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Abstract

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JEL Classification: D74, N35, N45

Keywords: Weather shocks

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Economic Shocks and Religious Conflict in Medieval India*

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March 14, 2023

Abstract

Economic downturns can create conditions for conflict that may occur along religious or ethnic lines. In this paper, we provide arguably the first empirical evidence of this phenomenon in medieval India. Using centuries of geo-referenced data we document a positive relationship between weather fluctuations and the destruction of Hindu temples under Muslim rule. Specifically, during periods of large weather fluctuations a Muslim state is 0.4 percentage points more likely to desecrate a Hindu temple under its rule, compared to one outside its control (compared to no difference in probabilities in non-shock periods). We explore various mechanisms that could drive the ruler's response including looting and battles, showing that maintaining regime stability by suppressing rebellions resulting from weather shocks is the likely explanation for this relationship.

Keywords: Religious repression, Political stability, Weather shocks, Temple desecration.

JEL Classification: D74; N35; N45.

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1 Introduction

Economic downturns caused by adverse weather shocks can result in religious or ethnic conflict. The relationship might be due to economic downturns threatening an authoritarian ruler's hold over power by creating the conditions for mass uprisings (Acemoglu and Robinson, 2001, 2005; Brückner and Ciccone, 2011). The authoritarian ruler can respond to the threat by targeting specific religious or ethnic groups.

This paper examines these interactions in the case of medieval South Asia. Economic studies of South Asia typically focus on the contemporary situation or the British colonial period. There is very little research carried out by economists on the medieval period in South Asia, in the era before colonization. This omission is striking especially because the Mughal Empire, which preceded the British in South Asia, was the pre-eminent empire of its time in the medieval world, on par with many of the world's great empires including the Roman Empire and the Ottoman Empire. This paper attempts to bridge this serious gap in economic scholarship. While there is much academic scholarship on medieval European societies on concerns such as religious persecution, the same cannot be said of equally diverse regions in other parts of the globe. We focus our attention on the medieval period, showing a positive relationship between weather fluctuations and the destruction of Hindu temples under Muslim rule, using a newly compiled dataset on medieval India that spans over five centuries (1190-1730 CE). These data involved an elaborate matching exercise in which medieval religious site locations were matched to the contemporary polities that cover the extent of modern-day India, and we were able to create a panel of 9288 observations over 54 decades across 172 religious sites. Given the dearth of available data on medieval India, we had to combine a variety of secondary sources which did not always concord perfectly. We use several robustness checks to address some of the econometric issues that could arise due to the lack of a perfectly matched dataset and these are outlined in detail later in the paper.

During periods of large weather fluctuations, we show that Muslim rulers were 0.4 percentage points more likely to desecrate temples under their rule than those outside their control, compared to no difference in non-shock periods, and relative to a baseline desecration probability of 0.3%. Desecrating a temple that is already under a Muslim State's rule will involve different motivations than one that was outside its control, where the desecration could be part of a looting operation or due to collateral damage during battles. We further show that the relationship between large weather fluctuations and temple desecration under Muslim rule was diminished in locations with high soil fertility. This is in line with evidence that better soil quality reduces the negative effect of weather fluctuations on agricultural productivity (Porter and Semenov, 2005; Malik and Temple, 2009). This result is important because it suggests that religious zeal alone may not influence religious repression, and that this is significantly mediated by important economic channels.

We then carefully evaluate possible explanations proposed by historical, cultural, and political studies of South Asia. First, we rule out that the destruction of temples in Muslim States was due to scapegoating of Hindu minorities during adverse weather shocks. This is because Muslim States ruled over majority Hindu populations in medieval India and minority repression is not a likely channel in our context. Next, using novel data on ancient pilgrimage centers, we show that looting can not explain away the relationship between weather fluctuations and temple desecration under Muslim rule. We then use data on inter-state conflicts to rule out that weather fluctuations resulted in higher collateral damage in the form of temple desecration by increasing the intensity of Hindu Muslim battles (Iyigun et al., 2017). Further, a Muslim State's battle victory over a Hindu State did not affect the likelihood of temple desecration. This weighs against the hypothesis proposed by some historians that Muslim States were more likely to desecrate temples during state expansion through battle victory against a Hindu State (Eaton, 2000).

We finally evaluate the possibility that economic shocks could lead to rebellion by the Hindu masses and the temple desecration could have been a ruler's response to civil strife. The Muslim ruler might have responded to a rebellion by destroying the temple that the masses revered, a form of public punishment to reinforce the imperial authority and to dissuade further strife. Another interpretation relates to the local Hindu elites using the religious legitimacy, that they acquired by patronizing temples, to coordinate a revolt against the Muslim ruler. The Muslim ruler might have destroyed the temple associated with the reneging Hindu elites to discredit them and underscore their inability to lead a successful rebellion. We showcase the potential link between weather shocks, rebellions, and temple desecration in two ways. We first present a case study of agrarian rebellions in the late seventeenth and early eighteenth century in North India (Rana, 1987). We find that weather fluctuations increased the duration of agrarian revolts, and this effect was dampened in locations with better soil quality. This result highlights the nexus between weather fluctuations, soil quality, and civil strife, which we suggest motivates temple desecration. We then present circumstantial evidence in support of the regime stability mechanism where we show that the likelihood of a temple desecration was higher early in Muslim rulers' tenure when they were more susceptible to revolts. This result is in line with the historical evidence that Indo-Muslim rulers were more likely to experience challenges to their authority at the onset of their tenure (Faruqui, 2012). We also find that the increase in the likelihood of temple desecration due to weather fluctuations was stronger in religious site locations closer to the capital of the ruling state. This result is in line with the conjecture that a revolt closer to the capital carries a higher threat to the ruler's authority than a revolt that occurred remotely (Acemoglu et al., 2010).

2 Related literature

This study contributes to different strands of the current economics literature. Our work relates to research on political instability and the religious policies of authoritarian rulers (Auriol and Platteau, 2017a,b; Rubin, 2017). Our study is closest to Chaney (2013) who documents an increase in the political influence of the head judge (religious authority) as well as higher spending on religious structures (co-option) following Nile shocks in medieval Egypt. The relationship is however predicated on the ruler and the masses having a common religion. Our work is different because in our case the ruler *differs* in his or her religious beliefs from the masses.[1]

[1] All Muslim rulers in medieval India were men with one exception. Razia Sultana ruled Delhi from 1236 to 1240 CE making her the only woman to ever rule Delhi.

We contribute to the climate-economy literature (Dell et al., 2014), particularly on the relationship between weather and conflict or political instability across different time periods (Brückner and Ciccone, 2011; Dell et al., 2012; Fenske and Kala, 2015; Iyigun et al., 2017) including repression of religious minorities in pre-modern societies (Anderson et al., 2017; Grosfeld et al., 2020; Johnson and Koyama, 2019).[2] To the best of our knowledge, we are first to draw a causal link between weather shocks and repression of the religion of the majority population by a ruling elite that is a religious minority. This is an important case that can apply to many other historical contexts, for example the case of colonization.

We add to a small but upcoming literature that studies religion, politics and conflict in historical or contemporary settings (Iyer, 2016, 2018). These studies provide a conceptual framework to understand the salience of religion across different time periods (Iyigun, 2008; Becker and Woessmann, 2009; Michalopoulos et al., 2017; Bentzen, 2015; Mitra and Ray, 2014). We contribute to the empirical literature on the economic and political history of South Asia, which has mainly focused on the institutional aspects of the colonial era (Banerjee and Iyer, 2005; Chaudhary, 2009; Kuran and Singh, 2013; Broadberry et al., 2015; Chaudhary et al., 2015; Roy, 2016; Verghese, 2016). This is primarily because pre-colonial history suffers from a dearth of systematic event records (Bayly, 1985). In a seminal paper, Jha (2013) uses inter-ethnic complementarity in trade in medieval India as a determinant of violence in the 19th century and onward.[3] In contrast, our study focuses on the contemporary economic and political determinants of inter-religious conflict in medieval India. To that end, our work is also a new contribution to the economic history of South Asia.

Finally, from a public policy perspective, our work adds new insight to studies of the destruction of cultural or religious sites, a phenomena that is observed across cultures and at different time periods. A subset of this literature focuses on the cultural explanations for such conflict (Huntington, 1997). Religious scholarship widely attributes the desecration of sacred sites to the aversion for imagery among the Abrahamic

[2] In their framework, an extractive society maintains a weak tolerance for its minorities. Negative economic shocks lead to an unraveling of this tolerance, leading to greater persecution of the minority.

[3] Similarly, Dincecco et al. (2022) show the relationship between pre-colonial warfare and development outcomes in modern day India.

traditions (Morgan, 2003). The practice of 'iconoclasm' or image-breaking assumes greater significance in Islam as it is often connected to the removal of idols from the Ka'ba in Mecca. Recent incidents ranging from the desecration of the Bamiyan Buddhas by the Taliban in 2001, to the ravaging of several religious and cultural sites by the Islamic State in Iraq and Syria in the 2010s-2020s, to the destruction of the Babri Masjid in India in 1992 with permission now granted by India's Supreme Court in 2020 to build a Hindu temple on the formerly disputed mosque site, are presented to highlight this connection.

Yet iconoclasm has not been perpetrated by religious regimes alone. Studies focus on political drivers of such desecrations at various times in history and committed by regimes with various ideological moorings. For every site that was destroyed during the Calvinist reformation in Switzerland or during the Wahhabi attacks on the early Islamic heritage in the 18th century, we have examples of iconoclasm carried out by the secular regimes during the French revolution or during the Cultural Revolution in China (Reinders, 2004; Noyes, 2013). A common thread running through all these cases is that the destruction of incumbent religious and cultural institutions goes hand in hand with the process of state building (Noyes, 2013). Desecration of religious or cultural sites is therefore a part of the coercive process through which states emerge (Weber, 1965; Tilly, 1985; Olson, 1993). We bring new intuition to this literature by showing that economic shocks can disrupt the political equilibria which leads to the destruction of sites of cultural or religious significance. To that end, our work contributes to several existing themes in economics, even as it addresses an issue of great historical importance for religion, politics and economics worldwide.

The rest of the paper is organized as follows. We present the historical background in Section 3. We introduce the dataset in Section 4 followed by the empirical specification and the baseline findings in Section 5. We address the plausible explanations of the results in Section 6. Section 7 concludes.

3 Historical Backround

3.1 Origins and Expansion of Muslim Rule in Medieval India

Islam was introduced to India by the Arab traders in early eighth century, forging small Muslim communities by the southern seacoasts (Metcalf, 2009). These traders performed key economic roles and were patronized by local non-Muslim kings. For three centuries thereafter the political influence of Islam stayed limited to the North-West of Indian subcontinent, where the Muslim armies annexed a small region now known as Sindh (Metcalf, 2009).[4]

The process of Islamic expansion in India began in earnest in the eleventh century with the onslaught of Central Asian raiders into the subcontinent (Gommans, 1998). Devoid of territorial aims these forays were initially restricted to looting expeditions.[5] The landscape changed by the end of the twelfth century when a wave of fresh conquests by the Persianised Turks established the first Muslim State in North India.[6] With its base in Delhi, the earliest State of Turkic slaves rapidly extended its control over the entire North India. By the time of its collapse at the end of fourteenth century the Turkic Slave dynasty had extended its control over the South-West India and had made forays even deep into South India.

The fall of the Turkic Slave dynasty was followed by a fractured regional polity where smaller polities competed for territorial sway in the North and North-West of India (Metcalf, 2009). The South-West region, which had seceded from the Delhi based Sultans, also split into smaller Muslim kingdoms. The southern most part of India remained the last bastion of prominent Hindu kingship under the Vijaynagara empire. The Muslim kingdoms in the South-West fought against each other and clashed, as well as sometime aligned, with the Vijaynagara empire for regional supremacy (Metcalf, 2009).

The period of regional attrition came to an end after the establishment of the Mughal dynasty in early

[4] The Sindh region is in modern day Pakistan.

[5] Mahmud of Ghazni (998-1030 CE), pivotal among these raiders, is famous for carrying out multiple looting expeditions into India during the course of which he desecrated Hindu temples.

[6] The Persianized Turks under the leadership of Muhammad of Ghor began the conquests in Punjab, annexed Delhi, and subsequently the two eminent Hindu kingdoms of that time, Ajmer and Kannauj.

sixteenth century. For the next two centuries the Mughals held sway over an empire which, at its pinnacle, exceeded in wealth and might any contemporaneous state in the Islamic world (Metcalf, 2009). Mughal power started to wane by the beginning of eighteenth century, ceding space to many regional states. The most prominent among these regional polities were the Rajputs in the North-West, the Marathas in the South-West, the Sikhs in the Punjab and Jats to the south east of Delhi (Metcalf, 2009). Political arithmetic once again seems to override any religious differences in this period. The non-Muslim states engaged in strategic cooperation with Muslim rulers, as well as fought against each other (Metcalf, 2009).

3.2 Temples as the Source of Political Legitimacy for Hindu Rulers

The building of monumental temples in stone for congregational worship had become a characteristic of the Indian subcontinent before the emergence of medieval Muslim States in twelfth century (Bakker, 1992).[7] The rise of these temple establishments went hand in hand with the military expansion of regional Hindu polities. The newly acquired territories came to be ruled through a system of subjugated princes (*Samantachakra*) that were obliged to pay a regular tribute and serve the king loyally (Kulke and Rothermund, 2016). The system was however inherently unstable. As soon as the political center's authority weakened, the princes would assert to reclaim their independence (Kulke and Rothermund, 2016).

In such a milieu the cult of royal temples developed in order to reinforce the political legitimacy of the ruler. Paintings inside the temple or sculptures outside often depicted the king like a god and the gods in turn were embellished with royal features (Kulke and Rothermund, 2016). Some kings enhanced their legitimation by ruling as the god's representative or as his son (*putra*). Thus the kings used temples as the instruments of governance and could threaten the defiant princes (*Samanta*) with the wrath of god if they flouted the king's orders (Kulke and Rothermund, 2016).

In addition to monumental temple building, the new royal cult involved gift-giving, both in the form of monetary and land endowment, as a medium to acquire religious merit (Bakker, 1992). This system of

[7] While the kingship ideology in the first millenia relied on the direct relationship between the king and the *Brahman* (priest), the legitimacy of medieval Hindu kingship became associated with a network of holy sites (Bakker, 1992).

patronage was replicated by elites at a different level of power that would mirror their sphere of influence.[8] The cult of sacred places also became prominent, creating centers of pilgrimage where religious rites such as sacred bathing or religious penance were performed (Bakker, 1992). The royal observance of religious rituals at these pilgrimage centers became instruments for public display of legitimacy to the masses.[9]

Even after Muslim States emerged and established their pre-eminence in South Asia, the cult of royal temples continued to accord legitimacy within contemporary Hindu States. By the fourteenth century, generous gifts to temples and their priests (*Brahmanas*) had become synonymous with Hindu kingship or the *rajadharma* (Rao, 2016). Under the rule of Vijaynagara empire (1336-1646), a powerful medieval Hindu dynasty in Southern India, the construction of temples became a marker of the ruler's power. The Vijaynagara kings were strategic in using religious donations to reinforce imperial authority, at times when internal peace was necessary or in anticipation of an external threat (Rao, 2016).[10]

3.3 Economic and Religious Conditions Under Muslim Rule

3.3.1 Agrarian System under Muslim Rule

With the rise of medieval Muslim polities a new ruling class emerged that changed the pattern of surplus extraction (Habib, 1983).[11] The center shifted from the countryside to the town, which was driven by Islam's urban orientation (Habib, 1983). Urban growth rested mainly on the ruling elite's capacity to extract agrarian surplus. To maximize rent extraction the early Muslim States introduced a consolidated land-tax system (*Kharaj*) which replaced a host of taxes and cesses claimed by the previous Hindu aristocracy.

[8]For example, village-level leaders would patronize the temple of their village god (*gramdevta*), while the local princes would patronize the cults of sub-regional deities (Kulke and Rothermund, 2016).

[9]For example, the royal service of ritual cleaning of the three large chariots of the *Jagannatha* trinity became the most important ritual privilege for the kings of Puri (Bakker, 1992).

[10]The strategic nature of religious co-option is highlighted from the reign of Krishnadevaraya (1509–1529), who sought to undercut the power of territorial chiefs of his realm. Krishnadevaraya offered new opportunities for secular employment to Brahmins as administrators and fort commanders (Bakker, 1992). Furthermore, through generous endowments and complex ritual and pilgrimage systems he made the royal temple the foci of religious and cultural influence (Bakker, 1992).

[11]Nobility records from the reign of Mughal king Akbar, who is famous for building alliances with Hindu Rajput kings, suggest that their religious and ethnic composition was pre-dominantly Muslim and particularly of non-Indian descent (Khan, 1968).

The state however preserved the inherited structure of rural society and used it for collecting land taxes. This was a sort of compromise where the erstwhile Hindu aristocracy (this class came to be known formally as Zamindars in the Mughal period) were accorded certain hereditary rights over the territory they controlled and allowed to maintain armed retainers. The aristocrats retained a part of land taxes while transferring the rest to imperial coffers, and provided military assistance to the king when needed (Habib, 1983). The Zamindar was not the only type of intermediate class to emerge. In areas where the Zamindari class did not exist (raiyati), the state mobilized caste driven social stratification among the peasants.[12] In these cases the village headman (Chaudhary) would act as a local representative of imperial authority (Rana, 1987).

The medieval Muslim States essentially operated as a "decentralized polity" where the regime's military and economic strength progressed from the bottom to the top (Gupta et al., 2016). There was always a threat of rural resistance to the imposition of state power (Richards, 2004). The peasants were armed and ready to abandon cultivation and fight when necessary. Their warriors responded to the calls for resistance from the Zamindars for the common defense against external threats. Perhaps, the greatest threat to the state came from the Zamindars, who often fought against imperial agents seeking to collect taxes or tribute (Richards, 2004). The state maintained this tenuous control over rural society through a sound intelligence system, efficient bureaucracy and crushing response to rebellion (Gupta et al., 2016).

3.3.2 Religious Policy of Muslim Rulers

The attitudes and policies of Muslim rulers towards their predominantly Hindu subjects underwent two phases. The rule of Mughal king Akbar (1556-1605 CE) acts as the dividing line between the systems of governance. The rulers before Akbar mainly ruled through military strength. The system of governance was based on a distinction between Hindu and Muslim subjects regarding their religious practices (Sharma, 1972). The Hindu subjects were required to pay a poll tax (*jizya*) as well as a pilgrimage tax

[12] This absence of Zamindari could be due to the destruction of older aristocracy or its inability to transform into the new intermediate class. It is also plausible that in some areas the class with the hereditary rights did not exist even in the pre-medieval period (Habib, 1983).

in lieu of participating in Hindu religious fairs. The payment of pilgrimage tax acted as a compromise between strict prescription of Islamic law to now tolerate the public expression of non-Muslim practices and the desire of majority Hindu subjects to perform their religious rituals (Sharma, 1972).

Public performance of religious rituals was only allowed in places that were sanctified by centuries of religious tradition (Sharma, 1972). This meant that the construction of new temples was generally forbidden in this period (Sharma, 1972). However, very few Muslim rulers actively engaged in religious persecution and forcible conversion of their Hindu subjects (Sharma, 1972). These select cases include Sikander Butshikan of Kashmir (1389-1413), who conducted waves of persecution, desecrated temples, and forcibly converted thousands of Hindus to Islam. Similarly, Jalal-ud-Din of Bengal (1414-1430), a convert himself, converted hundreds of Hindus to Islam and persecuted the rest.

The tenure of Mughal king Akbar marked a departure from the religious policies of his predecessors. His tenure saw the abolition of both poll tax and the pilgrimage tax. Akbar further removed all restrictions on the building of Hindu temples (Sharma, 1972). Akbar's Hindu officials built new temples at famous places of Hindu pilgrimage.[13] There is also evidence that Akbar tried to co-opt Hindu religious authority by making donations at select Hindu shrines.[14]

The policy of religious toleration and occasional co-option of Hindu temples was largely pursued by Akbar's successors, Jahangir (1605–1627), and to a less extent by Shah Jahan (1628–1658).[15] The tenure of Akbar's great-grandson, Aurangzeb (1658-1707), however, brought an end to the period of religious tolerance. Shortly after coming to the throne, he issued an edict in 1659 that banned any new construction of Hindu temples (Sharma, 1972). He reimposed the poll-tax on Hindus in 1679. Orders were also issued to the provincial governors to destroy Hindu temples and schools and put and end to the educational activity and religious practices of the *infidel*. Nicolaas De Graaf, a European surgeon, and traveler, who was in Bengal in 1670, heard of these orders and reported:

[13] The anecdote highlights the even under Muslim rule the temples continued to provide legitimacy to the Hindu elite.

[14] For example, local tradition ascribes Akbar with the presentation of a golden umbrella to the shrine of Hindu fire goddess (*Jwala Mukhi*) in modern-day Punjab. The implication of Akbar's actions was however not lost on Muslim orthodoxy that "spread tales of his fall from the true path throughout the empire." (Sharma, 1972).

[15] Shah Jahan did not reimpose the poll tax on Hindus, however, the pilgrimage tax was revived under his tenure.

> In the month of January, all the governors and native officers received an order from the Great Mughal prohibiting the practice of Pagan religion throughout the country and closing down all the temples and sanctuaries of the Idol worshippers...in the hope that some Pagans would embrace the Muslim religion. (Orme, 1805).

3.4 Temple Desecration and State Maintenance Under Muslim Rule

In two centuries prior to the first Muslim State being established in North India in 1192 CE, Persianized Turks from their base in Afghanistan systematically attacked urban centers of South Asia and razed its temples. These attacks were motivated for material reasons, the looted wealth from Indian cities and its materially endowed temples was used to finance military conquests in Central Asia (Eaton, 2000). However, as Muslim States established their footprint in the Indian subcontinent, attacks on temples became infrequent and came to be by specific political objectives (Eaton, 2000).[16]

The overview of religious conditions under Muslim rule and the data on temple desecrations suggest that barring few rulers the Muslim States generally pursued a policy of pragmatism towards the temples that already lay in their annexed territories. The temples were treated as state property, generally protected, and on occasion resources were spent for their maintenance.[17]

However, this relationship of general tolerance and occasional patronage of temples was broken during periods of social turmoil. The Indo-Muslim rulers were well aware of the political salience of temples in according legitimacy to their patrons (Eaton, 2000). Even when former Hindu aristocrats or their descendants were assimilated into the Indo-Muslim State apparatus, there was always a threat that temple's authority would be used for political mobilization (Eaton, 2000). Conversely, desecrating the temple

[16] Eaton (2000) defines temple desecration as an act in which a "temple was normally looted, redefined or destroyed". Going through individual events we find that different tactics were used in desecrating temples. These tactics ranged from sacking the stone image of god as in the case of temple desecration in Puri in 1359, to complete destruction of the temple as was the case of the great temple in Orchha in 1635, to conversion of the temple into a mosque in Mathura in 1670.

[17] For example, a Sanskrit inscription records that Muslim king Muhammad Bin Tughluq appointed Muslim officials to carry out repairs of a Shiva temples in 1326, thirteen years after having conquered that territory. Similarly, there is an example of Kashmiri ruler Sultan Shihab al-Din (1355-73) dissuading his minister from destroying Hindu and Buddhist temples to obtain sudden wealth.

associated with the reneging official could discredit the officer and highlight his political vulnerability against the State. The link between the temple, the deity, and political vulnerability is highlighted in a passage from the *Brhatsamita*, a sixth-century Hindu text.

> If a Siva linga, image or temple breaks apart, moves, swears, cries, speaks or acts with no apparent cause, this warns of the destruction of the king and his territory. (Davis, 1999).

Therefore, when a non-Muslim officer showed signs of disloyalty and engaged in open rebellion the state often desecrated the temple which was closely associated with that officer. For example, in 1478, when a garrison on the Andhra coast mutinied and killed the Governor, the Sultan personally stormed the fort and destroyed its temple (Eaton, 2000). In 1635, Mughal king Shah Jahan destroyed the temple at Orchha that had been patronized by the father of a high-ranking officer who at that time was engaged in an open rebellion against the throne.

There is also evidence that agrarian distress due to adverse weather conditions created conditions for rebellion, and the state responded by desecrating the temple that was associated with its leader. For example, between 1660 to 1663 severe droughts were experienced in Northern India, which caused immense disruption to agricultural production (Rana, 1987). A large number of peasants disbanded their land, which in turn put an additional tax burden on the remaining cultivators. With an agrarian crisis in the background a widespread peasant uprising broke out in Mathura, in which the city congregational mosque's patron was killed. After the leader of these rebellions was captured in 1670 the Mughal king Aurangzeb ordered the destruction of the city's Keshava Deva temple and built an Islamic prayer structure on the site (Eaton, 2000), perhaps to remind the recalcitrant masses of the imperial power.

The evidence presented in this section suggests that the rebellion threat from local Hindu masses and their leaders affected the Indo-Muslim State's equilibrium policy of religious tolerance, and increased the probability of temple desecration.

4 Data

We embarked on a challenging data collection exercise to enable empirical analysis. We create a cross-section of religious sites in medieval India from maps of key religious and cultural sites by Schwartzberg et al. (1992). Two reference maps are available for the given period. The first map highlights key religious and cultural sites between 1200 and 1525 CE, while the second map shows key religious and cultural sites from 1526 to 1707 CE. Superimposing these maps on the territorial maps of modern-day India we were able to geo-locate 172 religious sites where a prominent temple or several temples would be located during the medieval period.

To the medieval religious sites we match a temple desecration dataset assembled by a noted historian of South Asia, Richard Eaton, for the period from 1192 to 1730 CE (Eaton, 2000). The dataset includes desecration episodes that were carried out by Muslim rulers or their officials, that occurred within the geography of modern-day India, and therefore bound the rest of our data collection exercise to this region. Note that Eaton (2000)'s dataset does not identify the number of temples that were destroyed during a particular desecration episode. It is plausible that a Muslim ruler or his official destroyed more than one temple in the vicinity during a specific episode of temple desecration.

We also identified the territorial boundaries of various political units in this period using maps of medieval dynasties by Schwartzberg et al. (1992). We matched them with historical weather data (Mann et al., 2009, Shi et al., 2018) to create a panel dataset at the religious site-polity-decade level. We briefly explain the data collection exercise and describe the main variables in the following section. Further details of dataset construction are given in Section I in the Appendix.

4.1 Temple Desecrations

We code temple desecration events from the dataset compiled by Eaton (2000). Relying on contemporary or near-contemporary epigraphic and literary sources, Eaton (2000) identifies 80 episodes of temple desecration for the period between 1192 and 1730 “whose historicity is reasonably certain”. The dataset provides information on the location and year of the desecration, as well as the characteristics of the perpetrator.

Our sample of temple desecration episodes should be a lower bound for the actual number of desecrations. Eaton (2000) strictly relies on evidence recorded in contemporary or near-contemporary epigraphic and literary evidence. Desecration instances codified at a later date are thus excluded. It is also plausible that some acts of desecrations were never recorded or their records did not survive (Eaton, 2000).

It is important to note that the desecration episode at a religious site does not preclude the possibility of future desecration at the same site. This is because there could be multiple temples located at the same site or the temple could have been rebuilt over time, before being desecrated again. The rebuilding, though, would have to happen when the site was under Hindu control as most Muslim rulers outlawed the construction of new temples (Sharma, 1972).

Not all locations in Eaton (2000)’s list of temple desecration episodes are included in the list of important religious sites that we compiled from Schwartzberg et al. (1992). These locations might comprise temples that were not of enough significance to be identified as an important religious site by Schwartzberg et al. (1992). Since we do not have a corresponding list of religious sites of lesser significance that did not observe a temple desecration, our analysis focuses on desecration episodes that occurred at important religious sites of medieval India.[18]

Overall, we have 30 desecration episodes in our sample. Of the 172 religious sites in our sample, 25 sites experienced a temple desecration episode at least once. Three locations observed a desecration episode twice and one thrice. Out of the 54 decades in our sample period, 21 decades had at least one desecration episode. This indicates that temple desecrations were spread out quite widely over time and space. The map in Figure A-1 in Appendix shows the medieval religious sites that observed a temple desecration and those that did not observe a temple desecration.

[18]For a list of temple desecration that we use in main analysis see Table A-1 in Appendix.

4.2 Polities

Polities data is obtained from twelve maps on medieval polities, covering different time periods and regions from Schwartzberg et al. (1992). We identified 60 polities which existed at some point during the medieval period in India. The polity maps were superimposed on the modern territorial map of India to identify their approximate political borders. By merging the geo-coded maps of polities and religious sites we were able to approximately identify the polity where a religious site was located in a given decade.

We could not identify the corresponding polity for every religious site in a given period. Hence, we pair the unmatched religious sites to the nearest polities in a given decade as an approximation. As a robustness check, we conduct a sub-sample analysis where we only focus on religious sites that are matched exactly to a polity in a given period.

We also collected supplementary information such as the religion of the state, the capital location, Muslim ruler characteristics such as the tenure of the ruler.

4.3 Battles

We compile a dataset of battles from two different sources. Our primary source is Jaques (2007) which provides a description of about 8,500 battles across the world from antiquity till the 21st century. Jaques (2007) covers battles ranging from an epic engagement that lasted weeks to skirmishes with few dozen men to the side. In that sense, the source is not biased toward big battles and wars. From their descriptions, we teased out information such as the year and location of the battle, and the identity of the battle participants. We supplemented this information by collecting data on the religion of each participant. To crosscheck our data we relied on another resource, Narvane (1996), which lists key battles in medieval India, especially between 15th and 18th century.

Overall, we identified 240 battles during the given period. Around 200 of these battles were identified in our primary, or primary as well as the second source. The remaining battle events were identified only in the secondary source. Out of these 77 battles involved a Hindu polity fighting a Muslim polity, out of which 40 battles were won by a Muslim polity. The second most frequent combination, with 67 events, was a Muslim polity fighting against another Muslim polity. Clearly, the medieval period was an exemplar of Muslim state expansion.

4.4 Temperature deviation

We use two different paleoclimatic datasets to construct our weather variable. These datasets reconstruct historical temperature and precipitation respectively, and differ in both spatial and temporal coverage.

The first dataset reconstructs surface temperature for past 1500 years and is obtained from Mann et al. (2009). The construction combines data from different paleoclimatic studies that calculated historical temperatures using data from different proxy indicators. These include tree rings, coral, ice core and other long instrumental records. The dataset has a global coverage and reports the average annual temperature for 5 degree by 5 degree grids, and is available for each year from 500 to 1959 CE. The data accurately estimate decadal temperature averages but not for finer time periods (Iyigun et al., 2017). Historical temperature data are reported as deviations, measured in degree Celsius, from the 1961–1990 mean temperature.

Using GIS we match the annual temperature deviation and precipitation data to each religious site and then take the decadal average. For our baseline specification we use temperature shock as the explanatory variable, which compares the temperature in a location in a given decade with the distribution of temperature at that location over our entire period of study. Hence the use of temperature deviations from 1961-1990 as against absolute temperature values does not make any difference to our estimation procedure.

Although this dataset provides is spatially and temporally comprehensive for our purpose, it also comes with a few caveats. Modern panel data studies that use climate data indicate that results can be sensitive to the data source due to measurement errors, which are amplified via fixed effects (Fisher et al., 2012).

Also, since the temperature values are interpolated from a limited set of proxies, there is likely to be a spatial correlation between the values. Also, the 5 degree by 5 degree resolution is quite coarse, giving us about 20 grid points across India.

To address the issue of potential spatial correlation, we do robustness checks to allow for spatial clustering (along with serial correlation) in standard errors within a radius varying from 200km to 1500km, using the algorithm developed by Colella et al. (2019).

4.5 Precipitation

We use precipitation data from Shi et al. (2018), which is at a much finer resolution to assess the relationship between weather shocks and rebellions. The dataset combines tree-ring proxies and historical documentary records to obtain summer rainfall estimates annually for the period from 1470 till 1920 CE at a 0.5 degree by 0.5 degree grid resolution. The availability of precipitation dataset at a finer level enables us to assess the relationship between weather shocks and rebellions, using cross-sectional data on agrarian rebellions in North India, thus providing some evidence for the economic channel that mediates the relationship between weather shocks and temple desecration under Muslim under.

The unconditional probability of temple desecration under Muslim and non-Muslim rule, differentiated by periods of weather fluctuations, is presented in Appendix Table A-2.

5 Results

Since Muslim rulers, or their military commanders, conducted the temple desecration, religion clearly has a role to play. But it is not obvious that religious zeal was driving the temple desecration. 48% of the religious site-decade observations are where the site is under Muslim rule. 90% of the sites came under Muslim rule at some point in time, and more than half of the sites were under Muslim rule for more than 50% of the sample period. Hence, there was ample opportunity to desecrate temples if the desecration was driven by religious zeal. However, the data does not indicate rampant temple desecration. In fact, out of the total of 27 religious sites that were under Muslim rule for the entire sample period of 54 decades, only 5 ever experienced a temple desecration.

Hence, we need to consider factors other than religious zeal that might be at play. We investigate the role of economic shocks in these desecrations. We use temperature fluctuations as a proxy for economic shocks and examine whether they had a role to play in temple desecrations.

5.1 Effect of temperature fluctuations

We define a religious site *i* in period *t* as having had a temperature fluctuation if the temperature deviation recorded in decade *t* was either in the top or bottom quartile of the temperature deviations in site *i*. We find that temperature fluctuations increase the probability of temple desecration at religious sites which are under Muslim rule versus those that are not. When there is a temperature fluctuation, 12 out of the 15 desecration episodes occur in Muslim-ruled sites. In contrast, 7 out of 15 desecration episodes occur at Muslim-ruled sites in other periods. Table A-2 in Appendix shows the difference in the probability of a desecration episode happening in Muslim versus Hindu-ruled polities in periods with and without temperature fluctuations.

The descriptive evidence suggests a qualitative change as desecrating a temple that is already under Muslim rule may have different motivations as compared to desecrating one under the control of a Hindu ruler, and where the motivation could be religious, or it could be part of looting expeditions or collateral damage during battles. We formally estimate this relationship using the following specification.

$$D_{ikt} = \beta_1 M_{ikt} + \beta_2 T_{ikt} + \beta_3 M_{ikt} \times T_{ikt} + \mathbf{FE}_k + e_{ikt} \quad (1)$$

D_{ikt} is a dummy equal to 1 if a desecration episode was recorded at a religious site *i* in polity *k* in period *t*. M_{ikt} is a dummy that equals 1 if religious site *i* was under Muslim rule in period *t*. We can not match each religious site to a corresponding polity in a given period.[19] To preserve observations we assign the unmatched religious sites to their nearest polity. We find that our results are robust to dropping the non-matched observations (see Appendix subsection H.2).

T_{ikt} is a dummy that equals 1 if temperature deviation recorded in period t was either in the top or bottom quartile the temperature deviations in site i. This definition of the variable is preferred as it is simple and allows for a non-linear relationship between temperature and agricultural productivity as is observed in modern climate economy literature (Schlenker and Roberts, 2009; Burke et al., 2015). We further investigate the effect of abnormally hot and cold periods separately in a robustness check in Appendix subsection H.3. Our approach in the baseline model is similar to Chaney (2013) who estimate the effect of large deviations in historical Nile floods on the power of incumbent religious authority. β_3 is the coefficient of interest that measures the increase in the probability of temple desecration under Muslim rule during a period of large weather fluctuation.[20]

As the temperature fluctuation is exogenous, we do not need to add a large number of controls. However, to check if the effect is largely driven by a particular polity, we include polity fixed effects FE_k, which control for unobserved polity characteristics, such as the type of Islamic jurisprudence followed by a Muslim polity, that could have influenced the likelihood of temple desecration.[21]

In our model the time dimension is set at the decade level. The desecration of a temple is a rare event and it is reasonable to aggregate these events over a decade. Estimating at the decade level also reduces the measurement error if event years were not recorded accurately. Moreover, the reconstructed temperature data is less reliable at finer frequencies than a decade (Iyigun et al., 2017).

We estimate equation 1 using a linear probability model (LPM). LPM has an advantage over an ordinary logit model in that its statistical properties are invariant to the rare event bias. The problem of estimating rare events in a logit model is particularly exacerbated with the inclusion of fixed effects. Such a model

[19] See Appendix Section I for details on the dataset construction.

[20] We later check the robustness of the results to different definitions of weather shocks. The results are reported in Table A-6 in Appendix.

[21] For example, traditions of Sunni jurisprudence differ in their prescribed treatment of religious minorities (Friedmann, 1975).

Table 1: Effect of temperature fluctuations on temple desecration

	Temple desecration			
	(1)	(2)	(3)	(4)
Temperature deviation	0.003	0.003	-0.205	-0.207*
	(0.119)	(0.118)	(0.142)	(0.118)
Muslim rule		0.195*	-0.019	-0.164**
		(0.100)	(0.158)	(0.068)
Muslim rule * Temp deviation			0.430**	0.431**
			(0.194)	(0.179)
Dynasty fixed effects	No	No	No	Yes
Observations	9288	9288	9288	9288

Notes: All coefficients are of the order 10^{-2}. Standard errors are clustered at the dynasty level. Desecration is a dummy equal to 1 if a desecration event was recorded at religious site i in polity k in period t. Temperature deviation is a dummy that equals 1 if temperature deviation recorded in period t was either in the top or bottom quartile of the temperature deviations in religious site i. Muslim rule is a dummy that equals 1 if site i was under Muslim rule in period t and 0 otherwise. $^{*}p < 0.10$; $^{**}p < 0.05$; $^{***}p < 0.01$

can yield inaccurate (often inflated) estimates of the predictor effects (Cook et al., 2018).[22]

The results from the baseline model are reported in Table 1. The coefficient of interest is the interaction term that shows the increase in the incremental probability of temple desecration in Muslim versus non-Muslim areas during the period of temperature fluctuation. The coefficient remains positive and statistically significant across specifications with different fixed effects.

Column 4 is our preferred specification, where the interaction term has a coefficient of 0.431. This indicates that the incremental probability of a temple being desecrated under Muslim rule, as compared to outside Muslim rule, is 0.4 percentage points higher during a period of temperature fluctuation. This represents a significant increase compared to the overall incremental probability of 0.2 percentage points as reported in Column 2.[23]

[22] The corresponding non-linear estimates are reported in a robustness check in appendix Table A-8.

[23] Results presented in Table A-9 of Appendix show that the coefficient of interest is similar with additional fixed effects (religious site and decade fixed effects).

5.2 The economic nature of temperature shocks

One mechanism through which temperature fluctuations can affect temple desecration is by dampening agricultural productivity and therefore resulting in an economic downturn at the location.

Ideally, we would like to have data on agricultural production to see if shocks to it were correlated with temple desecration. In absence of systematic data to construct such metrics, we propose an alternative way to test if weather fluctuations increased the likelihood of temple desecration by hampering agricultural productivity. There is evidence that better soil quality reduces the negative effect of weather fluctuations on agricultural productivity (Porter and Semenov, 2005; Malik and Temple, 2009). Locations with better soil quality would thus be less likely to experience economic shocks during periods of weather fluctuation.

We test this mechanism in Table 2. We use two different measures of soil quality - the soil's nitrogen and carbon content respectively- which are used as metrics for soil quality assessment (Ge et al., 2013). The data is taken from EarthDATA Spatial Data Access Tool (SDAT). The data has a spatial resolution of 0.08 degree × 0.08 degree (or roughly 10 × 10 kilometers). The gridded soil quality data is matched with religious sites using a geospatial software, which we use to construct the average nitrogen and carbon density level for site (i).

We classify all religious sites to be above or below median levels of soil quality using each metric. We then repeat our baseline regressions in these sub-samples. The results are shown in Table 2. The first and third columns show the results with low soil quality, using nitrogen and carbon density respectively, and the second and fourth columns show the results with high soil fertility, in the same order. We find that the effect is present only in areas with below median soil quality, supporting the hypothesis that temperature fluctuations are affecting temple desecration through economic shocks.

A potential concern with interpreting these results is that the modern soil characteristics might not proxy well soil quality in the medieval period. To alleviate this concern we present a case study in Section 6.3.1 where we show that better soil quality (measured by the modern-day proxies) weakens the effect

Table 2: Effect of temperature fluctuations mediated by soil fertility

	(1) Low fertility N	(2) High fertility N	(3) Low fertility C	(4) High fertility C
Temperature fluctuation	-0.410*	-0.008	-0.335	-0.099
	(0.236)	(0.125)	(0.239)	(0.090)
Muslim rule	-0.341**	-0.013	-0.679***	0.141
	(0.133)	(0.118)	(0.158)	(0.089)
Muslim rule * Temp fluctuation	0.796***	0.034	1.132***	-0.389
	(0.292)	(0.313)	(0.335)	(0.240)
Dynasty fixed effects	Yes	Yes	Yes	Yes
Observations	4590	4698	4644	4644

Notes: All coefficients are of the order 10^{-2}. Standard errors are clustered at the dynasty level. The dependent variable is the Desecration dummy which is equal to 1 if a desecration event was recorded at religious site i in polity k in period t. Temperature Fluctuation is a dummy that equals 1 if temperature deviation recorded in period t was either in the top or bottom quartile the temperature deviations in religious site i. Muslim rule is a dummy that equals 1 if site i was under Muslim rule in period t. The first two columns are using the temple locations that have low and high fertility respectively as measured by present day soil nitrogen levels. The last two columns are using the temple locations that have low and high fertility respectively as measured by present day soil carbon levels.$^{*}p < 0.10$; $^{**}p < 0.05$; $^{***}p < 0.01$

of weather shocks on agrarian rebellions in medieval India, which suggests that the moderating effect of modern soil quality measures that we identify in Table 2 is not spurious.

6 Explanations

There could be different explanations for why an economic shock would increase the probability of a temple being desecrated in Muslim rules areas relative to Hindu-ruled areas. We explore three mechanisms (i) looting (ii) battles (iii) rebellion.

6.1 Looting

It might be that the economic shock would lead to lower revenue from the affected area and that would prompt the ruler to raid the temple in their own territory, as opposed to attacking temples in the territories of Hindu rulers. Hindu temples would often accumulate wealth and Muslim rulers are known to have plundered medieval Hindu temples for their wealth. It is said of Mahmud of Ghazni's sacking of the Somnath temple in 1024 CE that:

> not a hundredth part of the gold and precious stones he obtained were found in the treasury of any king of Hindustan. (Habib, 1981).

It is therefore plausible that weather fluctuations and the subsequent negative shock to agricultural productivity reduced tax revenues of Muslim rulers and increased their economic incentive for looting a Hindu temple that was under their rule. An alternative explanation weighs against this possibility. Muslim rulers often contested over a religious site to control the pilgrimage economy. For instance, in the 16th century the Muslim Subahdars of Cuttack engaged in a protracted struggle with the Hindu Raja of Khurda to control the pilgrimage center Puri (Bakker, 1992). For a Muslim ruler the economic cost of destroying an asset (revenue from pilgrimage taxes) under his control would have weighed against its sacking during the period of economic distress. The trade-off between temple desecration and preserving rents from the pilgrimage economy is highlighted in the actions of Muhammad bin Qasim, an 8th-century Muslim conqueror of Sind and Punjab:

> Mohommad bin Qasim carried out his plan of destruction systematically in Sind, we have seen, but he made an exception of the famous temple at Multan for the purposes of revenue, as this temple was a place of resort for pilgrims, who made large gifts to the idol." (Titus, 1930).

We use novel data on pilgrimage networks in ancient India to proxy the wealth of religious sites in our dataset. These pilgrimage networks are described in the *Tirtha-Yatra* (pilgrimage) section of the epic Mahabarata, which is considered to have been composed between 3rd century BC and 3rd century CE (Eck, 2012). Bhardwaj (1983) reconstructed these pilgrimage routes and listed the important places of pilgrimage of the Indian subcontinent. Mahabarata lists 24 important places of pilgrimage that are within the geography of modern-day India. We match them to our dataset of medieval religious sites (see Figure A-2 in Appendix). Out of the 24 pilgrimage centers that are mentioned in Mahabarata, twenty are matched with the religious sites of medieval India, which suggests that the pilgrimage centers of ancient India continued to be important during the medieval period, and would have generated significant pilgrimage revenue.

We test the looting channel in Table 3. We create a dummy $Pilgrimage\ Site$ that equals 1 if the religious site i is an important pilgrimage center since antiquity, according to the Mahabarata. We hypothesize that these important pilgrimage centers would be wealthier due to pilgrimage activity. The looting channel would suggest that these centers would be more likely to experience a temple desecration under Muslim rule during adverse weather shocks.

We find that while pilgrimage centres are more likely to be desecrated overall, the probability of desecration does not increase during an economic shock. Also, controlling for whether or not a religious site is a pilgrimage center does not change the result that economic shocks increase the likelihood of temple desecration in Muslim-ruled areas compared to those in Hindu-ruled territories.

6.2 Battles

Weather shocks can affect the probability of battles taking place.[24] For example, decline in agricultural productivity can increase the demand for land which escalates the competition over its control. Similarly, decline in agricultural wages can increase the labor supply for military recruitment. On the other hand, rising food prices can also increase the cost of maintaining an army. It is plausible that weather fluctuation increased the likelihood of conflict between Hindu and Muslim polities. The collateral damage from these battles can affect the probability of temple desecration.

[24]Using data on conflicts in Europe, North Africa and Near East between 1400 and 1900 CE, Iyigun et al. (2017) find that cooling is associated with increased conflict.

Table 3: Effect of temperature fluctuations on temple desecration while controlling for temples being pilgrimage centres

	Temple desecration			
	(1)	(2)	(3)	(4)
Pilgrimage centre	0.524**	0.523*	0.520**	0.520*
	(0.242)	(0.269)	(0.241)	(0.262)
Temperature deviation		0.004	-0.204*	-0.204
		(0.131)	(0.117)	(0.129)
Pilgrimage * Temp deviation		0.001		-0.000
		(0.562)		(0.554)
Muslim rule			-0.127*	-0.127*
			(0.070)	(0.068)
Muslim rule * Temp deviation			0.425**	0.425**
			(0.178)	(0.178)
Dynasty fixed effects	Yes	Yes	Yes	Yes
Observations	9288	9288	9288	9288

Notes: All coefficients are of the order 10^{-2}. Standard errors are clustered at the dynasty level. The dependent variable is the Desecration dummy which is equal to 1 if a desecration event was recorded at religious site i in polity k in period t. Temperature deviation is a dummy that equals 1 if temperature deviation recorded in period t was either in the top or bottom quartile the temperature deviations in religious site i. Muslim rule is a dummy that equals 1 if site i was under Muslim rule in period t. Pilgrimage centre is a cross-sectional dummy variable that takes the value 1 for all temple locations that are on historical pilgrimage routes. $^{*}p < 0.10$; $^{**}p < 0.05$; $^{***}p < 0.01$

Historians of medieval India propose another explanation to why temple desecration might increase due to battles between Hindu and Muslim rulers. According to this hypothesis temple desecrations typically occurred when Muslim polities expanded into the territories of Hindu polities through battle victories (Eaton, 2000). The underlying intuition is that royal temples acted as a legitimizing agent for the Hindu kingship. The invading Muslim polity undertook destruction of these temples to delegitimize the political authority of the incumbent Hindu ruler and suppress the religious authority's likely support for mass rebellion (Eaton, 2000). It is possible that Muslim polities anticipated a greater threat to their authority in a newly occupied territory when the occupation coincided with a weather shock. The Muslim polity would respond to the anticipated social unrest in a newly conquered territory by desecrating the Hindu temple.

We test these hypotheses by compiling data on Hindu-Muslim battles. The data is obtained from Jaques (2007) which provides a description of about 8,500 battles from antiquity till the 21st century that happened around the world. We cross-check this data from a second resource, which lists key battles in medieval India, especially those which occurred between the 15th and the 18th centuries (Narvane, 1996).

Table 4 tests for the mediating effect of weather fluctuation on temple desecration through Hindu Muslim battle intensity or through the battle outcome in favor of a Muslim ruler. We control for the interaction between number of Hindu Muslim battles, that occurred in the proximity of religious site i in period t, and the weather fluctuation dummy in Column 2.[25] In Column 4 we interact the number of battle victories for Muslim rulers to the weather fluctuation dummy in Column 4. We find that the battle measures or their interaction with weather fluctuation, are statistically not different from zero. Also, our main effect $(M_{ikt} \times T_{ikt})$ is robust to the interaction between weather fluctuations and Hindu-Muslim battles or their outcomes.

[25] We consider those battles that occurred within 200 km of a religious site as proximate.

Table 4: Effect of temperature fluctuations on temple desecration while controlling for battles

	Temple desecration			
	(1)	(2)	(3)	(4)
Temperature deviation	0.034	0.011	-0.179	-0.207*
	(0.110)	(0.104)	(0.111)	(0.113)
Hindu Muslim rulers battle	0.646		0.650	
	(0.794)		(0.797)	
Battle * Temperature deviation	-0.839		-0.817	
	(0.774)		(0.776)	
Muslim ruler battle victory		1.000		1.004
		(1.204)		(1.206)
Muslim ruler victory * Temperature deviation		0.306		0.330
		(1.837)		(1.830)
Muslim rule			-0.336	-0.233
			(0.234)	(0.149)
Muslim rule * Temp deviation			0.433**	0.444**
			(0.181)	(0.182)
Dynasty fixed effects	Yes	Yes	Yes	Yes
Observations	9288	9288	9288	9288

Notes: All coefficients are of the order 10^{-2}. Standard errors are clustered at the dynasty level. The dependent variable is the Desecration dummy which is equal to 1 if a desecration event was recorded at religious site i in polity k in period t. Temperature deviation is a dummy that equals 1 if temperature deviation recorded in period t was either in the top or bottom quartile the temperature deviations in religious site i. Muslim rule is a dummy that equals 1 if site i was under Muslim rule in period t. Hindu Muslim ruler battle, or Battle, is a dummy variable that takes the value 1 if there was a battle between a Hindu and a Muslim ruler within a 200km range of the temple location i in decade t. Muslim ruler battle victory is a dummy that takes a value 1 if the Muslim ruler won in the Hindu Muslim battle as described above. $^{*}p < 0.10$; $^{**}p < 0.05$; $^{***}p < 0.01$

6.3 Rebellion

Finally, we consider the potential role of state maintenance, to explore the relationship between weather shocks, agricultural productivity and the desecration of temples under Muslim rule. This would help to explain why Muslim rulers would destroy valuable asset like temples that were under their rule and generated revenue in the form of pilgrimage taxes.

Consider the economy of a Muslim State in medieval India where tax on agricultural output is the primary source of state income. Agrarian output is dependent on weather conditions, soil quality and other inputs. The Muslim ruler uses a decentralized tax collection system to raises taxes from largely Hindu peasants. The local landed elite (such as a Zamindar or Chaudhary) who also serve as tax collecting agents are also predominantly Hindu. In normal years the Muslim ruler raises additional revenue by charging a pilgrimage tax on visits to temple sites. In return for these taxes, the Hindu masses are allowed to practice their religion.

When a weather shock reduces agricultural productivity, the resulting economic distress creates conditions for social conflict that threatens the Muslim ruler's hold over power (Acemoglu and Robinson, 2005). The decline in agrarian productivity can create opportunity for rebellion by fueling *resentment* and by reducing the *opportunity cost* of engaging in conflict. The literature on medieval India specifically highlights the role of weather-related agrarian shocks in creating resentment among cultivators and the local Hindu elite against the Muslim State. For example, Habib et al. (1963) argues that agrarian revolts against the Mughal empire were a reaction of an impoverished peasantry that were led by the Zamindars.[26]

Observing a civil uprising, the Muslim ruler destroys a temple that the masses revere as a form of exemplary, and public, punishment to dissuade a widespread revolt against the state. The intuition follows from anecdotal evidence that authoritarian rulers often use public punishment to reinforce imperial power and

[26] The tax on peasantry was determined according to size of the landholding and was independent of actual production (Habib, 1983). Bad harvest periods would have increased the tax burden on cultivators fueling resentment. Bad harvest periods would also have created resentment among local Hindu elite who had to forego part of their share in taxes to make up for lost state revenue. The local elite may have identified agrarian unrest as a "window of opportunity" to extract concessions from the state (Aidt and Leon, 2016).

to dissuade further civil strife. For example, Acemoglu and Robinson (2005) discuss the case of the Comunero rebellion of 1781. After the rebellion in Guanentá had subsided to an extent, the royal government handed exemplary punishment to the leader and his three associates in 1782. The rebels were decapitated and their heads and limbs were displayed on poles in public squares in the capital and in towns that had participated prominently in the unrest. The anecdote of Mughal king Aurangzeb destroying the Keshava Deva temple in 1670 CE following a peasant uprising, that we discuss in Section 3.4, provides an example of temple desecration being used as public punishment to dissuade civil strife.

In addition, the local Hindu elite patronized temples to enhance their legitimacy among the masses.[27] The Muslim ruler would have another incentive to destroy the temple patronized by the local Hindu elite to discredit them and reinforce their inability to lead a mass rebellion against the Muslim State. The anecdote of the Mughal king Jahangir destroying a temple associated with a reneging Hindu official in 1635, that we highlight in Section 3.4, provides an example of temple desecration as a mechanism to discredit the local Hindu elite, and weaken their ability to coordinate a mass revolt.

The preceding discussion on rebellions and temple desecration suggests that during periods of adverse weather shocks, a Muslim State is more likely to desecrate a Hindu temple under its rule, as compared to one under Hindu rule. We explore the link between rebellions and temple desecration under Muslim rule in the following ways. We first present a case study where we document the role of weather shocks and agricultural productivity on agrarian rebellions in the 17th-century North India. We then turn to circumstantial evidence on regime instability and temple desecration under Muslim rule.

6.3.1 Case Study: Weather Fluctuations, Soil Quality and Agrarian Rebellions in North India

We perform a case analysis to assess the link between weather shocks, our measures of soil quality and agrarian rebellions that occurred in North India from 1670 to 1730 CE. The data on rebellions is compiled by Rana (1987), who uses village-level records to study the tensions between the Mughal State and the

[27] There is evidence across contexts and religious traditions that elites offer inducements to the religious authorities to build support among the masses (Rubin, 2017; Chaney, 2013; Auriol and Platteau, 2017b; Platteau, 2017).

local landlords (Zamindars) in North India. The author compiles a list of agrarian rebellions that took place across parganas (comparable to sub-districts in modern day India) in Mughal provinces of Ajmer and Agra in late seventeenth and early eighteenth centuries (see Figure A-3 in Appendix). Using this list we create a cross-sectional dataset of rural rebellions for sixty-six parganas. Our outcome of interest is the total years of agrarian revolt experienced by pargana (i) during the period from 1670 to 1730 CE.[28] Next, we match the parganas to our proxies of weather fluctuations and soil quality. The temperature data does not have enough cross-sectional variation at the pargana level, so we rely on precipitation data to create a proxy for weather fluctuation.

Our weather fluctuation measure, $PrecipitationDeviationDecades$, is the number of decades from 1670 to 1730 CE for which precipitation level for pargana (i) was either in the top or bottom quartile of its precipitation sample. Using this dataset we test whether experiencing more decades of weather fluctuation increase the duration of rebellion, and whether this effect is mediated by soil quality. Columns (1) and (2) of Table 5 show that after controlling for soil quality, an additional decade of large weather fluctuation increased the rebellion duration by approximately 3 years (compared to a sample average of 38 years). Columns (3) and (4) show that the effect of weather shocks on total rebellion duration is dampened in parganas with higher soil quality.

Taken together, Table 1 and Table 5 support our hypothesis that adverse weather shocks hampered agrarian productivity, creating conditions for rebellion by largely Hindu masses, and the Muslim ruler responded to this challenge by desecrating a Hindu temple.

[28] Rana (1987) only provides the total duration of agrarian revolts that occurred in a pargana during the period between 1670 to 1730 CE. There is no temporal dimension in this dataset.

Table 5: Mechanism- Weather shock, soil quality, and rural rebellions

	Duration of Agrarian Revolt			
	(1)	(2)	(3)	(4)
Precipitation Deviation Decades	2.622*	2.538*	30.362***	14.579***
	(1.556)	(1.458)	(10.373)	(5.060)
Log Nitrogen Density	2.236		15.548***	
	(1.516)		(5.478)	
Log Nitrogen Density * Precipitation Deviation Decades			-4.237***	
			(1.507)	
Log Carbon Density		7.767**		22.975***
		(3.885)		(7.041)
Log Carbon Density * Precipitation Deviation Decades				-5.923***
				(2.117)
Observations	66	66	66	66

*Notes:**** p<0.01, ** p<0.05, * p<0.10. Standard errors are clustered at the pargana level. Precipitation Deviation Decades measures the number of decades for which pargana *i* precipitation level was either in the top or bottom quarter of its precipitation sample.

6.3.2 Circumstantial evidence

Guided by historical literature, we next assess the regime characteristics that could mediate the relationship between weather fluctuations and temple desecration. We assess the mediating relationship between a Muslim ruler's tenure and temple desecration during the period of weather fluctuation. This follows from the intuition that a newly designated Muslim ruler was particularly sensitive to mass rebellion during periods of adverse weather shocks, as it could galvanize potential challengers from within the ruling coalition. The historical literature suggests that the Muslim rulers were especially vulnerable to intra-dynasty feud at the onset of their tenure, since absence of fixed rules of succession often resulted in a violent transition period for the new ruler (Hurewitz, 1968; Kokkonen and Sundell, 2014). A famous example of such violent transition is the turmoil of 1675-58 when Mughal king Shah Jahan anointed his oldest son, Dara Shukoh as his successor (Hurewitz, 1968). This resulted in a war of succession that involved the four princes. The war of succession lasted for more than a year, finally resulting in the victory of prince Aurangzeb, while the remaining brothers were killed and king Shah Jahan was imprisoned for life.

We investigate the link between Muslim ruler tenure, weather fluctuations and temple desecration in two parts. First, we verify if Muslim rulers faced a violent transition period after ascending the throne. We collect data on the nature of death for rulers of the fourteen Muslim polities in our sample. Out of 166 Muslim rulers that were in power during our sample period, we can ascertain the nature of death for 95 rulers. We are particularly interested in the timing of Muslim rulers' assassinations since they were mostly orchestrated by a member of the royal family. Figure A-4 in Appendix shows the distribution of Muslim rulers' assassinations by their tenure. Note that about 70% of all Muslim ruler assassinations occurred in the first five years of their tenure. The descriptive evidence confirms that Muslim rulers were susceptible to intra-dynastic politics at the beginning of their tenure.

We divide the sample observations that were under Muslim rule into above and below median ruler tenure. Column (2) shows that the relationship between weather fluctuations and temple desecration under Muslim rule is driven by rulers at an early period of their tenure. This shows that Muslim rulers that were yet to consolidate their authority are more likely to respond to economic shocks by desecrating a temple under their rule. This provides circumstantial evidence in support of the rebellion channel underlying the link between weather fluctuations and temple desecration under Muslim rule.

We use the distance of religious site i to ruling dynasty k's capital in period t as a proxy for its remoteness. Civil strife in a remote location may pose a lower threat to the ruling elite (Acemoglu et al., 2010), and therefore is less likely to elicit a response in form of temple desecration. This variable has a time dimension as some polities in our sample changed their capital over time. We divide all observations into above and below-median distances from the capital. We find that the effect is driven by the less remote

Table 6: Effect of temperature fluctuations on temple desecrations for different durations of Muslim rule, and for remote and not remote temple locations

	Temple desecration			
	(1) All	(2) All	(3) Less remote	(4) More remote
Temperature deviation	-0.207*	-0.207*	-0.328**	-0.026
	(0.118)	(0.118)	(0.131)	(0.204)
Muslim rule	-0.164**		-0.398***	-0.246**
	(0.068)		(0.093)	(0.118)
Muslim rule * Temp deviation	0.431**		1.018***	-0.046
	(0.179)		(0.237)	(0.266)
Short duration Muslim rule		-0.081		
		(0.090)		
Short rule *Temp deviation		0.507***		
		(0.164)		
Long duration Muslim rule		-0.162		
		(0.118)		
Long rule *Temp deviation		0.327		
		(0.284)		
Dynasty fixed effects	Yes	Yes	Yes	Yes
Observations	9288	9288	4477	4811

Notes: All coefficients are of the order 10^{-2}. Standard errors are clustered at the dynasty level. The dependent variable is the Desecration dummy which is equal to 1 if a desecration event was recorded at religious site *i* in polity *k* in period *t*. Temperature deviation is a dummy that equals 1 if temperature deviation recorded in period *t* was either in the top or bottom quartile the temperature deviations in religious site *i*. Muslim rule is a dummy that equals 1 if site *i* was under Muslim rule in period *t*. Long and Short tenures are dummy variables that take the value 1 if the tenure of the Muslim ruler is above or below the sample median. The third (fourth) column includes those observations where the religious site *i* is less (more) than the median distance from the capital of its ruling polity in decade *t*. $^{*}p < 0.10$; $^{**}p < 0.05$; $^{***}p < 0.01$

temple locations, thus further supporting the rebellion explanation.

6.4 Scapegoating

There are alternative explanations for why Muslim rulers would destroy Hindu temples during adverse weather shocks. For example, an emerging literature has shown that religious minorities can be repressed under authoritarian rule during periods of economic turmoil (Grosfeld et al., 2020; Anderson et al., 2017; Johnson and Koyama, 2019). However, scapegoating is unlikely to be the underlying mechanism in our case since Muslim rulers in medieval India ruled over predominantly Hindu populations. Rough estimates from 1600 CE suggest that Muslims only constituted between 10% to 11% of the total population in the Indian subcontinent (Lal, 1973). Even when disaggregate population numbers become available from British census records in the 20th century, Muslims do not appear to exceed more than 10% of the total population in areas that constitute modern day India (see Figure A-5 in Appendix).

7 Conclusion

Our study addresses the relationship between authoritarian rule and religious authority during economic downturns. The events of temple desecration in medieval India are the center piece of our analysis. Using a novel dataset on medieval polities and religious sites, events of temple desecration and weather fluctuation, we show a positive relationship between weather fluctuation and temple desecration under Muslim rule. Additional evidence suggests that state maintenance is the likely explanation underlying this relationship.

We do not dismiss that certain Muslim rulers desecrated Hindu temples for purely ideological reasons. Instead, it appears that the Muslim States generally maintained a tenuous equilibrium of tolerance towards the religion of the masses. The medieval history literature offers some explanation for this result. One explanation is that the conciliatory approach could have been politically most expedient as Muslim elites were vastly outnumbered by Hindu subjects. The Muslim elite also had to rely on mainly Hindu intermediaries for state functioning. strict imposition of Islamic law could have affected this relationship and resulted in more frequent rebellions. Second, the Hanafi school of law, which is the most prominent school of Islamic jurisprudence in India, adopted a conciliatory approach towards the religious practices of Indic religions. It advocated concession of religious freedom for Hindus in lieu of a religious tax. In that sense Muslim States in medieval India were mainly guided by a conciliatory interpretation of Islamic law.

This type of study is vital in the current political milieu. The rise of modern fundamentalist Muslim quasi-States such as the Taliban or the Islamic State, and their association with iconoclastic events, have been ascribed by some to the presence of religious extremism amongst Islamic societies. Our findings tell a cautionary tale- that actions driven by seemingly religious motives could mask the political and economic processes at play. The same caution needs to be extended when it comes to the discourse on past temple desecrations in India, which has been responsible for severe Hindu-Muslim riots in the recent past, causing a great deal of harm to life and property. We hope that going forward this study will better inform the discussion on temple desecrations in medieval India.

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For Online Publication

Supplement to "Economic Shocks and Temple Desecration in Medieval India"

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A List of temple desecration by Muslim rulers (1190CE-1730 CE)

Table A-1: List of temple desecration

Desecration site	Latitude	Longitude	Decade
Varanasi	25.3	82.97	1190
Ajmer	26.449	74.63	1190
Delhi	28.61	77.2	1190
Rajgir	25.01	85.41	1200
Ujjain	23.17	75.78	1230
Puri	19.81	85.8	1290
Somnath	20.9	70.38	1290
Madurai	9.92	78.11	1310
Chidambaram	11.399	79.69	1310
Simhachalam	17.77	83.2	1320
Brahmagiri	19.78	85.61	1350
Somnath	20.9	70.38	1390
Anantnag	33.73	75.15	1400
Srinagar	34.08	74.79	1400
Kanchipuram	12.82	79.71	1470
Dwarka	22.24	68.96	1470
Bharuch	21.7	72.99	1500
Brahmagiri	19.78	85.61	1550
Ahobilam	15.13	78.67	1570
Kalahasti	13.749	79.69	1590
Anmakonda	18	79.557	1590
Puskara	26.48	74.55	1610
Varanasi	25.3	82.97	1630
Anmakonda	18	79.557	1640
Varanasi	25.3	82.97	1660
Rangpura	26.98	94.63	1660
Mathura	27.49	77.67	1670
Vrindavan	27.56	77.65	1670
Draksharama	16.79	82.05	1690
Surat	21.17	72.83	1710

Notes: The table lists temple desecration episodes that occurred at the important religious sites of medieval India. Religious sites data is collected from Schwartzberg et al. (1992). Temple desecration data is compiled by Eaton (2000).

B Summary statistics of temple desecration

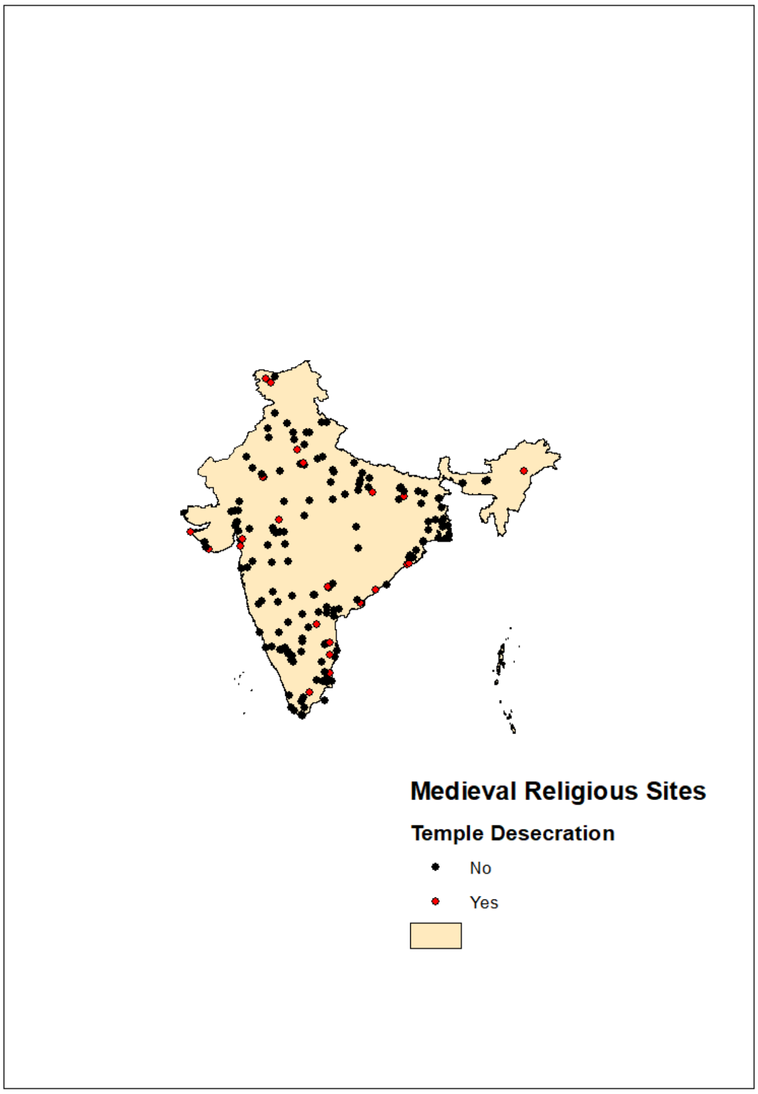
Table A-2: Summary Statistics- Probability of Temple Desecration

Sample Type	Mean	N
All	0.003	9288
Muslim Rule and Temperature Deviation	0.005	2236
Hindu Rule and Temperature Deviation	0.001	2384
Muslim Rule and No Temperature Deviation	0.003	2247
Hindu Rule and No Temperature Deviation	0.003	2421

Notes: Temperature Deviation is a dummy variable equal to 1 if the temperature deviation recorded in period t was either in the top or bottom quartile of religious site i's sample.

C Medieval religious sites and temple desecration

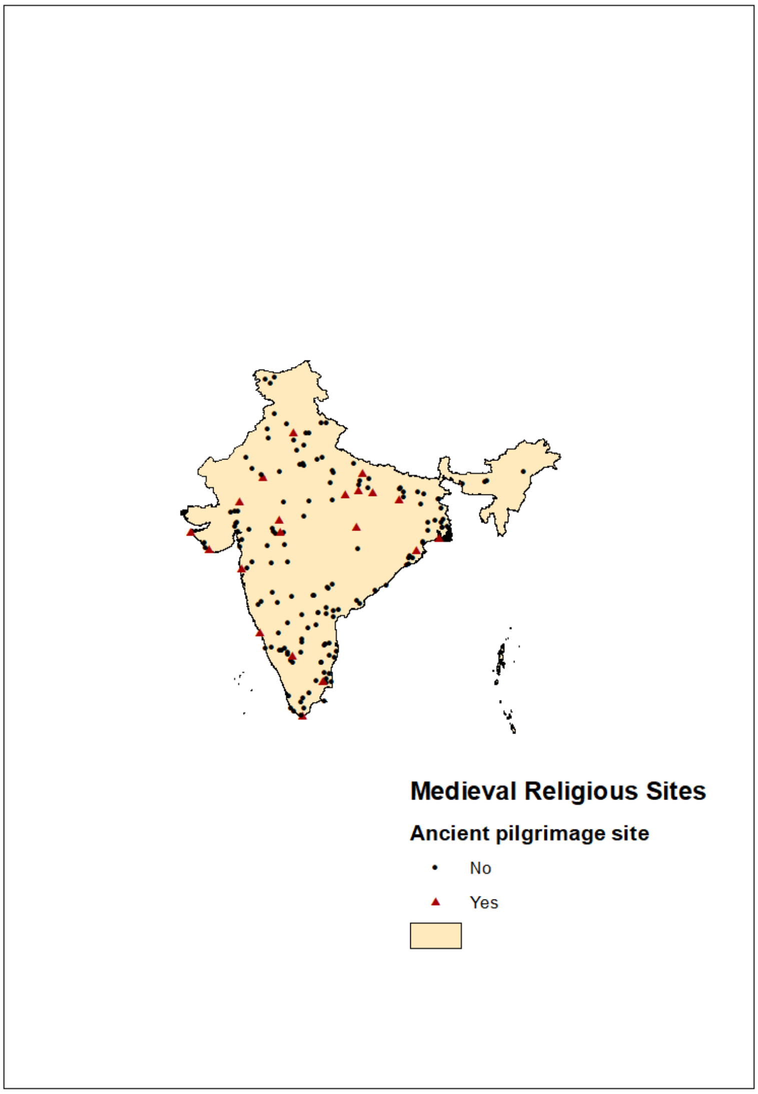
Figure A-1: Medieval religious sites and temple desecration



Notes: Religious sites data is collected from Schwartzberg et al. (1992). Temple desecration data is compiled by Eaton (2000).

D Ancient pilgrimage sites

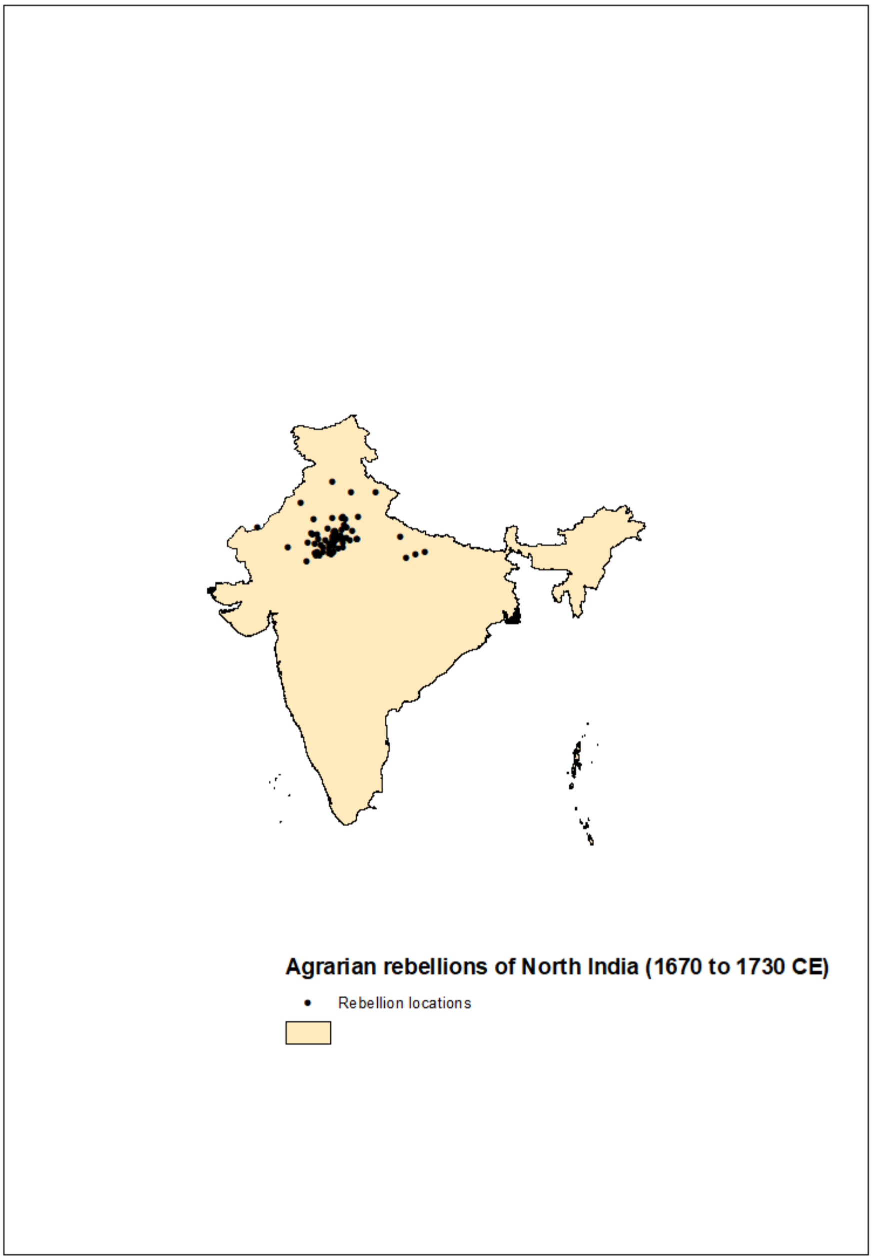
Figure A-2: Ancient pilgrimage sites



Notes: Religious sites data is collected from Schwartzberg et al. (1992). Ancient pilgrimage sites data is collected from Bhardwaj (1983).

E Agrarian Rebellions of North India (1670 to 1730 CE)

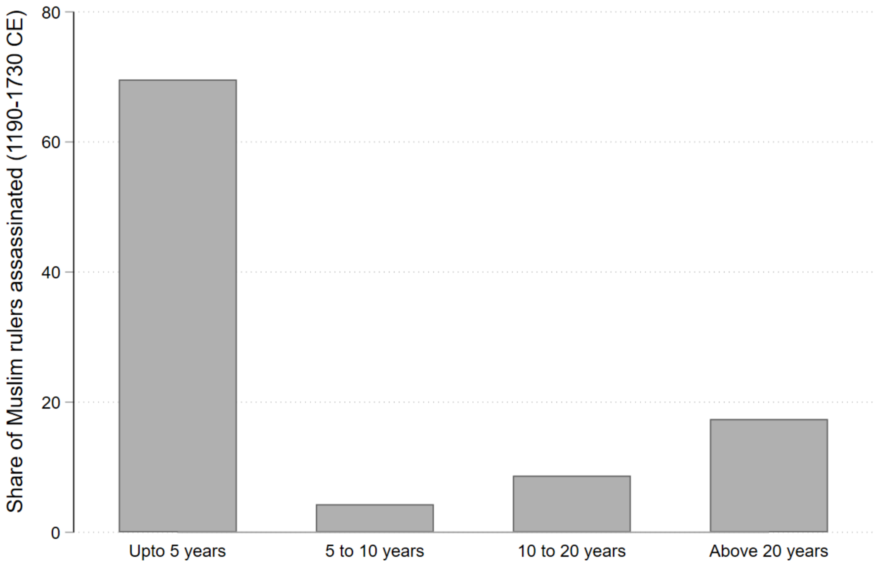
Figure A-3: Agrarian rebellions of North India



Notes: The data on agrarian rebellions is sourced from Rana (1987).

F Muslim rulers tenure and assassination

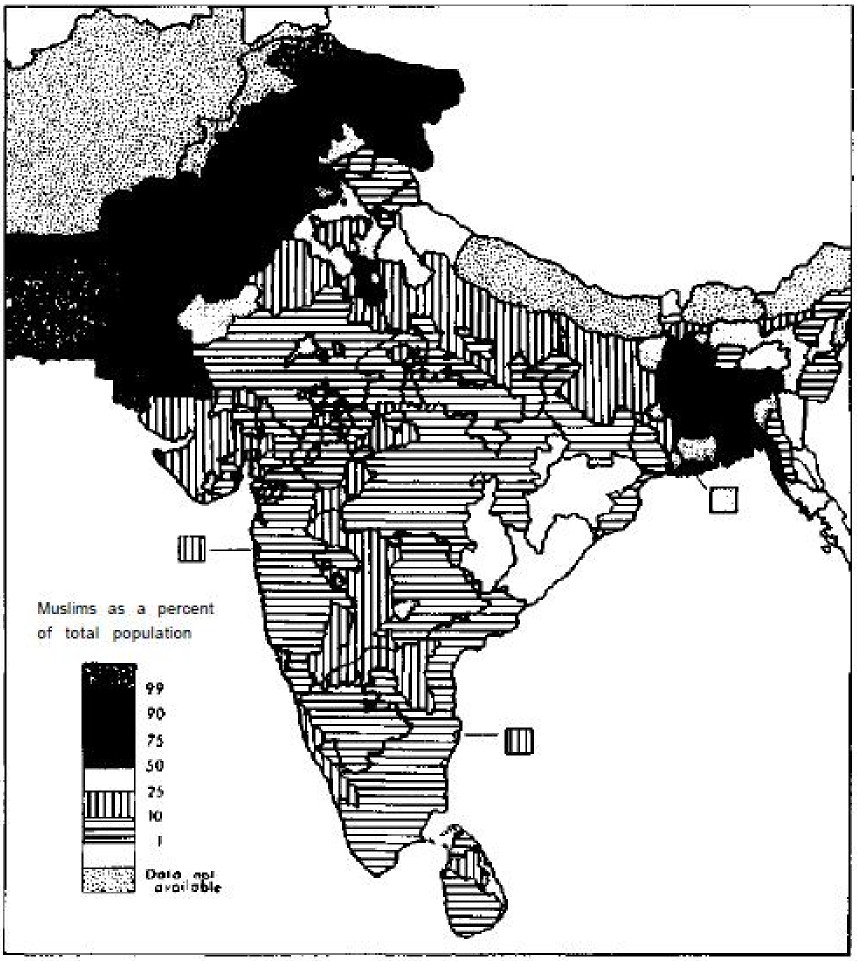
Figure A-4: Muslim ruler tenure and assassination



Notes: The graph shows the distribution of medieval Muslim rulers that were assassinated, by their tenure. The information on Muslim ruler characteristics is collected from Hunter (1908) and Lane-Poole (1986).

G Muslim population distribution in pre-independence India

Figure A-5: Muslim population share in Pre-Independence India



Notes: The map is sourced from Eaton (1985). The underlying data comes from British-administered censuses that were held in 1931 and 1941. The dark-coloured areas where Muslims were in majority are now in modern-day Pakistan and Bangladesh and are not covered in this study.

H Robustness Checks

H.1 Lagged effect of weather fluctuation

Prolonged periods of weather fluctuation could fundamentally alter institutions or weaken social cohesion. Thus, Muslim States that experienced weather fluctuation over successive periods could have resorted to repressing the masses in a fundamentally different manner. To capture this possibility we interact a lagged term of the weather fluctuation dummy with the Muslim rule dummy. Table A-3 shows that the contemporaneous effect is similar to our baseline result and is not affected by the introduction of a lag structure.

Table A-3: Effect of lagged temperature fluctuations on temple desecrations during Muslim rule

	Temple desecration			
	(1)	(2)	(3)	(4)
Temperature deviation	0.080	0.081	-0.136	-0.169
	(0.132)	(0.131)	(0.121)	(0.113)
Lagged temp deviation	-0.122	-0.123		
	(0.180)	(0.181)		
Muslim rule		0.214**	0.145	-0.044
		(0.103)	(0.197)	(0.123)
Muslim rule * Temp deviation			0.476**	0.508***
			(0.190)	(0.186)
Muslim rule * Lagged temp deviation			-0.343	-0.355
			(0.254)	(0.252)
Dynasty fixed effects	No	No	No	Yes
Observations	9116	9116	9116	9116

Notes: All coefficients are of the order 10^{-2}. Standard errors are clustered at the dynasty level. Desecration is a dummy equal to 1 if a desecration event was recorded at religious site i in polity k in period t. Temperature deviation is a dummy that equals 1 if temperature deviation recorded in period t was either in the top or bottom quartile the temperature deviations in religious site i. Muslim rule is a dummy that equals 1 if site i was under Muslim rule in period t. $^{*}p < 0.10$; $^{**}p < 0.05$; $^{***}p < 0.01$

H.2 Alternative definition of Muslim rule

In our dataset approximately 30% of religious site-decade observations could not be matched to a polity. In our main specification, we assign the nearest polity to those religious site-decade observations where a polity is not identified. Here we construct an alternative measure where we drop observations where would could not match a religious site-decade to a polity. Hence, the number of observations reduce to 6286. The results are presented in Table A-4. The coefficient of interest is robust to this alternative specification.

Table A-4: Results using alternative definition of Muslim rule

	Temple desecration			
	(1)	(2)	(3)	(4)
Temperature deviation	0.003	0.016	-0.224**	-0.227**
	(0.119)	(0.141)	(0.095)	(0.088)
Muslim rule alt		0.261**	-0.004	-0.208**
		(0.115)	(0.193)	(0.090)
Muslim rule alt * Temp deviation			0.544**	0.554**
			(0.221)	(0.224)
Dynasty fixed effects	No	No	No	Yes
Observations	6286	6286	6286	6286

Notes: All coefficients are of the order 10^{-2}. Standard errors are clustered at the dynasty level. Desecration is a dummy equal to 1 if a desecration event was recorded at religious site i in polity k in period t. Temperature deviation is a dummy that equals 1 if temperature deviation recorded in period t was either in the top or bottom quartile the temperature deviations in religious site i. Muslim rule alt is a dummy that equals 1 if site i was under Muslim rule in period t and 0 otherwise. $^{*}p < 0.10$; $^{**}p < 0.05$; $^{***}p < 0.01$

H.3 Hotter versus colder periods

Our construction of weather fluctuation variable implies that both positive and negative weather shocks hamper agricultural productivity equally, which then creates condition for temple desecration. Positive shocks may however have different effect on agricultural productivity than negative shocks. For example, Sarkar et al. (2019) show that heat shocks substantially reduce wheat output in modern day India. In

Table A-5 we separately test the effect of hotter and colder periods. Results suggest that Muslim polities were more like desecrate temples under their rule at a location that experienced large and positive weather fluctuation in period t.

Table A-5: Results with positive and negative shocks

	Temple desecration			
	(1)	(2)	(3)	(4)
Positive shock	0.070	0.084	-0.256*	-0.273**
	(0.165)	(0.167)	(0.138)	(0.124)
Negative shock	-0.063	-0.077	-0.139	-0.121
	(0.094)	(0.092)	(0.151)	(0.128)
Muslim rule		0.206*	-0.019	-0.272***
		(0.108)	(0.158)	(0.092)
Muslim rule * Positive shock			0.782***	0.902***
			(0.271)	(0.286)
Muslim rule * Negative shock			0.139	0.014
			(0.180)	(0.155)
Dynasty fixed effects	No	No	No	Yes
Observations	9288	9288	9288	9288

Notes: All coefficients are of the order 10^{-2}. Standard errors are clustered at the dynasty level. Desecration is a dummy equal to 1 if a desecration event was recorded at religious site i in polity k in period t. Positive shock and Negative shock are dummy variable that equal 1 if temperature deviation recorded in period t was in the top or bottom quartile respectively of the temperature deviations in religious site i. Muslim rule is a dummy that equals 1 if site i was under Muslim rule in period t and 0 otherwise. $^{*}p < 0.10$; $^{**}p < 0.05$; $^{***}p < 0.01$

H.4 Alternative definition of weather fluctuation

In our baseline specification we use an arbitrary threshold to define our weather fluctuation dummy. To ensure the results are not being determined by a particular threshold we use three alternative cut-offs to define our dummy. In Table A-6 we estimate the baseline results with the alternative definitions. In Panel (a) the weather fluctuation dummy equals 1 for the top and bottom 20 percentile of temperature variation. Similarly, in Panel (b) and (c) the dummy equals 1 for for top and bottom 30 and 35 percentile of temperature variation respectively. The main interaction is similar to our baseline result, even when we use alternative thresholds to define the weather fluctuation dummy.

Table A-6: Results with different definitions of temperature shocks

Panel (a). Dummy equals 1 for top and bottom 20th percentile	(1)	(2)	(3)	(4)
Temperature deviation	0.109	0.109	-0.197*	-0.208**
	(0.124)	(0.124)	(0.100)	(0.083)
Muslim rule		0.195*	-0.050	-0.150***
		(0.100)	(0.133)	(0.036)
Muslim rule * Temperature deviation			0.632***	0.654***
			(0.170)	(0.158)
Observations	9288	9288	9288	9288
Panel (b). Dummy equals 1 for top and bottom 30th percentile	(1)	(2)	(3)	(4)
Temperature deviation	-0.059	-0.063	-0.227	-0.215
	(0.108)	(0.107)	(0.162)	(0.141)
Muslim rule		0.196*	-0.013	-0.167*
		(0.101)	(0.174)	(0.086)
Muslim rule * Temperature deviation			0.342*	0.321*
			(0.186)	(0.166)
Observations	9288	9288	9288	9288
Dynasty Fixed Effects	No	No	No	Yes

Notes: All coefficients are of the order 10^{-2}. Standard errors are clustered at the dynasty level. Desecration is a dummy equal to 1 if a desecration event was recorded at temple location i in polity k in period t. Temperature deviation is a dummy that equals 1 if temperature deviation recorded in period t was either in the top or bottom 20th and 30th percentiles, for the top and below panels respecctively, of the temperature deviations in religious site i. Muslim rule is a dummy that equals 1 if site i was under Muslim rule in period t. $^{*}p < 0.10$; $^{**}p < 0.05$; $^{***}p < 0.01$

H.5 Spatial and serial correlation

In our baseline specification, standard errors are clustered across religious sites within a polity. Instead, we apply an arbitrary clustering structure, where standard errors are assumed to be spatially correlated over a radius between 200 km to 1500 km. Further we assume a serial correlation that decays over 100 years. We implement the arbitrary clustering in STATA using the acreg module developed by Colella et al. (2019). The results are reported in Table A-7. For ease of presentation, we only show the coefficient on the interaction term. It is evident that the standard errors are quite stable and comparable to the baseline findings.

Table A-7: Results with standard errors corrected for spatial and serial correlatoin

	(1)	(2)
Panel a: Spatial distance 200 km		
Muslim Rule × Temperature Deviation	0.430*	0.431*
	(0.251)	(0.249)
Panel a: Spatial distance 500 km		
Muslim Rule × Temperature Deviation	0.430	0.431
	(0.268)	(0.262)
Panel a: Spatial distance 1000 km		
Muslim Rule × Temperature Deviation	0.430*	0.431*
	(0.251)	(0.251)
Panel a: Spatial distance 1500 km		
Muslim Rule × Temperature Deviation	0.430*	0.431*
	(0.251)	(0.242)
Observations	9288	9288
Dynasty Fixed Effects	No	Yes

Notes: All coefficients are of the order 10^{-2}. Standard errors are generated allowing for arbitrary clustering, spatial clustering with radii mentioned in the table, and with serial correlation decaying over 100 years. Desecration is a dummy equal to 1 if a desecration event was recorded at religious site i in polity k in period t. Temperature Deviation is a dummy that equals 1 if temperature deviation recorded in period t was either in the top or bottom quartile the temperature deviations in religious site i. Muslim rule is a dummy that equals 1 if site i was under Muslim rule in period t.$^{*} p < 0.10$; $^{**} p < 0.05$; $^{***} p < 0.01$

H.6 Non-linear estimation

We allow for a non-linear functional form and estimate our baseline specification using a logit and conditional logit model respectively. Results presented in Table A-8 show that the marginal effects in the logit model are similar to the linear probability model. The number of observations in the last column is lower because dynasties where there are no desecrations are dropped.

Table A-8: Results using non-linear estimation

	Temple desecration			
	(1)	(2)	(3)	(4)
Temperature deviation	0.010	0.009	-0.967	-0.977
	(0.368)	(0.367)	(0.753)	(0.683)
Muslim rule		0.618*	-0.059	2.109***
		(0.347)	(0.493)	(0.309)
Muslim rule * Temp deviation			1.514*	1.515*
			(0.842)	(0.784)
Dynasty fixed effects	No	No	No	Yes
Observations	9288	9288	9288	5730

Notes: All coefficients are marginal effects and are of the order 10^{-2}. Standard errors are clustered at the dynasty level. Desecration is a dummy equal to 1 if a desecration event was recorded at religious site i in polity k in period t. Temperature deviation is a dummy that equals 1 if temperature deviation recorded in period t was either in the top or bottom quartile of the temperature deviations in religious site i. Muslim rule is a dummy that equals 1 if site i was under Muslim rule in period t and 0 otherwise. $^{*}p < 0.10$; $^{**}p < 0.05$; $^{***}p < 0.01$

H.7 Including religious site and decade fixed effect

Since our dataset is a panel with religious sites as the cross-sectional unit and decades as the temporal units, we can include these fixed effects as well. We present the results in Table A-9. The first column presents the results from our baseline specification and the rest of the columns add site and decade-fixed effects. The coefficient estimates of the interaction term remain robust to including additional fixed effects.

Table A-9: Results with religious site and decade fixed effects

	Temple desecration			
	(1)	(2)	(3)	(4)
Temperature deviation	-0.207*	-0.124	-0.220**	-0.145
	(0.118)	(0.093)	(0.109)	(0.096)
Muslim rule	-0.164**	0.256	0.495	0.347
	(0.068)	(0.383)	(0.799)	(0.734)
Muslim rule * Temp deviation	0.431**	0.343*	0.456***	0.356*
	(0.179)	(0.197)	(0.157)	(0.179)
Dynasty fixed effects	Yes	Yes	Yes	Yes
Decade Fixed Effects	No	Yes	No	Yes
Location fixed effects	No	No	Yes	Yes
Observations	9288	9288	9288	9288

Notes: All coefficients are of the order 10^{-2}. Standard errors are clustered at the dynasty level. Desecration is a dummy equal to 1 if a desecration event was recorded at religious site *i* in polity *k* in period *t*. Temperature deviation is a dummy that equals 1 if temperature deviation recorded in period *t* was either in the top or bottom quartile the temperature deviations in religious site *i*. Muslim rule is a dummy that equals 1 if site *i* was under Muslim rule in period *t*. $^{*}p < 0.10$; $^{**}p < 0.05$; $^{***}p < 0.01$

I Data Construction

Religious sites

We used two maps from Schwartzberg et al. (1992). The first map shows key religious and cultural sites between 1200 and 1525 AD, and the second map shows them from 1526 to 1707 AD. Superimposing these maps on the territorial maps of modern day India we were able to identify these sites and their coordinates. Overall, we were able to identify 136 religious sites for the first period and 74 for the second period, with a total of 172 different locations.

Temple desecrations

The list of temple desecrations is documented by Eaton (2000). We matched the locations to the current location of towns and districts and then geo-located them. The 80 events of temple desecrations that are documented by Eaton (2000) are matched to the sites to the key religious sites found in medieval maps. 25 sites occur in both lists and account for 30 temple desecration events. We thus compile a list of religious sites, with atleast one major temple in medieval India or many temples in medieval India, where we observe a temple desecration and those where we do not observe a temple desecration.

Construction of panel data

A panel dataset was constructed with 172 religious sites as the cross-sectional variable and 54 decades starting from 1190, which was the beginning of Islamic rulers invading of India, till 1730 which approximately coincides with the decline of the Mughal empire, which was the last major Islamic dynasty in India.

Temperature

The temperature data is obtained from Mann et al. (2009). The construction combines data from different paleoclimatic studies that calculated historical temperatures using data from different proxy indicators. These include tree rings, coral, ice core and other long instrumental records. The data have a global coverage and report the average annual temperature for five degree latitude by five degree longitude grids, and are available for each year from 500 to 1959 CE. This corresponds to roughly a 500 km by 500 km grid in India. While the cross sectional variation is coarse, the temporal variation is at an annual level. Even there, the accuracy is high for decadal temperature averages but not for finer time periods (Iyigun et al., 2017).

Historical temperature data are reported as deviations, measured in degrees Celsius, from the 1961–1990 mean temperature. As we are interested in temperature extremes, it doesn't matter whether we use levels or deviations from a fixed baseline. Using GIS we match the yearly temperature data for each temple location and then take the decadal deviation average.

Precipitation

The precipitation data is obtained from Shi et al. (2018). The construction combines tree ring proxies and documentary evidence to record summer precipitation estimates (in mm) for the period from 1470 to 1920 CE. The dataset covers all Asia and reports the annual summer precipitation for 0.5 degree latitude by 0.5 degree longitude grids. This corresponds to roughly a 50 km by 50 km grid in India.

Identification of polity

The next task was to identify the polity governing a particular religious site in a particular decade. For this, we used 12 maps for different periods from Schwartzberg et al. (1992). We were able to identify 60 polities or dynasties and their approximate political borders. Superimposing these borders on the locations of religious sites allowed us to assign the polities that governed these sites at different periods of time. A significant number of religious sites-decade observations fell into areas where there were no ruling polities identified. These could either be because the polities that governed those sites were too small, or because the sites were in inaccessible locations like mountain tops, which were free of the control of any State.

We determine the religion of each polity and assign the variable Muslim Rule as 1 if a site in a decade was ruled by a Muslim polity. As there are 12 maps covering a period of 54 decades, these assignments are coarse. Since the measurement error is in the explanatory variable here, it will dampen the coefficients, leading us to lower bounds of actual coefficients.

We also create a variable determining the distance of the site from the capital of the ruling polity – own capital distance. This would be a proxy for the political importance of the site. Here we lose all those observations where we do not know the polity that governed a particular religious site.

We then use historical sources to gather information about the tenure of rulers of all Muslim polities (Hunter, 1908; Lane-Poole, 1986).

Battles

The battles dataset is compiled from two different sources. Our primary source is Jaques (2007) which provides a description of about 8,500 battles across the world from antiquity till the 21st century. Jaques (2007) covers battles ranging from epic engagement that lasted weeks to skirmishes with a few dozen men to a side. From their descriptions we collated information such as the year and location of the battle, and identity of the battle participants. We supplemented this information by collecting data on the religion of each participant. To crosscheck our data we relied on another resource, Narvane (1996), which lists key battles in medieval India, particularly between the 15th and the 18th centuries. Overall, we identified 223 battles for the given period. About 80% of these battles were identified in our primary, or primary as well as a secondary source. The remaining battle events were identified only in the secondary source.

We then matched this dataset with our religious sites panel data to identify the battles that happened within a given range of each temple site in that decade. We show results with a range of 200 km but the results are robust to varying the range.

Soil fertility

We use the nitrogen and carbon content of soil as a measure of soil fertility. The data is taken from EarthDATA Spatial Data Access Tool (SDAT). The data has a spatial resolution of 0.08 degree $\times$ 0.08 degree (or roughly 10 $\times$ 10 kilometers). Carbon density of the soil is measured int is kg/cubic meter, while for nitrogen it is in g/cubic centimeter. The gridded soil quality data is matched with temple locations using a geospatial software, which we use to construct the average nitrogen and carbon density level for religious site (*i*).

Pilgrimage Sites

Bhardwaj (1983) reconstructed ancient pilgrimage networks of Indian subcontinent that are mentioned in the *Tirtha-Yatra* (pilgrimage) section of the epic *Mahabarata*. He also lists the important centers of pilgrimage that are found on the ancient routes. Using GIS we match these pilgrimage centers to the medieval religious sites. We create a dummy that equals 1 if site i was also listed as a pilgrimage center in *Mahabarata*. We expect these sites to be wealthier due to the pilgrimage activity.