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# Choosing Ungoverned Space: The Removal of Pakistan's Frontier Crimes Regulation

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**Abstract**

Why do administratively competent states sometimes leave substantial swathes of their territory ungoverned? We explore this question in the context of the Frontier Crimes Regulation (FCR) in Pakistan, a British Colonial law only abrogated in 2018, that left legal decisions up to local customary councils. This contrasts with areas where the British and Pakistani state built modern political and bureaucratic institutions. Using primary legal documents we create a dataset of when and where FCR applied between 1901 and 2012. Exploiting spatial variation in the Green Revolution's impact in the 1960s, we show that governance was preferentially extended to places where the state stood to benefit the most in terms of land revenue. Our results show that technological changes which shift the returns to control influence where states choose to govern.

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# 1 Introduction

Territory with little or no effective state presence—ungoverned space—persists in many developing countries (for example, Colombia, India, Morocco, Myanmar, New Guinea, and Pakistan, among others). In addition to having few state services, these areas also provide room for terrorists, smugglers, drug manufacturers, and criminals to operate, creating negative externalities locally and globally. Pakistan has many such areas, and has had them for over a century, as both a British colony and an independent nation. Unusually among such states, the legal status of ungoverned space in Pakistan is set forth in law, the Frontier Crimes Regulation (FCR) of 1901. This law cleanly delineates between areas with state institutions and areas subject to customary tribal law, and allows for documenting how these areas have changed over time. The history of the FCR thus provides a unique opportunity to study the determinants of state control. We study one key predictor of the extent of the FCR jurisdiction over time—potential government revenue as it was impacted by technological change during the Green Revolution.

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.[1] Here, the British put a small number of "political agents" in charge of large tribal areas with almost no colonial institutions backing them. Instead, institutions already in existence were given the force of law, and traditional local councils, or Jirgas, made most legal decisions and were allowed to continue collective punishment. As a result of the British division, independence and subsequent partition left roughly half of modern-day Pakistan effectively ungoverned by the state. Over time, all of Pakistan has been removed from the FCR, with the small regions along the Afghan border known as the Federally Administered Tribal Areas (FATA) and a few small Provincially Administered Tribal Areas (PATA) being removed only in 2018.[2]

[1]There was also a third way 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]These areas have periodically provided safe haven to domestic and international terrorists. Training facilities operate openly and with impunity to this date in some of them.

We theorize a cost-benefit logic for ungoverned space with a simple framework in which a central authority's cost of implementing full institutions is relatively static while the benefits of doing so can shift quickly due to technological innovations. This approach has two sharp predictions. First, technological innovation should increase the amount of territory governed by the central authority. Second, since costs are heterogeneous within states, areas that benefit relatively more should be more likely to be integrated. Our core objective in this paper is to empirically test this logic.

We test this cost-benefit logic in two stages. First, we make use of geo-spatial information and crop suitability data from the Food and Agriculture Organization of the United Nations to study why the British chose to apply FCR to over half of modern-day Pakistan in 1901. Once we condition on proxies for local productivity and the cost of imposing state institutions we find no correlation between a sub-district's crop suitability for wheat (the main crop influenced by the Green Revolution in Pakistan) and the initial British choice to apply FCR. This first result is correlational. It is consistent with our hypothesis that increased potential revenue should have increased the British government's desire to govern many parts of Pakistan if it was the costs of implementing institutions that was much more binding initially.

Next, we exploit the differential impact of the Green Revolution by crop suitability to understand Pakistan's decisions to continue to apply or to roll FCR back across parts of the country throughout the 1960s and 1970s. The technological innovations of the Green Revolution created a plausibly exogenous differential increase in agricultural land value. In this case, the Green Revolution in South Asia is widely understood to have increased productivity for wheat more in marginal areas than in already-productive regions—it allowed lower-suitability sub-districts to 'catch-up' to other districts in potential revenue extraction. These originally-marginal areas would then be more likely to switch from expected revenue negative to positive as a result of the Green Revolution, and should be relatively more likely to be integrated into the state.

Our results suggest a substantively large correlation between small productivity changes and integration. A one unit increase in crop suitability is associated with a 9.6 percentage points differential increase in the likelihood that FCR continues to be applied to a sub-district following the Green Revolution. This result has a causal interpretation to the extent that: (i) the initial decision to apply the FCR was conditionally-independent of wheat crop

suitability (which it appears to have been); and (ii) the timing of the Green Revolution varietals' introduction in Pakistan was exogenous to planned changes in the extent of the FCR.

We provide corroborating evidence for a productivity change using data from the 1960 and 1972 agricultural censuses in Pakistan. We show that areas of low wheat suitability saw disproportionate increases in the amount of farm land 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 our simple logic predicts.

It is important to acknowledge that in Pakistan there were no widespread violent conflicts when the government integrated outlying regions, that integration was broadly supported both by the state and by citizens living in peripheral regions.[3] In the language of our theory, this uncontested governance implies that any revenue extraction after integration must have left the representative individual at least as well off as they were under informal government. While far from conclusive, such is plausible as access to public goods provided by the central authority, such as roads, access to courts and greater protection of property rights, and access to government support for agricultural production (i.e. access to high-yielding variety of seeds)—a highly relevant consideration during the state-led Green Revolution in Pakistan—may increase interest in integration.[4]

This paper makes at least two contributions. First, we contribute to a literature on empirical attempts to understand the initial choice to govern a space during colonial times. Several competing hypotheses have emerged to explain the broad patterns in the historical record: (i) the availability of resources, and the ease with which they can be extracted (Acemoglu, Johnson, and Robinson, 2001); (ii) natural terrain, and the military advantage it affords indigenous groups (Fearon and Laitin, 2003; Nunn and Puga, 2012); and/or (iii) the efficiency of indirect governance (Padró i Miquel and Yared, 2012; Scott, 2009). All three perspectives are consistent with the British decision to set up minimal governance

[3]As such, our focus is different from work on how order emerges during wartime (Staniland, 2012).

[4]In the words of Alesina and Spolaore (1997), policy preferences in peripheral regions will shift to be more aligned with the central authority's policy, resulting in a new equilibrium with greater integration of peripheral regions.

institutions in areas initially under the FCR. Other related studies have focused on the role of public finance in the emergence of the modern democratic state (Stasavage, 2003), on the emergence of modern fiscal systems (Dincecco, 2011), and on the formation of state capacity (Berwick and Christia, 2018).

Second, we contribute to a literature studying changes over time in state presence within internationally-recognized borders. Several authors have modeled these changes: (i) based on a vote cost-benefit analysis by parties (Acemoglu, Robinson, and Santos, 2013; Migdal, 1988; Fearon, 1994); according to constrained kleptocrats who may find it optimal to not control their entire territory (Grossman and Noh, 1990,9); when the expenditures required to efficiently contest rebel control are high relative to the costs rebels can impose (Berman, Shapiro, and Felter, 2011); when there are changes in the power structure in the peripheral proto-state (Gerring et al., 2011); and/or (iv) when one gains rents from having limited ungoverned space within one's territory (Felter, 2006; Bapat, 2011). All of these papers suggest a simple cost-benefit calculus: extend control to a given region when the net benefits of doing so exceed the costs. Lee (2018) adds to this discussion by accounting for international factors.

A related literature documents the socioeconomic impacts of these important institutional decisions.[5] Iyer (2010) compares British direct colonial rule to indirect rule (princely states). The author finds that areas under indirect rule have better education, health, and road systems in the postcolonial period. Banerjee and Iyer (2005) study variation in land revenue institutions, finding that areas of the Raj with landlords subsequently have less investment in land as well as in education and health. Others have studied variation in rulers' religions identity (Chaudhary and Rubin, 2016), in industrial investment (Gupta, 2014), and in political elites (Cheema, Mohmand, and Patnam, 2009). Others yet have studied the limits of the impacts of long-term colonial institutions (Chaudhary and Garg, 2015; Roy, 2002). A closely link literature studies the impact of the partition of India at independence (see, for example, Bharadwaj and Fenske (2012); Bharadwaj and Mian (2015)).

Our results provide new evidence on the importance of technology-driven changes in potential government revenue for the choice to integrate peripheral areas into the state. We

[5]We would ideally also directly test the long-term impacts of the FCR but have not found modern household socioeconomic data with sufficient geographic coverage for this exercise in Pakistan.

also provide additional evidence on the importance of the Green Revolution in South Asia. Our novel contribution to the literature on state development is to provide concrete evidence that technological change can lead to ungoverned spaces being folded into country's cores without civil war or serious violence. What stopped the government from integrating major parts of Pakistan, and those living in these peripheral areas from consenting to integration without violence, may have been, at least in part, a simple cost-benefit calculation.

This paper proceeds as follows. Section 2 provides additional background on the FCR, Section 3 provides a simple model to give us intuition on the choice to govern, Section 4 outlines our data, Section 5 describes our empirical strategy, Section 6 presents results, and Section 7 concludes.

# 2 Background

## 2.1 Frontier Crimes Regulation, Through Independence (1901-47)

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 modern legal system, and other bureaucratic structures. However, they met limited success in what was to become the North Western Frontier Province (NWFP), in at least two important ways.[6] First, much of the area was operating at a deficit due to limited crop yields and heavy security expenses. Second, the British legal system, being codified throughout India at the time through the 1860 Indian Penal Code and the Code of Criminal Procedure, was vehemently resisted by local Pashtun clan leaders and other established elites in favor of a customary legal system. Among other major differences, this customary system forgave crimes for honor reasons, including killings. Such differences were highly publicized, especially in cases involving women (Nichols, 2013).

After multiple decades of struggle, the British eventually decided to stop fighting the customary legal system in favor of appropriating it in what would be codified in 1901 as the

[6]Initially, these areas were the districts of Hazara, Peshawar, Kohat, Bannu, Dera Ismail and Dera Ghazi Khan in the Punjab province. These and several other districts were then made into the NWFP in November, 1901. NWFP was renamed Khyber-Pakhtunkhwa in 2010.

Frontier Crimes Regulation (FCR). On April 26, 1902, the Viceroy and Governor General of India Lord Curzon traveled north to Peshawar to address 3,000 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 (PA)" (Akins, 2017, p 7) 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 importantly, Jirgas could not sentence anyone to death. The Jirgas and the political agent could, however, pass collective judgment 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.

Perhaps of equal importance, with this unique legal system in the NWFP 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), though the army was present near the borders, 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 that "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 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, FCR changed very little. Besides extending it to a few additional regions, the legal systems and lack of other institutions remained fixed. The British had found an acceptable solution in dealing with these areas.

## 2.2 Frontier Crimes Regulation Since Independence (1947-2012)

Perhaps surprisingly, after independence FCR was not revoked from most of modern-day Pakistan; the language of the regulation was left intact for over half of a century. Political agents were still appointed, now by the head of the Punjab Province. Cases still went to Jirgas. In fact, several years after the country's independence, FCR was extended to including 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 remain under FCR today. We detail these geographic changes in Section 4 below.

Throughout this time period, the debate about FCR no longer centered around controlling criminal activity but focused more on the explicit choice of whether or not to extend governance to tribal areas. In a famous address to the assembled leaders of the tribal jirgas of Pakistan on April 17, 1948, the founding leader of Pakistan Muhammad Ali Jinnah discussed this choice. He said:

> "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 and help in your educational, social and economic uplift, and not be left as you are dependent on annual doles, as has been the practice hitherto which meant that at the end of the year you were no better off than beggars asking for allowances, if possible a little more. 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..."[7]

Here Jinnah is making explicit the cost-benefit logic that this paper empirically tests when he calls areas under FCR a deficit province.

The debate in recent decades has shifted much more towards representation, as it was not until 1997 that Pakistanis in FCR regions were even granted representation in the national legislature. Party-based elections were only introduced to areas under the FCR in 2013, decades after the rest of the country.

[7]See http://www.jinnah.pk/2009/09/27/the-frontier-policy-of-pakistan/. Accessed August 28, 2018.

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, FCR would no longer be applied for governing the remaining tribal and frontier regions. The local populations will elect new members to the KP assembly within a year to get direct representation at the provincial level.

Importantly, tax exemptions for the newly incorporated area suggests that the bargaining that preceded the merger focused extensively on how the state would phase-in taxation in the area. The Economic Coordination Committee, the highest financial decision-making body of the Government Pakistan, announced 5 year sales, income, and corporate tax exemptions for these areas.[8] Debates in the Khyber Pakhtunkwa Assembly also revolved around issues of tax exemptions, aid packages, and law and order.[9] This focus is consistent with that of our paper—on the costs and benefits of government.

# 3 Theoretical Framework

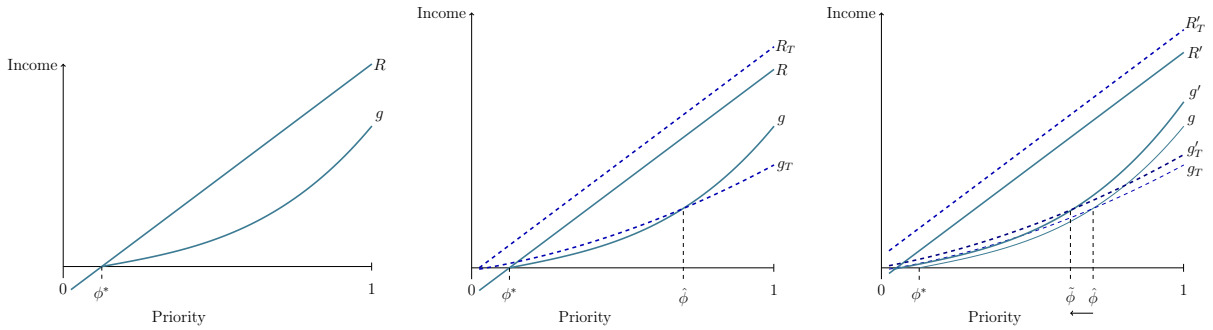
Consider a government that prioritizes the governance of some regions over others. Its territory is unit mass ordered in terms of potential income, $I$. Define $I(\phi)$ with $\phi \in [0, 1]$ to be the income from any given point in the territory so that $I' > 0$ at all points. Assume the government can tax that income, or collect revenue otherwise, at cost $k$ so that net revenue at any point, $R$, is equal to $I - k$. Figure 1a illustrates control of territory for that government, where the vertical axis measures income and the horizontal axis captures the priority of space, increasing priority from left to right. In the figure, that logic would yield a frontier, $\phi^*$, at which net income becomes zero, beyond which the government would optimally choose to leave space ungoverned.

Citizens in the regions captured in Figure 1a have a choice between contributing to government revenue and receiving a resulting public good $g$, or resisting through non-payment or perhaps open rebellion.[10] To have uncontested governance in a given region revenue extrac-

[8]See `https://www.thenews.com.pk/print/323999-ecc-approves-tax-exemptions-for-fata-pata-for-next-five-years`, accessed Aug 28, 2018.

[9]See `https://dailytimes.com.pk/245672/kp-assembly-seals-merger-with-fata/`, accessed Aug 28, 2018.

[10]This is similar to the tradeoff of a constrained kleptocrat modeled in Grossman and Noh




(a) Ungoverned by Choice (b) Competition (c) Increase in Value of Land

Figure 1: Framework

tion must leave the representative individual in any region at least as well off as they would be without government.[11] That is, it must be that $g \geq i$, where $i$ is the representative individual's share of a region's $I$ under the next best alternative. Assume no transfers between regions and that public goods provision is functional so that $g'(R) > 0$ for all $R > 0$–i.e. government can always meet the revolution constraint in areas with positive revenue where there is no competition.[12] Finally, assume $g''(R) > 0$ so the government has economies of scale in public goods provision, but $g(R(1)) < R(1)$ so there is no free lunch. This describes the generic setting where public good provision is correlated with revenue, $I - k$, but must lie below the revenue curve across all governed territories.

Now allow for informal local governance in low-income areas, perhaps by tribes or clans. Such informal governance, which might use traditional institutions like the Maliks and elders, is simple and low-cost, making it efficient to use in areas where government revenue potential is minimal. Moreover, it can be financed through informal taxes on agricultural goods unable to reach markets and requires fewer formal institutions. This makes revenue collection easier by informal groups than by government. We formalize this intuition by assuming tribes pay a lower cost to collect revenue, $k_T < k$ so that net tribal revenue is greater than government revenue. But, consistent with the literature on efficient production requiring strong institutions we assume that tribes are not as good at providing public goods as

(1990,9).

[11]We can think of governance here as a "contingent consent" equilibrium, in the sense of Lake (2010).

[12]This is an obvious simplification but is useful for fixing intuition.

the government. Formally define $g_T(R)$ such that $g'_T < g' \forall R$ and assume $g(I(1) - k) > g_T(I(1) - k_T)$ so that at high levels of income the government is a better provider of public goods than the rebels. Figure 1b represents this interaction and the intersection of $g$ and $g^T$ defines a frontier $\hat{\phi}$, to the left of which tribes will control territory, because residents prefer to receive public services from tribes than from government. If the government attempts to collect revenue in this area residents will revolt.

Given this simple set-up, we can proceed to analyze the effects of an increase in the value of land in some or all areas in the state. In the specific case of the Green Revolution, we can imagine that the introduction of high-yielding variety seeds will yield an increase in taxable income $I$ but not necessarily shift the relative costs of revenue collection. This would come with an increase in the amount of $g$ available to maintain the contingent consent equilibrium between citizens and the government. This shift up in $g$ can be seen in Figure 1c. As we can see, this will lead to shifts up in revenue under either party's control, shifts up in both parties' public goods provision, but a net shift down in the proportion of ungoverned space in the country from $\hat{\phi}$ to $\tilde{\phi}$ as government has greater economies of scale to public goods provision. Given government's comparative advantage in public goods provision a shift up in income will necessarily lead to shift out in the governed frontier.

This simple framework leads to two predictions that correspond to the two questions we ask in this paper: (i) an increase in potential benefits for the government relative to tribes will (weakly) lead to an increase in the proportion of the country governed; and (ii) a larger increase in potential benefits in one ungoverned region relative to another (weakly) increases the probability of the former region becoming governed relative to the latter. This second prediction is not shown in our figures but intuitively follows from Figure 1c. If one area gains more potential benefits than the other, it will move up in priority and be more likely to end up to the right of the new frontier $\tilde{\phi}$.[13]

Note this very simple framework makes predictions that several other simple models do not. One competing model could be that the extent of ungoverned space in a country over time is simply a function of capacity constraints—the government may only have the military capacity, for example, to bring one area into formal government at a time. Another set of

[13]In both cases in a richer model the predictions would be weakly positive because it could be that a change in potential benefit is not enough to move the frontier at all, or that the costs of collecting such revenue offset the benefits.

competing models could be those with the same mechanics but different costs and benefits driving the governments choice. For example, the government might care more about the changing strategic value of land domestically and/or internationally Atzili (2011), or leaders may only care about available rents to be captured, including votes (Acemoglu, Robinson, and Santos, 2013). Neither of these models predicts that the initial choice to govern will be independent of crop suitability once we condition out factors influencing the difficulty of revenue collection and productivity given initial technology (in our case productivity proxies in 1901) and neither predicts that changes in marginal revenue will drive changes in control efforts. We will speak to these specifically in our identification and robustness check sections.

One could write an alternative model where the choice to be governed rests with citizens, who petition a central state to extend governance to their areas. Such a model would be consistent with the results in Dasgupta (2018) who finds that the Green Revolution in India strengthened the incentives and capacity of politically excluded groups. As we do not have data on specific demands of citizens around the advent of the Green Revolution in Pakistan, we do not focus on this mechanism of change, though we note that this story is complementary to the state-centered story we report.

Our theory is broadly consistent with work by scholars of state capacity who more explicitly consider the interaction of a central state and a local power group (e.g. Gerring et al., 2011; Migdal, 1988; O'donnell, 2004). While Gerring et al. (2011) and Scott (2009), for example, examine principally how the characteristics of peripheral regions/states impact the ultimate bargain between local and central elites, we focus on the incentives of the dominant state. From that perspective the provision of FCR is one channel through which a 'weak state' as in Migdal's thesis, 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.

Note also that our explanation assumes that the cost of governing a territory was more-or-less static during the period we study. In our case most of the shocks we study were in the mid-1960s, which was not a time of major change to the technologies of rebellion available to the potential insurgents in FATA, nor to the government forces. The big shock to these technologies was the loss of Bangladesh, which did not come until 7 years after most of the changes we study.[14]

[14]See Kalyvas and Balcells (2010) and Lyall and Wilson (2009) on how technological innovation can change the cost of rebellion and counterinsurgency.

# 4 Data

## 4.1 FCR Application, 1901-2012

In order to understand both the British and later Pakistan's decisions to apply FCR to and continue to maintain FCR in large parts of Pakistan, we use primary legal documents to create a dataset of when and where FCR has applied between 1901 and 2012 for all 403 sub-districts (tehsils) in Pakistan. Basic summary stats are presented in Table 1 and in Figure 2. The years selected in the table and figure were intentional. They represent all of the years in which there have been changes in FCR status of at least one sub-district, in addition to 2012 (or present as it has not changed since then). 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 follow the changes that occurred before and after the Green Revolution. In 1965, the biggest roll-back in FCR thus far occurred. This roll-back will provide the primary variation for our differences-in-differences analysis, which we will discuss below. The choice of 2012 demonstrates that FCR application has not changed since 1978.

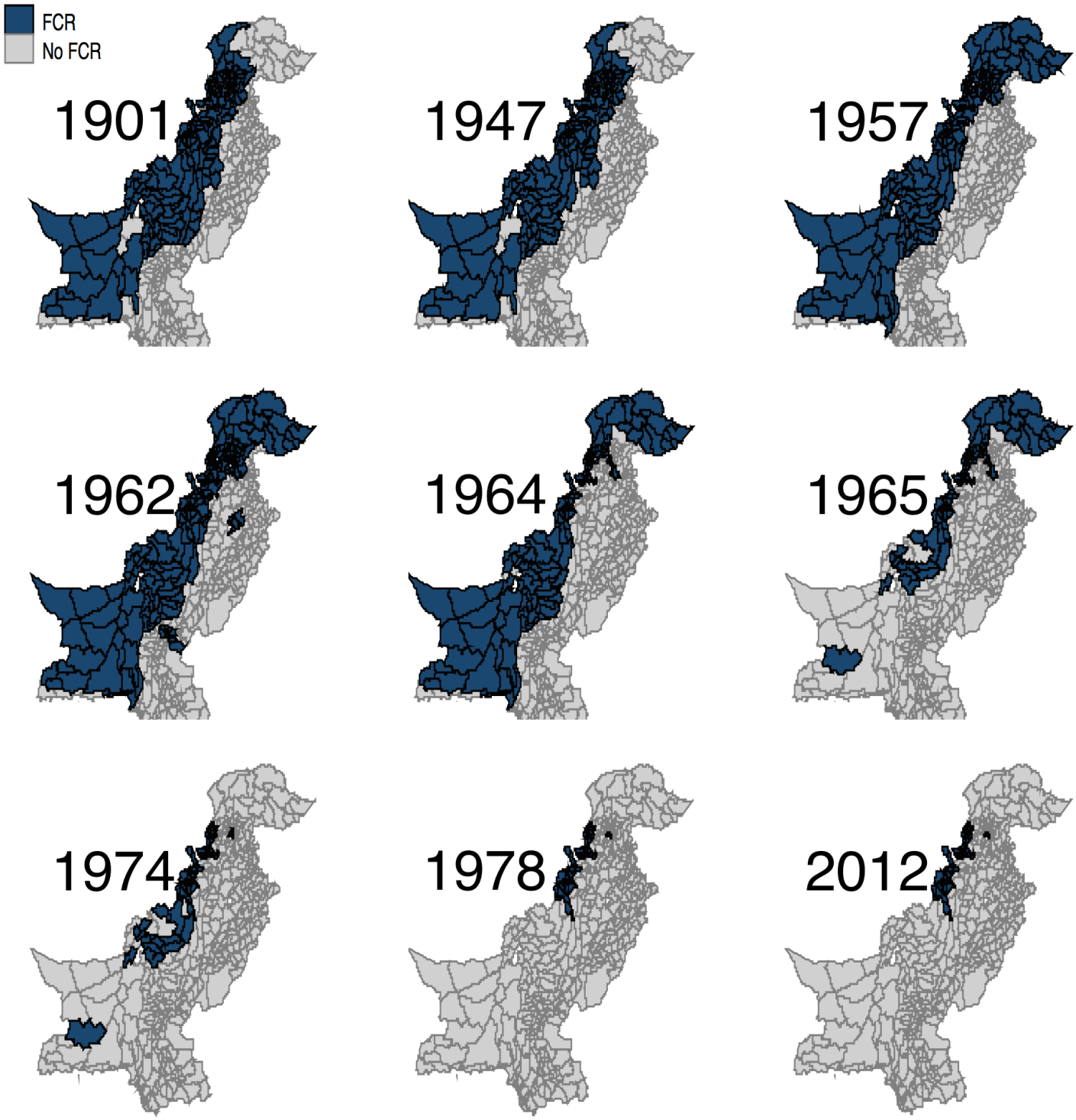
Table 1: FCR Application Summary Statistics

| | % of Sub-districts under FCR | % area under FCR ($km^2$) |
|---|---|---|
| *Year:* | | |
| 1901 | 42.93 | 52.08 |
| 1947 | 42.43 | 50.07 |
| 1957 | 43.42 | 58.15 |
| 1962 | 46.65 | 59.66 |
| 1964 | 34.00 | 52.12 |
| 1965 | 23.57 | 21.77 |
| 1974 | 15.63 | 10.21 |
| 1978 | 11.91 | 02.97 |
| 2012 | 11.91 | 02.97 |

*Notes*: Percentage sub-districts (tehsils) under FCR based on a total of 403 sub-districts. Area under FCR based on a total area of 872,027 square kilometers.

A complication in coding FCR exists due the presence the Princely States that comprised

Figure 2: FCR Application over Time




Sub-district (tehsil) boundaries marked. White sub-districts are those for which we do not have data, due to changes in sub-district boundaries between 1901 and 2012. For the main analysis we code all Princely States as FCR, though their formal status differed. Please see text for a discussion of the robustness of our results if we do not consider these areas.

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 directly under the ambit of the central state. We also report robustness of the results to an alternate coding where we drop Princely States from the analysis. Also note that several princely states were shifted to be under FCR officially when they were dissolved rather than into Pakistan's central government.

## 4.2 Crop Suitability and the Green Revolution

For a time-invariant measure of potential crop yields, we utilize crop suitability data from the Food and Agriculture Organization of the United Nations (FAO, 2012). The FAO provides us with sub-district level indices of agro-climactical 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. Our measure of crop suitability is the average of these FAO indices across different potential irrigation levels at low input.

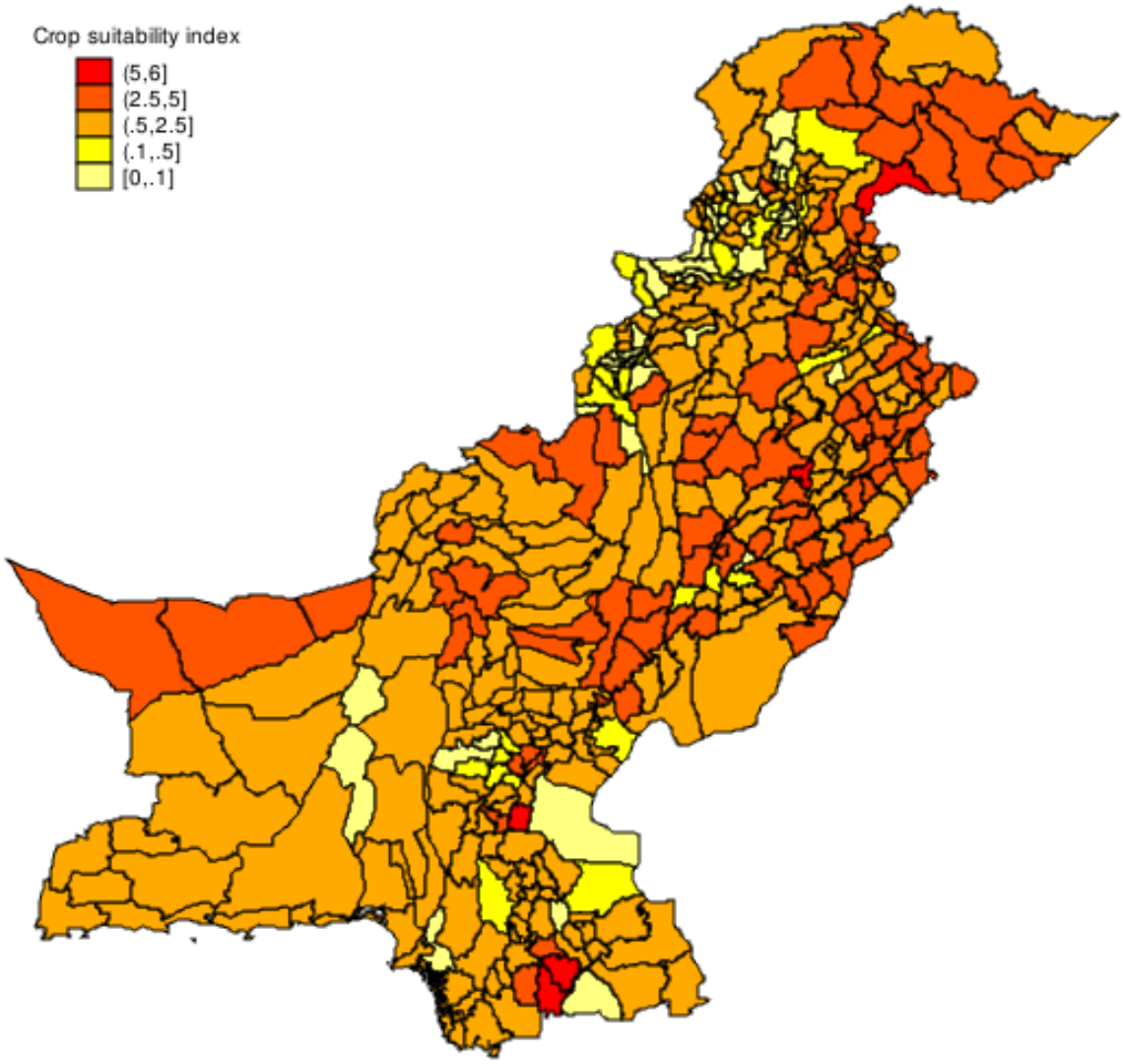
Figure 3 shows the extent of geographic variation in crop suitability for wheat. While most of Pakistan falls in the medium to not suitable categories, there is a fair amount of geographic variation, especially in areas that at one point had or have FCR.[15]

Though the data used to create these FAO indices include more recent weather information than many of the years in our analysis, we believe that the cross-sectional variation applies across this time period given that the geography is fixed and that rainfall and temperature are very slow to change. Consequently, we use these data as control variables in the analysis on the initial application of FCR.

Importantly, we have also documented the point at which the Green Revolution first began in Pakistan—1965. These changes were driven by the technological changes in wheat production, which was the most important Green Revolution Crop in Pakistan. And with

[15]Note that the FAO crop suitability data is provided in raster images with various resolutions depending on the crop. Sub-district-level means for each input level are extracted from each raster images, and then these means are averaged to form a single index for each crop.

Figure 3: Crop Suitability




Sub-district (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.

wheat the key changes were not in terms of inputs. Rather, the key change was the introduction of new high-yielding varieties first introduced in Punjab in 1965.[16] In Western Pakistan, wheat production increased by 79 percent from 1966 to 1969, with a peak growth rate of agricultural output of 15 percent during fiscal 1967-68 (Child and Kaneda, 1975).

The Green Revolution in South Asia was characterized by increased crop yields among the staple crops. With wheat there were few required changes in input technologies, labor to capital ratios, or irrigation. We will therefore consider the Green Revolution to mitigate the importance of crop suitability for wheat.[17] This is consistent with Foster and Rosenzweig (1996) and with Child and Kaneda (1975).[18]

## 4.3 Pakistan Censuses of Agriculture

We have also hand coded the 1960 and 1972 Pakistan Censuses of Agriculture for all sub-districts for which information was available in both years (109). While this is only roughly one quarter of sub-districts, it does cover all of Pakistan, including 13 sub-districts in Balochistan, 15 in NWFP, now Khyber Pakhtunkhwa, 62 in Punjab, and 19 in Sindh.

For each of these sub-districts, 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.

[16]See Dowswell (1989). Using similar data, the International Maize and What Improvement Center (CIMMYT) reports that the 118156 wheat variety, the basis for the most important Green Revolution varieties, was first released in 1966 (Lantican, Dubin, and Morris, 2005).

[17]This is different from Southeast Asia where the introduction of new rice varieties effected both input requirements (more fertilizer) as well as the modes of cultivation and distribution of returns (see e.g. Scott, 1977).

[18]Note that we are unable to provide district-specific trends in Green Revolution take-up for Pakistan as Foster and Rosenzweig (1996) do for India due to a lack of available data.

# 5 Empirical Approach

We conduct three complementary analyses. First, we correlate fixed, sub-district-level characteristics, including crop suitability, with the initial decision that the British made to select roughly half of Pakistan for 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 FCR back across parts of the country throughout the 1960s and 1970s.

## 5.1 Initial FCR Application in 1901

For our first analysis, we will use a simple empirical specification:

$$\begin{aligned} \text{FCR\_applied\_1901}_d = \alpha + \beta_1 \, \text{Sub-district\_area} + \beta_2 \, \text{Ruggedness}_d \\ + \beta_3 \, \text{Distance\_to\_capital}_d + \beta_4 \, \text{Latitude}_d + \beta_5 \, \text{Longitude}_d + \beta_6 \, \text{Crop\_suitability}_d + \epsilon_d \end{aligned} \tag{1}$$

Where $\text{FCR\_applied\_1901}_d$ is a dummy for whether FCR was initially applied to sub-district $d$ in the 1901 FCR legislation, $\text{Sub-district\_area}_d$ is is the area of sub-district $d$ in thousands of square kilometers, $\text{Ruggedness}_d$ is a sub-district measure of terrain roughness (SD of height above sea level), $\text{Distance\_to\_capital}_d$ is the distance, in 1000s of kilometers, from the centroid of each sub-district to the capital through the late 1960s (Karachi), $\text{Latitude}_d$ and $\text{Longitude}_d$ are the latitude and longitude of each sub-district's centroid, and $\text{Crop\_suitability}_d$ is a sub-district's crop suitability measure. Note that FCR was originally applied at the district level, so we cluster the standard errors by district. We leave the specification at the sub-district level, however, to avoid having to aggregate up the geo-specific measure any more than has already been done.

This analysis will give us a correlation. What is informative is that while sub-district geographic characteristics that proxy for productivity at the time of territorial demarcation (which happened over the latter half of the 19th century), the challenge of exerting control, and transportation costs all correlate in the expected direction with FCR application, FCR application is conditionally independent of crop suitability for wheat. We proxy for initial productivity with sub-district area because administrative units were sized to capture similar populations during the initial demarcation in the mid-19th century and more productive places were more densely populated at the time. We therefore expect productive areas to

have had physically smaller administrative units. We proxy for the challenge of exerting control with the standard deviation of elevation. It is well established that rougher terrain is harder to police given modern military technologies and this was certainly true in a time before mechanized transportation. We proxy for transportation costs with the distance to the Karachi, the main port at the time for areas that would become Pakistan, because wheat was an important export crop. The value of controlling territory where it was produced was therefore likely related to the costs of moving it to market. Controlling for the latitude and longitude of a subdistrict is a more flexible way to account for all of the geographic variation in our sample. We do not have pre-1901 data to control for potential omitted variables such as differential time trends in productivity, or for specific time-invariant covariates of a sub-district. As such, we will only consider results from this analysis as suggestive.

## 5.2 The Green Revolution and Agricultural Productivity Gains in Pakistan

We are interested in confirming that the spread of high-yielding varieties of wheat seeds in Pakistan at the onset of the Green Revolution did increase the productivity (and thus potential government revenue) disproportionately in originally less-suitable areas as this is a necessary condition for us to test our theory in the next subsection. We would ideally use a direct measure of productivity, either yields or government revenue, but we have not found records of such measures for this time period. As a second best, we will consider agricultural input and usage variables from the agricultural census that we believe would be positively correlated with yields and revenue. That is, we would expect greater differential investments during the Green Revolution in places that gained differentially in terms of productivity during this time.

For this analysis, we will use another correlational specification:

$$\text{Y(1972-1960)}_d = \alpha + \beta_1 \, \text{Below\_Median\_Wheat\_Suitability}_d + \beta_2 \, \text{Area}_d + \epsilon_d \tag{2}$$

Where$\text{Y(1972-1960)}_d$ is an outcome from the census of agriculture in 1972 minus that same outcome in 1960 and $\text{Area}_d$ is a control for the area of the subdistrict. Again, we cluster standard errors by district. We also limit our analysis to sub-districts that were not subject to FCR at the start of the Green Revolution, akin to limiting to "control" sub-districts so

that we can document a pattern between suitability and agricultural productivity without changes in FCR status potentially confounding our simple analysis.

## 5.3 FCR Application and the Green Revolution

For our third and primary analysis we exploit 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 incentives for rolling back the FCR. Our primary specification will be as follows:

$$\begin{aligned} \text{FCR\_applied}_{dt} = \alpha + \beta_1 \, \text{Crop\_suitability}_d + \beta_2 \, \text{Post\_GR}_t + \\ \text{Post\_GR\_Crop\_suitability}_{dt} + \delta_t + \epsilon_{dt} \\ \text{for sub-district } d \in \{\text{ever had fcr}\} \\ \text{for year } t \in \{1947, 1957, 1962, 1964, 1965, 1974, 1978\} \end{aligned} \tag{3}$$

Here $\text{FCR\_applied}_{dt}$ is a dummy for whether FCR continued to apply to sub-district $d$ in year $t$, $\text{Crop\_suitability}_d$ is our crop suitability measure of sub-district $d$, and $\text{Post\_GR\_Crop\_suitability}_{dt}$ is the linear interaction of the the two terms. $\delta_t$ are year fixed effects. Note that we will not be able to separately identify $\beta_1$ from sub-district fixed effects.

Analysis for Equation 3 is limited to sub-districts in Pakistan that ever had FCR and to years $t \in \{1947, 1957, 1962, 1964, 1965, 1974, 1978\}$. The latter limitation is to all the years in which one or more sub-districts changed FCR application, within 20 years of the Green Revolution.[19] We limit to these years as an event study of sorts, assuming that there was enough of a political cost to changing the FCR legislation that it could not be done continuously. This approach matches the historical record in that decisions to remove sub-districts from the law happened episodically and in groups. There are two more extreme 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 sub-district and run a simple difference of means between pre and post the Green Revolution. We see our specification as superior to (i) because it will not over-emphasize the many zeros that likely did not represent real decisions and to (ii) because it allows for a more accurate accounting for variation across

[19] And more or less within a much larger window considering the little change in FCR between 1901 and 1947 and the no change in FCR after 1978.

time.[20]

With year fixed effects, and with a differences-in-differences estimator, we will consider this analysis to capture the causal differential impact of the Green Revolution, or more generally of an exogenously timed change in a sub-district's agricultural land value, on the choice by the Pakistani government to maintain or remove FCR. For our identification strategy to hold, we need that there were no time-varying omitted variables that differentially impacted sub-districts before and after 1965. In other words, we need that there were no other major changes other than the Green Revolution happening at or around 1965 that had differential impacts on FCR application by crop suitability. We will discuss other major potential changes in the context of our results below.

# 6 Results

This section presents results from two complementary analyses of the choice to apply, and then maintain, FCR provision in regions of Pakistan. First, we correlate fixed, sub-district-level crop suitability with the initial decision that the British made to select roughly half of Pakistan for FCR in 1901. Second, we exploit the differential impact of the Green Revolution by crop suitability to understand Pakistan's decisions to roll FCR back across parts of the country throughout the 1960s and 1970s.

## 6.1 Initial FCR Application in 1901

Table 2 presents results for this analysis. In-line with our framework, column (1) shows that the British applied FCR in less productive places (under our assumption that sub-district area was negatively correlated with productivity), column (2) shows that places which were more costly to tax due to rough terrain, as proxied by height above sea level, were more likely to be in the FCR, and column (3) shows that places with higher transportation costs (and thus lower revenue potential given productivity) were more likely to be included. Column

[20]Note that if we take the conservative approach and run analysis on data for all 20 years before and after the Green Revolution as in (i), we obtain coefficients with 1/3 to 1/2 of the magnitude and the same level of significance. These are still very meaningful magnitudes. Results available upon request.

(4) shows that latitude and longitude were also important predictors. Column (5) does show that there is an unconditionally positive correlation between wheat crop suitability and initial FCR application, but column (6) then shows that once our other factors are accounted for the sub-district suitability for wheat is uncorrelated with initial FCR application.

Table 2: Crop Suitability and Initial FCR Application

| | FCR applied in 1901 (=1) | | | | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Sub-district Area (Square KM / 1000) | 0.019** | | | | | 0.004 |
| | (0.009) | | | | | (0.008) |
| Sub-district SD of height above sea level (FT / 100) | | 0.023*** | | | | -0.004 |
| | | (0.006) | | | | (0.005) |
| Distance to Capital (KM / 1000) | | | 0.351*** | | | -0.543 |
| | | | (0.107) | | | (0.529) |
| Longitude of sub-district centroid | | | | -0.178*** | | -0.165*** |
| | | | | (0.013) | | (0.024) |
| Latitude of sub-district centroid | | | | 0.163*** | | 0.226*** |
| | | | | (0.011) | | (0.056) |
| Sub-district Wheat Crop Suitability | | | | | 0.061* | -0.007 |
| | | | | | (0.031) | (0.027) |
| Mean of dependent variable | 0.429 | 0.429 | 0.429 | 0.429 | 0.429 | 0.429 |
| # Observations | 403 | 403 | 403 | 403 | 403 | 403 |
| # Clusters | 129 | 129 | 129 | 129 | 129 | 129 |
| R-Squared | 0.016 | 0.145 | 0.074 | 0.591 | 0.034 | 0.598 |

*Notes*: Unit of observation is the sub-district (tehsil). *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$. 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. Karachi was the capital at independence and the main export port in the late-1900s.

Thus we argue that initial assignment to the FCR is plausibly exogenous to wheat crop suitability once we condition for proxies for local productivity and the cost of imposing state institutions.

## 6.2 The Green Revolution and Agricultural Productivity Gains in Pakistan

Ideally, we would analyze the effects of the Green Revolution on taxes and other state revenue to support our theory. However, after considerable effort, we are unable to locate or confirm

Table 3: The Green Revolution and Changes in Agricultural Inputs

| | Difference between 1972 and 1960 values | | | | | Farms with |
|---|---|---|---|---|---|---|
| | Cropped Area | Wheat Area | Irrigated Area | Cropped Area with Fertilizer | Farms using Fertilizer | Tractors '72 − Ploughs '60 |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Panel A: Linear models | | | | | | |
| Sub-district Wheat Suitability | -27313** | -6996* | -21441*** | -34656*** | -3968*** | -395 |
| | (10294) | (3807) | (4407) | (7800) | (621) | (1128) |
| Mean of dependent variable | 135309 | 40521 | 83165 | 144702 | 3966 | 573 |
| # Observations | 96 | 96 | 95 | 92 | 92 | 89 |
| # Clusters | 58 | 58 | 57 | 56 | 56 | 54 |
| R-Squared | 0.072 | 0.063 | 0.189 | 0.226 | 0.375 | 0.004 |
| Panel B: Non-linear models | | | | | | |
| Below Median Wheat Suitability (=1) | 42424 | 13524 | 49229*** | 71816** | 12247*** | -5235 |
| | (34818) | (10073) | (18233) | (30154) | (2398) | (4314) |
| Mean of dependent variable | 135309 | 40521 | 83165 | 144702 | 3966 | 573 |
| # Observations | 96 | 96 | 95 | 92 | 92 | 89 |
| # Clusters | 58 | 58 | 57 | 56 | 56 | 54 |
| R-Squared | 0.017 | 0.034 | 0.086 | 0.097 | 0.302 | 0.036 |

*Notes* :$^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$. Standard errors clustered at the district level reported in parentheses. All regressions include controls for total sub-district (tehsil) area. 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 FCR at the start of the Green Revolution. For reference, there are 215 total tehils subject to 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

the existence of these data at the sub-district level for the relevant period. Instead, we provide evidence corroborating the fact that initially less suitable areas of Pakistan gained the most from the Green Revolution in Table 3 using data from the 1960 and 1972 agricultural censuses in Pakistan. We correlate wheat suitability, both linearly in Panel A and with a dummy for below median suitability in Panel B, 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). We find that areas of low wheat suitability saw disproportionate increases in all of these measures between 1960 and 1972. These increases are significant for eight of the 12 regressions. In all cases, the increases are large in magnitude as well. For example, irrigated area increased by 83,165 acres in above median wheat suitability sub-districts during this team period. In below median wheat suitability sub-districts it increased by an additional 59 percent, or 49,229 acres.

While correlational and on a limited sample, these results are consistent with the fact that that the extension of state control led to shifts in investment decisions in the same pattern our simple logic predicts. In other words, as it was originally less suitable areas that gained the most from the Green Revolution, it is those areas that received the greatest increased investment in resources (many of which were state controlled in Pakistan during this period). While we have argued above that with Green Revolution varieties of wheat there were few required changes in input technologies, labor to capital ratios, or irrigation, we would also expect changes at the extensive margin (land that was not used before the Green Revolution but was after) to drive these inputs up as cropped area increased.

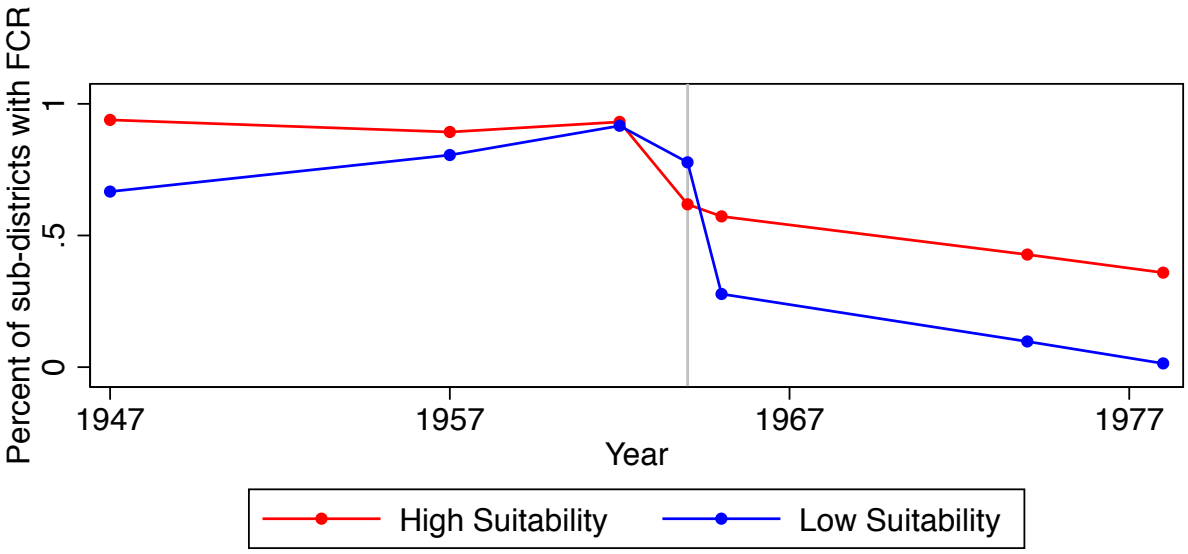
## 6.3 FCR Application and the Green Revolution

Now we present results for our third and primary analysis—exploiting the differential impact of the Green Revolution by crop suitability to understand the integration of peripheral areas into the state throughout the 1960s and 1970s. Figure 4 presents our primary result visually. It shows FCR application before and after the Green Revolution, where we group sub-districts into above and below median crop suitability. We see that after the Green Revolution low suitability districts became much less likely to have FCR maintained.

Table 4 presents regression analysis results. Panel A presents models with a linear measure of wheat suitability, and Panel B using a dummy variable for below median wheat suitability. In both panels, we first present a simple correlation of sub-district crop suitability and FCR application across the years in this analysis with and without year fixed effects. In columns (1) and (2), we see that there is no clear correlation between sub-district wheat suitability and FCR status when we do not use our Green Revolution instrument but do use the same empirical specification and sample otherwise. This is not surprising as our previous results from 1901 suggest that wheat suitability might not have been an important predictor of FCR application initially, and there were very few changes in FCR before the Green Revolution. It is also consistent with the fact that the Green Revolution cause wheat suitability to matter differentially at a discrete point in time.

Second, we present a differences-in-differences specification, adding year fixed effects and then sub-district controls column-by-column. We can see that crop suitability differentially positively predicts FCR's continued application after the Green Revolution relative to before by 9.6 percentage points regardless of specification in Panel A. In Panel B, when we divide

Figure 4: FCR application over time by crop suitability




Points show the mean sub-district FCR application dummy values in years used in analaysis within above (high) and below (low) medium wheat crop suitability bins. Lines are fitted using locally weighted scatterplot smoothing.

Table 4: Crop Suitability and FCR Application Before and After the Green Revolution

| | FCR applied (=1) | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Panel A: Linear models | | | | |
| Sub-district Wheat Suitability | 0.029 | 0.029 | -0.013 | -0.056* |
| | (0.037) | (0.037) | (0.034) | (0.030) |
| Post Green Revolution (=1) | | | -0.741*** | -0.741*** |
| | | | (0.071) | (0.071) |
| Wheat Suitability * Post Green Revolution | | | 0.096*** | 0.096*** |
| | | | (0.031) | (0.031) |
| Mean of dependent variable | 0.952 | 0.952 | 0.952 | 0.952 |
| # Observations | 1421 | 1421 | 1421 | 1421 |
| # Clusters | 74 | 74 | 74 | 74 |
| R-Squared | 0.006 | 0.291 | 0.308 | 0.447 |
| Panel B: Non-linear models | | | | |
| Below Median Wheat Suitability (=1) | -0.169** | -0.169** | -0.054 | 0.187** |
| | (0.070) | (0.070) | (0.074) | (0.075) |
| Post Green Revolution (=1) | | | -0.510*** | -0.510*** |
| | | | (0.088) | (0.088) |
| Below Median Wheat Suitability (=1) * Post | | | -0.270*** | -0.270*** |
| | | | (0.092) | (0.092) |
| Mean of dependent variable | 0.952 | 0.952 | 0.952 | 0.952 |
| # Observations | 1421 | 1421 | 1421 | 1421 |
| # Clusters | 74 | 74 | 74 | 74 |
| R-Squared | 0.028 | 0.312 | 0.330 | 0.448 |
| Year FEs? | NO | YES | YES | YES |
| Sub-district controls | NO | NO | NO | YES |

*Notes* :*$p < 0.1$, **$p < 0.05$, ***$p < 0.01$. 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 sub-district had FCR removed—1922,1937,1947,1956,1963,1964,1971,1973,1977. Sub-dsitrict controls are Sub-district Area (Square KM / 1000), Sub-district SD of height above sea level (FT / 100), Distance to Capital (KM / 1000), and latitude and longitude.

crop suitability at the median, we find that below median crop suitability sub-districts are *less* likely to have FCR retained after the Green Revolution. This point estimate is substantively large — 27 percentage points.[21] Note also that before the introduction of the Green Revolution wheat suitability negatively predicts FCR application once we introduce sub-district controls, which is what our theory would predict.

This result is consistent with the fact that the Green Revolution mitigated the importance of crop suitability. As mentioned above, the Green Revolution is characterized by increased crop yields among the staple crops of South Asia with little to no required changes in input technologies, labor to capital ratios, or irrigation. Thus places that were once harder to farm became relatively easier, causing lower-suitability sub-districts 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 as a result of the Green Revolution, and these districts were relatively more likely to have their FCR application removed.[22]

Our results suggest a fairly large magnitude of an effect as well. We find that a one unit increase in crop suitability, from say 'medium' to 'good,' is associated with a 10 percentage points differential increase in the likelihood that FCR continues to apply to a sub-district following the Green Revolution.

## 6.4 Robustness Checks

We present four robustness checks to our Green Revolution result. First, we conduct a placebo check in which we add to our main specification the interaction of a dummy for post Green Revolution with crop suitability levels for other crops that were not impacted by the Green Revolution in Pakistan during this time period (rice became important in the 1980s), including gram (the second most important crop in Pakistan before the Green Revolution by cultivated area), and an average over gram, cotton, and rice. Results are presented in Table

[21]Note that the coefficients on the interaction term and post-Green Revolution dummy do not change with the addition of sub-district controls. That is because all sub-district controls are time-invariant and therefore orthogonal to both time and its interaction with wheat suitability by construction. Controlling for time-invariant factors with sub-district fixed effects does not change the results.

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

5. Note we do not show cotton or rice separately. For cotton, this is because it is 97 percent correlated with wheat suitability in our sample. For rice, it is because there is no variation in rice suitability in all of Balochistan (it is zero throughout). In columns (2) and (3), our results remain completely driven by wheat crop suitability. This assures us that our results are not driven by some correlate of wheat suitable sub-districts that has nothing to do with potential government revenue—if such was the case it seems unlikely such a spurious result would exist with crop suitability for wheat but not the second most important crop or an average across three important crops.

Table 5: Robustness Check 1—Other Crop Suitability Placebos

| | FCR maintained (=1) | | |
|---|---|---|---|
| | (1) | (2) | (3) |
| Wheat Crop Suitability * Post Green Revolution | 0.096*** | 0.087 | 0.147* |
| | (0.033) | (0.074) | (0.082) |
| Gram Crop Suitability * Post Green Revolution | | 0.011 | |
| | | (0.083) | |
| Other Crop Average Crop Suitability * Post Green Revolution | | | -0.090 |
| | | | (0.125) |
| Mean of dependent variable | 0.952 | 0.952 | 0.952 |
| # Observations | 1421 | 1421 | 1421 |
| # Clusters | 74 | 74 | 74 |
| R-Squared | 0.454 | 0.454 | 0.455 |
| Year FEs? | YES | YES | YES |
| Sub-district FEs? | YES | YES | YES |

*Notes* :*$p < 0.1$, **$p < 0.05$, ***$p < 0.01$. Standard errors clustered at the district level reported in parentheses. Other crop suitability is the average of gram, cotton, and rice crop suitability.

Second, we conduct a placebo check in which we vary the year in which the Green Revolution supposedly took place. If there were pre-existing trends in low- relative to high-suitability sub-districts, such a placebo check should pick them up. Results are presented in Table 6. As you can see, we only get results when we use the true year of the Green Revolution in Pakistan. This is encouraging, and consistent with the pre-trends visible in Figure 4.

Third, most importantly, we turn to alternative changes that could have occurred in exactly 1965 in Pakistan that differentially affected some sub-districts over others in a way

Table 6: Robustness Check 2—Year Placebos

| | FCR maintained (=1) | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Wheat Crop Suitability * Post Green Revolution | 0.096*** | | | |
| | (0.033) | | | |
| Wheat Crop Suitability * Post 1957 | | -0.063 | | |
| | | (0.046) | | |
| Wheat Crop Suitability * Post 1962 | | | -0.008 | |
| | | | (0.033) | |
| Wheat Crop Suitability * Post 1964 | | | | 0.031 |
| | | | | (0.035) |
| Mean of dependent variable | 0.952 | 0.952 | 0.952 | 0.952 |
| # Observations | 1421 | 1421 | 1421 | 1421 |
| # Clusters | 74 | 74 | 74 | 74 |
| R-Squared | 0.454 | 0.433 | 0.428 | 0.430 |
| Year FEs? | YES | YES | YES | YES |
| Sub-district FEs? | YES | YES | YES | YES |

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

that is correlated with both wheat suitability and FCR application.[23] From the history of Pakistan around 1965, two plausible alternative stories arise. The first is Pakistan's on-going dispute with India over areas of northern Pakistan, including Kashmir and Gilgit-Baltistan. In 1965, there was a war between the two countries in this region which involved skirmishes in Kashmir (the Indo-Pakistani War of 1965). It is possible that this war constrained Pakistan's ability to roll back FCR from the northern region of the country in 1965. If this is the case, and the northern area is on average more suitable for wheat than Balochistan, where FCR was mainly rolled back in 1965, we could be obtaining spurious results. To ensure this is not the case, in Table 7, column (2), we limit our analysis to only Balochistan, the province for which there are major changes in FCR status in 1965. We see that, if anything, our result becomes stronger when limited to only Balochistan. This ensures that the northern areas of Pakistan are not driving our results.

Table 7: Robustness Check 3—Focus on Balochistan

| | FCR maintained (=1) | | |
|---|---|---|---|
| | (1) | (2) | (3) |
| Wheat Suitability * Post Green Revolution | 0.096*** | 0.198** | 0.190* |
| | (0.033) | (0.083) | (0.100) |
| Mean of dependent variable | 0.952 | 0.842 | 0.799 |
| # Observations | 1421 | 420 | 315 |
| # Clusters | 74 | 25 | 18 |
| R-Squared | 0.454 | 0.776 | 0.845 |
| Year FEs? | YES | YES | YES |
| Sub-district FEs? | YES | YES | YES |
| Sample | All | Balochistan Only | Non-Pashtun Balochistan |

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

The second alternative story that we consider takes place within Balochistan. Balochistan has historically been dominated by two ethnic groups—the Baloch and the Pashtuns. The Pashtuns have lived in the north of the province and the Baloch in the south. The President

[23]Note we consider the Green Revolution to encapsulate all changes in crop technology at the time, so we are not concerned about other simultaneous agricultural advances.

of Pakistan in 1965, General Ayub Khan, had different relationships with the two groups that might have affected FCR decisions, possibly because of an active insurgent movement in certain parts of Balochistan. If the Pashtun or Baloch groups were systematically on more or less suitable land and General Khan wanted to extend formal governance to specifically Pashtun areas for security reasons, the mechanism of change would be different from the one posited. To ensure this is not the case, in Table 7, column (3), we limit our analysis to only the historically Balochi sub-districts in Balochistan.[24] We find that our results generally hold (our standard errors get larger with the smaller sample but the main result remains significant at 10%). Thus, putting together our results from this table, even in the Baloch-dominated districts in Balochistan, we see the same relationship hold in which crop suitability differentially positively predicts FCR's continued application after the Green Revolution relative to before.

Fourth, we ensure that our results are robust to whether we consider princely states to be ungoverned (and thus coded as if under FCR) or governed (and thus coded as not under FCR). As we can see in Tables 8 and 9, our results, including our initial application correlations, are not at all sensitive to how we code princely states. This is not a surprise at they do not represent a large area of Pakistan.

# 7 Conclusion

In this paper, we showed 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 developing full institutions through 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 show first that the choice by the British to apply FCR to over half of Pakistan in 1901 was conditionally uncorrelated with crop suitability. We then exploit the fact that Green Revolution had a greater marginal effect in areas of low crop suitability to understand Pakistan's selective roll-back of FCR throughout the 1960s and 1970s. We find that sub-districts more suitable to agriculture were more likely to see continued FCR application after the Green Revolution raised the

[24]Historically, Baloch and Pashtun sub-districts were hand-coded using a map created by Dr. Michael Izady at www.Gulf2000.Columbia.edu/maps.shtml.

Table 8: Robustness Check 4—Crop Suitability and FCR (dropping Princely States)

| | FCR maintained (=1) | | | | |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| Sub-district Area (Square KM / 1000) | 0.024** | | | | 0.019* |
| | (0.011) | | | | (0.010) |
| Sub-district SD of height above sea level (FT / 100) | | 0.023*** | | | 0.025*** |
| | | (0.006) | | | (0.007) |
| Distance to Capital (KM / 1000) | | | 0.322*** | | -0.108 |
| | | | (0.113) | | (0.178) |
| Sub-district Wheat Crop Suitability | | | | 0.057* | 0.079** |
| | | | | (0.032) | (0.039) |
| Mean of dependent variable | 0.425 | 0.425 | 0.425 | 0.425 | 0.425 |
| # Observations | 360 | 360 | 360 | 360 | 360 |
| # Clusters | 119 | 119 | 119 | 119 | 119 |
| R-Squared | 0.016 | 0.130 | 0.059 | 0.031 | 0.174 |

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

Table 9: Robustness Check 5—FCR application after the Green Revolution (with and without Princely States)

| | FCR maintained (=1) | |
|---|---|---|
| | (1) | (2) |
| Wheat Suitability * Post Green Revolution | 0.096*** | 0.086** |
| | (0.031) | (0.033) |
| Mean of dependent variable | 0.952 | 0.960 |
| # Observations | 1421 | 1225 |
| # Clusters | 74 | 67 |
| R-Squared | 0.454 | 0.423 |
| Sample | All | Non-Princely States |

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

relative value of less-suitable sub-districts.

Because the timing of the Green Revolution in Pakistan was exogenous to local politics we are able to isolate a plausibly causal effect of agricultural land value on FCR application. Our results suggest a large effect. Specifically, a one unit increase in crop suitability from 'medium' to 'good' is associated with a differential increase in a sub-district's probability of being left ungoverned by over twenty percent following the Green Revolution, relative to before. Though counter intuitive at first glance, this pattern is actually consistent with our hypothesis that the Green Revolution mitigated the importance of crop suitability and thus caused lower-suitability sub-districts to 'catch-up' to other districts in potential revenue extraction. Thus lower-suitability districts were more likely to switch from expected revenue negative to positive as a result of the Green Revolution, and these districts were relatively more likely to have FCR removed.

These results are important for at least four reasons. First, we provide micro-evidence on the importance of extractable land value, and technology-driven changes in land value, to the choice to govern land, supporting the hypothesis of a rich macroeconomic development literature when applied at the sub-national level. Second, we provide additional evidence on the importance of the Green Revolution in South Asia, not only in increasing land values and growth but in influencing the choice of the Pakistani government to govern (and Pakistani citizens to accept government in) large parts of the country that had thus far remained ungoverned. Third, we present evidence in support of the idea of Fearon (2008) and Besley and Persson (2011) of *ungoverned-by-choice* space. Lastly, we provide heartening evidence that technological chance can lead to ungoverned spaces being folded into country's cores without civil war or serious violence. The parts of Pakistan that still have FCR today are, of course, the most resistant to government control, but so were many parts of the sub-districts that were brought into the government in the 1970s. Yet what was stopping the government from integrating them, and those living in these peripheral areas from consenting to integration without violence, at least in part, a simple cost-benefit calculation.

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