The Historical State and Path Dependence: Evidence from Ottoman Syria’s Stateless Frontier

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Abstract

This paper investigates the long-term effects of statelessness in Ottoman Syria by analysing the region divided by the “desert line”, a boundary that separated Ottoman-controlled areas from those subject to tribal raids. Using a spatial regression discontinuity design, I estimate the impact of historical statelessness on contemporary economic outcomes. The results show that historically stateless areas have lower incomes, less developed human and physical capital, and a higher share of workers in the primary sector. These effects persist primarily due to lower population density, which explains a significant portion of the economic gap. This persistence reflects path-dependent consequences: emigration and low population density, initiated by statelessness, continue to hinder economic development in these areas today. The results are robust to geographic controls and testing for competing hypotheses including the roles of institutions and culture.

1. Introduction

A large and growing literature examines the various factors influencing economic development. Recent studies highlight the significance of institutional persistence as a key determinant of economic development (Acemoglu et al. 2001, Michalopoulos and Papaioannou 2013, Dell et al. 2018). There is also a growing focus on the role of path dependence in sustaining regional inequality, emphasizing how historical shocks and initial conditions influence economic outcomes even centuries later (Krugman 1992, Bleakley and Lin 2012, Michaels and Rauch 2018, Dalgaard et al. 2022, Baerlocher et al. 2024). Together, this research highlights the need to examine how historical legacies, particularly those tied to state formation and governance, continue to shape patterns of development today. At the same time, no studies have isolated the causal effect of the absence of state control itself, disentangling it from geography, culture, or endogenous processes of institutional evolution.

This paper fills this gap by examining the long-run economic consequences of historical statelessness in Ottoman Syria. Specifically, I estimate the causal impact of statelessness on modern economic outcomes using a spatial regression discontinuity design (RDD) that compares communities located on either side of the "desert line"—a historical boundary that delimited the eastern edge of effective Ottoman control until the mid-19th century.

The desert line which separated Ottoman Syria from the stateless areas to the east did not denote the actual extent of the desert, but rather the area where land was largely abandoned due to Bedouin raids and lack of security and rule of law. The term was used by European explorers and cartographers who travelled across Syria in the 18th and 19th centuries (Lewis 1987). Areas west of the border line were under Ottoman state control and formed the economic and demographic centre of Syria, whilst areas east of the border only came under state control in the middle of the 19th century. The expansion of the Ottoman state in this period came as part of a larger shift towards the east precipitated by the loss of Ottoman territories in Europe and the Caucasus, and as part of a broader set of reforms that sought to centralize and modernize the Ottoman state.

The credibility of the causal design rests on two key assumptions: First, the location of the desert line, as reconstructed from 18th- and 19th-century explorer accounts (Lewis 1987), is plausibly exogenous to later economic development - it reflected the limits of Ottoman security provision and military reach, not any systematic economic or cultural cleavage. Second, in the immediate vicinity of the line, geographic conditions - including rainfall, elevation, and agricultural suitability - vary smoothly. This supports the continuity assumption necessary for RDD identification: that any discontinuity in outcomes at the boundary can be attributed to the treatment of historical statelessness, rather than to underlying spatial trends.

Guided by this design, I use village-level measures of contemporary income, human and physical capital, and sectoral employment from the 2004 Syrian Population and Housing Census, as well as data on the geographic and climatic features of these villages which support the identifying assumption of the econometric design. The analysis results show large and persistent economic disadvantages in historically stateless areas: lower incomes, lower levels of education and infrastructure, and a greater reliance on agriculture. These differences remain robust when controlling for fine-grained geographic variables, spatial trends, and alternative specifications including spatial autoregressive lag models.

To assess mechanisms, I test competing hypotheses related to institutional persistence and cultural differences. While historically stateless regions display somewhat higher informality in property ownership, this does not explain the observed economic gaps. Nor do differences in ethnic and religious composition. Instead, the results point to path dependence in settlement patterns as the dominant mechanism: population density explains a substantial share of the differences in income and human capital, consistent with theories of agglomeration and self-reinforcing economic geography (Krugman 1992; Bleakley and Lin 2012).

These findings advance the literature in several respects. First, while prior work has emphasized variation in the strength or centralization of historical states (Michalopoulos and Papaioannou 2013, Dell et al. 2018), this study isolates the effect of prolonged statelessness relative to adjacent governed areas. Secondly, by demonstrating that lower historical state capacity translated into persistent underdevelopment primarily through the channels of demography and economic geography, the paper underscores the importance of considering path-dependent processes alongside institutional legacies, further contributing the literature on the roles of population agglomeration and path dependence in shaping economic development (Boserup 1965, Krugman 1992, Bleakley and Lin 2012, Oto-Peralías 2020). The contribution is part of the broader debates on the persistence of historical institutions (Nunn, 2020) and the role of state capacity in long-term economic growth (North et al., 2009). The paper also relates to the literature on agricultural-pastoral frontier zones (Bai and Kung 2011, McGuirk and Nunn 2024). Whereas previous literature has focused on the climactic drivers of conflict in similar settings, this paper contributes to this line of research by showing the long-term implications of statelessness in a frontier zone.

2. Historical background

2.1. The Desert Line

Following the Ottoman conquest of Syria in 1516, state authority remained spatially uneven. Ottoman control was strongest in the western provinces stretching from

Aleppo to Damascus, which served as administrative and economic hubs. By contrast, the steppe regions to the east experienced only intermittent oversight, as their open terrain and the mobility of Bedouin tribes limited Ottoman reach (Ma'oz 2013).

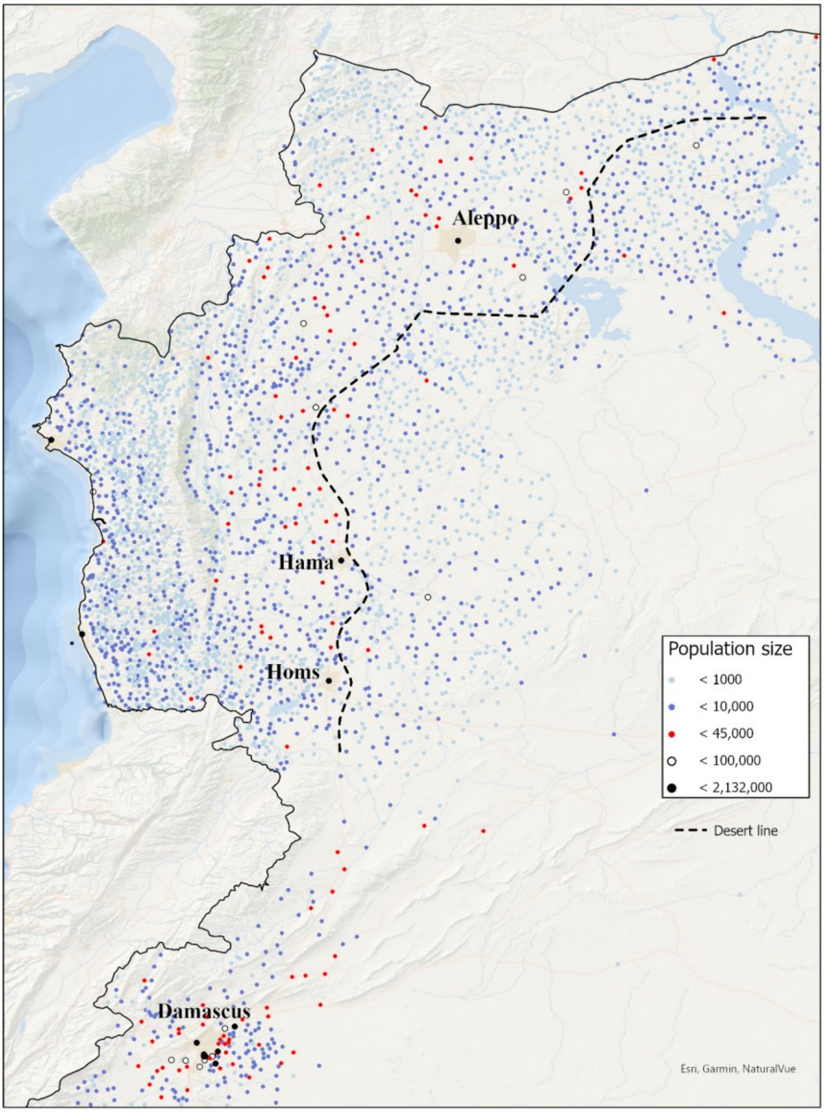
The boundary termed the 'desert line' marked the effective limit of Ottoman protection and taxation before the mid-19th century. European travellers and cartographers documented this zone with unusual precision. Carsten Niebuhr's 18th-century expeditions produced systematic surveys of the area, documenting village abandonment (Hopkins 1967; Lewis 1987). Niebuhr and his successors consistently observed that villages east of this line were abandoned due to tribal raids, whereas settlements just to the west were subject to regular Ottoman administration.

Importantly, this line did not reflect climatic desert boundaries. Rather, it emerged as a frontier shaped by the state's military capacity and the incentives to project power over taxable agricultural production. This historical contingency is critical: the desert line was a product of Ottoman state-building constraints, rather than of any natural division in soil quality or rainfall. This supports the assumption that, in the absence of Ottoman expansion, settlement conditions on either side would have been comparable.

The region that surrounds the boundary is a transitional zone between the steppe or semi-desert of the interior and the well-watered lands towards the coast. Lewis (1987) describes the transitional zone in the 19th century as a 'debatable area between the steppe and the settled farming country of western Syria, and often a zone of contention between nomads and peasants'. The Syrian desert, located to east of this zone, was the heartland of nomadic tribes. In the present day, the majority of the transitional zone is under cultivation, with seasonal grazing by herders during the summer, though settled villagers constitute the dominant population. Describing the relationship between the state and economic development in the area after the middle of the 19th century, Lewis states that 'as the state extended and strengthened its hold on the countryside, the economy of the country developed, peasants and landlords moved into the transitional zone, and the nomads gradually changed their way of life.'

Figure 1 shows the desert line as mapped by Lewis (1987). Areas south and east of the line were outside of state control until the middle of the 19th century. Lewis's study places the desert line in the middle of the transitional zone.

Figure 1: Map of the desert line in the west of Syria with surrounding cities, towns, and villages in 2004 according to population size



Source: Author's own map based on Lewis (1987) and the Syrian Population Census of 2004. Background ESRI OpenStreetMap.

Carsten Niebuhr first used the expression 'desert line' in his 1774 book which records his travels through Syria and Palestine as part of the 'Danish Arabia expedition'. Lewis uses the account of Niebuhr and other explorers of the era to pinpoint the location of the line from their recorded observations. The observations were systematic enough to allow Lewis to create a map of the line, which is consistent with Niebuhr himself being a trained cartographer and mathematician, and who created some of the first precise maps in parts of the Middle East using modern survey methods (Hopkins 1967). The traveller accounts used by Lewis were unanimous in singling out the tribes, including specific tribes like the Mawali, for depredations and exactions which resulted in deserted farmlands and villages (Lewis 1987, pp. 8). The Ottoman state also received blame for the poor state of public security, and for the exactions of tax collectors. Earlier accounts of the conditions in Ottoman Syria suggest similar dynamics, with the Ottoman state constantly faced with tribal incursions as recorded in the Ottoman provincial yearbooks *(Salname)* as early as the 1500's (Bayat 2017).

The desert line closely aligns with the location of the major urban centres of Aleppo, Hama, and Homs. These cities, with Damascus further south, form the political and demographic centre of Syria. Cities in this region were highly fortified to defend against raids and invasions, including those from the nearby desert. It is likely that to location of these cities was an important determining factor that shaped the location and extent of state authority in the region. The line also follows the location of the strategically important 'sultanic road' which connected the Syrian cities together with the rest of the empire. Areas west of the line are bounded in the west and north by mountain ranges, which makes holding this territory easier as compared to areas east of the desert line, which are open in the east and south to the desert steppe. This fits with the circumscription theory of state formation (Carneiro 1970), which posits that the emergence and persistence of centralized political authority is more likely in ecologically or geographically circumscribed areas where populations cannot easily disperse. In areas west of the line, the combination of defensible mountain terrain to the west and the presence of walled cities to the east made the area well circumscribed, in contrast to areas east of the line. Therefore, areas to the west were easier for the Ottoman state to control and offered greater rewards than the lands to the east. This cost-benefit calculation may have influenced the Ottoman policy of leaving the lands east of the desert line under tribal control until the middle of the 19th century.

The shifting frontier of settlement and the challenge of defending it against incursions from the steppe have been recurring themes in the region's history. In the 2000's, an archaeological team discovered the remains of a defensive wall, termed the 'Very Long Wall' (Geyer et al. 2010). The wall was built in the late third millennium BC, extends for 220 km in the area east of the transitional zone, situated east of the desert line and reaching well into the steppe region. The Amorite kings of Hama likely built it to delimit their territory and protect agricultural development against roaming nomads. A later fortified network of structures was also found in the same area dating to the Middle Bronze Age, which is associated with a recession of the frontier of settlement towards the west (Rousset et al. 2020). During antiquity, the frontier of settlement in the transitional zone moved significantly across time, reaching its furthest extent towards the east under Byzantine rule in the 5th and 6th centuries (Geyer 2011), as a part of a cycle of intensification and abatement common to agricultural-pastoral frontier regions in the MENA (Wickham 2006, p. 19). Similar to the Ottomans but with more success, Romans and Byzantines relied on sedentarized nomads to rule inland Syria, with the city of Palmyra emerging as an important seat of power in late Antiquity (Liebeschuetz 2015).

The cities and towns on the Syrian Euphrates, which were ruined and abandoned by the time of Ottoman rule, had prospered from Antiquity well into the Middle Ages, and continued to play a significant role under the Islamic Caliphates. However, the entire area of present-day Syria was devastated by the Mongol invasions in the middle of the 13th century. In the present, the only cities in the transitional zone east of the desert line are Manbij and Salamiyah, both minor cities re-established by migrant groups in the 19th century (Circassians and Ismailis respectively) with support from the Ottoman state.

While Lewis (1987) framed his reconstruction of the desert line as a study of settlement abandonment, the historical sources he used make clear that this pattern was a direct manifestation of the operational reach of Ottoman authority. In Ottoman Syria, the viability of sedentary agricultural settlements depended on the state's ability to provide security from raids. Contemporary traveller accounts, Ottoman provincial reports, and local narratives repeatedly identify the same causal link: settlements east of the line were abandoned not due to environmental unsuitability, but because they lay beyond the effective protection of the state; those to the west persisted precisely where garrisons, tax collection, and administrative oversight were continuous. This tight coupling of settlement persistence and governance capacity means that the mapped frontier of abandonment is also the frontier of state presence. Lewis's line is therefore not simply a demographic boundary, but a historically grounded, spatially precise measure of the limits of Ottoman rule in the pre-reform period.

2.2. Geographic continuity across the desert line

A key requirement for the regression discontinuity design is that geography changes smoothly across the desert line. This condition is well supported by the region's physical geography. The study area forms a continuous whole, bounded in the west by the coastal mountain range and opening eastward toward the desert. It is one of Syria's main agricultural zones and contains three of the country's four largest cities (Aleppo, Homs, and Hama) highlighting its agricultural potential. Although soil fertility and rainfall decline gradually from west to east, there is no sharp environmental break along the desert line.

Settlements immediately to the west and east of the line are similarly close to major urban centres. The strategic Sultanic Road, which linked these cities to the wider empire, ran parallel to the frontier, ensuring trade access on both sides. With no major natural barriers at the boundary, and in the absence of differences in security or governance, communities near the line would have enjoyed broadly similar prospects for agricultural development and market integration.

Travellers that documented the abandonment of villages in stateless areas were aware of the agricultural potential of these abandoned areas (Robinson and Smith 1856; Lewis 1987). For example, the district of Salamiyah was described by Robinson and Smith (1856) as 'entirely deserted' even though it was described by locals as 'exceeding even the neighbourhood of Homs and Hama, in the fertility of its soil.' Thus, the observed spatial discontinuity in later development outcomes cannot be plausibly attributed to differences in geographic features across the border line.

To ensure that continuity holds in geographic variables across the border line, Table 1 presents balance checks for the two sides of the border line using a set of geographic variables.

Table 1: Balance checks

	Dependent variable:						
	Slope	Elevation	Temperature	Precipitation	Flow Accum.	Wheat suitability	Cotton suitability
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: Unadjusted mean values							
Stateless	1.568	436.949	17.895	123.184	78.237	8991.516	8266.816
Control	3.353	433.248	17.202	206.730	271.769	8423.155	7728.057
Difference	-1.785	3.701	0.694	-83.546	-193.532	568.361	538.759
Panel B: Regression estimates (cubic polynomial)							
Stateless	0.718^{**}	-38.759^{***}	0.125^{***}	4.127^{**}	139.573	-256.537	357.065
	(0.300)	(10.754)	(0.045)	(1.795)	(233.060)	(198.060)	(278.609)
Observations	1,908	1,908	1,907	1,907	1,908	1,908	1,908

*p<0.1; **p<0.05; ***p<0.01

Note: Panel A shows unadjusted mean values for the geographic variables across the stateless and control areas and the difference between them, Panel B shows the RD cutoff effect using a cubic polynomial in latitude and longitude for each variable.

The unadjusted mean values in Panel A show that the stateless and control areas are similar on measures like slope (ruggedness), elevation, temperature, and wheat and cotton suitability, but diverge in measures of precipitation and flow accumulation. This can be explained by the proximity of stateless areas to the desert, with reduced precipitation levels in the east. Panel B shows the coefficients on the stateless dummy variable in the regression of each geographic variable on the RDD model detailed in the methods section, with a cubic polynomial in longitude and latitude. The resulting coefficient show that the differences in precipitation and flow accumulation are not discontinuous at the border line. The coefficient is small and positive for the precipitation variable, and statistically insignificant for flow accumulation. The difference in temperature is also reduced to a very low level of one tenth of a degree Celsius. The magnitude of these effects suggests that they do not represent a threat to identification. Additionally, the analysis below shows that adding these geographic variables as controls in the main econometric model does not shift the effect sizes significantly.

2.3.Ottoman state expansion and reform

The abandonment of villages in the stateless areas of Ottoman Syria fit into a broader pattern of de-population and demographic decline. Population numbers in Syria had reached their peak under the early Islamic empires, and despite growing during Ottoman rule, vast regions of the empire remained well below the population peaks reached in prior eras. Contributing factors included the black death and other plague epidemics and natural disasters, the declining role of Mediterranean trade in favour of the Atlantic trade, as well as the Bedouin raids and rural insecurity. According to Williams (1981), rural depopulation was a chronic problem from the turn of the 17th century until the middle of the 19th century, and it figured prominently in Ottoman government reports, as well as in the writings of European travellers and consuls (Lewis 1987, Williams 1981). Walker (2012) refers to a ‘nomadization’ of the rural hinterland and the disappearance of villages in the southern Levant from the start of the Ottoman era.

In response to this problem, the Ottoman state implemented various measures to stabilize rural populations. One strategy involved replacing tax farming tenancies with life leases, giving tax farmers a long-term stake in the well-being of peasants. Additionally, the government undertook settlement projects across Anatolia and Syria to bring more land into cultivation and expand the tax base. These projects took various forms, including land grants to incoming refugees from the Balkans and the Caucasus and the forced sedentarization of nomadic populations, particularly in eastern Syria. Ma'oz (1968, Chapter 9) describes this settlement activity as sporadic, although efforts were more sustained in the Aleppo region, where authorities incentivized settlement by granting land, seeds, tools, and tax exemptions. However, these efforts were often undermined by the government's failure to protect newly sedentary populations from nomadic raids.

On the eastern fringes of the Syrian provinces, The Ottoman state allowed the Bedouin tribes considerable autonomy in managing their affairs. The relationship between the Bedouins and the Ottoman state was a complex one, with the Ottomans attempting to co-opt the Bedouins by appointing a Bedouin governor (Emir of Badia) who was at the head of a tribal confederation and was tasked with keeping order in the frontier areas and protecting trade routes. Still, regions close to the desert were subject to constant tribal raiding. Ma'oz (1968, Chapter 9) suggests that the Ottoman co-optation policy was ineffective, with Bedouin tribes in government employment frequently attacking villages and trade caravans. The populations of stateless regions paid protection tax to the tribes (Khuwah), yet the tribes did not ensure order and rule of law. According to Ma'oz (1968), the protection duty paid out to a dominant tribe rarely secured a village from extortion or attack from other tribes, or even from the 'protector' tribe. Villages outside of state control were also required to pay tax to Ottoman officials, representing a double burden of taxation with little security in exchange. The Ottoman state did not maintain any presence deep in the Syrian desert, which formed the centre of power for the largest tribes. Migration of tribes from the Arabian Peninsula in the Syrian desert also led to conflict over grazing rights and may have pushed some tribes towards raiding.

Travelers in the region south-east of the desert line in the 18th and 19th centuries report that many villages were abandoned to the nomads, while the remains of medieval towns and cities were deserted and in ruins (Lewis 1987). Comparatively few villages remained inhabited on the south and east side of the desert line as compared to those lying on the western side, despite the abundance of cultivable land and their proximity to the urban centres of Aleppo, Hama, and Homs.

The first significant steps undertaken by the Ottoman state to extend its control over the east of Syria came in the late 1850's and early 1860's with the creation of new administrative districts and the building of military outposts in the Euphrates valley east of Aleppo, followed by the establishment of a garrison at Deir ez-Zor. Arab tribes occupying these areas were subdued in the process and agreed to pay tax to the Ottoman government, while the protection tax paid by peasants to the tribes was abolished. By the 1870's the Euphrates valley tribes were 'completely under control' and paid taxes regularly (Lewis 1987). The nomadic tribes settled new villages and expanded existing villages, towns, and cities throughout the rest of the 19th century and into the 20th century.

The Provincial Reform (Vilayet) law of 1864 was a crucial part of the Tanzimat reforms which re-defined the central government's authority over the provinces, with Syria one of the first regions to be re-organized (Rogan 1995). The aim of the law was to centralize and modernize the administrative system, enhancing the state's control over its territory. The regions controlled by Bedouin tribes were not the only ones affected by this development, with the Alawi coastal region and the Druze areas in the south experiencing similar centralization. Certain social classes such as urban elites and merchants played a key role in extending state authority in this period according to Rogan (1995), with the state providing favourable conditions for trade and economic activity. Barakat (2015) shows that tribal leaders as well as middling groups of nomads obtained positions as low-level bureaucrats by assisting in the modernization of land administration during the Hamidian period (1876-1909).

The Ottoman state modernization and reforms of the 19th century were likely due to outside pressures on the empire. The loss of Ottoman territory in Europe, the modernization efforts of Muhammad Ali of Egypt and his occupation of Syria in the 1930's, as well as western pressures for governmental reform and the strong pull of the western modernization. State centralization in the Syrian provinces also came with reforms that promoted legal equality for religious minorities and sought to reduce the power of local elites as well as the influence of European powers within Ottoman lands. The reforms were not particular to the study area, and were largely exogenous to its internal dynamics, even if their implementation had profound implications for the region.

2.4. Historical parallels in the MENA region

Parallels to the Ottoman state centralization in Syria can be found across the MENA region. Several studies of the late Ottoman empire focus on frontier regions including Trans-Jordan, Kurdistan, the Persian Gulf, Eastern Arabia, and Yemen (Reinkowski 2001). Recent historical work highlights the history of governance in the Ottoman peripheries, as in the case of the Kurdish principalities (Özok-Gündoğan 2014) and the inter-imperial borderlands of the Balkans (Esmer 2014). While most countries in the region came under colonial control by the early 20th century, the pre-colonial era was characterized by diversity in terms of state centralization. In many cases, the pre-colonial empires, kingdoms, and sheikhdoms exercised weak control over their territories, especially in marginal areas and frontier regions. Scholars recognized this division in studies of pre-colonial North Africa (Hoffman 1967). The terms Bled Al-Makhzan (land of the treasury[1]) and Bled Al-Siba (land of anarchy) were used to denote the land held under government control and those which remained outside direct government rule respectively. Geography clearly shapes the Makhzan and the Siba in the setting of North-African, with the coastal areas and cities situated near the mediterranean coast being the centres of state control, while mountainous and desert regions further south were the centres of tribal presence and control. An earlier parallel is that of the border region between Byzantines and Seljuks in Anatolia which was occupied by Turkic tribes, and which experienced depopulation due to tribal raiding on peasant communities according to Lindner (2017).

A pattern of state formation in the Middle East region involves tribes on the margins of imperial states. This is most clearly seen in the case of Saudi Arabia and other

[1] The Arabic word makhzan, meaning "warehouse", came to signify the state in western North Africa. This usage likely stems from the term's historical association with the treasury and the presence of state tax collectors in regions under government authority.

states in the Gulf region, as well as some early modern examples like the tribal Kurdish confederacies in eastern Anatolia and the tribal confederacies of North Africa (Khoury and Kostiner 1990), and even the Ottoman state itself which originated in a tribal setting in Anatolia (Lindner 2017). In the Syrian case, the Kurdish and Arab tribes that settled the north-east of Syria were initially operating outside the bounds of the state but were eventually integrated into Ottoman state structures in the mid-19th century, with the aim of safeguarding the frontier region and creating sources of tax revenue. The Ottoman state supported the settlement and sedenterization of tribes in the north-east and even assigned a tribal leader as governor of Raqqa (Winter 2006), a pattern that followed in south-eastern Anatolia as well. Early on, the relationship between the tribes and the state was marked by conflict, with tribal authorities often undermining the Ottoman rule of law. But the tribes in the Syrian north-east did not create alternative state structures as was the case in the Arabian Peninsula. Proximity to the well-established Ottoman state in the west of Syria may have played a role, with little opportunity for the tribes to control urban areas and establish separate governance structures, as in the case of the Arabian Peninsula.

3. Historical statelessness and path dependence

An established line of research examines the role of pre-colonial state history and institutions in shaping present-day economic inequalities. Studies typically measure historical state centralization and find strong correlations with contemporary economic outcomes across and within countries. Gennaioli and Rainer (2007) show that pre-colonial state centralization in Africa is associated with better public goods provision today, arguing that hierarchical chiefdom structures foster greater accountability to state authorities and more effective policy implementation. Michalopoulos and Papaioannou (2013) extend this approach using ethnic group-level data, demonstrating a robust relationship between historical state centralization and economic development, proxied by nightlight density. Dell et al. (2018) further investigate this effect in Vietnam, exploiting a historical boundary between the centralized Dai Viet kingdom and the less centralized southern region under Khmer influence. Their findings suggest that state centralization is linked to improved economic outcomes through the persistence of village governance institutions. Another set of studies use macro-level data and analyse the effect of time under state institutions and find that it correlates with a range of contemporary economic and political measures (Bockstette et al. 2002, Chanda and Putterman 2007, Borcan et al. 2018).

Recent work has also explored how historical state centralization interacts with geography, conflict, and economic persistence. Oto-Peralías (2020) examines how historical frontier warfare in Spain influenced state formation and long-run economic geography. The author argues that insecure frontier regions developed weaker state institutions and lower economic activity due to persistent violence and instability, shaping regional economic patterns into the present. This perspective highlights how security conditions influence the long-term concentration of people and economic activity, a theme that intersects with the literature on path dependence and economic geography.

Path dependence plays a central role in explaining regional economic disparities. Initial advantages in geographic conditions, resource endowments, or political stability can generate self-reinforcing agglomeration effects, whereby economic activity and population remain concentrated over long periods. Krugman (1992) illustrates this by noting that one-third of the U.S. population still resides within the original thirteen colonies, despite centuries of economic shifts. Similarly, Bleakley and Lin (2012) show that historical portage sites in the U.S. continue to influence population density, even after their original economic function has become obsolete. This persistence reflects the role of increasing returns to scale, which can sustain economic activity long after initial advantages have disappeared. Baerlocher et al. (2024) provide further evidence from Brazil, demonstrating how Portuguese-era road networks, originally constructed to serve gold mines, continue to shape contemporary economic density.

The effect of historical state centralization on economic geography is also linked to the role of population density in development. Densely populated areas are more likely to urbanize, facilitating specialization, investment, and technological advancement. Boserup (1965) argued that agricultural productivity is shaped by population density, while Kremer (1993) posited that larger populations foster faster technological growth. Klasen and Nestmann (2006) further show that population density spurs technological change, particularly in low-technology environments. High-density regions also benefit from greater returns to public goods investments, reinforcing development advantages over time.

Based on the theoretical and empirical literature reviewed above, I expect to find that historically stateless regions are less economically developed today than areas with a longer history of statehood. This effect is anticipated to persist due to path-dependent mechanisms, particularly those related to population density. Insecure frontier zones and areas with weak historical governance likely experienced lower long-run settlement density, limiting the emergence of agglomeration economies, specialization, and public goods provision. Accordingly, I expect the long-run developmental disadvantage of stateless areas to correlate more strongly with differences in population density than with cultural or institutional persistence. This would suggest that the legacy of historical statelessness operates primarily through its influence on spatial population patterns, rather than through the direct transmission of institutional norms or cultural traits.

4. Data and methods

The data used in this study comes from the Syrian population and housing census of 2004. The census data records a rich array of information on the population, labour force, and infrastructure and housing, aggregated at the level of the city, town, and village. Information on the historical boundary of the desert line comes from the work of Norman Lewis (1987) which uses Ottoman government reports and traveller accounts to pinpoint the boundaries of state control prior to the mid-19th century. In this context, settlement persistence was inseparable from state presence, making Lewis's (1987) mapped line a direct proxy for the historical boundary between governed and stateless areas. Because the line reflects a security frontier rather than a natural or cultural divide, its location is plausibly exogenous to later economic outcomes and satisfies the continuity assumption required for the regression discontinuity design.

The analysis exploits the discontinuous change in exposure to historical state control, comparing towns and villages in areas outside the control of the Ottoman state in the period before the middle of the 19th century with those that were incorporated previously when the Ottomans invaded Syria in 1516. I use the methods employed in Dell (2010) and Dell et al. (2018) and treat the desert line as a two-dimensional discontinuity in longitude-latitude space. The regression model takes the form:

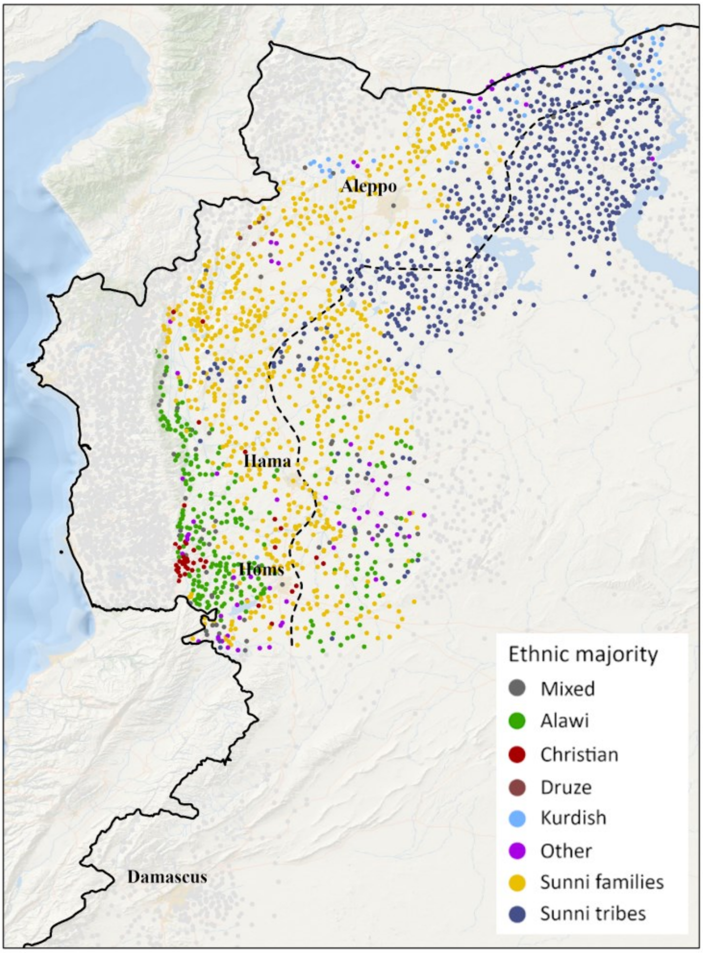
$$outcome_i = \alpha + \gamma \, Statless_i + f(geographic\ location_i) + \beta \, to\_Aleppo_i + \epsilon_i$$

Where $outcome_i$ is the outcome variable in village i, and $Stateless_i$ is an indicator equal to 1 if village i was on the south-east side of the desert line (i.e. outside of Ottoman state control before the middle of the 19th century) and equal to zero otherwise. $f(geographic\ location_i)$ is the RD polynomial which controls for smooth functions of the geographic location. to_Aleppo_i is the log distance to the centre of Aleppo city, which is the largest city in the region and an important trading centre. The analytical sample is limited to towns and villages within 50 kilometres of the desert line and excludes towns or cities with populations over 10,000. The reason for excluding major urban centres is that the location of the line itself is likely endogenous to the location of these centres, but towns and villages can be treated as if randomly distributed across the line, with towns and villages on either side of the border being in close proximity to the major cities and having similar geography as will be shown in the next section.

The estimation framework relies on the assumption that all relevant factors besides treatment vary smoothly at the boundary. Geographic characteristics may vary across the two sides of the desert line, such as precipitation, soil quality, or ruggedness of the terrain. The variation in outcomes that is due to these factors will be captured by the included geographic function.

Figure 2 shows a map of the study area according to ethnic group. The analysis controls for ethnic majority, as the estimation framework is also sensitive to selective sorting across the boundary.

Figure 2: Map of the study area with ethnic majorities



Source: Author's own map based on ethnic majority data from Khaddour and Mazur (2018). Background ESRI OpenStreetMap.

The regression model controls for ethnic composition based on the ethnic majority of each village or town. The ethnicity data comes from the work of Khaddour and Mazur (2018), where the ethnicity variable captures ethnic identity, religious and sectarian identity, as well as belonging to an Arab tribe. Controlling for tribal belonging is particularly relevant, as areas east of the desert line were settled by

Arab tribes whose culture may differ from that of the population west of the desert line and the analysis accounts for this fact.

Another threat to identification is due to spatial correlation in the error terms, which can lead to inflated t-values as detailed in Kelly (2019). To address this issue, I estimate spatial autoregressive lag models that relax the assumption of no correlation in the error terms.

To estimate gaps in incomes across areas, an income index is created using data on the local composition of the labour force in each village and town. Incomes are imputed based on the national-level average wages are used which are conditional on occupation, along with the local mix of sectors. The wage data comes from Syrian Labour Force Survey of 2007. The sectoral income variable reflects within-country differences in the composition of the economy but does not account for other sources of income inequality such as differentials in payoff to the same work across areas. The imputation formula takes the form:

$$Income_i = \sum_{j=1}^{7} Sector\ wage_j \ .\ Sector\ share_{ij}$$

Where i refers to the city, town, or village and j to the sector. Sector wage refers to the national-level average wage of sector j, and Sector share is the share of workers in the city/town/village employed in that sector. The set of sectors used to construct the sectoral income measure are agriculture, industry, construction, hotels and restaurants, transportation, finance and real estate, and other services. An alternative specification of the income measure is used in addition. Income is imputed in this case using educational attainment measures and corresponding average wages conditional on educational attainment using the following formula:

$$Income_i = \sum_{j=1}^{7} Mean\ wage_j \ .\ Educational\ attainment\ share_{ij}$$

Where the educational attainment share refers to the share of the adult population in attainment categories: illiterate, literate, elementary school, middle school, high school, middle academy, and university educated. Mean wage refers to the national-level average wage conditional on the educational attainment category. Both imputed incomes are normalized as z-scores using population-weighted mean and standard deviation across all cities, towns, and villages in Syria. The resulting measures represent deviations from population-weighted mean income.

This imputed income measures should be interpreted an index of expected local average earnings given the composition of the workforce, rather than observed local wages. By applying national-level average wages (by sector or educational attainment) to the local distribution of employment or education, the measure captures within-country differences in income potential arising from variation in economic structure and human capital. It does not reflect local wage differentials for the same occupation or education level, nor other sources of income such as informal work, self-employment, remittances, or returns from local resources. As such, the measure is best understood as a proxy for structural income potential associated with the local labour force, abstracting from location-specific pay differences and cost-of-living variation.

In addition to imputed income, the analysis makes use of other data that proxy local economic development. Measures of the share of households connected to each of the electricity network, sanitation network, and water network are used, as well as measures that directly capture different development in the local labour force, including the share of white-collar workers (managers) and the share of workers in agriculture. Finally, direct measures of human capital are included which are the share of adults with a university education and the illiteracy rate in the adult population. Additional data is used in the analysis, such as geographic data that capture information on the climate, agricultural suitability, and land ruggedness. The data available in the census also allows for addressing mechanisms. The analysis makes use of data on informality in property ownership to examine whether private property institutions play a role in explaining the economic gaps across the desert line.

5. Results

5.1. Descriptive statistics

Table 2 shows descriptive statistics for the main variables used in the analysis. The income z-scores measure at -1.26 and -0.80 for the stateless and Ottoman areas respectively. Villages and towns in both areas are below the Syria national average in terms of income, though areas with a history of statelessness stand out. The alternative measure of income imputed using education levels gives slightly lower values at -1.20 and -0.72 respectively. The historically stateless region has worse infrastructure overall. Fewer households are connected to the sanitation network (17.8%) as compared to those in the Ottoman state areas (35.3%). A similar gap is found in the share of households connected to the freshwater network (39.7% and 65.8% respectively). The only exception is the proportion of households connected to the electricity network, with both sides of the border line reaching over 90% and with a small gap of less than 3%.

Table 2: Descriptive statistics

	Stateless	Ottoman state	Difference
Income index	-1.26	-0.80	-0.46
Education-based income index	-1.20	-0.72	-0.48
Electricity network	90.6	93.4	-2.88
Sanitation network	17.8	35.3	-17.43
Water network	39.7	65.8	-26.12
Managers	3.5	7.7	-4.19
Farmers	39.1	43.4	4.28
University educated	0.6	1.2	-0.59
Illiteracy rate	34.2	25.0	9.21
Population	1,030	1,644	-614
Population within 5 km	5,668	13,322	-7,654
Population within 10 km	30,797	75,512	-44,715
Observations	797	1111	

Note: The table shows mean values of outcomes used in the analysis according to the placement of each town or village in relation to the Ottoman state border line. Income indices are standardized z-scores. Other outcomes are in percentages (except for population sizes).

Areas with a stateless legacy also have worse labour market outcomes and lower levels of education. The proportion of workers in managerial positions is at 3.5% and 7.7% in stateless and Ottoman areas respectively, while the proportion of farmers is at 39.1% and 43.4% respectively. Education levels are also lower in areas with a stateless history, with the proportion of university educated adults at 0.6% and 1.2% in areas with historical state control and areas under Ottoman control, while the illiteracy rates are at 34.2% and 25% respectively.

Areas with a stateless legacy are less urbanized, with lower mean population in the towns and villages as compared to areas with a legacy of Ottoman state control, and a lower number of towns and villages. The overall gap is best captured by the measures of population within 5km and 10km radius, as these measures include the population size of the village or town itself, as well as any villages or towns centred within the radius. According to this measure, the population density is much higher in areas with a legacy of Ottoman state control, reaching 75,512 within a 10 km radius as compared with 30,797 for towns and villages with a stateless legacy.

5.2. Regression results

Table 3 shows the results for the main regression discontinuity models (full model estimates are available in appendix tables A3 to A6).

Table 3: Regression discontinuity effects

	Dependent variable:								
	Income index	Education-based income index	Electricity network	Sanitation network	Water network	Managers	Farmers	University educated	Illiteracy rate
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: Linear model									
Stateless	-0.532***	-0.438***	-3.410**	-21.942***	-22.491***	-5.010***	7.098***	-0.530***	9.216***
	(0.061)	(0.037)	(1.326)	(2.047)	(2.529)	(0.407)	(1.853)	(0.075)	(1.039)
Panel B: Cubic polynomial model									
Stateless	-0.577***	-0.431***	-7.754***	-2.006	-27.177***	-3.648***	10.098***	-0.471***	13.676***
	(0.113)	(0.066)	(2.659)	(4.073)	(4.289)	(0.797)	(3.446)	(0.154)	(1.956)
Panel C: Added geographic controls									
Stateless	-0.500***	-0.409***	-7.338***	-0.903	-26.805***	-3.589***	7.743**	-0.421***	13.541***
	(0.112)	(0.067)	(2.673)	(4.080)	(4.313)	(0.806)	(3.379)	(0.157)	(1.959)
Panel D: Added ethnicity controls									
Stateless	-0.645***	-0.523***	-8.703***	-3.232	-28.155***	-4.279***	11.210***	-0.653***	14.533***
	(0.111)	(0.062)	(2.729)	(4.122)	(4.289)	(0.735)	(3.448)	(0.145)	(1.977)

*p<0.1; **p<0.05; ***p<0.01

Note: The table shows the RD cutoff effect for different model specifications and outcomes. Standard errors clustered by district in parentheses (92 clusters). All regressions control for log distance to Aleppo. The basic linear model includes controls for latitude and longitude on each side of the regression discontinuity line. The cubic polynomial model includes controls for latitude and longitude on each side of the discontinuity of the form $x + y + x^2 + y^2 + xy + x^3 + y^3 + x^2y + xy^2$ where x and y denote longitude and latitude. The third and fourth rows include the cubic polynomial model and controls for geographic variables (elevation, slope, temperature, precipitation, and flow accumulation) and for ethnic majority composition respectively. Full regression outputs are included in Appendix tables A3 to A6.

The cells show the RD effect of being located in the region with a stateless legacy, for different outcome measures in the different columns. The panels represent the different model specifications. The model in Panel A is linear in longitude and latitude, and the effects are all negative and statistically significant (except for the illiteracy rate, which is higher in the area with a stateless legacy). For the income index, the gap is at -0.532 while the gap in education-based income is estimated at -0.438. The infrastructure effects vary, with both the sanitation network and the freshwater network being significantly less developed in the south-east (effect sizes of -21.8 and -22.5 respectively), while the effect for the electricity network is much smaller at -3.4 and significant only at the 0.05 level. When looking at the labour force variables, the proportion of managers in the south-east is lower by 0.5, while the proportion employed in agriculture is 7 percentage points lower. The proportion of adults with a university education is 0.53 percentage points lower, and the illiteracy rate is 9.2 percentage points higher. Overall, the estimated effects resemble the unadjusted gaps presented in the descriptive statistics table earlier, which suggests that these gaps are mainly driven by the desert line discontinuity and are not primarily due to geographic trends across the study region.

Panel B of Table 3 provides the effect estimates for the model controlling for cubic polynomial terms in longitude and latitude on each side of the border line. The effects sizes are similar level as in the previous model, except for the gap in the sanitation network which becomes small and statistically insignificant. The robustness of the results to the cubic polynomial controls suggest that they are not driven by geographic trends. In some cases, the effects are even larger in this model, as in the income index, the electricity and freshwater networks, and the share of farmers in the labour force as well as the illiteracy rate.[2]

To further ensure that geographic factors are not the drivers behind the results, Panel C adds controls for elevation, slope, temperature, precipitation, and flow accumulation. In this model, the effect sizes are also on a similar level to the above model and are equally significant.

Controlling for ethnic groups in the fourth row in addition to the cubic polynomial model does not shift the effect estimates much either. The income effects appear slightly larger at -0.65 and -0.52 for the income index and education-based income respectively, and the other effects are slightly higher each but remain broadly similar

[2] The results for these base models are replicated using 25km bands around the border line with similar results (see Online Appendix Table A1). Effect size sensitivity to bandwidth changes is shown in Appendix Figure A1 using a cubic polynomial model, and bandwidth sensitivity with a 5km donut around the desert line is shown in Appendix Figure A2. Appendix Table A2 shows the same results adding line segment fixed effects. The effect sizes are overall robust and become larger when adding line segment fixed effects.

and statistically significant. The role of ethnicity is explored further in the next sub-section.

The regression results are graphed in figure 3, which shows a map of the study area split by the desert line with each town and village plotted on the longitude on the x-axis and the latitude on the y-axis. Predicted values are estimated from the cubic polynomial model for a grid of longitude-latitude values for each outcome (excluding the sanitation network outcome). The background colours are synonymous with the typical two-dimensional curve in RD plots, while the dots show the actual outcomes as measured in the census. The maps show both considerable variation in the outcome variables across space but also capture the discontinuity in outcomes across the border line.

Figure 3: Regression discontinuity graphs

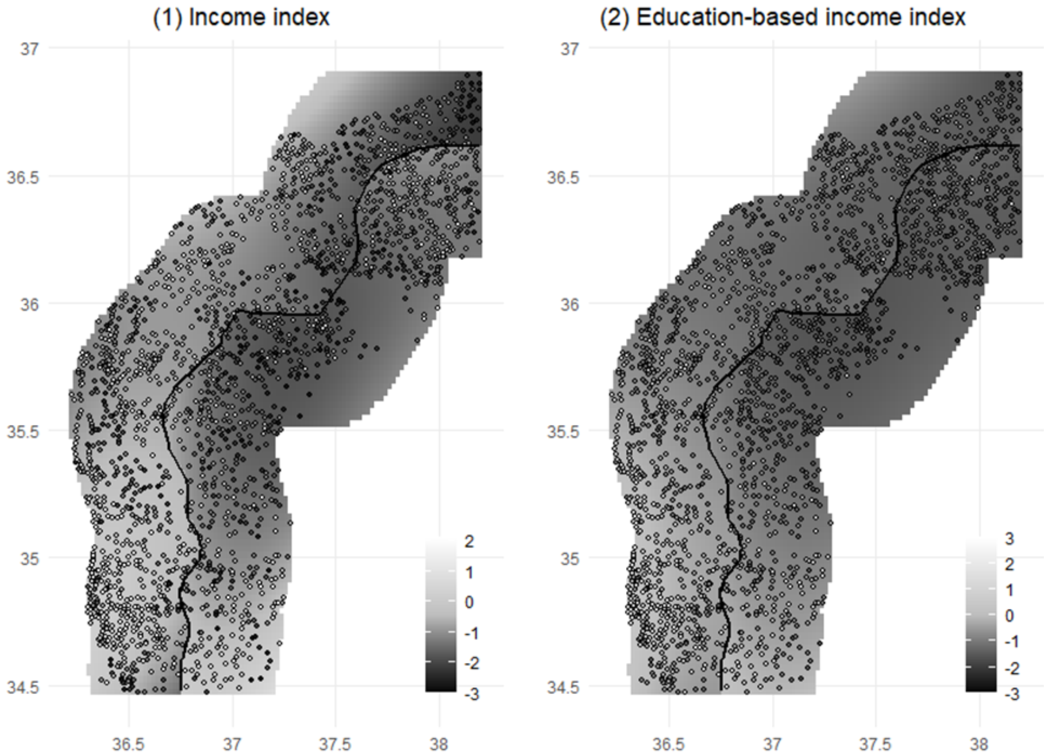


Figure 3 (continued)

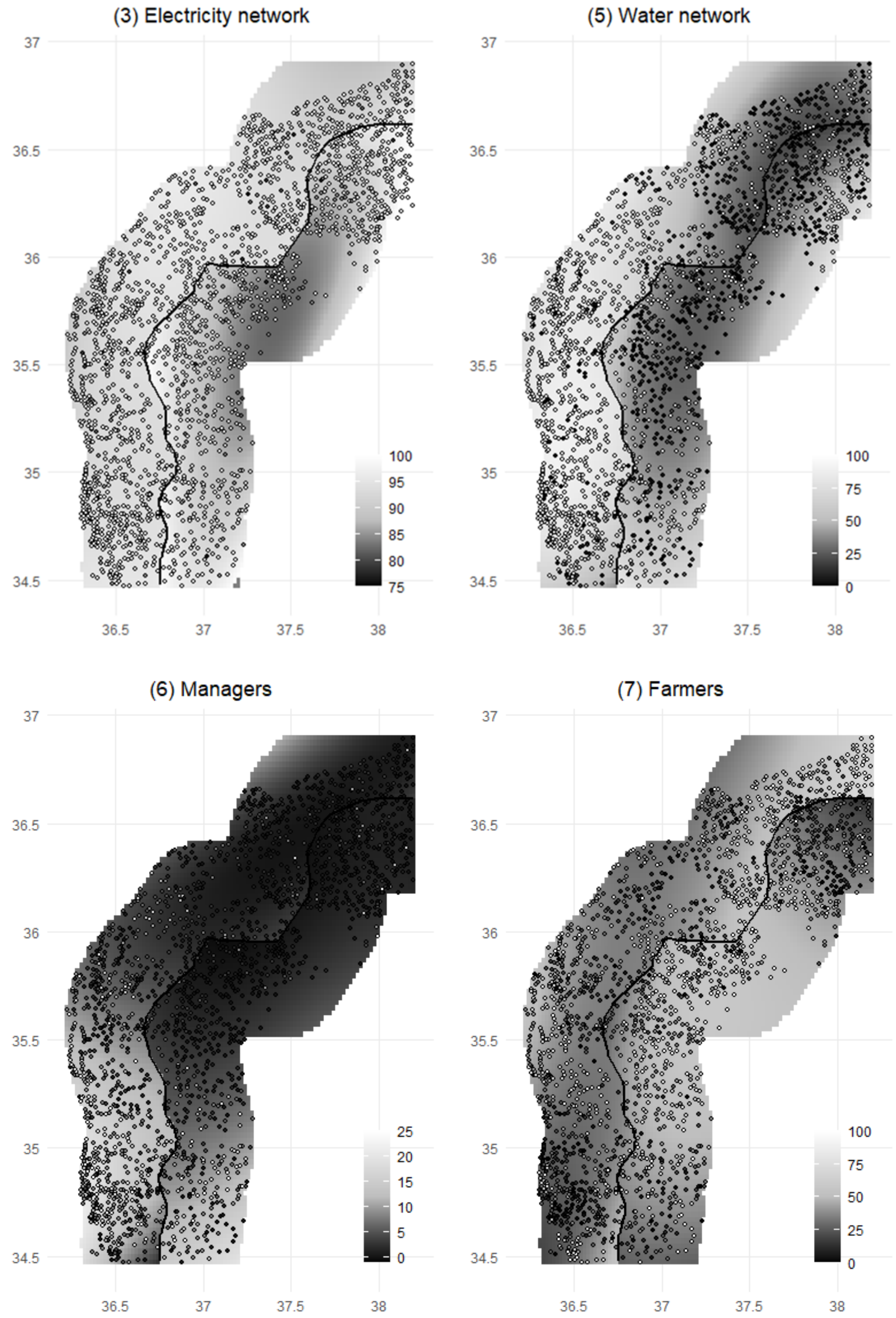
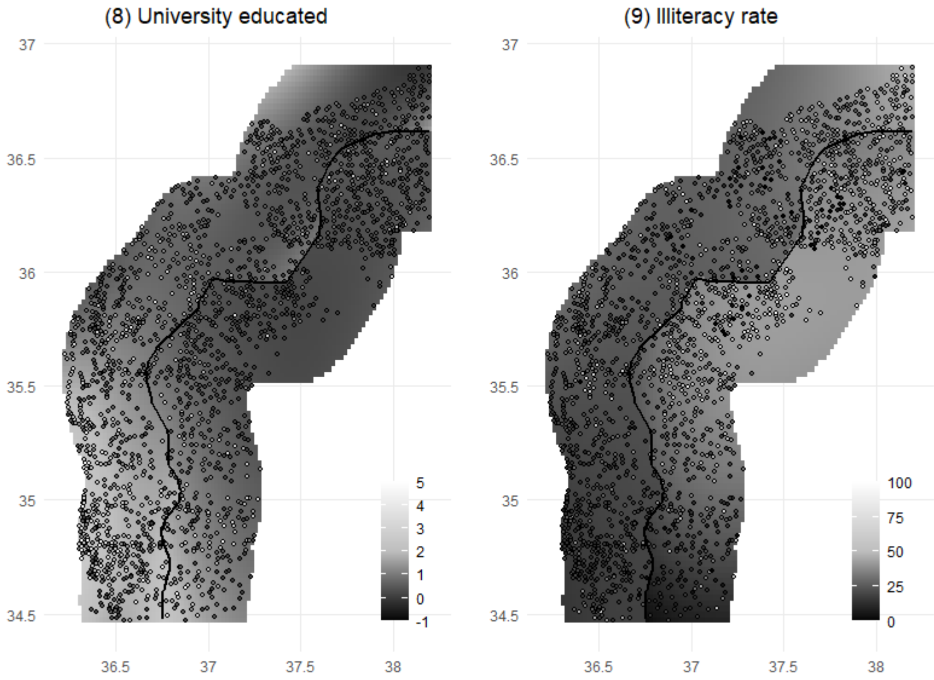


Figure 3 (continued)



Note: The x-axis and y-axis represent longitude and latitude. The data value is shown using an evenly spaced monochromatic colour scale. Actual data is shown as dots. The background shows predicted values, for a finely spaced grid of longitude-latitude coordinates, from a regression of the outcome variable using the main model detailed in the data and methods section with a cubic polynomial function in longitude and latitude.

To further evaluate the robustness of the results, I estimate spatial autoregressive lag models which address the Kelly critique (Kelly 2019) by relaxing the assumption of uncorrelated error terms. The models included in Table 4 allow each error terms to covary with that of the eight nearest observations in the sample (keeping the cubic polynomial functional form). This ensures that the effect estimates are not due to observations being correlated geographically.

In this case, the effects are overall smaller but remain statistically significant, and some remain on a similar level to those reported in the base models. The income effect is measured at -0.21 and that of education-based income at -0.19, while the effect on the electricity network and water network measures at -6.14 and -13.95 respectively (with the sanitation network effect not statistically significantly different from zero). The effect on the proportion of managers in the labour force is at -1.63, while the effect on the share of the labour force in agriculture is not statistically significantly different from zero. Finally, the effects on human capital measures appear to be robust, measuring at -0.28 for the share with a university education, and 8.19 for the illiteracy rate.

Table 4: RD cutoff effects from spatial autoregressive lag models

	Dependent variable:								
	Income index	Education-based income	Electricity network	Sanitation network	Water network	Managers	Farmers	University educated	Illiteracy rate
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Stateless	-0.211**	-0.191***	-6.144**	-2.441	-13.954***	-1.625*	3.751	-0.283**	8.189***
	(0.103)	(0.066)	(2.460)	(3.885)	(4.032)	(0.895)	(2.819)	(0.143)	(1.767)
Observations	1,908	1,908	1,908	1,908	1,908	1,908	1,908	1,908	1,908

*p<0.1; **p<0.05; ***p<0.01

Moran's I statistics are reported to examine correlation in the error terms of the estimated models. Moran's I statistic takes values between -1 and +1, where 0 corresponds to random spatial patterns without spatial autocorrelation, and a value of 1 suggests perfect clustering where locations with similar values are adjacent to each other. Table 5 reports Moran's I statistics for the residual terms in the base cubic polynomial models and the spatial lag models. Overall, Moran's I for the base cubic polynomial models are reported at values between 0.1 and 0.3, which suggests some level of clustering in the residuals. Clustering is not pronounced as the values are on the lower end of the scale. In the case of the spatial lag models, all Moran's I statistics are not statistically significantly different from zero.

Table 5: Moran's I statistics

	Dependent variable:								
	Income index	Education-based income	Electricity network	Sanitation network	Water network	Managers	Agriculture	University educated	Illiteracy rate
Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: Cubic polynomial model									
Moran's I	0.280***	0.246***	0.071***	0.177***	0.205***	0.255***	0.295***	0.139***	0.171***
	[25.64]	[22.583]	[6.565]	[16.188]	[18.764]	[23.48]	[26.994]	[12.886]	[15.706]
Panel B: Spatial autoregressive lag model									
Moran's I	-0.011	-0.008	-0.005	-0.008	-0.011	-0.014	-0.015	-0.007	-0.011
	[-0.98]	[-0.676]	[-0.413]	[-0.675]	[-0.916]	[-1.239]	[-1.299]	[-0.590]	[-0.976]

*p<0.1; **p<0.05; ***p<0.01

Note: The above table reports the Moran's I statistics for the cubic polynomial models and the spatial autoregressive lag models based on the 8 nearest neighbours of each point. Z-scores are reported in brackets.

Panel B of Table 6 reports results for a set of placebo outcomes estimated using linear models in longitude and latitude. These variables—unemployment rate, female labour force participation (FLFP), characteristics of dwellings in the local area (share of dwellings under refurbishment, share rented, and share vacant), and the gender gap in educational attainment—are chosen because they are not expected to be shaped by the region's historical state presence and do not serve as close proxies for contemporary economic development.

Unemployment and FLFP capture labour market conditions, rather than the long-run structural advantages linked to state history. The selected housing characteristics primarily reflect current real estate dynamics and local demand–supply conditions and thus are unlikely to have been persistently influenced by pre-modern political structures. Similarly, the gender gap in education is a product of modern schooling policies and social norms, not the historical institutional environment.

The estimates confirm these expectations: the effects on the placebo outcomes are statistically insignificant, except for a very small and marginally significant effect (at the 10 % level) on the share of vacant dwellings. This pattern supports the validity of the main causal estimates by showing no systematic differences for outcomes unrelated to long-run economic development.

Table 6: RD effects using placebo outcomes

	Dependent variable:					
	Unemployment	FLFP	Dwellings in refurbishment	Rented dwellings	Empty dwellings	Gender gap in schooling
	(1)	(2)	(4)	(5)	(6)	(7)
Stateless	0.845	-1.232	-0.132	-0.224	1.270*	0.223
	(0.974)	(1.091)	(0.441)	(0.571)	(0.753)	(0.365)
Mean Y (control)	12.855	15.837	4.839	65.831	1.540	9.624
SD	15.271	16.701	6.108	39.261	6.669	10.437
Observations	1,908	1,908	1,908	1,908	1,908	1,908

*p<0.1; **p<0.05; ***p<0.01

Note: The table shows the regression discontinuity effects using a set of placebo outcomes with a linear function in longitude and latitude. The outcomes considered are the unemployment rate, female labour force participation rate (FLFP), ratio of males to females, ratio of dwellings undergoing refurbishment, ratio of rented dwellings, ratio of empty dwellings, and the percentage points gap in secondary education completion rates between females and males.

6. Mechanisms

6.1. Ethnicity and religion

The previous section showed that the results are robust to controlling for ethnic and religious identity. This factor is explored further in Table 7, which shows the regression discontinuity effects for different sub-groups. Panel A excludes all area with non-Sunni Muslim majorities. The results remain broadly similar and statistically significant, and in many cases the effects are larger than those found in the full sample. Panel B further excludes areas with tribal majorities. In this case, the effects are larger for the income and education outcomes and are more than doubled for the percentage of farmers in the labour force, though they are statistically insignificant for the infrastructure variables.

Table 7: RD effects according to ethnic group

	Dependent variable:								
	Income index	Education-based income	Electricity network	Sanitation network	Water network	Managers	Farmers	University educated	Illiteracy rate
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: Sunni Muslims									
Stateless	-0.624^{***}	-0.563^{***}	-9.876^{***}	-5.631	-28.045^{***}	-3.885^{***}	10.260^{***}	-0.806^{***}	14.511^{***}
	(0.124)	(0.068)	(3.101)	(4.603)	(4.807)	(0.642)	(3.923)	(0.152)	(2.115)
Mean Y (Control)	-1.066	-1.006	93.736	30.316	61.615	3.831	42.332	0.849	27.304
Observations	1,438	1,438	1,438	1,438	1,438	1,438	1,438	1,438	1,438
Panel B: Sunni Muslims excluding tribes									
Stateless	-1.151^{***}	-0.799^{***}	14.797	-13.331	-5.628	-2.220	23.947^{**}	-1.360^{***}	14.057^{**}
	(0.386)	(0.219)	(9.144)	(14.423)	(15.667)	(2.283)	(11.190)	(0.459)	(6.115)
Mean Y (Control)	-0.826	-0.867	94.187	36.507	74.914	4.932	37.299	1.004	24.254
Observations	745	745	745	745	745	745	745	745	745
Panel C: Sunni tribes									
Stateless	-0.132	-0.128	-7.481	-13.781	1.739	-1.425	3.485	-0.322	4.318
	(0.364)	(0.160)	(7.317)	(13.355)	(17.025)	(1.217)	(11.791)	(0.326)	(8.036)
Mean Y (Control)	-1.565	-1.296	92.798	17.452	33.981	1.544	52.792	0.528	33.640
Observations	693	693	693	693	693	693	693	693	693

*p<0.1; **p<0.05; ***p<0.01

Note: The table shows the regression discontinuity effect for three subsamples. Panel A includes only locations with majority Sunni Muslim populations. Panel B further excludes locations with majority tribal populations. Panel C includes only locations with majority tribal populations. Mean outcomes are shown for areas with an Ottoman state legacy.

Overall, the results are robust to excluding minority groups such as Christians, Alawis, Druzes, and Ismailis whose outcomes may differ from that of the Sunni Muslim majority for factors unrelated to the border line (such as discrimination or differences in cultural norms). The results also do not simply reflect a penalty held by the tribal population of North-East Syria either, as the effects are larger when this group is excluded (except for the infrastructure outcomes).

Panel C of Table 7 shows the effects for the subsample of areas with a Sunni tribal majority. The effects on income and education level are reduced to very low levels and none of the effects are statistically significant at the 0.1 level. Though the mean outcomes for tribal areas are overall closer to those of areas with a stateless legacy (in non-tribal areas). The lack of an effect in tribal areas is consistent with the stateless legacy of these communities, with settlement in Ottoman controlled areas occurring in the 19th century precluding a state legacy for the affected communities even if the land itself had been under state control prior to the 19th century.

6.2. Property rights

To analyse the role of institutions as a mechanism for persistence, I use data on informality in home ownership. The data records the share of housing deeds according to the type of deed, where different deed types correspond to different levels of informality. Three types are recorded in the data - formal deeds, agricultural deeds, and public notary contracts. Formal deeds correspond to the share of formally owned homes. Agricultural deeds correspond to the share of homes built on formerly agricultural land without a government permit. And public notary contracts correspond to the share of homes where owners possess a notarized contract verifying their purchase of the property from the previous owner, but without holding an official deed to the property.

Table 8 shows that informality in home ownership is higher in historically stateless areas. The share of homes owned with an official deed is significantly lower, and the proportion of homes owned via an agricultural deed higher, in historically stateless areas (columns 1 and 3 respectively). Similar effects are present when controlling for ethnic and religious identity (columns 2 and 4). However, no effect is found on the proportion of homes owned via notary contract. The models in this case control for linear terms in longitude and latitude, but similar effects hold when controlling for cubic polynomial terms, even if they mostly become statistically insignificant (see Appendix Table A7).

Table 8: RD effects on informality in property ownership

	Dependent variable:					
	Official deed		Agricultural deed		Public notary	
	(1)	(2)	(3)	(4)	(5)	(6)
Stateless	-8.376***	-6.710***	5.235**	4.754**	-0.431	-0.388
	(2.169)	(2.197)	(2.314)	(2.392)	(0.351)	(0.358)
Ethnicity	-	Y	-	Y	-	Y
Mean Y (Control)	37.894	37.894	20.615	20.615	1.105	1.105
SD	36.521	36.521	34.773	34.773	5.460	5.460
Observations	1,908	1,908	1,908	1,908	1,908	1,908

*p<0.1; **p<0.05; ***p<0.01

Note: The table shows the regression discontinuity effect on the share of properties owned according to official deeds, agricultural deeds, and public notary deeds, using a linear function in longitude and latitude.

Despite the observed effect of statelessness on property rights, Table 9 shows that differences in property rights across the desert line do not contribute significantly to explaining the gaps in economic development across the line. The regression discontinuity effects remain largely the same as in the unadjusted model in Table 3 (panel B). Overall, the effects of the property ownership variables on income and human capital are very small, but those for the infrastructure outcomes are more significant, yet they do not shift of the effect of historical statelessness. The effect sizes for the institutional variables remain largely similar when dropping the regression discontinuity variable and treating the study area as one region (See Appendix Table A8).

Table 9: RD effects on development outcomes controlling for institutional variables

	Dependent variable:								
	Income index	Education-based income	Electricity network	Sanitation network	Water network	Managers	Farmers	University educated	Illiteracy rate
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Stateless	-0.584***	-0.441***	-7.974***	-3.476	-28.096***	-3.628***	10.353***	-0.500***	13.889***
	(0.113)	(0.066)	(2.581)	(3.794)	(4.194)	(0.800)	(3.435)	(0.154)	(1.938)
Official deed	0.002**	0.001***	0.150***	0.294***	0.210***	-0.00002	-0.039**	0.005***	-0.010
	(0.001)	(0.0005)	(0.016)	(0.026)	(0.027)	(0.007)	(0.020)	(0.001)	(0.011)
Agricultural deed	0.001	-0.001*	0.126***	0.028	0.036	0.001	0.001	-0.0002	0.042***
	(0.001)	(0.0004)	(0.017)	(0.021)	(0.026)	(0.006)	(0.021)	(0.001)	(0.012)
Public notary	0.001	0.008***	0.194***	0.778***	0.665***	0.029*	-0.017	0.007*	-0.213***
	(0.002)	(0.002)	(0.042)	(0.171)	(0.113)	(0.015)	(0.102)	(0.004)	(0.075)
Observations	1,908	1,908	1,908	1,908	1,908	1,908	1,908	1,908	1,908

*p<0.1; **p<0.05; ***p<0.01

Note: The table shows the regression discontinuity effects and the effects of institutional variables on development outcomes, using a cubic polynomial in longitude and latitude.

6.3. Population density

Table 10 shows the regression discontinuity effects on three different measures of population density - the population size of the town or village itself, population size within a 5 km diameter, and population size within a 10 km diameter. The effects are generally large, on the scale of one standard deviation of the mean, and robust to the addition of ethnicity controls. This points to an important effect for historical statelessness in shaping population density, which can have important consequences for economic development. The evidence here is in line with the historical narratives that emphasize land abandonment and emigration from stateless areas.

Table 10: RD effect on population density

	Dependent variable:					
	Total population		Population within 5 Km diameter		Population within 10 Km diameter	
	(1)	(2)	(3)	(4)	(5)	(6)
Stateless	-1,360.842***	-1,409.517***	-17,343.250***	-18,178.850***	-99,027.280***	-99,859.590***
	(171.637)	(173.711)	(3,760.468)	(3,983.053)	(11,083.590)	(10,891.420)
Ethnicity	-	Y	-	Y	-	Y
Mean Y (Control)	1,644	1,644	13,323	13,323	75,512	75,512
SD	1,464	1,464	20,515	20,515	109,010	109,010
Observations	1,908	1,908	1,908	1,908	1,908	1,908

*p<0.1; **p<0.05; ***p<0.01

Note: The table shows the regression discontinuity effect on the total population in the village or town, total population within a 5 Km diameter, and total population within a 10 Km diameter, controlling for a cubic polynomial function in longitude and latitude.

To explore whether population density can explain the effect of stateless legacy on economic development today, Table 11 shows the regression discontinuity effects on economic development outcomes controlling for the population density measures. The last row compares the regression discontinuity effects here to those in the unadjusted model (Table 3, Panel B). The inclusion of the population size and density controls accounts for around half of the effect on incomes and human capital, and an even larger share of the effects on physical capital and the share of farmers. The coefficients on the density variables are generally significant but show slightly different patterns. For income and human capital, the population of the village or town itself matters most, whereas population density within a larger diameter matters more for infrastructure development outcomes. Being embedded in a wide dense network of towns and villages appears to matter most for infrastructure outcomes, and accounts for most of the effects observed for historical statelessness. The regression discontinuity effect on the sanitation network (which is small and insignificant in the unadjusted cubic polynomial model) becomes positive and statistically significant, suggesting that historically stateless areas have an advantage in this outcome once low-density constraints are taken into account.

Table 11: RD effects controlling for population density

	Dependent variable:								
	Income index	Education-based income	Electricity network	Sanitation network	Water network	Managers	Farmers	University educated	Illiteracy rate
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Stateless	-0.297**	-0.190***	0.592	19.027***	-7.949*	-3.483***	2.837	-0.236	6.398***
	(0.122)	(0.070)	(2.835)	(4.225)	(4.582)	(0.928)	(3.765)	(0.155)	(2.083)
ln population	0.181***	0.152***	4.057***	11.728***	8.433***	1.013***	-4.841***	0.214***	-2.754***
	(0.025)	(0.016)	(0.596)	(0.844)	(0.868)	(0.232)	(0.699)	(0.035)	(0.420)
ln population within 5 Km	0.064***	0.030**	0.898*	1.106	1.351*	0.348***	-1.806***	0.014	-1.143***
	(0.018)	(0.013)	(0.462)	(0.763)	(0.753)	(0.134)	(0.519)	(0.024)	(0.309)
ln population within 10 Km	0.008	0.030	1.989***	4.888***	5.799***	-0.881**	0.014	-0.004	-1.993***
	(0.034)	(0.026)	(0.729)	(1.286)	(1.315)	(0.344)	(1.056)	(0.067)	(0.550)
Observations	1,908	1,908	1,908	1,908	1,908	1,908	1,908	1,908	1,908
% explained by population	49	56	100	-	71	5	72	50	53

*p<0.1; **p<0.05; ***p<0.01

Note: The table shows the regression discontinuity effect controlling for the size of the local population and the population of the neighbouring area within diameters of 5- and 10-kilometers distance (in log form). The last row displays the percentage of the unadjusted RD effect explained by adding controls for population density, comparing the RD effects in this table with those in the unadjusted model in Table 3 (Panel B).

6.4. Emigration

The evidence above is in line with a role for path dependence as a mechanism for persistence. Historical statelessness can shape outcomes today through its effect on population density, by causing persistent emigration flows. While data on historical population movements is not currently available, it is possible to detect contemporary emigration through its effect on the age structure of the population. If we assume that high emigration rates disproportionally affect males in working age (age 15 to 64), then there should be a detectable effect on the share of that group in the overall population in historically stateless areas.

Table 12 shows the results from estimating the effect of historical statelessness on the proportion of each age group within the male population (columns 1 to 3) and on the ratio of males to females within each age group (columns 4 to 6). The first set of measures show that the stateless legacy reduces the proportion of working-age males within the overall male population. Areas with a stateless history experience a gap of -2.5 percentage points in the working age male population, as compared to control areas. Meaning that historical statelessness reduces the working-age male share by 4.7% relative to the control mean value. This effect is mirrored in the male-to-female ratio within the same age group, which declines by 0.048 in historically stateless areas, also representing a 4.7% relative reduction in gender balance within the working-age group. These consistent effects strongly indicate male-selective out-migration. The effect is also robust to controlling for fertility rates (see Appendix table A9), and to excluding areas with non-Sunni majorities (See Appendix Table A10).

Table 12: RD effects on age structure in the male population and the sex ratio according to age

	Dependent variable:					
	Males under 15	Males 15 to 64	Males 65 and over	Males/females under 15	Males/females 15 to 64	Males/females 65 and over
	(1)	(2)	(3)	(4)	(5)	(6)
Stateless	2.890^{***}	-2.513^{***}	-0.377^{***}	0.026^{**}	-0.048^{**}	0.079
	(0.375)	(0.346)	(0.120)	(0.011)	(0.021)	(0.068)
Mean Y (Control)	43.012	53.174	3.813	1.081	1.027	1.412
SD	7.314	6.174	2.459	0.153	0.311	0.832
Observations	1,872	1,872	1,872	1,872	1,872	1,856

*p<0.1; **p<0.05; ***p<0.01

Note: The table shows the RD effects on the proportion of each age group within the male population divided by the proportion of the age group in the total population (columns 1 to 3), and the RD effects on the sex ratio within each age group, controlling for linear terms in longitude and latitude.

7. Discussion and conclusion

The results above provide evidence of the long-term economic consequences of historical statelessness in Ottoman Syria. The findings reveal a persistent economic gap between regions that experienced prolonged state control and those that remained outside its reach until the mid-19th century. These results contribute to the broader literature on institutional persistence, economic geography, and path dependence by highlighting how the absence of stable governance in the past continues to shape economic outcomes in the present.

The analysis demonstrates that historically stateless areas have lower incomes, less developed infrastructure, lower levels of human capital, and a less industrialized economy. These gaps remain robust even when controlling for potential confounders such as geography and ethnic differences. Importantly, the results suggest that these economic disparities are not primarily driven by differences in private property institutions or ethnic composition but are instead strongly correlated with population density. The lower population density in historically stateless regions appears to be a major mechanism of persistence, with historical insecurity leading to emigration and reduced long-term settlement in these areas.

The role of population density in sustaining regional economic disparities aligns with existing research on path dependence in economic development (Bleakley and Lin 2012; Baerlocher et al. 2024). The historical insecurity and lack of state protection in stateless areas created conditions that discouraged permanent settlement and economic investment. Over time, these conditions led to lower population densities, which in turn limited the potential for human and physical capital accumulation. The regression results indicate that differences in population density account for a significant portion of the observed income and human capital gaps, reinforcing the argument that path dependence is a key mechanism through which historical state presence influences contemporary economic development.

The findings are further corroborated by evidence on contemporary migration patterns. The persistent out-migration of working-age males from historically stateless regions suggests that these areas continue to struggle with retaining their labor force, further exacerbating their economic disadvantage. This persistent demographic pattern aligns with historical narratives of rural insecurity and land abandonment due to tribal incursions and weak state authority. These dynamics highlight how frontier conditions can have enduring effects on local economic structures, a pattern observed in other historical contexts as well (Oto-Peralías 2020).

The findings have important implications for policy efforts aimed at reducing regional inequalities and promoting economic development in historically marginalized areas. Policies that address population density constraints—such as targeted infrastructure investments, incentives for urbanization, and improvements in local governance—may help mitigate some of the long-term disadvantages faced by historically stateless regions. In particular, investments in transportation networks, educational institutions, and economic diversification strategies could help attract and retain populations in these areas, fostering more sustainable long-term development.

These challenges are deeply rooted in historical patterns of settlement and conflict. The tension between settled agrarian communities and nomadic groups has shaped the economic geography of the MENA region for centuries and continues to influence the politics of many developing countries today, particularly in Sub-Saharan Africa. In a world affected by climate change, such frontier zones remain sites of recurring conflict, as worsening climatic conditions increase pressures on pastoralist populations (McGuirk and Nunn 2024, Bai and Kung 2011). The analysis here highlights how these conflicts can have lasting consequences for economic development, shaping patterns of human settlement and urbanization in ways that persist over time. Addressing these historical legacies through forward-looking policies may be key to fostering more inclusive and resilient development trajectories.

References

Abu-Ismail, K., Abdel-Gadir, A., & El-Laithy, H. (2016). Poverty and Inequality in Syria. *Arab Development Challenges Report Background Paper 2011* (15).

Baerlocher, D., Firmino Costa da Silva, D., Lambais, G., Reis, E., & Veras, H. (2025). Old but gold: historical pathways and path dependence. Available at SSRN 4513384.

Bai, Y., & Kung, J. K. S. (2011). Climate shocks and Sino-nomadic conflict. *Review of Economics and Statistics, 93*(3), 970-981.

Barakat, N. E. (2015). *An Empty Land? Nomads and Property Administration in Hamidian Syria* (Doctoral dissertation, UC Berkeley).

Barout, M.J. (2013). *Contemporary History of the Syrian Jazeerah: Challenges of Urban Transition for Nomadic Communities.* Arab Centre for Research and Policy Studies.

Bayat, F.M. (2017), *البلاد العربية في الوثائق العثمانية*. Research Centre for Islamic History, Art and Culture (IRCICA).

Bleakley, H., & Lin, J. (2012). Portage and path dependence. *The quarterly journal of economics, 127*(2), 587-644.

Bockstette, V., Chanda, A., & Putterman, L. (2002). States and markets: The advantage of an early start. *Journal of Economic growth, 7*(4), 347-369.

Borcan, O., Olsson, O., & Putterman, L. (2018). State history and economic development: evidence from six millennia. *Journal of Economic Growth, 23*(1), 1-40.

Boserup, E. (2014). *The conditions of agricultural growth: The economics of agrarian change under population pressure.* Routledge.

Chanda, A., & Putterman, L. (2007). Early starts, reversals and catch-up in the process of economic development. *Scandinavian Journal of Economics, 109*(2), 387-413.

Dalgaard, C. J., Kaarsen, N., Olsson, O., & Selaya, P. (2022). Roman roads to prosperity: Persistence and non-persistence of public infrastructure. *Journal of Comparative Economics, 50*(4), 896-916.

Dell, M. (2010). The persistent effects of Peru's mining mita. *Econometrica, 78*(6), 1863-1903.

Dell, M., Lane, N., & Querubin, P. (2018). The historical state, local collective action, and economic development in Vietnam. *Econometrica, 86*(6), 2083-2121.

Esmer, T. U. (2014). Economies of violence, banditry and governance in the Ottoman empire around 1800. *Past & Present, 224*(1), 163-199.

Gennaioli, N., & Rainer, I. (2007). The modern impact of precolonial centralization in Africa. *Journal of Economic Growth, 12*(3), 185-234.

Geyer, B. (2011). The steppe: human occupation and potentiality, the example of northern Syria's arid Margins. Syria. *Archéologie, art et histoire* (88), 7-22.

Geyer, B., Calvet, Y., Awad, N., Al-Dbiyat, M., & Rousset, M. O. (2010). Un «Très Long Mur» dans la steppe syrienne. *Paléorient*, 57-72.

Hatton, T. J. (2020). Asylum migration to the developed world: Persecution, incentives, and policy. *Journal of Economic Perspectives, 34*(1), 75-93.

Hinnebusch, R. (2012). Syria: from 'authoritarian upgrading' to revolution? *International Affairs, 88*(1), 95-113.

Hoffman, B. G. (1967). *The structure of traditional Moroccan rural society.* Mouton.

Hopkins, I. W. (1967). The maps of Carsten Niebuhr: 200 years after. *The Cartographic Journal, 4*(2), 115-118.

Khaddour, K. and Mazur, K. (2018), *Syria town database.* Harvard Dataverse, V1.

Khoury, P. S., & Kostiner, J. (Eds.). (1990). *Tribes and state formation in the Middle East.* University of California Press.

Klasen, S., & Nestmann, T. (2006). Population, population density and technological change. *Journal of Population Economics, 19*(3), 611-626.

Kremer, M. (1993). Population growth and technological change: One million BC to 1990. *The Quarterly Journal of Economics, 108*(3), 681-716.

Krugman, P. (1992). *Geography and trade.* MIT press.

Liebeschuetz, J. H. W. G. (2015). Arab tribesmen and desert frontiers in late antiquity. *Journal of Late Antiquity, 8*(1), 62-96.

Lindner, R. P. (2017). *Nomads and Ottomans in medieval Anatolia.* Routledge.

Lowes, S., Nunn, N., Robinson, J. A., & Weigel, J. L. (2017). The evolution of culture and institutions: Evidence from the Kuba Kingdom. *Econometrica, 85*(4), 1065-1091.

Ma'oz, M. (2013). The emergence of modern Syria. In *Syria Under Assad (RLE Syria)* (pp. 9-35). Routledge.

Ma'oz, M. (1968). *Ottoman reform in Syria and Palestine, 1840-1861: The impact of the Tanzimat on politics and society.* Clarendon Press.

Michaels, G., & Rauch, F. (2018). Resetting the urban network: 117–2012. *The Economic Journal, 128*(608), 378-412.

McGuirk, E. F., & Nunn, N. (2025). Transhumant pastoralism, climate change, and conflict in Africa. *Review of Economic Studies, 92*(1), 404-441.

Michalopoulos, S., & Papaioannou, E. (2013). Pre-colonial ethnic institutions and contemporary African development. *Econometrica, 81*(1), 113-152.

Lewis, N. N. (1987). *Nomads and settlers in Syria and Jordan, 1800-1980.* Cambridge University Press.

North, D. C., Wallis, J. J., & Weingast, B. R. (2009). *Violence and social orders: A conceptual framework for interpreting recorded human history.* Cambridge University Press.

Nunn, N. (2020). The historical roots of economic development. *Science, 367*(6485), eaaz9986.

Rogan, E. L. (2002). *Frontiers of the state in the late Ottoman Empire: Transjordan, 1850-1921 (Vol. 12)*. Cambridge University Press.

Robinson, E. and Smith, E. (1856). *Biblical researches in Palestine, Mount Sinai and Arabia Petraea: A journal of travels in the year 1838 (Vol. 4).* J. Murray.

Rogan, E.L., 1995. Ottomans, Merchants and Tribes in the Syrian Frontier (1867-1900). in D.Panzac, ed, *Histoire Économique et Sociale de l'Empire Ottoman et de la Turquie (1326- 1960)* (Paris: Peeters, 1995) pp. 251-62.

Rousset, M. O., Geyer, B., Awad, N., & Shabo, S. (2020). The defensive system of the arid margins of the Northern Levant during the Middle Bronze Age. In *11th International Congress on the Archaeology of the Ancient Near East* (pp. 349-362). Harrassowitz Verlag.

Oto-Peralías, D. (2020). Frontiers, warfare and economic geography: The case of Spain. *Journal of Development Economics, 146,* 102511.

Özok-Gündoğan, N. (2014). Ruling the Periphery, Governing the Land: The Making of the Modern Ottoman State in Kurdistan, 1840-70*. Comparative Studies of South Asia, Africa and the Middle East, 34*(1), 160-175.

Walker, B. J. (2012). The phenomenon of the "disappearing" villages of late medieval Jordan, as reflected in archaeological and economic sources. *Bulletin d'études orientales, (Tome LX),* 161-176.

Wickham, C. (2005). *Framing the early middle ages: Europe and the Mediterranean, 400-800.* Oxford University Press.

Williams, S. L. (1981). Ottoman land policy and social change: The Syrian provinces. *Acta Orientalia Academiae Scientiarum Hungaricae, 35*(1), 89-120.

Winter, S. (2006). The Other" Nahḍah": The Bedirxans, the Millîs and the Tribal Roots of Kurdish Nationalism in Syria. *Oriente Moderno, 25*(3), 461-474.

Appendix

Table A1: Regression discontinuity effects using 25km bands

	Dependent variable:								
	Income index	Education-based income index	Electricity network	Sanitation network	Water network	Managers	Farmers	University educated	Illiteracy rate
Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: Linear model									
Stateless	-0.321***	-0.333***	-3.706***	-15.950***	-17.691***	-3.984***	2.503	-0.417***	9.216***
	(0.064)	(0.040)	(1.398)	(2.210)	(2.665)	(0.464)	(1.962)	(0.087)	(1.039)
Panel B: Cubic polynomial model									
Stateless	-0.563***	-0.548***	-10.448***	-5.398	-24.111***	-0.794	11.722***	-0.707***	17.231***
	(0.143)	(0.080)	(3.232)	(5.168)	(5.401)	(0.933)	(4.406)	(0.180)	(2.408)

*p<0.1; **p<0.05; ***p<0.01

Note: Standard errors clustered by district are in parentheses (92 clusters). All regressions control for log distance to Aleppo. The basic linear model includes controls for latitude and longitude on each side of the regression discontinuity line. The cubic polynomial model includes controls for latitude and longitude on each side of the discontinuity of the form $x + y + x^2 + y^2 + xy + x^3 + y^3 + x^2y + xy^2$ where x and y denote longitude and latitude.

Table A2: Regression discontinuity effects with controls for line segment fixed effects

	Dependent variable:								
	Income index	Education-based income index	Electricity network	Sanitation network	Water network	Managers	Farmers	University educated	Illiteracy rate
Model	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: Linear model									
Stateless	-1.382***	-0.718***	-7.427*	-14.025*	-39.782***	-3.009**	35.223***	-1.306***	14.230***
	(0.224)	(0.123)	(4.119)	(7.704)	(9.287)	(1.485)	(6.493)	(0.236)	(3.040)
Panel B: Cubic polynomial model									
Stateless	-1.121***	-0.600***	14.324	-3.535	4.686	-0.716	26.420**	-1.146**	6.927
	(0.418)	(0.230)	(9.319)	(14.545)	(16.443)	(2.349)	(11.860)	(0.494)	(6.459)

*p<0.1; **p<0.05; ***p<0.01

Note: Standard errors clustered by district are in parentheses (92 clusters). All regressions control for log distance to Aleppo. The basic linear model includes controls for latitude and longitude on each side of the regression discontinuity line. The cubic polynomial model includes controls for latitude and longitude on each side of the discontinuity of the form $x + y + x^2 + y^2 + xy + x^3 + y^3 + x^2y + xy^2$ where x and y denote longitude and latitude.

Table A3: RD regression models with linear longitude and latitude

	Dependent variable:								
	Income index	Education-based income	Electricity network	Sanitation network	Water network	Managers	Agriculture	University educated	Illiteracy rate
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Stateless	-0.532***	-0.438***	-3.410**	-21.942***	-22.491***	-5.010***	7.098***	-0.530***	9.216***
	(0.061)	(0.037)	(1.326)	(2.047)	(2.529)	(0.407)	(1.853)	(0.075)	(1.039)
log(to_Aleppo)	0.064	0.263***	1.897	-4.460**	4.832**	2.511***	1.820	0.291***	0.559
	(0.051)	(0.025)	(1.153)	(1.963)	(2.105)	(0.237)	(1.658)	(0.044)	(1.005)
Stateless:long	0.608***	0.097	2.143	14.725***	19.644***	4.324***	-16.727***	-0.082	-3.884
	(0.146)	(0.089)	(2.506)	(4.333)	(6.004)	(0.960)	(4.240)	(0.133)	(2.430)
Stateless:lat	-0.781***	-0.504***	-0.152	-22.324***	-17.730***	-7.478***	6.335*	-0.323***	13.796***
	(0.135)	(0.078)	(2.133)	(3.823)	(4.688)	(1.080)	(3.551)	(0.115)	(1.853)
long:Control	-0.517***	-0.341***	-0.849	2.815	-45.193***	-2.290***	9.300***	-0.223	4.748***
	(0.097)	(0.062)	(1.837)	(3.456)	(3.145)	(0.837)	(2.633)	(0.148)	(1.304)
lat:Control	-0.357***	-0.320***	1.638	-21.362***	8.828***	-5.116***	6.159**	-0.579***	6.489***
	(0.094)	(0.062)	(1.791)	(3.303)	(3.069)	(0.888)	(2.453)	(0.156)	(1.234)
Constant	-1.186***	-1.936***	85.048***	55.066***	35.440***	-3.640***	33.210***	-0.100	23.611***
	(0.230)	(0.114)	(5.110)	(8.812)	(9.353)	(1.085)	(7.375)	(0.215)	(4.457)
Observations	1,908	1,908	1,908	1,908	1,908	1,908	1,908	1,908	1,908
Adjusted R^2	0.197	0.407	0.004	0.121	0.248	0.308	0.059	0.196	0.206
Residual Std. Error	0.999	0.620	20.554	34.832	36.227	8.374	27.628	1.242	15.350

*p<0.1; **p<0.05; ***p<0.01

Table A4: RD regression models with cubic polynomial longitude and latitude

	Dependent variable:								
	Income index	Education-based income	Electricity network	Sanitation network	Water network	Managers	Agriculture	University educated	Illiteracy rate
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Stateless	-0.577***	-0.431***	-7.754***	-2.006	-27.177***	-3.648***	10.098***	-0.471***	13.676***
	(0.113)	(0.066)	(2.659)	(4.073)	(4.289)	(0.797)	(3.446)	(0.154)	(1.956)
log(to_Aleppo)	-0.431***	-0.051	6.645**	-18.919***	-3.179	-2.916***	7.264*	-0.013	0.803
	(0.119)	(0.065)	(2.691)	(4.873)	(4.970)	(0.652)	(3.752)	(0.119)	(2.348)
Stateless:long	-1.283***	-0.711***	-26.378***	3.557	-41.342***	0.638	34.690***	-0.870***	19.960***
	(0.257)	(0.160)	(6.125)	(8.990)	(11.380)	(1.319)	(7.998)	(0.223)	(4.888)
Stateless:lat	-0.693**	-0.593***	18.348**	-29.362**	10.328	-11.177***	0.627	-0.398	1.206
	(0.335)	(0.198)	(7.438)	(12.329)	(13.887)	(2.094)	(9.890)	(0.329)	(5.550)
Stateless:I(long2)	4.244***	2.006***	8.333	-39.324	168.202***	14.447***	-103.296***	0.502	-38.963**
	(0.984)	(0.576)	(23.013)	(31.054)	(40.521)	(4.633)	(30.744)	(0.957)	(17.851)
Stateless:I(lat2)	1.146***	0.485**	15.010**	6.574	39.609***	4.392	-23.156**	0.340	-19.748***
	(0.370)	(0.219)	(6.915)	(10.539)	(12.555)	(2.886)	(9.378)	(0.306)	(4.566)
Stateless:I(long3)	-1.352	-0.784	44.052	92.287**	-35.050	-7.799	63.843	0.869	20.437
	(1.540)	(0.962)	(32.183)	(46.954)	(60.395)	(8.142)	(45.528)	(1.417)	(28.023)
long:Control	-1.028***	0.189	-0.364	-8.392	-71.508***	3.428	45.334***	1.264	3.839
	(0.398)	(0.281)	(7.888)	(15.269)	(15.294)	(3.121)	(12.162)	(0.781)	(7.304)
lat:Control	-1.215***	-1.043***	12.139	-34.183**	-14.549	-19.257***	-4.806	-1.906***	6.528
	(0.400)	(0.265)	(7.509)	(14.863)	(13.643)	(3.080)	(10.787)	(0.618)	(5.222)
I(long2):Control	-0.100	1.994**	2.685	54.489	-6.858	14.513	52.462*	5.810**	-3.051
	(0.980)	(0.781)	(15.680)	(35.423)	(33.707)	(10.670)	(28.749)	(2.446)	(14.450)

Table A4 (continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
I(lat2):Control	0.694	0.803*	-3.888	45.299***	7.173	5.527	6.523	2.383*	-4.571
	(0.469)	(0.415)	(7.754)	(17.504)	(16.662)	(5.431)	(12.305)	(1.353)	(6.102)
I(long3):Control	0.686	1.284*	23.837	45.496	56.780*	0.755	-10.192	4.842**	-11.681
	(0.921)	(0.682)	(16.348)	(34.803)	(31.143)	(8.970)	(26.977)	(2.053)	(13.388)
Control:I(lat3)	1.862***	0.703*	-7.802	45.668***	39.235***	20.397***	-20.401*	0.409	-0.834
	(0.477)	(0.359)	(8.996)	(17.267)	(14.567)	(4.747)	(11.868)	(1.071)	(5.660)
Stateless:long:lat	-0.648	0.256	-4.485	78.115**	-106.757***	-2.458	33.977	1.926*	10.024
	(1.115)	(0.693)	(20.732)	(36.527)	(40.930)	(8.245)	(29.094)	(0.998)	(15.637)
Stateless:lat:I(long2)	-2.476	-1.295	-70.232	-156.345*	-7.889	-3.646	-48.651	-2.935	1.445
	(2.890)	(1.880)	(49.050)	(84.778)	(104.594)	(19.450)	(75.564)	(2.451)	(48.397)
Stateless:long:I(lat2)	2.321	0.927	22.072	43.891	-41.618	8.830	-6.409	0.738	-0.976
	(1.451)	(0.921)	(23.895)	(42.777)	(51.037)	(11.162)	(36.929)	(1.326)	(22.467)
long:lat:Control	0.170	-1.821	-8.093	-46.805	-4.616	-6.889	-62.188*	-6.849*	8.908
	(1.310)	(1.122)	(22.552)	(48.078)	(45.988)	(14.862)	(36.884)	(3.612)	(18.924)
lat:I(long2):Control	0.017	-3.424**	-29.093	-28.718	-4.773	0.033	-34.567	-11.416**	29.946
	(2.126)	(1.736)	(38.033)	(77.756)	(66.692)	(24.159)	(56.631)	(5.527)	(27.615)
long:I(lat2):Control	-1.759	0.902	4.612	-60.545	-27.705	-20.505	46.328	5.004	-12.402
	(1.508)	(1.309)	(26.844)	(53.739)	(43.422)	(18.363)	(36.137)	(4.313)	(16.195)
Constant	0.569	-0.835***	68.959***	92.621***	68.507***	16.131***	15.063	0.922**	21.981**
	(0.454)	(0.245)	(10.468)	(18.701)	(18.851)	(2.409)	(14.329)	(0.420)	(8.884)
Observations	1,908	1,908	1,908	1,908	1,908	1,908	1,908	1,908	1,908
Adjusted R^2	0.264	0.451	0.021	0.164	0.288	0.346	0.126	0.224	0.246

$^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

Table A5: RD regression models with cubic polynomial longitude and latitude and controls for ethnic majority

	Dependent variable:								
	Income index	Education-based income	Electricity network	Sanitation network	Water network	Managers	Agriculture	University educated	Illiteracy rate
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Stateless	-0.645***	-0.523***	-8.703***	-3.232	-28.155***	-4.279***	11.210***	-0.653***	14.533***
	(0.111)	(0.062)	(2.729)	(4.122)	(4.289)	(0.735)	(3.448)	(0.145)	(1.977)
log(to_Aleppo)	-0.318***	0.062	7.177***	-17.825***	-2.463	-1.680***	5.594	0.144	-0.266
	(0.118)	(0.065)	(2.589)	(4.930)	(4.991)	(0.645)	(3.644)	(0.121)	(2.320)
Ethnicity Alawi	0.913***	0.615***	2.342	1.473	7.301**	9.941***	-15.601***	0.575***	-6.887***
	(0.109)	(0.072)	(2.200)	(3.515)	(3.267)	(1.117)	(2.508)	(0.137)	(0.974)
Ethnicity Christian	0.620***	1.320***	4.993	33.353***	18.697***	0.051	-12.192***	3.253***	-8.362***
	(0.188)	(0.142)	(3.275)	(5.305)	(4.191)	(1.721)	(4.480)	(0.389)	(1.336)
Ethnicity Druze	-0.139	0.307*	0.143	-34.472***	13.482***	3.329	15.540*	0.648*	-4.832
	(0.361)	(0.165)	(2.648)	(5.707)	(4.097)	(2.527)	(8.859)	(0.339)	(5.197)
Ethnicity Kurdish	-0.864***	-0.179**	-8.462**	-17.445***	-21.603***	-0.143	26.962***	-0.153	8.061**
	(0.121)	(0.079)	(3.509)	(6.217)	(6.610)	(0.578)	(4.434)	(0.117)	(3.703)
Ethnicity Mixed	0.557***	0.489***	6.035***	3.694	3.765	5.394***	-10.857***	0.651***	-4.311***
	(0.143)	(0.090)	(1.403)	(4.713)	(4.608)	(1.323)	(3.165)	(0.190)	(1.481)
Ethnicity Other minority	0.234	0.341***	-0.621	-1.590	0.866	4.922**	-1.375	0.670*	-1.308
	(0.157)	(0.124)	(3.433)	(5.284)	(5.279)	(1.972)	(3.655)	(0.346)	(1.792)
Ethnicity Sunni tribes	-0.177**	0.008	-5.617***	-3.789	-7.262**	0.782	5.829**	0.048	3.975***
	(0.084)	(0.048)	(2.137)	(2.857)	(3.444)	(0.488)	(2.450)	(0.095)	(1.527)
Stateless:long	-1.374***	-0.891***	-23.633***	5.607	-38.304***	-2.326*	34.216***	-1.139***	18.958***
	(0.250)	(0.153)	(6.161)	(9.443)	(11.333)	(1.272)	(7.990)	(0.229)	(4.930)

Table A5 (continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Stateless:lat	-0.007	-0.110	26.177***	-23.109*	20.637	-5.846***	-12.982	0.249	-6.712
	(0.346)	(0.202)	(7.438)	(12.814)	(14.537)	(2.229)	(10.125)	(0.366)	(5.686)
Stateless:I(long2)	4.089***	1.785***	12.068	-37.138	172.891***	10.542**	-103.059***	0.298	-40.040**
	(0.993)	(0.550)	(23.437)	(31.591)	(40.980)	(4.690)	(31.119)	(0.885)	(18.322)
Stateless:I(lat2)	1.252***	0.558***	18.982***	9.473	43.458***	4.270	-26.260***	0.514	-22.104***
	(0.358)	(0.206)	(7.068)	(10.736)	(12.832)	(2.771)	(9.339)	(0.314)	(4.663)
Stateless:I(long3)	-0.943	-0.303	37.241	87.194*	-41.753	1.046	61.276	1.364	21.677
	(1.529)	(0.931)	(32.728)	(47.702)	(61.267)	(8.142)	(46.004)	(1.349)	(28.378)
long:Control	-1.127***	-0.164	3.941	-11.906	-70.013***	1.432	44.910***	0.511	2.803
	(0.389)	(0.261)	(8.253)	(15.368)	(15.625)	(2.959)	(11.940)	(0.747)	(7.307)
lat:Control	-0.616	-0.514**	14.839**	-28.179*	-7.312	-13.959***	-15.054	-1.152*	0.712
	(0.382)	(0.246)	(7.537)	(14.733)	(13.724)	(2.904)	(10.422)	(0.600)	(5.119)
I(long2):Control	-1.097	0.753	-5.134	35.502	-22.775	6.729	68.851**	3.451	8.594
	(0.941)	(0.721)	(16.563)	(35.549)	(34.067)	(10.151)	(27.657)	(2.313)	(14.466)
I(lat2):Control	0.306	0.401	-10.575	38.115**	-1.785	3.209	13.678	1.603	1.862
	(0.464)	(0.380)	(8.330)	(17.439)	(16.870)	(5.202)	(12.252)	(1.275)	(6.290)
I(long3):Control	0.458	0.984	15.380	35.523	47.777	0.975	-5.278	4.104**	-5.099
	(0.909)	(0.653)	(17.369)	(34.670)	(31.475)	(8.705)	(26.442)	(2.013)	(13.650)
Control:I(lat3)	1.273***	0.127	-10.770	42.466**	30.516**	15.028***	-11.666	-0.420	5.748
	(0.467)	(0.348)	(9.403)	(17.262)	(14.813)	(4.492)	(11.741)	(1.019)	(5.471)
Stateless:long:lat	-0.723	0.276	-15.534	68.430*	-118.121***	1.651	39.843	1.732*	15.930
	(1.103)	(0.669)	(20.893)	(37.247)	(42.357)	(8.317)	(29.381)	(0.992)	(16.054)
Stateless:lat:I(long2)	-2.976	-1.858	-54.139	-143.214*	5.727	-17.365	-48.190	-3.310	-3.323
	(2.843)	(1.827)	(49.207)	(85.862)	(106.240)	(19.563)	(76.424)	(2.413)	(48.582)

Table A5 (continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Stateless:long:I(lat2)	1.846	0.690	6.350	32.165	-57.984	9.405	7.359	0.256	9.169
	(1.461)	(0.907)	(23.698)	(43.558)	(52.394)	(11.631)	(38.144)	(1.344)	(22.534)
long:lat:Control	0.664	-1.132	2.346	-30.733	11.331	-5.679	-71.460**	-5.265	-1.222
	(1.253)	(1.023)	(23.463)	(47.283)	(45.730)	(14.216)	(35.427)	(3.435)	(18.953)
lat:I(long2):Control	1.472	-2.130	-11.188	7.709	20.903	7.614	-67.074	-8.931*	12.267
	(2.090)	(1.627)	(39.323)	(77.138)	(67.016)	(23.127)	(55.540)	(5.262)	(27.839)
long:I(lat2):Control	-1.858	1.136	-2.225	-72.876	-29.311	-18.686	54.948	5.349	-10.814
	(1.493)	(1.228)	(27.845)	(53.133)	(43.632)	(17.604)	(36.024)	(4.103)	(16.162)
Constant	0.233	-1.230***	70.215***	91.168***	69.758***	11.062***	18.491	0.415	23.798***
	(0.448)	(0.244)	(10.468)	(18.862)	(18.999)	(2.334)	(13.895)	(0.424)	(8.931)
Observations	1,908	1,908	1,908	1,908	1,908	1,908	1,908	1,908	1,908
Adjusted R^2	0.317	0.508	0.028	0.180	0.295	0.414	0.161	0.305	0.261
Residual Std. Error	0.921	0.565	20.302	33.645	35.074	7.703	26.082	1.155	14.806

*p<0.1; **p<0.05; ***p<0.01

Table A6: RD regression models with cubic polynomial longitude and latitude and controls for geographic variables

	Dependent variable:								
	Income index	Education-based income	Electricity network	Sanitation network	Water network	Managers	Farmers	University educated	Illiteracy rate
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Stateless	-0.500***	-0.409***	-7.338***	-0.903	-26.805***	-3.589***	7.743**	-0.421***	13.541***
	(0.112)	(0.067)	(2.673)	(4.080)	(4.313)	(0.806)	(3.379)	(0.157)	(1.959)
log(to_Aleppo)	-0.490***	-0.055	4.725*	-23.100***	-3.729	-1.779**	9.849**	-0.136	0.165
	(0.125)	(0.068)	(2.809)	(5.009)	(5.101)	(0.728)	(3.860)	(0.131)	(2.367)
Slope	-0.018***	-0.009***	0.104	-0.688***	-0.375**	-0.078	0.475***	-0.001	0.325***
	(0.005)	(0.003)	(0.087)	(0.178)	(0.172)	(0.052)	(0.128)	(0.008)	(0.093)
Elevation	0.001*	0.0003*	0.004	-0.013	-0.003	0.001	-0.009	0.001***	0.002
	(0.0003)	(0.0002)	(0.006)	(0.009)	(0.009)	(0.003)	(0.007)	(0.0004)	(0.004)
Temperature	-0.354***	-0.052	-0.393	-1.274	-0.192	-1.707**	11.347***	0.017	0.591
	(0.078)	(0.049)	(1.889)	(2.834)	(2.680)	(0.690)	(1.917)	(0.098)	(1.115)
Precipitation	0.001	0.001	-0.073***	-0.218***	-0.035	0.061***	0.044	-0.002	-0.027*
	(0.001)	(0.001)	(0.026)	(0.045)	(0.040)	(0.014)	(0.032)	(0.002)	(0.015)
Flow accumulation	-0.00001**	0.00000	0.00003	-0.00003	0.0001	-0.00005	0.0002**	-0.00000	-0.00002
	(0.00000)	(0.00000)	(0.0001)	(0.0002)	(0.0002)	(0.00004)	(0.0001)	(0.00001)	(0.0001)
Stateless:long_d	-0.751***	-0.547***	-31.095***	-10.987	-43.756***	7.412***	22.488***	-0.990***	17.227***
	(0.289)	(0.185)	(6.651)	(10.124)	(12.152)	(1.831)	(8.531)	(0.294)	(5.114)

Table A6 (continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Stateless:lat_d	-0.909***	-0.680***	20.556***	-23.125*	11.294	-14.023***	4.788	-0.398	2.667
	(0.336)	(0.202)	(7.527)	(12.531)	(13.996)	(2.177)	(9.808)	(0.339)	(5.579)
Stateless:I(long_d2)	1.921*	1.335**	10.368	-12.633	173.235***	-1.267	-42.243	-0.196	-34.851*
	(1.039)	(0.615)	(23.421)	(34.136)	(42.726)	(5.466)	(31.991)	(1.063)	(18.364)
Stateless:I(lat_d2)	0.202	0.222	15.520**	14.597	41.007***	-1.586	2.193	0.072	-17.876***
	(0.388)	(0.235)	(7.655)	(11.714)	(13.527)	(3.037)	(9.824)	(0.349)	(4.923)
Stateless:I(long_d3)	0.987	-0.138	47.430	75.874	-39.012	4.029	-0.072	1.900	18.839
	(1.559)	(0.981)	(32.642)	(48.635)	(61.571)	(8.612)	(46.025)	(1.480)	(28.336)
long_d:Control	-0.427	0.408	-4.559	-23.642	-73.894***	10.151***	32.243***	1.330*	1.093
	(0.411)	(0.295)	(8.055)	(15.817)	(15.539)	(3.427)	(12.219)	(0.804)	(7.472)
lat_d:Control	-1.814***	-1.250***	12.085	-29.157**	-13.984	-22.635***	10.179	-2.237***	7.832
	(0.398)	(0.276)	(7.785)	(14.873)	(13.923)	(3.309)	(10.553)	(0.645)	(5.436)
I(long_d2):Control	-1.243	1.449	33.451*	152.109***	10.985	-17.403	63.976*	6.913***	8.188
	(1.193)	(0.891)	(19.601)	(41.577)	(39.731)	(12.167)	(33.986)	(2.638)	(17.231)
I(lat_d2):Control	-0.015	0.556	5.721	78.501***	13.698	-6.697	20.087	2.693*	-0.600
	(0.528)	(0.445)	(9.151)	(19.496)	(18.878)	(5.822)	(13.825)	(1.401)	(7.127)
I(long_d3):Control	-0.487	0.810	38.228**	92.847**	64.121*	-17.573*	11.999	5.076**	-4.182
	(0.984)	(0.707)	(17.179)	(36.612)	(33.133)	(9.303)	(29.064)	(2.085)	(14.543)
Control:I(lat_d3)	2.714***	1.009***	-11.762	36.207**	39.776***	27.821***	-41.251***	0.522	-5.653
	(0.479)	(0.368)	(9.618)	(17.655)	(15.376)	(4.983)	(11.794)	(1.084)	(6.227)

Table A6 (continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Stateless:long_d:lat_d	0.922	0.686	-1.337	73.452*	-107.873***	4.354	-9.536	2.667***	8.469
	(1.120)	(0.700)	(21.574)	(37.493)	(41.795)	(8.321)	(29.451)	(1.026)	(15.911)
Stateless:lat_d:I(long_d2)	-4.370	-1.777	-79.273	-158.128*	-6.621	-8.285	6.184	-4.139*	0.232
	(2.869)	(1.879)	(49.795)	(85.222)	(105.066)	(19.548)	(75.038)	(2.465)	(48.470)
Stateless:long_d:I(lat_d2)	2.882**	1.019	28.647	57.094	-39.893	6.978	-25.715	1.212	0.519
	(1.438)	(0.919)	(24.360)	(43.019)	(51.325)	(11.194)	(36.469)	(1.338)	(22.506)
long_d:lat_d:Control	1.375	-1.340	-33.811	-125.850**	-18.904	21.178	-80.308**	-7.892**	-1.483
	(1.449)	(1.193)	(25.392)	(52.107)	(50.663)	(15.684)	(40.550)	(3.731)	(21.340)
lat_d:I(long_d2):Control	3.655	-1.883	-85.986**	-210.771**	-35.007	66.972**	-95.514	-12.781**	3.120
	(2.490)	(1.903)	(43.866)	(88.714)	(78.429)	(26.396)	(67.055)	(5.791)	(33.675)
long_d:I(lat_d2):Control	-4.441**	-0.219	44.061	53.082	-11.693	-66.670***	94.641**	6.009	9.388
	(1.738)	(1.416)	(31.061)	(61.185)	(52.032)	(19.828)	(42.741)	(4.489)	(21.026)
Constant	7.009***	-0.135	90.924**	163.611***	79.725	35.155**	-204.279***	0.896	16.027
	(1.592)	(0.992)	(40.893)	(58.041)	(56.421)	(13.712)	(40.404)	(1.893)	(24.634)
Observations	1,907	1,907	1,907	1,907	1,907	1,907	1,907	1,907	1,907
Adjusted R^2	0.288	0.454	0.023	0.176	0.287	0.361	0.156	0.229	0.249
Residual Std. Error	0.940	0.595	20.357	33.730	35.263	8.044	26.161	1.216	14.932

*p<0.1; **p<0.05; ***p<0.01

Table A7: RD effects on informality in property ownership

	Dependent variable:					
	Official deed		Agricultural deed		Public notary	
	(1)	(2)	(3)	(4)	(5)	(6)
Stateless	7.376*	6.517	-4.981	-4.410	-0.435	-0.487
	(3.885)	(3.969)	(4.113)	(4.185)	(0.751)	(0.739)
Ethnicity	-	Y	-	Y	-	Y
Mean Y (Control)	37.894	37.894	20.615	20.615	1.105	1.105
SD	36.521	36.521	34.773	34.773	5.460	5.460
Observations	1,908	1,908	1,908	1,908	1,908	1,908

*p<0.1; **p<0.05; ***p<0.01

Note: The table shows the regression discontinuity effect on the share of properties owned according to official deeds, agricultural deeds, and public notary deeds, using a cubic polynomial function in longitude and latitude.

Table A8: Effects of institutional variables on development outcomes

	Dependent variable:								
	Income index	Education-based income index	Electricity network	Sanitation network	Water network	Managers	Farmers	University educated	Illiteracy rate
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Official deed	0.003^{***}	0.002^{***}	0.150^{***}	0.329^{***}	0.215^{***}	0.007	-0.067^{***}	0.005^{***}	-0.031^{***}
	(0.001)	(0.0005)	(0.015)	(0.026)	(0.027)	(0.007)	(0.020)	(0.001)	(0.011)
Agricultural deed	0.002^{**}	-0.0001	0.117^{***}	0.015	-0.029	0.002	-0.022	-0.0001	0.009
	(0.001)	(0.0004)	(0.015)	(0.020)	(0.027)	(0.006)	(0.021)	(0.001)	(0.012)
Public notary	0.002	0.009^{***}	0.188^{***}	0.835^{***}	0.619^{***}	0.027	-0.028	0.008^{**}	-0.252^{***}
	(0.003)	(0.002)	(0.038)	(0.172)	(0.114)	(0.018)	(0.104)	(0.004)	(0.068)
Observations	1,908	1,908	1,908	1,908	1,908	1,908	1,908	1,908	1,908

*p<0.1; **p<0.05; ***p<0.01

Note: The table shows the effects of institutional variables on development outcomes, treating the study region as one area and controlling for linear terms in longitude and latitude.

Table A9: RD effects on age structure controlling for fertility rates

	Dependent variable:					
	Males under 15	Males 15 to 64	Males 65 and over	Males/females under 15	Males/females 15 to 64	Males/females 65 and over
	(1)	(2)	(3)	(4)	(5)	(6)
Stateless	2.215^{***}	-1.966^{***}	-0.249^{**}	0.029^{**}	-0.044^{**}	0.126^{*}
	(0.356)	(0.332)	(0.120)	(0.011)	(0.020)	(0.067)
Mean Y (Control)	43.012	53.174	3.813	1.081	1.027	1.412
SD	7.314	6.174	2.459	0.153	0.311	0.832
Observations	1,872	1,872	1,872	1,872	1,872	1,856

$^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

Note: The table shows the RD effects on the proportion of each age group within the male population (columns 1 to 3), and the RD effects on the sex ratio within each age group(columns 4 to 6), controlling for linear terms in longitude and latitude.

Table A10: RD effects on age structure in the male population and the sex ratio according to age (Sunni Muslim sample)

	Dependent variable:					
	Males under 15	Males 15 to 64	Males 65 and over	Males/females under 15	Males/females 15 to 64	Males/females 65 and over
	(1)	(2)	(3)	(4)	(5)	(6)
Stateless	1.416^{***}	-1.575^{***}	0.158	0.025^{**}	-0.046^{**}	0.068
	(0.381)	(0.362)	(0.118)	(0.012)	(0.018)	(0.075)
Mean Y (Control)	45.821	50.915	3.262	1.079	1.028	1.486
SD	5.440	5.006	1.839	0.177	0.281	1.021
Observations	1,406	1,406	1,393	1,406	1,406	1,393

$^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

Note: The table shows the RD effects on the proportion of each age group within the male population (columns 1 to 3), and the RD effects on the sex ratio within each age group (columns 4 to 6), controlling for linear terms in longitude and latitude. The sample excludes non-Sunni Muslim groups and adds a dummy variable for areas with a tribal majority.

Figure A1: Bandwidth sensitivity of the effect of statelessness on outcomes

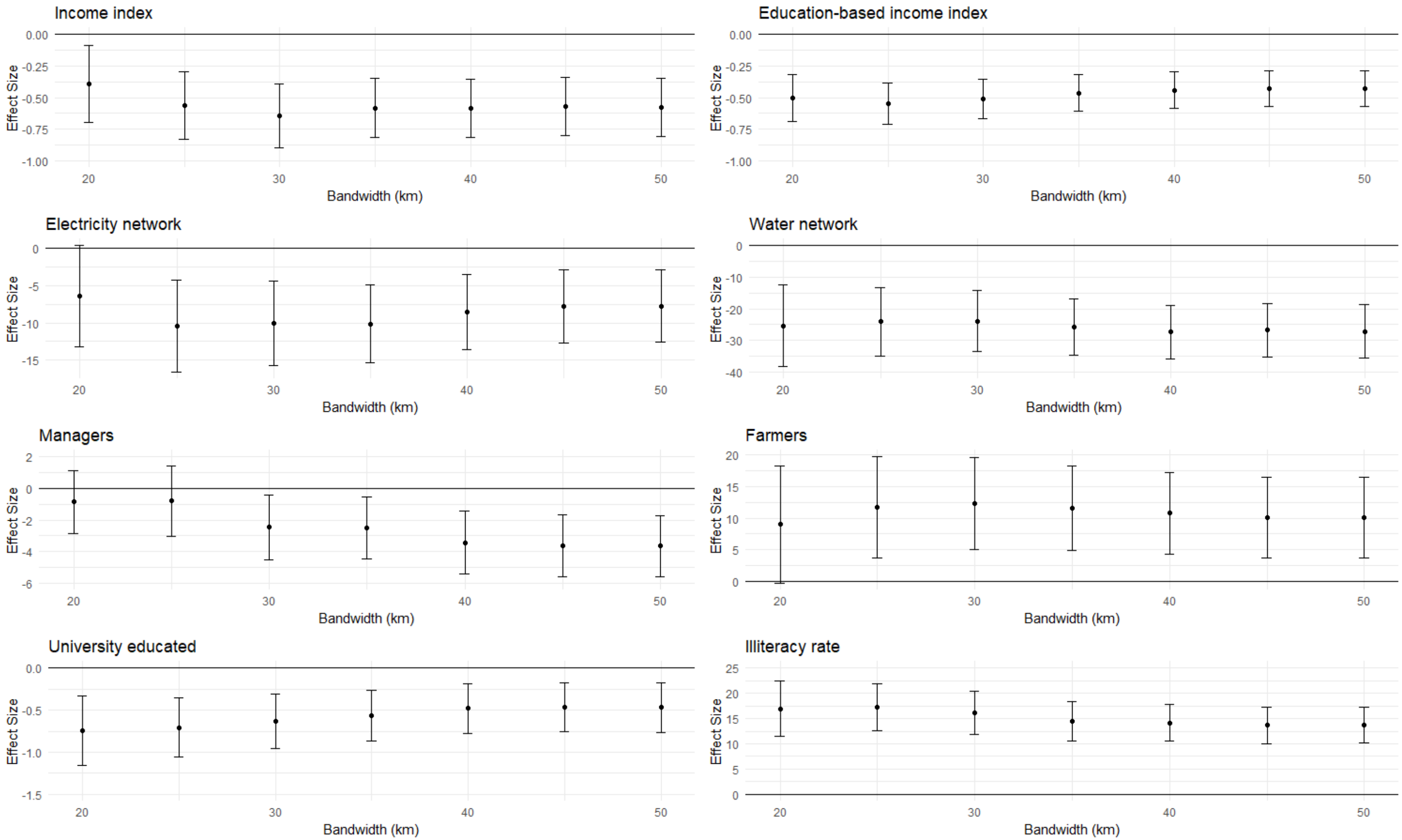


Figure A2: Bandwidth sensitivity with a 5k donut