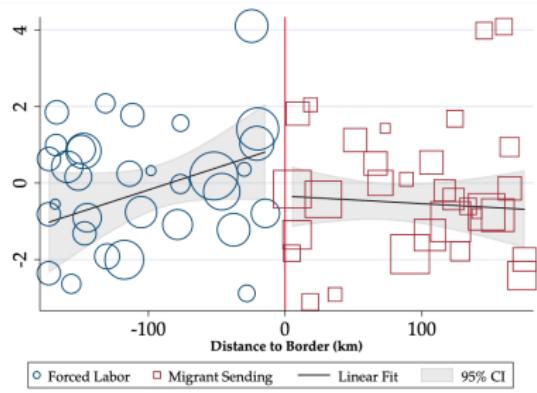
# Appendix: RD Plots for Age Disparities between Partners



Census: Women with Spouse

Net of Age, Age Squared, Longitude

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DHS: Men with Last Sex Partner

Net of Age, Age Squared, Longitude, Year FE