Borders, Barriers, and Beliefs:
Terrain, Missions, and Cross-Border Religious Similarity

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Abstract

Rugged terrain at international borders divides religious belief. Across 308 contiguous country pairs, and outside Africa, a one-standard-deviation increase in border ruggedness lowers cross-border religious similarity by roughly a quarter of a standard deviation. Africa is the exception. Between African country pairs the barrier dissipates, and across 2,125 paired Afrobarometer survey clusters it turns positive: rugged African borders carry more shared religion, not less. Colonial Christian mission placement tracks the reversal. Terrain predicts where stations went, and mission density absorbs nearly the whole African departure from the global pattern. Contemporary restrictions on religion do not account for that departure, but they interact with the same geography: where average restrictions are high, the terrain gradient between countries steepens, consistent with populations unable to cross rough ground to escape.

1 Introduction

Norway and Sweden have nearly identical religious compositions. Sudan and South Sudan share a long land border and are divided by most common religion. Across the 308 pairs of countries with a shared land frontier and measured composition, the chance that two people drawn at random from either side share a tradition averages 0.613 with a standard deviation of 0.278. One predetermined feature of the border predicts where a pair falls in that range: terrain ruggedness.

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Religion moves through people, and people move through terrain. If physical barriers slow cultural diffusion, neighbors separated by rugged frontiers should hold more divergent beliefs. I test that prediction on 308 land-contiguous country pairs, matching Pew's national religious composition estimates to satellite terrain within a 25 km buffer of each shared frontier, then take the same question down to geocoded survey clusters paired across African borders.

Terrain divides belief. Log border ruggedness enters at -0.061 (SE 0.024) with dyad controls across 308 pairs, and interacting terrain with an Africa indicator puts the non-African slope at -0.071 (SE 0.023). On that slope a one-standard-deviation increase in ruggedness moves similarity down by 0.072 units, roughly 26% of its standard deviation across pairs.

Rugged borders inside Africa do not divide belief. The Africa interaction enters at 0.093 (SE 0.038), leaving an implied African slope of 0.022, a statistical null. Below the national level the sign turns over. Pairing each border-proximate Afrobarometer enumeration area with its nearest counterpart across a border gives 2,125 pairs, and log local ruggedness enters at 0.183 (SE 0.025): rugged African frontiers carry more shared religion, not less.

Colonial missionary placement is the candidate mechanism. Terrain predicts mission density and explains 32% of the variation in where stations went; mission density predicts similarity; and with missions in the specification the African terrain coefficient goes to zero. The Islamic channel through pre-colonial trade routes runs in the mirror direction but is not precisely estimated.

Contemporary policy interacts with the same geography without explaining the African pattern. Between border dyads, restrictions steepen the terrain gradient, the sign predicted when populations cannot cross rough ground to escape pressure.

Three literatures meet here. Geography predicts cultural diversity: Michalopoulos [2012] links within-homeland variation to ethnolinguistic fragmentation, Nunn and Puga [2012] show that African ruggedness impeded development while sheltering populations from slave raiding, and Cogneau and Moradi [2014] trace religious divergence across the Ghana–Togo border, at one frontier rather than a global frame. Missions have long reach—Nunn [2010], Woodberry [2012] and Valencia Caicedo [2019]—but that work treats a mission as a local shock to the people it reached, not as an organization whose spatial distribution left a signature along an entire frontier. A third literature takes religious diversity as a determinant of economic outcomes and as given [Iannaccone, 1998, Iyer, 2016, Alesina et al., 2003]. This paper joins them: border geography predicts similarity between neighboring states, and the mission literature extends from individual conversion to the spatial distribution of belief.

Section 2 states the three predictions, Sections 5 to 7 establish the barrier and test the channels, and Section 8 turns to restrictions.

2 Theoretical Framework

Terrain as a barrier. Religious traditions spread through social contact, migration and institutional networks, and distance and physical barriers raise the cost of those interactions [Hägerstrand, 1967, Tobler, 1970, Spolaore and Wacziarg, 2013]. None of that work tests religion; it establishes the spatial-diffusion premise. A frontier running through mountains should therefore transmit less doctrine than one crossing a plain, and Cogneau and Moradi [2014] document a divide of this kind across the Ghana–Togo border. The prediction is a negative coefficient on border ruggedness wherever diffusion is the only force operating.

Terrain as a channel. An organization that chooses its locations *on* terrain can reverse the barrier, because it delivers the same doctrine to both sides of a frontier that would otherwise have divided them. Mission placement may have reflected accessibility, disease environment, colonial reach, competition between societies and local demand [Gallego and Woodberry, 2010, Nunn, 2010, Jedwab et al., 2022]. This paper does not adjudicate among those determinants. It tests whether the resulting distribution covaries with terrain and with cross-border similarity: terrain should predict mission density, missions should predict similarity, and the terrain coefficient should fall where missions operated. Jedwab et al. [2022] find that societies reached richer and more accessible places first and less developed places later, which concerns the order of expansion. The measure here is the terminal stock Roome [1925] maps, and a path starting in accessible cores need not end in a distribution carrying the sign of its first wave.

Islam offers a mirror-image geography. Michalopoulos et al. [2018] show that proximity to pre-600 CE trade routes predicts contemporary Muslim adherence. The step from route access to low ruggedness is my implication, not their result: they control for ruggedness and argue through aridity and land quality as much as terrain. The two channels predict different spatial signatures, which makes them separable in one sample.

Terrain and state restriction. Where a state restricts religious practice, what binds at a frontier is movement across it. Under *exit foreclosure*, rugged terrain traps minorities who cannot migrate to escape that pressure [Hirschman, 1970]. The prediction is a negative interaction between average dyad restrictions and border ruggedness: where the state presses and the ground is hard to cross, neighbors diverge.

3 Data

Religious composition. Pew's Global Religious Composition Estimates [Hackett et al., 2025a] give population shares across seven religious categories for 2010 and 2020; Hackett et al. [2025b] document the methodology, including the revision of the 2010 baseline. The seven-category scheme is the one that holds consistent across Pew releases, so I use it throughout rather than the finer partition some vintages report. Write s_{ig} for the share of country i's population in category g. For each contiguous pair I construct a bilateral match probability,

$$S_{ij} = \sum_{g} s_{ig}\, s_{jg}, \tag{1}$$

the chance that one person drawn at random from each population falls in the same religious category. It is the bilateral analogue of the Alesina et al. [2003] fractionalization index, not that index applied to a pair. Of the 316 land-contiguous dyads, 308 have a non-missing outcome. Cosine, Euclidean, overlap $\sum_g \min(s_{ig}, s_{jg})$ and shared-category constructions enter as alternatives. The scheme is coarse in a way that bears on the African result: folk religions are absorbed into a residual *other religions* category, inflating measured overlap for African dyads. I report the 2020 vintage.

Terrain. Border ruggedness is the mean Terrain Ruggedness Index of Riley et al. [1999] within a 25 km buffer of the shared frontier, computed from raw 30-arc-second elevation data [U.S. Geological Survey, 1996] following the methodology in Nunn and Puga [2012]. I compute the index rather than take their published values, because the unit is a border buffer rather than a national territory. Mean elevation, mean slope, and 10 km and 50 km buffers enter as alternatives; region fixed effects use the Natural Earth admin-0 assignment [Natural Earth]. Appendix A documents the buffer.

Missions and trade routes. Christian mission stations are geocoded from Roome [1925], an ethnographic survey of Africa showing missionary society stations. Mission density is stations per kilometer of shared border. Trade access is inverse mean distance from the border to a route on the pre-600 CE network Michalopoulos et al. [2018] assemble [Brice, 1981, Talbert, 2000, de Graauw, 2017].

Jedwab et al. [2022] compare a Ghana mission census against the two most-used atlases, Roome among them, and find they omit more than 90% of stations and selectively report early European residence missions in more developed areas. Mission density here therefore measures atlas-recorded stations, which oversample accessible places. That selection predicts the scale dis-

crepancy in Section 7: a null first stage at enumeration-area resolution is close to what one should expect.

Restrictions. Pew's Government Restrictions Index provides an annual panel from 2007 to 2022 [Majumdar, 2024], built on the coding framework Grim and Finke [2006] and Grim and Finke [2011] developed.

Sub-national and individual data. Geocoded Afrobarometer Round 5 enumeration areas [Afrobarometer, 2013] give 2,125 cross-border cluster pairs and 20,977 respondents with religion recorded; BenYishay et al. [2017] document the geocoding and its accuracy tiers. Afrobarometer geolocates respondents, so it supports finer-resolution composition measures than the national estimates, but covers Africa only. The Demographic and Health Surveys displace cluster coordinates before release, by up to 2 km in urban clusters and 5 km in rural ones [Burgert et al., 2013], a meaningful fraction of a 25 km border buffer. The microdata results below therefore rest on Afrobarometer.

Data availability. The Pew sources, the elevation raster and Natural Earth boundaries are public, and the two surveys are public on registration. The Roome [1925] coordinates, the dyad frame, the border buffers and the slave-trade aggregation are author-constructed and documented in Appendix A.

4 Empirical Strategy

I regress religious similarity between contiguous countries on log border ruggedness, an Africa indicator, their interaction and dyad controls:

$$S_{ij} = \beta_1 \ln(\text{TRI}_{ij}) + \beta_2 \text{Africa}_{ij} + \beta_3 \left[\ln(\text{TRI}_{ij}) \times \text{Africa}_{ij}\right] + \mathbf{X}'_{ij}\gamma + \delta_r + \varepsilon_{ij}, \tag{2}$$

where S_{ij} is religious similarity between countries i and j, TRI_{ij} is mean border ruggedness, $\mathbf{X}_{ij}$ holds border length and capital-city distance, and δ_r are region fixed effects. The global barrier is β_1; the African slope is $\beta_1 + \beta_3$.

Terrain is fixed on any timescale relevant to religious diffusion, so reverse causation is not the threat to interpreting β_1. Rugged frontiers are disproportionately old, remote and poor, so the error term holds pre-colonial political organization, distance from administrative centers, and everything else that made a boundary fall where it did. The dyad controls absorb the crudest of these. The estimates are conditional correlations on a predetermined regressor, following Nunn and Puga [2012] and Michalopoulos [2012].

The Afrobarometer specification tightens the comparison. Fixed effects absorb what is constant within a pair of countries. Terrain is then identified off variation among areas along the same border: two countries sharing a colonizer and a frontier contribute only the difference between their rough segments and their flat ones.

Standard errors on the dyad specifications are two-way clustered on both countries following Cameron et al. [2011]. Clustering alone does not bound the dependence in these residuals. Moran's I at a 500 km cutoff is 0.455 against an expectation of -0.012, a z-statistic of 4.74. A permutation test on the African terrain coefficient places the observed value at $p = 0.145$, and $p = 0.097$ when permutation is restricted within origin country. Simulating outcomes as spatially correlated noise with a 300 km range and re-estimating 500 times places the observed t-statistic of 1.48 at $p = 0.328$. The African interaction is significant under two-way clustering and not against a spatially correlated null; a referee is entitled to weight the second.

Coverage of the composition data is itself a function of terrain. An indicator for having religion data regressed on border ruggedness returns -0.037 (SE 0.013) across 315 dyads: the roughest borders are the likeliest to be missing. Those are the observations where the barrier should be strongest, so the selection biases against the finding rather than generating it.

5 Border Geography and Religious Similarity

5.1 The global barrier

Table 1 reports the barrier. Without controls the coefficient on log border ruggedness is -0.059 (SE 0.023) across 308 dyads; adding border length and capital distance leaves -0.061 (SE 0.024).

Columns 3 and 4 add a shared-colonizer indicator and a GDP ratio, which restricts the sample to the 75 dyads with every control populated, and log ruggedness enters at $+0.043$ (SE 0.035).

5.2 The African departure

Table 2 interacts terrain with an Africa indicator on the full 308-dyad frame. Log ruggedness enters at -0.070 (SE 0.021) and the interaction at 0.092 (SE 0.039); with dyad controls, -0.071 (SE 0.023) and 0.093 (SE 0.038). Splitting the sample gives the same answer: -0.073 (SE 0.022) across 205 non-African dyads and 0.034 (SE 0.034) across 103 African ones. The implied African slope is 0.022.

Africa does not reverse the barrier at this level of aggregation; it nulls it. The difference from the rest of the world is significant and survives four of five alternative constructions of the outcome. The Africa main effect is large and negative throughout, between -0.550 and -0.556, a level

Table 1: Border ruggedness and cross-border religious similarity

	(1)	(2)	(3)	(4) +Region FE
(Intercept)	0.837***	0.922***	−0.113	
	(0.083)	(0.330)	(0.623)	
ln_tri	−0.059**	−0.061**	0.043	0.043
	(0.023)	(0.024)	(0.035)	(0.035)
ln_border_length		0.028	0.054*	0.054*
		(0.018)	(0.029)	(0.029)
ln_capital_dist		−0.038	0.034	0.034
		(0.033)	(0.064)	(0.064)
same_colonizer			0.080	0.080
			(0.070)	(0.070)
ln_gdp_ratio			0.044	0.044
			(0.031)	(0.031)
Num.Obs.	308	308	75	75
R2	0.063	0.080	0.124	0.124
R2 Adj.	0.060	0.071	0.061	0.061
R2 Within				0.124

Columns (3) and (4) are estimated on the complete-case frame, 75 of 316 dyads.
* p <0.1, ** p <0.05, *** p <0.01

Table 2: Border ruggedness and religious similarity

	No controls	Dyad controls	Africa only	Non-Africa
Log(Ruggedness)	−0.070***	−0.071***	0.034	−0.073***
	(0.021)	(0.023)	(0.034)	(0.022)
Africa dyad	−0.550***	−0.556***		
	(0.144)	(0.135)		
Rugg x Africa	0.092**	0.093**		
	(0.039)	(0.038)		
ln_border_length		0.015	0.046	0.009
		(0.018)	(0.032)	(0.021)
ln_capital_dist		−0.014	0.070	−0.031
		(0.033)	(0.062)	(0.038)
Num.Obs.	308	308	103	205
R2	0.210	0.213	0.054	0.277
R2 Within	0.083	0.087	0.054	0.101
Std.Errors	by: iso3_i & iso3_j	by: iso3_i & iso3_j	by: iso3_i & iso3_j	by: iso3_i & iso3_j
FE: region	X	X	X	X

* p <0.1, ** p <0.05, *** p <0.01

Table 3: The African slope under alternative identification

	All	+Controls	+Sub-region FE	2way ctry FE
(Intercept)	0.637***	−0.272		
	(0.138)	(0.618)		
ln_tri	0.004	0.039	0.011	−0.016
	(0.035)	(0.034)	(0.030)	(0.019)
ln_border_length		0.049	0.033	0.042
		(0.030)	(0.025)	(0.025)
ln_capital_dist		0.074	−0.038	−0.041
		(0.065)	(0.049)	(0.049)
same_colonizer		0.050	0.060	0.127**
		(0.058)	(0.046)	(0.049)
Num.Obs.	106	82	82	82
R2	0.000	0.094	0.426	0.972
R2 Within			0.059	0.213

Sub-region fixed effects partition Africa using the Natural Earth subregion assignment.
* p <0.1, ** p <0.05, *** p <0.01

difference the Christian–Muslim frontier readily explains.

5.3 The African slope under alternative designs

Table 3 estimates the African relationship directly, up a ladder of fixed effects: 0.004 (SE 0.035) without controls on 106 dyads, 0.039 (SE 0.034) with them on 82, 0.011 (SE 0.030) under sub-region fixed effects, and -0.016 (SE 0.019) under two-way country fixed effects. The African slope is a statistical null in every column.

Colonial administration is what predicts similarity within Africa: a shared colonizer enters at 0.127 (SE 0.049) under two-way country fixed effects, more reliably than terrain does. The Michalopoulos [2012] contiguous-pairs design in differences agrees, with absolute elevation difference at -0.049 (SE 0.087) and 0.098 (SE 0.156) once controls bind. Geographic heterogeneity does not predict diversity *within* units the way terrain predicts similarity *across* borders: variation in elevation enters between -0.121 (SE 0.093) across 186 countries and 0.016 (SE 0.022) across 711 one-degree grid cells, with 117 virtual countries and 951 adjacent fine-unit pairs in between. Agricultural productivity does predict diversity, at 0.392 (SE 0.104). The African pattern is not ethnolinguistic fragmentation measured another way.

6 Missions and Trade Routes

6.1 The mission channel

Missions located on rough terrain in Africa. Figure 1 puts all three layers on one map: border color is ruggedness, country fill is Christian share, and point size is mission density. The Saharan frontiers are the pale lines, straight and flat, and they carry almost no stations. The darkest segments—the Rift Valley through the Great Lakes, and the escarpment around Lesotho—carry the densest clusters on the continent.

The fill carries the second leg. Where stations cluster, countries are Christian-majority on both sides of almost every internal border, so neighbors there match whatever the terrain between them does. North of that band the fill is uniformly Muslim-majority.

Mission placement does not follow the religious frontier. Stations line the Mediterranean coast and run down the Nile inside countries that are Muslim-majority today, and they cluster through the Swahili corridor of southeast Africa, where Islam was the established commercial religion before the mission era and the composition is Christian-majority now. Placement crosses the frontier in both directions, which is what the mediation needs: missions have to supply doctrine, not mark the doctrine already there. What the map cannot do is weigh the legs against each other, and atlas coverage oversamples accessible places [Jedwab et al., 2022]. Section 6.3 tests the composition split directly.

Table 4 estimates the chain across African dyads. Log ruggedness predicts log mission density at 0.007 (SE 0.002), explaining 32% of the variation in mission placement, and log mission density predicts similarity at 5.414 (SE 1.678). With both in, mission density holds at 4.752 (SE 1.607) while terrain collapses to -0.001 (SE 0.030); sub-region fixed effects leave missions at 5.080 (SE 0.909) and terrain at -0.017 (SE 0.032).

Both legs are elasticities and neither is readable alone: their product, $0.007 \times 5.414 = 0.038$, is the mediated path, and it is the size of the 0.039 base African coefficient. Missions drive that coefficient to zero, tracking nearly the whole African departure from the global barrier. Three qualifications bound the result. Mission density is zero for 82% of dyads, so the first stage is identified off a minority of frontiers. The formal proportion mediated is not identified, with a point estimate of 1.02 and an interval from -4.58 to 6.60. And the first stage does not reproduce at enumeration-area resolution, which is what atlas coverage predicts. The table supports coefficient absorption, which is descriptive.

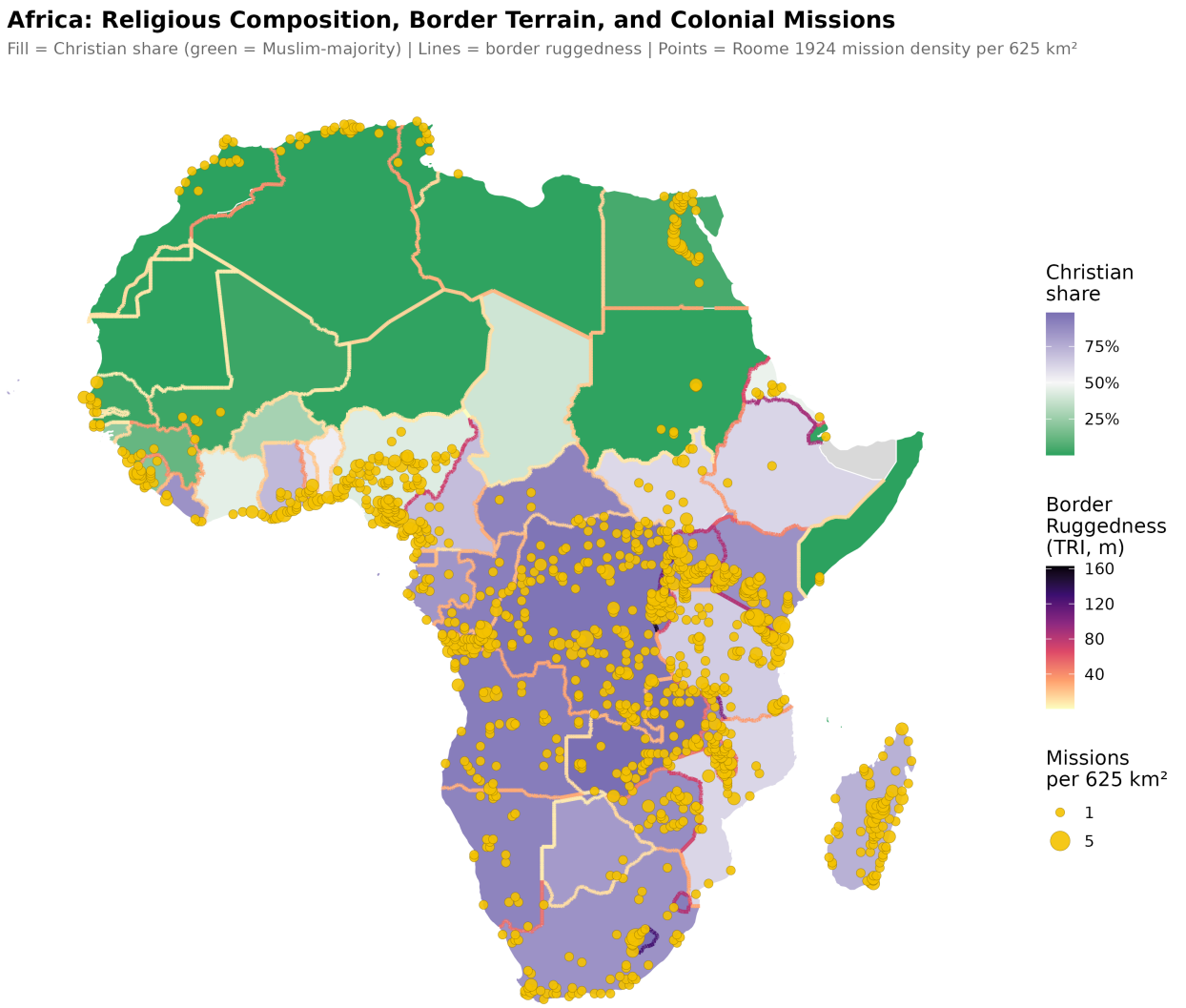


Figure 1: Religious composition, border ruggedness and colonial mission stations in Africa. Country fill is the Christian population share [Hackett et al., 2025a]: green is Muslim-majority, purple Christian-majority. Border color is the mean Terrain Ruggedness Index of Riley et al. [1999] along each segment, in meters. Point size is the count of mission stations geocoded from Roome [1925] per 625 km^2 of land area. Stations are binned to cells for display, so that points near a common frontier remain separable; the regressions in Table 4 use the underlying station counts, normalized by kilometer of shared border.

Table 4: Terrain, mission density and cross-border religious similarity

	Rug- Miss	Miss- Sim	Both	Both +Sub-regionFE
(Intercept)	0.006	−0.380	−0.429	
	(0.008)	(0.512)	(0.626)	
ln_tri	0.007***		−0.001	−0.017
	(0.002)		(0.030)	(0.032)
ln_border_length	−0.004**	0.054	0.068**	0.051*
	(0.002)	(0.032)	(0.032)	(0.026)
ln_missions_per_km		5.414***	4.752***	5.080***
		(1.678)	(1.607)	(0.909)
ln_capital_dist		0.097	0.093	−0.007
		(0.065)	(0.067)	(0.045)
same_colonizer			0.047	0.051
			(0.055)	(0.039)
Num.Obs.	106	106	82	82
R2	0.322	0.106	0.148	0.472
R2 Within				0.134

The mediator is mission density on a log-count scale.
* p <0.1, ** p <0.05, *** p <0.01

Table 5: Terrain, trade-route access and cross-border religious similarity

	Rug- Trade	Trade- Sim	Both	Both +Sub-regionFE
(Intercept)	0.013	−0.794	−0.709	
	(0.204)	(0.702)	(0.658)	
ln_tri	0.066**		0.036	0.011
	(0.027)		(0.036)	(0.028)
ln_border_length	−0.008	0.056**	0.046	0.025
	(0.033)	(0.027)	(0.029)	(0.027)
trade_access		0.345	0.305	0.271
		(0.216)	(0.256)	(0.320)
dmecca_dyad_min		0.068*	0.059	0.075
		(0.037)	(0.037)	(0.056)
ln_capital_dist		0.119*	0.105	0.001
		(0.067)	(0.065)	(0.067)
same_colonizer			0.037	0.058
			(0.062)	(0.047)
Num.Obs.	97	97	82	82
R2	0.078	0.130	0.147	0.459
R2 Within				0.113

The mediator is proximity to a pre-600 CE trade route; distance to Mecca enters as a control.
* p <0.1, ** p <0.05, *** p <0.01

6.2 The trade-route channel

Table 5 estimates the parallel chain on 97 dyads, 82 once controls bind. Log ruggedness predicts trade access at 0.066 (SE 0.027), and trade access predicts similarity at 0.345 (SE 0.216); with both in, terrain sits at 0.036 (SE 0.036) and trade access at 0.305 (SE 0.256). The Islamic channel runs in the predicted direction without reaching conventional significance at this sample size. Entering both channels together drives the African terrain coefficient past zero, but on 82 dyads that overshoot sits within sampling error of complete absorption.

6.3 Christian and Muslim borders

Table 6 splits African dyads by the composition on either side. Terrain enters at 0.010 (SE 0.044) at Christian–Christian borders on 51 dyads and -0.010 (SE 0.038) at Muslim–Muslim borders on 36. In a pooled specification neither the Christian–Muslim interaction, 0.082 (SE 0.081), nor the

Table 6: Heterogeneity by religious tradition at the border

	Chr-Chr	Mus-Mus	Interaction
(Intercept)	0.516	−0.152	0.033
	(0.632)	(0.406)	(0.426)
ln_tri	0.010	−0.010	0.022
	(0.044)	(0.038)	(0.049)
ln_border_length	0.014	0.056	0.037*
	(0.019)	(0.042)	(0.019)
ln_capital_dist	0.008	0.087	0.053
	(0.079)	(0.068)	(0.050)
border_religious_typeChristian-Muslim			−0.605**
			(0.264)
border_religious_typeMuslim-Muslim			0.049
			(0.211)
same_colonizer			0.044
			(0.053)
ln_tri × border_religious_typeChristian-Muslim			0.082
			(0.081)
ln_tri × border_religious_typeMuslim-Muslim			−0.006
			(0.059)
Num.Obs.	51	36	82
R2	0.005	0.096	0.401

Cells below 20 dyads are omitted rather than reported.
* p <0.1, ** p <0.05, *** p <0.01

Muslim–Muslim interaction, −0.006 (SE 0.059), is distinguishable from zero.

At 51 and 36 dyads per cell those standard errors admit differences several times the size the mediation results imply, so this is an imprecise null. The table does establish a large level effect: Christian–Muslim border pairs are 0.605 units less similar (SE 0.264) than Christian–Christian pairs, roughly two standard deviations. Composition differences across the continent's main religious frontier dominate anything terrain does within a border type.

Table 7: Cross-border religious similarity, paired enumeration areas

	Pooled	Country FE	Country FE + dist controls
Border TRI (log)	0.044	0.183***	0.064***
	(0.033)	(0.025)	(0.021)
Dist. to border (km)			0.000
			(0.001)
EA-pair distance (km)			0.000
			(0.000)
Num.Obs.	2125	2125	836
R2	0.016	0.205	0.286

The outcome is the cosine similarity of enumeration-area religion-share vectors. The sample is Afrobarometer Round 5 enumeration-area pairs across international borders.
* p <0.1, ** p <0.05, *** p <0.01

7 Microdata and Religious Similarity in Africa

Table 7 regresses cross-border religious similarity between paired Afrobarometer enumeration areas on log local ruggedness across 2,125 pairs. Pooled, terrain enters at 0.044 (SE 0.033); with fixed effects it rises to 0.183 (SE 0.025); adding distance to the border and between the paired areas leaves 0.064 (SE 0.021) on the 836 pairs with both distances recorded.

This is the reversal, at finer geographic resolution. The construction pairs nearest cross-border enumeration areas; it observes no travel, contact or social network. Two orders of aggregation give the same sign with very different precision, as one expects if the dyad-level null reflects aggregation rather than absence. Neither the distance controls nor the fixed effects are innocuous: distance to the border is plausibly a channel rather than a confounder, and 0.183 rests on a thin residual slice.

The mission channel holds at the individual level. Table 8 regresses an indicator for sharing the modal religion across the border on proximity to a historical mission station: 0.073 (SE 0.013) without controls, 0.050 (SE 0.014) adding terrain and an urban indicator, 0.039 (SE 0.013) under country fixed effects, and 0.045 (SE 0.012) under country-by-neighbor fixed effects, across 20,977 respondents. Living near a mission raises the chance of matching across the border by four to seven percentage points.

Table 8: Afrobarometer individual religion-match across borders

	OLS	+TRI	Country FE	Country×Neighbor FE
Near mission (≤25 km)	0.073***	0.050***	0.039***	0.045***
	(0.013)	(0.014)	(0.013)	(0.012)
Urban		−0.016	0.005	0.017
		(0.014)	(0.012)	(0.011)
Border TRI (log)		0.057***		
		(0.009)		
Num.Obs.	20 977	20 977	20 977	20 977
R2	0.005	0.014	0.187	0.233

* p <0.1, ** p <0.05, *** p <0.01
SEs clustered at EA level.

8 Policy Restrictions and Geography

Pew's Government Restrictions Index places 59 countries at high or very high restriction in 2022, the peak of the series [Majumdar, 2024]. Whether such restrictions reshape religious demography or entrenched populations resist them is unsettled. Border terrain separates the two, because it decides whether a population under pressure can leave.

Table 9 adds institutional distance to the dyad specification under continent-pair fixed effects, on 305 dyads. Absolute difference in the Government Restrictions Index enters at -0.115 (SE 0.083) and the interaction between average dyad restrictions and border ruggedness at -1.333 (SE 0.576); with that interaction included the ruggedness main effect turns positive, 0.248 (SE 0.110). Where restrictions are low, rough borders carry more religious similarity; as restrictions rise, the gradient rotates negative. This is the exit-foreclosure sign: where the state presses hardest, populations that cannot cross rough ground diverge from their neighbors. The interaction runs between -1.148 and -1.337 and is significant at 5% across five constructions of the outcome, the residualized measure excepted at 0.716 (SE 0.425).

Restrictions do not explain the African pattern. On 305 dyads the Africa–terrain interaction is 1.883 (SE 0.557), and adding the restrictions interaction beside it leaves 1.864 (SE 0.459), a movement of one percent, with the restrictions interaction at -1.315 (SE 0.493). Both moderators survive each other at full strength, so what suppresses the terrain gradient in Africa is not restriction policy—which a historical mission mechanism predicts and a contemporary-institutions account does not.

Table 9: GRI and Ruggedness on Similarity

	geo [cont_pair]	+—dGRI— [cont_pair]	+GRIxTRI [cont_pair]
ln(border TRI) (std)	−0.006	0.000	0.248**
	(0.034)	(0.035)	(0.110)
—d elevation— (std)	0.011	−0.004	0.009
	(0.095)	(0.098)	(0.097)
—d caloric/100— (std)	−0.094	−0.081	−0.052
	(0.081)	(0.085)	(0.085)
—d GRI— (std)		−0.115	−0.126
		(0.083)	(0.088)
GRI_avg x TRI			−1.333**
			(0.576)
Num.Obs.	308	305	305
R2	0.163	0.162	0.200
R2 Within	0.012	0.022	0.067
RMSE	0.91	0.91	0.89
Std.Errors	by: iso3_i & iso3_j	by: iso3_i & iso3_j	by: iso3_i & iso3_j
FE: cont_pair	X	X	X

* p <0.1, ** p <0.05, *** p <0.01

9 Conclusion

Terrain is a barrier to religious diffusion. Across 308 contiguous country dyads a one-standard-deviation increase in border ruggedness lowers cross-border religious similarity by roughly a fifth of a standard deviation, and by a quarter outside Africa.

Africa is the exception, and the dyad-level evidence points to historical mission placement as a plausible contributor. At the level of country pairs the barrier cancels; at paired survey clusters it turns positive. Terrain predicts where atlas-recorded missions went, missions predict cross-border similarity, and mission density absorbs nearly the whole African departure on 82 controlled dyads. What the evidence supports is that an organized evangelical enterprise ended up in locations correlated with terrain, and that where it did, terrain stops behaving like a barrier.

Contemporary restrictions do not explain that pattern, but they bear on the same geography. What binds between countries is whether people and doctrine can cross, and there restrictions steepen the barrier: the terrain gradient rotates negative as average dyad restriction rises. That interaction holds beside the Africa interaction at full strength, so the coercive channel it identifies sits alongside the mission mechanism rather than displacing it.

Geography has no fixed relationship to culture. The ruggedness that divides populations in most of the world coincides with shared religion across African frontiers, where an organized enterprise placed itself on that same ruggedness. Physical geography sets the terrain on which diffusion happens, not its direction.

A Data Construction

This appendix documents the four constructions that are mine rather than a published source's. Each is available from the author.

The dyad frame. The frame is the set of country pairs sharing a land boundary, 316 in total, built from Natural Earth admin-0 boundaries [Natural Earth]. Region and subregion fixed effects take the Natural Earth assignment. Of the 316, 308 carry a non-missing similarity outcome and 305 carry a Government Restrictions Index value for both members.

Border buffers. Border ruggedness is the mean Terrain Ruggedness Index [Riley et al., 1999] of raster cells falling inside a buffer of the shared boundary segment, computed on a 30-arc-second elevation raster. The preferred buffer is 25 km; 10 km and 50 km enter as alternatives.

Mission station geocoding. Station coordinates are geocoded from Roome [1925]. Mission density is the station count within the border buffer divided by boundary length in kilometers, and is zero for 82% of dyads. Section 3 states the atlas coverage limitation [Jedwab et al., 2022], which applies to every quantity built from this source.

Slave-trade exposure at the dyad. Nunn and Wantchekon [2011] measure slave-export exposure at the ethnic homeland. The dyadic measure aggregates that exposure onto shared frontiers and is my construction, not one they validate.

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