# Jihad over Centuries*

Masahiro Kubo† *CERDI*
Shunsuke Tsuda‡ *University of Essex*

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**Abstract**

This paper investigates the origins of Islamist insurgencies as a form of cultural revival in West Africa. Exploiting variation in access to ancient water sources, which have largely disappeared, as an instrument, we show that the decline of trans-Saharan cities—once-prosperous under pre-colonial Islamic states—led to contemporary hotspots of Islamist violence. Contradicting the common view that conflict breeds conflict, contemporary violence is concentrated not where colonial resistance by Islamic states was fiercest, but where overwhelming military asymmetries drove outward submission. This strategic adaptation allowed radical Islamism to survive defeat and persist as a latent colonial legacy. Qualitative evidence suggests that transmission was sustained through a religious practice of internally preparing to reassert Islamic purity. This mechanism is further supported by a dynamic model of conflict and individual-level surveys examining extreme religious ideologies. Moreover, the concentration of Islamist violence in areas that experienced reversals of fortune mirrors a global pattern.

**Keywords**: Conflicts, Geography, Colonization, Ideologies, Islam, Persistence, Revival
**JEL codes**: N37, N47, O17, Z12

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†Université Clermont Auvergne, CNRS, IRD, CERDI, F63000, Clermont-Ferrand. E-mail: masahiro.kubo@uca.fr
‡University of Essex. E-mail: shunsuke.tsuda@essex.ac.uk

# 1 Introduction

Islamic extremist conflict and violence, commonly referred to as *jihad,*[1] pose a global threat. Beyond its global salience since the September 11 attacks and the rise of the Islamic State of Iraq and Syria (ISIS), jihadist violence displays substantial spatial variation, even *within* the Islamic world, and expands beyond the Middle East, particularly into Africa.[2] Moreover, while jihadist activity has risen sharply in recent decades, it is not a merely contemporary phenomenon but has been cyclic over the centuries (Cook 2015; Sanneh 2016). Understanding its origins is important not only for the economics of conflict (Blattman 2023; Rohner et al. 2025), but also for broader questions about how cultural attachment, religious identity, and ideology shape behavior (Bisin and Verdier 2011; Lowes et al. 2025). Yet, the roles that geography and history—particularly prehistoric nature, pre-colonial economy and culture, and colonial legacies—play in explaining this variation and persistence remain poorly understood.

We approach this question through the lens of past prosperity, decline, and cultural revival. Cultural revival refers to the reassertion of group identity through the recovery of traditions perceived as lost due to colonization, displacement, oppression, or modernization (Anderson 1983; Hobsbawm and Ranger 1983; Smith 1991). Revival movements have also occurred with violence across diverse contexts, such as "The Troubles" in Northern Ireland, the Khmer Rouge in Cambodia, and the January 6 United States Capitol Attack.[3] Jihadist movements can likewise be framed as radical forms of cultural revival against Westernization and secularization (Lewis 1990; Sounaye 2017; Yates 2007). While the phenomenon is widely studied in history, political science, and sociology, recent theoretical work in economics also offers valuable insights (Carvalho et al. 2024; Iyigun et al. 2021). Yet, the historical roots and long-run pathways leading to cultural revival and its political or ideological resurgence remain empirically underexplored.

In this paper, we investigate the origins of Islamist insurgencies, focusing on the historical rise and decline of Islamic civilization. We exploit the historical transformation of pre-colonial trans-

[1]The literal meaning of "jihad" in Arabic is "striving or exerting oneself (with regard to one's religion)" (Cook 2015). Jihad also has a number of other meanings, such as "the effort to lead a good life, to make society more moral and just, and to spread Islam through preaching, teaching, or armed struggle" (Esposito 1999). See Cook (2015) for detailed discussions. Although there is controversy over whether the word's interpretation is exclusively spiritual or if it includes military action, this paper uses the terms "jihadist violence", "jihad", and "Islamist violence" interchangeably. We broadly define a jihadist organization as a non-state group that aims to topple a government or to govern a particular region to establish an Islamic caliphate based on a strict interpretation of Shariah law.

[2]Jihadist organizations are major drivers of instability in Africa. According to authors' calculation using the Armed Conflict Location and Event Data (ACLED), between 2001 and 2019, approximately 30% of violent events involving non-state rebels and militias were linked to jihadist groups, resulting in more than 100,000 total fatalities.

[3]Generally, various contexts illustrate political and cultural consequences following declines from past prosperity across the globe. Notable examples include Europe (Colantone and Stanig 2018; Fouka and Voth 2023; Henn and Huff 2024; Narciso and Severgnini 2023; Ochsner and Roesel 2024), the United States (Autor et al. 2020; Baccini and Weymouth 2021), and Islamic contexts in the Middle East and Asia (Binzel and Carvalho 2017; Chen 2010).

Saharan trade hubs that once flourished under Islamic states but subsequently became peripheral, following environmental change, colonial conquest, and shifts in trade technologies. Using an instrumental variable (IV) strategy, we estimate the persistent effects of these declined centers on contemporary jihadist violence, which escalated markedly in the 2010s. We then propose a mechanism linking this revival to power relations between Islamic states and European colonizers during the early colonial era, which shaped long-run ideological persistence. Finally, we explore whether this spatial pattern of jihadist violence aligns with a broader, global phenomenon.

West Africa has experienced a stark historical reversal of fortune and today suffers disproportionately from jihadist violence. In the pre-colonial era, economic activities were concentrated in landlocked regions under the influence of Islamic states, which controlled trans-Saharan trade routes—founded up to the 1800s.[4] However, with the arrival of Europeans, economic activity gradually shifted from inland to coastal areas, as trade patterns and technologies changed. Consequently, the inland regions lost their comparative advantage, and many pre-colonial core cities declined. Today in West Africa, economic activity is concentrated in a small number of large cities, leaving vast inland regions economically marginalized, and violent events involving jihadist groups have substantially increased, both in frequency and geographical scope.[5]

Mapping our primary data reveals two key facts. First, as the left map of Figure 1 shows, many pre-colonial, landlocked cities that later declined were located near ancient water sources, yet today few populated cities remain around them.[6] Second, as the right map illustrates, contemporary Islamist violence is concentrated around several historically significant but now-declined inland trade points and in regions once governed by Islamic states, particularly pronounced in locations tied to specific Islamic states. Together, these patterns underscore the enduring influence of declined historical cities and the legacies of distinct Islamic states.

Motivated by the historical background and facts, we empirically estimate the persistent influence of core pre-colonial trading cities that flourished during the height of Islamic state power and have since declined on contemporary Islamist insurgencies, as violent religious revival. As a proxy for access to such declined cities, we focus on proximity to inland pre-colonial core cities with small contemporary populations. For empirical analysis, we construct artificial $0.5 \times 0.5$ degree (about 55km $\times$ 55km) grid cells covering the entirety of West Africa.

[4]The link between pre-colonial state centralization and trade networks is well-documented not only in the trans-Saharan region but broadly across pre-colonial Africa (Fenske 2014). Pre-colonial state structures in Africa are also closely associated with contemporary economic development (Michalopoulos and Papaioannou 2013).

[5]In this region, jihadist groups were involved in more than 40% of conflict and violent events during 2001-2019. These incidents claimed approximately 40,000 lives, accounting for more than one-third of the total jihadist-related fatalities across the entire African continent.

[6]Timbuktu in Mali (Figure A.1) provides a notable example. It was a major trade hub under the Songhai Empire in the 15th and 16th centuries and was therefore known as the "golden city." However, this once-prosperous city later fell into the periphery, and its economy remains underdeveloped relative to other major cities in Mali in the modern era. For more details about the development of pre-colonial states and cities, see Section 2.1.

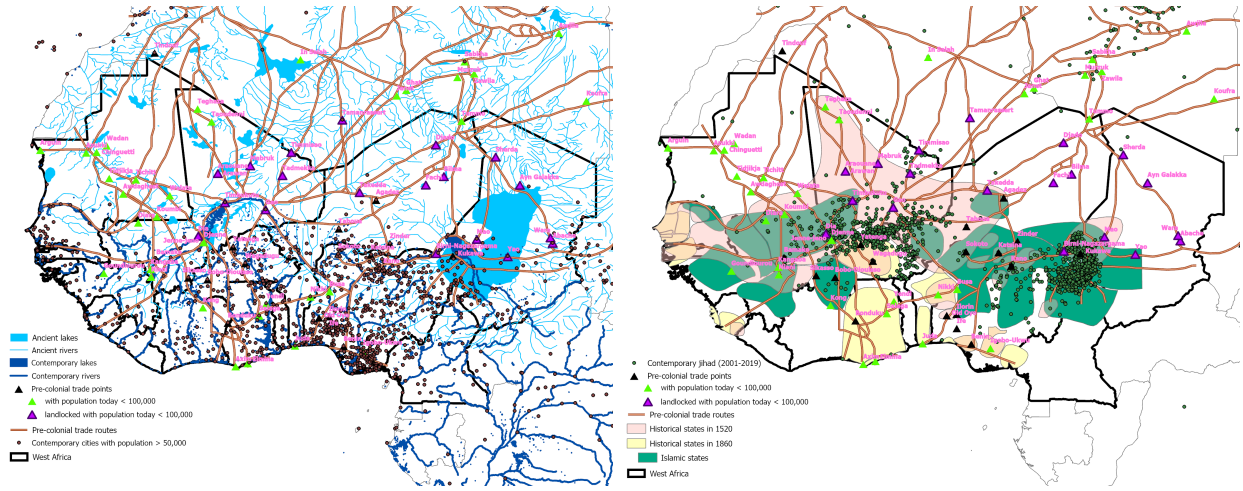



Figure 1: Water Sources, Historical Islamic Economy, and Contemporary Jihadist Violence

*Notes*: This left map shows ancient and contemporary water sources, historical trade points, and contemporary cities. Data sources include Drake et al. (2011), Natural Earth, HydroLAKES, O'Brien (1999), Kennedy (2002), Bossard (2014), Urban Centre Database, and Michalopoulos et al. (2018). This right map shows historical states (circa 1520 and 1860), historical trade points, and contemporary jihadist violent events. Data sources include Cultures of West Africa, O'Brien (1999), Kennedy (2002), Bossard (2014), Michalopoulos et al. (2018), and ACLED (Raleigh et al. 2010). Section 3 provides details for these data sources.

As an instrument for the decline of pre-colonial core cities, we use access to ancient water sources, which have mostly shrank. By controlling for contemporary water access, this IV essentially captures variation in access to ancient water sources that have disappeared. Beyond the predetermined nature of water access in ancient periods, two identifying assumptions are required for causal inference. First, ancient water access affects contemporary outcomes only through its influence on economic activities in historical states before colonization. Second, conditional on observable geographical characteristics, unobservable factors driving contemporary Islamist insurgencies are uncorrelated with ancient water access. The following arguments support these assumptions. Most ancient lakes have vanished due to exogenous long-term climate and environmental changes, making it unlikely that they directly affect present-day jihadist activities. Furthermore, we empirically demonstrate that ancient water access is largely uncorrelated with predetermined features, including geographical conditions and pre-colonial cultural and institutional variables.

Figure 2 summarizes our empirical results, along with the history and geography in the context of this study. Our main finding, as illustrated by the bold arrow, is that the historical decline of core trans-Saharan cities led to contemporary hotspots of Islamist violence. Specifically, grid cells closer to these formerly prosperous cities exhibit a higher probability of conflict onset, greater violence intensity, and closer spatial proximity to jihadist activity since 2010. To support the relevance of our instrument underlying this result, we show that proximity to ancient lakes that disappeared

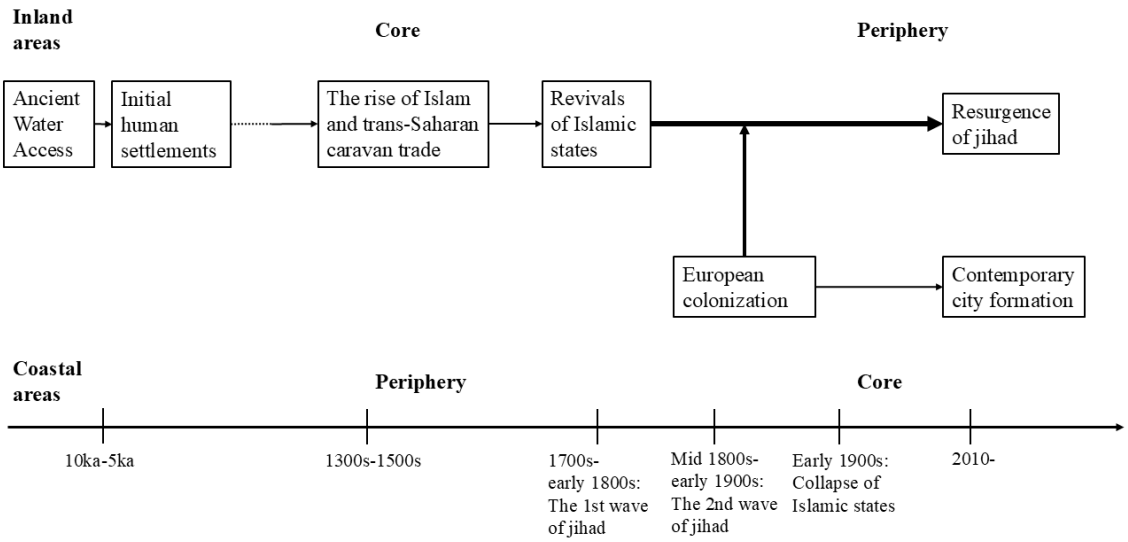



Figure 2: Summary of History, Geography, and Empirical Results

strongly predicts the locations of these declined cities, with substantially greater explanatory power than alternative combinations of historical cities. Supplementing this, we also observe that the initial geography does not predict contemporary economic outcomes.

We argue that the primary mechanism behind the main empirical result is the persistence of jihadist ideology as a legacy of European colonization. Islamic state forces with better access to weapons adopted confrontation strategies and engaged in more intense fighting with European colonizers. As a result, the European forces militarily defeated such states. Consequently, these states ceased to exist, and the seeds of jihadist ideology within them were also diminished. In contrast, Islamic state forces in areas with limited access to weapons did not engage as intensively with the colonial invasion, given the pronounced asymmetry in military capacity. Under such conditions, strategies of alliance, acquiescence, or outward submission to colonial authorities were often adopted. Consequently, the ideological foundations of radical Islamism in these areas survived defeat and were *not* extinguished underground, potentially fueling future jihadist mobilization. However, while such ideological persistence may be a necessary condition for contemporary jihadist activities, it is not sufficient on its own. This persistence, when coupled with a contemporary shock that strengthens insurgent forces (e.g., the inflow of fighters and weapons from a neighboring country), can trigger a sudden surge in contemporary jihad.

We support this mechanism in five complementary ways. First, we document the cyclical nature of jihad, using historical records on the spatial variation in the intensity of historical jihads and the strategies adopted by Islamic states in response to colonization. These observations reveal a striking reversal of the conventional view that conflict breeds conflict: contemporary jihads disproportionately arise in areas *without* intense armed resistance against colonial invasions.

Second, qualitative evidence on the religious practice of *taqiyya*, combined with quantitative evidence on historical weapon access, supports the mechanism: overwhelming military asymmetries limited intense armed resistance by Islamic states in "past-core" areas, instead inducing outward adaptation to circumstances that could not be immediately altered while internally preserving the intention to reassert Islamic purity when time is ripe.

Third, we rationalize the observed patterns using a simple dynamic model of conflict between a colonizer and an Islamic state, characterized by asymmetric military capabilities and territorial endowments, building on Baliga and Sjöström (2020).

Fourth, we provide further direct quantitative evidence, drawn from individual-level survey data from Muslims, that extreme religious ideologies—such as excluding other religions, governing by religious law, and restricting female education—are concentrated near declined cities.

Fifth, if place-based ideological persistence drives jihadist violence in these areas, a natural implication is that violent groups operating there rely on localized recruitment. To test this, we examine heterogeneity across contemporary jihadist groups. We find that the persistent influence of declined cities on violent events is stronger for Islamic State (IS) affiliates and Boko Haram than for Al Qaeda affiliates. Additional supportive evidence suggests IS and Boko Haram's greater dependence on localized recruitment. Together, these findings also support the proposed mechanism.

We rule out prominent alternative mechanisms and conduct extensive robustness checks. We first demonstrate that the relationship between declined pre-colonial inland cities and contemporary jihadist violence is not fully driven by contemporary environmental factors (such as current water availability, groundwater access, or precipitation patterns), by the historical spread of Islam per se, or by other colonial activities (such as national borders, infrastructure investments, or European settlement) and state capacity measures. The results also persist when restricting the sample to predominantly Muslim regions, ruling out explanations based on religious composition or Christian-Muslim differences. We further validate the specificity of our mechanism through a placebo test, showing that the persistent influence of declined cities does not extend to general, non-jihadist conflicts. Finally, our estimates are also robust to alternative measures of ancient water access and city decline, a different conflict dataset, and adjustments for spatial autocorrelation.

Finally, we argue that the spatial pattern revealed in West Africa—where jihadist activities concentrate in locations that experienced reversals of fortune over the centuries—extends globally. Regions that were once prosperous and interconnected through religious and commercial networks, including prominent cases such as Afghanistan and Syria, tend to experience violent religious revivalism today, shaped in part by colonial legacies and unfolding beyond the boundaries of modern nation-states. At the same time, our findings underscore that the detailed mechanisms translating long-run decline into contemporary violence might be inherently local, reflecting context-specific historical trajectories, institutional arrangements, and modes of ideological transmission. Under-

standing jihadist violence would thus require combining a global perspective on structural reversals with close attention to the local pathways through which cultural revival and conflict emerge.

**Related literature.** This paper contributes to three strands of literature. First, this paper contributes to the literature on the economics of conflicts, being closely connected to research on the historical origins of contemporary conflicts (Arbatlı et al. 2020; Boxell et al. 2019; Besley and Reynal-Querol 2014; Depetris-Chauvin and Özak 2020; Jha 2013; Michalopoulos and Papaioannou 2016; Moscona et al. 2020). In particular, Depetris-Chauvin (2015) and Heldring (2021), which examine the relationship between historical states and contemporary conflicts, are most relevant to our work.[7] These papers examine the long-term influence of the existence of historical state-like institutions, whereas we focus on variations within a particular institution, Islam, among historical states and reveal a long-term nexus between the religious institution and conflicts, emphasizing how the decline of historical civilization in these states shaped contemporary violence.[8] This paper also relates to theoretical arguments about cycles and the persistence of conflict and violence (Acemoglu and Wolitzky 2014; Rohner et al. 2013b), as well as empirical evidence on their long-run cyclical nature (e.g., Arbatlı et al. 2020; Dincecco et al. 2019; Voigtländer and Voth 2012). Particularly relevant to our study is Besley and Reynal-Querol (2014), documenting a positive correlation between historical and post-colonial conflicts in Africa. However, this paper highlights the contrasting relationship: contemporary Islamist violence is more prevalent in areas where intense armed resistance was *not* present during the colonial conquest. Moreover, we not only advance the understanding of jihad's cyclical nature with distinct spatial distributions across centuries but also identify the underlying mechanism through which ideological persistence fuels contemporary jihadist violence.

Second, this paper relates to the literature on the deep roots of development and the persistent effects of historical institutions in Africa (see Michalopoulos and Papaioannou 2020 for a review), particularly the legacy of colonization (e.g., Acemoglu et al. 2001; Bauer et al. 2022; Canning et al. 2021; García Ponce and Wantchekon 2011; Heldring and Robinson 2018; Huillery 2009; Michalopoulos and Papaioannou 2013; Nunn and Puga 2012; Okoye et al. 2019). This paper makes three key contributes to this literature. First, we examine the persistence of extreme ide-

[7] Depetris-Chauvin (2015) documents the negative relationship between the political centralization of historical states in 1000–1850 CE and contemporary civil conflicts. Heldring (2021) examines the effect of exposure to historical state institutions under centralized rule one century earlier on contemporary violence in Rwanda. He argues the culturally transmitted norm of obedience as the primary mechanism, supported by differential impacts interacted with contemporary government policies and by lab-in-the field experiments to measure rule-following behavior.

[8] Focusing on the decline of once-prosperous pre-colonial states also contributes to the literature on the long-term effects of pre-colonial centralized states on economic prosperity (e.g., Gennaioli and Rainer 2007; Michalopoulos and Papaioannou 2013; Angeles and Elizalde 2017; Dell et al. 2018). While this body of work has primarily focused on the enduring effects of historically flourishing states, it has paid little attention to the process of their subsequent decline and its consequences.

ology and the eruption of related activities long after the colonial oppression. While prior work has primarily documented short-run backlash to oppression (García Ponce and Wantchekon 2011; Fouka 2020), we reveal a more delayed and severe response: the surge of jihadist violence emerging in subsequent generations, roughly fifty years after independence. Furthermore, we emphasize how the institutional arrangement of *taqiyya* underpinned the cultural transmission of jihadist ideology across generations. These dynamics, culminating in jihadist violence aimed at Islamic revival, echo the joint evolution of culture and institutions (e.g., Lowes et al. 2017; Bisin and Verdier 2025). Second, this paper focuses on the period of colonial invasion rather than colonial policies and institutions. We shed light on the interaction between pre-colonial states and colonial forces, demonstrating how variation in the responses of pre-colonial Islamic states to invasion—before colonial rule was fully consolidated—shaped contemporary patterns of violence. Finally, we explore dynamic natural geography, overcoming challenges in prior work that often relies on static geographic features. This paper documents the distinctive role of ancient water sources, relative to contemporary ones, in shaping both the prosperity and decline of pre-colonial core cities, without persistent effects on modern city formation.[9]

Third, this paper contributes to the literature on the economics of religion, particularly studies of the Islamic world and the rise of violent extremism. Much of the economic research on violent extremism examines proximate causes, such as counterinsurgency strategies (Berman et al. 2011; Fetzer et al. 2021) and contemporary shocks (Brockmeyer et al. 2022; Condra et al. 2018; McGuirk and Nunn 2025; Limodio 2022; Rexer 2022), or on the organizational logic of extremist groups as providers of club goods and social services (Berman 2011).[10] A key unanswered question, however, is why jihadist violence takes root in some parts of the Islamic world but not others. We address this gap by offering a deep historical explanation for this spatial heterogeneity. We trace the geography of contemporary jihad back to its ancient origins, long predating the arrival of Islam, and to the intersection of pre-colonial economic prosperity with the colonial encounter. By framing jihadist movements as radical forms of cultural revival against Westernization, our analysis also connects the West African case to a broader pattern of cultural backlash and revival that emerges in response to modernization and perceived oppression across diverse global contexts.

[9] In this respect, this paper also connects to recent research that empirically investigates the origins of cities and economic activities through geographical fundamentals and history (e.g., Bakker et al. 2021; Bleakley and Lin 2012; Ellingsen 2021; Henderson et al. 2018; Jedwab et al. 2017; Maloney and Valencia Caicedo 2016; Michaels and Rauch 2018). This paper exploits the effects of changing natural geography over a long horizon, while most previous research has only examined the changing effects of fixed natural geography over time, albeit with some recent exceptions (Allen et al. 2023; Jedwab et al. 2022; Seror 2020). Moreover, this paper finds not only a lack of persistence of initial geography on modern economic activities but also its persistence on peculiar activities (jihadist activities).

[10] See Iyer (2016) and Kuran (2018) for reviews of broader studies of the Islamic economy. Several studies investigated the historical, geographical, and institutional determinants of the spread (e.g., Bazzi et al. 2020; Michalopoulos et al. 2018), the politics (e.g., Chaney 2013), and the economic performance (e.g., Bosker et al. 2013; Campante and Yanagizawa-Drott 2015; Rubin 2017) of Islam.

**Roadmap.** Section 2 describes the historical background. Section 3 introduces data sources. Section 4 presents the empirical strategy and results. Section 5 documents the mechanism behind the empirical results. Section 6 provides further discussions. Section 7 concludes the paper.

# 2 Historical Background

We provide the historical backgrounds of Islamic states from pre-colonial period to the independence period. First, we detail the spread of Islam and Islamic pre-colonial states and cities with historical anecdotes. Second, we describe how Islamic states in the 19th century emerged and their access to weapons. Finally, we summarize how Islamic states reacted against European colonization and about Muslims in the colonial and independence periods.

## 2.1 Pre-Colonial Cities and Islam in West Africa

Back to five thousands years ago, with the ample lakes and rivers, the Sahara was attractive to human settlements (Drake et al. 2011). After the African Humid Period (AHP), water sources in the Sahara became gradually depleted, which resulted in the Sahara Desert. Nevertheless, the Sahara Desert, "one of the world's greatest barriers to human movement" was bridged by trade, which led to the births of the core trading cities (Bovill 1968; Connah 1987, p.98).

At the first millennium AD, a primal position with natural resources such as gold and salt exchanged with the North African empires primarily brought the power and economic prosperity in the Ghana Empire (Trimingham 1962; Chu and Skinner 1965). After the collapse of the Ghana Empire in 1235, the Muslim king Sundiata founded the Mali Empire. The empire situated in full savanna, also well provided with natural resources, including control of gold-bearing area. With the trade contact with North Africa, the Mali Empire spread Islam, embracing large numbers of subject states of diverse populations (Trimingham 1962, p.61). In the 15th and the 16th centuries, as the Mali Empire became weakened, the Songhai Empire with the Muslim kings gained power and brought a brilliant civilization (Trimingham 1962; Ki-Zerbo et al. 1997).

Timbuktu, located in the modern West African country of Mali, is an exemplary example of the core trading cities governed by the Islamic states. It was the second capital of Songhai Empire and had experienced the "Golden Age" in the 15th and 16th centuries (Singleton 2004; Austen 2010, p.57) until it was invaded by Moroccans in 1590s. The shaded boundaries in the right map of Figure 1 represent historical states in the 16th century, including the Songhai Empire in the center. In the writing of al-Sa'di about Jenne (near Timbuktu) in 1655, "caravans flock to Timbuktu from all points of horizon" (translated by Connah 1987, p.97). Also, Timbuktu was not only the center

of trade network but also a scholarly center (Kane 2017).

Near Timbuktu, Gao was also an important center of Saharan trade even before the Islamic era and became an early attraction for trans-Saharan commerce (Austen 2010, p.57). Sailing down the Niger river (he was calling it "Nile") from Timbuktu (Tumbuktá), Ibn Battuta reached Gao (Gawgaw) in 1353 at the age of Mali Empire depicted in the top left map in Figure B.1. He describes the prosperity in Battuta (2004):

> "I went on from there to Gawgaw [Gogo], which is a large city on the Nile, and one of the finest towns in the Negrolands. It is also one of their biggest and best-provisioned towns, with rice in plenty, milk, and fish, and there is a species of cucumber there called *'ināán* which has no equal. The buying and selling of its inhabitants is done with cowry-shells, and the same is the case at Mállí."

Bilma and Taoudenni were also indispensable trading centers with salt production. Trans-Saharan caravans exchanged their goods for salt and passed through as a transit point to the Sudan (Austen 2010, p.38).

The core trading cities in the pre-colonial period has gradually declined as the European reached to the coastal trading posts. Austen (2010) writes "the beginning of the twentieth century clearly marks the end of trans-Saharan trade as a significant avenue of international commerce." Since then, the economy in West Africa moved away from the desert toward the Atlantic Ocean (Austen 2010, p.119).

## 2.2 Islamic States in the 19th Century

From the 17th to the early 19th century, the first wave of jihad occurred throughout Africa, which mainly aimed for purification and extension of Islam and Islamic law (Curtin 1971; Walther and Miles 2017; Ruthven et al. 2004, p.74-75). According to Lovejoy (2016), "the idea of jihad was rooted in the confrontation of established political authority through the purification of Islamic practice and the imposition of governments that were forcefully committed to governance on the basis of Islamic law and tradition." The green areas in Figure 1 represent pre-colonial Islamic states in the 19th century, some of which involved in jihad against the colonization forces.

The Futa Jallon jihad was done by the Muslim settlers with Fulani pastoralists against the dominant Jalonke landlords to whom they paid taxes on trade and cattle (Lapidus 2002, p.418). The Futa Toro jihad was conducted by religious teachers who took Muslim leadership and itinerant beggars. They rebelled against the local dynasty in protest of fiscal oppression and lack of protection from Mauritanian raids (Lapidus 2002, p.419). Sokoto Califate was founded by Islamic scholar, 'Uthman Don Fodio, who conducted the jihad against the rulers of Gobir.

Among the Islamic states in the same period, Kong and Samori (Wassoulou) empires were established by Muslim merchants and traders. Rather than jihads, their aim was to control over trade without dependence on states. Hence, commercial considerations outweighed Islamic factors in the state formation process (Azarya 1980, p.428).

From the 15th century before colonization, the Atlantic slave trades intensified and fostered the spread of weapons in West Africa. Due to slave raids, individuals and communities obtained weapons, such as iron knives, spears, swords or firearms to defend themselves. These weapons could be obtained from Europeans in exchange for slaves. As a result, slave raids intensified and to protect oneself, individuals and communities seek for weapons. This vicious cycle has been named "gun-slave cycle" (e.g., Lovejoy 2011) or the "iron-slave cycle" (e.g., Hawthorne 2003) among historians. Not only local communities but also states engaged in slave raids to finance army purchases. They purchased firearms and horses which the European traders began to bring large quantities for sale (Law 1976, p.72). For example, Samori, the leader of the Wassoulou Empire, financed arms purchases from the exchange of slaves for horses in the Sahel and Mossi regions (Boahen 1985, p.123). Bornu actively engaged in slave raiding in order to finance trade with the Ottoman Empire in exchange for weapons and luxury goods (e.g., Lovejoy 2011, p.69 and Lapidus 2002, p.405).

## 2.3 Muslim Societies under Colonial Rule and after Independence

During the period 1880 to 1914, Europeans, mainly the French and the British, brought the whole of West Africa except Liberia under colonial rule. The French brought West Africa under control exclusively by military conquest rather than the treaties of protectorate as the British did (Boahen 1985 p.117).[11] Africans resorted to three options against colonization: confrontation, alliance and acquiescence or submission (Boahen 1985 p.117).[12] The land of Islam falling into hands of non-Muslim and colonial powers caused confrontations between some Islamic states and colonial conquests, the second wave jihad (Walther and Miles 2017).

While some Muslim reactions against the French and the British invasion were militant, armed resistance largely subsided after colonial consolidation. Nevertheless, Muslim opposition to colonial rule persisted indirectly through schools and reform movements (Lapidus 2002, p.737; Nyang 1984). For instance, in Ibadan (Nigeria), the Bamidele movement advocated for the preservation of Arabic language, Muslim attire, and reformed Islamic practices. Furthermore, Muslim ethnic groups such as the Hausas and Yorubas organized to safeguard their Muslim identity. These cultural and ideological resistance endured across generations, as Muslims regarded colonial rule as a temporary setback (*fitna*) rather than a cause for cultural surrender (Nyang 1984). The continu-

[11] There are discussions about how aggressive the French imperialists were (McGowan 1981, p.245).

[12] Appendix F provides historical evidence of strategies taken by Islamic states.

ity of Muslim identity during colonial times was also sustained through *taqiyya*, a practice which enabled them to accept outwardly colonial rules, while internally waiting patiently for the tides to turn (Hiskett 1994; Sanneh 2016; Umar 2006). "*Taqiyya* is based on the Qur'anic injunction about the obligation of remaining 'faithful' and true to Islam in situations of danger and hostility, with dispensation for withholding the truth and hiding one's true intentions to ride out the challenge" (Qur'an 3: 28, 19:18; 49:13; Sanneh 2016, p.262).

On the other hand, the colonial powers regarded Muslims as culturally and educationally more advanced than non-Muslim Africans, and appointed Muslim chiefs and clerks as administrators in non-Muslim areas (Lapidus 2002, p.736). However, most Sudanic and West African peoples were and are ruled by narrow—often military—elites, in the name of interests and ideologies that do not, with some exceptions, reflect the values and identities of the masses. The new elites were commonly non-Muslims and were primarily concerned with political and economic modernization. They accepted Islam as a "personal religion" on a par with Christianity and not necessarily as relevant to the political order (Lapidus 2002, p.736).[13]

These colonial situations generated friction within the Muslim community. By the 1950s, attacks against Muslim leaders (*marabouts*) cooperating with the colonial administration began to surface (Loimeier 2003). In Nigeria, although the reintroduction of Shariah criminal law extended to twelve northern states in 2001, it ultimately functioned merely as a tool for political elites in their power struggles (Loimeier 2016). Amid growing disillusionment with the secular state and a desire for Islamic revival, radical movements emerged among young Salafists, ultimately paving the way for Boko Haram's campaign of terrorism (Brigaglia 2012). This phenomenon was not limited to Nigeria; rather, such resistance to secularization and Westernization—processes advanced under colonial rule—contributed to the rise of reformist movements and Salafism across West Africa, which advocated for the purity and revival of Islam (Sounaye 2017).

# 3 Data

The main data sources are as follows. Appendix C describes other data.

**Pre-colonial Islamic states.** Cultures of West Africa creates the maps that show spatial locations of historical states before colonization as well as modern countries after independence by using multiple sources of references.[14] We digitize maps of historical states over the centuries from pre-colonial periods to the colonial era (Figure B.1 and Figure B.2). In Appendix B, we describe how to identify Islamic states in detail.

[13]The Muslim community gradually became larger with significant conversions to Islam among pagan peoples. The Muslim population of West Africa approximately doubled between 1900 and 1960, and continues to grow substantially in later periods (Lapidus 2002, p.736).

[14]The references and maps are available in the website.

**Pre-colonial trade routes and points.** We rely on three sources: O'Brien (1999), Kennedy (2002), and Bossard (2014). They provide us with historical trade routes, trade points and ancient cities in pre-colonial period. Regarding the trade routes, we use the mapped ones before 1800 in Kennedy (2002) supplemented by O'Brien (1999). They were digitized by Michalopoulos et al. (2018).[15] To identify cities that have been declined or obsolete nowadays, we make use of Bossard (2014) (Map 1.15 p. 39) that shows ancient cities and present day cities on the pre-colonial routes based on multiple sources. Also, we utilize O'Brien (1999) and Kennedy (2002) for information of those cities by using current population information.

**History of Sahara.** We use the map of ancient lakes and rivers (more than 5 thousand years ago) constructed by Drake et al. (2011).[16] They assess and map the paleohydrology of the entire Sahara. In particular, they use a digital elevation model (DEM) and Landsat satellite imageries to identify ancient river channels and lake shorelines. Ancient lake areas were then basically estimated from the shorelines identified by the DEM. As a complement, remote sensing is also being used to map lake sediment outcrops, which are readily distinguished from other materials observed in the satellite imageries. For more technical details, see Drake and Bristow (2006) and the Supporting Information of Drake et al. (2011).

**Jihadist groups in the contemporary world.** The main data source for contemporary conflict events and actors involved in conflicts is Armed Conflict Location and Event Data (ACLED, Raleigh et al. 2010). Each actor appeared in ACLED is classified into an Islamist group or not by hand. Information about violent Islamist groups causing contemporary conflicts is drawn from several sources. Information sources include ACLED reports, Africa Center for Strategic Studies (ACSS), Mapping Millitants Project (MMP), the Foundations of Rebel Group Emergence (FORGE) Dataset, and Walther and Miles (2017). Appendix D lists major jihadist groups and their stated ideologies and goals.

**Contemporary conflict events involving jihadist groups.** We construct event-level measures of jihadist violence using ACLED data and restrict the sample as follows. First, we focus on violent events involving jihadist groups, defined above, classified as rebel groups or political militias between 2001 and 2019 (spanning the post-9/11 period up to the year preceding the COVID-19 pandemic).[17] Second, we retain two categories of violence involving these groups. The first in-

[15] We appreciate the authors for their generosities to share the digitized data.

[16] During the "African Humid Period" from around 10,000 years ago, the Sahara enjoyed climatic and environmental conditions favourable for human habitation and cattle raising and it has been referred as the "Green Sahara" (e.g., deMenocal et al. 2000; Dunne et al. 2012). We rely on the map of ancient water sources depicted by a cartographer, Carl Churchill. It is available here.

[17] See the codebook ACLED (2019) for detailed classifications of conflict actors. Rebel groups are defined as "political organizations whose goal is to counter an established national governing regime by violent acts." Political militias are defined as "a more diverse set of violent actors, who are often created for a specific purpose or during a specific time period and for the furtherance of a political purpose by violence."

cludes violence against state forces in a broad sense, encompassing both domestic government actors and external forces, such as international organizations, foreign state militaries, private security firms, and independent mercenaries. According to ACLED classifications, this category includes both battles and explosions or remote violence. The second category includes violence against civilians, covering both direct attacks and explosions or remote violence when civilians are targeted. No minimum fatality threshold is imposed.[18] The left map of Figure D.1 maps jihadist violence in West Africa from 2001 to 2019.

**Historical conflict events versus European conquests.** Our data on conflicts against European conquest come from Brecke (1999), which records violent events with at least 32 deaths worldwide between 1400 and 2000.[19] As described in Brecke (2012), the dataset includes interstate wars, rebellions, and domestic political conflicts. For each event, it reports the actors involved, the start and end years, and the region of onset. Actors are defined as political entities exercising effective sovereignty over territories (e.g., states, kingdoms, or sub-national groups). We focus on conflicts in West Africa in which the actors consist of historical states and European countries. Table E.1 lists all recorded colonial conflicts involving historical states in the region. In total, the database documents 42 such conflict events, of which 15 involve Islamic states. To geocode conflict locations, we rely on Fenske and Kala (2017), which comprehensively geolocate conflict events between 1700 and 1900 in Africa. For conflicts after 1901, we manually geocode the regions listed in Brecke (1999) using web-based sources such as Wikipedia and Google Maps.

# 4 Persistent Effects of Declined Cities

In this section, we empirically examine the persistent influence of core trans-Saharan cities that flourished under pre-colonial Islamic states but have since declined on contemporary Islamist insurgencies. As the locations of these declined cities were unlikely to have been determined randomly, we employ an instrumental variable strategy. This section proceeds as follows. First, we define the empirical specification. Second, we describe the logic and validity of the instrumental variable. Finally, we presents the empirical results.

[18] According to ACLED (2019), a battle is defined as "a violent interaction between two politically organized armed groups at a particular time and location." Explosions/Remote violence are defined as "one-sided violent events in which the tool for engaging in conflict creates asymmetry by taking away the ability of the target to respond." Violence against civilians is defined as "violent events where an organized armed group deliberately inflicts violence upon unarmed non-combatants." We exclude violent interactions between jihadist groups and other non-state actors. Indeed, the selected two categories account for over 90 percent of all violent events involving Islamist groups.

[19] The raw data are publicly available on this website. Previous studies (e.g., Besley and Reynal-Querol 2014; Dincecco et al. 2019) have also used Brecke's database.

## 4.1 Empirical Specification

We construct artificial 0.5 × 0.5 degree (about 55km × 55km) grid cells covering the entirety of West Africa. Unless otherwise noted, each grid cell is the unit of analysis throughout the empirical analysis.

### Defining city decline

The primary variable of interest captures proximity to declined historical cities in the trans-Saharan caravan routes founded up to the 1800s when historical Islamic states played significant economic roles before European colonization. Due to the unavailability of systematic data on historical city populations, it is infeasible to measure decline based on population changes directly. Instead, we construct a credible proxy based on the shifting core-periphery structure of the region. Specifically, we proxy a "declined historical city" by a landlocked pre-colonial city with a contemporary population of less than 100,000. This definition rests on two premises. First, during the era of historical Islamic states, core cities were predominantly landlocked, driven by overland trade. Second, contemporary cities with populations below 100,000 can reasonably be classified as peripheral in today's economy. We then measure access to these locations by defining $CityDecline_o$ as the straight-line distance from the centroid of grid cell $o$ to the nearest declined historical city. Furthermore, as Section 6.1 illustrates, we also verify that our empirical results are robust to alternative definitions of $CityDecline_o$, including different contemporary population thresholds and alternative definitions of "landlocked" (benchmarked as >1,000 km from the coast).[20]

### The instrumental variable exploiting the *shrinkage* of ancient water sources

As an instrument for $CityDecline_o$, we exploit variation in proximity to water resources in ancient periods (more than five thousand years ago). This subsection focuses on the definition and empirical specification, while the following subsection details the underlying identification logic. The instrument, $AncientWaterAccess_o$, is defined as the straight-line distance from grid cell $o$ to the nearest ancient lake (specifically, the nearest boundary between land and lake). Alternatively, we also construct a size-weighted measure of ancient water access, $\sum_w \frac{AncientLakeArea_w}{Distance_{ow}}$, where $Distance_{ow}$ is the distance from grid cell $o$ to ancient lake $w$. This alternative measure accounts for the surface area of each ancient lake size, $AncientLakeArea_w$, reflecting that larger lakes

[20]The set of declined historical cities includes prominent examples such as Gao, Tadmakka, Takedda, Timbuktu, and Wara, which were major urban and religious centers in the pre-colonial period but have experienced substantial decline over time, consistent with the historical record (e.g., Austen 2010; Gomez 2018; Jeppie and Diagne 2008; Nixon 2013). These locations also hosted important historical mosques, reflecting their role as centers of Islamic learning and religious life (Pradines, 2022). To demonstrate that our results are not driven solely by pre-colonial religiosity, Section 6.1 conducts robustness checks that explicitly control for proximity to historical mosques.

offered superior water resource accessibility.

Importantly, because we control for contemporary water access throughout the analysis, the instrument essentially captures *variation in access to ancient lakes that have since shrunk.* Indeed, Section 6.1 also confirms that the empirical results are robust to alternative measures that directly capture the proximity to only ancient lake areas where water sources have disappeared today. However, we do not use these measures in the main specification. This is because they are constructed using information on contemporary lakes and rivers, whose locations and extents may also be potentially shaped by human economic activity, including deforestation, dam construction, and water infrastructure.

Note also that we capture walking distance in these measures for the following reasons. First, there were no modern roads in the ancient periods and the pre-colonization age. Second, there were no modern cars in these periods. Camels were the means of transportation for the trans-Saharan trade. Third, walking distance matters even today in insurgent activities. Rebel groups tend to move not only through roads but also through off-road (e.g., Tao et al. 2016). Throughout the empirical analysis, we primarily use the straight-line distance measures for both $CityDecline_o$ and $AncientWaterAccess_o$ because these measures are the simplest and most straightforward ones to capture walking distance without specific assumptions about travel costs. Section 6.1 shows that our empirical results are robust to alternative accessibility measures.

**Estimating equations**

We first test whether ancient water access can predict past prosperity and decline of the historical cities by taking logarithms and estimating the following first-stage regression:

$$\log(CityDecline_o) = \gamma_0 + \gamma_1 \log(AncientWaterAccess_o) + \gamma_2 X_o + \phi_c + u_o \tag{1}$$

where $o$ represents a grid cell, $X_o$ is a vector of cell-level geographical controls,[21] $\phi_c$ is a contemporary country fixed effect, and $u_o$ is an error term.

We then use the predicted proximity to a declined city from the first stage to estimate the following two-stage least squares:

$$Y_o = \beta_0 + \beta_1 \log(CityDecline_o) + \beta_2 X_o + \phi_c + \epsilon_o \tag{2}$$

where $Y_o$ is an outcome of interest regarding insurgent activities by violent Islamist organiza-

[21] Grid cell-level geographical controls include a landlocked dummy, average malaria suitability, average caloric suitability in post 1500, average elevation, terrain ruggedness, proximity to contemporary water sources, and contemporary populations.

tions and $\beta_1$ is the coefficient of interest.[22] We report standard errors adjusting for spatial autocorrelation with distance cutoff at 100 km.[23]

In our baseline estimations, $Y_o$ takes the following three variables: (i) a dummy which takes 1 if cell $o$ has at least one violent event by a jihadist organization in ACLED from 2010-2019; (iii) log (number of violent events by jihadist organizations from 2010-2019 in cell $o$); (iii) log (distance from the nearest point of violent event by a jihadist organization between 2010 and 2019 from the centroid of cell $o$).

## 4.2 Logic and Validity of the Instrument

We first argue that ancient water sources and their shrinkage can in theory explain both the past prosperity and the subsequent decline of pre-colonial cities. We then outline the identification assumptions underlying our IV strategy and present empirical support.

### Ancient water sources as drivers of pre-colonial city prosperity and decline

The logic begins with the role of ancient lakes in shaping early human settlements. In the presence of high inland transportation costs across the Sahara, locations with a greater capacity to sustain human life were particularly attractive for settlement. Proximity to lakes and rivers provided direct benefits, such as drinking water and support for agriculture, as well as indirect benefits through their support of animal life. Livestock depended critically on water sources, while fishing enhanced food security. Moreover, terrestrial animals congregated near water, lowering hunting costs for humans. This mechanism is consistent with Bosker (2021), who emphasizes the availability of reliable water sources as the fundamental "city seed" under high transportation costs. Drake et al. (2011) provide further empirical support.[24]

The subsequent evolution of cities, particularly those that thrived under historical Islamic states, was therefore shaped in part by factors common to initial human settlements—notably the hydro-

[22] As $X_o$ also includes contemporary populations, our specification effectively compares areas with similar contemporary population sizes but differing past prosperities, allowing us to isolate the persistent effects of historical Islamic civilization. Nevertheless, our results remain robust and virtually unchanged whether or not controlling for contemporary populations. In a later section of robustness checks, we also demonstrate that the main results are robust to controlling for nightlight luminosity, which captures local economic development.

[23] With this distance cutoff, the standard error is equivalent to be clustered by 3 × 3 grid cell squares (the own grid cell at center and surrounding eight grid cells). Section 6.1 reports that the standard errors exhibit similar magnitudes across a range of higher distance cutoffs.

[24] By compiling records of refuges, sightings, fossils, and rock art sites, they show that the estimated spatial distribution of faunal species (such as fish, molluscs, and savannah mammals) overlaps significantly with ancient water sources. Records of barbed bones, used exclusively for hunting large water-dependent animals, further reveal a strong correlation between human settlements and ancient lakes. See the Supporting Information of Drake et al. (2011) for more technical details. See also, for example, Dunne et al. (2012) and Sereno et al. (2008), for additional evidence of human settlements and animal use in the Sahara in the African Humid Period.

logical and topographical continuities that made water accessible through lakes, rivers, and oases. Despite the gradual shrinkage of these water sources, this spatial dependence persisted throughout the pre-colonial era; as long as camels served as the primary mode of transport and overland trade costs remained high, these locations retained their comparative advantage.

After colonization, the economic geography of West Africa underwent a profound transformation. The comparative environmental advantages that had sustained inland cities was eroded due to the disappearance of most water resources combined with the simultaneous rise of modern trading technologies that favored coastal areas, reorienting economic activity away from overland trade. Together, these forces help explain the decline of once-prominent inland cities, reducing them from the core under pre-colonial Islamic states to the periphery of the modern states.

Table 1: Correlations—Access to Ancient Lakes and Pre-Determined Characteristics

| **(A) Geography** | | | | | |
|---|---|---|---|---|---|
| | (1) Ecological diversity | (2) Temperature | (3) Precipitation | (4) Caloric suitability | (5) Pastoralism suitability |
| Log (Distance to an ancient lake) | 0.00144 | -0.0149 | 3.356*** | 0.00522*** | -0.00426 |
| | (0.00526) | (0.0411) | (0.654) | (0.00127) | (0.00642) |
| $R^2$ | 0.011 | 0.606 | 0.875 | 0.994 | 0.519 |
| Adj-$R^2$ | 0.008 | 0.605 | 0.874 | 0.994 | 0.518 |
| Observations | 2571 | 2615 | 2615 | 2616 | 2616 |
| Mean (Dep. Var.) | 0.416 | 28.065 | 54.530 | 0.532 | 0.375 |
| SD (Dep. Var.) | 0.422 | 2.007 | 52.202 | 0.533 | 0.194 |
| **(B) Pre-colonial culture and institution** | | | | | |
| | (1) Jurisdictional hierarchy | (2) Polygamy | (3) Irrigation | (4) Class stratification | (5) Local headman |
| Log (Distance to an ancient lake) | -0.0279 | -0.0190 | 0.000665 | -0.0119 | -0.0104 |
| | (0.0357) | (0.0125) | (0.0118) | (0.0213) | (0.00789) |
| $R^2$ | 0.356 | 0.336 | 0.563 | 0.189 | 0.616 |
| Adj-$R^2$ | 0.353 | 0.333 | 0.561 | 0.185 | 0.614 |
| Observations | 1749 | 1869 | 1880 | 1700 | 1345 |
| Mean (Dep. Var.) | 2.443 | 0.836 | 0.272 | 1.332 | 0.182 |
| SD (Dep. Var.) | 0.888 | 0.371 | 0.445 | 0.705 | 0.386 |
| Country FE | Yes | Yes | Yes | Yes | Yes |
| Geographic Controls | Yes | Yes | Yes | Yes | Yes |

*Notes*: All regressions are estimated using OLS. The unit of observation is a grid cell (about 55km × 55km). In panel (A), the dependent varibles are (1) ecological diversity (2) average temperature (3) average precipitation (4) average caloric suitability (5) average pastoralism suitability. In panel (B), the dependent varibles from the *Ethnographic Atlas* are (1) jurisdictional hierarchy (v33) (2) polygamy (v9) (3) irrigation (v28) (4) class stratification (v66) (5) local headman (v72). We control for the logarithm of distance (km) to the nearest water sources today, landlocked dummy, average malaria suitability, average caloric suitability in post 1500, average elevation, ruggedness, and logarithm of one plus population in 2010 in all the specifications. We report standard errors adjusting for spatial auto-correlation with distance cutoff at 100km in parentheses. $^{*}$ $p < 0.1$, $^{**}$ $p < 0.05$, $^{***}$ $p < 0.01$.

### Identification assumptions

Beyond the predetermined nature of water access in ancient periods, we need the following identifying assumptions for causal inference. The exclusion restriction requires that ancient water access influences contemporary outcomes only through its influence on economic activities in historical states prior to colonization. The independence assumption posits that, after controlling for cell-level geographical characteristics, unobservable determinants of contemporary Islamist insurgencies are uncorrelated with ancient water access. There is no direct way to test these assumptions, but the following two arguments support them.

First, most lakes in ancient periods have now disappeared due to exogenous long-term climate and environmental changes. Paleoclimatic and paleohydrological studies indicate that most ancient lakes had desiccated long before the rise of pre-colonial Islamic civilizations and the colonial era, thereby strengthening the conceptual validity of the instrument's exclusion restriction. The African Humid Period ended around 6,000–5,000 years before present (e.g., deMenocal et al. 2000). Rather than disappearing abruptly, ancient lakes gradually contracted after this transition, as permanent high-level lacustrine systems gave way to more fragmented and shallow water bodies (Lézine et al. 2011). With the exception of megalakes—most notably Lake Chad—most inland ancient lakes had disappeared as permanent surface water bodies by approximately 2,700–2,500 years before present due to sustained aridification (Drake and Bristow 2006; Kröpelin et al. 2008; Lézine et al. 2011). Therefore, ancient lakes are not likely to have a direct influence on contemporary Islamist insurgencies.[25]

Second, we check the correlation between ancient water access and a set of pre-determined charasteristics, including geographical conditions and pre-colonial variables of culture and institutions, after controlling for the baseline geographical controls and contemporary country fixed effects. Geographical variables include ecological diversity, temperature, precipitation, caloric suitability, and pastoralism suitability. Pre-colonial variables include jurisdictional hierarchy of local community, polygamy as a marital composition, reliance on irrigation, degree of class stratification, and rules of political succession of local headman, drawing from the *Ethnographic Atlas*. Table 1 reports that the accessibility of ancient water sources is mostly uncorrelated with these pre-determined characteristics. In particular, we find no systematic relationship with key pre-colonial institutional features, suggesting that access to ancient lakes does not capture deep-rooted institutional differences. Importantly, reliance on irrigation, highlighted by Allen et al. (2023) as an important coordination device in response to the loss of water sources, is also orthogonal to ancient water access, reinforcing that it does not capture irrigation-based institutional adaptation.[26]

[25] Nevertheless, to further rule out any potential hydrological advantages as an alternative explanation, Section 6.1 shows that controlling for contemporary groundwater availability does not explain our results.

[26] We see significant correlations with precipitation and caloric suitability. However, most variations of these vari-

## 4.3 Main Empirical Results

We begin by presenting the first-stage results, followed by the second-stage results.

### The first stage

Columns (1)-(3) of Table 2 reports the estimation results of the first stage regression (1). According to column (3), our preferred specification, a 1% increase in proximity to an ancient lake from a grid cell increases proximity to a pre-colonial trade point by 0.13% at the 1% level of statistical significance. The F-statistics for this first-stage specification is 50.81. The F-statistics from alternative specifications across robustness checks in a later section remain consistently around 30-50. These results indicate a strong first-stage relationship between the instrument and city decline, supporting the reliability of the second-stage estimates.

Table 2: First Stage—Ancient Water Sources and Historical Landlocked Cities

| | Log distance to | | | | | |
|---|---|---|---|---|---|---|
| | Inland trade point (< 100,000) | | | Inland trade route | | |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Log (Distance to an ancient lake) | 0.108*** | 0.108*** | 0.128*** | 0.0898** | 0.0879** | 0.170*** |
| | (0.0161) | (0.0162) | (0.0177) | (0.0352) | (0.0354) | (0.0286) |
| Log (Distance to a lake/river today) | -0.0162 | -0.0140 | 0.00787 | -0.0304 | -0.0291 | 0.00791 |
| | (0.0222) | (0.0222) | (0.0190) | (0.0412) | (0.0414) | (0.0294) |
| F-stat | 44.52 | 44.08 | 50.81 | 6.41 | 6.08 | 34.84 |
| Observations | 2616 | 2616 | 2616 | 2616 | 2616 | 2616 |
| Colonizer FE | No | Yes | No | No | Yes | No |
| Country FE | No | No | Yes | No | No | Yes |
| Geographic Controls | Yes | Yes | Yes | Yes | Yes | Yes |

*Notes*: All regressions are estimated using OLS. The unit of observation is a grid cell (about 55km × 55km). All Log(Distance) variables indicate the logarithm of one plus distance (km) to the nearest object. The dependent variables are the logarithm of one plus distance (km) to the nearest pre-colonial landlocked trade point whose contemporary population is less than 100,000 (columns 1-3) and the logarithm of one plus distance (km) to the nearest pre-colonial landlocked trade route up to 1800 (columns 4-6). Landlocked is defined as the 1000km faraway from the nearest coast point. We control for landlocked dummy, average malaria suitability, average caloric suitability in post 1500, average elevation, ruggedness, and logarithm of one plus population in 2010 in all the specifications. We report standard errors adjusting for spatial auto-correlation with distance cutoff at 100km in parentheses. $^{*}$ $p < 0.1$, $^{**}$ $p < 0.05$, $^{***}$ $p < 0.01$.

Columns (4)-(6) provide supplementary evidence. Distance to ancient lakes also significantly predicts proximity to historical inland trade routes, which constituted the backbone of trans-Saharan commerce prior to colonization. This result is consistent with the idea that ancient water sources shaped not only the locations of pre-colonial cities but also the spatial structure of inland trade networks that sustained them. Together, these findings reinforce the interpretation that ancient water

ables are concentrated in coastal countries and the high correlations pick these effects. We confirm the robustness of our main results when additionally controlling for average precipitation in section 6.1.

access captures fundamental determinants of pre-colonial economic activity, rather than serving merely as a source of exogenous variation that narrowly predicts a single historical outcome. [27]

The following three observations further support the validity of the instrument. First, the IV has the highest power for predicting the set of declined cities captured in $CityDecline_o$ among possible combinations of pre-colonial cities. Figure A.2 reports the same coefficient estimates for the first-stage regressions with alternative combinations of pre-colonial cities. The first row represents our main specification, same as the estimate reported in Table 2. The second row of the figure reports that the coefficient size for the proximity to any pre-colonial city is 0.07, which is almost half of that for the proximity to a declined city. Other rows also confirm that the ancient water access cannot well predict other sets of cities, including non-declined cities or coastal cities.

Second, relatedly, ancient water sources do not predict contemporary city formation. Table A.1 presents the relationship between contemporary economic development and past and present water sources and contemporary economic development. In Panel (A), the dependent variable is the log distance (in km) to the nearest city with a contemporary population exceeding 50,000. Proximity to an ancient lake has a small and statistically insignificant effect, indicating a lack of persistent influence of initial geography on contemporary city formation. In Panel (B), we proxy local economic activity using nighttime light intensity in 2015 from the Visible Infrared Imaging Radiometer Suite (VIIRS), which provides high-resolution measures. We find a negative effect of proximity to ancient lakes, while proximity to contemporary water sources has a positive and statistically significant effect. Together, these results highlight the importance of accounting for changes in first-nature geography over time, illustrated by the shrinking of ancient water sources and the rising economic relevance of the Niger River.

Third, proximity to contemporary water sources has no explanatory power for proximity to a core pre-colonial city. As Table 2 illustrates, the coefficients on a contemporary water source are statistically insignificant in most specifications and their sizes are also significantly smaller than those on proximity to an ancient water source. These results imply that locations of the core trade cities reflect the initial geography from ancient periods rather than contemporary water sources.

### The second stage

We begin by presenting the correlation between city decline and contemporary jihad, alongside the reduced-form relationship between our instrument and the outcome. We then report the main instrumental variable estimates.

**The correlation.** Figure 3 visually illustrates the strong correlation between pre-colonial cities and contemporary jihad. This map overlays two residuals—the red scheme represents residuals

[27] As Figure 1 shows, we also have information on ancient rivers. However, we observe the overall weak result of the ancient river effects. The results are available upon request.

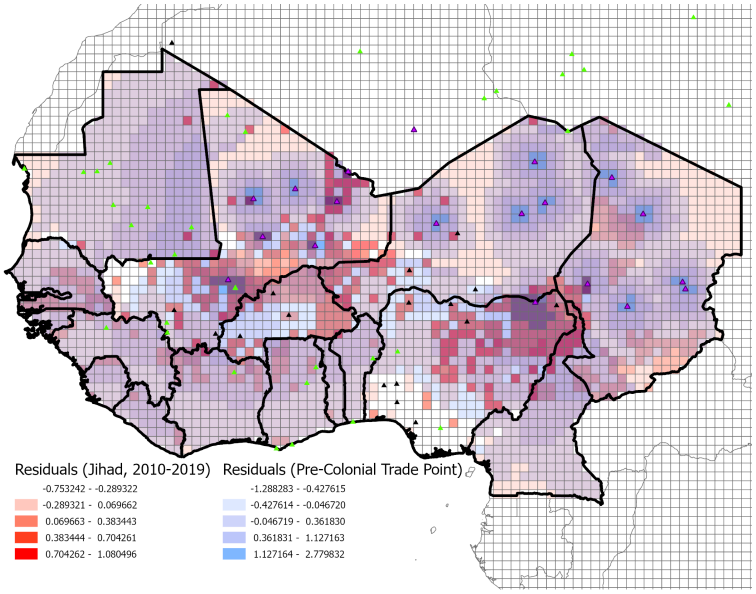



Figure 3: Overlay of Residuals for Jihadist Violence and Pre-Colonial Trade Points

*Notes*: This figure overlays two residuals—the red scheme represents residuals from the regression of a dummy variable of jihad (2010-2019) on all the control variables; the blue scheme represents negative residuals from the regression of log distance to a pre-colonial inland trade point with less than 100,000 population today on the full controls. The full controls include landlocked dummy, malaria suitability, caloric suitability in post 1500, elevation, ruggedness, and country fixed effects. The purple triangles indicate pre-colonial inland trade points with less than 100,000 population today, the yellow green triangles indicate pre-colonial coastal trade points with less than 100,000 population today, and the black triangles indicate the other pre-colonial trade points. The color of cells where high residuals overlap turns purple.

from regressing the jihad dummy on the full controls used in the main IV specification; the blue scheme represents negative residuals from regressing log distance to a pre-colonial core inland trade point on the full controls. The color of cells where high residuals overlap turns purple (a mix of red and blue). Around several pre-colonial inland trade points, we observe dark purple cells.

**The reduced-form results.** Table A.2 reports the regression results of contemporary jihadist incidents directly on the proximity to ancient water lakes. ccording to column (1) of all the panels, a 1% increase in proximity to ancient lakes from a grid cell increases the probability of experiencing a jihadist event in the cell by 0.04%, the number of jihadist events in the cell by 0.16%, and the proximity to a jihadist event from the cell by 0.15% during 2001-2019 (all $p < 0.01$). Columns (2)-(3) indicate that these effects are concentrated in 2010-2019, as we describe details later. These results demonstrate that ancient water access—a key determinant of historical prosperity and subsequent decline—robustly predicts contemporary jihadist activity, reinforcing the relevance of the instrument and corroborating the causal interpretation of the following IV estimates.

**The main IV results.** Table 3 reports the IV estimates of the effects of the declined cities

on contemporary jihad (2001-2019). According to column (1) of all the panels, a 1% increase in proximity to a declined city from a grid cell increases the probability of experiencing a jihadist event in the cell by 0.3%, the number of jihadist events in the cell by 1.2%, and the proximity to a jihadist event from the cell by 1.2% during 2001-2019 (all $p < 0.01$).

Table 3: IV Estimates of Persistent Effects on Jihad

| **(A)** | | | | **Onset** | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| | All | 2001-09 | 2010-19 | All | 2001-09 | 2010-19 |
| Log (Distance to a landlocked trade point (< 100,000)) | -0.325*** | -0.00422 | -0.327*** | | | |
| | (0.0786) | (0.0135) | (0.0787) | | | |
| Log (Distance to a landlocked trade route up to 1800) | | | | -0.244*** | -0.00317 | -0.246*** |
| | | | | (0.0550) | (0.00996) | (0.0548) |
| Observations | 2616 | 2616 | 2616 | 2616 | 2616 | 2616 |
| Mean (Dep. Var.) | 0.133 | 0.011 | 0.129 | 0.133 | 0.011 | 0.129 |
| SD (Dep. Var.) | 0.339 | 0.106 | 0.335 | 0.339 | 0.106 | 0.335 |
| **(B)** | | | | **Intensity** | | |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| | All | 2001-09 | 2010-19 | All | 2001-09 | 2010-19 |
| Log (Distance to a landlocked trade point (< 100,000)) | -1.233*** | -0.0236 | -1.234*** | | | |
| | (0.357) | (0.0218) | (0.357) | | | |
| Log (Distance to a landlocked trade route up to 1800) | | | | -0.926*** | -0.0177 | -0.926*** |
| | | | | (0.235) | (0.0158) | (0.235) |
| Observations | 2616 | 2616 | 2616 | 2616 | 2616 | 2616 |
| Mean (Dep. Var.) | 0.249 | 0.011 | 0.244 | 0.249 | 0.011 | 0.244 |
| SD (Dep. Var.) | 0.775 | 0.109 | 0.771 | 0.775 | 0.109 | 0.771 |
| **(C)** | | | | **Distance** | | |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| | All | 2001-09 | 2010-19 | All | 2001-09 | 2010-19 |
| Log (Distance to a landlocked trade point (< 100,000)) | 1.164*** | 0.310 | 1.306*** | | | |
| | (0.274) | (0.211) | (0.283) | | | |
| Log (Distance to a landlocked trade route up to 1800) | | | | 0.874*** | 0.233* | 0.980*** |
| | | | | (0.167) | (0.139) | (0.173) |
| Observations | 2616 | 2616 | 2616 | 2616 | 2616 | 2616 |
| Mean (Dep. Var.) | 4.816 | 5.698 | 4.932 | 4.816 | 5.698 | 4.932 |
| SD (Dep. Var.) | 1.101 | 0.743 | 1.157 | 1.101 | 0.743 | 1.157 |
| Country FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Geographic Controls | Yes | Yes | Yes | Yes | Yes | Yes |

*Notes*: All regressions are estimated using IV with logarithm of one plus distance (km) to the nearest ancient lake as an instrument. The unit of observation is a grid cell (about 55km × 55km). The dependent variables are (A) dummy variables which take a value of 1 if jihad occurred during a period given in each column, otherwise take a value of 0, (B) logarithm of one plus the number of jihad events during a given period in each column, and (C) logarithm of one plus distance (km) to the nearest jihad during a period given in each column. All Log(Distance) variables indicate the logarithm of one plus distance (km) to the nearest object. Landlocked is defined as the 1000km faraway from the nearest coast point. The interest variables are the logarithm of one plus distance (km) to the nearest pre-colonial landlocked trade point whose contemporary population is less than 100,000 in columns (1)-(3), and the logarithm of one plus distance (km) to the nearest pre-colonial landlocked trade route up to 1800 in columns (4)-(6). We control for the logarithm of distance (km) to the nearest water sources today, landlocked dummy, average malaria suitability, average caloric suitability in post 1500, average elevation, and ruggedness in all the specifications. We report standard errors adjusting for spatial auto-correlation with distance cutoff at 100km in parentheses. $^{*}$ $p < 0.1$, $^{**}$ $p < 0.05$, $^{***}$ $p < 0.01$.

These effects are mostly concentrated in 2010-2019, during which the intensity of jihadist events have significantly risen. The mean of log intensity of jihadist events is 0.245 in 2010-2019 and 0.011 in 2001-2009. From column (2) of all the panels, we observe statistically insignificant

effects of the declined cities during 2001-2010 and their coefficient sizes are also significantly smaller. In column (3) of all the panels, point estimates of the effects of the declined cities during 2010-2019 and their level of statistical significance are similar to those in column (1). These results indicate that the jihadist events during 2010-2019 are closely linked to the historical Islamic places, the core trade cities tracing back to more than 200 years ago. Section 5 discusses the mechanism behind these results.

We also use the same specification but with the explanatory variable being proximity to the trade route network up to 1800CE constructed by Michalopoulos et al. (2018). We pick the inland trade route network and calculate the distance to the nearest trade route from each grid cell. Columns (4)-(6) in Table 3 show the results for the alternative measure. We find the qualitatively same results as in columns (1)-(3). Importantly, the coefficient size of proximity to a trade route network is smaller than proximity to a core trading city, implying that proximity to a core trading *city* matters more than proximity to a trade *route*.

# 5 Persistence of Jihadist Ideology as a Colonial Legacy

We argue that the persistence of jihadist ideology as a legacy of European colonization serves as the primary local mechanism underlying the empirical results above. We support this mechanism in five ways. First, we emphasize that jihad has been cyclic, with distinct spatial distributions over the centuries. Second, we provide qualitative historical evidence on responses to colonization forces—shaped by military asymmetry and a prevalent religious practice—contributing to the persistence of jihadist ideology. Quantitative evidence on historical weapon access further support the story. Third, we rationalize the mechanism and the observed patterns using a simple multi-period model of conflict between a colonizer and an Islamic state. Fourth, we offer consistent quantitative evidence using individual-level survey data on extreme religious ideologies. Finally, we highlight heterogeneity across contemporary jihadist organizations, documenting differences in their reliance on localized recruitment strategies, which further reinforce the proposed mechanism.

## 5.1 Cycle of Jihad with Distinct Spatial Distributions over the Centuries

Recall Figure 1, which yields two observations about the relationship between pre-colonial state presence and contemporary Islamist insurgency. First, contemporary Islamist violence is concentrated in areas formerly governed by historical Islamic states, but not in regions associated with historical non-Islamic states. This pattern suggests that, insofar as jihads against European colonizers in the 19th century were centered in territories of Islamic states, jihadist violence exhibits a degree of historical recurrence.

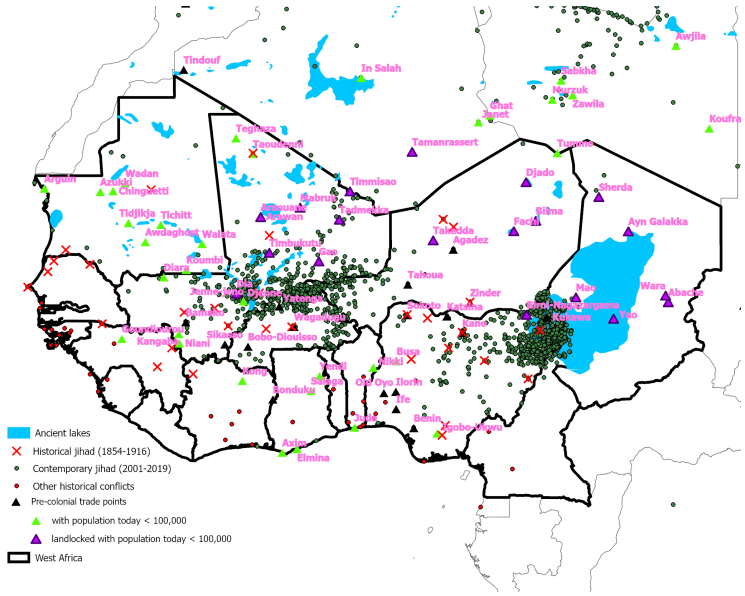



Figure 4: Historical and Contemporary Jihad

*Notes*: This figure shows the locations of historical (red crosses) and contemporary jihad (green points), along with pre-colonial cities, ancient lakes and other historical conflicts. Data on historical conflicts between 1854 and 1916 are drawn from Brecke (1999) and supplemented with additional geocoding based on multiple sources, as detailed in Section 3. Historical jihad refers to conflicts against European forces, whereas other historical conflicts include all the other conflicts. The purple triangles indicate pre-colonial inland trade points with less than 100,000 population today, the yellow-green triangles indicate pre-colonial coastal trade points with less than 100,000 population today, and the black triangles indicate all the other pre-colonial trade points.

Second, there is also substantial spatial variation in contemporary conflicts involving Islamist organizations across different areas within the former territories of historical Islamic states. Such conflicts are not uniformly distributed across all historical Islamic states, but instead concentrated in specific states. A key distinction across these historical Islamic states lies in the extent to which they avoided a hard confrontation as a strategy against European forces.[28] For example, contemporary jihadist violence is concentrated in the former territory of the Tukulor Empire, spanning much of present-day western and central Mali, and that of the Sokoto Caliphate, centered largely in northern Nigeria. Both of these historical Islamic states resisted European invasion for a short time, but ultimately offered no effective resistance against European conquest (Crowder 1971). By contrast, we observe very little contemporary jihadist violence in the former territory of the Samori (Wassoulou) Empire, located mainly in present-day Guinea, which adopted a hard confrontation strategy against European forces (Legassick 1966).

To further investigate the spatial distributions of jihads over time, Figure 4 shows both historical

[28] Appendix E and F summarize the confrontation against Europeans and the strategies adopted, drawing on multiple historical sources. Figure F.1 displays the spatial distribution of contemporary jihadist violence over historical Islamic states in 1860.

and contemporary jihads with the ancient lakes and historical trade cities. The historical jihad information is based on Brecke (1999). This map implies the following two observations. First, locations of historical jihads against colonization forces are distant from both ancient lakes and core cities in the historical trade routes. In other words, historical jihads are distributed more in the periphery of the historical trade routes and in the coastal areas. Second, most historical jihads are distant from areas where contemporary jihads are concentrated.

Table 4: Ancient Water Sources and Historical Conflicts

| | All | | | Jihad | | |
|---|---|---|---|---|---|---|
| | (1) Onset | (2) Duration | (3) Distance | (4) Onset | (5) Duration | (6) Distance |
| Log (Distance to an ancient lake) | 0.00360* | 0.00964* | -0.0471** | 0.0000728 | 0.00371 | 0.0263 |
| | (0.00186) | (0.00579) | (0.0216) | (0.00151) | (0.00541) | (0.0224) |
| Log (Distance to a lake/river today) | -0.00805** | -0.0174* | 0.0737** | -0.00489 | -0.00562 | 0.0533* |
| | (0.00367) | (0.0102) | (0.0288) | (0.00316) | (0.00754) | (0.0299) |
| Colonizer FE | Yes | Yes | Yes | Yes | Yes | Yes |
| $R^2$ | 0.056 | 0.011 | 0.418 | 0.009 | 0.003 | 0.214 |
| Adj-$R^2$ | 0.054 | 0.009 | 0.417 | 0.006 | 0.000 | 0.212 |
| Observations | 2616 | 2616 | 2616 | 2616 | 2616 | 2616 |
| Mean (Dep. Var.) | 0.024 | 0.058 | 5.397 | 0.013 | 0.036 | 5.612 |
| SD (Dep. Var.) | 0.152 | 0.552 | 0.896 | 0.112 | 0.450 | 0.802 |

*Notes*: All regressions are estimated using OLS. The unit of observation is a grid cell (about 55km × 55km). The dependent variables are dummy variables which take a value of 1 if any historical conflict, otherwise take a value of 0 (Onset), total duration years of historical conflicts in the unit of analysis (Duration), and logarithm of one plus distance (km) to the nearest historical conflict (Distance). We control for landlocked dummy, average malaria suitability, average caloric suitability in post 1500, average elevation, and ruggedness in all the specifications. We report standard errors adjusting for spatial auto-correlation with distance cutoff at 100km in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 4 reports results of regressing historical jihads on the ancient water access. That is, the regression specification is identical to our first-stage one except for changing the dependent variable from historical trade points to the historical jihads. According to columns (4)-(6), the locations of ancient lakes have statistically insignificant effects on historical jihads against colonization forces and their coefficient sizes are also small.

Table A.3 reports results of the IV regression with the same specification as the main empirical analysis except for changing the dependent variable to the historical jihads. In columns (3)-(4), the core cities in the historical trade routes also have statistically insignificant effects on historical jihads against colonization forces and their coefficient sizes are smaller than those on contemporary jihads reported in Table 3.

To study the link between locations of contemporary jihad (2010-2019), historical jihad and core cities, we estimate the IV regression with the same specification as the main empirical analysis except for the dependent variable. Since neither historical nor contemporary conflict occurred in approximately 85% of the grid cells spanning in West Africa, to capture the meaningful variations,

we use the relative locations of contemporary jihad to the historical jihad as the dependent variable. Specifically, we calculate the (logarithm of one plus) distance to the nearest contemporary jihad divided by the (logarithm of one plus) distance to the nearest historical jihad. Table A.4 reports the results of the IV estimates for the effects of proximity to the core cities. The results show that contemporary jihad occurred closer to a grid cell with more proximity to the core cities relative to locations of historical jihad.

Table 5: Cycle of Jihad—Relative Contemporary Jihad Locations to Historical Jihad

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
|---|---|---|---|---|---|---|---|---|---|
| Onset of Africa vs European (1850-) | 2.456*** | | | | | | -0.0543 | | |
| | (0.745) | | | | | | (0.100) | | |
| Intensity of Africa vs European (1850-) | | 2.775*** | | | | | | -0.0899 | |
| | | (0.918) | | | | | | (0.111) | |
| Duration of Africa vs European (1850-) | | | 0.447*** | | | | | | -0.0297 |
| | | | (0.157) | | | | | | (0.0256) |
| Onset of jihad vs European (1850-) | | | | 4.417*** | | | 4.471*** | | |
| | | | | (1.123) | | | (1.123) | | |
| Intensity of jihad vs European (1850-) | | | | | 5.399*** | | | 5.487*** | |
| | | | | | (1.444) | | | (1.441) | |
| Duration of jihad vs European (1850-) | | | | | | 0.687*** | | | 0.716*** |
| | | | | | | (0.213) | | | (0.216) |
| Country FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| $R^2$ | 0.327 | 0.320 | 0.275 | 0.408 | 0.410 | 0.301 | 0.408 | 0.410 | 0.301 |
| Adj-$R^2$ | 0.325 | 0.318 | 0.273 | 0.407 | 0.408 | 0.299 | 0.406 | 0.408 | 0.298 |
| Observations | 2616 | 2616 | 2616 | 2616 | 2616 | 2616 | 2616 | 2616 | 2616 |
| Mean (Dep. Var.) | 0.818 | 0.818 | 0.818 | 0.818 | 0.818 | 0.818 | 0.818 | 0.818 | 0.818 |
| SD (Dep. Var.) | 1.154 | 1.154 | 1.154 | 1.154 | 1.154 | 1.154 | 1.154 | 1.154 | 1.154 |

*Notes*: All regressions are estimated using OLS. The unit of observation is a grid cell (about 55km × 55km). The dependent variable is distance (km) to the nearest contemporary jihad (2010-2019) divided by distance (km) to the nearest historical jihad. The definitions of variables as follows: the dummy variable which takes a value of 1 if African entities confronted against Europeans after 1850 in column (1), the logarithm of one plus number of conflicts where African entities confronted against Europeans after 1850 in column (2), the total duration (years) of conflict event where African entities confronted against Europeans after 1850 in column (3), the dummy variable which takes a value of 1 if African entities confronted against Europeans after 1850 in Islamic areas in column (4), the logarithm of one plus number of conflicts where African entities confronted against Europeans after 1850 in Islamic areas in column (5), and the total duration (years) of conflict event where African entities confronted against Europeans after 1850 in Islamic areas in column (6). We control for the logarithm of distance (km) to the nearest water sources today, landlocked dummy, average malaria suitability, average caloric suitability in post 1500, average elevation, ruggedness, and logarithm of one plus population in 2010 in all the specifications. We report standard errors adjusting for spatial auto-correlation with distance cutoff at 100km in parentheses. $^{*}$ $p < 0.1$, $^{**}$ $p < 0.05$, $^{***}$ $p < 0.01$.

Finally, to examine the link between locations of historical and contemporary jihad, we use the distance to the nearest contemporary jihad divided by the distance to the nearest historical jihad as in the above. Table 5 and Figure 4 report the correlations between historical and contemporary jihads. According to columns (4)-(6), contemporary jihad occurred in further away from a grid cell with more prevalence of historical jihad in terms of onset, intensity and duration respectively. Since the results in columns (1)-(3) indicate that the relative locations of contemporary jihad to historical jihad are significantly correlated with historical conflict including non-jihadistic events, the correlations between contemporary jihad and historical jihad can be simply driven by the common factors with historical conflict. To alleviate this concern, columns (7)-(9) report the results of horse race regressions. Then the significance of the estimated coefficients of historical conflicts disappears and the size of the estimated coefficients shrinks towards zero, confirming our arguments about the significantly negative correlations between contemporary jihad and historical jihad.

These observations stand in contrast to a widely recognized pattern in previous studies, namely that violence tends to recur in the same locations possibly through intergenerational transmission of grievances, distrust, and memories of past conflicts (e.g., Besley and Reynal-Querol 2014; Dincecco et al. 2019; Fearon and Laitin 2014; Rohner et al. 2013a; Voigtländer and Voth 2012). In contrast to these findings, our evidence suggests that contemporary Islamist insurgencies in West Africa are not concentrated in the very same areas where historical jihads against European colonizers took place. Instead, they emerge in regions *without* armed resistance against European invasions, pointing to a distinct spatial distribution over time rather than a simple perpetuation of localized historical conflict.

## 5.2 Strategic Adaptation to Colonial Rule through Religious Practice

To substantiate the proposed mechanism, this section proceeds in three steps. First, drawing on qualitative historical evidence, we describe how overwhelming military asymmetries during colonial invasion shaped strategies of outward submission rather than open confrontation, which could lead to the persistence of jihadist ideology. Second, we provide complementary quantitative evidence on military asymmetries using data on historical weapon access. Third, we provide qualitative evidence on the religious practice that enabled such strategic adaptation and facilitated the intergenerational ideological transmission.

### Military asymmetry during colonial invasion and the persistence of jihadist ideology

The interpretation most consistent with the set of our empirical findings concerns the balance of military power between Islamic states and European military forces during colonial invasion.

Islamic state forces with reasonable access to coastal areas could directly obtain arms and ammunition from European traders (Law 1976; Kea 1971; Smith 1989; Thornton 1999), influencing how they confronted European invasion. Samori's (Wassoulou) state forces exemplify this pattern. Benefiting from access to weapons from European traders, they imported more modern weapons from Sierra Leone, and adopted a hard confrontation strategy against European forces, including guerilla tactics (Legassick 1966; Crowder 1971). Such Islamic state forces with relatively good access to modern weapons engaged in more intense fighting with European colonizers. As a result, European military forces decisively defeated such state forces. Consequently, these states ceased to exist, and the seeds of jihadist ideology within them might also have diminished.

By contrast, Islamic state forces with limited access to weapons did not engage as fiercely with European forces due to stark asymmetries in military capacity. Two prominent examples are the Tukulor Empire and the Sokoto Caliphate, both of which ultimately adopted submission as primary strategy in the face of overwhelming military asymmetries. For example, Crowder (1971)

notes, "the reasons for the ineffectiveness of Tukulor military resistance are fairly obvious," further describing them as "hopelessly outgunned" by the French military, which resulted in no military resistance for most of the conquest period. Similarly, in the Sokoto Caliphate, limited access to European weapons and the resulting inferiority in weapon quality ultimately left it with "no tactics, no personal gallantry and no resistance" against European conquest (Crowder 1971, p. 294). Under such circumstances, these state forces resorted to strategies of alliance, acquiescence, or submission to European powers. While these states also ceased to exist, the seeds of jihadist ideology within them were *not* diminished, fueling future jihadist conflicts.

At the same time, even when examining variation within the two states, areas characterized by relatively better access to weapons witnessed direct confrontation, further consistent with the same underlying mechanism. In the Tukulor Empire, the well-known gun-slave cycle operated not solely at the level of the state but at the level of individual warriors, generating substantial variation in access to weapons across territories (Roberts 1987). In its capital, Segu, where access to firearms was relatively better in the mid-nineteenth century, state forces engaged in armed confrontation with French troops during the 1850s, as recorded in Brecke (1999), our source for historical conflict data. The Sokoto Caliphate provides further evidence: although submission became the dominant state-level outcome, military capacity varied across emirates (Smaldone 1977). Certain emirates, notably Sokoto and Kano, possessed relatively greater concentrations of firearms, and episodes of armed confrontation with British forces are documented in these areas, albeit for short durations (Brecke 1999).

These patterns indicate that both across and within states, military confrontation was more likely where access to weapons was comparatively better, whereas limited access was associated with the absence of sustained resistance, such that the seeds of jihadist ideology were not diminished and instead persisted beyond the colonial conquest.

However, while the presence of jihadist ideology might be a necessary condition for contemporary jihadist activities, it is not sufficient on its own. This persistence cannot solely explain why significant effects on contemporary jihad were observed only during 2010–2019 and not in the earlier period of 2001–2009. The persistence of jihadist ideology, coupled with a contemporary shock that strengthens insurgent forces, such as the inflow of fighters and weapons from Libya following its security collapse (Shaw 2013), could trigger a sudden surge in contemporary jihad. Indeed, it has been well-documented that the influx of weapons from Libya since 2011 has contributed to a widespread violent conflict in West Africa (e.g., Marsh 2017; Mangan and Nowak 2019).

**Empirical support for the military asymmetry with historical weapon access information**

Consistently, Table 6 provides direct empirical support for the military-asymmetry channel by linking proximity to ancient lakes—and, by construction, proximity to declined cities—to historical

Table 6: Weapon Access in the Pre-Colonial Period

| | Gun access in 1757-1806 | | Slave exports in 1700s | | Slave exports in 1800s | |
|---|---|---|---|---|---|---|
| | (1) OLS | (2) IV | (3) OLS | (4) IV | (5) OLS | (6) IV |
| Log (Distance to an ancient lake) | 0.0168*** | | 0.270*** | | 0.186*** | |
| | (0.00621) | | (0.0712) | | (0.0714) | |
| Log (Distance to a landlocked trade point (< 100,000)) | | 0.269** | | 4.169*** | | 2.884** |
| | | (0.121) | | (1.581) | | (1.415) |
| Log (Distance to the coast) | -0.241*** | -0.155** | -0.481* | 0.858 | -0.886*** | 0.0401 |
| | (0.0383) | (0.0660) | (0.288) | (0.659) | (0.234) | (0.571) |
| $R^2$ | 0.740 | 0.642 | 0.302 | 0.087 | 0.322 | 0.176 |
| Adj-$R^2$ | 0.739 | 0.641 | 0.299 | 0.084 | 0.320 | 0.173 |
| Observations | 2616 | 2616 | 2489 | 2489 | 2489 | 2489 |
| Mean (Dep. Var.) | 3.747 | 3.747 | 2.319 | 2.319 | 2.720 | 2.720 |
| SD (Dep. Var.) | 0.465 | 0.465 | 4.407 | 4.407 | 3.827 | 3.827 |
| Colonizer FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Geographic Controls | Yes | Yes | Yes | Yes | Yes | Yes |

*Notes*: Columns (1), (3), and (5) report OLS estimates, while Columns (2), (4), and (6) report IV estimates using the logarithm of one plus distance (km) to the nearest ancient lake as an instrument. The unit of observation is a grid cell (about 55km × 55km). All Log(Distance) variables indicate the logarithm of one plus distance (km) to the nearest object. Landlocked is defined as the 1000km faraway from the nearest coast point. The dependent variables are the logarithm of a quantity-weighted measure of gun access in 1757–1806 (columns 1–2), the logarithm of one plus the number of Atlantic slave trade exports in the 1700s (columns 3–4), and in the 1800s (columns 5–6). We control for the logarithm of distance (km) to the nearest water sources today, landlocked dummy, average malaria suitability, average caloric suitability in post 1500, average elevation, and ruggedness in all the specifications. We report standard errors adjusting for spatial auto-correlation with distance cutoff at 100km in parentheses. $^{*}$ $p < 0.1$, $^{**}$ $p < 0.05$, $^{***}$ $p < 0.01$.

access to weapons prior to colonization.

Columns (1)-(2) examine gun access in 1757–1806. The gun access measure is constructed as a quantity-weighted measure that weights gun imports by the inverse of the distance from each grid cell's centroid to coastal trading locations involved in the Anglo–West African gun trade. We rely on Inikori (1977), which reports the destinations and quantities of guns carried on 111 trading voyages from England to West Africa between 1757 and 1806. For each destination, we aggregate the total number of guns shipped over this period and assign geographic coordinates to representative trading locations when destinations are reported at a broad regional level. Additional details on port assignments and data construction are provided in Appendix C.

These columns show that distance to ancient lakes and to declined cities significantly predicts gun access. Specifically, a 1% increase in distance from an ancient lake and from a declined city leads to a 0.02% ($p < 0.01$) and 0.27% ($p < 0.05$) increase in gun access, respectively. Importantly, these estimates are conditional on distance to the coast, which is strongly correlated with gun access, reflecting the fact that firearms were initially imported through coastal ports and subsequently transported inland. These results imply that areas farther from the historical inland cores had systematically better access to firearms prior to colonial encounters.

Columns (3)-(6) examine slave exports in the 1700s and 1800s, a key channel through which

weapons were obtained in exchange with European traders, as noted in Section 2.2.[29] Across both centuries, distance from ancient lakes and from declined cities significantly predicts slave exports. Specifically, a 1% increase in distance from an ancient lake and from a declined city leads to a 0.27% and 4.17% increase in slave exports in 1700s (both $p < 0.01$), and with a 0.19% ($p < 0.01$) and 2.88% ($p < 0.05$) increase in 1800s, respectively. This finding reinforces the interpretation that areas farther from the historical cores had greater access to European trade networks, and by extension, to weapons.

Taken together, these results confirm that the "past-core" areas faced a severe disadvantage in acquiring modern arms. This lack of access to guns and the economic means to acquire them (slave trade) substantiates the historical narrative that state forces in these areas were "hopelessly outgunned." This overwhelming military asymmetry vis-à-vis European forces forced them into strategies of outward submission rather than armed confrontation, thereby allowing the seeds of jihadist ideology to persist.

### The religious practice of *taqiyya*

These arguments also align with the historical accounts detailed in Section 2.3. The persistence of ideology can be interpreted as being sustained through the religious practice of *taqiyya*, which allowed Muslims to outwardly adapt to situations they could not change while internally preparing to reassert Islamic purity. The outward conformity coupled with inward resistance, reinforced through educational institutions, can be transmitted across generations until the time is ripe.[30] Importantly, "taqiyya is of fundamental importance in Islam and practically every Islamic sect agrees to it and practices it" (Mukaram 2004; Ibrahim 2010). Furthermore, taqiyya was not confined to the colonial period; it has also been observed among contemporary jihadists. To illustrate this continuity, the following sections examine how taqiyya has been practiced: first, in the colonial period, and second, in the strategies of present-day jihadist groups such as Al Qaeda, the Islamic State, and Boko Haram.

**Historical jihad.** Islamic radicalisation in Northern Nigeria can be traced back to the onset of colonial rule (Pérouse De Montclos, ed 2014). Under British domination, Muslim actors engaged in strategic accommodation through taqiyya—religiously sanctioned dissimulation. After

[29]The data come from Nunn (2008). We assign each grid cell to ethnic homeland by Arc GIS. In panel (C), this is grid-cell level analysis although variation of the dependent variable (the logarithm of one plus the number of Atlantic slave exports in the 1800s) comes from ethnic homeland level. Since the data has missing values for the uninhabited areas, the number of observations decreases to 2489.

[30]Originating in the early Middle Ages, taqiyya was practiced among Shi'ite and other minority sects and transmitted across generations as a survival strategy under Sunni domination (Bowering et al. 2012; Daftary 2007; Friedman 2009). Moreover, similar practices of dissimulation can be found beyond the Islamic notion of taqiyya: among crypto-Jews in early modern Spain (Yovel 2009) , the 'hidden Christians' in Tokugawa Japan (Turnbull 1998), and African diasporic religions under slavery, which concealed African deities under Catholic forms (McGoldrick et al. 2005; Johnson 2015).

the fall of the Sokoto Caliphate in 1903, many Muslim elites outwardly accepted colonial rule while covertly preserving Islamic authority and identity. As Last (2008) notes, “full closure was not possible, but a degree of closure was feasible, whether through dissimulation or social distance.” Leaders such as the Vizier of Sokoto chose to remain under colonial rule and participated in reconfiguring a new form of *jama'a*—a collective Islamic life—under Christian overlordship, thus keeping alive the idea of *Dar al-Islam* as a mental and spiritual space.

This practice was not simply individual but systematic. Pérouse De Montclos, ed (2014) states clearly that during most of the early colonial period, “taqiyya (’dissimulation’) became the main pillar of resistance against colonial rule.” Similarly, Naniya (1993), in her study of the Kano Emirate, observes that the ‘ulama’, while publicly complying with the new order, "resorted to clandestine activities in opposition to the new society being created by the British." In this sense, taqiyya operated as a long-term method of ideological survival and quiet resistance beneath the surface of colonial governance. As Hiskett (1994) explains, “Taqiyya enables the Muslim outwardly to accept a situation he is powerless to change, while inwardly waiting for the tide to turn. It condones dissimulation. It allows Muslims to cooperate with an infidel authority when there is no alternative, while reserving the moral right to restore Islam to its proper position of dominance when the time is ripe” (p.115).

Beyond Northern Nigeria, similar dynamics appeared in the Western Sudan. In Timbuktu, local marabouts and *Alfa* mediated between Islamic authority and French colonial power. As Marty (1920) remarked, with Timbuktu’s submission "it can be said that they are now almost on our side. It should be remembered that holy war was not an absolute obligation. Many documents prove this, and the Alfas of Timbuktu are well acquainted with those documents." This observation highlights the ways in which local Muslim leaders employed dissimulation and pragmatic accommodation to preserve religious authority while outwardly cooperating with colonial administrators.

**Contemporary jihad.** The practice of taqiyya is also well-documented in the context of contemporary jihadist movements, including both Al Qaeda (Shultz Jr and Beitler 2004; Campbell 2005) and the Islamic State (Bunzel 2019). Campbell (2005) describes jihadists practicing taqiyya as “super sleepers” committed to becoming embedded in target societies, and “permitted” to drink alcohol, live together, pray together, eat during Ramadan, dress in Western style and socialise with women, to avoid suspicion or detection. The use of taqiyya has also been repeatedly highlighted in European court cases against French jihadists (Hecker and Tenenbaum 2017; Hecker 2018, 2021; Louarn 2013). For instance, Hecker (2018) documents “the prosecutor noted that one of the defendants claimed to want to return to a normal life, but in reality he continued to visit jihadist websites and attempt to recruit sympathizers”. Similar references to taqiyya also appear in Dutch Salafist court cases (Koning 2020).

This tactic has also shaped the operations of Boko Haram, active not only in Nigeria but also

in neighboring states such as Niger and Chad. Following intensified military pressure after 2009, Boko Haram leaders adopted a strategy of dispersion and withdrawal. Antimbom (2016) interprets this as a conscious invocation of the Sultan of Sokoto's tactic in 1903, noting: "Boko Haram's leaders settled to a strategy of scattering (taqiyya), like the Sultan of Sokoto in 1903, who called his followers to disband to avoid being defeated by the British." In this way, taqiyya functions not merely as a theological doctrine but as a transhistorical strategic logic, linking colonial-era Islamic non-resistance to contemporary jihadist insurgency.

## 5.3 The Dynamic Model of Conflict

To rationalize the proposed mechanism, we present a two-period model of conflict between an European colonizer and an Islamic state, built on Baliga and Sjöström (2020). We simulate the model to replicate the nature of historical and contemporary jihad that we observed.

### The model setup

There are two players, a colonization force ($F$) and an Islamic state ($M$), who are competing over a divisible territory. There are two periods ($t = 1, 2$), with no discounting of future payoffs. The total amount of the territory is normalized to 1, and the allocation at the beginning of period $t$ is given by $\omega_{Ft}$ and $\omega_{Mt}$ for players $F$ and $M$, respectively, where $\omega_{Ft} + \omega_{Mt} = 1$. We assume that player $F$, a colonizer, has a smaller amount of initial territory at the beginning of the game, thereby $\omega_{F1} < \omega_{M1}$. The relative military strength of player $i \in \{F, M\}$ is denoted by $\lambda_i$ where $\lambda_F + \lambda_M = 1$. We assume that player $F$ is military stronger, thereby $\lambda_F > \lambda_M$. The analysis will demonstrate that the degree of this asymmetric power relations matters to explain both the historical and contemporary jihads. The cost of conflict for player $i$ is denoted by $\phi_i$.

In each period, the bargaining game has two stages. In Stage 1, Player $i \in \{F, M\}$ can either "challenge" by making a claim $\sigma_{it}$ where $\omega_{it} < \sigma_{it} \leq 1$, or make no claim. If neither challenges, both players will keep controlling a share $\sigma_{it} = \omega_{it}$. The cost of making a challenge for player $i$ is $c_i$, which is private information and drawn from distribution $F(c)$. Stage 2 is reached if only one play makes a claim and the other player does not make a claim. The other player decides whether to concedes to the claim. In other words, if the both players make claims or if neither claims, then the second stage is not reached and the game ends.

A winner of conflict will take the full territory (i.e., $\sigma_{it} = 1$ if $i$ wins), where conflicts occur in the following two cases. The first case is where only one player makes a claim in Stage 1 and the other player does not concede to it in Stage 2. Suppose $F$ is the only player who makes a claim. Then, $F$'s winning probability is $\lambda_F + \theta$ while $M$'s winning probability becomes $1 - (\lambda_F + \theta) = \lambda_M - \theta$, where $\theta$ is a parameter governing the first-mover advantage. We assume $0 \leq \lambda_i - \theta$ and

$\lambda_i + \theta \geq 1$ for all $i$ to be able to define the probabilities. The second case is where both players make claims in Stage 1. In this case, the winning probability of player $i$ is $\lambda_i$ as the both players are simultaneously challenging.

Player $i$'s instantaneous utility from controlling a share $\sigma_{it}$ in period $t$ is given by $u_i(\sigma_{it})$, where $u_i$ is an increasing, strictly concave, and differentiable function on $[0, 1]$. Without loss of generality, we normalize the function such that $u_i(1) = 1$ and $u_i(0) = 0$.

The dynamic game proceeds as follows. If conflict has occurred in $t = 1$, then the game ends and both players continue to get utilities from the obtained (or lost) territory in $t = 2$. If territorial transfer from one player to the other due to concession has occurred in $t = 1$, then the territory after the transfer becomes the new status quo territory at the beginning of $t = 2$ ($\omega_{F2}, \omega_{M2}$). If neither player challanges in $t = 1$, then the status quo territory remains the same in $t = 2$ ($\omega_{i2} = \omega_{i1}$). We solve the dynamic game by backward induction.

**Optimal strategies in $t = 2$ as in the one-shot game**

Given the new status quo territory ($\omega_{F2}, \omega_{M2}$) realized after $t = 1$ (in the scenario where conflict has not occurred in $t = 1$), we solve for optimal strategies in $t = 2$ as in the one-shot game.

We begin with deriving the optimal amount of the claim. Suppose $j$ makes a claim $\sigma_{j2}$ in Stage 1 and $i$ is the second mover. Then, player $i$ concedes if:

$$u_i(1 - \sigma_{j2}) \geq (\lambda_j + \theta) \cdot u_i(0) + (1 - (\lambda_j + \theta)) \cdot u_i(1) - \phi_i = \lambda_i - \theta - \phi_i$$

When $\sigma_{j2} = 1$, this condition becomes $\phi_i \geq \lambda_i - \theta$. If this condition is violated, player $j$'s optimal challenge is $\sigma_{j2} = 1 - \eta_{i2}$ such that $u_i(\eta_{i2}) = \lambda_i - \theta - \phi_i$. To sum, the optimal challenge by $j$ in $t = 2$ is $\sigma_{j2} = 1 - \eta_{i2}$ where:

$$\eta_{i2} = \begin{cases} u^{-1}[\lambda_i - \theta - \phi_i] & \text{if } \phi_i < \lambda_i - \theta \\ 0 & \text{if } \phi_i \geq \lambda_i - \theta \end{cases}$$

Then, in any perfect Bayesian equilibrium, each player $i$ either make the optimal claim $\sigma_i = 1 - \eta_j$ or no challenge. This game can thus be expressed as a game in which both players simultaneously decide whether to challenge with the optimal amount of claim or not challenge. Labelling the optimal challenge Hawk ($H$) and no challenge Dove ($D$), the payoff matrix for the row player, $i$, becomes as follows:

| | H | D |
|---|---|---|
| $H$ | $\lambda_i - \phi_i - c_i$ | $u_i(1 - \eta_{j2}) - c_i$ |
| $D$ | $u_i(\eta_{i2})$ | $u_i(\omega_{i2})$ |

From this payoff matrix, the difference in player $i$'s net gains from choosing $H$ over $D$ between when $j$ chooses $H$ and when $j$ chooses $D$ is as follows, denoting player $i$'s instantaneous payoff in period $t$ when $i$ chooses $A_i$ and $j$ chooses $A_j$ where $A_i, A_j \in \{H, D\}$ by $\pi_{it}(A_i, A_j)$:

$$\begin{aligned}\Omega_i(\omega_{i2}) &\equiv [\pi_{i2}(H,H) - \pi_{i2}(H,D)] - [\pi_{i2}(D,H) - \pi_{i2}(D,D)] \\ &= \lambda_i - \phi_i - u(\eta_{i2}) - u(1-\eta_{j2}) + u(\omega_{i2})\end{aligned}$$

Using this function, we can define that actions are strategic complements for player $i$ if $\Omega_i(\omega_{i2}) > 0$ and strategic substitutes for player $i$ if $\Omega_i(\omega_{i2}) < 0$.

Player $i$'s strategy is $s_i : [\underline{c}, \bar{c}] \to \{H, D\}$. Suppose player $i$ thinks player $j$ will choose H with probability $p_j$. The expected payoffs from choosing $H$ and $D$ in the one-shot game, and their difference are:

$$\begin{aligned}E[\pi_{i2}(H)] &= p_j\pi_{i2}(H,H) + (1-p_j)\pi_{i2}(H,D) = p_j(\lambda_i - \phi_i) + (1-p_j)u_i(1-\eta_{j2}) - c_i \\ E[\pi_{i2}(D)] &= p_j\pi_{i2}(H,H) + (1-p_j)\pi_{i2}(H,D) = p_j u(\eta_{i2}) + (1-p_j)u(\omega_{i2}) \\ E[\pi_{i2}(H)] - E[\pi_{i2}(D)] &= \underbrace{p_j[\lambda_i - \phi_i - u_i(\eta_{i2})] + (1-p_j)[u_i(1-\eta_{j2}) - u_i(\omega_{i2})]}_{\equiv x_{i2}} - c_i\end{aligned}$$

Therefore, $s_i(c_i) = H$ if $c_i \leq x_{i2}$, so that the probability of playing H is $p_i = F(x_{i2})$. Hence, the best response function is given by:

$$x_{i2} = \Gamma_i(x_{j2}) \equiv F(x_{j2})[\lambda_i - \phi_i - u_i(\eta_{i2})] + (1 - F(x_{j2}))[u(1-\eta_{j2}) - u(\omega_{i2})]$$

In equilibrium, we have $\hat{x}_{i2} = \Gamma_i(\hat{x}_{j2})$ for $i, j \in \{F, M\}$. Baliga and Sjöström (2020) confirm the existence and uniqueness of the Bayesian Nash equilibrium. Solving the system by assuming that $c_i$ is uniformly distributed on [0, 1], we get:

$$\hat{x}_{i2}(\omega_{i2}) = \frac{u_i(1-\eta_{j2}) - u_i(\omega_{i2}) + \Omega_i(\omega_{i2})[u_j(1-\eta_{i2}) - u_j(\omega_{j2})]}{1 - \Omega_i(\omega_{i2})\Omega_j(\omega_{j2})}$$

**Optimal strategies in t = 1 under the shadow of the future**

Denote the optimal challenge and equilibrium cutoff in $t = 1$ for plaeyer $i$ by $1 - \eta_{j1}$ and $\hat{x}_{i1}$. We first derive $(\eta_{F1}, \eta_{M1})$ and then obtain $(\hat{x}_{F1}, \hat{x}_{M1})$.

When player $i$ makes its decision in $t = 1$, it takes into account the "shadow of the future". In particular, player $i$ takes into account the expected payoff in $t = 2$, depending on a potential new status quo $(\omega_{F2}, \omega_{M2})$, before the challenge cost $c_i$ is realized: Under the assumption that $c_i$

uniformly distributed over [0,1], this expected payoff becomes:

$$\begin{aligned}
E\pi_{i2}(\omega_{i2}) &= F(\hat{x}_{i2})F(\hat{x}_{j2})[\lambda_i - \phi_i - E\{c_i : c_i \leq \hat{x}_{i2}\}] + F(\hat{x}_{i2})(1 - F(\hat{x}_{j2}))[u_i(1-\eta_{j2}) - E\{c_i : c_i \leq \hat{x}_{i2}\}] \\
&\quad + (1 - F(\hat{x}_{i2}))F(\hat{x}_{j2})u_i(\eta_{i2}) + (1 - F(\hat{x}_{i2}))(1 - F(\hat{x}_{j2}))u_i(\omega_{i2}) \\
&= \hat{x}_{i2}\hat{x}_{j2}[\lambda_i - \phi_i - \frac{\hat{x}_{i2}}{2}] + \hat{x}_{i2}(1 - \hat{x}_{j2})[u_i(1-\eta_{j2}) - \frac{\hat{x}_{i2}}{2}] \\
&\quad + (1 - \hat{x}_{i2})\hat{x}_{j2}u_i(\eta_{i2}) + (1 - \hat{x}_{i2})(1 - \hat{x}_{j2})u_i(\omega_{i2})
\end{aligned}$$

where $\hat{x}_{i2} = \hat{x}_{i2}(\omega_{i2})$ and $\hat{x}_{j2} = \hat{x}_{j2}(\omega_{j2})$. That is, the new territory allocation in $t = 2$, which depends on players' actions in $t = 1$, can determine the equilibrium cutoffs in $t = 2$, from which the expected payoff is calculated. Then, the value functions for player $i$ are as follows:

$$\begin{aligned}
V_i(H, H) &= \pi_{i1}(H, H) + \lambda_i u_i(1) + (1 - \lambda_i)u_i(0) = 2\lambda_i - \phi_i - c_i \\
V_i(H, D) &= \pi_{i1}(H, D) + E\pi_{i2}(\hat{w}_{i2}) = u_i(1 - \eta_{j1}) - c_i + E\pi_{i2}(1 - \eta_{j1}) \\
V_i(D, H) &= \pi_{i1}(D, H) + E\pi_{i2}(\hat{w}_{i2}) = u_i(\eta_{i1}) + E\pi_{i2}(\eta_{i1}) \\
V_i(D, D) &= \pi_{i1}(D, D) + E\pi_{i2}(\omega_{i1}) = u_i(\omega_{i1}) + E\pi_{i2}(\omega_{i1})
\end{aligned}$$

To derive $\eta_{M1}$, suppose player $M$ is the second mover. If $M$ concedes to $F$, $M$'s value function is $V_M(D, H)$. If $M$ does not concede to $F$, $M$'s value function is:

$$V_M(\text{not } D, H) = 2[1 - (\lambda_F + \theta)] - \phi_M = 2(\lambda_M - \theta) - \phi_M$$

Hence, $M$ concedes to $F$ if $V_M(D, H) \geq V_M(\text{not } D, H)$. For $\sigma_{F1} = 1$, $M$ concedes if $\pi_{M2}(\omega_{M2} = 0) \geq V_M(\text{not } D, H)$. If this holds, $\eta_{M1} = 0$. If not, the optimal challenge by $F$, $1 - \eta_{M1}$, satisfies:

$$u_M(\eta_{M1}) + E\pi_{M2}(\eta_{M1}) = V_M(\text{not } D, H)$$

We can derive the similar conditions for $\eta_{F1}$ as well. We can numerically solve for $(\eta_{F1}, \eta_{M1})$.

Next, given the obtained optimal challenges $(\eta_{F1}, \eta_{M1})$, we obtain the equilibrium cutoff strategies in $t = 1$. Suppose player $i$ thinks $j$ will choose H in $t = 1$ with probability $p_j$. The expected values that $i$ gains from choosing $H$ and $D$, and their difference are:

$$\begin{aligned}
E[V_i(H)] &= -c_i + p_j[2\lambda_i - \phi_i] + (1 - p_M)[u_i(1 - \eta_{j1}) + E\pi_{i2}(1 - \eta_{j1})] \\
E[V_i(D)] &= p_j[u_i(\eta_{i1}) + \pi_{i2}(\eta_{i1})] + (1 - p_j)[u_i(\omega_{i1}) + E\pi_{i2}(\omega_{i1})] \\
E[V_i(H)] - E[V_i(D)] &= -c_i + p_j[2\lambda_i - \phi_i - u_i(\eta_{i1}) - E\pi_{i2}(\eta_{i1})] \\
&\quad + (1 - p_j)[u_i(1 - \eta_{j1}) + \pi_{i2}(1 - \eta_{j1}) - u_i(\omega_{i1}) - E\pi_{i2}(\omega_{i1})]
\end{aligned}$$

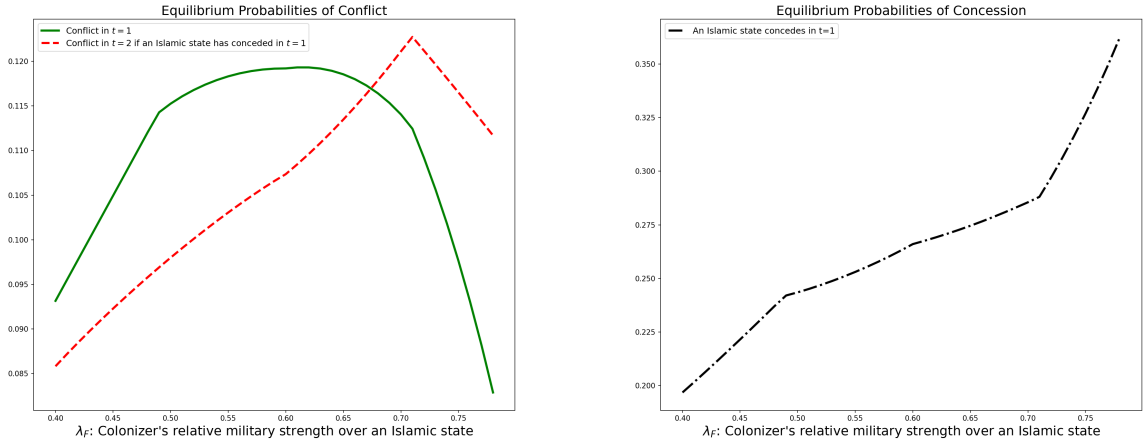



Figure 5: Simulated Equilibrium Probabilities of Conflict and Concession

*Notes*: This figure shows the simulated equilibrium probabilities of conflict and concession from the presented dynamic model of conflict. The horizontal axis in both panels represents the colonizer's relative military strength over an Islamic state ($\lambda_F$). Note that the maximum value this parameter can take is 0.8 because $\theta = 0.2$ (the first mover advantage), which also adds to the conflict winning probability.

Hence, the best response function for player $i$ $t = 1$ is given by:

$$x_{i2} = \tilde{\Gamma}_i(x_{j1}) \equiv F(x_{j1})[2\lambda_i - \phi_i - u_i(\eta_{i1}) - E\pi_{i2}(\eta_{i1})] + (1 - F(x_{j1}))[u_i(1-\eta_{j1}) + \pi_{i2}(1-\eta_{j1}) - u_i(\omega_{i1}) - E\pi_{i2}(\omega_{i1})]$$

In equilibrium, whose existence we numerically verify under reasonable ranges of parameter values, we have $\hat{x}_{i1} = \tilde{\Gamma}_i(\hat{x}_{j1})$ for $i, i \in \{F, M\}$. Solving this, we get:

$$\hat{x}_{i1} = \frac{u_i(1-\eta_{j1}) + E\pi_{i2}(1-\eta_{j1}) - u_i(\omega_{i1}) - E\pi_{i2}(\omega_{i1}) + \tilde{\Omega}_i(\eta_{i1})[u_j(1-\eta_{i1}) + E\pi_{j2}(1-\eta_{i1}) - u_j(\omega_{j1}) - E\pi_{j2}(\omega_{j1})]}{1 - \tilde{\Omega}_i(\eta_{i1})\tilde{\Omega}_j(\eta_{j1})}$$

where

$$\tilde{\Omega}_i(\eta_{i1}) \equiv 2\lambda_i - \phi_i - u_i(\eta_{i1}) - E\pi_{i2}(\eta_{i1}) - u_i(1-\eta_{j1}) - E\pi_{i2}(1-\eta_{j1}) + u_i(\omega_{i1}) + E\pi_{i2}(\omega_{i1})$$

**Simulating equilibrium probabilities of conflict and concession**

The equilibrium probability of conflict in $t = 1$ is $F(\hat{x}_{F1}) \cdot F(\hat{x}_{M1})$, the equilibrium probability that player $F$ challenges and player $M$ concedes in $t = 1$ is $F(\hat{x}_{F1}) \cdot (1 - F(\hat{x}_{M1}))$, and the equilibrium probability of conflict in $t = 2$ conditional on that $F$ had challenged and $M$ had conceded in $t = 1$ is $F(\hat{x}_{F2}(1 - \eta_{M1})) \cdot F(\hat{x}_{M2}(\eta_{M1}))$.

Figure 5 plots the simulated equilibrium probabilities of conflict and concession by setting

$\theta = 0.2$, $\omega_F = 0.3$, $\phi_i = 0.2$, $v_i = 1.5$, $g_i = 0.5$, $u_i(\sigma_{it}) = \sigma_{it}^{0.6}$, and that $c_i$ is uniformly distributed on [0, 1] for all $i$. The left panel illustrates that relative military strength has a non-monotonic effect on the conflict probability in $t = 1$. As the military strength of the "rising power" ($F$) increase from below to moderately above that of the "status quo power" ($M$), the conflict probability in $t = 1$ rises. However, once $F$ becomes significantly stronger and the asymmetry becomes sufficiently large, the conflict probability in $t = 1$ drops sharply. The right panel shows that the probability that player $F$ invades and player $M$ concedes increases monotonically with the rising power's military strength. Additionally, the left graph demonstrates that, after $M$ has conceded to $F$ in $t = 1$, the conflict probability in $t = 2$ is substantially higher under high military asymmetry than under moderate asymmetry. Notably, this outcome arises even without a positive shock to player $M$'s military capacity. Incorporating such a shock would further reinforce this relationship.

Finally, recall that in the context of jihad in West Africa, player $F$ corresponds to an colonizer and $M$ corresponds to an Islamic state. Conflict in $t = 1$ reflects historical jihad against the colonizer, while conflict in $t = 2$ reflects contemporary jihad (broadly understood as resistance to Westernization, including European military forces). Empirically, we observed more historical jihad and less contemporary jihad in regions with moderate military asymmetry at the time of colonial invasion. We also observed less historical jihad and more contemporary jihad in regions with higher military asymmetry at that time, particularly where historical Islamic states did not intensely fight with colonization forces. The simulation results illustrate that such empirical patterns can be rationalized within a simple multi-period model of bargaining and conflict.

## 5.4 Extreme Religious Ideologies from Individual-Level Surveys

We leverage the Afrobarometer survey to provide supportive evidence of the persistence of jihadist ideology. The Afrobarometer comprises nationally representative, individual-level surveys conducted across several African countries, with geo-coded information available in each enumeration area (EA). We use two waves (rounds 6 and 7), implemented between 2014 and 2018, which include relevant variables for this study.

Although there are no direct questions on jihadist ideology or violent extremism, we use variables that capture religious ideologies broadly related to jihadism. This approach aligns with the widely held perspective that jihadist ideology seeks to preserve the purity of Islam against the secularization and Westernization of culture and institutions, as exemplified by movements such as Salafi jihadism (Sounaye 2017). These include views on excluding other religions, governance by religious law (particularly the Shariah law), and restrictions on female education. Notably, these three variables are the only ones we found in the Afrobarometer that closely relate to jihadism, despite the presence of many variables on religious practices.

We estimate the following IV regression:

$$Y_{rei} = \beta_0 + \beta_1 CityDecline_e + \beta_2 X_{rei} + \beta_3 X_e + \phi_c + \phi_r + \epsilon_{rei} \quad (3)$$

where the unit of analysis is individual $i$ who resides in enumeration area $e$ and participated in the survey at round $r$. $Y_{rei}$ is one of the three outcome variables introduced above. CityDecline$_e$ is the log of one plus distance to a declined city from enumeration area $e$ and we instrument it by the ancient water access from $e$. $X_i$ is a vector of individual-level controls and $X_e$ is a vector of enumeration area-level geographical controls.[31] We additionally control for the round fixed effects $\phi_r$ when an outcome variable is available in the both rounds. We report standard errors clustered at the region level in this specification. To capture variations within the Muslim population, rather than across different religious groups, we restrict the sample for analysis to Muslim respondents.

Table 7: IV Estimates of Persistent Effects on Religious Ideology of Muslims

| | **Neighbors from different religion:** 1 (strongly like) - 5 (strongly dislike) | | **Governed by religious law:** 1 (strongly disagree) - 5 (stronlgy agree) | | **Equal opportunities to education:** 1 (strongly agree) - 5 (stronlgy disagree) | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Log (Distance to a landlocked trade point (< 100,000)) | -0.477*** | | -0.445** | | -0.321*** | |
| | (0.132) | | (0.202) | | (0.0940) | |
| Log (Distance to a landlocked trade route in 1800) | | -0.398*** | | -0.342** | | -0.245*** |
| | | (0.114) | | (0.139) | | (0.0759) |
| Observations | 17427 | 17427 | 9166 | 9166 | 9252 | 9252 |
| Mean (Dep. Var.) | 2.322 | 2.322 | 2.611 | 2.611 | 1.637 | 1.637 |
| SD (Dep. Var.) | 1.416 | 1.416 | 1.702 | 1.702 | 0.960 | 0.960 |
| F-stat | 38.196 | 54.627 | 44.525 | 69.565 | 45.756 | 72.583 |
| No. of Clusters | 191 | 191 | 172 | 172 | 172 | 172 |
| Round FE | Yes | Yes | No | No | No | No |
| Country FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Geographic Controls | Yes | Yes | Yes | Yes | Yes | Yes |
| Individual Controls | Yes | Yes | Yes | Yes | Yes | Yes |

*Notes*: All regressions are estimated using IV with logarithm of one plus distance (km) to the nearest ancient lake as an instrument. The unit of observation is a respondent who is Muslim in countries of West Africa surveyed in Afrobarometer. In columns 1-2, the dependent variable is the ordered variable which indicates how much a respondent would dislike having people of a different religion as neighbors. This variable is available in round 6 (surveyed between 2014 and 2015) and 7 (surveyed between 2016 and 2018). In columns 3-4, the dependent variable is the ordered variable which indicates how much a respondent agrees with governance by religious law rather than civil law. This variable is available in round 7. In columns 5-6, the dependent variable is the ordered variable which indicates how much a respondent disagrees with girls and boys having equal opportunities to get an education. This variable is available in round 7. The interest variables are the logarithm of one plus distance (km) to the nearest pre-colonial landlocked trade point whose contemporary population is less than 100,000 and the logarithm of one plus distance (km) to the nearest pre-colonial landlocked trade route up to 1800. Landlocked is defined as the 1000km faraway from the nearest coast point. Geographic controls include the logarithm of distance (km) to the nearest water sources today, landlocked dummy, average malaria suitability, average caloric suitability in post 1500, and average elevation. Individual controls include age, age squared, female dummy, nine categorical indicators of education, and four categorical indicators of living condition. If a dependent variable is available from multiple rounds of Afrobarometer, we additionally control for round fixed effects. Standard errors clustered at the region levels in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

[31] Individual-level controls include age, age squared, female dummy, nine categorical indicators of education, and four categorical indicators of living condition. Enumeration area-level geographical controls include the logarithm of distance (km) to the nearest water sources today, landlocked dummy, average malaria suitability, average caloric suitability in post 1500, and average elevation. Since the Afrobarometer survey provides us with point data about each enumeration, we create a buffer with 50km radii around the locations of enumeration points when we calculate average malaria suitability, average caloric suitability in post 1500, and average elevation.

Table 7 reports results of the IV regression using the three dependent variables.[32] The dependent variables are ordered and standardized. The empirical results show that as a respondent's EA is closer to a declined city, he or she is more likely to dislike people of a different religion as neighbors (column 1), agree with governing a country by religious law rather than secular law (column 3), and disagrees with girls and boys having equal opportunities to education (column 5). All of these three effects are statistically significant at the 1% level. Hence, these empirical results, coupled with the qualitative evidence above, support that the persistence of jihadist ideology is the primary mechanism behind the main results.

## 5.5 Organizational Heterogeneity and Localized Recruitment

We have established that contemporary jihadist violence is concentrated around declined historical cities, arguing that persistent jihadist ideology in these locales serves as the underlying mechanism. If this persistence operates through place-based transmission, then organizations that rely more on localized recruitment would exhibit a stronger spatial association with these declined cities. To assess this implication, we examine heterogeneity across contemporary jihadist organizations, focusing on differences in their recruitment strategies.

Specifically, we focus on three primary jihadist factions active in West Africa: Al Qaeda affiliates, the Islamic State (IS) affiliates, and Boko Haram. The first two factions operate within a broader global framework dominated by the rivalry between Al Qaeda and the Islamic State, particularly following their split in 2014 (Hamming 2017; Novenario 2016; Zelin 2014). Although rival groups rarely engage in full-scale military conflict against one another, they compete for supremacy over the jihadist movement. We classify the specific West African groups and their affiliations in Table D.1.[33]

Motivated by the organizational evolution of these groups, we divide the contemporary time periods into the following three periods: 2001-2009, 2010-2015, and 2016-2019. The period 2010-2015 corresponds to the initial stage period of IS-linked groups, given that the split of the Islamic extremist groups into Al Qaeda and Islamic States as two competing factions occurred in February 2014. In the later period 2016-2019, violent events by IS-linked groups became more prevalent compared to the earlier period until 2015.

Figure 6 reports results of the main empirical IV specification for Al Qaeda-linked groups, IS-linked groups, and Boko Haram, respectively. Observing the three signs of coefficients (distance,

[32] See Appendix C for detailed sources and definitions of the variables that we use in this analysis. The Afrobarometer data is available in most African countries. Chad is an exceptional country where we observe jihadist events but the data is not available.

[33] Note that the relationship between Boko Haram and Al Qaeda is complicated and time-variant. See Cummings (2017) and Zenn (2020) for details. Note also that the Islamic State in West Africa was established in 2015 after splitting from Boko Haram (Bohm 2020).

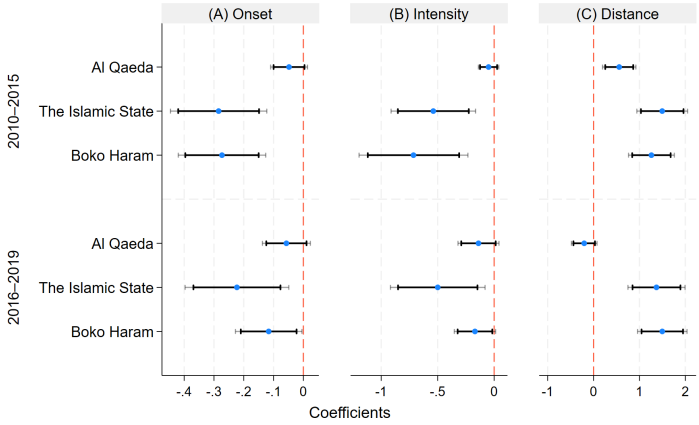



Figure 6: Heterogeneous Persistent Effects across Contemporary Jihadist Factions

*Notes*: All regressions are estimated using an IV of logarithm of one plus distance (km) to the nearest ancient lake. The unit of observation is a grid cell (about 55km × 55km). The dependent variables are (A) a dummy which takes 1 if jihad involving each faction occurred, (B) logarithm of one plus the number of such jihadist events, and (C) logarithm of one plus distance (km) to the nearest such jihadist event. The interest variable is the logarithm of one plus distance (km) to the nearest pre-colonial landlocked trade point whose contemporary population is less than 100,000, where landlocked is defined as the 1000km faraway from the nearest coast point. We use standard errors adjusting for spatial auto-correlation with the 100km cutoff. The darker black lines represent 90% confidence intervals, whereas the lighter black lines represent 95% confidence intervals.

onset, and intensity) in the tables, the results for all the three factions during 2010-2015 are consistent with the main result (Table 3). However, the explanatory power of declined cities is highly heterogeneous across time within the Al Qaeda faction. For the Al Qaeda-linked groups, in the initial stage periods (2001-2009), all the three signs are opposite to those in 2010-15. Moreover, declined landlocked cities explain less for their evolution over time (2016-19) as well. For the IS-linked groups and Boko Haram, declined explain well both their emergence (2010-2015) and evolution over time (2016-19), consistent with the main results.

**Supportive evidence of localized recruitment**

Al Qaeda-affiliated groups depend less on the locations of declined landlocked cities compared to IS-affiliated ones or Boko Haram, as evidenced by the comparison of results between factions during 2016-2019. While uncovering the precise causal mechanism behind this across-group heterogeneity is beyond the scope of this paper, one plausible interpretation can be put forward from the perspective of organizational structures and operation strategies. If Al Qaeda-linked groups have a core set of members to move around especially in their evolutional stages and the other groups depend more on local recruitment at any given time, and if local recruitment is facilitated in areas with a stronger persistence of jihadist ideology, then this across-faction heterogeneity is

reasonably explainable. Consistent with this interpretation, it has been documented that, in contrast to Al Qaeda's lesser reliance on the local constituency and limited ability to recruit local populations, Boko Haram and IS have adopted more localized recruitment strategies, relying on existing community networks to expand their support base (Bloom 2017; Botha et al. 2017).

Finally, we provide quantitative evidence highlighting the different recruitment strategies by Al Qaeda-affiliated groups, IS-affiliated groups, and Boko Haram. Simply assuming that jihadist groups attack both Muslim and non-Muslim (mostly Christian in West Africa) populations and that operating members of jihadist groups are Muslim, we define two concepts of the "insurgent's (market) access" measures. Insurgent's "target access" (ITA) in district $o$ is approximately defined as $ITA_o \approx \sum_d \frac{\text{population}_d}{\text{distance}_{od}}$ and insurgent's "labor market access" (ILMA) in district $o$ is approximately defined as: $ILMA_o \approx \sum_d \frac{\text{Muslim population}_d}{\text{distance}_{od}}$ where populations are measured using the WorldPop datasets and the World Religion Database (WRD), both of which are introduced in Appendix C. Note that the unit of analysis for this exercise is a second-level subnational administrative division (not a grid cell), given the measurability of Muslim populations. The right map of Figure D.1 shows these units, contemporary Muslim population shares, and violent events by Al Qaeda- and IS-linked groups in 2016-19.

Table D.2 reports the regression results to show the correlation between violent events by each faction and ILMA, the key accessibility measure to the potential pool of insurgent's labor market. The coefficient sign of log (ILMA) is surprisingly negative only for Al Qaeda-linked groups while it is positive for IS-linked groups and Boko Haram. This contrast is consistent with the contrast in the previous heterogeneity results in Figure 6, as well as with qualitative evidence on the differential reliance on localized recruitment strategies.

# 6 Discussions

## 6.1 Alternative Mechanisms and Robustness Checks

We rule out prominent alternative mechanisms and conduct extensive robustness checks.

### Water resources

Are our results driven by contemporary water resources? While our main specification already controls for modern access to lakes and rivers, one might still be concerned that the current availability of other water resources could be influencing our findings. Motivated by prior research linking groundwater availability to local conflict (Couttenier et al. 2025) and precipitation or rainfall variability to violence (e.g., Miguel et al. 2004; Decet and Marcucci 2023; McGuirk and Nunn

2025), we examine whether these factors account for our results. Specifically, we additionally control for shallow groundwater availability (0–50 m depth) and average precipitations for the period 2001-2017 with the detailed explanation in Appendix C. In Figure A.3, our main estimates remain virtually unchanged in magnitude and statistical significance, which confirms that contemporary groundwater access or precipitation patterns do not drive our results.

### The spread of Islam

A natural alternative interpretation of our results is that they simply reflect the historical spread of Islam rather than the rise and decline of pre-colonial cities or colonial legacies. In particular, trade centers may have facilitated the diffusion of Islam, implying that locations historically connected to trade networks could remain more religious today and therefore exhibit higher levels of Islamist violence, even in the absence of subsequent decline or colonial resistance.

We assess this possibility by explicitly controlling for the historical spread of Islam. To do so, we collect data on mosques constructed prior to 1920 from Pradines (2022) and use proximity to historical mosques as a proxy for early Islamic penetration, with the detailed explanation in Appendix C. Figure A.3 shows that after controlling for distance to historical mosques constructed before 1860, our main results remain robust: the coefficients of interest are nearly identical in magnitude and significance to those in the benchmark specification. This indicates that early Islamic diffusion alone cannot account for the persistent relationship between declined cities and contemporary jihadist violence.

We find an only moderately positive correlation between proximity to historical core trade points and proximity to historical mosques (Table A.5), as mosques have been more widely distributed across peripheral and rural areas over time. This pattern aligns with existing evidence showing that the spread of Islam in Africa was shaped by multiple forces, including the slave trade (Panza et al. 2025). Overall, these findings suggest that the historical spread of Islam, while related to trade networks, does not constitute the dominant mechanism driving our main results.

### Colonial activities and state capacity

We next investigate the roles of colonial activities and state capacity, as highlighted in previous studies, to address concerns that these historical and institutional factors may be driving our results.

**Colonial activities**. We first consider whether features inherited from the later colonial period could account for our findings. One concern is proximity to present-day national borders, as Alesina et al. (2011) and Michalopoulos and Papaioannou (2016) document that colonial border design often partitioned ethnic groups in ways that shaped post-independence conflict. Another possibility is the spatial distribution of colonial infrastructure investments—railways, roads, and

related projects—highlighted in previous studies (e.g., Huillery 2009; Ricart-Huguet 2021; Jedwab et al. 2017), which link these investments to long-term economic and political outcomes. A further channel emphasized in the literature is the pattern of European settlement, shown by Acemoglu et al. (2001) and Huillery (2011) to have persistent effects on institutions and development. Christian missionary activities are well-known entities which fostered education and built health facilities in colonial Africa (e.g., Nunn et al. 2014; Cagé and Rueda 2020). We incorporate measures for each of these dimensions into our baseline specification, yet in all cases, Figure A.3 shows that our main results remain stable in magnitude and statistical significance.

**State capacity.** We next examine the role of "state capacity," proxied by distance to the capital city. This measure is motivated by evidence that distance to the seat of government is negatively associated with the provision of public goods and administrative reach (Michalopoulos and Papaioannou 2014; Campante and Do 2014). Once included in our regressions, this variable does not alter our main coefficient.

### Christian-Muslim difference

Could the main results simply be capturing differences between Christian and Muslim populations? In West Africa, the spatial distribution of the Christian population largely reflects missionary activities during the colonial period. They influenced not only religious affiliation, but also human capital (Nunn et al. 2014), culture and trust (Okoye 2021), and political engagement (Henn et al. 2025). Figure A.3 shows that our results are unchanged when we additionally control for proximity to historical mosques and missionary activities, which capture the relative dominance of Islam and Christianity across space. This suggests that the main results are not driven by differences in the religious composition of the population. Nevertheless, there are several areas relatively close to the coast where we observe a large number of jihad events in regions with a mixed presence of Christian and Muslim populations (e.g., Nigeria and Burkina Faso). To address this concern more directly, we restrict the sample to grid cells only in countries covering the Sahara (Mauritania; Mali; Niger; Chad), where the Muslim population share is almost 100% (recall Figure D.1). Figure A.4, and Table A.6 confirm the robustness of the main results with this restricted sample. This exercise also confirms that the main results are not solely driven by the large ancient Lake Chad or by the extreme concentration of jihad events associated with Boko Haram and the Islamic State in West Africa around northeastern Nigeria. Last but not least, all of these Sahara-covering countries were former French colonies, which rules out differences in colonial policies and institutions—particularly those between British and French rule (e.g., Ali et al. 2019)—as alternative explanations.

### General factors driving conflicts

One potential concern is that the IV regression result may not be due to the persistent effect of declined landlocked cities but due possibly to other unobserved structural factors that drive conflicts and violence around these locations. If this were the dominant mechanism, then we would also expect similar IV estimates for non-jihad conflict events. In order to address this concern, Table A.9 reports the result of IV regression with the same specification as the main empirical analysis except for changing the dependent variable to violent events involving non-state and non-jihadist organizations. For this test, we again select the countries covering the Sahara, not only to focus on Muslim-dominated areas for the same reason as above, but also to exclude coastal areas where clearly different types of conflicts (e.g., conflict in the Niger Delta) are taking place. This test works as a placebo test. For all of the three outcome variables (onset, intensity, and distance) in Table A.9, the coefficients are statistically insignificant and their sizes are also significantly smaller than those in the corresponding results with jihadist events reported in Table A.6.

Note that this contrast between jihadist and non-jihadist events does not mean that typical localized and contemporary factors underlying insurgency, such as economic and political factors, are not important for jihad. For example, as Decet and Marcucci (2023) also argue in detail, proximity to contemporary water sources has similar effects on jihadist events (column 3 of Table A.6) and non-jihadist events (column 3 of Table A.9). As another example, Dowd (2015) and Dowd and Raleigh (2013) point out that not only the global jihadist ideology but also domestic contexts, such as political marginalization and grievances, are important factors driving jihadist movements in West Africa. Benjaminsen and Ba (2019), through anecdotes and interviews taken in multiple cities in Mali, argue that local land-use conflicts lead pastoral groups to support or join jihadist groups. McGuirk and Nunn (2025) quantitatively show that droughts in Africa, through the mechanism that they disrupt the arrangement between transhumant pastoralists and sedentary agriculturalists, impact both jihadist and non-jihadist events similarly. Combining our findings with these research, it is apparent that both jihad-specific and general factors underlying insurgency matter to explain contemporary jihad. Quantifying relative importance of these factors and understanding local dynamics of jihad are important future research agendas.

### Other robustness checks

Finally, we provide various robustness checks using alternative data sources and inferences.

**Alternative measures of the ancient water access.** We further assess the robustness of our results using alternative IV measures, as illustrated in Figure A.5. In addition to the size-weighted measure of ancient water access defined in Section 4.1, we consider four alternative instruments based on the presence of lost ancient lakes, all of which exclude areas covered by contemporary

lakes. Specifically, we use: (i) the distance to the nearest lost ancient lake, without excluding contemporary rivers; (ii) a dummy equal to one if the area of lost ancient lakes within a grid cell is positive, again without excluding contemporary rivers; (iii) the distance to the nearest lost ancient lake after additionally excluding areas within a 1 km buffer of contemporary river lines; and (iv) a dummy equal to one if the area of lost ancient lakes within a grid cell is positive under the same river-exclusion criterion. Across all alternative IV specifications, the estimated effects are very similar to the main results in terms of onset, intensity, and distance outcomes, both in magnitude and statistical significance.

**Alternative measures of declined cities.** Figure A.4 confirms the robustness of main results under a stricter definition of the "decline", restricting to historical core cities with present-day populations below 50,000.[34] We further apply the same restriction within Muslim-dominated areas, thereby excluding not only the "Chad Lake effect" in Nigeria but also the "Timbuktu effect" in Mali. The results remain qualitatively unchanged. Note that the estimated effects are not simply driven by contemporary underdevelopment by controlling for contemporary population levels. Additionally, while Table A.1 shows that proximity to ancient lakes has a small and statistically insignificant effect on contemporary city formation, Figure A.3 also demonstrates that the results are robust when controlling for nightlight luminosity. This additional test further strengthens our argument, ruling out contemporaneous urbanization as a confounding factor.

**Uppsala Conflict Data Program Georeferenced Event Dataset (UCDP-GED).** We use the UCDP-GED, an alternative conflict event dataset, to check robustness of the main results where we used the ACLED. There are two key differences between these two datasets. First, the UCDP-GED contains conflict and violent events that caused at least 1 fatality with the pair of actors (including the one-sided violence, in which case "civilians" is another side of actors) involved in the conflict that caused at least 25 fatalities in at least one calendar year. Given that the ACLED contains events regardless of the number of fatalities, we check the robustness of our results with relatively severe events. Table A.8 confirms the robustness of main results. Surprisingly, restricting to the relatively severe events by construction of this data, we also find statistically significant effects of the historical trade points on contemporary jihad (1% for the distance and 5% for the other two measures) during 2001-2009, unlike the main results from the ACLED. Note also that the coefficient size for the distance is similar between 2001-2009 and 2010-2019 and that the coefficient sizes for the onset and intensity in 2001-2009 are smaller than those in 2010-2019.

**Adjusting for spatial auto-correlations.** To address spatial autocorrelation, we additionally controll for latitude and longitude and adjust the standard errors (Conley and Kelly 2025). Figure A.3 shows taht our estimates are robust even when controlling for latitude and longitude in both

[34]The results are also robust to a range of alternative population thresholds between 50,000 and 100,000, which are available upon request.

linear and quadratic forms. Moreover, Table A.7 reports standard errors allowing for spatial correlation with higher distance cutoffs (200km, 300km, 400km, 500km, and 1000km) for the main IV estimation results. The size of standard error is non-monotonic in the size of distance cutoff. The main results in terms of statistical significance are robust to different cutoffs. At the largest standard errors, the coefficients from the three main outcomes (distance, onset, and intensity) are statistically significant at 5% levels.

## 6.2 Global Perspective: Jihad in "Past-Core-and-Present-Periphery"

Why do jihadist activities emerge in some places but not in other places *within* the Islamic world? While the previous sections have focused on a local mechanism specific to West Africa, this section broadens the scope to examine whether the pattern of "past-core-and-present-periphery"—and the associated colonial legacies—extends globally. We observe that many contemporary hotspots of jihadist violence are located in regions that were historically central to overland trade and Islamic civilization but have since declined relative to modern geopolitical centers. Crucially, consistent with our proposed mechanism in West Africa, the transition of these regions from core to periphery was frequently cemented by colonial interventions that reshaped local power dynamics. This pattern advances the broader argument of reversal of fortune in Acemoglu et al. (2001, 2002), by linking historical reversals to the eruption of violent religious revivalism.

To provide an illustrative global perspective on this observation, we draw on global-scale information about historical overland trade routes from Michalopoulos et al. (2018), worldwide populations over the centuries from the History database of the Global Environment (Hyde), and contemporary jihadist events (2001-2019) from the Uppsala Conflict Data Program Georeferenced Event Dataset (UCDP GED) as this dataset contains conflict events in the entire world. Obviously, uncovering the causal relationship between past core locations (or present peripheral locations) and jihads in the global scale is beyond the scope of this paper, without exogenous time-variant natural geography to predict city formation, unlike in West Africa. It is nevertheless worth examining its correlation and case studies.

Figure 7 maps this information. We observe concentrations of jihadist events in Syria, Iraq, Afghanistan, and Pakistan.[35] While these countries are today often regarded as peripheral, they were historically core hubs of global overland trade networks. The following observations suggest that our findings from West Africa are consistent with the broader global pattern.

**The Levant: French Mandate and the Syrian Reversal.** Cities such as Damascus, Aleppo, Raqqa, and Deir ez-Zor constituted the historical centers of Sunni political, religious, and economic power—the country's "past core." During the Great Syrian Revolt (1925–27), these core

[35]The countries with the highest number of contemporary jihad events are, in descending order, as follows: Afghanistan, Syria, Iraq, Pakistan, Somalia, Nigeria, Algeria, Yemen, Philippines, and Mali.

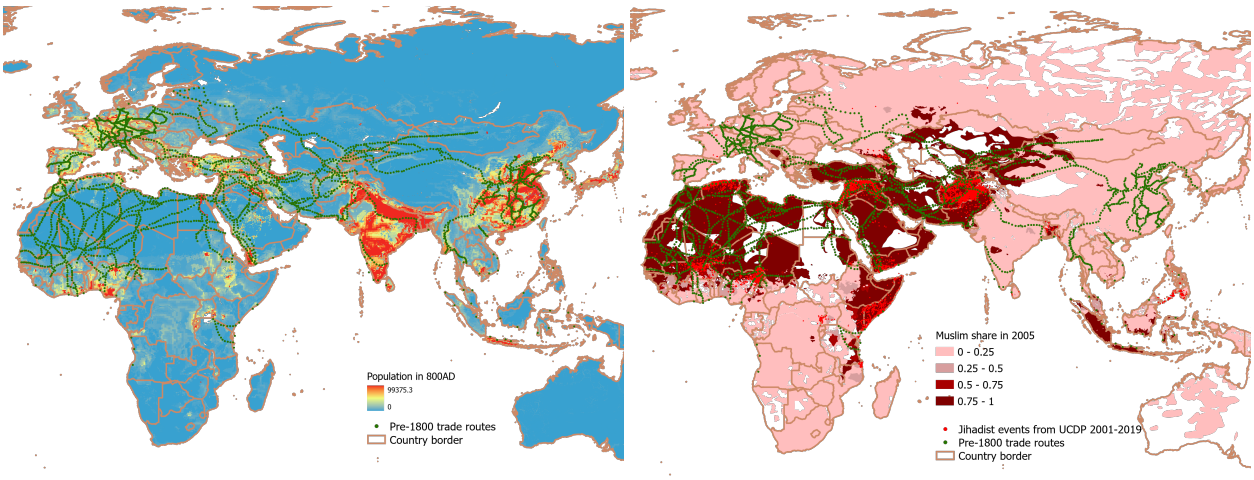



Figure 7: Historical Populations, Overland Trade, and Contemporary Islam and Jihad

*Notes*: Both panels show the overland trade routes up to 1800AD: the left panel adds population in 800AD (HYDE 3.1), while the right panel overlays the Muslim share in 2005 (World Religion Database) at ethnic homeland (Ethnologue 2005) together with contemporary jihadist violent events (UCDP GED).

areas, particularly Damascus, experienced intense repression by the French mandatory authorities (Provence 2005). The bombardment of Damascus and the prolonged counterinsurgency campaign not only caused extensive physical destruction but also produced profound psychological effects. As Khoury notes, "the physical and psychological exhaustion produced by nearly two years of full-scale rebellion led to a general demoralization of the Syrian masses" (Khoury 2014). This episode marked a decisive rupture in the political centrality of Syria's traditional urban core.

At the same time, the French Mandate fundamentally restructured the relationship between religion and political authority. During the interwar period, the influence of Sunni religious leaders was progressively eroded as Islamic institutions were brought under closer administrative control of the state (Khoury 2014). Through the regulation of waqf property, religious courts, and clerical appointments, Islam was not abolished but increasingly incorporated into a framework of state management. This transformation laid the foundations of what later scholars describe as a system of state-controlled Islam, a legacy that survived independence and was further consolidated under subsequent regimes.

In parallel, French military and administrative policies empowered peripheral social groups, most notably the Alawites, who were disproportionately recruited into the Troupes Spéciales du Levant—the colonial force that later evolved into the Syrian army (Khoury 2014; Dam 2011). This policy produced a long-term inversion of Syria's socio-political hierarchy: the historically dominant Sunni urban elite increasingly found themselves governed by a military establishment rooted in formerly marginal regions (Perlmutter 1969).

Under the Alawi-dominated Ba'thist regime, this inversion translated into a persistent pattern of Sunni political exclusion and grievance. As Dam (2011) emphasizes, Sunni opposition did not disappear but remained a recurrent and latent feature of Syrian politics, periodically surfacing under conditions of crisis. Over time, the persistent and deep-seated grievances help to fuel the resurgence of Sunni jihadist movements, which framed their violence not as a reaction to secularism but as an assault on an illegitimate, state-managed Islam and a sectarian political order (Naji 2006; Lister 2015).

While there is no direct empirical evidence, it is notable that the organization's principal strongholds emerged not in the heavily repressed urban cores of the Mandate period, but in eastern and peripheral regions such as Raqqa and Deir ez-Zor, with Raqqa serving as the Islamic State's de facto capital and Deir ez-Zor forming a key zone of territorial expansion, areas that historically lay outside the main theaters of colonial counterinsurgency (Provence 2005; Lister 2015). This spatial contrast between the heavily bombed urban core—most notably Damascus—and later jihadist strongholds in peripheral regions parallels the pattern observed in West Africa, where regions that did not experience decisive military defeat and political exhaustion later became the epicenters of contemporary Islamist insurgency. Together, this contrast suggests that the long-term weakening of the urban Sunni core—through wartime devastation, political demoralization, and the erosion of religious authority—combined with uneven state penetration in past-core-and-present-peripheral regions, may have shaped the terrain on which jihadist mobilization later became possible.

**Mesopotamia: British Legacy in Iraq.** Neighboring Iraq had similar experience over the centuries. In the 8th century, the rise of the Abbasid dynasty transformed Baghdad into a premier center of trade and Islamic culture. Bosker et al. (2013) point out that "In 800, only four decades after its founding, Baghdad had become a metropolis of more than 300,000 inhabitants... [and] the center of economic and political power in the Islam world." Later in 1920s, the British Mandate constructed a state that forced together diverse ethnic and sectarian groups—Sunni, Shia, and Kurd—under a centralized administration in Baghdad. The British relied heavily on the Sunni minority to staff the administration and military, institutionalizing a sectarian imbalance to govern the Shia majority (Dodge 2003; Fieldhouse 2006). This colonial reliance on a specific sect created a fragile state structure where political exclusion became a central feature of governance. Following the eventual collapse of this order in the post-2003 era, the former Sunni "core"—now marginalized and stripped of power (a "present periphery" in political terms)—became the primary breeding ground for insurgency and jihadist organizations like Al-Qaeda in Iraq and later the Islamic State.

**Afghanistan and Pakistan.** Afghanistan and Pakistan offer a parallel case of colonial distortion. Historically, the Pashtun areas served as a gateway for trade, and conquest into India. However, the British Empire, seeking to secure its Indian frontier against Russia during the "Great

Game" established the Durand Line in 1893. This artificial border bisected Pashtun tribal lands, transforming a historical center of connectivity into a marginalized borderland, later institutionalized as the Federally Administered Tribal Areas (FATA) (Hopkins, 2008). Although Afghanistan gained formal independence after successive wars against the British army, British policy after 1842 focused on isolating Afghanistan from imperial economic and political circuits rather than incorporating it into the colonial order (Hopkins 2008; Dalrymple 2013). The British "Forward Policy" further reinforced this isolation by leaving frontier regions intentionally underdeveloped and autonomously governed in order to function as a buffer zone. Periods from the late nineteenth century through the interwar and early Cold War years up to 1978 were largely characterized by political stability rather than continuous jihadist mobilization while Islamic revival movement occasionally occurred (Hopkins, 2008).

However, the Soviet invasion in 1979 triggered Afghan jihad, highlighting the importance of external shocks in reactivating latent ideological resources. As documented in existing scholarship, this mobilization was embedded in transnational flows of fighters, finance, and weapons shaped by Cold War geopolitics rather than arising solely from domestic conditions (Rashid 2002; Abbas 2014). This pattern aligns closely with our broader argument that large-scale jihadist mobilization emerges through the interaction between persistent ideological repertoires and major external shocks including invasion into land, foreign fighter inflows or arms transfers.

Pakistan followed a distinct yet complementary trajectory. Large parts of present-day Pakistan were directly incorporated into British India and thus experienced prolonged colonial rule, missionary activity, and administrative restructuring. After the failure of the 1857 rebellion, many Muslim religious leaders concluded that sustained rebellion against British rule was no longer viable and increasingly emphasized religious education, moral reform, and communal life rather than direct political confrontation (Metcalf, 2014).

During and after the Soviet–Afghan war, militant networks based not only in Pakistan's frontier zones but also in colonized interior regions supplied fighters, training, and ideological resources to jihad in Afghanistan. As existing scholarship emphasizes, Afghan jihad relied heavily on recruitment, sanctuary, and mobilization on the Pakistani side of the border (Kepel 2002; Rashid 2002). Taken together, these patterns suggest not that jihadist ideology persisted through continuous mobilization under colonial rule, but that religious institutions and ideological resources were not eradicated and could later be reactivated with external shocks.

**Takeaways.** These observations suggest that our findings from West Africa are consistent with a broader global pattern. To assess its generalizability, further research is needed to systematically examine the relationship between past prosperity, decline, and various forms of cultural revival, including both jihadist and non-jihadist violent movements, on a global scale.

# 7 Conclusion

This paper explores the origins and persistence of jihadist insurgencies in West Africa through the lens of historical geography, colonial disruption, and religious ideology. We demonstrate that contemporary jihadist violence is disproportionately concentrated in areas that were once central to Islamic political and economic life but have since become peripheral. These "past-core-and-present-periphery" regions illustrate the enduring influence of initial geographic advantage, even after its material importance has diminished. This pattern aligns with global phenomena of ideological revival in formerly prosperous but later marginalized regions.

A key mechanism underlying this persistence is the transmission of jihadist ideology as a legacy of European colonization. We argue that this legacy is shaped by both historical conflict and religious practice. In particular, the practice of *taqiyya*—concealment of one's beliefs in the face of threat—offers a powerful explanation for how ideological continuity could survive colonial suppression and later reemerge in culturally resonant ways. This mechanism is supported by multiple strands of evidence: individual-level survey data indicating extreme ideological views in historically significant regions, a dynamic model of conflict between colonizers and Islamic states, and the use of localized recruitment strategies by contemporary jihadist groups.

Together, these findings provide a unified framework for understanding the spatial persistence and ideological continuity of jihadist violence in post-colonial contexts, with implications for both historical political economy and contemporary security policy. Future research should further explore how historical legacies interact with contemporary political, social, and economic factors to shape patterns of conflict and ideological resurgence.

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# ONLINE APPENDIX

# Jihad over Centuries

**Masahiro Kubo & Shunsuke Tsuda**

## A Additional Figures and Tables



Figure A.1: Timbuktu

*Notes*: Salt (top-left), which has been used for various purposes (bottom-left), is still transported by caravan (top-right) even today. The bottom-right picture shows the Djinguereber mosque, which was broken by a jihadist group Ansar Dine in 2012. The top-left picture was taken by Daiki Kobayashi and the other three ones were taken by Shunsuke Tsuda in 2010, before the surge of Islamist insurgencies in Mali.

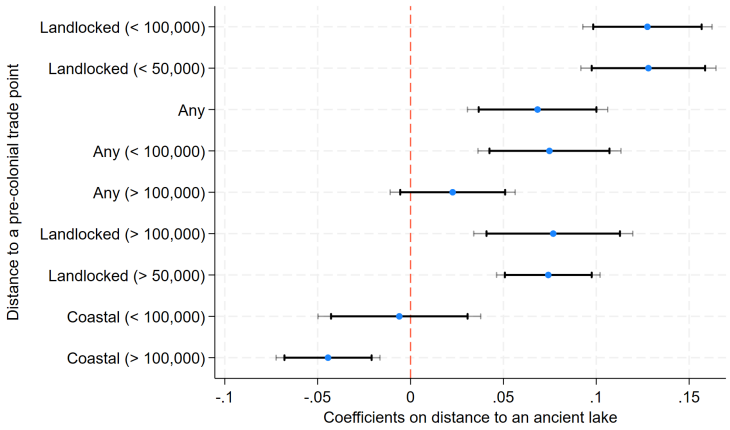



Figure A.2: Placebo First Stage—Ancient Water Sources and Historical Cities

*Notes*: All regressions are estimated using OLS. The unit of observation is a grid cell (about 55km × 55km). All distance variables indicate the logarithm of one plus distance (km) to the nearest object. The dependent variables are represented in the y-axis. Landlocked is defined as the 1000km faraway from the nearest coast point. We control for landlocked dummy, average malaria suitability, average caloric suitability in post 1500, average elevation, ruggedness, and logarithm of one plus population in 2010 in all the specifications. We use standard errors adjusting for spatial auto-correlation with the 100km cutoff, and the 95% confidence intervals are shown.

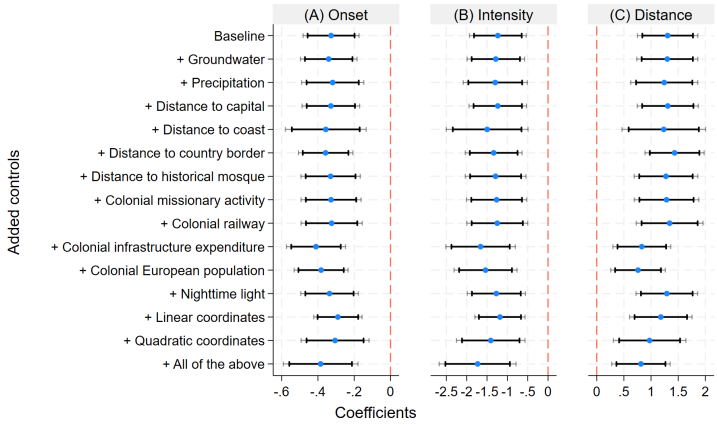



Figure A.3: Robustness Checks with Additional Controls

*Notes*: All regressions are estimated using an IV of logarithm of one plus distance (km) to the nearest ancient lake. The unit of observation is a grid cell (about 55km × 55km). The dependent variables are (A) a dummy which takes 1 if jihad occurred, (B) logarithm of one plus the number of jihadist events, and (C) logarithm of one plus distance (km) to the nearest jihadist event. The interest variable is the logarithm of one plus distance (km) to the nearest pre-colonial landlocked trade point whose contemporary population is less than 100,000, where landlocked is defined as the 1000km faraway from the nearest coast point. As a baseline, we control for landlocked dummy, average malaria suitability, average caloric suitability in post 1500, average elevation, ruggedness, and logarithm of one plus population in 2010 in all the specifications. We additionally control for groundwater availability, average precipitation today, distance to the capital, distance to the coast, distance to the country border, distance to the nearest historical mosque established before 1860, distance to the Christian missionary acitivity, distance to the colonial railway, infrastructure expenditures, and European population in the colonial period, the logarith of one plus nighttime luminocity in 2009, and latitude and longitude in both linear and quadratic forms, each entered separately as control variables (see Appendix C for variable definitions). Finally, we include all these variables jointly in the specification. We use standard errors adjusting for spatial auto-correlation with the 100km cutoff. The darker black lines represent 90% confidence intervals, whereas the lighter black lines represent 95% confidence intervals.

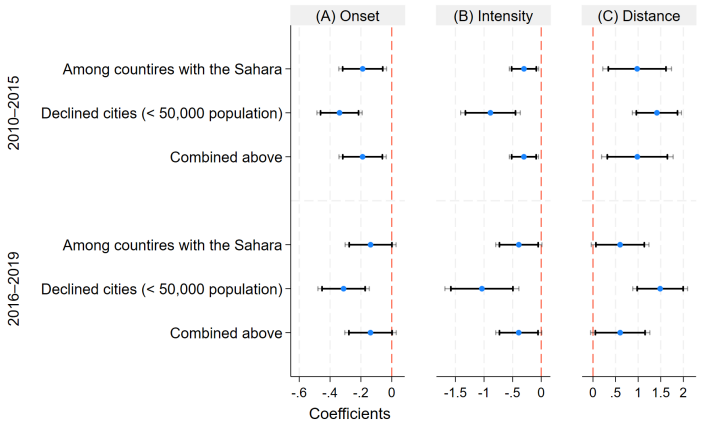



Figure A.4: Robustness Checks with Alternative Geographical Specifications

*Notes*: All regressions are estimated using an IV of logarithm of one plus distance (km) to the nearest ancient lake. The unit of observation is a grid cell (about 55km × 55km). The dependent variables are (A) a dummy which takes 1 if jihad occurred, (B) logarithm of one plus the number of jihadist events, and (C) logarithm of one plus distance (km) to the nearest jihadist event. In each panel and period, the top row reports results for grid cells located in countries that cover the Sahara (Mauritania; Mali; Niger; Chad). The middle row reports results using an interest variable defined as the logarithm of one plus distance (km) to the nearest pre-colonial landlocked trade point whose contemporary population is below 50,000. The bottom row reports results that combine both restrictions. We use standard errors adjusting for spatial auto-correlation with the 100km cutoff. The darker black lines represent 90% confidence intervals, whereas the lighter black lines represent 95% confidence intervals.

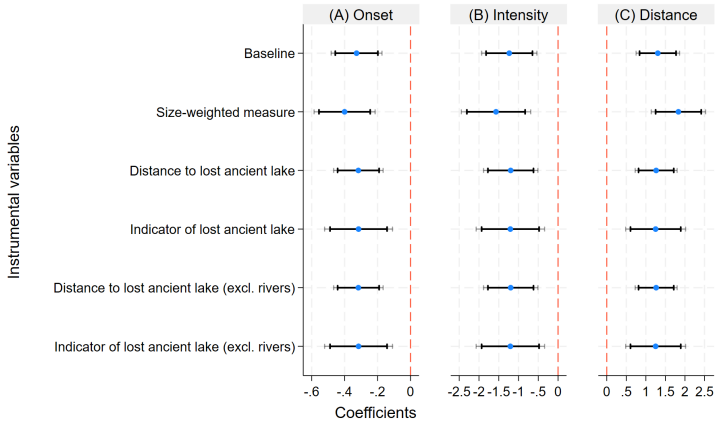



Figure A.5: Robustness Checks with Alternative IV Definitions

*Notes*: All regressions are estimated using alternative IVs. In addition to the logarithm of one plus distance (km) to the nearest ancient lake and a size-weighted measure of ancient water access, we employ two alternative definitions of lost ancient lakes and use both distance-based and indicator-based instruments. The first definition identifies areas where ancient lakes existed but no contemporary lakes remain; the corresponding instruments are the distance to the nearest such lost ancient lake and a dummy that takes a value of 1 if a grid cell lies in such an area. The second definition further restricts these areas to those where neither contemporary lakes nor rivers are present; again, we use the distance to the nearest such lost ancient lake and a dummy that takes a value of 1 if a grid cell lies in such an area. These are labeled as "lost ancient lake (excl. rivers)" in the figure. The unit of observation is a grid cell (about 55km × 55km). The dependent variables are (A) a dummy which takes 1 if jihad occurred, (B) logarithm of one plus the number of jihadist events, and (C) logarithm of one plus distance (km) to the nearest jihadist event. We use standard errors adjusting for spatial auto-correlation with the 100km cutoff. The darker black lines represent 90% confidence intervals, whereas the lighter black lines represent 95% confidence intervals.

Table A.1: Water Sources and Contemporary Cities

| **(A)** | **Log (Distance to a city ($>$ 50,000))** | |
|---|---|---|
| | (1) | (2) |
| Log (Distance to an ancient lake) | -0.0259 | -0.00935 |
| | (0.0212) | (0.0179) |
| Log (Distance to a lake/river today) | 0.346*** | 0.315*** |
| | (0.0254) | (0.0243) |
| $R^2$ | 0.660 | 0.730 |
| Adj-$R^2$ | 0.659 | 0.729 |
| Observations | 2616 | 2616 |
| Mean (Dep. Var.) | 4.497 | 4.497 |
| SD (Dep. Var.) | 1.167 | 1.167 |
| **(B)** | **Nightlight luminosity in 2015** | |
| | (1) | (2) |
| Log (Distance to an ancient lake) | 0.252*** | 0.140*** |
| | (0.0402) | (0.0467) |
| Log (Distance to a lake/river today) | -0.522*** | -0.439*** |
| | (0.0704) | (0.0643) |
| $R^2$ | 0.432 | 0.531 |
| Adj-$R^2$ | 0.430 | 0.529 |
| Observations | 2616 | 2616 |
| Mean (Dep. Var.) | 1.875 | 1.875 |
| SD (Dep. Var.) | 2.636 | 2.636 |
| Country FE | No | Yes |
| Geographic Controls | Yes | Yes |

*Notes*: All regressions are estimated using OLS. The unit of observation is a grid cell (about 55km × 55km). All Log(Distance) variables indicate the logarithm of one plus distance (km) to the nearest object. The dependent variables are (A) the logarithm of one plus distance (km) to the nearest city whose contemporary population over 50,000, and (B) the logarithm of one plus total night light luminosity (VIISR) in 2015. We control for landlocked dummy, average malaria suitability, average caloric suitability in post 1500, average elevation, and ruggedness in all the specifications. We report standard errors adjusting for spatial auto-correlation with distance cutoff at 100km in parentheses. $^{*}$ $p < 0.1$, $^{**}$ $p < 0.05$, $^{***}$ $p < 0.01$.

Table A.2: Reduced Form—Ancient Water Sources and Jihad

| **(A)** | | **Onset** | |
|---|---|---|---|
| | (1) | (2) | (3) |
| | All | 2001-09 | 2010-19 |
| Log (Distance to an ancient lake) | -0.0415*** | -0.000539 | -0.0418*** |
| | (0.00971) | (0.00173) | (0.00969) |
| Log (Distance to a lake/river today) | -0.0430*** | 0.00341 | -0.0465*** |
| | (0.0122) | (0.00318) | (0.0120) |
| $R^2$ | 0.328 | 0.027 | 0.338 |
| Adj-$R^2$ | 0.326 | 0.024 | 0.336 |
| Observations | 2616 | 2616 | 2616 |
| Mean (Dep. Var.) | 0.133 | 0.011 | 0.129 |
| SD (Dep. Var.) | 0.339 | 0.106 | 0.335 |
| **(B)** | | **Intensity** | |
| | (1) | (2) | (3) |
| | All | 2001-09 | 2010-19 |
| Log (Distance to an ancient lake) | -0.157*** | -0.00301 | -0.157*** |
| | (0.0448) | (0.00282) | (0.0448) |
| Log (Distance to a lake/river today) | -0.101*** | 0.00334 | -0.105*** |
| | (0.0333) | (0.00342) | (0.0331) |
| $R^2$ | 0.328 | 0.028 | 0.331 |
| Adj-$R^2$ | 0.326 | 0.025 | 0.329 |
| Observations | 2616 | 2616 | 2616 |
| Mean (Dep. Var.) | 0.249 | 0.011 | 0.244 |
| SD (Dep. Var.) | 0.775 | 0.109 | 0.771 |
| **(C)** | | **Distance** | |
| | (1) | (2) | (3) |
| | All | 2001-09 | 2010-19 |
| Log (Distance to an ancient lake) | 0.148*** | 0.0396 | 0.167*** |
| | (0.0312) | (0.0270) | (0.0303) |
| Log (Distance to a lake/river today) | 0.148*** | 0.0231 | 0.140*** |
| | (0.0395) | (0.0319) | (0.0397) |
| $R^2$ | 0.560 | 0.378 | 0.611 |
| Adj-$R^2$ | 0.559 | 0.376 | 0.610 |
| Observations | 2616 | 2616 | 2616 |
| Mean (Dep. Var.) | 4.816 | 5.698 | 4.932 |
| SD (Dep. Var.) | 1.101 | 0.743 | 1.157 |
| Country FE | Yes | Yes | Yes |
| Geographic Controls | Yes | Yes | Yes |

*Notes*: All regressions are estimated using OLS. The unit of observation is a grid cell (about 55km × 55km). The dependent variables are (A) dummy variables which take a value of 1 if jihad occurred during a period given in each column, otherwise take a value of 0, (B) logarithm of one plus the number of jihad events during a given period in each column, and (C) logarithm of one plus distance (km) to the nearest jihad during a period given in each column. All Log(Distance) variables indicate the logarithm of one plus distance (km) to the nearest object. Landlocked is defined as the 1000km faraway from the nearest coast point. We control for landlocked dummy, average malaria suitability, average caloric suitability in post 1500, average elevation, ruggedness, and logarithm of one plus population in 2010 in all the specifications. We report standard errors adjusting for spatial auto-correlation with distance cutoff at 100km in parentheses. $^{*}$ $p < 0.1$, $^{**}$ $p < 0.05$, $^{***}$ $p < 0.01$.

Table A.3: IV Estimates of the Effects of Historical Trade Cities on Historical Conflicts

| **(A)** | **Onset** | | | |
|---|---|---|---|---|
| | All | | Jihad | |
| | (1) | (2) | (3) | (4) |
| Log (Distance to a landlocked trade point (< 100,000)) | 0.0339* | | 0.000685 | |
| | (0.0189) | | (0.0142) | |
| Log (Distance to a landlocked trade route up to 1800) | | 0.0413 | | 0.000834 |
| | | (0.0275) | | (0.0174) |
| Observations | 2616 | 2616 | 2616 | 2616 |
| Mean (Dep. Var.) | 0.024 | 0.024 | 0.013 | 0.013 |
| SD (Dep. Var.) | 0.152 | 0.152 | 0.112 | 0.112 |
| **(B)** | **Duration** | | | |
| | All | | Jihad | |
| | (1) | (2) | (3) | (4) |
| Log (Distance to a landlocked trade point (< 100,000)) | 0.0907 | | 0.0349 | |
| | (0.0582) | | (0.0523) | |
| Log (Distance to a landlocked trade route up to 1800) | | 0.110 | | 0.0425 |
| | | (0.0830) | | (0.0670) |
| Observations | 2616 | 2616 | 2616 | 2616 |
| Mean (Dep. Var.) | 0.058 | 0.058 | 0.036 | 0.036 |
| SD (Dep. Var.) | 0.552 | 0.552 | 0.450 | 0.450 |
| **(C)** | **Distance** | | | |
| | All | | Jihad | |
| | (1) | (2) | (3) | (4) |
| Log (Distance to a landlocked trade point (< 100,000)) | -0.443* | | 0.248 | |
| | (0.227) | | (0.203) | |
| Log (Distance to a landlocked trade route up to 1800) | | -0.540 | | 0.301 |
| | | (0.394) | | (0.215) |
| Observations | 2616 | 2616 | 2616 | 2616 |
| Mean (Dep. Var.) | 5.397 | 5.397 | 5.612 | 5.612 |
| SD (Dep. Var.) | 0.896 | 0.896 | 0.802 | 0.802 |
| Colonizer FE | Yes | Yes | Yes | Yes |
| Geographic Controls | Yes | Yes | Yes | Yes |

*Notes*: All regressions are estimated using IV with logarithm of one plus distance (km) to the nearest ancient lake as an instrument. The unit of observation is a grid cell (about 55km × 55km). The dependent variables are dummy variables which take a value of 1 if any historical conflict, otherwise take a value of 0 (Onset), total duration years of historical conflicts in the unit of analysis (Duration), and logarithm of one plus distance (km) to the nearest historical conflict (Distance). The interest variables are the logarithm of one plus distance (km) to the nearest pre-colonial landlocked trade point whose contemporary population is less than 100,000 in columns (1) and (3), and the logarithm of one plus distance (km) to the nearest pre-colonial landlocked trade route up to 1800 in columns (2) and (4). We control for the logarithm of distance (km) to the nearest water sources today, landlocked dummy, average malaria suitability, average caloric suitability in post 1500, average elevation, and ruggedness in all the specifications. We report standard errors adjusting for spatial auto-correlation with distance cutoff at 100km in parentheses. $^{*}$ $p < 0.1$, $^{**}$ $p < 0.05$, $^{***}$ $p < 0.01$.

Table A.4: IV Estimates on Relative Contemporary Jihad Locations to Historical Jihad

| | Distance | | Log (Distance) | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Log (Distance to a landlocked trade point (< 100,000)) | 0.412*** | | 0.154*** | |
| | (0.148) | | (0.0467) | |
| Log (Distance to a landlocked trade route up to 1800) | | 0.309*** | | 0.115*** |
| | | (0.108) | | (0.0296) |
| Log (Distance to a lake/river today) | -0.0308 | -0.0268 | 0.0215*** | 0.0230*** |
| | (0.0527) | (0.0526) | (0.00758) | (0.00723) |
| Country FE | Yes | Yes | Yes | Yes |
| Observations | 2616 | 2616 | 2616 | 2616 |
| Mean (Dep. Var.) | 0.818 | 0.818 | 0.884 | 0.884 |
| SD (Dep. Var.) | 1.154 | 1.154 | 0.202 | 0.202 |

*Notes*: All regressions are estimated using IV with logarithm of one plus distance (km) to the nearest ancient lake as an instrument. The unit of observation is a grid cell (about 55km × 55km). The dependent variable is distance (km) to the nearest contemporary jihad (2010-2019) divided by distance (km) to the nearest historical jihad. Likewise, we calculate the relative distance by taking log for each distance. The interest variables are the logarithm of one plus distance (km) to the nearest pre-colonial landlocked trade point whose contemporary population is less than 100,000 in columns (1) and (3), and the logarithm of one plus distance (km) to the nearest pre-colonial landlocked trade route up to 1800 in columns (2) and (4). We control for landlocked dummy, average malaria suitability, average caloric suitability in post 1500, average elevation, and ruggedness in all the specifications. We report standard errors adjusting for spatial auto-correlation with distance cutoff at 100km in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A.5: Historical Trade Networks and Historical Mosques

| | Log distance to historical mosque before | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 1860 | | | | 1900 | | | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Log (Distance to a landlocked trade point (< 100,000)) | -0.129 | 0.362** | | | -0.154 | 0.368** | | |
| | (0.218) | (0.181) | | | (0.219) | (0.181) | | |
| Log (Distance to a landlocked trade route up to 1800) | | | -0.158 | 0.272** | | | -0.187 | 0.276** |
| | | | (0.292) | (0.135) | | | (0.299) | (0.136) |
| Observations | 2616 | 2616 | 2616 | 2616 | 2616 | 2616 | 2616 | 2616 |
| Mean (Dep. Var.) | 5.196 | 5.196 | 5.196 | 5.196 | 5.181 | 5.181 | 5.181 | 5.181 |
| SD (Dep. Var.) | 0.887 | 0.887 | 0.887 | 0.887 | 0.894 | 0.894 | 0.894 | 0.894 |
| Colonizer FE | Yes | No | Yes | No | Yes | No | Yes | No |
| Country FE | No | Yes | No | Yes | No | Yes | No | Yes |
| Geographic Controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

*Notes*: All regressions are estimated using IV with logarithm of one plus distance (km) to the nearest ancient lake as an instrument. The unit of observation is a grid cell (about 55km × 55km). The dependent variables are the logarithm of one plus distance (km) to the nearest historical mosque built before 1860 (columns 1–4), and before 1900 (columns 5–8). All Log(Distance) variables indicate the logarithm of one plus distance (km) to the nearest object. Landlocked is defined as the 1000km faraway from the nearest coast point. We control for the logarithm of distance (km) to the nearest water sources today, landlocked dummy, average malaria suitability, average caloric suitability in post 1500, average elevation, and ruggedness in all the specifications. We report standard errors adjusting for spatial auto-correlation with distance cutoff at 100km in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A.6: IV Estimates of Persistent Effects on Jihad within Countries with the Sahara

| **(A)** | | | | **Log(Distance)** | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| | 2010-19 | 2010-15 | 2016-19 | 2010-19 | 2010-15 | 2016-19 |
| Log (Distance to a landlocked trade point (< 100,000)) | 0.575* | 0.978** | 0.600* | | | |
| | (0.337) | (0.388) | (0.326) | | | |
| Log (Distance to a landlocked trade route up to 1800) | | | | 0.421** | 0.717*** | 0.440** |
| | | | | (0.202) | (0.210) | (0.194) |
| Log (Distance to a lake/river today) | 0.217*** | 0.128* | 0.277*** | 0.217*** | 0.129*** | 0.278*** |
| | (0.0632) | (0.0722) | (0.0573) | (0.0497) | (0.0488) | (0.0441) |
| Observations | 1616 | 1616 | 1616 | 1616 | 1616 | 1616 |
| Mean (Dep. Var.) | 5.038 | 5.270 | 5.333 | 5.038 | 5.270 | 5.333 |
| SD (Dep. Var.) | 1.114 | 0.961 | 1.157 | 1.114 | 0.961 | 1.157 |
| **(B)** | | | | **Onset** | | |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| | 2010-19 | 2010-15 | 2016-19 | 2010-19 | 2010-15 | 2016-19 |
| Log (Distance to a landlocked trade point (< 100,000)) | -0.139* | -0.188** | -0.137 | | | |
| | (0.0841) | (0.0790) | (0.0842) | | | |
| Log (Distance to a landlocked trade route up to 1800) | | | | -0.102* | -0.138** | -0.101 |
| | | | | (0.0610) | (0.0568) | (0.0619) |
| Log (Distance to a lake/river today) | -0.0791*** | -0.0643*** | -0.0895*** | -0.0792*** | -0.0645*** | -0.0896*** |
| | (0.0176) | (0.0194) | (0.0171) | (0.0155) | (0.0158) | (0.0150) |
| Observations | 1616 | 1616 | 1616 | 1616 | 1616 | 1616 |
| Mean (Dep. Var.) | 0.110 | 0.051 | 0.095 | 0.110 | 0.051 | 0.095 |
| SD (Dep. Var.) | 0.312 | 0.220 | 0.293 | 0.312 | 0.220 | 0.293 |
| **(C)** | | | | **Intensity** | | |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| | 2010-19 | 2010-15 | 2016-19 | 2010-19 | 2010-15 | 2016-19 |
| Log (Distance to a landlocked trade point (< 100,000)) | -0.458** | -0.301** | -0.392* | | | |
| | (0.224) | (0.131) | (0.206) | | | |
| Log (Distance to a landlocked trade route up to 1800) | | | | -0.336** | -0.221** | -0.287* |
| | | | | (0.164) | (0.0934) | (0.153) |
| Log (Distance to a lake/river today) | -0.200*** | -0.0888*** | -0.184*** | -0.201*** | -0.0891*** | -0.185*** |
| | (0.0482) | (0.0284) | (0.0436) | (0.0403) | (0.0233) | (0.0373) |
| Observations | 1616 | 1616 | 1616 | 1616 | 1616 | 1616 |
| Mean (Dep. Var.) | 0.186 | 0.070 | 0.154 | 0.186 | 0.070 | 0.154 |
| SD (Dep. Var.) | 0.619 | 0.355 | 0.551 | 0.619 | 0.355 | 0.551 |
| Country FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Geographic Controls | Yes | Yes | Yes | Yes | Yes | Yes |

*Notes*: All regressions are estimated using IV with logarithm of one plus distance (km) to the nearest ancient lake as an instrument. The unit of observation is a grid cell (about 55km × 55km). The dependent variables are (A) logarithm of one plus distance (km) to the nearest jihad during a period given in each column, (B) dummy variables which take a value of 1 if jihad occurred during a period given in each column, otherwise take a value of 0, (C) logarithm of one plus the number of jihad events during a given period in each column. All Log(Distance) variables indicate the logarithm of one plus distance (km) to the nearest object. The interest variables are the logarithm of one plus distance (km) to the nearest pre-colonial landlocked trade point whose contemporary population is less than 100,000 in columns (1)-(3), and the logarithm of one plus distance (km) to the nearest pre-colonial landlocked trade route up to 1800 in columns (4)-(6). Landlocked is defined as the 1000km faraway from the nearest coast point. We control for the logarithm of distance (km) to the nearest water sources today, landlocked dummy, average malaria suitability, average caloric suitability in post 1500, average elevation, ruggedness, and logarithm of one plus population in 2010 in all the specifications. We report standard errors adjusting for spatial auto-correlation with distance cutoff at 100km in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A.7: Robustness to Spatial-Autocorrelation

| **(A)** | | **Onset** | | |
|---|---|---|---|---|
| | | (1) | (2) | (3) |
| | | 2010-19 | 2010-15 | 2016-19 |
| Log (Distance to a landlocked trade point ($<$ 100,000)) | | -0.327 | -0.340 | -0.314 |
| | *200km cutoff* | [0.125]*** | [0.121]*** | [0.142]** |
| | *300km cutoff* | [0.134]** | [0.132]** | [0.155]** |
| | *400km cutoff* | [0.122]*** | [0.121]*** | [0.140]** |
| | *500km cutoff* | [0.102]*** | [0.102]*** | [0.116]*** |
| | *1000km cutoff* | [0.108]*** | [0.0927]*** | [0.121]*** |
| Observations | | 2616 | 2616 | 2616 |
| Mean (Dep. Var.) | | 0.129 | 0.071 | 0.100 |
| SD (Dep. Var.) | | 0.335 | 0.258 | 0.301 |
| **(B)** | | | **Intensity** | |
| | | (1) | (2) | (3) |
| | | 2010-19 | 2010-15 | 2016-19 |
| Log (Distance to a landlocked trade point ($<$ 100,000)) | | -1.234 | -0.892 | -1.042 |
| | *200km cutoff* | [0.576]** | [0.425]** | [0.540]* |
| | *300km cutoff* | [0.613]** | [0.449]** | [0.570]* |
| | *400km cutoff* | [0.558]** | [0.419]** | [0.510]** |
| | *500km cutoff* | [0.474]*** | [0.364]** | [0.429]** |
| | *1000km cutoff* | [0.474]*** | [0.339]*** | [0.425]** |
| Observations | | 2616 | 2616 | 2616 |
| Mean (Dep. Var.) | | 0.244 | 0.118 | 0.188 |
| SD (Dep. Var.) | | 0.771 | 0.520 | 0.668 |
| **(C)** | | | **Distance** | |
| | | (1) | (2) | (3) |
| | | 2010-19 | 2010-15 | 2016-19 |
| Log (Distance to a landlocked trade point ($<$ 100,000)) | | 1.306 | 1.421 | 1.493 |
| | *200km cutoff* | [0.466]*** | [0.415]*** | [0.515]*** |
| | *300km cutoff* | [0.525]** | [0.445]*** | [0.595]** |
| | *400km cutoff* | [0.520]** | [0.420]*** | [0.598]** |
| | *500km cutoff* | [0.498]*** | [0.388]*** | [0.573]*** |
| | *1000km cutoff* | [0.588]** | [0.427]*** | [0.666]** |
| Observations | | 2616 | 2616 | 2616 |
| Mean (Dep. Var.) | | 4.932 | 5.211 | 5.264 |
| SD (Dep. Var.) | | 1.157 | 1.021 | 1.180 |
| Country FE | | Yes | Yes | Yes |
| Geographic Controls | | Yes | Yes | Yes |

*Notes*: All regressions are estimated using IV with logarithm of the Ancient Water Access as an instrument. The unit of observation is a grid cell (about 55km × 55km). The dependent variables are (A) dummy variables which take a value of 1 if jihad occurred during a period given in each column, otherwise take a value of 0, (B) logarithm of one plus the number of jihad events during a given period in each column, and (C) logarithm of one plus distance (km) to the nearest jihad during a period given in each column. All Log(Distance) variables indicate the logarithm of one plus distance (km) to the nearest object. Landlocked is defined as the 1000km faraway from the nearest coast point. The interest variables are the logarithm of one plus distance (km) to the nearest pre-colonial landlocked trade point whose contemporary population is less than 100,000 in columns (1)-(3). We control for landlocked dummy, average malaria suitability, average caloric suitability in post 1500, average elevation, ruggedness, and logarithm of one plus population in 2010 in all the specifications. We report standard errors adjusting for spatial auto-correlation with distance cutoffs in brackets. $^{*}$ $p < 0.1$, $^{**}$ $p < 0.05$, $^{***}$ $p < 0.01$.

Table A.8: IV Estimates of Persistent Effects on Jihad (UCDP)

| **(A)** | | | | **Onset** | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| | All | 2001-09 | 2010-19 | All | 2001-09 | 2010-19 |
| Log (Distance to a landlocked trade point (< 100,000)) | -0.363*** | -0.0840** | -0.374*** | | | |
| | (0.0808) | (0.0406) | (0.0814) | | | |
| Log (Distance to a landlocked trade route up to 1800) | | | | -0.273*** | -0.0631** | -0.281*** |
| | | | | (0.0588) | (0.0300) | (0.0591) |
| Log (Distance to a lake/river today) | -0.0463*** | -0.000444 | -0.0468*** | -0.0470*** | -0.000607 | -0.0476*** |
| | (0.0120) | (0.00362) | (0.0121) | (0.0107) | (0.00407) | (0.0108) |
| Observations | 2616 | 2616 | 2616 | 2616 | 2616 | 2616 |
| Mean (Dep. Var.) | 0.123 | 0.015 | 0.120 | 0.123 | 0.015 | 0.120 |
| SD (Dep. Var.) | 0.328 | 0.123 | 0.325 | 0.328 | 0.123 | 0.325 |
| **(B)** | | | | **Intensity** | | |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| | All | 2001-09 | 2010-19 | All | 2001-09 | 2010-19 |
| Log (Distance to a landlocked trade point (< 100,000)) | -1.248*** | -0.0827** | -1.250*** | | | |
| | (0.354) | (0.0402) | (0.355) | | | |
| Log (Distance to a landlocked trade route up to 1800) | | | | -0.937*** | -0.0621** | -0.938*** |
| | | | | (0.236) | (0.0295) | (0.236) |
| Log (Distance to a lake/river today) | -0.0747** | -0.00109 | -0.0746** | -0.0771** | -0.00125 | -0.0770** |
| | (0.0368) | (0.00358) | (0.0368) | (0.0319) | (0.00405) | (0.0318) |
| Observations | 2616 | 2616 | 2616 | 2616 | 2616 | 2616 |
| Mean (Dep. Var.) | 0.217 | 0.013 | 0.214 | 0.217 | 0.013 | 0.214 |
| SD (Dep. Var.) | 0.712 | 0.112 | 0.708 | 0.712 | 0.112 | 0.708 |
| **(C)** | | | | **Distance** | | |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| | All | 2001-09 | 2010-19 | All | 2001-09 | 2010-19 |
| Log (Distance to a landlocked trade point (< 100,000)) | 1.322*** | 1.112*** | 1.473*** | | | |
| | (0.270) | (0.214) | (0.280) | | | |
| Log (Distance to a landlocked trade route up to 1800) | | | | 0.992*** | 0.834*** | 1.105*** |
| | | | | (0.175) | (0.138) | (0.184) |
| Log (Distance to a lake/river today) | 0.159*** | 0.0685** | 0.155*** | 0.162*** | 0.0706** | 0.158*** |
| | (0.0396) | (0.0275) | (0.0412) | (0.0341) | (0.0291) | (0.0343) |
| Observations | 2616 | 2616 | 2616 | 2616 | 2616 | 2616 |
| Mean (Dep. Var.) | 4.959 | 5.866 | 5.070 | 4.959 | 5.866 | 5.070 |
| SD (Dep. Var.) | 1.099 | 0.779 | 1.169 | 1.099 | 0.779 | 1.169 |
| Country FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Geographic Controls | Yes | Yes | Yes | Yes | Yes | Yes |

*Notes*: All regressions are estimated using IV with logarithm of one plus distance (km) to the nearest ancient lake as an instrument. The unit of observation is a grid cell (about 55km × 55km). In this table, the jihadistic events data comes from Uppsala Conflict Data Program (UCDP) in 2001-2019. The dependent variables are (A) dummy variables which take a value of 1 if jihad occurred during a period given in each column, otherwise take a value of 0, (B) logarithm of one plus the number of jihad events during a given period in each column, and (C) logarithm of one plus distance (km) to the nearest jihad during a period given in each column. All Log(Distance) variables indicate the logarithm of one plus distance (km) to the nearest object. Landlocked is defined as the 1000km faraway from the nearest coast point. The interest variables are the logarithm of one plus distance (km) to the nearest pre-colonial landlocked trade point whose contemporary population is less than 100,000 in columns (1)-(3), and the logarithm of one plus distance (km) to the nearest pre-colonial landlocked trade route up to 1800 in columns (4)-(6). We control for landlocked dummy, average malaria suitability, average caloric suitability in post 1500, average elevation, ruggedness, and logarithm of one plus population in 2010 in all the specifications. We report standard errors adjusting for spatial auto-correlation with distance cutoff at 100km in parentheses. $^{*}$ $p < 0.1$, $^{**}$ $p < 0.05$, $^{***}$ $p < 0.01$.

Table A.9: IV Estimates of Persistent Effects on Non-Jihad within Countries with the Sahara

| **(A)** | | | | **Onset** | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| | All | 2001-09 | 2010-19 | All | 2001-09 | 2010-19 |
| Log (Distance to a landlocked trade point (< 100,000)) | 0.0185 | 0.132* | -0.0732 | | | |
| | (0.0947) | (0.0711) | (0.0826) | | | |
| Log (Distance to a landlocked trade route up to 1800) | | | | 0.0136 | 0.0967* | -0.0537 |
| | | | | (0.0691) | (0.0547) | (0.0640) |
| Log (Distance to a lake/river today) | -0.0397* | 0.0168 | -0.0613*** | -0.0397* | 0.0169 | -0.0614*** |
| | (0.0217) | (0.0142) | (0.0190) | (0.0217) | (0.0143) | (0.0198) |
| Observations | 1616 | 1616 | 1616 | 1616 | 1616 | 1616 |
| Mean (Dep. Var.) | 0.166 | 0.062 | 0.130 | 0.166 | 0.062 | 0.130 |
| SD (Dep. Var.) | 0.372 | 0.242 | 0.336 | 0.372 | 0.242 | 0.336 |
| **(B)** | | | | **Intensity** | | |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| | All | 2001-09 | 2010-19 | All | 2001-09 | 2010-19 |
| Log (Distance to a landlocked trade point (< 100,000)) | 0.137 | 0.201 | -0.0391 | | | |
| | (0.193) | (0.126) | (0.153) | | | |
| Log (Distance to a landlocked trade route up to 1800) | | | | 0.100 | 0.148 | -0.0287 |
| | | | | (0.140) | (0.0967) | (0.114) |
| Log (Distance to a lake/river today) | -0.0953** | 0.0368 | -0.133*** | -0.0951** | 0.0370 | -0.133*** |
| | (0.0462) | (0.0234) | (0.0393) | (0.0457) | (0.0235) | (0.0396) |
| Observations | 1616 | 1616 | 1616 | 1616 | 1616 | 1616 |
| Mean (Dep. Var.) | 0.256 | 0.085 | 0.194 | 0.256 | 0.085 | 0.194 |
| SD (Dep. Var.) | 0.676 | 0.383 | 0.590 | 0.676 | 0.383 | 0.590 |
| **(C)** | | | | **Distance** | | |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| | All | 2001-09 | 2010-19 | All | 2001-09 | 2010-19 |
| Log (Distance to a landlocked trade point (< 100,000)) | -0.259 | -0.867*** | 0.00606 | | | |
| | (0.275) | (0.309) | (0.248) | | | |
| Log (Distance to a landlocked trade route up to 1800) | | | | -0.190 | -0.636** | 0.00444 |
| | | | | (0.203) | (0.260) | (0.182) |
| Log (Distance to a lake/river today) | 0.138*** | 0.0857 | 0.201*** | 0.138*** | 0.0848 | 0.201*** |
| | (0.0500) | (0.0619) | (0.0447) | (0.0500) | (0.0575) | (0.0447) |
| Observations | 1616 | 1616 | 1616 | 1616 | 1616 | 1616 |
| Mean (Dep. Var.) | 4.433 | 5.047 | 4.576 | 4.433 | 5.047 | 4.576 |
| SD (Dep. Var.) | 0.930 | 0.934 | 0.892 | 0.930 | 0.934 | 0.892 |
| Country FE | Yes | Yes | Yes | Yes | Yes | Yes |
| Geographic Controls | Yes | Yes | Yes | Yes | Yes | Yes |

*Notes*: All regressions are estimated using IV with logarithm of one plus distance (km) to the nearest ancient lake as an instrument. The unit of observation is a grid cell (about 55km × 55km). The observations restrict grid cells in Mauritania, Mali, Niger and Chad. The dependent variables are (A) dummy variables which take a value of 1 if non-jihadist event occurred during a period given in each column, otherwise take a value of 0, (B) logarithm of one plus the number of non-jihadist events during a given period in each column, and (C) logarithm of one plus distance (km) to the nearest non-jihadist event during a period given in each column. All Log(Distance) variables indicate the logarithm of one plus distance (km) to the nearest object. Landlocked is defined as the 1000km faraway from the nearest coast point. The interest variables are the logarithm of one plus distance (km) to the nearest pre-colonial landlocked trade point whose contemporary population is less than 100,000 in columns (1)-(3), and the logarithm of one plus distance (km) to the nearest pre-colonial landlocked trade route up to 1800 in columns (4)-(6). We control for landlocked dummy, average malaria suitability, average caloric suitability in post 1500, average elevation, ruggedness, and logarithm of one plus population in 2010 in all the specifications. We report standard errors adjusting for spatial auto-correlation with distance cutoff at 100km in parentheses. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

# B Construction of Historical States

Cultures of West Africa creates the maps that show spatial locations of historical states before colonization as well as modern countries after independence by using multiple sources of references. They provide maps about state landscapes from 0 AD to 1980 AD. We digitized maps for historical states from 1330 AD to 1914 AD just after colonization conquest, using Arc GIS. Figure B.1 and Figure B.2 shows our digitized maps.

To identify which states consist of Muslims predominantly, we rely on Kasule (1998) (p.58) and Ruthven et al. (2004) (p.74-75) that show the extent of Islam circa 1800 AD and locations of states. However, Mossi state and Kong state extended out of Islamic extent. Hence, we rely on additional resources to judge if they were Islamic states. According to Azarya (1980) (p.425), since Kong state was ruled by Muslim, we judge it as the Islamic state. On the other hand, according to Skinner (1958) (p. 1102), since Mossi state was pagan until European conquests, it was not the Islamic state.

# C Additional Data Sources and Variables

## Pre-Colonial Variables

The pre-colonial variables we use are defined as follows.

**Cities in 1400.** Indicator for whether a city with a population larger than 200,000 in 1400 was in a given area. Source: Chandler (1987).

**Population in 800.** We use the History Database of the Global Environment (HYDE, version 3.1) constructed by Klein Goldewijk et al. (2010).

**Historical Islamic states.** The indicator which takes a value of one if a grid cell locates in historical Islamic states (given by Appendix B), otherwise takes a value of 0. If a grid cell strands in both Islamic states and Non-Islamic states, we assign the state information with larger size in a grid cell.

**Jurisdictional hierarchy.** We use "Jurisdictional Hierarchy beyond the Local Community" (v33) in *Ethnographic Atlas*. This is an ordered variable which indicates 1. "No political authority beyond local community (e.g., autonomous bands and villages)," 2. "One level (e.g., petty chiefdoms)," 3."Two levels (e.g., larger chiefdoms)," 4."Three levels (e.g., states)," and 5."Four levels (e.g., large states)."

**Polygamy.** We use "Marital composition: monogamy and polygamy" (v9) in *Ethnographic Atlas*. This is a categorical variable which indicates 1. "Monogamous," 2. "Polygynous, with polygyny occasional or limited," 3."Polygynous, with polygyny common and preferentially sororal, and co-wives not reported to occupy separate quarters," 4."Polygynous, with polygyny common and preferentially sororal, and co-wives typically occupying separate quarters," 5."Polygynous, with polygyny general and not reported to be preferentially sororal, and co-wives typically occupying separate quarters," 6. "Polygynous, with polygyny general and not reported to be preferentially sororal, and co-wives not reported to occupy separate quarters," and 7."Polyandrous." For our analyses, we use an indicator variable which takes a value of 0 if the categorical variable takes a value of either 0 or 7, otherwise takes a value of 1.

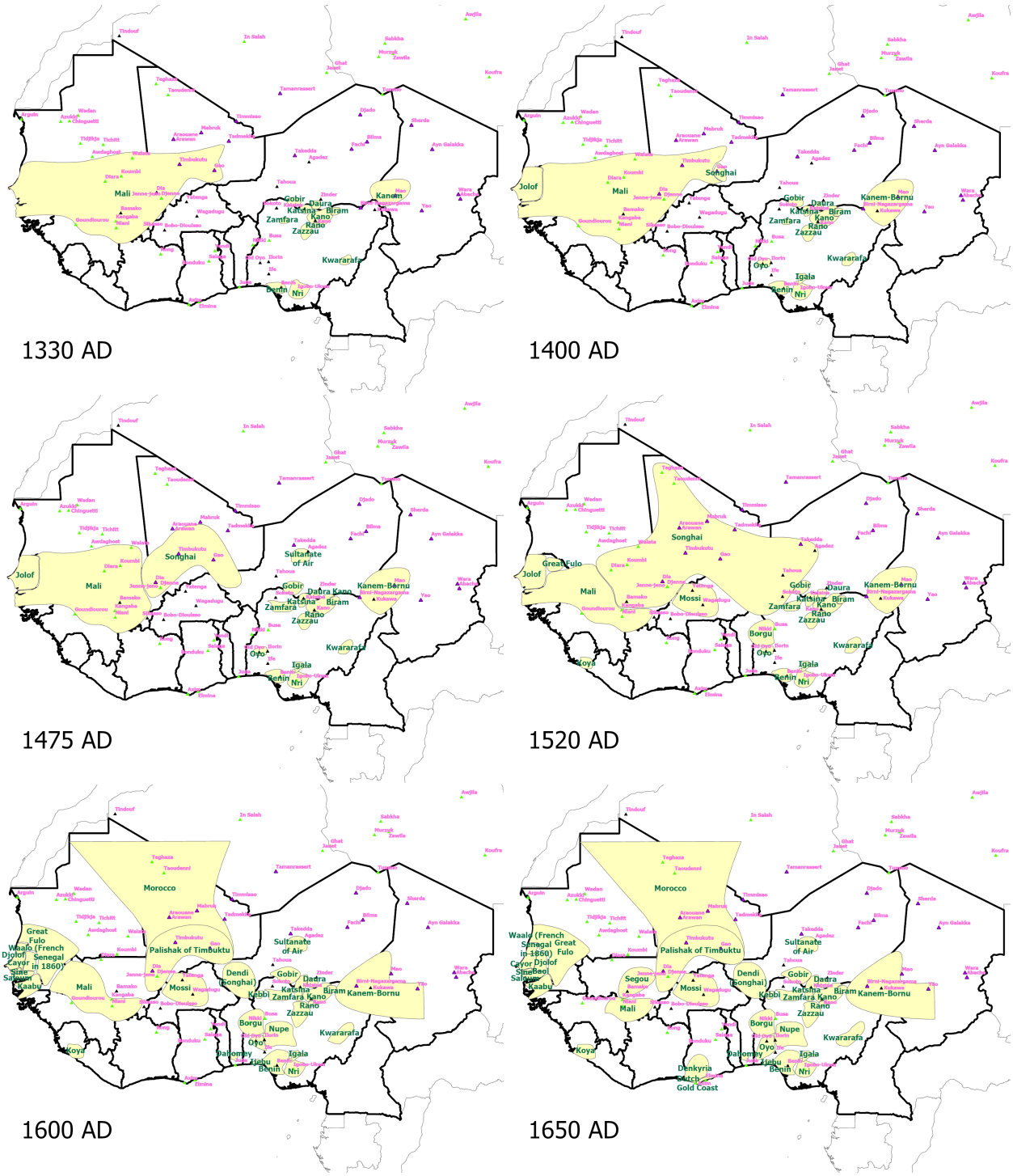



Figure B.1: Historical States over the Centuries

*Notes*: These maps show the evolution of historical states from 1330 AD to 1650 AD. Yellow regions indicate historical states. We digitize the maps from Cultures of West Africa. The purple triangles indicate pre-colonial inland trade points with less than 100,000 population today, the yellow green triangles indicate pre-colonial coastal trade points with less than 100,000 population today, and the black triangles indicate the other pre-colonial trade points.

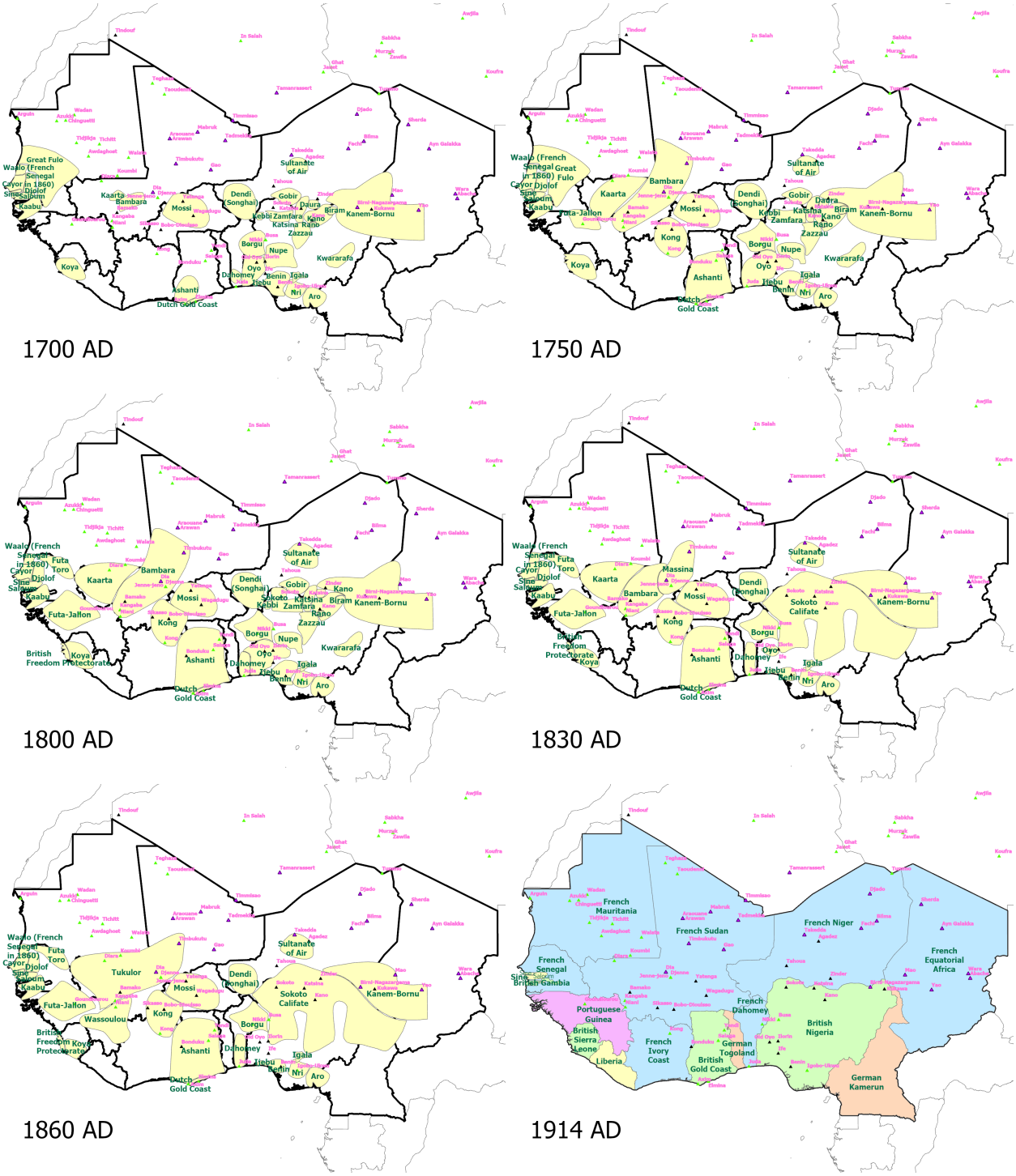



Figure B.2: Historical States over the Centuries (cont'd)

*Notes*: These maps show the evolution of historical states from 1700 AD to 1914 AD. Yellow regions indicate historical states before 1860 AD. In 1914 AD, the light blue regions indicate the French territory, the light green regions indicate British territory, the light purple region indicates Portuguese territory, the light orange regions indicate German territory, and the yellow regions indicate independent states. We digitize the maps from Cultures of West Africa. The purple triangles indicate pre-colonial inland trade points with less than 100,000 population today, the yellow green triangles indicate pre-colonial coastal trade points with less than 100,000 population today, and the black triangles indicate the other pre-colonial trade points.

**Irrigation.** We use "Agriculture: intensity" (v28) in *Ethnographic Atlas*. This is an ordered variables which indicates 1. "Complete absence of agriculture," 2. "Casual agriculture, i.e., the slight or sporadic cultivation of food or other plants incidental to a primary dependence upon other subsistence practices," 3."Extensive or shifting cultivation, as where new fields are cleared annually, cultivated for a year or two, and then allowed to revert to forest or brush for a long fallow period," 4."Horticulture, i.e., semi-intensive agriculture limited mainly to vegetable gardens or groves of fruit trees rather than the cultivation of field crops," 5."Intensive agriculture on permanent fields, utilizing fertilization by compost or animal manure, crop rotation, or other techniques so that fallowing is either unnecessary or is confined to relatively short periods," and 6."Intensive cultivation where it is largely dependent upon irrigation." For our analyses, we use an indicator variable which takes a value of 1 if the ordered variable takes a value of 6, otherwise takes a value of 0.

**Class stratification.** We use "Class differentiation: primary" (v66) in *Ethnographic Atlas*. This is a categorical variable which indicates 1. "Absence of significant class distinctions among freemen (slavery is treated in EA070), ignoring variations in individual repute achieved through skill, valor, piety, or wisdom," 2. "Wealth distinctions, based on the possession or distribution of property, present and socially important but not crystallized into distinct and hereditary social classes," 3."Elite stratification, in which an elite class derives its superior status from, and perpetuates it through, control over scarce resources, particularly land, and is thereby differentiated from a property-less proletariat or serf class," 4."Dual stratification into a hereditary aristocracy and a lower class of ordinary commoners or freemen, where traditionally ascribed noble status is at least as decisive as control over scarce resources," and 5."Complex stratification into social classes correlated in large measure with extensive differentiation of occupational statuses." For our analyses, we use an ordered variable which takes a value of 0 if the categorical variable takes a value of 1, and takes a value of 1 if the categorical variable takes a value of 1otherwise takes a value of either 2 or 3, otherwise takes a value of 2.

**Local headman.** We use "Political succession" (v72) in *Ethnographic Atlas*. This is a categorical variable which indicates 1. "Patrilineal heir," 2. "Matrilineal heir," 3."Nonhereditary succession through appointment by some higher authority," 4."Nonhereditary succession on the basis primarily of seniority or age," 5."Nonhereditary succession through influence, e.g., of wealth or social status," 6."Nonhereditary succession through election or some other mode of formal consensus," 7."Nonhereditary succession through informal consensus," and 8."Absence of any office resembling that of a local headman." For our analyses, we use an indicator variable which takes a value of 1 if the categorical variable takes a value of either 6 or 7, otherwise takes a value of 0.

**Atlantic slave exports.** The logarithm of one plus the number of the Atlantic slave trade exports at ethnic homeland in the 1700s and 1800s. Source: Nunn (2008).

**Gun access.** To capture pre-colonial gun access, we construct a quantity-weighted measure of gun access, $\sum_w \frac{GunImports_w}{Distance_{ow}}$, where $Distance_{ow}$ is the distance from grid cell $o$ to the nearest coastal trading location $w$. The underlying data on gun imports are drawn from Inikori (1977), specifically *Appendix II, An analysis of 111 trading voyages made from England to West Africa between 1757 and 1806, showing names of the vessels, year of voyage, destination in West Africa and the quantity of guns carried.* For each destination, we aggregate the total number of guns shipped across all recorded voyages between 1757 and 1806, and use this cumulative quantity to weight gun access.

The destination list in Inikori (1977) occasionally refers to broad regional categories rather than

specific ports (e.g., Senegambia, Gambia, Windward Coast, Sierra Leone, Gold Coast, Benin, and Cameroon). In such cases, we assign a representative coastal trading location that was central to Anglo–African commerce during the late eighteenth century. Specifically, we map Senegambia to Saint-Louis, Gambia to Bintang, the Windward Coast to Assinie-Mafia, Sierra Leone to Sherbro Island, the Gold Coast to Cape Coast Castle, Benin to Ouidah, and Cameroon to Bimbia. Latitude and longitude coordinates for these locations are obtained from Wikipedia and GeoNames.

**Historical mosques.** We use the logarithm of one plus distance (km) from the centroid of each grid cell to the nearest historical mosque established before 1860 and before 1900. The underlying data are drawn from Pradines (2022), specifically *Annex 2: Inventory and Atlas of Historical Mosques in Sub-Saharan Africa Listed by Contemporary States*. This annex provides maps with regional labels as well as a consolidated list of place names associated with historical mosques. We rely exclusively on the list of places rather than the regional names displayed on the maps, as the latter do not necessarily correspond to locations that actually contain historical mosques (for example, Accra in Ghana appears as a regional label despite the absence of a documented historical mosque).

On pages 3–4, Pradines (2022) defines "historical mosques" as African mosques constructed before 1920. However, among the place names that appear in the annexed list, several mosques are explicitly described in the main text as having been built after 1920 (for example, Doumga Ouro Alfa, discussed on page 109). To address this inconsistency and to focus on pre-colonial mosques, we focus on the mosques before 1860 and before 1900 and cross-checked mosque construction dates using available web-based sources, including Wikipedia, Archnet, and the Islamic Architectural Heritage Database.

Each place name in the annexed list is interpreted as indicating the presence of at least one historical mosque, rather than a precise count or geolocated inventory of individual structures. For instance, for N'Djamena, the main text (p. 144) notes that "according to a nineteenth-century Arabic manuscript, the mosques of N'Djamena, the new capital of the region, amounted to 38." Nevertheless, the annexed list records only "N'Djamena" without any further subdivision or enumeration of mosque locations within the city. Given this aggregation and the lack of consistent information on the number and exact locations of mosques within each place, we do not construct a count of historical mosques at the grid-cell level. Instead, we use the distance to the nearest historical mosque as our primary measure.

## Colonial Variables

The colonial variables we use are defined as follows.

**Distance to a mission station.** The logarithm of one plus distance (km) to the nearest mission station from a centroid of each grid cell. Source: Nunn (2010).

**Distance to a colonial railway.** The logarithm of one plus distance (km) to the nearest colonial railway from a centroid of each grid cell. Source: Nunn and Wantchekon (2011).

**Infrastructure expenditures.** The logarithm of total expenditures (in 1910–1940) on construction, transportation, sewage and electricity adjusted to 1910 French francs at colonial district level. Source: Ricart-Huguet (2021).[36]

[36]We thank Joan Ricart-Huguet for sharing the shape file of historical administrative boundaries in West Africa.

**European population.** The logarithm of European population at colonial district level in the 1920s-1930s. Source: Ricart-Huguet (2021).

## Geographical Variables

The geographical variables we use are defined as follows.

**Distance to water sources today.** The minimum distance to either river or lakes from a unit of analysis. The source of river centerlines and lakes come from Natural Earth, "Rivers + lake centerlines" version4.1.0. and from HydroLAKES, respectively.

**Elevation.** Mean elevation within a given area in kilometers. Source: Four Tiles: "GT30W020N40," "GT30E020N40," "GT30W020S10," and "GT30E020S10" from GTOPO30.

**Agricultural suitability.** Mean land quality for agriculture within a given area. Source: Michalopoulos (2012).

**Pastoralism suitability** The average suitability within the unit of analysis, calculated based on nomadic pastoralism suitability from Beck and Sieber (2010).

**Caloric suitability.** The average caloric suitability (1000 Cal) within the unit of analysis. Source: Galor and Özak (2015), Galor and Özak (2016) and Galor et al. (2017).

**Ecological diversity.** Ecological diversity constructed by Fenske (2014).

**Temperature.** The average temperature within the unit of analysis for the period 2001-2017, calculated based on Terrestrial Air Temperature: 1900-2017 Gridded Monthly Time Series (V 5.01) from Matsuura and Willmott (2018).

**Precipitation.** The average precipitation within the unit of analysis for the period 2001-2017, calculated based on Terrestrial Precipitation: 1900-2017 Gridded Monthly Time Series (V 5.01) from Matsuura and Willmott (2018).

**Groundwater availability.** The share of each cell with groundwater depth ranging from 0 to 50 meters. Source: MacDonald et al. (2012).

**Malaria suitability.** Mean malaria suitability index within a given area. Source: Sachs et al. (2004)

**Distance to the coast.** The logarithm of one plus distance (km) to the nearest coastal point from a centroid of each grid cell. Source: Natural Earth. "Coastline" version 4.1.0.

**Ruggedness.** Index of terrain ruggedness as constructed by Nunn and Puga (2012) for cells at 30 arc-second resolution. The variable used in the analysis is the average value of the index within the unit of analysis.

**Coordinates.** The coordinates—latitude and longitude—of each grid cell centroid are defined according to the World Geodetic System 1984 (WGS84).

## Contemporary Variables

The contemporary variables we use are defined as follows.

**Contemporary cities.** We have two sets of contemporary cities. As the first contemporary city data, we use Urban Centre Database UCDB R2019A. This database identifies the cities with over 50,000 population in 2015 all over the world and provides their geolocations.

**Nighttime lights.** We rely on two data sources. One of data sources comes from the Visible Infrared Imaging Radiometer Suite (VIIRS), which covers from 2012 to 2020. The other comes from

the Defense Meteorological Satellite Program'(DMSP) s Operational Linescan System, which covers from 1992 to 2013. [37]

**Distance to the capital.** The logarithm of one plus distance (km) from each grid cell centroid to the capital of its country. Source: United Nations (2018)

**Distance to the country border.** The logarithm of one plus distance (km) from each grid cell centroid to the nearest country border. Source: Source: Natural Earth. "Admin 0 – Countries" version 4.1.0.

**Ethnologue.** World Language Mapping System (WLMS) Database maps the location of ethnic groups' homelands. It maps the traditional homelands which correspond to the ones covered by the 15th edition of Ethnologue (2005). However, the WLMS does not map in the following: populations away from their homelands (e.g., in cities, refugee populations, etc.), immigrant languages, ethnic groups of unknown location, widespread ethnicities (i.e., groups whose boundaries are essentially identical to a countries boundary) and extinct languages. We match between Ethnologue and WRD based on the unique Ethnologue identifier for each ethnic group within a country.[38]

**Muslims in 2005.** World Religion Database (WRD) provides us with fractions of Muslims at ethnic group level within a country in 2005.

**Population.** WorldPop datasets provide approximately 100m$\times$100m cell-level estimated population density (Tatem 2017). See Stevens et al. (2015) and Lloyd et al. (2019) for the technical detail for constructing this dataset. From this raw data, we construct approximately 1km$\times$1km cell-level estimated population density in the both countries.

**Alternative conflict events data.** Additional data on conflict comes from Uppsala Conflict Data Program Georeferenced Event Dataset Version 21.1 (UCDP GED) (Croicu and Sundberg 2013; Pettersson and Öberg 2020; Pettersson et al. 2021; Sundberg and Melander 2013). The UCDP GED codes geo-locations of events, times of events, and names of conflict actors which engage in each event, covering the period between 1989 and 2020. We follow a similar strategy as what we did with the ACLED to pick jihadist organizations.

## Afrobarometer

We use respondents in West African countries available in rounds 6 and 7. The West African countries include Benin, Burkina Faso, Cabo Verde, Cameroon, Côte d'Ivoire, Gambia (round 7 only), Ghana, Guinea, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone and Togo. Round 6 was surveyed between 2014 and 2015. Round 7 was surveyed between 2016 and 2018. The variables we use are defined as follows.

**Age.** A respondent's age. Survey questions: Q1 (rounds 6 and 7).

**Female.** An indicator for female respondents. Survey questions: Q101 (rounds 6 and 7).

**Education.** The ten categories of educational attainment. They are classified as "no formal schooling," "Informal schooling only," "Some primary schooling," "Primary school completed," "Some secondary school/high school," "Secondary school completed/high school," "Post-secondary qualifications, not univ," "Some university," "University completed," or "Post-graduate." Survey questions: Q97 (rounds 6 and 7).

[37] The detailed explanations and discussions about the night light luminosity data can be found in Chen and Nordhaus (2015), Elvidge et al. (2021), Gibson et al. (2020), and Gibson et al. (2021)

[38] There are fifteen groups which cannot be matched to WRD. For the ethnic groups, we utilize the percent of each religion from Joshua Project.

**Living conditions.** The five categories of present living conditions. They are classified as "Very Bad," "Fairly bad," "Neither good nor bad," "Fairly good," or "Very good." Survey questions: Q4B (rounds 6 and 7).

**Religion.** A respondent's religion was asked in Q98A (round 6) and Q98 (round 7). They are condensed as "Christian," "Muslim," or "Other" in the variable "RELIG_COND" of rounds 6 and 7. We use the variable to restrict the sample to Muslim respondents.

**Neighbors from different religion.** A respondent was asked whether she would like having people of a different religion as neighbors, dislike it, or not care. A respondent chose one of the following answers: 1."Strongly dislike," 2."Somewhat dislike," 3."Would not care," 4."Somewhat like," or 5."Strongly like." We use the variable which takes the values of 1 through 5 as a dependent variable. Survey questions: Q89A (round 6) and Q87A (round 7). In Table 7, we re-scaled the variable to the following for the clearer interpretation of the results: 1."Strongly like," 2."Somewhat like," 3."Would not care," 4."Somewhat dislike," and 5."Strongly like."

**Governed by religious law.** A respondent was asked which of the following statements is closest to her view: "Our country should be governed primarily by religious law" (Statement 1) or "Our country should be governed only by civil law" (Statement 2). A respondent chose one of the following answers: 1."Agree very strongly with statement 2," 2."Agree with statement 2," 3."Agree with neither," 4."Agree with statement 1," or 5."Agree very strongly with statement 1." We use the variable which takes the values of 1 through 5 as a dependent variable. Survey question: Q65 (round 7).

**Equal opportunities to education.** A respondent was asked whether she disagrees or agrees with the following statement: "In our country today, girls and boys have equal opportunities to get an education." A respondent chose one of the following answers: 1."Strongly disagree," 2."Disagree," 3. "Neither agree nor disagree," 4."Agree," or 5."Strongly agree." We use the variable which takes the values of 1 through 5 as a dependent variable. Survey question: Q77A (round 7). In Table 7, we re-scaled the variable to the following for the clearer interpretation of the results: 1."Strongly agree," 2."Agree," 3."Neither agree nor disagree," 4."Disagree," and 5."Strongly disagree."

# D Appendix for Heterogeneity across Jihadist Organizations

Recall that the left map of Figure D.1 shows violence events by jihadist groups in West Africa. Table D.1 lists groups affiliated with Al Qaeda and the Islamic State, the two largest factions under global competition. Drawing directly from Mapping Millitants Project (MMP), we list stated ideologies and goals of major jihadist organizations below.

**Al Qaeda.** "Al Qaeda aims to rid the Muslim world of Western influence, to destroy Israel, and to create an Islamic caliphate stretching from Spain to Indonesia that imposes strict Sunni interpretation of Shariah law."

**The Islamic State.** "The Islamic State's ideology is rooted in Salafism—a fundamentalist movement within Sunni Islam—and Jihadism—a modern interpretation of the Islamic concept of struggle, often used in the context of defensive warfare...Salafis believe the most pure, virtuous form of Islam was practiced by the early generation of Muslims (known as Salaf) who lived around the lifetime of the prophet Muhammed...Since its inception, the Islamic State has sought to establish an Islamic caliphate based on its Salafi philosophy and fundamentalist interpretation of

Shariah law."

**AQIM: Al Qaeda in the Islamic Maghreb.** "The group's main focus was the overthrow of the Algerian government and establishment of an Islamic caliphate in the Maghreb that would enforce Shariah law...expanded this goal in the early 2000s to include the overthrow of the governments of Mauritania, Morocco, Tunisia, and Mali, and the reclamation of lost Islamic lands in southern Spain."

**Ansar Dine.** "Ansar Dine was a Salafi-jihadist group that aimed to establish Shariah law across Mali and targeted western civilians, especially peacekeepers in Mali. Ansar Dine's ideology closely mirrored that of AQIM, which came to view Ansar Dine as its southern arm in Mali. Unlike the MNLA, Ansar Dine did not seek independence for northern Mali but rather a country unified under Islam."

**Ansaroul Islam.** "Ansaroul Islam's main goal is allegedly to reconquer and rebuild Djeelgodji, an ancient Fulani empire that disappeared after French colonization in the late 19th century...Ansaroul Islam interacts closely with AQ front groups and affiliates in North Africa; Ansaroul Islam activity has purportedly created a front allowing AQ to achieve its primary aim—inspiring Muslims globally to attack enemies of Islam—in Burkina Faso."

**JNIM: Group for Support of Islam and Muslims.** "The group's goals and ideological basis are closely aligned with those of AQIM, and it seeks to build up a Salafi-Islamist state while restoring the caliphate. The merger of various AQ-affiliates into the JNIM was consistent with AQ's new operational focus on "unity" as a means to fully and effectively implement Shariah law in areas where the jihadists previously had not possessed complete control."

**MUJAO: Movement for Unity and Jihad in West Africa.** "MUJAO's stated goal was to engage in and encourage the spread of jihad in West Africa, as well as establish Shariah law in the region...MUJAO's ideology and goals closely mirrored those of AQ and AQIM, the group it broke off from."

**Al Mulathamun Battalion.** "Despite its split from AQIM, the AMB claimed to remain loyal to the ideology and command of Al Qaeda Central. The militant group aimed to spread jihad through all of the Sahara and impose Shariah law in North Africa."

**Islamic State in the Greater Sahara.** "The ISGS draws much of its strategic direction and ideological goals from the IS. As an affiliate of the Islamic State, the ISGS has pledged loyalty to the IS's goal of restoring the Islamic caliphate."

**Boko Haram.** "Boko Haram, which translates roughly to "Western education is forbidden," is a Sunni Islamist militant organization that opposes Western education and influence in Nigeria. Its founder Mohammad Yusuf...originally followed and preached the Izala doctrine, which advocates the establishment of a Muslim society that follows the lessons of its pious ancestors. After his initial radicalization in 2002, Yusuf's ideology evolved and radicalized into a philosophy that rejected all Western and secular aspects of Nigerian society. Boko Haram originally advocated a doctrine of withdrawal from society but did not aim to overthrow the Nigerian government. Yusuf's death and increased conflict with the Nigerian government in 2009 sparked the political opposition and violent campaign that Boko Haram became known for. Under the leadership of Abubakar Shekau and Abu Musab al-Barnawi, the group sought to establish an Islamic caliphate to replace the Nigerian government."

Table D.1: Jihadist Organizations in West Africa Affiliated with Al Qaeda and the Islamic State

| Al Qaeda-affiliated groups | IS-affiliated groups |
|---|---|
| AQIM: Al Qaeda in the Islamic Maghreb | Islamic State in West Africa |
| Ansar Dine | Islamic State in the Greater Sahara |
| Ansaroul Islam | |
| JNIM: Group for Support of Islam and Muslims | |
| MUJAO: Movement for Unity and Jihad in West Africa | |
| Katiba Macina | |
| Al Mourabitoune Battalion | |
| GMA: Mourabitounes Group of Azawad | |
| Ansaru | |
| Katiba Salaheddine | |
| MIA: Islamic Movement of Azawad | |

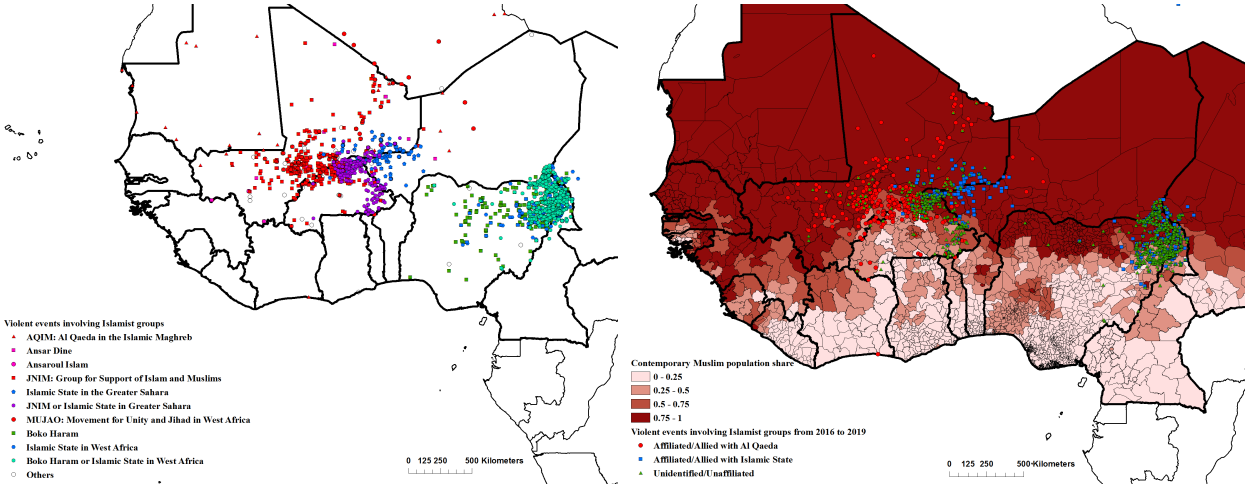



Figure D.1: Contemporary Muslim Population and Jihad in West Africa

*Notes*: The left map shows violence and conflict events by all identified jihadist/Islamist groups in West Africa from 2001 to 2019. The right map shows contemporary Muslim population and violence and conflict events by groups affiliated with Al Qaeda and the Islamic State from 2016 to 2019 (because the split occurred in 2015). Sources: ACLED and the World Religion Database.

Table D.2: Market Access and Jihadist Violence by Major Organizations

| | log (Number of Jihadist Violence) | | | | | |
|---|---|---|---|---|---|---|
| | Al Qaeda | | Islamic State | | Boko Haram | |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| log (ILMA) | -0.00554** | -0.00321 | 0.0256*** | 0.0171*** | 0.0454*** | 0.0286*** |
| | (0.00225) | (0.00213) | (0.00404) | (0.00369) | (0.00561) | (0.00497) |
| log (ITA) | -0.0189*** | 0.00409 | -0.0591*** | -0.143*** | -0.0831*** | -0.249*** |
| | (0.00734) | (0.0102) | (0.00826) | (0.0181) | (0.00888) | (0.0224) |
| log (Population) | | -0.0109*** | | 0.0399*** | | 0.0789*** |
| | | (0.00397) | | (0.00559) | | (0.00768) |
| Country × Year FE | Yes | Yes | Yes | Yes | Yes | Yes |
| $R^2$ | 0.307 | 0.307 | 0.069 | 0.075 | 0.052 | 0.069 |
| Adjusted $R^2$ | 0.299 | 0.299 | 0.059 | 0.064 | 0.041 | 0.058 |
| Mean (Dep. Var.) | 0.020 | 0.020 | 0.018 | 0.018 | 0.024 | 0.024 |
| SD (Dep. Var.) | 0.194 | 0.194 | 0.185 | 0.185 | 0.209 | 0.209 |
| Observations | 15320 | 15320 | 15320 | 15320 | 15320 | 15320 |

*Notes*: Robust standard errors in parentheses. The sample includes all districts in West Africa from 2010 to 2019. Other controls include district area size. ITA ≡ Insurgent's Target Market Access. ILMA ≡ Insurgent's Labor Market Access.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

# E Conflict Catalogue

In this section, we construct conflict confrontation sample between European actors and historical states from conflict catalogue. We match conflict actors in the database with historical states in 1860 from Cultures of West Africa by using online resources.[39] We follow the procedures below:

1. We match a historical state with a conflict actor by its name (direct match).

2. If a state name cannot be found in conflict catalogue, we match by its alternate names or spellings (alternate name match). Matched conflicts must occur following the establishment years.

However, Brecke (1999) includes many conflicts that indicate only larger ethnic groups (e.g., Fulani) or larger areas (e.g., Sierra Leone) that may have been related to historical states. As additional sources, we make use of information about locations of conflict from Fenske and Kala (2017) and Boxell et al. (2019). Fenske and Kala (2017) provides the information about conflicts between 1700 and 1900. Regarding conflicts after 1901, we use digitized information by ourselves, using web sources (e.g., wikipedia and google maps).

Below Table E.1 lists up all the conflicts related to historical states in West Africa from Brecke (1999).[40]

[39] We mainly depend on wikipedia, and Joshua Project.

[40] We exclude the following conflicts from the list since they are not identified in alternative sources: "France-England (Benin), 1792", "Nikki-France (Borgou, Benin), 1916" and "Adja-France (Mono, Benin), 1918-19".

Table E.1: Colonial Conflicts in West Africa involving Historical States

| Historical State | Islamic | European Enemy | Start Year | End Year |
|---|---|---|---|---|
| Djolof | N | Portugal | 1697 | 1697 |
| Ashanti | N | Britain | 1711 | 1712 |
| Dahomey | N | Britain | 1727 | 1729 |
| Ashanti | N | Denmark | 1742 | 1742 |
| Ashanti | N | Denmark | 1743 | 1743 |
| Ashanti | N | Britain | 1823 | 1826 |
| Ijebu | N | Britain | 1851 | 1851 |
| Tukulor | Y | France | 1854 | 1861 |
| Saloum | N | France | 1856 | 1858 |
| Koya | N | Britain | 1861 | 1861 |
| Futa Toro | Y | France | 1862 | 1862 |
| Ashanti | N | Britain | 1863 | 1864 |
| Cayor | N | France | 1864 | 1864 |
| Dahomey | N | Britain | 1864 | 1865 |
| Ashanti | N | Britain | 1865 | 1865 |
| Ashanti | N | Britain | 1868 | 1869 |
| Cayor | N | France | 1869 | 1869 |
| Ashanti | N | Britain | 1873 | 1874 |
| Futa Toro | Y | France | 1875 | 1875 |
| Dahomey | N | Britain | 1878 | 1878 |
| Wassoulou | Y | France | 1881 | 1888 |
| Wassoulou | Y | France | 1885 | 1886 |
| Wassoulou | Y | France | 1888 | 1891 |
| Dahomey | N | France | 1889 | 1890 |
| Dahomey | N | France | 1892 | 1893 |
| Ashanti | N | Britain | 1893 | 1894 |
| Wassoulou | Y | France | 1894 | 1895 |
| Ashanti | N | Britain | 1895 | 1896 |
| Benin | N | Britain | 1897 | 1897 |
| Wassoulou | Y | France | 1898 | 1898 |
| Kanem-Bornu | Y | France | 1899 | 1901 |
| Ashanti | N | Britain | 1900 | 1903 |
| Aro | N | Britain | 1901 | 1901 |
| Kanem-Bornu | Y | Britain | 1902 | 1902 |
| Kanem-Bornu | Y | Britain | 1902 | 1902 |
| Sokoto Califate | Y | Britain | 1903 | 1903 |
| Sokoto Califate | Y | Britain | 1906 | 1906 |
| Ijebu | N | Britain | 1912 | 1913 |
| Benin | N | France | 1914 | 1914 |
| Benin | N | France | 1915 | 1916 |
| Wassoulou | Y | France | 1915 | 1915 |
| Wassoulou | Y | France | 1916 | 1916 |

*Note:* The names of the historical states come from Culture of West Africa. Y indicates a state is Islamic and N indicates it is not. The two conflicts against Britain in 1902 involving with Kanem-Bornu are not the same.

# F Strategies against Colonization

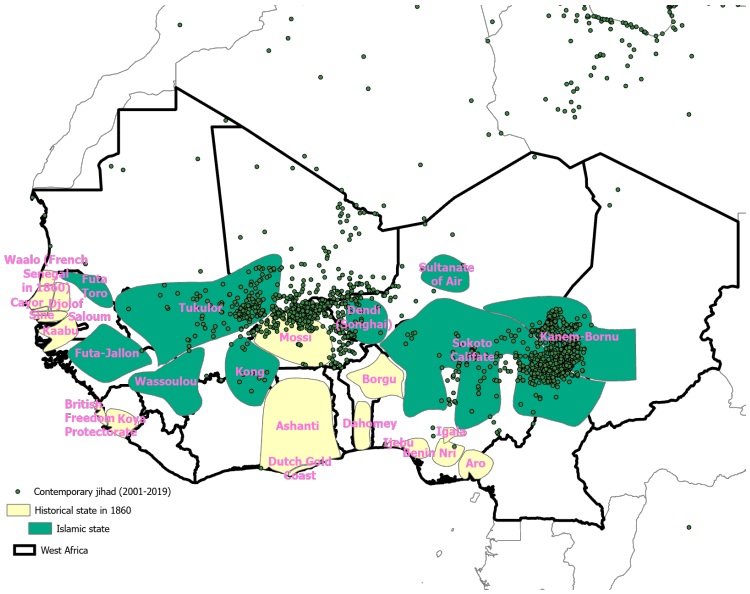



Figure F.1: Islamic States in 1860 and Contemporary Jihad
(Source: ACLED and Cultures of West Africa)

**Futa Toro.** The leader of Tukulor empire, Ahmadu, recruited *talibés* (i.e., students of religion who formed the backbone of his father's army) from Futa Toro (Boahen 1985 p.120).

**Futa Jallon.** Futa Jallon resistance to French expansion relied on the use of diplomacy rather than military measures (McGowan 1981, p.246).

**Kong Empire.** Kong empire was destroyed in 1895 by Samori who accused of soliciting French protection (Azarya 1980 p.434).

**Sokoto Califate.** The Sokoto Caliphate was conquered by British colonial forces in 1903. Although it was military conquest (Boahen 1985 p.137), Sokoto Caliphate had limited access to the European weapons, which ended up in "no tactics, no personal gallantry and no resistance" against the conquest (Crowder 1971, p.294). The territory was divided between British, French, and German powers.

**Tukulor Empire.** The leader Ahmadu, who succeeded the founder of the empire, chose strategies of alliance and militant confrontation and relied more on the alliance than confrontation (Boahen 1985 p.119). Besides the French, he was forced to fight on other two fronts: against his brothers who contested his authority and rebellions of his subjects. To deal with these two, he needed arms and ammunition as well as financial resources through trade, both of which necessitated friendly relations with the French (Boahen 1985 p.119-120).

**Wassoulou (Mandingo/Mandinka) Empire.** The ruler, Samori Ture, chose the strategy of confrontation (Boahen 1985 p.123).

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