Elite Conflict, Demographic Collapse, and the Transition to Direct Rule: Evidence from Colonial Mexico*

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April 2, 2017

Abstract

When do central governments centralize control over their regions? We develop a theory of the transition from indirect to direct rule, focusing on the contentious relationship between a ruler and local potentates, who provide civil order at the expense of a share of local revenue. A rapid fall in the local population reduces the threat of rebellion, as well as the willingness and ability of potentates to resist the ruler's efforts to centralize power. A demographic collapse thus enables the ruler to replace the potentates with direct agents of the state and invest in a fiscal bureaucracy, with important implications for the development of state capacity. We evaluate the theory using subnational panel data from 16th- and 17th-century Mexico around the time of one of the most dramatic demographic collapses in history. To identify the effect of the collapse on the centralization of fiscal authority, we employ a difference-in-differences empirical strategy and an instrumental-variables approach based on the climatic conditions associated with a series of epidemics that decimated the population during this period. Our results show that the centralization of power occurred faster in areas that experienced a more dramatic loss in population.

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Economic development depends on state capacity and centralization. States with centralized fiscal institutions and direct forms over their territory are more able to provide the basic administrative infrastructure necessary to sustain economic growth (e.g., Bockstette, Chanda and Putterman 2002; Gannaioli and Rainer 2007; Michalopoulos and Papaioannou 2013; Osafo-Kwaako and Robinson 2013; Dincecco and Katz 2014). By contrast, the reliance on indirect rule over the hinterland—allowing local elites to retain considerable power and autonomy in fiscal and military matters—has been linked to long-term political and economic undevelopment (e.g., Migdal 1988; Boone 1994; Mamdani 1996; Lange 2004; Hariri 2012; Acemoglu et al. 2014). Given the importance of state centralization to future development, it is crucial to understand the conditions under which rulers choose to transition to more direct forms of rule.

In this paper, we theoretically and empirically explore the transition to direct rule, drawing on quasi-experimental evidence from colonial Mexico. Building on past work on indirect rule and state formation, we construct a theory of political centralization that highlights the strategic dilemma faced by rulers as they seek to extend direct rule over their domain. Under indirect rule, local potentates provide civil order in exchange for political and fiscal autonomy in their regions. Centralization allows rulers to exert more control over their territory and increase their share of tax revenue, but it also strips power from local elites, who may be better able to monitor and enforce order in their regions. The transition to direct rule is therefore a risky enterprise, exposing rulers to an increased threat of rebellion by local elites, who may wish to contest their loss of power, and by commoners, who may take advantage of temporarily reduced local political control. We demonstrate that a rapid decline in local population can facilitate the adoption of direct rule by reducing both the threat of generalized rebellion and the incentives of local elites to resist the centralization of power.

We find empirical support for the theory, examining subnational variation in the transition to direct rule in 16th- and 17th-century Mexico. Following the Conquest, the Crown relied on local elites to provide control over conquered territories in exchange for the right to extract taxes and labor from the local population through an institutional arrangement known as the *encomienda*. As the Crown consolidated territorial control, royal officials gradually moved to centralize colonial administration, replacing private *encomiendas* with *corregimientos*, publicly held offices that directly collected taxes for the Crown. The establishment of a Crown-controlled bureaucracy in charge of tax collection laid the foundation for the later development of local state capacity. However, the transition to direct rule was uneven, and some parts of the colony remained under indirect rule until the end of the colonial period.

Crucially, the centralization of fiscal capacity in Mexico occurred alongside a cataclysmic demographic collapse. Within a century of the Conquest, Mexico's indigenous population had fallen by around 90%, mostly due to disease. The severity of the collapse varied considerably across space and shaped the Crown's ability and willingness to centralize power in different regions. In disease-affected areas, elites' opportunities to extract local tax revenue and labor evaporated, undermining both their incentives and ability to contest the loss of political authority to the center. Moreover, the population collapse reduced the threat of rebellion from survivors, greatly lessening the potential benefits of indirect rule. The Crown was thus more willing and able to wrest political control from local elites in areas of high population loss.

We empirically demonstrate the link between the demographic collapse and the adoption of direct rule using subnational panel data on population dynamics and local institutions in the early colonial period. We use two related empirical strategies. We first employ a difference-in-differences approach, exploiting within-district variation in population size and institutions over time. To further address potential concerns about reverse causality and measurement error, we also adopt an instrumental-variables approach based on the features of a series of climate-related epidemics that impacted the country beginning in the middle of the sixteenth century. These epidemics, caused by a pathogen known as cocolitzli, emerged during rebound periods of rainfall following severe droughts (Acuña Soto et al. 2002). Using an empirical strategy similar to that of Sellars and Alix-Garcia (2016), we instrument for the decline in population using proxies for these climate conditions derived from tree-ring chronologies (Cook and Krusic 2004). We show that the transition from indirect (encomienda) to direct (corregimiento) rule occurred more rapidly in areas that experienced a more precipitous decline in population. These results are robust under several different empirical specifications controlling for other potential correlates of state centralization. We further demonstrate that the effect of the collapse on the transition to indirect rule was magnified in areas where the threat of rebellion had been especially high and where elites had more profitable outside earnings opportunities, providing further support for the theory.

This paper contributes to the literatures on state formation, historical dependence and development, and the political economy of population. Past scholarship on the development of state capacity has emphasized the role of interstate war in the centralization of fiscal authority. In Europe, the increasing costs of interstate conflict generated incentives to centralize tax collection to wage wars successfully (e.g., Tilly 1990; Besley and Persson 2011; Hoffman 2012; Gannaioli and Voth 2015). The capacity-enhancing legacy of this tax-financed warfare has been demonstrated both in Europe and beyond (e.g., Herbst 2000; Centeno 2003; Queralt 2016). Other work on state centralization has focused on the availability of technologies to project direct rule into the hinterland (e.g., Cederman and Girardin 2010; Gerring et al. 2011; Mayshar, Moav and Neeman 2013) or on potential institutional bargains between the ruler and local elites (e.g., Ertman 1997; Hoffman and Rosenthal 1997; Dincecco 2009; Garfias 2016*a*). By contrast, we provide a rationale for state centralization that focuses on the role domestic elite conflict (e.g., Gerring et al. 2011; Mares and Queralt 2015; Beramendi, Dincecco and Rogers 2016; Garfias 2016*b*).

This focus on domestic elites also sets our paper apart from the literature on population dynamics and state formation, and particularly work linking the Black Plague with the rise of the European nation-state (e.g., Epstein 2000; Levine 2006; Voigtländer and Voth 2013*a*;*b*). In these and other works, the institutional impacts of population scarcity operate largely through increasing the income and bargaining power of surviving labor. This in turn undermines feudal arrangements and increases incentives for expanded interstate warfare and tax capacity. The severe drop in population serves a somewhat different role in our theory, weakening the bargaining power of elites through reducing their opportunities for rent-seeking and by decreasing the threat of local rebellion, thus obviating the Crown's need to outsource local political control. The theorized link between the collapse and the threat of rebellion is supported both by historical evidence on the time period and by the growing literature on population density and civil unrest (e.g., Katz 1988; Homer-Dixon 1999; Salehyan and Gleditsch 2006; Reuveny 2007). Furthermore, our work calls attention to several mechanisms through which population scarcity—rather than density—may facilitate state centralization and the growth of state capacity, providing an interesting contrast to work that has argued for the adverse effects of population scarcity on institutional development, especially in sub-Saharan Africa (e.g., Herbst 2000; Boone 2003; Fenske 2013).

More broadly, this paper also contributes to the literatures on historical dependence and development in Mexico and beyond. It is now well established that historical institutions, and especially those developed under colonial rule, have long-reaching impacts on development (e.g., La Porta et al. 1997; Acemoglu, Johnson and Robinson 2002; Nunn 2009; Mahoney 2010). Colonial institutions in general, and those resulting from the sixteenth-century population collapse in particular, have been blamed for contemporary Mexican underdevelopment (e.g., Borah 1951; Acemoglu and Robinson 2012; Sellars and Alix-Garcia 2016). Our work extends this literature by connecting the population collapse to shifts in elite conflict and the uneven development of Mexican state capacity.

The paper proceeds as follows. In Section 1, we present our theory on the transition to direct rule. We then discuss the empirical setting and provide preliminary evidence in support of our main argument in Section 2. We describe the sources and construction of our data in Section 3. We discuss our empirical strategy in Section 4. The results are presented in Section 5. We conclude in Section 6.

1. A Theory of Direct Rule

The centralization of political and fiscal authority is a key feature of state formation. Under forms of indirect rule, local potentates may maintain considerable political and fiscal authority while holding fealty to a ruler. This is the model of the relationship between lords and the monarch under feudalism, and similar arrangements can be found in the territorial organization of empires and the administration of colonial holdings acquired through conquest (e.g., Doyle 1986; Lange 2009; Gerring et al. 2011). The transition from indirect rule to forms of direct rule—where a central administration can deploy salaried agents and remove them through regularized bureaucratic procedures—not only strengthens the political authority of the ruler, but it also enhances state capacity in the region (e.g.. Dincecco 2009). The establishment of a class of public officials employed directly by the ruler lays the foundation for implementing policies that would be unfeasbile under indirect forms of rule, such as new forms of taxation.

Establishing direct fiscal control over territory, however, requires that rulers challenge the incumbent local political elite who may have considerable bargaining power. In many indirect-rule arrangements, these local potentates offer political order in exchange for a variety of concessions from the ruler. They often control key features of the local state apparatus, such as the institutions used to collect taxes and establish control over labor. By delegating fiscal authority to these local intermediaries, the ruler can extend control over territory without having to invest in the administrative apparatus necessary to govern directly. Though the potentates might not be powerful enough to directly challenge the ruler, they can often extract concessions through the veiled or explicit threat of popular unrest in their districts (e.g., Lange 2004; Hetcher and Kabiri 2008; Siroky, Dzutsev and Hechter 2013). These local elites are often better positioned to maintain control over their districts, which is why their services may be especially valuable to the ruler. When faced with the threat of losing the authority and rents they enjoy under indirect rule, local elites would have little incentive to invest in containing local uprisings on behalf of the ruler.

The ruler therefore faces a trade-off. Direct rule holds the promise of higher future revenue, but it also heightens the risk of rebellion and requires the costly investment of setting up an administrative apparatus.[1] As long as the risk of rebellion is high and the potentate has an incentive to contain it, the ruler has a lot to lose from instituting direct rule. However, when the risk of rebellion drops, elites lose bargaining power, and establishing direct rule becomes more attractive.

We formalize these ideas in a two-period model that considers the strategic interaction between a ruler and a local potentate, who maintains order in the region in exchange for a share of tax revenue. We show that if both tax revenue and the risk of rebellion are increasing in local population, as we argue was the case in early colonial Mexico, a precipitous decline in population will lead to a higher likelihood of a transition to direct rule. Furthermore, we show that the effect of the population

[1] The objective of the ruler to maximize revenue while carefully considering the risk of rebellion has a parallel in the *revenue* and *power* hypotheses in Gerring et al. (2011).

decline is amplified in regions where collective action and rebellion are easier (which raises the value of indirect rule) and where elites have more profitable outside options (which decreases elite incentives to contest the centralization of fiscal authority).

Actors and timing of the game. Consider two actors, a ruler (R) and a representative local potentate (E), who interact in a two period game, $s = \{1, 2\}$. In each period, the potentate raises taxes from the subjects in his district, T. He keeps an exogenous portion $\gamma \in (0, 1)$, and transfers the rest to the ruler. The local population, in response to extractive taxation, can rebel in the second period with an exogenous probability $W \in \{0, 1\}$. This probability is an increasing function of the total number of subjects (T) and the ease of local collective action (α): $p(W = 1) = \omega(T, \alpha)$, with $\omega_\alpha(T, \alpha) > 0$ and $\omega_T(T, \alpha) > 0$. The assumption that the probability of rebellion is increasing in T is supported by both Mexico-specific literature on unrest in the colonial period (e.g., Taylor 1979; Katz 1988) and by a broader literature linking population density with conflict (e.g., Boserup 1965; Homer-Dixon 1999; Goldstone 2002). Some factors that may facilitate local collective action include sharing a common language, which can enhance the population's ability to coordinate.

In the first period, the ruler can choose to implement direct rule (decision D) at a direct administrative cost C_D, and strip the potentate of his formal rights. If successful, this initiative leads to direct rule in the second period, which allows the ruler to capture all of the revenue in the region, T, without losing a fraction γ to the potentate. We normalize the tax revenue to 1 unit per local taxpayer.

The local potentate, in turn, makes two decisions in period one. First, he decides whether to pay a cost, C_G, to guard his region against rebellion (decision G). Second, after observing any attempt by the ruler to establish direct rule, the potentate can select a share of his first-period income to resist the ruler's efforts to centralize power, $r \in \{0, 1\}$. The potentate's income is a function of the local tax-paying population, γT. The probability that an attempt to displace the potentate fails is given by the concave function $\rho(r\gamma T) \in [0, 1]$, which is increasing in the intensity of his resistance against the ruler, $r\gamma T$. For simplicity, we assume a specific functional form, $\rho(r\gamma T) = \frac{\sqrt{r}\gamma T}{\bar{T}}$, where $\bar{T}$ is a finite upper bound for population in the region. In the appendix, we characterize the results using a general form for $\rho(\cdot)$.

In period 1, the ruler receives:

$$U_1^R = \begin{cases} (1-\gamma)T & \text{if } D = 0 \\ (1-\gamma)T - C_A & \text{if } D = 1, \end{cases}$$

where T are the capitation taxes levied from the population, and C_A is the administrative investment cost necessary to attempt to establish direct rule in the secons period.

Second-period payoffs depend critically on the probability of local rebellion. Whether this rebellion occurs depends on whether the potentate has decided to guard his region. For simplicity, we assume that the probability of rebellion is greater than zero when there is no protection, and zero when the region is protected by the potentate. In the second period, then, the ruler's expected payoff is:

$$E(U_2^R) = \begin{cases} (1-\gamma)T - \omega(T,\alpha)C_R & \text{if } D = 0 \text{ and } G = 0 \\ (1-\gamma)T & \text{if } D = 0 \text{ and } G = 1 \\ \big[1-\rho(r\gamma T)\big](T - \omega(T,\alpha)C_R) + \rho(r\gamma T)\big[(1-\gamma)T - \omega(T,\alpha)C_R\big] & \text{if } D = 1 \text{ and } G = 0 \\ \big[1-\rho(r\gamma T)\big](T - \omega(T,\alpha)C_R) + \rho(r\gamma T)\big[(1-\gamma)T\big] & \text{if } D = 1 \text{ and } G = 1, \end{cases}$$

where $\omega(T,\alpha)$ is the probability of rebellion in the second period in the absence of potentate protection, and $C_R > 0$ is an exogenous cost to putting down the rebellion.

The ruler can receive a higher share of the region's revenue if he successfully removes the potentate and sets up direct rule. This replacement, however, leaves the region unprotected against potential rebellion, captured by the non-zero probability $\omega(T,\alpha)$. An attempt to establish direct rule (i.e., $D = 1$) can also prompt a reaction from the potentate, who can choose to resist the ruler's initiative by setting $r > 0$. Resistance can improve the potentate's chances to keep his indirect-rule rights, which happens with probability $\rho(r\gamma T)$. On the other hand, if the ruler does not try to establish direct rule ($D = 0$), he keeps receiving a smaller share the taxes, $(1-\gamma)T$. If, additionally, the potentate decides to set up a costly defense for the region ($G = 1$), the risk of rebellion disappears.

The tradeoff for the ruler is clear: the possibility of higher future revenue comes with an increased risk of rebellion.

For the local potentate, the payoff in the first period is:

$$U_1^E = \begin{cases} (1-r)\gamma T & \text{if } G = 0 \\ (1-r)\gamma T - C_D & \text{if } G = 1, \end{cases}$$

where r is the share of his first-period income devoted to resist any attempt by the ruler to remove him, and C_D is the cost of preparing the defense of the region against rebellion in the next period. The potentate's expected payoff in the second period is:

$$E(U_2^E) = \begin{cases} (1-\omega(T,\alpha))\gamma T & \text{if } D = 0 \text{ and } G = 0 \\ \gamma T & \text{if } D = 0 \text{ and } G = 1 \\ \rho(r\gamma T)(1-\omega(T,\alpha))\gamma T + [1-\rho(r\gamma T)]\underline{\mathrm{u}} & \text{if } D = 1 \text{ and } G = 0 \\ \rho(r\gamma T)\gamma T + [1-\rho(r\gamma T)]\underline{\mathrm{u}} & \text{if } D = 1 \text{ and } G = 1, \end{cases}$$

where $\underline{\mathrm{u}}$ is the potentate's outside option if direct rule is successfully implemented. The potentate only gets his share of tax revenue in the second period if no rebellion breaks out, and if the ruler decides not to establish direct rule (or the attempt is successful resisted.)

In short, the ruler decides whether to attempt to establish direct rule, while the potentate makes two choices in response: first, whether to resist the ruler's attempt, and whether to set up a defense against rebellion. The timing of the game is:

1. Parameters are given, first-period incomes are realized.
2. The ruler decides whether to attempt to establish direct rule (decision D)
3. The local potentate chooses the share of income used to resist direct rule, r, and decides whether to guard the region against rebellion (decision G).
4. If the ruler tried to establish direct rule, his attempt fails with probability $\rho(\cdot)$, and succeeds with probability $1-\rho(\cdot)$.

5. If the local potentate chose not to guard the region or if the ruler successfully establishes direct rule, rebellion breaks out with probability $\omega(T,\alpha)$. Second period incomes are realized.

Solution. We employ subgame perfection as a solution concept. We solve by backward induction, starting first with the local potentate's choice of whether to set up a costly defense against rebellion in his region (decision G). His decision simply weighs the benefits of protecting the region, given the risk of rebellion, against the cost of defending it. He chooses to defend if:

$$C_D \leq \begin{cases} \omega(T,\alpha)\gamma T & \text{if } D=0 \\ \rho(r\gamma T)\omega(T,\alpha)\gamma T & \text{if } D=1. \end{cases} \tag{T1}$$

That is, the potentate guards the region if the cost of defense is smaller than his expected share of future taxes, weighed by the risk of rebellion and the probability of successfully resisting any attempt by the ruler to remove him to set up direct rule. Note that, when the ruler does not attempt to establish direct rule (i.e., $D=0$), the potentate will have an incentive to protect his region even for higher defense costs.

Now we turn to the optimal choice of resistance, r^*, which is chosen simultaneously by the potentate. When the ruler decides not to establish direct rule, the potentate does not need to resist, and thus $r^*=0$. When his rights are challenged by the ruler, however, the potentate's optimal resistance is given by

$$r^* = \begin{cases} \left[\frac{1}{2\bar{T}}[(1-\omega(T,\alpha))\gamma T - \underline{\mathrm{u}}]\right]^2 & \text{if } G=0 \\ \left[\frac{1}{2\bar{T}}[\gamma T - \underline{\mathrm{u}}]\right]^2 & \text{if } G=1, \end{cases} \tag{T2}$$

which emerges from the potentate's utility maximization problem.[2]

The ruler, in turn, anticipates the potentate's actions and decides whether to establish direct rule.

[2] In section A.1 of the appendix, we characterize the potentate's equilibrium behavior using a more general form for $\rho(\cdot)$.

He attempts to implement direct rule if:

$$C_A \leq \begin{cases} \left[1-\rho(r_{G=0}\gamma T)\right]\left[\gamma T\right] & \text{if } G=0 \\ \left[1-\rho(r_{G=1}\gamma T)\right]\left[\gamma T-\omega(T,\alpha)C_R\right] & \text{if } G=1. \end{cases} \tag{T3}$$

In deciding whether to attempt to establish direct rule, the ruler weighs the costs and benefits given the expected reaction from the potentate. A successful establishment of direct rule enables the ruler to capture a higher share of the tax revenue. On the other hand, the costly attempt to set up direct rule can be sabotaged by the potentate with some probability, and, even if it succeeds, direct rule potentially exposes the region to rebellion.

Comparative statics. We now consider how a fall in population affects the establishment of direct rule in equilibrium. We focus on dramatic demographic shocks, such as the one experienced in the Americas following the Conquest. In Section A.2 of the appendix, we characterize how the equilibrium changes with smaller demographic shifts.

Large shock to population. Consider a decline in population that shifts the equilibrium from one in which condition (T1) is met and the local potenate decides to guard the region against rebellion to one in which this is no longer preferred. This discontinuity occurs because there is a population threshold, $\underline{T}$, below of which the potentate will no longer pay to defend his district as both the risk of rebellion and his own expected share of future tax revenue are declining in population. Because all of the terms on the right hand side of condition (T1) are declining in population—the risk of rebellion, the potentate share of tax revenue, and the likelihood of successfully resisting political centralization—this condition will necessarily be satisfied if the population declines enough.

Note that the probability of successful resistance to the attempted establishment of direct rule, $\rho(r^*\gamma T)$, includes not only the resources available to the potentate, γT, but also the intensity of his opposition to direct rule, r^*. When the population threshold $\underline{T}$ is crossed and the potentate swiches from guarding his region ($G = 1$) to leaving it exposed to rebellion ($G = 0$), there is a discontinuous reduction in his equilibrium resistance to direct rule (i.e., $r^*_{G=1} > r^*_{G=0}$), as illustrated by condition (T2). This generates a discontinuity in the probability of succesfully stopping the ruler's attempt to establish direct rule, $\rho(r^*_{G=1}\gamma T) > \rho(r^*_{G=0}\gamma T)$.[3]

Given this discontinuous change in the potentate's behavior, the ruler has a greater incentive to attempt to establish direct rule because of the increased likelihood that such an effort will succeed. This expands the range of administrative costs at which the ruler is willing to seek the establishment of direct rule. To see this directly, consider the maximum administrative cost that the ruler is willing to disburse to establish direct rule (condition (T3)) at population threshold $\underline{T}$. This cost is higher when the potentate stops defending his region if:

$$\left[1 - \rho(r^*_{G=0}\gamma\underline{T})\right]\gamma\underline{T} \geq \left[1 - \rho(r^*_{G=1}\gamma\underline{T})\right]\left[\gamma\underline{T} - \omega(\underline{T},\alpha)C_R\right],$$

which simplifies to

$$C_R \geq \frac{\gamma\underline{T}}{\omega(\underline{T},\alpha)}\left[\frac{\rho(r^*_{G=0}\gamma\underline{T}) - \rho(r^*_{G=1}\gamma\underline{T})}{1 - \rho(r^*_{G=1}\gamma\underline{T})}\right]. \tag{T4}$$

This condition is always met, and it implies that for a given administrative cost of establishing direct rule, the ruler is more likely to seek a transition to direct rule when the population threshold $\underline{T}$ is crossed.[4]

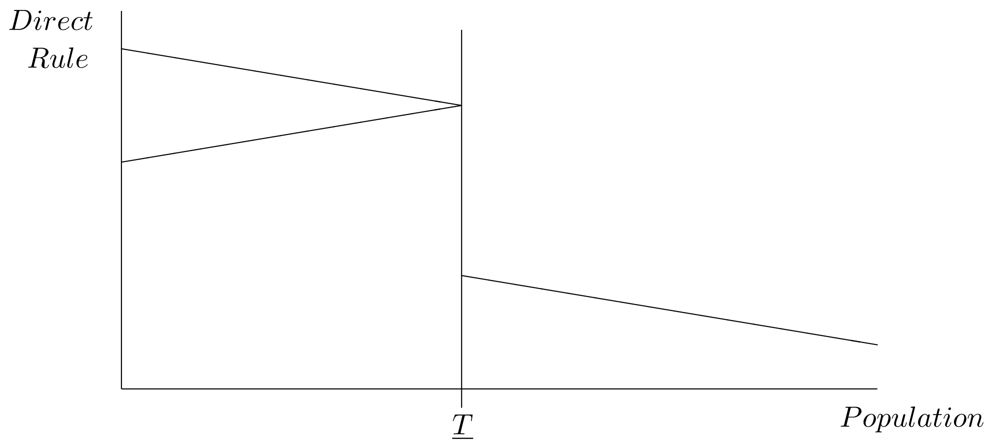
Figure 1 illustrates the direct rule outcome in equilibrium as a function of population. Above the population threshold $\underline{T}$, marginal decreases in population lead to a higher likelihood of direct rule; below the threshold, the marginal effect of population is ambiguous (see section A.2 of the appendix for a characterization of these results). As population declines and crosses the threshold, there is a discontinuous jump in the likelihood of adopting direct rule.

Condition (T4) also suggests that the discontinuous jump in the maximum cost that the ruler is willing to spend in establishing direct rule is increasing in the baseline probability of rebellion,

[3] Specifically, optimal potentate resistance implies that $\rho(r^*\gamma T) = \frac{1}{2\bar{T}^2}[\gamma T - \underline{\mathrm{u}}]$ if $G = 1$, and $\rho(r^*\gamma T) = \frac{1}{2\bar{T}^2}[(1 - \omega(T,\alpha))\gamma T - \underline{\mathrm{u}}]$ if $G = 0$. Thus, a discontinuous decline in potentate resistance from $r^*_{G=1}$ to $r^*_{G=0}$ leads to a discontinuous drop in the probability of successful resistance to direct rule, from $\rho(r^*_{G=1}\gamma T)$ to $\rho(r^*_{G=0}\gamma T)$.

[4] This is the case because the cost to put down a rebellion, C_R, is always positive by assumption, and the right hand side of the inequality must be negative (because $\rho(r^*_{G=1}\gamma T) > \rho(r^*_{G=0}\gamma T)$).

Figure 1: Direct Rule Adoption in Equilibrium



$\omega(\underline{T}, \alpha)$. To see this, note that the right hand side of condition (T4) declines with $\omega(\underline{T}, \alpha)$. For a given cost of putting down a rebellion, C_R, this implies a larger difference between the maximum administrative cost of direct rule, c, in condition (T3) when the potentate guards against rebellion, $G = 1$, as compared to when he does not, $G = 0$. Since $\omega(\cdot)$ is increasing in α, if a region's characteristics facilitate collective action (i.e., the region has higher α), the effect of the population collapse on the implementation of direct rule will be magnified.

The value of the potentate's outside option. We can draw one additional implication from the model related to the availability of an outside earnings option for the potentate. A more valuable outside option reduces the potentate's optimal level of resistance to any attempt by the ruler to establish direct rule. This is because being stripped of power becomes relatively less painful (see condition (T2)). Simultaneously, the potentate is less likely to defend the region for a given cost of defense (see condition (T1)). These changes in the potentate's behavior, make it more likely that the ruler will seek to establish direct rule. This is due both to the lower expected resistance from the potentate and the reduced likelihood that the potentate will provide an effective defense against local rebellion.

Observable implications. To summarize, we derive the following observable implications of the model:

(i) As population declines precipitously, the ruler is more likely to establish direct rule.

(ii) The effect of population collapse on the likelihood of direct rule is increasing in the rebelliousness of the region.

(iii) The effect of population collapse on the likelihood of direct rule is increasing in the value of the outside option available to the potentate.

(iv) More valuable outside options for the potentate lead to a higher likelihood of direct rule in equilibrium.

In the remainder of the paper, we empirically evaluate these predictions using evidence on the uneven transition to direct rule in colonial Mexico. We describe the setting that we examine in the following section.

2. Historical Setting

Though primarily thought of as an institution of labor exploitation, the Spanish *encomienda* was also designed to facilitate the rapid extension of political authority through indirect rule[5] (García Martínez 2011). Following the fall of the Triple Alliance (Aztec Empire), the Spanish Crown was faced with the challenge of administering an expansive new territory far from the metropole. Royal authorities used the promise of indigenous tribute (a traditional capitation tax levied on heads of household) and labor to outsource the conquest of new territory to conquistadors. In exchange, the encomenderos provided for local defense, tax collection, and Christian conversion. As with British indirect rule in Africa, the Spanish *encomienda* functioned by superimposing institutions of indirect rule over the pre-existing political organization and tribute system in the territory, in this case, primarily that of the Triple Alliance (Gibson 1964; Hassig 1985; Abernethy 2000; García Martínez 2011). In the early years of the colony, the *encomienda* provided a relatively low-cost way to incorporate both conquistadors and indigenous elites into the colonial state, providing a "rickety superstructure of government" in places where the reach of the Crown might not have extended otherwise (Gibson 1964; Knight 2002, p. 29; García Martínez 2011, p. 1938).

[5] The institutions associated with indirect rule vary widely. The Mexican case arguably corresponds most closely with what Naseemullah and Staniland (2014) term "hybrid rule" in their typology of direct rule institutions.

The delegation of power to local these local intermediaries does not come without costs, as highligted in Section 1. The emerging power and autonomy of the *encomendero* class quickly began to be perceived as a threat to the Church and the Crown (Gibson 1964; Yeager 1995; Knight 2002).The first royal decrees aimed at curtailing the rights of *encomenderos* came in 1523, only two years after the fall of Mexico-Tenochtitlan. However, the Crown's early efforts to regain political control from local elites were met with decidedly limited success given extensive *encomendero* resistance and the ongoing political challenges of the Conquest (Gibson 1964; Yeager 1995; Knight 2002). A striking example of this resistance came following the announcement of the New Laws of 1542, which were designed to place limits on *encomendero* authority, and which were quickly repealed in the face of a significant and organized elite rebellion (Gibson 1964; Knight 2002). While comparatively subdued in Mexico, the revolt of *encomenderos* in Peru culminated in the overthrow of the local colonial government and the execution of the viceroy, severely threatening control over the colony. Alarmed at these developments, King Charles I reversed course on plans to phase out the encomienda and rein in the *encomendero* class, tentatively allowing encomenderos to maintain a degree of local political autonomy (Zavala 1973; Knight 2002).

What eventually subverted *encomendero* power was the catastrophic collapse of Mexico's indigenous population. Though precise figures vary, it is estimated that the indigenous population of Central Mexico declined by over 90% during the first century of colonial rule due to drought and disease (Cook and Borah 1971; Hassig 1985; Knight 2002). Much of the demographic collapse can be attributed to a series of epidemics that swept across the country in the sixteenth century (Hassig 1985; Acuña Soto, Calderon Romero and Maguire 2000; Acuña Soto et al. 2002). The sharp decline of the population reshaped the political economy of the colony in numerous ways. First, the evaporation of tribute income undermined the *encomienda*, reducing both the willingness and ability of "politically subdued" and "largely impoverished" *encomenderos* to resist the Crown's efforts to centralize political authority (Zavala 1973; Hassig 1985; Knight 2002, p. 57). Faced with a declining local population to tax, elites increasingly transitioned to other forms of wealth extraction in the agricultural and mining sectors (Gibson 1964; Lockhart 1969; Zavala 1973). The collapse itself facilitated this process by making it easier for elites to acquire land and reducing the competition from indigenous growers in agricultural markets (Florescano 1976; Sellars and Alix-Garcia 2016). Increasing mining activity and the development of internal transport networks provided other opportunities for elites to gain wealth and power outside of the *encomienda*, further lowering their incentives to resist direct rule.

Beyond reducing the incentives and ability of elites to resist the transition from the encomienda, the demographic collapse had broader societal effects that also facilitated the centralization of political control. The sharp decline in population and subsequent relocation of survivors greatly depressed the the threat of indigenous rebellion. In the wake of major epidemics, indigenous social institutions facilitating collective action collapsed, population pressures on land decreased, and survivors were left "demoralized and disorganized" (Katz 1988, p. 80). Controlling local rebellion had been a central responsibility of *encomenderos* and a justification for the continuation of indirect rule. Though pacification efforts were costly to the Crown and *encomenderos* alike, the latter were perceived to be better able to provide security given their proximity to the districts and specialized local knowledge. The risk of increasing rebellion was even cited by some elites, and even the clergy, as a justification for opposing political centralization (Gibson 1964; Zavala 1973, p. 83). In a 1545 letter, one *encomendero* said that the mere act of announcing limits on *encomienda* holdings "had increased the insolence of the Indian population" and diminished local control (qtd in Zavala 1973, p. 84). However, as the threat of social unrest declined following the collapse, this lessened the value of maintaining indirect rule.

By the end of the sixteenth century, the Crown had implemented numerous provisions eroding *encomendero* power and the encomienda had faded from importance in much of central Mexico (Gibson 1964; Hassig 1985; Knight 2002). Private *encomiendas* were gradually replaced by *corregimientos*, public offices through which royal officials directly collected taxes for the Crown.[6] This institution had several features that enhanced royal control over the colony. Unlike *encomenderos*, the holders of these offices, *corregidores*, were paid directly by the royal government, answered to

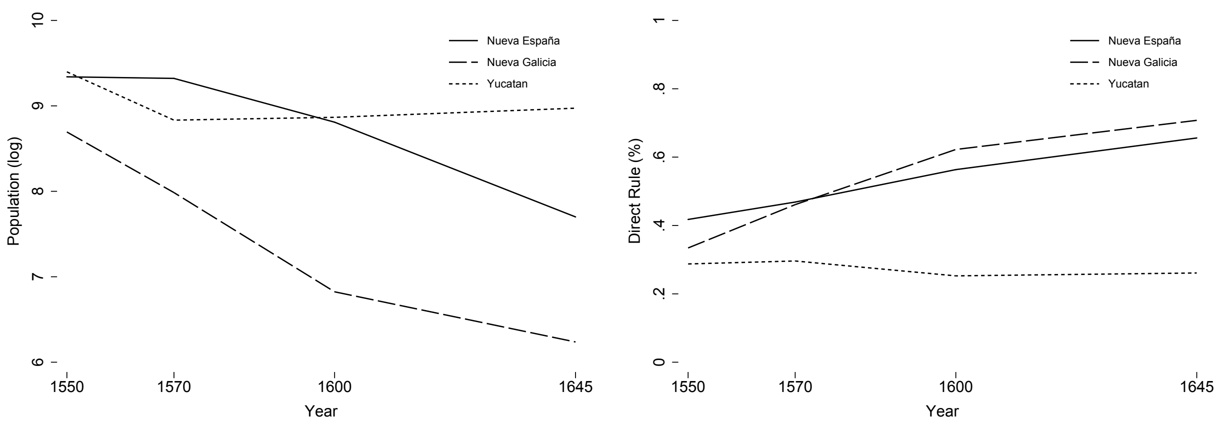
[6]Though *corregidores* were paid directly by the Crown, they retained some of the rights to local extraction previously held by *encomenderos*. These offices began as salaried positions, but the Crown began to auction them off in the second half of the seventeenth century (Pietschmann 1972; Guardado 2016).

higher-level royal officials, and were tasked with a variety of new administrative responsibilities (Gibson 1964; Knight 2002).

Though the immediate effects of this transition on the surviving indigenous population remain the subject of debate (e.g., Gibson 1964, 82–3), *corregidores* became "useful agents of centralization," helping the government to consolidate power within the royal bureaucracy (Knight 2002, 54). *Corregimientos* became the keystone of the Spanish bureaucracy in the Americas. Through centralizing tribute collection through the *corregimiento*, the Crown "penetrated and dissolved the private fiefs of the early *encomenderos*", reigning in the political and economic power of local elites and strengthening state institutions. The centralization of fiscal authority through the *corregimiento* enabled the Crown to standardize tribute rates and to further bureaucratize the process of tax collection (Gibson 1964; Knight 2002). As in Europe, this centralization of fiscal authority had wide-reaching implications for Mexico's future institutional development (Dincecco 2009).

Crucially, however, the transition to direct rule was not universal. While the Crown quickly moved to gain direct control over holdings in much of the country, in other areas it actively perpetuated the *encomienda* system, quickly reassigning private holdings to new *encomenderos* upon their reversion to Crown control. Scholars emphasizing the near-complete collapse of the Mexican *encomienda* by the end of the sixteenth century have focused almost exclusively on the area surrounding Mexico City (e.g., Gibson 1964; Hassig 1985). Several factors contributed to the rapid transition to direct rule in this region, as highlighted in Section 1. As the center of Spanish power in the Americas, Mexico City was a hub of economic and political activity and the primary area of colonist settlement (Gibson 1964; Knight 2002). Crown control over this region was as strong as anywhere else in the Empire, reducing the potential political and social benefits of indirect rule for royal officials. In addition, the relative attractiveness of maintaining the *encomienda* for local elites was somewhat diminished given other opportunities for economic extraction in the region. This was especially true as tribute revenues declined following the demographic collapse (Hassig 1985; Knight 2002). Land investment in particular became increasingly attractive as colonists' demand for agricultural products in Mexico City outstripped the productive capacity of the shrinking indigenous population. Land concentration and speculation powered the rise of a new class of landed elites in central Mexico, which included no small number of former *encomenderos* in its ranks (Gibson 1964; Lockhart 1969; Keith 1971; Florescano 1976). This economic and political shift to land (as opposed to tribute and labor) exploitation further dampened the incentives of local elites to contest the centralization of fiscal capacity through the *corregimiento* (Knight 2002).

Figure 2: Regional Trends in Indigenous Population and Direct Rule



(a) Population (log) (b) Direct rule

Note: The graphs plot the average population (log) and direct rule (%) across the districts in each region. Data sources and construction are discussed in Section 3. These data use a ten-year bandwidth around population cutpoints.

In the Yucatán by contrast, where indigenous populations remained relatively dense and tied to villages, the *encomienda* thrived as an institution well into the eighteenth century (Gerhard 1993*c*; Knight 2002). Though Spanish contact with Yucatán's indigenous population predated the conquest of central Mexico, political control over the region remained tenuous until the mid-1540s (Gerhard 1993*c*). The conquest of the Yucatán was complicated by several factors, many of which also contributed to the long-term survival of indirect rule. One such factor was the high level of resistance provided by the region's indigenous population due to its relative homogeneity (nearly all spoke intelligible dialects of Yucatec Maya) and to the surviving decentralized political structure of the Mayan Empire, which complicated efforts to consolidate political control (Gerhard 1993*c*). An additional factor was the difficulty of attracting Spanish settlement to the region due to the relative absence of outside earnings opportunities. The region contained few precious metals, and the potential for agricultural investment was limited both by the generally poor quality of its land

and by its considerable distance from trade routes in the center of the colony. Granting rights to indigenous tribute and labor thus remained the primary mechanism for attracting Spanish settlement to the Yucatán, and the Crown saw increasing settlement as crucial to maintaining control over the region (Gerhard 1993*c*; Knight 2002, p. 28–9). As a result, the Yucatec *encomienda* survived until late in the colonial period, continuing to serve as a low-cost method of colonial administration as it had earlier in central Mexico (Garcia Bernal 1979; Gerhard 1993*c*; Knight 2002).

In the north, the trajectory of the transition to direct rule differed considerably within the region. In much of Nueva Galicia, both economic and political conditions resembled those of central Mexico, and the centralization of fiscal capacity happened in a similar manner. Though farther from the capital, this region's fertile soil and proximity to growing mining centers like Guanajuato and Zacatecas made it especially suitable for agricultural production. In addition, the potential for rural revolt was reduced by the small and fragmented nature of much of the region's indigenous population, reducing the Crown's reliance on indirect rule for political control (Gerhard 1993*b*, p. 39–45). Together, these factors enabled the relatively quick centralization of fiscal authority, especially in the southern portions of Nueva Galicia (Gerhard 1993*b*; Knight 2002). Much of the north, however, differed from this general pattern. The areas north and east of Nueva Galicia rarely received *encomiendas* as they had existed in central Mexico. Too sparsely settled to provide a source of tribute, the *encomienda* in these regions referred to a distinct set of institutions aimed at harnessing indigenous labor for mining and other activities (Cuello 1988; Gerhard 1993*b*, p. 9–10, 165). Though different in practice from the *encomienda* of the center, the reasons for the long survival of the *encomienda* of the far north are similar to those explaining the institution's persistence in the Yucatán. In Nuevo León and Saltillo, for example, the long survival of *encomienda*, and the large-scale abuse of the institution, can be traced to the tenuous royal political control of the region, the ongoing threat of rebellion from indigenous groups, and the absence of outside possibilities for elite extraction to attract settlement (Cuello 1988, p. 693–4; Gerhard 1993*b*, p. 344–6).

The transition to direct rule thus differed considerably across space in Mexico. In some areas, the precipitous decline in population undermined the threat of rebellion and the economic value of local tribute collection, reducing the attractiveness of and reliance on indirect rule institutions for both the Crown and local elites. In other areas, the survival of the local population kept the threat of rebellion comparatively high and made the transition to wealth extraction through land more difficult. In the remainder of the paper, we systematically evaluate whether the differing severity of Mexico's demographic collapse can explain these spatial differences in Mexican institutional development.

3. Data

To empirically evaluate the relationship between Mexico's population collapse and the adoption of direct rule, we digitize subnational data on the population collapse, the dissolution of the *encomienda*, and a series of covariates for north-central, central, and southern Mexico. As discussed above, the institutions governed by the *encomienda* in the north of Mexico were fundamentally different given the absence of sedentary indigenous populations in much of this area. Our main source is Gerhard's classic three-volume guide to colonial Mexico (1993*a*; 1993*b*; 1993*c*), which contains a host of information on population, cultural history, and local political economy at the level of Mexico's political divisions as of 1786. We discuss the construction of our main variables below.

3.1 Colonial Indigenous Population

Gerhard draws on numerous sources to construct estimates of district population at scattered intervals during the colonial era, relying most heavily on the *relaciones geográficas*, a series of questionnaires distributed by the Crown to local officials beginning in the middle of the sixteenth century. A goal of these questionnaires was to assess the size of the local population to improve tribute collection and colonial administration (Gerhard 1993*a*; Knight 2002). Given the importance of this information, the Crown implemented several policies to discourage misrepresentation on the questionnaire, including a review process through which both Spanish and Indian observers could challenge the results in an official hearing (Cook and Borah 1960; 1971; Gerhard 1993*a*; Knight 2002). Gerhard complements information from the *relaciones* with additional sources, such as parish registers and census lists, to construct more complete population estimates when possible.

The reliability of Gerhard's population data is discussed in depth in Gerhard (1993*a*) and Sellars and Alix-Garcia (2016).

While data are sparse for much of the colonial period, we are able to construct comprehensive estimates of local population at four cutoffs between the middle of the sixteenth and middle of the seventeenth centuries: 1550, 1570, 1600, and 1645. These dates correspond with the years of relatively complete *relaciones* (Gerhard 1993*a*, p. 28–33). We use a five-year bandwidth on either side of each cutoff to measure district population.[7] Where district populations are measured in tributary units (i.e., the number of individuals paying tribute to the Crown), we convert to population using a multiplier of 2.8 as suggested by Cook and Borah (1960; 1971). In an appendix (Section B.2), we replicate our analysis in the subsample of district-years where data was recorded in terms of tributary units.

3.2 *Encomienda* and Direct Rule

To construct our measure of direct rule, we draw on Gerhard's lists of *encomiendas* in each district. These lists were compiled from the *relaciones geográficas* and other archival sources. Gerhard traces the history of each private holding where possible, noting the dates where an *encomienda* was brought under Crown control or was reassigned to another *encomendero*. Though the record of individual *encomienda* holdings is often sparse, we are able to use this source to calculate a district-level measure of the expansion of direct rule over time. To do this, we aggregate the list of *encomiendas* in Gerhard by district and calculate the proportion of holdings that have been taken by the Crown in each of the population cutoffs identified above. We exclude districts where there were no *encomiendas*, which were generally places with a limited pre-Columbian population.[8] We record the status of a given *encomienda* as missing if Gerhard is unable to identify its status as of a given cutoff, though this is relatively rare in the data.

[7]Our results are robust to using a slightly larger bandwidth to 10 years, which increases the sample size considerably. These results are repsented in appendix Section B.3.

[8]A small number of areas were exempted from the *encomienda* for political reasons, notably Tlaxcala for its cooperation with Cortés during the Conquest. These areas are also excluded from this analysis.

3.3 Additional Variables

We include a series of geographic and political control variables to account for other factors that might have influenced both the decline in population and the adoption of direct rule. Most of the social indicators, such as the number of languages spoken in each district at the time of the Conquest and the number of settlements in 1786, were also digitized from Gerhard's data. We also include a series of geographic controls. These include the district land area, the minimum distance from the district to Mexico City, the average district elevation, and an indicator for whether a given district contains land in a malarial zone (i.e., under 1000 meters of elevation). The distances were calculated using GIS software using data from Mexico's National Institute of Statistics and Geography (INEGI). The elevation measures were extracted from a 90-meter resolution digital elevation model provided by INEGI. We extract a measure of low-input, rain-fed maize productivity (the primary staple crop in Mexico) using data from the Food and Agriculture Organization's Global Agro-Ecological Zones. Finally, our measures of mine and road locations in the sixteenth century were digitized from data in UNAM (2007).

4. Research Design

Evaluating the causal relationship between population dynamics and the transition to direct rule is challenging given the complex interplay between demographics and political institutions. Mexico's population collapse was related to numerous geographic and political factors, many of which are likely to independently influence the decision to centralize tribute collection and political rule.

We adopt two related strategies to address these concerns. The first is a difference-in-differences approach, which allows us to examine within-district changes in population and the adoption of direct rule over time. This aproach allows us to account for time-invariant omitted variables that could be related to the adoption of direct rule in a given district and for unobservable features of the time period that are common across units. The baseline estimating equation is:

$$DirectRule_{it} = \beta lnPop_{it} + \lambda_t \times X_i + \lambda_t + \gamma_i + \varepsilon_{it}, \tag{1}$$

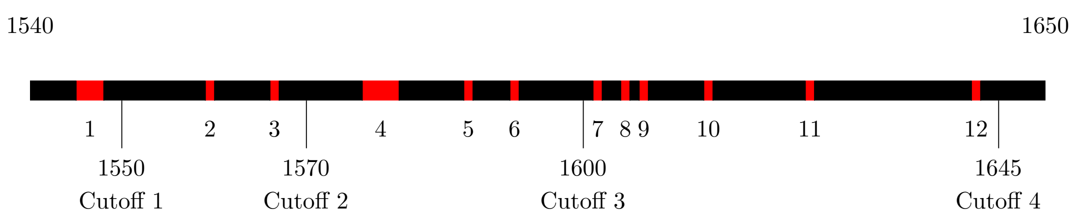
where $DirectRule_{it}$ is the proportion of *encomiendas* in division i that have been taken by the Crown and turned into *corregimientos* by year t; $lnPop_{it}$ is the log of the population of district i in year t; γ_i represent district indicators; X_i is a vector of district-specific controls interacted with each year indicator λ_t, and ε_{it} is an error term. While the year and district fixed effects address common and time-invariant factors that may have influenced the adoption of direct rule, respectively, we also include time-interacted controls for a variety of political and geographic factors (elevation, surface area, whether the district is in a malarial zone, and distance to Mexico City) that may have had evolving impacts on the adoption of direct rule over time. We also include time-interacted controls of climatic conditions (mean and standard deviation of the PDSI, as discussed below). Hypothesis (i) dervied from the model indicates that $\beta < 0$.

To causally interpret $\hat{\beta}_{OLS}$, we need to assume that $E(\varepsilon_{it}|lnPop_{it}, \lambda_t \times X_i, \lambda_t, \gamma_i) = 0$. In particular, this assumption implies that, in the absence of a demographic collapse, the trend towards direct rule would have remained parallel between those districts that suffered a relatively large population decline and those that did not. This assumption would be violated if there were any omitted, time-varying factors that are related to the population change and the adoption of direct rule. If direct rule had a causal effect on population dynamics, this would also violate this assumption. Of particular concern is the possibility, suggested by some scholars, that the extractive practices related to the *encomienda* may themselves have contributed in important ways to the demographic collapse (e.g., Reséndez 2016).

To address these concerns, we employ a second approach: an instrumental-variables empirical strategy based on the characteristics of a series of severe epidemics in the late sixteenth and early seventeenth centuries. The vast majority of population loss in the early colonial period was due to disease (Gibson 1964; Hassig 1985; Knight 2002). While some outbreaks—such as the famous smallpox of 1519–21—were caused by European diseases, numerous others have been traced to a pathogen originating in the Americas. Known as "cocolitzli," this disease is believed to have been a climate-related pathogen similar to hantavirus that was transmitted by rodents (Acuña Soto, Calderon Romero and Maguire 2000; Acuña Soto et al. 2002). Like hantavirus and other rodent-transmitted diseases, cocolitzli emerges during years of above-average rainfall following severe droughts. During periods of severe drought, disease-carrying rodents concentrate around limited water and food resources. This causes the pathogen to spread among the rodent population. When climatic conditions improve, the rodent population rebounds and spreads into farm fields and homes. People contract the disease by inhaling the rodents' feces.

Using a similar approach to that of Sellars and Alix-Garcia (2016), we construct instruments for the decline in population by identifying districts that experienced the climate conditions associated with cocolitzli transmission. Figure 3 presents a timeline of noted cocolitzli outbreaks from Acuña Soto et al. (2002) (in red) alongside the population cutoffs of the Gerhard data, as described above. To construct our instruments, we extract district-year measures of climate conditions around each of the epidemics using data from the North American Drought Atlas (Cook and Krusic 2004). This source provides an estimate of the annual Palmer Drought Severity Index (PDSI) for a grid of points in North America based on a network of overlapping tree-ring chronologies that have been linked with contemporary climate data. PDSI is measure of soil moisture relative to normal conditions at a given location, where negative values reflect drier-than-normal conditions. Using the Cook and Krusic (2004) grid, we interpolate a surface of estimated PDSI for each year, weighted by the inverse distance from Atlas grid points. We then extract the space-weighted average PDSI over the surface for each district-year in our sample.[9]

Figure 3: Population Cutoffs and Cocolitzli Epidemics



We construct two instruments for the decline in population based on the climate conditions associ-

[9]Because of the lack of usable tree rings in southeastern Mexico and the Yucatán penninsula, we do not have climate data for the southeastern portion of the sample and drop these observations in the instrumental-variables estimations.

ated with cocolitzli. The first instrument is an indicator for whether a given district experienced a severe, two-year drought ending 1-2 years prior to any outbreak of cocolitzli in the prior period. For example, the indicator would take the value 1 in a given district at the 1570 cutoff if that district had experienced a long drought ending just prior to the cocolitzli outbreaks of 1559 (2) or 1566 (3).[10] The second instrument we construct is the numeric difference between the peak severity of a given pre-outbreak drought (i.e., the lowest PDSI recorded in the drought ending 1-2 years prior to the outbreak) and the PDSI of the first non-drought year. Where a district experienced more than one pre-outbreak drought in a given period, we use the largest swing between severe drought and rainfall, in line with the argument of Acuña Soto et al. (2002) that the swing from drought conditions to rain was conducive to the emergence and spread of cocolitzli.

Formally, our IV estimating equations are:

$$lnPop_{it} = \delta PDSI_{it} + \lambda_t \times X_i + \lambda_t + \gamma_i + \nu_{it} \tag{2}$$

$$DirectRule_{it} = \beta ln\hat{P}op_{it} + \lambda_t \times X_i + \lambda_t + \gamma_i + \varepsilon_{it} \tag{3}$$

where the $PDSI_{it}$ is the instrument and the other variables are defined as above. Because PDSI is standardized across space, fluctuations in this measure are likely to be orthogonal to geographic or historical confounds. However, to account for the fact that certain locations may have higher year-to-year variability in PDSI, we include both the mean and standard deviation of PDSI across each period as a control variable. We also include these variables in the difference-in-differences estimations for consistency.

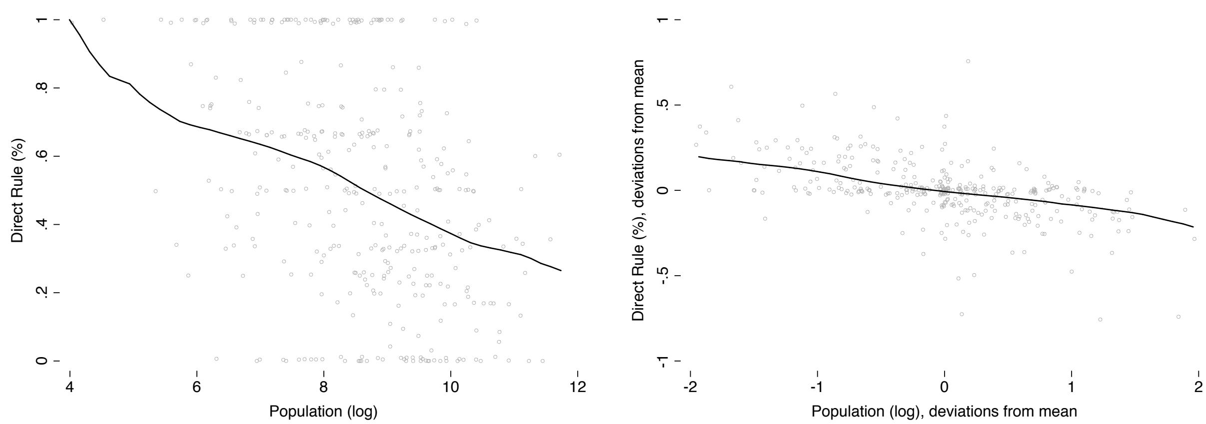
5. Results

As developed in Section 1, our theory posits an inverse relationship between the remaining size of the local indigenous population and the transition to direct rule. We begin by providing graphical evidence on this relationship in our data (Figure 4). In the left panel, we pool all district-year

[10]In table B.9 in the appendix, we compare average values of observables at the beginning of our panel (1550) between those districts that subsequently experienced at least one of these drought-rain shocks and those that did not. Only the distance to Mexico City is significantly different between these groups, with those affected by drought-rain shocks being father away from the capital on average.

observations and plot the proportion of *encomiendas* that have been taken by the Crown by a given year in a given district (i.e., the extent of the transition to direct rule) over the logged local indigenous population in that year. In line with our theory, there is steep negative relationship between these variables. In the right panel, we provide further graphical evidence of this inverse relationship by demeaning the data and examining within-unit changes in population and the strength of direct rule over time. Together, these provide a first set of suggestive results in support of our theory.

Figure 4: Indigenous Population and Direct Rule



(a) Pooled data

(b) Deviations from the mean

5.1 Difference-in-Differences Estimates

In Table 1, we report results from the difference-in-differences estimtation (equation 1). The dependent variable in these (and all other) regressions is the district proportion of local *encomienda* holdings that the Crown has brought into direct rule by a given year. Reported are the point estimates on the coefficient on district-year population and the standard errors, which are clustered by district in all specifications. In Columns (1) and (2), we provide estimates using the full sample of observations. The first column presents our baseline estimates, including only district and year fixed effects. In the second column, we add our full set of time-varying and time-interacted control variables as discussed above. We repeat our analysis in columns (3) and (4) on the subset of observations that have available climate data to execute our instrumental-variables empirical strategy.

This reduces the size of our sample by a little under 10%.

Table 1: Indigenous Population Collapse and Direct Rule: Difference-in-Differences

	Direct Rule (% of District)			
	Full Sample		IV Sample	
	(1)	(2)	(3)	(4)
Population (log)	-0.092**	-0.095*	-0.088**	-0.095*
	(0.044)	(0.051)	(0.043)	(0.049)
Climate controls	No	Yes	No	Yes
Controls × Year FE	No	Yes	No	Yes
Year FE	Yes	Yes	Yes	Yes
District FE	Yes	Yes	Yes	Yes
Within-District Mean of DV	0.50	0.51	0.51	0.51
Within-District SD of DV	0.14	0.13	0.13	0.13
R sq.	0.86	0.85	0.83	0.84
Observations	350	319	296	296
Number of districts	158	137	114	114

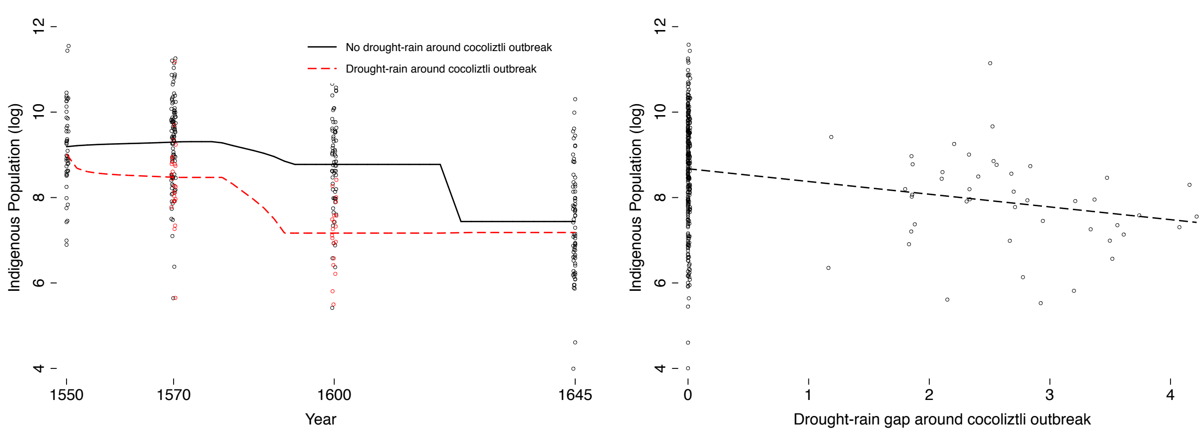
OLS estimations. See equations (1) for the econometric specification. The unit-of-analysis is the district-year. Standard errors (clustered at the district level) in parentheses.

In all four specifications, the estimates are negative and statistically significant at conventional levels. Moreover, they are of almost identical magnitude. This modest but sizeable effect is consistent across all four specifications, including or excluding the vector of time-interacted control variables and examining the full or restricted subsample of observations. In the Appendix, we replicate our findings using the same empirical specifications but with data recorded in tributary units (Section **??**). Together, these results provide strong support for the theorized negative relationship between population and the adoption of direct rule. Taking the estimates of column (2), the results suggest that a one standard deviation decrease in within-district population increases the proportion of holdings that have transitioned to direct rule by 8.4 percentage points, or roughly two-thirds of the within-district standard deviation of this variable.

5.2 Instrumental-Variables Estimates

We now turn our attention to the instrumental-variables regressions. We begin by graphically examining first-stage and reduced-form evidence linking our climate instruments—the indicator for whether a district experienced a long drought followed by rainfall prior to an outbreak of cocolitzli and the absolute change in PDSI between the severest point in the drought and the rebound in rainfall—with the population collapse and the adoption of direct rule, respectively. Figure 5 presents evidence on the first-stage relationship. In the left panel, we plot the trajectory of population over time in areas that experienced (red) and did not experience (black) drought-rain shocks around the time of known cocolitzli outbreaks. Areas affected with a drought-rain shock show a significant decline in population relative to unaffected areas. The effect of the climate shock on the decline in population is especially pronounced in the 1570 and 1600 cutoffs, which correspond with especially severe cocolitzli outbreaks (Acuña Soto et al. 2002). The right panel of Figure 5 relates district-year log population with the swing in PDSI between the low point in the drought and the maximum post-drought rainfall. As indicated by the figure, areas that experienced a larger swing in drought conditions around cocolitzli outbreaks had a lower surviving population on average. This finding is in line with scientific work on the pathogen by Acuña Soto and others. We provide a more comprehensive analysis of first-stage estimates in Table 3 below.

Figure 5: Drought-Rain Around Cocoliztli Outbreaks and Indigenous Population

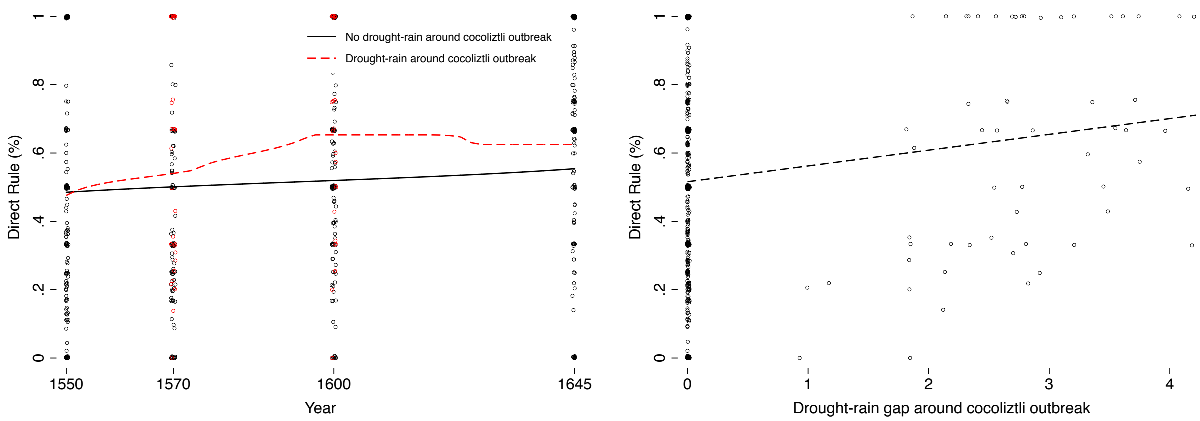


(a) Drought-Rain

(b) Drought-Rain Gap

Graphical evidence on the reduced-form relationship between the climate instruments and the adoption of direct rule is presented in Figure 6. The left panel of the figure plots the proportion of *encomiendas* that had been brought into direct rule by the Crown in districts that experienced (red) and did not experience (black) cocolitzli-related climate conditions. As illustrated by the figure, more *encomiendas* had been taken under the Crown's control by each of the cutoffs in areas that had experienced drought-rain shocks favorable to cocolitzli. As in the first-stage relationships, the reduced-form impact is especially strong in the 1570 and 1600 cutoffs, which is not surprising given the severity of the late-sixteenth-century cocolitzli outbreaks. The right side of the figure illustrates the positive relationship between the magnitude of the climate shock and the adoption of direct rule, as predicted by our theory. Population declined more precipitously in drought-affected areas, thus enabling the adoption of direct rule in these areas.

Figure 6: Drought-Rain Around Cocoliztli Outbreaks and Direct Rule



(a) Drought-Rain (b) Drought-Rain Gap

In Table 2, we present econometric evidence on these reduced-form relationships. The first two columns present reduced-form estimates using the gap between drought severity and rainfall as the climate measure, and the second two columns do the same with the indicator instrument. In Columns (1) and (3), we report baseline estimates, conditioning on year and district fixed effects only. In Columns (2) and (4) we also include the the time-varying climate and year-interacted controls. In all specifications, the coefficients on the climate variables are positive, indicating that districts experiencing climate conditions conducive to cocolitzli outbreaks saw an increase in the proportion of *encomienda* holdings that transition to direct rule by a given cutoff relative to those that did not. This provides additional evidence in support of the theory and the relevance of the climate instruments.

Table 2: Indigenous Population Collapse and Drought-Rain Around Cocoliztli Outbreaks: Reduced Form

	Drought-Rain Gap		Drought-Rain	
	(1)	(2)	(3)	(4)
Drought-rain around outbreaks			0.085	0.15^{*}
			(0.063)	(0.083)
Drought-rain gap around outbreaks	0.036^{*}	0.052^{**}		
	(0.021)	(0.022)		
Climate controls	No	Yes	No	Yes
Controls × Year FE	No	Yes	No	Yes
Year FE	Yes	Yes	Yes	Yes
District FE	Yes	Yes	Yes	Yes
Within-District Mean of DV	0.51	0.51	0.51	0.51
Within-District SD of DV	0.13	0.13	0.13	0.13
R sq.	0.82	0.83	0.82	0.83
Observations	296	296	296	296
Number of districts	114	114	114	114

OLS estimations. See equation (3) for the econometric specification. The unit-of-analysis is the district-year. Standard errors (clustered at the district level) in parentheses.

We now move to our instrumental-variables estimates of the impact of population on the adoption of direct rule. Our main results are reported in Table 3. The results in the first four columns present first-stage (1 and 2) and two-stage-least-squares (3 and 4) estimates using the continuous climate measure (the gap in PDSI between drought severity and the rebound rainfall) as the sole instrument. First-stage estimates indicate that the drought-rain gap is robustly negatively related to population. The Wald F-statistic on the excluded instrument is 17.5 in the baseline specification (3) 18.1 in the specification including control variables (4), providing evidence of instrument relevance. The IV estimates reported in Columns 3 and 4 indicate a strong negative relationship between surviving population and the adoption of direct rule, in line with our theoretical argument. In Columns 5–8, we repeat the analysis, instrumenting for log population using both climate-related measures described above: the drought-rain gap and the indicator for whether a district experienced a severe drought followed by rainfall around years of known cocolitzli outbreaks. First-stage F-statistics of the excluded instruments are slightly weaker than in the single-instrument regressions. P-values for Sargan-Hansen tests of IV overidentifying restrictions are 0.91 (baseline) and 0.76 (with covariates) respectively, which provides no evidence to reject the exogeneity of our instruments (under the assumption that one instruments is valid.) Point estimates for the two-stage least squares results in Columns 7 and 8 are negative and of almost the same magnitude as in the single-instrument regressions. This is additional evidence of the negative relationship between district population and the adoption of direct rule, supportive of the theory outlined in Section 1.

Table 3: Indigenous Population Collapse and Direct Rule: Instrumental Variables

	Population (log)		Direct Rule (% of District)		Population (log)		Direct Rule (% of District)	
	First Stage: OLS		2SLS		First Stage: OLS		2SLS	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Population (log)			-0.26**	-0.33**			-0.26**	-0.34**
			(0.12)	(0.13)			(0.12)	(0.14)
Drought-rain gap around outbreaks	-0.14***	-0.16***			-0.20*	-0.11		
	(0.042)	(0.054)			(0.11)	(0.14)		
Drought-rain around outbreaks					0.19	-0.15		
					(0.38)	(0.43)		
Climate controls	No	Yes	No	Yes	No	Yes	No	Yes
Controls × Year FE	No	Yes	No	Yes	No	Yes	No	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
District FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Within-District Mean of DV	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51
Within-District SD of DV	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
Wald F statistic of excluded instruments			17.9	14.5			13.9	7.10
Hansen J statistic			.	.			0.011	0.090
Hansen J p-value			.	.			0.91	0.76
R sq.	0.93	0.94	0.22	0.19	0.93	0.94	0.22	0.17
Observations	296	296	296	296	296	296	296	296
Number of districts	114	114	114	114	114	114	114	114

See equation (3) for the econometric specification. The unit-of-analysis is the district-year. Standard errors (clustered at the district level) in parentheses.

The IV coefficients are larger than the difference in differences OLS estimates in magnitude. Our IV results in column (4), for instance, suggest that a within-district one standard deviation decrease in population—a dramatic decrease of 0.9 log units—leads to an increase in the probability of direct rule of 29 percentage points, or roughly twice the within-district standard deviation of direct rule. Substantively, these results are supportive of the key role that demographic collapse played in the transition to direct rule.

Though the difference between our OLS and IV estimates is sizeable, we believe that it could be explained by a combination of reverse causality and measurement error in the OLS estimations.

First, the private *encomienda* had direct harmful consequences on the indigenous population, and there are reasons to believe that it may have exacerbated mortality. The abuses of *encomenderos* toward the populations under their control are widely documented in the historical literature, including forcing the population into slavery-like work conditions, imposing restrictions on internal movement, and depriving villages of food through the "over-extraction" of tribute (e.g., Gibson 1964; Zavala 1973; Knight 2002; Reséndez 2016). Any of these factors on their own could increase mortality, especially in the challenging drought and disease environment of the early colonial period. If the private *encomienda* exacerbated the population collapse, this could plausibly introduce a negative countervailing relationship between population and the survival of indirect rule (which are positively related in our theory), leading to attenuation of the point estimates.

Measurement error provides an additional reason that OLS estimates may be attenuated toward zero. Though there is strong evidence that the Gerhard data do capture meaningful variation in local population,[11] measurement error remains a significant concern given the low-information environment of early colonial Mexico and given the peculiarities of the tribute system, which exempted certain segments of the population from paying tribute and thus from being counted in the *relaciones* (e.g., Gibson 1964; Cook and Borah 1971; Gerhard 1993*a*). There are reasons to believe that the mismeasurement of the population variable could induce significant attenuation bias in our OLS estimates,[12] which alone could account for much of the differences in magnitude. Finally, the IV estimates could be larger because the local average treatment effect in the places affected by our instrument is larger that of the whole polity. One potential reason for this could be heterogeneity in the effect of population on the adoption of direct rule due to improved elite outside options. For example, the regions that were most affected by the climate shocks in the 1570 to 1600 period tended to be north of Mexico City, where mining activities had generared improved elite outside options, potentially magnifying the effect of the fall in population on the adoption of direct rule. We evaluate potential heterogeneity of the effect of the population decline in the following subsection.

[11]See Sellars and Alix-Garcia (2016), Appendix A.2.

[12]Card (2001) and Hausman (2001) show that attenuation bias of OLS estimates may exceed 30% due to measurement error in estimations of the impact of education in labor economics, and there is reason to believe that the signal to noise ratio of our population measures may be even smaller than in that context.

5.3 Heterogeneous Effects by Rebellion Potential and Encomendero Outside Options

In addition to linking population collapse and the transition to direct rule, the theory presented in Section 1 generates several additional observable implications: that the effect of the population collapse on the adoption of direct rule is magnified when the latent threat of rebellion is higher (hypothesis ii) and when the elite have more attractive outside options (hypothesis iii). The model also predicts that the adoption of direct rule will be higher in general in the presence of better outside options for elites (hypothesis iv). Because no appropriate instruments are available to evaluate these additional hypotheses, we adapt our difference-in-differences estimation strategy, amending equation 1 to estimate:

$$DirectRule_{it} = \beta_1 lnPop_{it} + \beta_2 lnPop_{it} \times M_i + \lambda_t \times X_i + \lambda_t + \gamma_i + \varepsilon_{it}, \tag{1}$$

where M_i measures either the local population's ability to coordinate a rebellion in district i (to evaluate hypothesis ii), or the value of outside options for the *encomenderos* (to evaluate hypotheses iii amd iv). We measure the potential to coordinate a rebellion with two variables: the number of languages spoken in the district, and the number of towns (available only for 1786).[13] A smaller number of languages/towns should facilitate coordination, and thus make the local population more likely to successfully launch a rebellion. Thus, from hypothesis (ii) we expect that $\beta_2 > 0$ when M_i measures the number of languages/towns.

To assess the heterogeneous effect of population by the availability of outside options for the *encomenderos*, we use the existence of mines in the district in 1600. Hypothesis (ii) indicates that $\beta_2 < 0$ when M_i measures the presence of any mines in the district. To evaluate hypothesis (iv), which states that more valuable outside options should increase the likelihood of direct rule, we simply interact the mine indicator with the year intercepts (i.e., λ_t). Hypothesis (iv) indicates that $M_i \times \lambda_t > 0$.

[13]We note that, if interpreted causally, the estimates of equation 1 could be subject to post-treatment bias when including the number of towns in 1786. This subsection is intended to provide suggestive evidence of potential heterogeneity, though the causal identification of these effects is complicated by this and other factors.

Table 4: Heterogeneous Effect of Indigenous Population Collapse on Direct Rule, by Rebellion Potential: Difference-in-Differences

	Direct Rule (% of District)					
	(1)	(2)	(3)	(4)	(5)	(6)
Population (log)	-0.12**	-0.14**	-0.13**	-0.16***	-0.15**	-0.23***
	(0.057)	(0.063)	(0.051)	(0.054)	(0.062)	(0.071)
Population (log) × Num. of languages	0.0095	0.015			0.0086	0.018*
	(0.0095)	(0.011)			(0.0094)	(0.011)
Population (log) × Num. of towns (1786)			0.0048	0.0074*	0.0048	0.0089**
			(0.0034)	(0.0038)	(0.0033)	(0.0040)
Climate controls	No	Yes	No	Yes	No	Yes
Controls × Year FE	No	Yes	No	Yes	No	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
District FE	Yes	Yes	Yes	Yes	Yes	Yes
Within-District Mean of DV	0.51	0.51	0.50	0.51	0.51	0.51
Within-District SD of DV	0.14	0.13	0.14	0.13	0.14	0.13
R sq.	0.85	0.85	0.86	0.86	0.85	0.86
Observations	332	317	350	319	332	317
Number of districts	143	136	158	137	143	136

OLS estimations. See equations (1) for the econometric specification. The unit-of-analysis is the district-year. Standard errors (clustered at the district level) in parentheses.

First, we evaluate hypothesis (ii), which posits that the effect of population on direct rule should be amplified in places with a high probability of rebellion. We argue that threat of rebellion should be higher where coordination is not complicated by the existence of numerous unintelligible languages or a large number of dispersed settlements. This argument is supported by historical work on our context (e.g., Katz 1988; Gerhard 1993*a*), and by a broader literature on homogeneity, population density, and collective action.In table 4 we present suggestive evidence that the effect of the collapse was magnified where the barriers to collective action were lower. The first column presents estimates of the heterogeneous effect of population on the adoption of direct rule by the number of languages spoken in the district, including only district and year fixed effects. In the second column, we include the full set of control variables. Columns (3) and (4) estimate analogous models using the number of settlements in 1786 as a proxy for the difficulty of collective action, and columns (5) and (6) use both the number of languages and the number of settlements. In all models, districts with less obstacles to coordination—fewer languages and distinct towns—experience a magnified effect of population collapse on the probability of direct rule adoption. The estimates of heterogeneous effect are consistent in magnitude across models, though they are precisely estimated only in columns (4) and (6) Taken together, however, this provide suggestive evidence in support of hypothesis (ii).

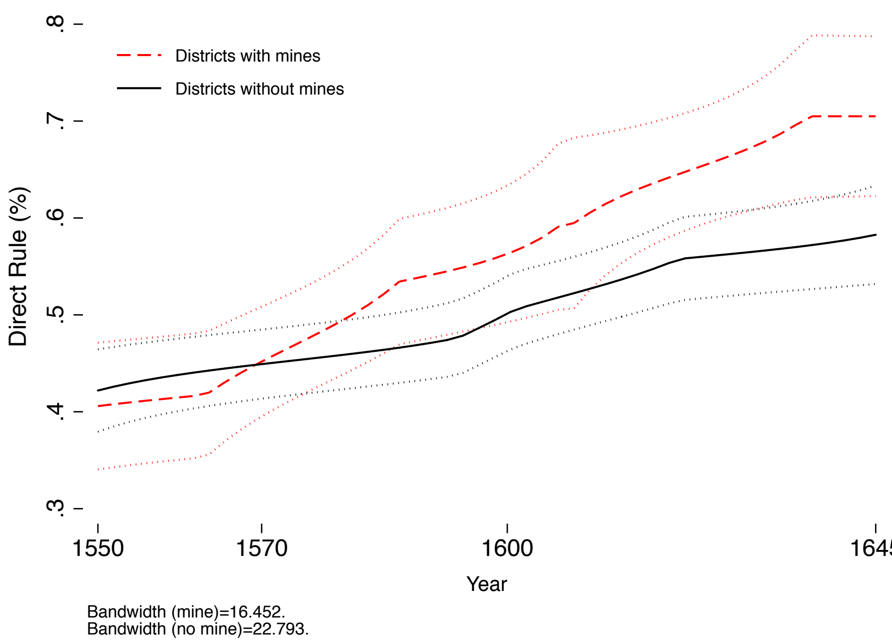
Table 5: Heterogeneous Effect of Indigenous Population Collapse on Direct Rule, by Outside Encomendero Options: Difference-in-Differences

	Direct Rule (% of District)			
	(1)	(2)	(3)	(4)
Population (log)	-0.066*	-0.072		
	(0.038)	(0.048)		
Population (log) × Any mine	-0.067	-0.070		
	(0.050)	(0.051)		
Any mine × 1570			0.18	0.21
			(0.13)	(0.14)
Any mine × 1600			0.20	0.22
			(0.14)	(0.14)
Any mine × 1645			0.23	0.25*
			(0.14)	(0.14)
Climate controls	No	Yes	No	Yes
Controls × Year FE	No	Yes	No	Yes
Year FE	Yes	Yes	Yes	Yes
District FE	Yes	Yes	Yes	Yes
Within-District Mean of DV	0.50	0.51	0.50	0.51
Within-District SD of DV	0.14	0.13	0.14	0.13
R sq.	0.86	0.86	0.86	0.85
Observations	350	319	350	319
Number of districts	158	137	158	137

OLS estimations. See equations (1) for the econometric specification. The unit-of-analysis is the district-year. Standard errors (clustered at the district level) in parentheses.

We now turn our attention to hypotheses (iii) and (iv), which posit that both the impact of population on the establishment of direct rule and the level of direct rule adoption in general should be greater in places where the *encomenderos* have a more valuable outside option. These predictions are generated by the fact that an *encomendero* should become less likely to invest in either defending his district from rebellion or resisting the Crown's attempts to centralize power as the value of his outside option increases. This decreases the Crown's relative cost of establishing direct rule, making it more likely that centralization will be attempted and will succeed. The first two columns in table 5 present suggestive evidence on hypothesis (iii), using the presence of at least one mine in the district as a measure of the value of the elite's outside option. In districts with mines, the effect of population collapse on the adoption of direct rule is larger, though this heterogeneous effect is not precisely estimated. Columns (3) and (4) in table 5 provide supportive evidence on hypothesis (iv). In every period, districts with mines are more likely to adopt direct rule. This pattern is clearly visible in figure 7, which plots the differential trajectory of direct rule adoption in districts with and without mines respectively.

Figure 7: Indigenous Population and Direct Rule, by Outside Encomendero Options



To summarize, we find strong evidence that the precipitous decline in population increased the likelihood of the establishment direct rule in some areas. The effect is sizeable, as estimated in both the difference-in-differences and IV estimations. We provide further support for the theory by assessing three additional implications of the model. We provide suggestive evidence that the effect of demographic collapse on the adoption of direct rule is higher in places with a higher potential for rebellion (i.e., places with fewer languages and towns) and in places with a more valuable outside option available to the *encomendero* (i.e., places that have mines). We also show that places with more attractive *encomendero* outside options tend to transition faster to direct rule.

6. Conclusion

It is now well established that colonial political arrangements leave a lasting legacy for political and economic development. Though numerous scholars have documented the perverse consequences of indirect colonial rule, less is known about how and why a ruler may choose to centralize power, thus building state capacity for future development. We develop a theory of the transition from indirect to direct rule that highlights the strategic interaction between rulers and local elites, who provide local political control in exchange for a cut of tribute and resource wealth. When the threat of elite resistance and generalized rebellion remain high, the ruler is willing to forego the economic benefits of centralization to maintain control over the population at a relatively low cost. When such threats are diminished, such as following a sharp decline in local population, this reduces the riskin of centralizing power, enabling the transition to direct rule. We provide empirical support for the theory using quasi-experimental evidence on the transition from *encomienda* to *corregimiento* in 16th- and 17th-century Mexico. We show that, in support of the theory, the transition to direct rule occurred more quickly in areas that lost more population in the early colonial period. We further show that this effect was magnified in areas with a greater latent threat of rebellion and with more profitable outside earnings opportunities for elites. The results call attention to the roles of elite conflict and population dynamics in institutional development.

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Appendix

Contents

A. Model

A.1 General Form for the Probability of Successful Potentate Resistance, $\rho(\cdot)$

Leaving $\rho(\cdot)$ in a general form delivers the main results described in the text. As established above, when the ruler decides not to establish direct rule, the potentate will not resist (i.e., $r^* = 0$). When the ruler attempts to strip the potentate's rights, however, the optimal resistance is the result of the following optimization problem solved by the potentate:

$$max_{\{r\}} \begin{cases} (1-r)\gamma T + (1-\rho(r\gamma T))\underline{\mathrm{u}} + \big[\rho(r\gamma T)\big]\big[(1-\omega(T,\alpha))\gamma T\big] & \text{if } G = 0 \\ (1-r)\gamma T + (1-\rho(r\gamma T))\underline{\mathrm{u}} + \big[\rho(r\gamma T)\big]\big[\gamma T\big] & \text{if } G = 1. \end{cases}$$

We assume that $\rho(\cdot)$ is concave and increasing in r. Making no further functional form assumptions about $\rho(\cdot)$, the optimal level of resistance is implicitly given by the optimality condition:

$$\frac{\partial}{\partial r}\rho(r^*\gamma T) = \begin{cases} \dfrac{1}{(1-\omega(T,\alpha))\gamma T - \underline{\mathrm{u}}} & \text{if } G = 0 \\ \dfrac{1}{\gamma T - \underline{\mathrm{u}}} & \text{if } G = 1. \end{cases} \tag{A1}$$

This equilibrium behavior by the potentate is affected in the same way by a large shock to population when using a more general form for $\rho(\cdot)$. When the population threshold $\underline{T}$ is crossed, so that the potentate swiches from guarding his region ($G = 1$) to leaving it exposed to rebellion ($G = 0$), there is a discontinuous reduction in his equilibrium resistance (i.e., $r^*_{G=1} > r^*_{G=0}$), which is visible in condition (A1). Note that as long as the potentate defends his region ($G = 1$) and the cost of putting down a rebellion are large enough (i.e., $C_R \geq \dfrac{\gamma}{\omega_T(T)}$), a marginal reduction in the population leads to an increase in the value of condition (T2). This implies that the level of resistance, r^*, which is implicitly defined in condition (T2), has to decline, since $\rho(\cdot)$ is a concave function of r. When the population threshold $\underline{T}$ is reached, the condition discontinuously increases in value, which implies a similarly discontinuous reduction in resistance; thus, $r^*_{G=1} > r^*_{G=0}$. In turn, lower potentate resistance discontinuously reduces the probability of stopping the ruler's attempt to establish direct rule, $\rho(r^*_{G=1}\gamma T) > \rho(r^*_{G=0}\gamma T)$. The rest of the results attained using the specific functional form for $\rho(\cdot)$ then follow.

A.2 Marginal Changes in Population

In this section, we examine the how the optimal level of resistance by the local potentate changes with marginal changes to population. Consider the case in which the potentate decides to guard his region against rebellion (i.e., $G = 1$). In this case, the optimal level of resistance decreases with population. This can be seen from condition (T2), which increases as T decreases. Since $\rho(\cdot)$ is concave in r (i.e., $\rho_{rr} < 0$), a higher value of $\rho_r(r^*\gamma T)$ can only be attained when r^* is smaller.

When the potentate guards his region and the cost for the ruler to put down a rebellion is large enough—that is, when $C_R \geq \dfrac{\gamma}{\omega_T(T)}$—then a decline in local population increases the probability that the ruler decides to establish direct rule. This can be seen from condition (T3), which unambiguously increases as population declines. This means that the ruler is willing to establish direct rule for a larger range of values of the investment/administrative cost of deploying direct rule, C_D.

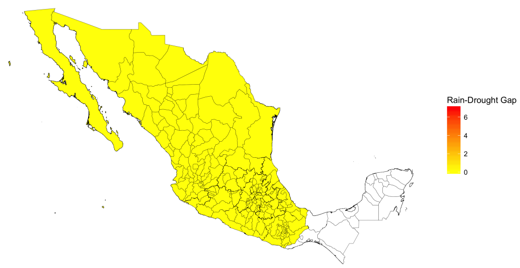
We now turn to the case in which the potentate chooses not to guard the region against rebellion (i.e., $G = 0$). In this case, the effect of increasing population becomes ambiguous. Now condition (T2) either increases or decreases its value depending on whether a decrease in population reduces the risk of rebellion more than it reduces the expected tax revenue that the potentate keeps (this can be seen in the denominator of condition (T2)). If the latter dominates, for example, then condition (T2) increases its value, and the optimal resistance by the potentate is less intense as population declines.

The effect of local population changes on the probability that the ruler decides to establish direct rule is also ambiguous, and can be examined in condition (T3). If the local potentate does not guard against rebellion (i.e., $G = 0$), then the ruler does not consider the probability of rebellion when deciding whether to set up direct rule, and expects less tax revenue as population declines. Even if a local drop in population reduces the resistance of the potentate and thus increases the probability of successfully instituting direct rule, capturing all the available tax revenue will not necessarily compensate for the absolute decline in the amount collected. Thus, a marginal decline in population when the potentate chooses not to guard his region has an ambiguous effect on the likelihood of direct rule.

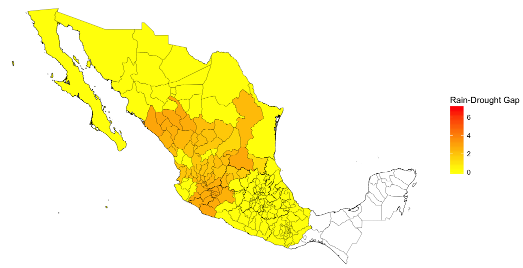
B. Additional Empirical Evidence

B.1 Geographic Distribution of Drought-Rain Shocks

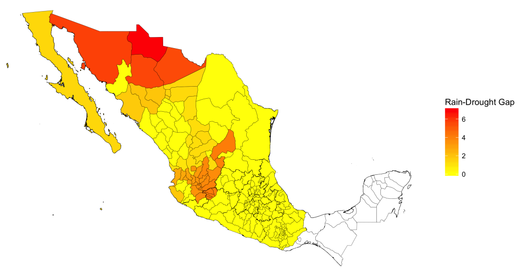
Figure B.1: Drought-Rain Gap Around Cocoliztli Outbreaks



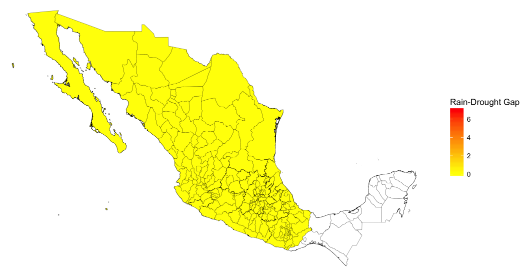
(a) 1521-1550



(b) 1551-1570



(c) 1571-1600



(d) 1601-1645

B.2 Empirical Analysis with Tributaries

Table B.1: Tributary Collapse and Direct Rule: Difference in Differences

	Direct Rule (% of District)			
	Full Sample		IV Sample	
	(1)	(2)	(3)	(4)
Tributaries (log)	-0.083*	-0.100*	-0.081*	-0.100*
	(0.044)	(0.054)	(0.043)	(0.052)
Climate controls	No	Yes	No	Yes
Controls × Year FE	No	Yes	No	Yes
Year FE	Yes	Yes	Yes	Yes
District FE	Yes	Yes	Yes	Yes
Within-District Mean of DV	0.51	0.51	0.51	0.51
Within-District SD of DV	0.14	0.14	0.14	0.14
R sq.	0.84	0.85	0.83	0.84
Observations	321	311	289	289
Number of districts	140	135	113	113

OLS estimations. See equations (1) for the econometric specification. The unit-of-analysis is the district-year. Standard errors (clustered at the district level) in parentheses.

Table B.2: Tributary Collapse and Direct Rule: Instrumental Variables

	Tributaries (log)		Direct Rule (% of District)		Tributaries (log)		Direct Rule (% of District)	
	First Stage: OLS		2SLS		First Stage: OLS		2SLS	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Tributaries (log)			-0.31**	-0.37**			-0.30**	-0.37**
			(0.15)	(0.16)			(0.13)	(0.16)
Drought-rain gap around outbreaks	-0.13***	-0.15***			-0.24**	-0.10		
	(0.041)	(0.056)			(0.11)	(0.15)		
Drought-rain around outbreaks					0.34	-0.16		
					(0.39)	(0.46)		
Climate controls	No	Yes	No	Yes	No	Yes	No	Yes
Controls × Year FE	No	Yes	No	Yes	No	Yes	No	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
District FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Within-District Mean of DV	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51
Within-District SD of DV	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14
Wald F statistic of excluded instruments			16.0	12.1			14.0	5.92
Hansen J statistic			.	.			0.0085	0.000032
Hansen J p-value			.	.			0.93	1.00
R sq.	0.93	0.95	0.12	0.12	0.93	0.95	0.13	0.12
Observations	289	289	289	289	289	289	289	289
Number of districts	113	113	113	113	113	113	113	113

See equations (**??**) and (**??**) for the econometric specification. The unit-of-analysis is the district-year. Standard errors (clustered at the district level) in parentheses.

Table B.3: Heterogeneous Effect of Tributary Collapse on Direct Rule, by Rebellion Potential: Difference-in-Differences

	Direct Rule (% of District)					
	(1)	(2)	(3)	(4)	(5)	(6)
Tributaries (log)	-0.11*	-0.14**	-0.12**	-0.16***	-0.14**	-0.23***
	(0.057)	(0.067)	(0.053)	(0.054)	(0.064)	(0.073)
Tributaries (log) × Num. of languages	0.0090	0.015			0.0083	0.018*
	(0.0095)	(0.011)			(0.0093)	(0.011)
Tributaries (log) × Num. of towns (1786)			0.0040	0.0068*	0.0039	0.0082**
			(0.0033)	(0.0037)	(0.0033)	(0.0039)
Climate controls	No	Yes	No	Yes	No	Yes
Controls × Year FE	No	Yes	No	Yes	No	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
District FE	Yes	Yes	Yes	Yes	Yes	Yes
Within-District Mean of DV	0.51	0.51	0.51	0.51	0.51	0.51
Within-District SD of DV	0.14	0.13	0.14	0.14	0.14	0.13
R sq.	0.84	0.85	0.84	0.85	0.84	0.86
Observations	318	309	321	311	318	309
Number of districts	138	134	140	135	138	134

OLS estimations. See equations (1) for the econometric specification. The unit-of-analysis is the district-year. Standard errors (clustered at the district level) in parentheses.

Table B.4: Heterogeneous Effect of Tributary Collapse on Direct Rule, by Outside Encomendero Options: Difference-in-Differences

	Direct Rule (% of District)			
	(1)	(2)	(3)	(4)
Tributaries (log)	-0.064	-0.080		
	(0.039)	(0.050)		
Tributaries (log) × Any mine	-0.060	-0.065		
	(0.054)	(0.057)		
Any mine × 1570			0.18	0.21
			(0.13)	(0.14)
Any mine × 1600			0.20	0.22
			(0.14)	(0.14)
Any mine × 1645			0.23	0.25*
			(0.14)	(0.14)
Climate controls	No	Yes	No	Yes
Controls × Year FE	No	Yes	No	Yes
Year FE	Yes	Yes	Yes	Yes
District FE	Yes	Yes	Yes	Yes
Within-District Mean of DV	0.51	0.51	0.50	0.51
Within-District SD of DV	0.14	0.14	0.14	0.13
R sq.	0.85	0.85	0.86	0.85
Observations	321	311	350	319
Number of districts	140	135	158	137

OLS estimations. See equations (1) for the econometric specification. The unit-of-analysis is the district-year. Standard errors (clustered at the district level) in parentheses.

B.3 Empirical Analysis with 10-Year Window for Cutpoints

Table B.5: Indigenous Population Collapse and Direct Rule: Difference-in-Differences

	Direct Rule (% of District)			
	Full Sample		IV Sample	
	(1)	(2)	(3)	(4)
Population (log)	-0.12***	-0.093*	-0.089**	-0.093*
	(0.039)	(0.049)	(0.044)	(0.047)
Climate controls	No	Yes	No	Yes
Controls × Year FE	No	Yes	No	Yes
Year FE	Yes	Yes	Yes	Yes
District FE	Yes	Yes	Yes	Yes
Within-District Mean of DV	0.47	0.51	0.51	0.51
Within-District SD of DV	0.13	0.13	0.13	0.13
R sq.	0.86	0.85	0.83	0.84
Observations	400	327	307	307
Number of districts	158	137	117	117

OLS estimations. See equations (1) for the econometric specification. The unit-of-analysis is the district-year. Standard errors (clustered at the district level) in parentheses.

Table B.6: Indigenous Population Collapse and Direct Rule: Difference-in-Differences with Tributary Measure

	Direct Rule (% of District)			
	Full Sample		IV Sample	
	(1)	(2)	(3)	(4)
Tributaries (log)	-0.086*	-0.10*	-0.084*	-0.10*
	(0.045)	(0.052)	(0.044)	(0.051)
Climate controls	No	Yes	No	Yes
Controls × Year FE	No	Yes	No	Yes
Year FE	Yes	Yes	Yes	Yes
District FE	Yes	Yes	Yes	Yes
Within-District Mean of DV	0.51	0.51	0.51	0.51
Within-District SD of DV	0.14	0.13	0.13	0.13
R sq.	0.84	0.85	0.83	0.84
Observations	328	318	299	299
Number of districts	140	135	116	116

OLS estimations. See equations (1) for the econometric specification. The unit-of-analysis is the district-year. Standard errors (clustered at the district level) in parentheses.

Table B.7: Indigenous Population Collapse and Direct Rule: Instrumental Variables

	Population (log)		Direct Rule (% of District)		Population (log)		Direct Rule (% of District)	
	First Stage: OLS		2SLS		First Stage: OLS		2SLS	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Population (log)			-0.25**	-0.34**			-0.25**	-0.35**
			(0.12)	(0.15)			(0.12)	(0.16)
Drought-rain gap around outbreaks	-0.14***	-0.14**			-0.19*	-0.087		
	(0.041)	(0.057)			(0.11)	(0.14)		
Drought-rain around outbreaks					0.14	-0.19		
					(0.37)	(0.42)		
Climate controls	No	Yes	No	Yes	No	Yes	No	Yes
Controls × Year FE	No	Yes	No	Yes	No	Yes	No	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
District FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Within-District Mean of DV	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51
Within-District SD of DV	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
Wald F statistic of excluded instruments			19.3	10.7			14.0	5.24
Hansen J statistic			.	.			0.071	0.045
Hansen J p-value			.	.			0.79	0.83
R sq.	0.93	0.94	0.23	0.14	0.93	0.94	0.22	0.13
Observations	307	307	307	307	307	307	307	307
Number of districts	117	117	117	117	117	117	117	117

See equation (3) for the econometric specification. The unit-of-analysis is the district-year. Standard errors (clustered at the district level) in parentheses.

Table B.8: Tributary Collapse and Direct Rule: Instrumental Variables with Tributary Measure

	Tributaries (log)		Direct Rule (% of District)		Tributaries (log)		Direct Rule (% of District)	
	First Stage: OLS		2SLS		First Stage: OLS		2SLS	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Tributaries (log)			-0.33**	-0.40**			-0.32**	-0.39**
			(0.16)	(0.17)			(0.14)	(0.18)
Drought-rain gap around outbreaks	-0.12***	-0.14**			-0.23**	-0.084		
	(0.040)	(0.058)			(0.11)	(0.15)		
Drought-rain around outbreaks					0.33	-0.17		
					(0.39)	(0.46)		
Climate controls	No	Yes	No	Yes	No	Yes	No	Yes
Controls × Year FE	No	Yes	No	Yes	No	Yes	No	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
District FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Within-District Mean of DV	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51
Within-District SD of DV	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
Wald F statistic of excluded instruments			15.4	9.80			13.2	4.78
Hansen J statistic			.	.			0.017	0.00030
Hansen J p-value			.	.			0.90	0.99
R sq.	0.94	0.95	0.055	0.053	0.94	0.95	0.074	0.054
Observations	299	299	299	299	299	299	299	299
Number of districts	116	116	116	116	116	116	116	116

See equations (**??**) and (**??**) for the econometric specification. The unit-of-analysis is the district-year. Standard errors (clustered at the district level) in parentheses.

B.4 Balance on Observables in 1550

Table B.9: Balance on Observables in 1550 Between Districts Affected and Unaffected by Drought-Rain Shocks

	No Drought-Rain		Drought-Rain		Difference	P-value	t-statistic
	N	Average	N	Average			
Direct Rule (%)	31	0.40	15	0.48	-0.07	0.52	-0.65
Population (log)	31	9.19	15	9.08	0.11	0.73	0.35
Tributaries (log)	31	8.16	9	8.01	0.14	0.73	0.35
Num. of languages	31	2.77	15	3.07	-0.29	0.60	-0.53
Any mine	31	0.26	15	0.33	-0.08	0.61	-0.52
Malarial zone	31	0.74	15	0.60	0.14	0.34	0.97
Distance to Mexico City	31	229.19	15	477.45	-248.26	0.00	-4.87
Avg. elevation	31	1466.36	15	1299.62	166.74	0.40	0.85
Surface area (log)	31	7.56	15	7.61	-0.05	0.91	-0.11