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Extending the formal state: the case of Pakistan's Frontier Crimes Regulation

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Abstract

Why do modern states allow parts of their territory to be governed by non-state actors? We study this question using the Frontier Crimes Regulation (FCR) in Pakistan, a British Colonial law abrogated only in 2018, which left governance to pre-colonial tribal councils in large parts of modern day Pakistan. In areas where the FCR did not apply, the British and then Pakistani state built modern political and bureaucratic institutions. Using primary legal documents, we build a dataset of when and where the FCR applied between 1901 and 2012. The territorial extent of the formal state is both cleanly demarcated by this law and varies substantially over time, permitting an empirical examination of the determinants of state control. The data reveal that the Green Revolution's potential to transform agriculture played a major role in extending the formal state. The law was repealed first from areas where agricultural productivity benefited the most from the Green Revolution. This is consistent with a model in which technological changes that shift the returns to control influence where states choose to govern.

1 | INTRODUCTION

In *Against the Grain: A Deep History of the Earliest States*, Scott (2017) argues that the coexistence of formal, organized states with less organized polities has been much more common than appreciated throughout human history. This coexistence persists in many developing countries today (e.g. Colombia, India, Morocco, Myanmar, New Guinea and Pakistan, among others). And the parts of these countries governed by less organized polities (sometimes erroneously referred to as 'ungoverned spaces') often provide room for terrorists, drug manufacturers and criminals to operate, and preventable diseases such as polio to persist, creating negative externalities locally and globally. Correspondingly, understanding variation in formal

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state control and its implications for long-run development is important both for policy and for political economy research (Dell *et al.* 2018; Allen *et al.* 2023).

We study variation in formal state control in the case of Pakistan. During colonial rule, the British divided Pakistan into two main regions. The first was the Raj—areas where the British built modern political and bureaucratic institutions. This included a modern legal system, a tax system, a civil service, and an army. The second was governed according to the Frontier Crimes Regulation (FCR) of 1901.[1] Here, the British gave a small number of 'political agents' ultimate authority, but also legally enshrined the authority of pre-existing tribal councils called Jirgas. The FCR persisted through the independence and subsequent partition of the subcontinent. While it was slowly rolled back through the 20th and early 21st centuries, some regions along the Afghan border known as the Federally Administered Tribal Areas and a few small Provincially Administered Tribal Areas remained under it until 2018.

The combination of a law that delineates cleanly between areas subject to the formal, organized state and areas subject to less organized polity, along with variation in the law's application over time, presents a unique opportunity to study the determinants of formal state control.

We frame our analysis around a simple cost–benefit logic for understanding state decisions about extending the formal, organized state into less organized polities within the state's territory. This logic is similar to that of Scott (2017) in that it allows both supply side (e.g. tax revenue) and demand side (e.g. citizen demand for public goods) forces. This logic also makes clear that technological innovations may change a central authority's calculus about where to exert control. More precisely, technological innovation should increase the amount of territory within the formal, organized state so long as the innovation increases the benefits of control more than the costs. And areas subject to less organized polity that benefit relatively more from an innovation are more likely to be integrated into the formal, organized state.[2]

We test this logic by exploiting a plausibly exogenous increase in agricultural productivity created by technological innovation. Specifically, the Green Revolution in South Asia increased wheat productivity differentially in marginal areas, allowing them to catch up with already productive regions. Broadly, this resulted from the introduction of drought- and flood-resistant as well as high-yielding wheat varieties along with the expansion of irrigation, pesticide and fertilizer use. These innovations made substantial swathes of South Asian farmland more productive, potentially raising their value to the state through increased revenue as well as increased demand for modern institutions from now wealthier landowners. This increased value could plausibly exceed the costs of administering these regions.

We find through difference-in-differences estimation that one unit lower wheat crop suitability—for example, from 5 to 4 on the 0–7 point scale of the Food and Agriculture Organization (FAO) of the United Nations, explained below—is associated with an approximately 10 percentage points differential decrease in the likelihood that the FCR continues to apply to a subdistrict following the Green Revolution. In other words, the government of Pakistan was much more likely to roll back the FCR in exactly the subdistricts that we would have expected to gain more because of the Green Revolution. These results are robust to specification, including to non-linear models (above/below median wheat crop suitability). We also present a series of robustness checks to rule out that our estimated effects are driven by other events happening in Pakistan during the Green Revolution, including placebo tests using suitability for crops that were important to Pakistani agriculture but not affected by the advent of the Green Revolution.

We provide corroborating evidence for these lower-suitability subdistricts gaining more productivity from the Green Revolution using data from the 1960 and 1972 agricultural censuses in Pakistan: areas of low wheat suitability saw disproportionate increases in the amount of farmland being fertilized and in the number of farms using fertilizer between these years. This suggests that the extension of state control led to shifts in investment decisions in the same pattern that our simple logic predicts.

This paper contributes to a small but important literature on the frontier between the organized, formal state and less organized polities. Dell *et al.* (2018) take the boundary between formal state and 'non-state' to be exogenous, and study the long-term consequences. An important implication of this paper is that this sort of boundary should not be treated as exogenous. Allen *et al.* (2023) conduct a similar exercise to this paper, leveraging changes in the returns to irrigation when rivers moved in ancient Mesopotamia to show that the formal state moves into space where the returns—potentially to states and to citizens—are high. We see our paper as demonstrating a similar phenomenon in a different place and nearly 5000 years later.

A large literature in political economy identifies variation in economic endowments as a source of differences in state capacity (Engerman and Sokoloff 1997; Acemoglu *et al.* 2001). More recent empirical work provides evidence that the interaction of endowments and technologies—such as the plough (Alesina *et al.* 2013), steamships (Pascali 2017) and minerals (Sánchez de la Sierra 2020)—interact to shape political and economic development.[3]

Our framework is in the tradition of models that consider the interaction of a central state with domestic (Gerring *et al.* 2011; Migdal 1988; O'Donnell 2004) or international power groups (Lee 2018). Gerring *et al.* (2011) and Scott (2009), for example, examine how the characteristics of peripheral regions/states impact the ultimate bargain between peripheral and central elites. By contrast, we focus on the incentives of the dominant state. From that perspective, the application of the FCR is one channel through which a 'weak state', as in the thesis of Migdal (1988), or a 'brown area', as in O'Donnell (2004), could be co-opted. And its removal reflected in part a decision by the central state to seek more direct control.

This paper also relates to a literature studying variation in territorial control between a central government and rebel organization(s). Approaches to modelling this include: a cost–benefit analysis by parties (Acemoglu *et al.* 2013; Migdal 1988; Fearon 1994); constrained kleptocrats considering whether to control their entire territory (Grossman and Noh 1990); whether the expenditures required to efficiently contest rebel control are high relative to the costs that rebels can impose (Berman *et al.* 2011); changes in the power structure in the peripheral proto-state (Gerring *et al.* 2011); whether a government gains rents by having limited ungoverned space within its territory (Felter 2005; Bapat 2011); and incentives for interference by foreign actors (Lee 2018).[4]

Many of these studies suggest a simple cost–benefit calculus: extend control to a given region when the net benefits of doing so exceed the costs. This perspective suggests that technological shocks that change the net benefits of control will shift the frontiers of formal governance. We assess the impact of one such change, the Green Revolution, on decisions about integrating peripheral areas.[5] While the Green Revolution has been compared to the Industrial Revolution in terms of its agricultural impact (Evenson and Gollin 2003), its impact on political development has received less attention (Wharton 1969).[6]

2 | BACKGROUND

2.1 | The FCR until independence (1947)

In the 1840s, the British began to replace the Sikh government in Punjab with the same colonial institutions that were taking hold across the British Raj—tax collectors, police, a legal system, and other bureaucratic structures. However, they had limited success in what was to become the North Western Frontier Province (NWFP), in at least two important ways. First, much of the area was operating at a deficit due to limited crop yields and heavy security expenses. Second, the British legal system, codified in the 1860 Indian Penal Code and the Code of Criminal Procedure, was vehemently resisted by local Pashtun leaders and other established elites in favour of a customary legal system. Among other major differences, this customary system forgave crimes for honour reasons, including killings. Such differences were highly publicized, especially in cases involving women (Nichols 2013).

After multiple decades of struggle, the British stopped fighting the customary legal system and appropriated it in the 1901 FCR.[7] On 26 April 1902, the Viceroy and Governor General of India, Lord Curzon, travelled north to Peshawar to address 3000 tribal leaders, giving 'a complete account of the new British frontier policy' (Akins 2017):

> Now the great desire of the trans-border tribesman is, I take it, to maintain his religion and his independence. The British Government have not the smallest desire to interfere with either … The policy of the Government of India towards the trans-border men is very simple, and it is this. We have no wish to seize your territory or interfere with your independence. (Thomas 1906, p. 422)

Under the FCR, 'political agents', appointed by the local Governor, were put in charge of the entire region. 'While the British frontier policy under the FCR recognized the authority of tribal leadership and their internal autonomy, the key to tribal administration along the frontier, in Lord Curzon's eyes, was the Political Agent' (Akins 2017, p. 7), whose primary responsibility was to prevent mass violence from erupting. Criminal cases were to be first sent to a local council of elders, or Jirga, for trial. The political agent would then approve of the Jirga's ruling or could overturn it. Convicted criminals were not allowed appeals, and Jirgas could not sentence anyone to death. The Jirgas and the political agent could, however, pass collective judgement on communities, or punish relatives of those convicted—rulings that were very much customary and would not be allowed in the modern British legal system.

With this unique legal system came a profound lack of other institutions. Revenue collection was minimal (the political agent was also in charge of this, and had limited enforcement capacity despite absolute authority). The army was present near the borders, but there were few police, and other public services were non-existent. Local tribal communities were left more or less untouched, so long as crime reports remained acceptable. Akins (2017) writes: 'In the Tribal Areas, it is famously said that the authority of the British Raj only existed along the main roads and a hundred yards to each side. Beyond this lay the land of riwaj, or tribal custom.' As a result, there was a 'striking dearth of schools, hospitals, and infrastructure by the end of British rule' (Akins 2017, p. 8) in tribal areas.

Over the next half-century, the FCR changed very little. Besides extending it to a few additional regions, the legal systems and lack of other institutions remained fixed.

2.2 | The FCR since independence (1947–2018)

After independence, the FCR was not revoked from most of modern-day Pakistan. In fact, several years after the country's independence, the FCR was extended to include additional parts of Balochistan and, briefly, new areas in Punjab and Sindh. It was only over the course of several decades that it was slowly rolled back to the tribal areas, which remained under the FCR until 2018. We detail these geographic changes in Section IV.

After independence, the debate about the FCR shifted from controlling criminal activity to the explicit choice of whether or not to extend governance to tribal areas. In a famous address to the leaders of the tribal Jirgas of Pakistan on 17 April 1948, Pakistan's founder, Muhammad Ali Jinnah, discussed this choice:

> Pakistan has no desire to unduly interfere with your internal freedom. On the contrary; Pakistan wants to help you and make you, as far as it lies in our power, self-reliant and self-sufficient … We want to put you on your legs as self-respecting citizens who have the opportunities of fully developing and producing what is best in you and your land. You know that the Frontier Province is a deficit province. (Pakistan Directorate of Electronic Media & Publications 2021, pp. 225, 216)

When Jinnah calls areas under the province subject to the FCR a deficit province, he is making explicit the cost–benefit logic that this paper tests.

In recent decades, the debate has shifted towards representation. In 1997, Pakistanis in the FCR regions were finally granted representation in the national legislature. Party-based elections were introduced to these regions in 2013, decades after the rest of the country. In May 2018, the President of Pakistan approved the 31st Amendment to the Constitution, which began the merger of tribal areas into the 'settled' part of the Khyber Pakhtunkhwa (KP) province. Under the reform, the FCR would no longer be applied for governing the remaining tribal and frontier regions. The local populations elected new members to the KP assembly in 2019, finally gaining direct representation at the provincial level.

2.3 | The FCR and the essential functions of the state

Tilly (1985) defines the 'essential function of the state' as follows:

> Under the general heading of organized violence, the agents of states characteristically carry on four different activities:
>
> i. War making: Eliminating or neutralizing their own rivals outside the territories in which they have clear and continuous priority as wielders of force;
> ii. State making: Eliminating or neutralizing their rivals inside those territories;
> iii. Protection: Eliminating or neutralizing the enemies of their clients; and
> iv. Extraction: Acquiring the means of carrying out the first three activities—war making, state making, and protection. (Tilly 1985, pp. 133–4)

The FCR did not imply zero state presence, or that these territories were ungoverned. The central state still had a monopoly on war-making in the FCR areas during the Green Revolution. Equally unambiguous was the fact that the central state was not engaged in extraction in the FCR areas. While the central state provided protection across its territories in the broadest sense, many of the complaints about the Jirga legal system in the FCR areas centred around criminal punishments, suggesting weak or little protection (this depended on specific political agents). The role of the central state in state-making within the FCR areas is also unclear. Many rivals to Pakistan's central government and military persisted in the FCR areas, though it is unclear if that is through the central state's choice or not.

One state function that is not captured in this definition is the provision of public goods. This has become a more relevant function of states in modern times, and it is the case that the central state did not provide any public goods outside of broad protection to the FCR areas. Furthermore, the less organized polities in the areas—the tribes—did provide competing public goods such as dispute adjudication, (religious) schooling and social insurance.

Taken together, we therefore argue that while the FCR areas may not be fully ungoverned, the areas nevertheless represent a deliberate choice of the central state to cede several of its functions to the less formal governance of tribes.

3 | THEORETICAL FRAMEWORK

In this paper, we test the hypothesis that a state is more likely to extend its formal, organized self into less organized polities within its territory when those less organized polities become more productive because of technological innovation. We have in mind a simple cost–benefit logic governing this choice. That the central state expands and retracts ('collapses') control

over less organized polities based on the potential agricultural productivity of these polities, specifically productivity in grains, has been well documented going back to the earliest civilizations (Scott 2017).

On the cost side, we can imagine technologies that decrease the cost of extending the formal state, such as new/improved means of coercion, improved infrastructure, or technologies with increasing returns to scale across space. We can also imagine technologies that increase the cost of extending the formal state, such as cellular networks that allow for better coordination among so-called rebels. On the benefit side, we mainly have in mind technology-driven changes in tax revenue, though if the central state cares about its citizens, then there could also be direct benefits of the technology.

Another distinction that can be made for costs and benefits is whether they are supply (i.e. government) or demand (i.e. citizens) driven. For example, citizens may respond to a new technology by increasing their demand for the formal state if the new technology is a public good that the central state is uniquely positioned to provide. Allen *et al.* (2023) focuses on this distinction, arguing that 'the demand for such [public] goods and services matters for the origin of government as an organization'. Though this paper also shows that as the central state enters areas and provides public goods (irrigation canals), the state collects revenue, suggesting that supply and demand drivers may be inseparable. Indeed, the paper argues for a 'cooperative' theory of state formation that suggests that both sides are benefiting, as opposed to an extractive theory that suggests that elites supply government only for their own benefit (Lessnoff 1986; Engels 1934).[8]

We will not attempt to distinguish between the cooperative and extractive theories in our context. Any new technology likely affects both costs and benefits of extending the formal state simultaneously and along many dimensions. Our focus, instead, is on the examination of the net change after a technological innovation. More precisely, technological innovation should increase the amount of territory within the formal, organized state so long as the innovation increases the benefits of control more than the costs. And peripheral areas that benefit relatively more from an innovation are more likely to be integrated into the formal, organized state.

In the case of the Green Revolution in Pakistan, we believe that the first-order effects were (i) increases in agricultural revenues, particularly in places that were initially less suitable and thus gained the most from new seed varieties, and (ii) increases in economic surpluses arising from the presence of the state in those same locations. Effect (i) is a supply-side benefit—simply that the state could collect more taxes from more agriculturally productive areas. As Scott (2017) puts it, what matters is whether the soils 'were productive enough per hectare to sustain a large population in a compact area and to produce taxable surplus'. Effect (ii) is a demand-side benefit—Pakistan's central government maintained a monopoly on the supply of new high-yielding varieties of seeds during the Green Revolution, and supplied seeds only to its formal territories (Dowswell 1989), so citizens in less organized polities would now see a greater benefit to joining the central state.

4 | DATA

4.1 | FCR application, 1901–2012

We use primary legal documents to create a dataset of when and where the FCR has applied between 1901 and 2012 for all 403 subdistricts (tehsils) in Pakistan. To compile this dataset, we first hired an active lawyer based at the Lahore High Court to conduct a search across several hard-copy legal archives in Pakistan. These included the Gazette of India, the Imperial Gazetteer of India, the Gazette of (West) Pakistan, the Supreme Court Monthly Review, the All India Reporter, the Pakistan Law Journal, the Pakistan Law Digest, and the Pakistan Criminal Law Journal. We found any instance of mention of the FCR, for instance the text of the original

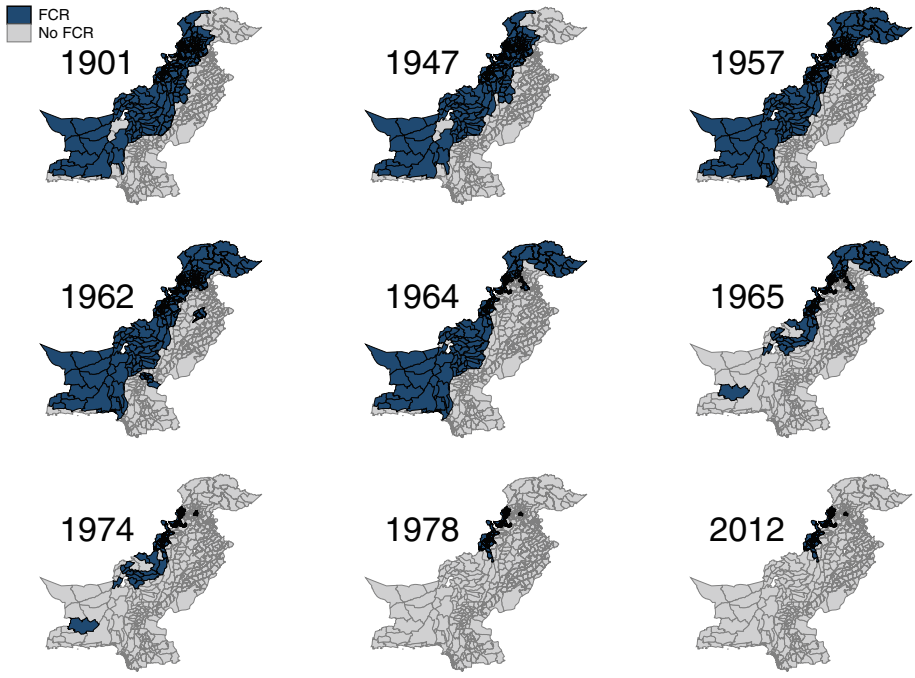

FIGURE 1 FCR application over time. *Notes*: Subdistrict (tehsil) boundaries marked. White subdistricts are those for which we do not have data, due to changes in subdistrict boundaries between 1901 and 2012. For the main analysis, we code all princely states as FCR areas, though their formal status differed. Results are robust to dropping these areas.

legislation in 1901, which included a list of areas designated under the law, and several announcements from District Governors about the changing of borders, which resulted in one or more tehsils moving to or from a district under the FCR. Second, we created a tehsil mapping between 1901 and 2012, which was possible because in almost all cases, new tehsils were created from the splitting of old tehsils without changing boundaries. We then used the information from our legal search to assign FCR status at the subdistrict level across time. Finally, we verified our dataset by sharing with several historical scholars in Pakistan.[9]

Figure 1 plots changes over time; Online Appendix Table A1 provides summary statistics. The dates selected in the table and figure represent all years in which there have been changes in the FCR status of at least one subdistrict, in addition to 2012 (as it did not change between then and 2018). The first two years demonstrate that there was very little change in FCR application between 1901 and Pakistan's independence from the British in 1947. The following six years show changes that occurred before and after the Green Revolution. The choice of 2012 is arbitrary; FCR application did not change between 1978 and 2018.

A complication in coding the FCR is that princely states comprised a third regime of governance under the British Raj and Pakistani government. While technically not governed under the FCR, we code princely states as FCR for the main analysis as they were not administered directly by the central state, and several princely states were shifted to be under the FCR officially when they were dissolved. Our results are robust to dropping princely states.

4.2 | Crop suitability and the Green Revolution

For a time-invariant measure of potential crop yields, we utilize crop suitability data from the FAO (2012). The FAO data enable us to calculate subdistrict level indices of agroclimatical

suitability for a variety of crops. We focus on wheat, which was by far the most common crop in Pakistan around the time of the Green Revolution, and the crop that would overwhelmingly benefit from the new technologies. The FAO indices are based on factors such as location-specific geography, rainfall and temperature over the period 1961–1990.[10] For each crop, the FAO provides six possible indices—varying input levels (i.e. use of capital) between low, intermediate and high, and water sources between rain-fed and irrigated. Our preferred measure of crop suitability is the average of these FAO indices across different input levels with rain-fed for the water source.[11]

Figure 2 shows the geographic variation in crop suitability for wheat. While most of Pakistan falls in the medium to not suitable categories, there is a fair amount of variation in areas that at one point were subject to the FCR.[12]

We assume that the Green Revolution in Pakistan began when key varieties of wheat started being available. Wheat was the most important Green Revolution crop in Pakistan, and the first availability of the most prominent high-yield wheat variety, Mexipak-65, was the key moment for the state's decision calculus as to which areas to incorporate, and which ones to leave under the FCR. These initial decisions of incorporation themselves then affected the quantity and distribution of seed production.[13] In Western Pakistan, wheat production increased by 79% from 1966 to 1969 (Child and Kaneda 1975).

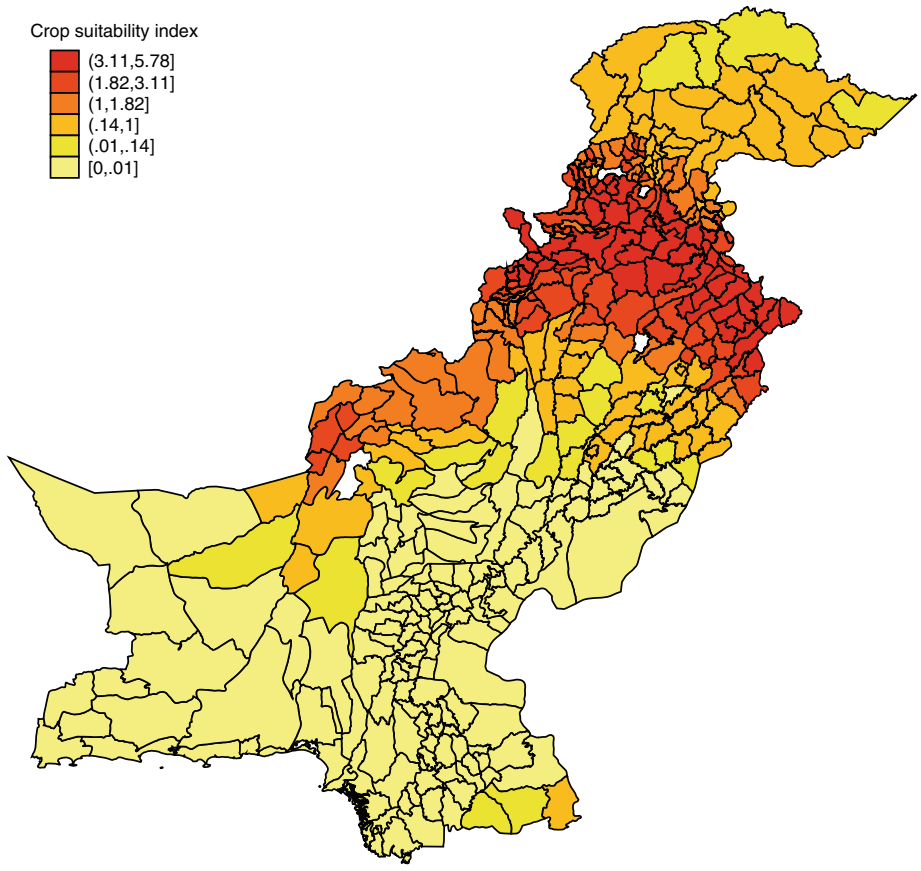

FIGURE 2 Crop suitability. *Notes*: Subdistrict (tehsil) boundaries marked. Crop suitability scores are as follows: 0 is not suitable, 1 is very marginal, 2 is marginal, 3 is moderate, 4 is medium, 5 is good, 6 is high, and 7 is very high. Data from FAO (2012)

The Green Revolution in South Asia was characterized by increased yields for staple crops. With wheat, there were few required changes in input technologies, labour to capital ratios, or irrigation. We will therefore consider the Green Revolution to mitigate the importance of crop suitability for wheat.[14] This is consistent with Foster and Rosenzweig (1996) and with Child and Kaneda (1975).

4.3 | Pakistan censuses of agriculture

To measure input usage, we hand-coded the 1960 and 1972 Pakistan censuses of agriculture for all subdistricts for which information was available in both years ($n = 109$). While this is only roughly one-quarter of subdistricts, it does cover all of Pakistan, including 13 subdistricts in Balochistan, 15 in the NWFP (now Khyber Pakhtunkhwa), 62 in Punjab, and 19 in Sindh. For each of these subdistricts, we have total cropped area, wheat cropped area, irrigated area, cropped area with fertilizer, and farms using fertilizer. In 1960, we additionally have number of ploughs, and in 1972, number of tractors.

5 | RESULTS

We conduct three complementary analyses. First, we provide the correlates of where the British decided to implement the FCR in 1901. Second, we correlate crop suitability with changes in agricultural inputs and usage during the Green Revolution. Finally, we exploit the differential impact of the Green Revolution by crop suitability to understand Pakistan's decisions to roll the FCR back across parts of the country throughout the 1960s and 1970s.

5.1 | Initial FCR application in 1901

To describe where the British decided to implement the FCR initially in 1901, we correlate fixed subdistrict-level characteristics, including crop suitability, with FCR status in 1901. The pairwise correlation between subdistrict wheat crop suitability and FCR application (see Online Appendix Table A2, column (5)) is positive, which suggests that initially, the British were less likely to control more suitable areas. While this runs counter to the basic intuition of our model, a bivariate regression likely omits several important variables. If we add controls for the costliness of taxing (rough terrain, costs of transportation, and general spatial correlates as captured by latitude and longitude), then subdistrict suitability for wheat becomes uncorrelated with initial FCR application by the British (column (6)).[15]

5.2 | Agricultural inputs and usage

5.2.1 | Empirical approach

We first need to confirm that the spread of high-yielding varieties of wheat at the onset of the Green Revolution did increase productivity (and thus potential government revenue) disproportionately in originally less-suitable areas, as this is a necessary condition for using this case to test our theory. Ideally, we would use a direct measure of productivity, either yields or government revenue, but we have not found records of such for this time period. As a second best, we consider data from the agricultural census on inputs whose usage would be positively correlated with yields and revenue.

We check for greater changes in investments after the Green Revolution in places that gained more in terms of productivity using the correlational specification

$$Y(1972–1960)_d = \alpha + \beta_1 \text{ Wheat Suitability}_d + \varepsilon_d, \quad (1)$$

where $Y(1972–1960)_d$ is an outcome from the census of agriculture in 1972 minus that same outcome in 1960, and Wheat Suitability$_d$ is the subdistrict's continuous crop suitability measure as shown in Figure 2, where a score of 0 is not suitable, 1 is very marginal, 2 is marginal, 3 is moderate, 4 is medium, 5 is good, 6 is high, and 7 is very high. We also present a non-linear difference-in-differences version of this specification in which we instead include the dummy Below Median Wheat Suitability$_d$ as our independent variable. We measure the median in the sample of subdistricts with data in the agricultural census. In this sample, the median is 0.14, so we are effectively splitting between originally unsuitable farmland and marginal or better. We cluster standard errors by district, and limit our analysis to subdistricts that were not subject to the FCR at the start of the Green Revolution, akin to limiting to 'control' subdistricts so that we can document a pattern between suitability and agricultural productivity without changes in FCR status potentially confounding our analysis.

5.2.2 | Results

Initially less-suitable areas of Pakistan appear to have gained the most from the Green Revolution, as we see in Table 1. Wheat suitability is positively correlated with changes in cropped area, wheat area, irrigated area, cropped area with fertilizer, farms using fertilizer, and farm equipment (tractors in 1972, and ploughs in 1960), both linearly in panel A and with a dummy for below-median suitability in panel B. Areas of low wheat suitability saw disproportionate increases in all of these measures between 1960 and 1972, statistically significantly so for 8 of the 12 regressions. The increases are large in magnitude as well. Irrigated area increased by 83,165 acres in above-median wheat suitability subdistricts during this time period, but in below-median wheat suitability subdistricts, it increased by an additional 59%, or 49,229 acres.

Originally less-suitable areas that gained the most from the Green Revolution also experienced the greatest increased investment in resources (many of which were state controlled in Pakistan during this period). Given that Green Revolution varieties of wheat required few changes in input technologies, labour to capital ratios, or irrigation, we suspect that these results reflect primarily changes at the extensive margin; use of these inputs went up as land that was not used before the Green Revolution was put into production (i.e. cropped area increased).

5.3 | FCR application and the Green Revolution

Our primary analysis exploits the interaction of pre-existing cross-sectional variation in the marginal impact of Green Revolution wheat varieties on productivity with an exogenously timed technological change (the introduction of those varieties) to identify impact of changing incentives for rolling back the FCR.

5.3.1 | Empirical approach

Our main specification is

$$\text{FCR}_{dt} = \alpha + \beta_1 \text{ Wheat Suitability}_d + \beta_2 \text{ Post GR}_t + \text{Post} \times \text{Suitability}_{dt} + \delta_t + \varepsilon_{dt} \quad (2)$$

TABLE 1 The Green Revolution and changes in agricultural inputs.

	Difference between 1972 and 1960 values					Farms with
	Cropped area (1)	Wheat area (2)	Irrigated area (3)	Cropped area with fertilizer (4)	Farms using fertilizer (5)	tractors 1972, ploughs 1960 (6)
Panel A: Linear models						
Subdistrict wheat suitability	−27,216**	−5677	−21,130***	−30,802***	−3598***	−326
	(10,475)	(3968)	(4576)	(8000)	(670)	(1071)
Mean of dependent variable	135,309	40,521	83,165	144,702	3966	573
No. of observations	96	96	95	92	92	89
No. of clusters	58	58	57	56	56	54
R-squared	0.072	0.029	0.188	0.165	0.300	0.002
Units	Acres	Acres	Acres	Acres	No. of farms	No. of farms
Panel B: Difference-in-differences models						
Below-median wheat suitability (= 1)	43,714	11,971	49,486***	68,886**	11,973***	−5264
	(33,249)	(10,519)	(17,998)	(30,439)	(2479)	(4275)
Mean of dependent variable	135,309	40,521	83,165	144,702	3966	573
No. of observations	96	96	95	92	92	89
No. of clusters	58	58	57	56	56	54
R-squared	0.015	0.011	0.084	0.066	0.266	0.035
Units	Acres	Acres	Acres	Acres	No. of farms	No. of farms

Notes: Standard errors clustered at the district level reported in parentheses. Data source: 1960 and 1972 Pakistan censuses of agriculture. Sample: tehsils for which agricultural census information was available in both 1960 and 1972, and that were not subject to the FCR at the start of the Green Revolution. For reference, there are 215 total tehsils subject to the FCR after the start of the Green Revolution. All areas are in acres. Crop suitability scores are as follows: 0 is not suitable, 1 is very marginal, 2 is marginal, 3 is moderate, 4 is medium, 5 is good, 6 is high, and 7 is very high.
*, **, *** indicate $p < 0.1$, $p < 0.05$, $p < 0.01$, respectively.

for subdistrict $d \in \{\text{ever had FCR}\}$, for year $t \in \{1947, 1957, 1962, 1964, 1965, 1974, 1978\}$. Here, FCR_{dt} is a dummy for whether the FCR continued to apply to subdistrict d in year t, $\text{Wheat Suitability}_d$ is our wheat crop suitability measure for subdistrict d, Post GR_t is a dummy for years after 1964, and $\text{Post} \times \text{Suitability}_{dt}$ is the linear interaction of the two terms; δ_t are year fixed effects. Note that we cannot separately identify β_1 from subdistrict fixed effects, and including district or province fixed effects does not affect any of our results, so we leave them out for simplicity. We also present a non-linear version of this specification in which we use the dummy $\text{Below Median Wheat Suitability}_d$ rather than a continuous wheat suitability measure. In this sample, the median is 1.15, or a little more suitable than 'very marginal'.

We first limit our analysis to subdistricts in Pakistan that ever had the FCR, and to years $t \in \{1947, 1957, 1962, 1964, 1965, 1974, 1978\}$, that is, years within 20 years of the Green Revolution in which one or more subdistricts changed FCR application.[16] One can think of this sample restriction as imposing an event study under the assumption that there was enough political cost to changing FCR legislation that it could not be done continuously. This approach matches the historical record in that decisions to remove subdistricts from the law happened episodically and in groups. There are two alternatives: (i) leave the data at the yearly level and run the same specification; or (ii) collapse the data down to two observations for each subdistrict, and run a simple difference of means between pre and post the Green Revolution. We see our main specification as superior to (i) because it will not over-emphasize the many zeros that likely did not represent real decisions (whose inclusion would thus artificially deflate our standard errors), and to (ii)

because it allows for a more accurate accounting for variation across time, but we report results from all below.

We consider this analysis to capture the causal *differential* impact of the Green Revolution, or more generally of an exogenously timed change in a subdistrict's agricultural land value, on the choice by the Pakistani government to maintain or remove the FCR. Our identification strategy requires that there are no time-varying omitted variables that differentially impacted subdistricts with low wheat suitability before and after 1965. In other words, for our identification strategy to be valid, there need to be no major changes other than the Green Revolution happening at or around 1965 that had differential impacts on FCR application by crop suitability. We discuss several such potential changes in robustness checks.

5.3.2 | Results

Table 2 presents the main results. Panel A uses a linear measure of wheat suitability, and panel B uses a dummy variable for below-median wheat suitability. In all three columns, we present a differences-in-differences specification with year fixed effects. In column (2), we add

TABLE 2 Crop suitability and FCR application before and after the Green Revolution.

	FCR maintained (= 1)		
	(1)	(2)	(3)
Panel A: Linear models			
Subdistrict wheat suitability	−0.013	−0.056*	−0.061**
	(0.034)	(0.030)	(0.029)
Wheat suitability ∗ Post Green Revolution	0.096***	0.096***	0.108***
	(0.031)	(0.031)	(0.031)
Mean of dependent variable	0.617	0.617	0.617
No. of observations	1421	1421	1421
No. of clusters	74	74	74
R-squared	0.308	0.447	0.452
Panel B: Non-linear models			
Below-median wheat suitability (= 1)	−0.044	0.027	0.051
	(0.071)	(0.064)	(0.062)
Below-median wheat suitability (= 1) ∗ Post	−0.321***	−0.321***	−0.377***
	(0.084)	(0.084)	(0.083)
Mean of dependent variable	0.617	0.617	0.617
No. of observations	1421	1421	1421
No. of clusters	74	74	74
R-squared	0.346	0.462	0.468
Year fixed effects	Yes	Yes	Yes
Subdistrict controls	No	Yes	Yes
Time-trend interacted controls	No	No	Yes

Notes: Standard errors clustered at the district level reported in parentheses. Crop suitability scores are as follows: 0 is not suitable, 1 is very marginal, 2 is marginal, 3 is moderate, 4 is medium, 5 is good, 6 is high, and 7 is very high. Post Green Revolution is a dummy for years after 1964. Years in analysis limited to those years where any subdistrict had the FCR removed, i.e. 1922, 1937, 1947, 1956, 1963, 1964, 1971, 1973, 1977. Subdistrict controls are Subdistrict Area (square km per 1000), Subdistrict SD of height above sea level (feet per 100), Distance to Capital (km per 1000), and latitude and longitude. Time trends are by year.
*, **, *** indicate $p < 0.1$, $p < 0.05$, $p < 0.01$, respectively.

subdistrict controls. In column (3), we additionally add subdistrict controls interacted with year time trends. Our preferred specification is column (3) with time-varying controls. A one unit drop in crop suitability, from say 'good' to 'medium', is associated with a 10 percentage points differential decrease in the likelihood that the FCR continues to apply to a subdistrict following the Green Revolution. In panel B, we divide crop suitability at the median, finding that below-median crop suitability subdistricts are *less* likely to have the FCR retained after the Green Revolution. This point estimate is substantively large, 32–38 percentage points.[17] Note also that before the introduction of the Green Revolution, wheat suitability negatively predicts FCR application once we introduce subdistrict controls, which is what our theory would predict.

Table 3 presents the main results varying how many years we include in our analysis. In column (1), we run our main specification, including data for all 20 years before and after the Green Revolution. Not surprisingly, we find a smaller coefficient (0.066 versus 0.096 above) given that we are only adding in years with no change in FCR status. But this result remains significant at 10%. In columns (2)–(4), we include only one pre and one post year in our analysis. In all cases, we consider 1964 as the pre Green Revolution year. We vary the post Green Revolution year as the Green Revolution occurred over a period. In all three cases, our result persists and, if anything, is stronger than when we include our preferred set of years.

Figure 3 presents the results visually. It shows FCR application before and after the Green Revolution, where we group subdistricts into above- and below-median crop suitability. Figure 3(a) presents 'raw' data, or the percentage of subdistricts subject to the FCR over time, split into above- and below-median wheat crop suitability. Figure 3(b) plots yearly differences in these FCR rates between above- and below-median crop suitability subdistricts conditional on our preferred set of subdistrict controls interacted with year time trends, from a single regression interacting below-median crop suitability with year dummies (excluding 1964 as the reference year) with a specification otherwise corresponding to column (3) in panel B of Table 2. In both parts of Figure 3, we see that after the Green Revolution, low-suitability districts became much less likely to have the FCR maintained. We can additionally consider the coefficients before 1964 in Figure 3(b) as a formal test of pre-trends. We find no statistically significant pre-trends. Appendix Figure A1 provides the same analysis for only the years included in Table 2.

TABLE 3 Crop suitability and FCR varying years in analysis.

	FCR maintained (= 1)			
	(1)	(2)	(3)	(4)
Subdistrict wheat suitability	−0.042*	−0.120***	−0.114***	−0.117***
	(0.021)	(0.043)	(0.042)	(0.043)
Wheat suitability ∗ Post Green Revolution	0.066*	0.140***	0.169***	0.191***
	(0.038)	(0.033)	(0.032)	(0.032)
Mean of dependent variable	0.602	0.571	0.493	0.456
No. of observations	8323	406	406	406
No. of clusters	74	74	74	74
R-squared	0.490	0.310	0.371	0.403
Year fixed effects	Yes	Yes	Yes	Yes
Subdistrict controls	Yes	Yes	Yes	Yes
Years in analysis	1945–1985	1964–1965	1964 & 1974	1964 & 1978

Notes: Standard errors clustered at the district level reported in parentheses.
*, **, *** indicate $p < 0.1$, $p < 0.05$, $p < 0.01$, respectively.

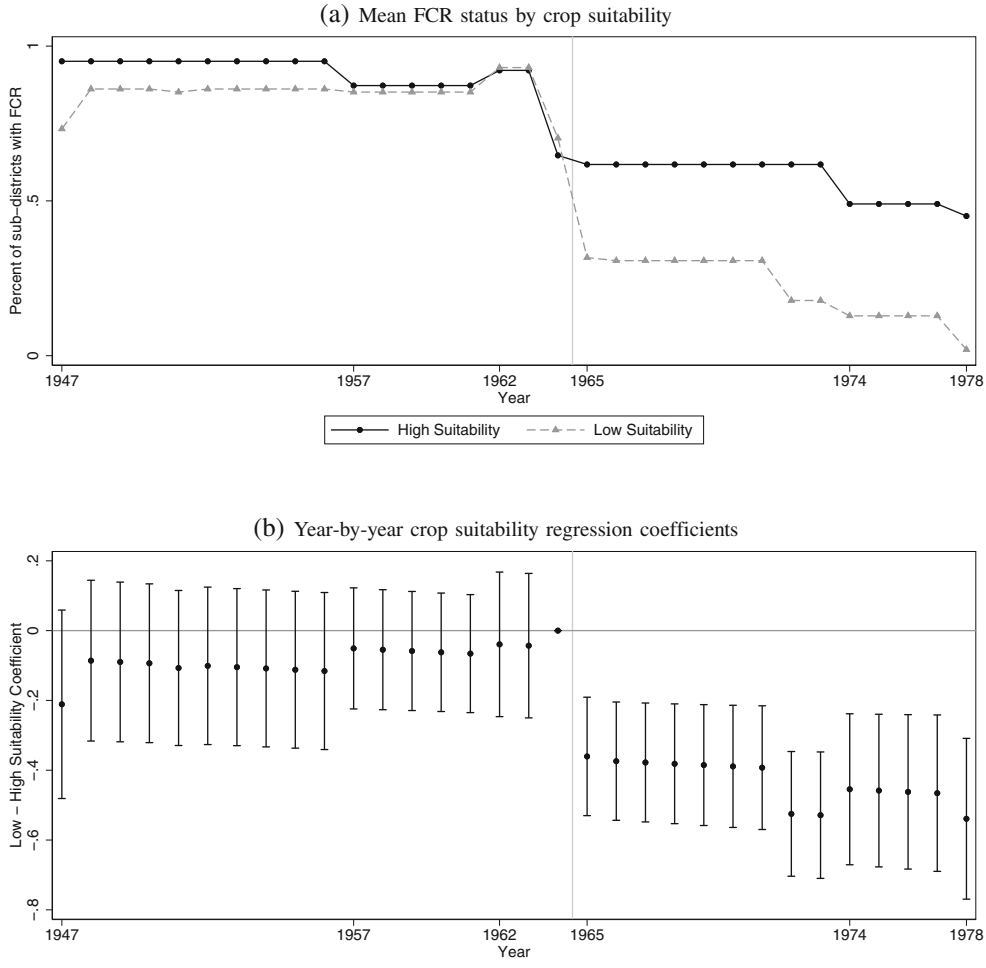

FIGURE 3 FCR application over time by crop suitability, 1947–1978. *Notes*: (a) Points show the mean subdistrict FCR application dummy values for years 1947–1978 within above (high) and below (low) medium wheat crop suitability bins. (b) Points show regression coefficients of below median wheat suitability interacted with year dummies, with a specification corresponding to Table 3, column (1).

These results are consistent with the fact that the Green Revolution mitigated the importance of crop suitability. As mentioned above, the Green Revolution for wheat was characterized by increased crop yields with little to no required changes in input technologies, labour to capital ratios, or irrigation. Places that were once harder to farm became relatively easier, causing lower-suitability subdistricts to 'catch-up' to other districts in potential revenue collection. Thus lower-suitability districts were more likely to switch from expected revenue negative to positive, and these districts were relatively more likely to have their FCR application removed.[18]

Importantly, these changes are better explained by the Green Revolution than by changes in external competition (Lee 2018). Many areas bordering Afghanistan were removed from the FCR in 1965 following a reduction in tensions in 1963 (Fair and Watson 2015, p. 283), but so were many areas far from the border. Online Appendix Table A9 shows that our results are unaffected by controlling for the interaction between being adjacent to the Afghan border and years that were during the reduction of tensions from 1963 to 1972.

5.3.3 | Robustness checks

Online Appendix Subsection A.III probes the robustness of our results. First, we show that our results are robust to whether we use the FAO measure of crop suitability assuming rain-fed agriculture, or their measure assuming irrigated agriculture. Second, we show that crop suitability matters for wheat, but not for other major crops. This shows that the results are not driven by some correlate of wheat-suitable subdistricts that has nothing to do with potential government revenue. Third, we conduct a placebo check in which we vary the year in which the Green Revolution supposedly took place, and show that results disappear when we do this. Fourth, and perhaps most importantly, we show that results are not driven by other potential events that occurred in exactly 1965 in Pakistan that differentially affected some subdistricts over others in a way that is correlated with both wheat suitability and FCR application. Fifth, we show that our results are robust to whether we consider princely states to be ungoverned (thus coded as if under the FCR) or governed (thus coded as not under the FCR). And finally, we ensure that our results are not driven by subdistricts that bordered Afghanistan during a period of reduced Afghan support to Pashtun nationalist organizations that happened to overlap with the Green Revolution.

5.4 | Supply or demand?

As discussed in the theoretical framework section above (Section III), one might wish to distinguish whether an expansion of the formal, organized state within its boundaries is supply (i.e. government) or demand (i.e. citizens) driven. With the roll-back of the FCR, we believe that a case can be made for both drivers. On the supply side, the Green Revolution increased the production of areas under the FCR and thus their potential for revenue generation. On the demand side, the Green Revolution increased the benefit to citizens of joining the formal state as it was that state that controlled the new seeds and the increased economic surpluses that they brought. Increases in income might also have increased demand for state-provided public goods.

We are not aware of data that would allow us to quantify the role of supply versus demand in driving the roll-back of the FCR. Ultimately, the lack of violence in areas where the FCR was removed during the Green Revolution may be the strongest evidence in support of both demand and supply drivers being relevant, or of cooperative state formation (Allen *et al.* 2023).

There is qualitative evidence for demand-side drivers in newly searchable transcriptions of National Assembly debates in Pakistan.[19] We found 23 instances of public debate relating to the FCR from 1964 to 1974. In ten of these debates, there is a clear demand-side argument in favour of repealing the FCR.[20] For example, on 29 January 1973, Pakistan's Minister of the Interior, Abdul Qaiyum Khan, argued: 'Sir, this was the demand of the people who inhabit the former states of Swat, Dir, Chitral and the common people of Malakand Agency that the Frontier Crimes Regulation should be done away with and they should be treated on par in a manner of legal justice with the other citizens of Pakistan.' While many of the calls to remove the FCR focus on the legal system, some expressly mention government services. For example, on 16 June 1974, Ch. Zahoor Illahi spoke in Urdu specifically about the need for government services in areas still under the FCR.

6 | CONCLUSION

Political and economic development can be characterized as the conflict between states' efforts to increase their capabilities and existing social forces that they must accommodate and to which they must be accountable (Acemoglu and Robinson 2019). This conflict is definitional at the frontiers of the formal state. The combination of a law that clearly demarcates the end of the

formal state combined with the agriculture transformation precipitated by the Green Revolution makes 20th century Pakistan an ideal setting to study these processes.

We show that the trajectory of state presence within the borders of modern-day Pakistan is consistent with a theoretical framework in which states extend governance to areas where the economic benefits of investing in institutions for taxation and resource extraction outweigh the costs of doing so. Using crop-suitability data from the Food and Agriculture Organization of the United Nations, we demonstrate first that the choice by the British to apply the Frontier Crimes Regulation (FCR) to over half of Pakistan in 1901 was (conditionally) unrelated to crop suitability. We then exploit the fact that the Green Revolution created more fundamental agricultural transformation in areas of low crop suitability to understand Pakistan's selective roll-back of the FCR throughout the 1960s and 1970s. Subdistricts made suitable to agriculture by the Green Revolution were more likely to see the FCR removed.

The data provide novel evidence that otherwise-competent states leave significant regions outside of full formal governance because the costs of incorporating them exceed the benefits to doing so. Our findings are consistent with characterizations of state development in which technology-driven changes in land value affect the territorial extent of formal governance (Fearon 2008; Besley and Persson 2011). The gradual elimination of the FCR in Pakistan provides an important example of ungoverned spaces being folded into a country's core without civil war or major violence. Our analysis suggests that technological changes, and in particular the way they affect the value of land for organized polities, play a role in determining the extent of the formal state.

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ENDNOTES

[1] There was also a third type of indirect governance in what were called 'princely states', including most notably Kashmir, but these were not nearly so prominent as in areas that are now within India.

[2] As we discuss in Section III, we are not restricting benefits to the state to be only tax revenue. Increased demand from citizens themselves for governance would add to the benefit of exercising control.

[3] See Nunn (2020) for a current review on the historical roots of development.

[4] Importantly, our explanation for governance choices is distinct from that in Lee (2018), which in Pakistan's case would predict that regions near Afghanistan would be harder to govern due to meddling by the foreign rival. Where Lee focuses on external influences, we consider the costs of governing to be a function primarily of the territory and its population's preferences. In general, both mechanisms could be operative, but in this case we will see that variation in the internal cost–benefit calculus is more consistent with the data.

[5] A related literature examines how technological innovation can change the cost of rebellion and counter-insurgency. See Kalyvas and Balcells (2010) and Lyall and Wilson (2009).

[6] There are some recent papers in comparative politics that examine the political impacts of this technological change. See, for example, Dasgupta (2018).

[7] Note while the FCR formalized areas with state institutions and areas subject to customary tribal law, such demarcations had largely been in place since about 1872 (see Hopkins 2015). We provide more details in Section II.

[8] Others focus on the specific negotiations between the formal state and less organized polities. That is, the exact terms of cooperation may change over time. See, for example, Bapat (2006)and Felter (2005).

[9] There were also occasional changes to other language in the FCR beyond where it applied. The largest changes, granting areas under the FCR national representation, happened after the window of analysis in the paper. Other smaller changes did not alter the FCR vis-à-vis the function of the state, so we do not consider such variation.

[10] We cannot rule out that crop suitability in this window is different to what it was as far back as 1901. However, the FAO model does not include available seeds as an input, so could not have been affected by the availability of Green Revolution high-yielding varieties.

[11] The distinction between input levels does not matter for our sample; these crop suitability measures are correlated above 0.97 in all cases. For water source, while it is true that many farmers in Punjab, Pakistan have access to irrigation canals built during the British colonial period, the majority of our variation in FCR status is from other provinces in Pakistan that relied on rain-fed agriculture for our entire period.

[12] FAO crop suitability data are provided in raster images with various resolutions depending on the crop. Subdistrict means for each input level are extracted from each raster image, and then these means are averaged to form a single index for each crop. Though these FAO indices use more recent weather information than for many of the years in our analysis, we believe the cross-sectional variation applies across this time period, given that the geography is fixed and that rainfall and temperature are slow to change.

[13] Interviews with government officials of the time suggest that the government closely managed the distribution and production of seeds. See Dowswell (1989) for details. Using similar data, the International Maize and Wheat Improvement Center (CIMMYT) reports that the 118156 wheat variety, named Mexipak-65 after the collaboration between Pakistan and Mexico, forms the basis for the most important Green Revolution varieties.

[14] This is different from South-east Asia, where the introduction of new rice varieties affected both input requirements (more fertilizer) as well as the modes of cultivation and distribution of returns (see, for example, Scott 1977).

[15] Details of this analysis are in Online Appendix Subsection A.II.

[16] And more or less within a much larger window considering there was little change in FCR application between 1901 and 1947, and no change between 1978 and 2018.

[17] The coefficients on the interaction term and post Green Revolution dummy do not change with the addition of subdistrict controls because all subdistrict controls are time-invariant and therefore orthogonal to both time and its interaction with wheat suitability. Controlling for all time-invariant factors with subdistrict fixed effects does not change the results.

[18] This is consistent with Foster and Rosenzweig (1996) and Child and Kaneda (1975).

[19] See http://osamakhalid.org/nationalarxiv.html (accessed 18 March 2024).

[20] We categorized ten of 23 debates as explicitly supporting a demand-side argument for repealing the FCR, three as neutral, and the remainder as not relating to repealing the law. We found no arguments in the National Assembly relating to potential revenue from newly formalized areas (supply side). It is worth noting that the National Assembly was not involved in revenue collection at the time; it was largely a military operation.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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