Encomienda, the Colonial State, and Long-Run Development in Colombia

Jean-Paul Faguet[1] Camilo Matajira[2] Fabio Sánchez[3]

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Abstract

The Spanish *encomienda,* a colonial forced-labour institution that lasted three centuries, killed many indigenous people and caused others to flee into nomadism. What were its long-term effects? We digitize a great deal of historical data from the mid-1500s onwards and reconstruct the Spanish conquerors' route through Colombia using detailed topographical features to calculate their least-cost path. We show that Colombian municipalities with *encomiendas* in 1560 enjoy better outcomes today across multiple dimensions of development than those without: higher municipal GDP per capita, tax receipts, and educational attainment; lower infant mortality, poverty, and unsatisfied basic needs; larger populations; and superior fiscal performance and bureaucratic efficiency, but also higher inequality. Why? Two mediation exercises using data on local institutions, populations and racial composition in 1794 shows that *encomiendas* affected development primarily by helping build the local state. Deep historical evidence fleshes out how *encomenderos* founded local institutions early on in the places they settled. Places lacking *encomiendas* also lacked local states for 3-4 centuries. Local institutions mobilized public investment in ways that doubtless suited *encomenderos*, but, over time, spurred greater economic and human development.

Keywords: *Encomienda*, institutions, forced labour, state capacity, extraction, colonialism, development, Colombia

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[1] Department of International Development and STICERD, London School of Economics, Houghton Street, London WC2A 2AE, UK, j.p.faguet@lse.ac.uk. +44 20 7955 6435. Corresponding author.

[2] Independent, ca.matajira966@gmail.com

[3] Department of Economics, Universidad de los Andes, fasanche@uniandes.edu.co

1 Introduction

The Spanish *encomienda* was an important colonial institution that stretched from Mexico in the north to Argentina and Chile in the south. Emerging from the *Reconquista*, it was established in the Americas in 1501 by Queen Isabella, where it persisted in law until 1791, and in practice in some areas into the early 1800s. But its significance exceeds even these large facts. As we explain below, the *encomienda*, which permitted colonists to extract labour from indigenous people, was one of the fundamental institutions that structured the Spanish empire (Avellaneda 1995, Batchelder and Sánchez 2013, Hernández 1978, Lockhart and Schwartz 1983, Yeager 1995). It governed labour relations in the agricultural economy, social relations between Spaniards and natives,[4] and generated important fiscal flows for the Crown (Colmenares 2015, Groot 2008, Herrera 2007, Meisel and Ramírez 2015, Villamarín 1972). It provided the economic basis for Spanish settlements, which they governed via *cabildos*, which we argue sowed the seeds of the earliest instances of the local state in Colombia's extraordinarily difficult geography. Indeed, *encomienda* and gold were the principal prizes that lured conquerors across the ocean to the New World (Avellaneda 1995, Colmenares 1999, Hernández 1978, Safford and Palacios 2002).

Despite this, the *encomienda* is little studied in the economics literature. As with other key institutions of Spanish colonialism, such as the *capitulación, rescate* and *resguardo,* few empirical studies have been undertaken, and little is known about the long-run effects of the *encomienda* on economic and human development. This article seeks to answer such questions for the case of Colombia using an original database incorporating archival evidence that we digitized. We merged a 1560 survey of colonial conditions by an imperial *visitador* (agent), and comparable data from the late 18th, mid-19th, and early 20th centuries, with contemporary data on present-day municipalities' geographic, institutional, social, and economic characteristics. We use it to analyse the effects of the 16th century *encomienda* on modern-day economic, human, and institutional development outcomes across all of Colombia's 1100+ municipalities.

Two challenges to identification in this context are: (i) the possibility that modern

[4] For convenience, we henceforth use 'natives' in place of the longer 'indigenous people'.

development outcomes are driven by unobserved variables that also determined where natives settled (Maloney and Valencia 2016), and hence where *encomiendas* were located; and (ii) the probability of measurement error in our 16th-century data. Our empirical strategy accounts for this, first, through the use of neighbour-pair fixed effects (NP-FE), which compares all pairs of adjacent municipalities where one had *encomienda* and the other did not. This method allows us to control for time-invariant unobservables common across a municipal boundary. But it leaves other, time-varying unobservables as potential sources of bias, and does not address the problem of mismeasurement.

We then employ two complementary strategies to account for these: (i) we implement a method initiated by Altonji, Elder and Taber (2005) and further developed by Oster (2019) that uses the sensitivity of treatment to added controls to assess the degree of bias in OLS estimates due to unobservables; and (ii) we instrument for the location of *encomiendas* using distance to our least-cost calculation of the path the Spanish conquerors took as they founded the earliest colonial settlements (and associated *encomiendas*), transposed onto modern municipal boundaries.

The latter relies on land inclination data from NASA's Shuttle Radar Topography Mission; our approach is similar to Fajgelbaum and Redding (2022). Our least-cost path approximates not only the *conquistadores'* journeys of conquest but also the route taken by the imperial *visitador* in 1560 from which our detailed *encomienda* data derives. Indeed, it significantly improves on historical maps of both originating in the 19th century, before modern maps of Colombia became available. We argue that an instrument that uses topographical features to calculate efficient routes for 16th-century modes of transport (horseback, walking) is plausibly independent of modern-day development outcomes, and also corrects for imperial agents' likely undercount of *encomiendas*. The instrument and underlying data are our first contribution.

The *encomienda* forced natives to pay yearly tribute to Spanish *encomenderos* (*encomienda* holders) in money, labour, or kind in exchange for their protection and instruction in the Catholic faith. That it was extractive, oppressive, and brutal is beyond question. To escape it, some natives fled their communities and became nomads in the wild (Tovar 2013). Of those who remained, many died through overwork in their places of work, often with their tools in their hands. Thus, the *encomienda* contributed significantly to population collapse in the 16th and 17th centuries. Abuse of natives was sufficiently severe that it made slavery appear benign in the eyes of contemporary Spanish visitors (Perdices and Ramos-Gorostiza 2015). The Crown granted *encomiendas* in some areas of Colombia but not others. We exploit this variation to explore its effects on long-term outcomes across four broad dimensions: economic development, human development, land inequality, and state capacity. Using neighbour-pair fixed effects (NP-FE), we find that *encomiendas* are associated with higher levels of land inequality today, as one might expect from an institution of labour extraction. More surprisingly, it is also associated with a variety of better economic, human, and institutional development outcomes: higher municipal GDP per capita, tax receipts, and years of education; larger populations; lower levels of infant mortality, multidimensional poverty, and unsatisfied basic needs; and higher indicators of state capacity today. It is highly unlikely that the entirety of these estimated effects is driven by unobserved variables.

We then explore the likely channels via a mediation exercise based on historical data from 1780 and 1794. Colonial *encomiendas* had 3 distinct effects on the local societies that implemented them: they attracted European (mostly Spanish) colonists, many with relatively high human capital, but enforced their social segregation from natives and enslaved people; they fomented population growth; and they triggered the construction of the local state. The channels that run via local state capacity-building and larger populations, implying the persistence of wealth and economic activity, are both likely to be positive. By contrast, the channel that operates via the white population is likely to be mixed: positive from higher human capital, but negative from social segregation and the political and economic exclusion that implies. Our empirical results show that *encomienda's* strongest channel of influence on modern development outcomes is via the construction of the local state, which dominates population agglomeration and racial composition effects. Estimated population and racial composition effects are statistically less significant and sometimes negative, whereas local state development effects are more significant and consistently positive.

These results concur with detailed historical evidence that we marshal on the earliest Spanish *conquistadores*, who settled, founded cities, and built town halls (*cabildos*) and other local state institutions in places where large settled indigenous populations could be exploited via *encomiendas*. This combination of historical and econometric evidence supports the presence of a causal channel from *encomiendas* in 1560 to improved economic and human development outcomes today via, first, a stronger, more capable local state, and secondly larger populations, during the intervening centuries. By contrast, areas without *encomienda* waited much longer to develop a local state or settle populations – in many cases three centuries or more. Many municipalities were only formally incorporated in the 1960s-70s, e.g., San José del Guaviare (1976). The most recent, Barrancominas, was incorporated in 2019. Such places are demonstrably worse off today in economic and human-development terms.

The sad context of Colombia is the wholesale destruction of the indigenous civilization, including the decimation of its population by Spanish conquerors and the diseases and abuses they introduced (Herrera 1996, Langebaek 2015, Tovar 1988). Pre-existing indigenous institutions were mostly wiped out, surviving in only a few remote peripheries, such as the Sierra Nevada and the Amazon (Gamboa 2013, Safford and Palacios 2002). We hypothesize that obtaining and then holding *encomiendas* provided an important incentive and a substantial share of the means for colonists: (a) to settle in certain places, and (b) to invest in the local state in those places. Our counterfactual is that the building of local state institutions began much later in areas without *encomienda* – often centuries later. *Encomienda* localities thus enjoyed a significant head start in key public goods that the local state provided, like law and order, dispute resolution, and basic infrastructure, as well as in maintaining populations as the Great Death swept the land.

This article contributes to the literature analysing the long-run development effects of Iberian colonial institutions in the Americas.[5] One of the most important of these was slavery, which, though distinct from the *encomienda* in essential respects, was also a lucrative form of labour extraction. Palma et al. (2021) finds that slavery in Brazil slowed the progress of industrialization, and areas with less slavery performed better economically. Laudares and

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[5] A number of studies (e.g., Angeles and Elizalde 2017, Arias and Girod 2014, Michalopoulos and Papaioannou 2013) argue that pre-colonial indigenous institutions are key determinants of present-day development outcomes. This is an especially relevant argument for countries in Africa, Asia, Guatemala and Bolivia, where indigenous communities and institutions survived the colonial encounter. But in Colombia, where 300 years of Spanish colonization dismantled and ultimately exterminated indigenous institutions, along with the vast majority of indigenous people, the argument is less plausible.

Valencia (2023) similarly find that slavery in Brazil is associated with higher income inequality, wider racial income gaps, worse education, enfranchisement, employment outcomes for Blacks, and greater anti-Black prejudice today. And for Colombia, Acemoglu, García-Jimeno and Robinson (2012) find that slavery is associated with higher poverty, lower educational outcomes, lower vaccine coverage, greater land inequality, and worse access to aqueducts and electricity today.

Our findings for *encomienda* go in the opposite direction across a similarly broad array of economic and human development outcomes. Interestingly, Acemoglu et al. (2012) find no effects of slavery on various measures of contemporary state presence. We find the opposite for *encomienda,* implying that these two institutions of colonial labour extraction had markedly different effects on building the local state in Colombia. We theorize that this is because *encomienda* was associated with the formation of Spanish settlements, and hence with building institutions of local self-government across hundreds of current-day municipalities, whereas slavery was deployed mostly in places where the Spanish did not settle, around the mining of gold and other minerals, and so was more purely extractive.

Another strand of literature studies the effects of colonialism on development via the vector of human capital (Easterly and Levine 2016, Montalvo and Reynal-Querol 2020). Valencia (2019) finds that Jesuit missions in Argentina, Brazil and Paraguay between 1609-1767 are associated with more years of schooling, higher literacy rates, and higher income today. Besley and Reynal-Querol (2023) explain heterogeneity in current development patterns across Latin American regions via the education and background of the Spaniards who conquered each. They hypothesize that more educated conquerors invested in organizing the state more effectively, with effects that persisted through the centuries. The latter is similar to our findings, which link *encomiendas* with early investments in the local state, which then provided basic public goods, such as law and order, property rights, and primary services such as rubbish management and potable water, throughout the colonial period and after.

We also add to the literature on 'good vs. bad' institutions. Bruhn and Gallego (2012) characterize "good, bad and ugly colonial activities" across Latin America's regions. Bad activities have lower long-run economic development than good or no activities, whereas the evidence for ugly activities is mixed. On the 'good' side, Arias and Flores-Peregrina (2021) find that Mexican municipalities located closer to colonial *haciendas* (rural estates) have better schooling outcomes, a less marginalized population, and higher urbanization rates. They argue that *haciendas* provided local public goods in a context of scarcity, with effects that persisted over the long term. Focusing on one very 'bad' institution, Lowes and Montero (2021) show that rubber concessions under the Congo Free State, where extreme violence was employed to force Africans to extract rubber for the Belgian Crown, are associated with significantly worse education, health, and wealth outcomes today. And in Ecuador, Rivadeneira (2020) finds that the *concertaje*, by which colonial landowners used debt to extract labour from indigenous workers, is associated with higher current incidences of extreme poverty, illiteracy, and worse educational achievement. Such results align with Dell's (2010) research on the Peruvian *mita*, which forced indigenous males to labour in Spanish mines in modern-day Peru and Bolivia. Areas subjected to it are today less integrated into road networks, household consumption is lower, and childhood stunting is higher than in comparable hacienda areas. We build on this literature by probing one particular 'ugly' institution, the *encomienda*, with fine-grained micro data to show why it might have opposing effects. Without a doubt, the *encomienda's* direct effects were extractive. But its indirect effects, via building a local state that provided public goods, and via population growth that expanded markets and economic activity, dominate over the long run.

Our results are similar to two other single-country studies that identify extractive, oppressive historical institutions nonetheless associated with better development outcomes today. In Java, Dell and Olken (2020) show that areas where Dutch colonizers established sugar factories in the mid-19$^{\text{th}}$ century are richer, more educated, have better infrastructure, and are more industrialized than comparable sites that did not receive the colonial treatment. In a similar vein, Summerhill (2010) argues that the *aldeamento*, a colonial institution that fixed semi-nomadic natives in place to extract their labour for the benefit of Portuguese colonists, is correlated with higher income per capita today in affected regions of Sao Paulo.

Lastly, we contribute to a rich literature that explores state building and development (see Besley and Persson 2011 and Bardhan 2016 for excellent overviews). At the broadest level, key functions of development-promoting institutions include providing property rights and other basic public goods, and establishing security and safety conditions conducive to investment and economic growth. Dell, Lane, and Querubín (2018) use the historical Dai Viet-Khmer boundary to compare villages with a traditionally bureaucratic state to villages characterized by patron-client relations. Villages exposed to the former for longer periods show higher levels of development, including better economic outcomes, public goods, and redistribution, over 150 years. Dulay (2022) shows that 16th-17th century Catholic missions in the Philippines established law and order, collected local taxes, and provided some essential public goods in territories they controlled, with positive effects on state capacity and levels of development today. Closer to home, Acemoglu, García-Jimeno, and Robinson (2015) show that local state capacity is a first-order determinant of public goods provision and prosperity in Colombian municipalities. We build on this by showing how this local state capacity began, linking it to Spanish *encomiendas* in the early 1500s.

During the 16th-18th centuries, Spain attempted to provide order, security, and some basic public goods via institutions of colonial rule that were in principle centralized. But the vast distances both within Spanish America and between America and the metropole – especially given extant technologies of transportation and communication – combined with the Spanish Crown's persistent fiscal weakness, led instead to frail, incomplete central institutions and an inefficient colonial bureaucracy unable to mobilize resources, provide security, or invest in public goods (Colmenares 1999; Hough and Grier 2015; Perdices and Ramos-Gorostiza 2015). In Colombia, early colonial governance resembled 'islands of authority' in a still-wild land (Safford and Palacios 2002). Throughout the three centuries that followed, provinces remained effectively independent of Bogotá, and the *Audiencia* (colonial seat) lacked authority over large expanses of its territory, especially in the west and south (Safford and Palacios 2002).

Faced with central weakness, colonists built their own local government institutions. These varied significantly amongst Colombia's different local geographies and economies (Bonet and Meisel 2006). In some areas local institutions proved short-lived, and in many other areas they never emerged at all. A third set of localities saw relatively strong local institutions built by *conquistadores* and subsequent settlers, whose traditions of local government persist in evolved form to this day (García-Jimeno 2005). Using historical data from the 16th, 18th, and early 20th centuries, we argue that *encomienda* explains where, why and how capable local institutions were built.

Colombia is a good setting for such a study because its combination of high natural geographic variation with costly transport created distinct and relatively isolated subnational economies with heterogeneous local conditions and resources. Very different institutions emerged in these regions (e.g. free labour vs. *encomienda* vs. African slavery), which developed along divergent trajectories between the 1500s-1900s (Cepeda and Meisel 2014). And Colombian data is high-quality and abundant compared to its Latin American neighbours and other middle-income countries. The rest of this article is organized as follows. Section 2 discusses the historical context of Colombian *encomiendas* and their links to local state-building. Section 3 presents our data and methodology. Section 4 analyses our main results in historical order, beginning with colonial-era outcomes. Section 5 re-estimates using distance to our least-cost calculation of the conquerors' route of conquest as an IV. Section 6 explores key transmission mechanisms via population growth, racial composition, and the construction of the local state. Section 7 concludes.

2 Historical evidence: *Encomienda* in Colombia

The initial Spanish occupation of New Grenada was remarkably precarious, characterized by small numbers of Spaniards concentrated in a few settlements on the Caribbean coast, marauding for resources and under constant attack by often-deadly indigenous warriors (Colmenares 1999). For example, in 1535, a decade after its founding, Santa Marta was little more than a trading post whose 9 horsemen and 40 footsoldiers were unable to guarantee the security of some 500 inhabitants against increasingly confident native assaults (Safford and Palacios 2002). As gold became scarce, the native population began collapsing on account of the Great Death and conqueror violence. Santa Marta's food supply began to falter; the water supply became contaminated (Avellaneda 1995). With the Spanish colonial project in New Grenada in danger of collapse, Spaniards re-organized to explore and conquer territories to the south. And so a new generation of *conquistadores* turned to a new form of extraction: the *encomienda* (Meisel and Ramírez 2015).

Encomienda

Encomiendas were assigned at the end of expeditions of conquest after the division of booty. Once the local population was subdued, the leader distributed captured treasure and natives amongst his men and their financiers according to military rank and/or contribution (Groot 2008). Smaller chiefdoms were assigned wholly to senior officers, while larger and more complex chiefdoms like Bogotá were split into several *encomiendas*, destroying their existing organization (Colmenares 2015, Gamboa 2013, Yeager 1995). Distribution marked the initiation of settlement (Villamarín 1972).

Assigning natives to *conquistadores* initially violated colonial law. Natives were regarded as free vassals by the Crown, and very few *capitulación* holders held the right to appropriate their labour.[6] And yet the practice flourished throughout the region. Informal titles were formalized when *encomenderos* petitioned the Crown to confirm their property rights during "two lives" – their own and their heir's – and the Crown agreed (Villamarín 1972). Royal vacillation between active protection of natives and passive non-application of its own laws was symptomatic of the weakness of Spanish rule in the Americas. The Crown possessed neither the men nor resources to administer its territories, and did not want to discourage *conquistadores'* private efforts on its behalf. Plus, it relied on a ready supply of indigenous labour for royal mines and, later, royal *encomiendas*. So a compromise was reached in which natives were obliged to work on settlers' farms, in their mines, and as their servants in exchange for being protected and instructed in Catholicism by *encomenderos* (Yeager 1995).

The abuses of the indigenous population that ensued were appalling and loudly denounced by the Church and others. In 1555, the newly established *Real Audiencia de Santafé* (Bogotá) sought to regulate *encomiendas*, stipulating that: (i) Natives would pay tributes to *encomenderos* in cash or kind twice a year; (ii) Native taxes would be communal, not individual, based on pre-conquest tributes to chiefs; (iii) Natives were obliged to plant, harvest, and deliver wheat, maize, barley, and potatoes to their *encomenderos*; and (iv) Native communities must provide labour for *encomenderos'* farms, transporting produce to market, supplying their haciendas with wood and fodder, and providing them with cooks, maids, and errand boys. The tribute that resulted is illustrated in appendix 1 for three communities. This reform was one of several attempts to soften the expansive dynamic of privately-led conquest

[6] Not even powerful Cortés in New Spain (Mexico).

in the Americas, limit the abuse of natives, and rein in the growing power of *encomenderos*; another was the New Laws of 1542. But a weak colonial government failed to enforce such rules, and the exploitation of natives remained heavy (Villamarín 1972, Yeager 1995, Batchelder and Sánchez 2013).

Encomiendas dominated colonial society during the 1500s, but declined asymmetrically from the early 1600s onwards. In some distant rural areas, they survived right up to the end of the empire in the early 1800s. Closer to cities and major economic centres, they died out more quickly. The single most significant cause was the demographic catastrophe of the Great Death, which devastated the indigenous population throughout Spanish America, killing 90 percent or more of many groups and completely exterminating others (Landes 1999; McFarlane 1993). Conflict amongst *encomenderos*, and between them and non-*encomenderos,* as well as the flight of natives escaping exploitation, also contributed. Labour force decline weakened *encomenderos* until they could no longer challenge the Crown (Colmenares 1999; Wiesner 2008).

How did these institutions perform economically? Naïve perceptions sometimes project the present into the past, viewing Latin America as perpetually sclerotic. But Arroyo and Van Zanden's (2016) recent estimates of GDP per capita in the two pillars of the Spanish empire, Mexico and Peru (including Bolivia), reveal dynamic economies with much more growth, higher real wages, and better literacy and numeracy than previously assumed. Sustained growth allowed both regions to close the income gap with Spain; Mexico achieved parity between 1650 and the late 1700s. Though less prosperous than Peru or Mexico, colonial Colombia also boomed economically during the second half of the 18th century following Bourbon reforms. It only stalled during the disorder that followed Independence (Kalmanovitz 2006). Growth across the region was nonetheless slower than the UK and US, and more frequently interrupted.

The full gamut of *rescate*, *repartimiento*, *encomienda*, and *mita* were designed to repress the living standards of natives and extract surpluses for Spaniards (Arroyo and Van Zanden 2016, Angeles and Elizalde 2017). This they did effectively. But the larger picture is of significant colonial extraction that coexisted with significant economic growth.

Encomienda and the construction of the local state

Even as *encomiendas* disappeared, their effects endured because they played a central role in the foundation of the local state in Colombia. The evolution of Colombia's local state can be divided into two phases: a highly decentralized, fragmented local state that emerged bottom-up, with the initial allocation of *encomiendas* to Spaniards from the 1530s onwards; and a more centralized, top-down local state that emerged in the early 17th century as the Crown sought to re-impose its authority and extract greater revenue (Jaramillo 1989; Meisel and Ramírez 2015; McFarlane 1993). We take each in turn.

The number of Spaniards migrating to Colombia during this period was tiny; Boyd-Bowman (1976) calculates a cumulative total of 3,838 by 1600. Conquerors settled in some of the places that had large indigenous populations whose labour they could exploit, permitting them to adopt the seigneurial lifestyle of a Spanish lord. Their first act was to found a town on a Spanish template, which they equated with civilization and colonial authority. These typically featured a town hall (*cabildo*), church, jail, plaza, and sometimes a notary – the first local public goods in what would become the colonial state (Colmenares 1999, Wiesner 2008). *Cabildos* then allocated urban plots where conquerors could build houses, and, thirdly, assigned natives to conquerors, thereby creating *encomiendas*. Appendix map A9.1 shows where these *encomiendas* were located, as well traditional understandings of the main conquerors' routes.

Cabildos administered justice for minor crimes, controlled access to urban and agricultural land, regulated commerce, and – crucially – served as the union of conquerors against the Crown. This last was key because conquerors sought to rule with minimal interference. They defended their privileges against what they described as the Crown's "arbitrary confiscations" by building local political power; town hall became their principal instrument (Colmenares 2015, Groot 2008). *Cabildos* were also tasked with providing key local public goods like street lighting, potable water, and public hygiene.[7] Their authority extended to large hinterlands, which they also governed.

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[7] We adhere to this basic definition of 'the local state' for historical and methodological reasons: (i) these are typical characteristics of the colonial *cabildos* that *encomenderos* founded throughout Colombia, and (ii) even as the Colombian state grew and acquired new functions (especially in the 20th century), these basic functions continued to be important for development, and local state institutions continued to be responsible for them.

Appendix 2 provides a case study of the origins and construction of the *cabildo* of Tunja*,* one of the most important towns in New Grenada, between its founding in 1539 and the early 1600s. *Encomenderos* banded together to construct local authority in the area just conquered. They ascribed to the *cabildo* a blend of criminal and civil powers that encompassed property rights; planning urban development and building public infrastructure; public order and justice; collecting taxes and duties; essential public services like health, water, and waste disposal; regulating artisans and trade; public celebrations; and representing Spanish residents before higher authorities (Wiesner 2008).

Encomenderos controlled *cabildos* throughout the 16th century and well into the 17th by monopolizing their most important offices, especially *regidores* (governors) and *alcaldes ordinarios* (judicial officers), deploying significant power in colonial society. They controlled the land and mines, owned key commercial enterprises, and regulated markets and commerce more broadly. They could force natives to work in mines and could exclude non-*encomenderos* from the mines. Their control over indigenous labour allowed them to control the rural economy more broadly. They even used *cabildo* powers to restructure indigenous society, concentrating natives in Spanish-style villages, specifying the sizes of their houses, what agricultural resources they could access, the dimensions and locations of their streets, and even specific peculiarities of their communal life. Hence, the institution of *encomienda* is crucial to understanding both colonial society and its economy. From it came political and economic power relations that largely defined colonial Colombia (Colmenares 1999; Wiesner 2008).

The uses and abuses of indigenous labour, and chronic disagreement over the taxes *encomenderos* paid (the *quinto real*, or royal fifth), were major sources of friction and the object of continual power struggles between settlers and Crown (Batchelder and Sanchez 2013). These frictions were magnified by the sheer quantity of wealth extracted via *encomiendas.* Fiscal flows were large and comparatively stable, creating a premium for whosoever could control the local state. To this end, the Crown undertook regular audits to determine the size of the declining indigenous population, the fairness of their tributes, and tax evasion by *encomenderos* (Colmenares 1999, Herrera 1996 & 2007).

Such tensions greatly contributed to forming and consolidating a stronger, more centralized state. To limit the power of local elites, the Crown appointed *corregidores* (magistrates; literally "correctors") at the end of the 16th century.[8] Each was in charge of administering regions with several *encomienda* towns. *Corregidores* broke the monopoly of *encomenderos* on indigenous labour, allowing other producers to hire natives. *Corregidores* also imparted justice and resolved conflicts, particularly disputes over tribute, between *encomenderos* and natives (Herrera 2007, Muñoz 2015). The Crown tasked *corregidores* with collecting indigenous tribute, deducting taxes due the Crown, and transferring the remainder to *encomenderos* (Colmenares 1999, Ocampo 2007).[9]

The establishment of the *corregidor* thus limited the *cabildo's* power and enhanced the Crown's control over communities and territories (García-Jimeno 2007). As *encomiendas* declined in the 17th century, an ascendant Crown strengthened its territorial control to institute a more ambitious fiscal state. Taxes on sales, trade, food, gold, silver and precious gems, road and port tolls, and religious tithes, amongst others, were established or increased. Many of these taxes were paid to and administered through *cabildos*, increasing their fiscal flows significantly (Ocampo 2007). *Corregimientos* also administered justice, upheld law and order (García-Jimeno 2007), and oversaw priests and the church (Herrera 1996 & 2007). But stepping back from this detail, it is worth noting that Spanish colonial government in New Grenada was divided and weak. Its rules and directives were routinely honoured in the breach. A 17th-century imperial visit found rampant corruption and few areas in which royal authority was not routinely flouted (McFarlane 1993).

Encomiendas and *corregimientos* were thus tied together as decentralized action and centralized reaction. The presence of *encomiendas* gave elite landowners strength and purpose via the formal institutions they established wherever they settled. It also called forth the establishment of *corregimientos*. The tension between the two served to build local fiscal capacity, and mechanisms and traditions of collective action, in areas that would later become municipalities.[10] *Cabildos* used these resources and problem-solving abilities to make early

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[8] *Corregidores* were appointed by the president of the *Audiencia Real*. The *Audiencia* was the Spanish Crown's main colonial tribunal of justice.

[9] Two centuries later, Spain's Bourbon reforms tried again to take power from the creole elite by reorganizing *corregimientos* into larger, more professional *intendencias* (Chiovelli et al. 2022).

[10] Unfortunately, data that would allow us to identify separate *encomienda* and *corregidor* effects on long-run development are simply not available. The incomplete data currently available list only when

investments in roads, education, water, resolve disputes, and provide order.

By contrast, areas without *encomienda* lacked a crucial spur for the development of local offices. In many such places, *cabildos* were never founded. There was simply less for them to do where they were, and some such *cabildos* eventually ceased to function. Table 1 illustrates the divergent pattern of public offices in municipalities without and with *encomiendas*. Of the 756 municipalities that existed in 1794, towards the end of the colonial period, only 39% (296) were registered with *encomiendas* in imperial records. But this minority contained 77% of public officials at all levels of colonial government. The other 61% of non-*encomienda* municipalities contained only 23% of colonial officials. This disparity is mirrored at the local level, where three-quarters of officials – most of them tied to the *cabildo* – are in the minority of *encomienda* municipalities. Even accounting for the much larger populations of *encomienda* municipalities (Tovar et al. 1994), the latter still had 25% more officials per white inhabitant.

Table 1: Public officials in New Grenada colony (1794)

	Non-*Encomienda*			***Encomienda***			**Totals**	
	Officials	**Municipalities**	Officials per 100,000 white inhabs.	**Officials**	**Municipalities**	Officials per 100,000 white inhabs.	**Officials**	**Municipalities**
No public officials	0	340	0	0	124	0		
Some public officials	404	120	809	1330	172	1008		
Totals	404	460	809	1330	296	1008	1734	1817
% of Total	23%	61%		77%	27%			
Of which:								
National-level officials								
Executive	15		30	94		71		
Legislative	11		22	32		24		
Totals	26		52	126		95	152	
% of Total	17%			83%				
Regional-level officials								
Executive	27		54	42		32	69	
% of Total	39%			61%				
Local-level officials								
Executive	233		467	472		358		
Legislative	0		0	102		77		
Judicial	0		0	58		44		
Other	118		236	530		402		
Totals	351		703	1162		881	1513	
% of Total	23%			77%				

Source: Durán y Díaz (1794). Number of white inhabitants comes from 1778 data in Tovar et al. (1994).

Areas without *encomiendas* and *cabildos* were mostly skipped by *corregimientos* as

certain *corregimientos* were decreed by the Crown. For most of these, we do not know when, or if, *corregidores* finally arrived and took up office across colonial Colombia's large, difficult geography.

well. Table 1 shows this clearly; 83% of national-level offices were concentrated in *encomienda* municipalities, while non-*encomienda* municipalities – three-fifths of the total – contained only 17%. In terms of the local state, many of these were empty parts of Colombia that waited three centuries or more before the earliest local government institutions began to operate. For example, the Spanish settled Simití and Necoclí – two towns in today's Antioquia department– in the early 1500s. Necoclí had been previously populated by the indigenous Tule and Simití by the Tahamí. According to colonial records, no *encomienda* was granted in either (Tovar, 1988). Simití was only formally incorporated as a municipality in 1968, and Necoclí in 1978.

Hence, both *encomiendas* and *corregimientos* were crucial to building local state capacity, both bottom-up and top-down, during the colonial period. They mattered not because they concentrated Spaniards in particular places – there were remarkably few Spaniards throughout the 1500s in New Grenada.[11] They mattered, rather, because they set rules and built institutions that allowed this tiny number of Spaniards, in a territory twice the size of Spain (see colonial map in appendix 3), to ultimately re-make society from the ground up. And because the local state so constructed long outlived the *encomiendas* and *corregimientos* that gave it birth.[12] But between the two, it is *encomiendas* that are primary. Historical evidence is clear that *encomiendas* provided the incentive to found *cabildos*, and sustained the wealth, status and power of *encomenderos* that the Crown then sought to rein in by establishing *corregimientos*. Hence we are confident that *encomiendas* are the ultimate cause of the long-run development effects we identify below.

3 Data and Methodology

Data

Our database is built from primary and secondary sources. Our main outcome variables measure different aspects of development: Unsatisfied Basic Needs (UBN), which varies between 0, when all basic needs are satisfied, and 100, when all are unsatisfied; human

[11] Colonial Governor Miguel Díez de Armendáriz reported no more than 800 (male, adult) Spaniards in the entire highland core of the New Grenada colony in the late 1540s (Colmenares 1999).

[12] The importance of *cabildos* was richly illustrated when Spain's Central Junta of 1809 invited *cabildos* throughout New Grenada to nominate representatives to join the revolutionary government. This was mirrored the following year by the Bogotá Junta, which called on *cabildos* to send delegates to form a new federal government.

development via infant mortality and school enrolment rates; municipal GDP per capita; population, a proxy for more productive economies in the preindustrial world (AJR 2002); different measures of inequality in the rural economy; measures of local state capacity; and a set of medium-term outcomes from the 18th, 19th and early 20th centuries. Our index of colonial state presence is from García-Jimeno (2005), which is based in turn on the original colonial source of Durán y Díaz (1794).[13] Precipitation and temperature (monthly averages, 1980-2010) are from IDEAM (*Instituto de Hidrología, Meteorología y Estudios Ambientales*). Most remaining variables – long-run development, inequality, state capacity outcomes, and geographic and other controls – are from Panel CEDE.[14] Unless otherwise specified, variable values are for 2005.

Our main independent variable measures *encomienda* via the number of tributary natives. This data was collected by colonial officers on periodic visits (*visitas a tierra*) to Spanish America from 1550 onwards. Their overarching aims were: (i) to register Spaniards and their assets, especially tribute-paying natives, for the sake of colonial taxation (the *quinto real*), and (ii) to judge the effectiveness of Christian evangelization and the extent of *encomenderos'* exploitation of natives. Working with a questionnaire prepared in advance, *visitadores* gathered detailed information on communities' social organization, Christian worship by natives, the number and location of tributary natives,[15] their economic activities and relationships with *encomenderos*, and how tributes were paid (Colmenares 1999, Román 2017, Montoya and Jaramillo 2010). Visitors listened to the complaints of natives, sometimes modified their tributes, and imposed summary sanctions on the most abusive *encomenderos* (Colmenares 2015). The most complete visit known was conducted by Tomás López between 1558-1560. The resulting registry of 1560 was transcribed and published by Tovar (1988) and georeferenced by us.

Georeferencing 450-year-old *encomiendas* to modern municipal borders was a non-

[13] Durán y Díaz (1794) constructs a full account of the colonial bureaucracy and fiscal accounts for 1794, including all Crown employees in each settlement, their salaries, and information about the presence of consumption taxes, mail services, state monopolies on tobacco, playing cards, *aguardiente,* gunpowder, and much else besides. Table 1 is from this source.

[14] Economic Development Research Center, Economics department, University of los Andes.

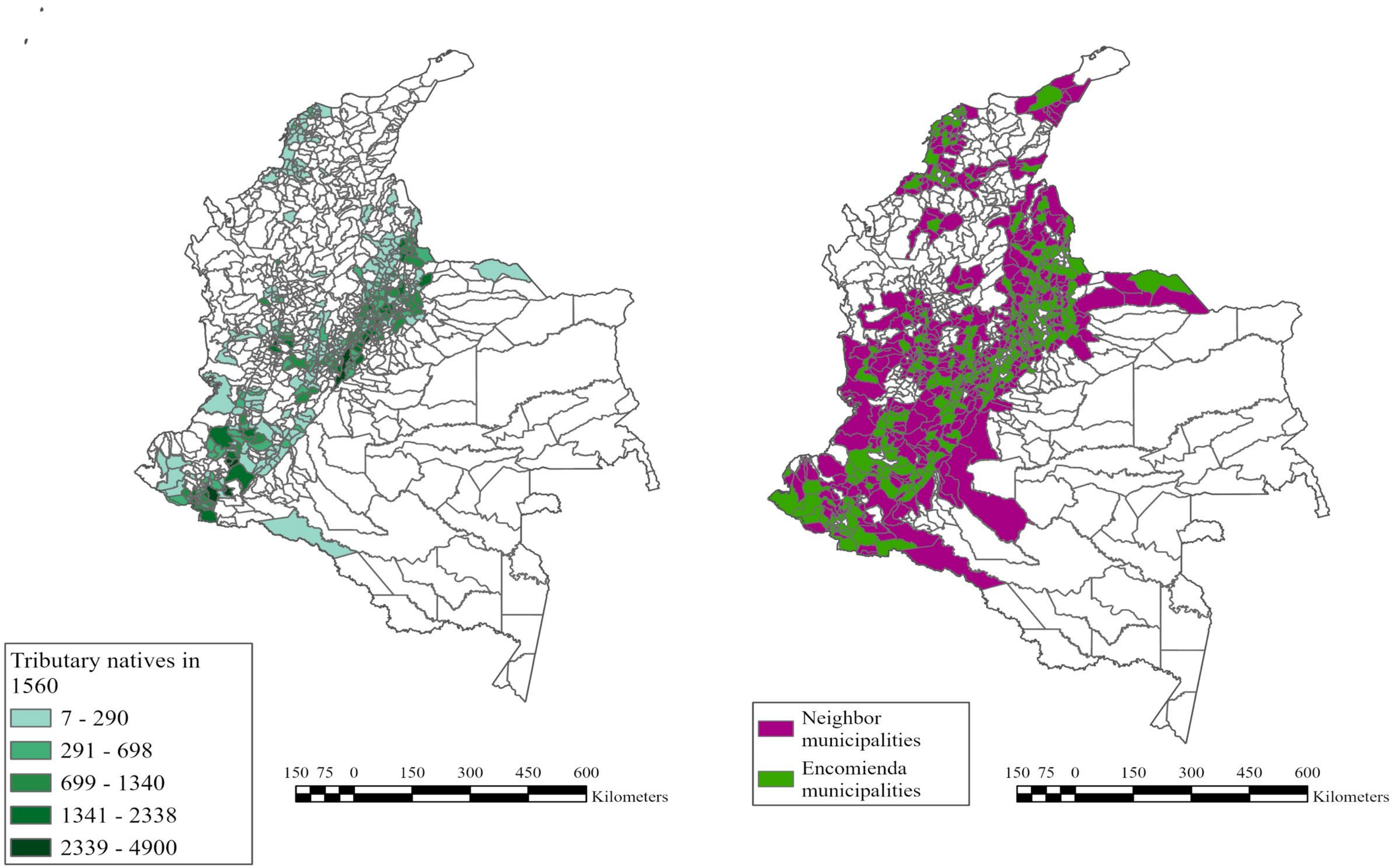
[15] Indigenous males 17-55 years old.

trivial exercise. Our database includes 1,861 *encomiendas*. Of these, we have detailed information on *encomenderos'* names, tributes paid, and the identity of the indigenous group (often the chief's name) for 1,030 *encomiendas*. Information for the remaining 831 *encomiendas* is aggregated at the town or city level (23 cities), and contains the town or city name, number of *encomenderos*, number of indigenous groups, and tributes paid. Geo-referencing the latter group was straightforward, as historical and current names have not changed for these cities. Geo-referencing the former group involved matching the names of relevant indigenous chiefs to current municipal borders using the wonderful Colombian Toponymic Dictionary (IGAC 1996),[16] which records geographic, historical, and ethnographic characteristics of Colombian settlements, such as ethnic and cultural groups resident at colonization, languages spoken, geographical features, and modern boundaries, amongst others. There are difficult cases where chiefs' names are not referenced, and others where specific chieftaincies correspond to more than one modern municipality. We resolve these ambiguities and missing data by tracing the routes López took and pinpointing reported stops on the modern map of Colombia.

Appendix 4 provides descriptive statistics for all our variables, as well as for samples of municipalities with and without *encomiendas*, and the subsample of non-*encomienda* municipalities adjacent to *encomienda* municipalities (neighbours). We see clear differences between *encomienda* and non-*encomienda* municipalities. *Encomienda* municipalities show better long-run development outcomes, such as UBN, poverty, and infant mortality. But they are also slightly more unequal. The presence of the state in 1794 and population in 1780 are higher in *encomienda* municipalities, but so is the Gini. The 1959 trunk road network is more extensive in municipalities without *encomienda*, implying greater central government provision of public goods. Other municipal characteristics also show systematic differences, excepting soil fertility and some river densities. This highlights the necessity of employing neighbour-pair fixed effects. We can control for observable differences between *encomienda* and neighbour municipalities; remaining unobservable differences are captured via pair fixed effects.

[16] Toponym = place name. IGAC is Colombia's Instituto Geográfico Agustín Codazzi.

Figure 1: Distribution of *encomiendas* in Colombia



a) Distribution of tributary natives **b) *Encomienda* and neighbour municipalities**

Figure 1 shows the distribution and intensity of tributary natives throughout Colombia in 1560, and where *encomienda* and neighbouring (non-*encomienda*) municipalities are located – principally in Colombia's eastern mountains. Our estimations focus on the latter sample (panel b), omitting the few *encomienda* municipalities wholly surrounded by other *encomienda* municipalities, i.e. those lacking a non-*encomienda* neighbour.

Methodology

To evaluate the long-term effects of *encomienda,* we use the neighbour-pair fixed effects approach of Acemoglu, García-Jimeno, and Robinson (2012). This approach aids identification by controlling for all time-invariant unobservables common across a municipal boundary. For simplicity, we retain their notation. Let M denote municipalities with *encomienda,* and N denote non-*encomienda* municipalities adjacent to the former. Note that we restrict our sample of Colombia's 1100+ municipalities to these two subgroups. Municipalities with *encomienda* are indexed by g ($g \in M$), and municipalities without *encomienda* are indexed by i ($i \in N$). Additionally, let $N(g) \subseteq N$ be the subset of non-*encomienda* municipalities adjacent to *encomienda* municipality g ($g \in M$). We denote $M(i) \subseteq M$ as the subset of *encomienda* municipalities neighbouring non-*encomienda* municipality i ($i \in N$). Lastly, y_τ denotes long-term/middle-term outcomes of economic, human, and institutional development, S_τ is our measure of *encomienda* (number of tributary natives), and $\boldsymbol{x_\tau}$ is a vector of geographic, agricultural, and other controls, all subscripted by $\tau = \{g, i\}$.

Neighbour-pair fixed effects

The NP-FE strategy compares pairs of adjacent municipalities where one had *encomienda* (measured by log of tributary natives) and the other did not. Hence our counterfactual is 'absence of *encomienda'*. NP-FE controls for time-invariant confounding factors that might make treatment (*encomienda* assignment) non-random. This supports treating the presence of *encomienda* as exogenous, especially when adjacent municipalities are small in area. Our database consists of every possible combination of pairs (g, i) where $g \in M, i \in N(g)$:

$$\begin{aligned} \mathrm{y_g} &= \beta S_g + \gamma \boldsymbol{x'_g} + \zeta_{gi} + v_g \qquad && g \in M \\ \mathrm{y_i} &= \beta S_i + \gamma \boldsymbol{x'_i} + \zeta_{gi} + v_i \qquad && i \in N(g) \end{aligned} \tag{1}$$

In this framework, ζ_{gi} captures neighbor-pair fixed effects – unobservables common to a neighbor pair (g,i), and v_τ are other unobservables – the error term. We assume that $cov(S,\zeta) \neq 0$ (hence the inclusion of fixed effects) and $cov(S,v) = 0$, implying that remaining unobservables are uncorrelated with our measure of *encomienda*. We estimate using OLS.

A violation of this last assumption, implying that unobservables are correlated with *encomienda,* would bias our results. We follow Cagé and Rueda (2016), Benson and Faguet (2022) and Turkoglu et al. (2023) in implementing a strategy originating in Altonji, Elder and Taber (2005), and further developed by Oster (2019), to evaluate the magnitude of any such bias. Oster's key insight is that the coefficient stability criterion many researchers frequently employ is insufficient. Omitted variable bias is proportional to coefficient movements as additional controls are added only if such movements are scaled by changes in R-squared. She describes a method for using the relationship between treatment and observables to recover the relationship between treatment and unobservables. This yields an estimate for the magnitude of bias, which we compare to estimated effects. Appendix 6 describes the method in more detail. In the interest of rigour, section 5 re-estimates our NP-FE models using IV.

Lastly, spillovers may also bias our results. Two types of spillovers are of particular interest in our setting: (i) institutional spillovers from higher-capacity *encomienda* municipalities to lower-capacity non-*encomienda* neighbours; and (ii) selective out-migration of higher-endowment individuals in terms of strength, wealth, human capital, or other ability from *encomienda* to non-*encomienda* neighbours. Both spillovers would tend to bias our estimates downwards by artificially raising non-*encomienda* outcomes. We correct for both effects via neighbours-of-neighbours analysis, which compares *encomienda* municipalities with non-*encomienda* ones farther away, where spillovers are likely to be smaller or inexistent.

4 Results: *Encomienda's* effects on development, inequality and state capacity

The neighbour-pair fixed effects approach resembles matching procedures, but using adjacency rather than, e.g., a propensity score to match municipalities. Before proceeding with analysis, it is important to assess the quality of matching between *encomienda* and non-*encomienda* pairs that adjacency produces. We do this in three ways. First, we regress each covariate as a function of an *encomienda* dummy ($\check{S}_\tau$) using NP-FE:

$$\mathrm{T_g} = \pi\check{S}_g + \zeta_{gi} + v_g \qquad g \in M \tag{2}$$

$$\mathrm{T_i} = \pi\check{S}_i + \zeta_{gi} + v_i \qquad i \in N(g)$$

Ideally *encomienda* coefficients will be insignificant, implying that adjacent municipalities do not differ systematically in these dimensions.

Results are shown in table 2, with each row representing a separate regression. Seven of the 11 coefficients are insignificant, including especially distance to Bogotá – the most important variable for the analysis that follows. Where there is statistical significance, the coefficients have small values by Colombian standards, implying modest economic importance. To better evaluate these differences, consider the context: Colombia is a large, very diverse country. At 1.1 million km^2, it is larger than France and Spain combined – 1,900 km at its longest (north to south) and 1,350 km at its widest; the Andean region has many cities between 1,000 and 3,000 m above sea level; average rainfall is 2,630 mm per year.[17] *Encomienda* municipalities are on average 3 km closer to the departmental capital (4% of the average for all municipalities; see appendix 4), 90 m above sea level higher (8%), receive 13 mm more rainfall per month (8%) and have a soil fertility index 0.08 units higher (3%) than their non-*encomienda* neighbours. Hence differences between treated (*encomienda*) and control (non-*encomienda*) municipalities are present but modest in magnitude in four dimensions, and absent in the other seven. We nonetheless control for all 11 characteristics in the results that follow.

[17] Mainland Colombia's geographic extremes are Punta Gallinas (La Guajira) in the north, Leticia (Amazonas) in the south, La Guadalupe, Guainía in the east, and San Andrés de Tumaco, Nariño in the west. As examples, Colombia's largest two cities, Bogotá and Medellín, are 2,625 and 1,495 m above sea level respectively.

Table 2: Neighbour covariate similarity check

Variable	NP-FE *Encomienda* Dummy	S.E.	Obs.
Distance to department capital (km)	-3.060**	(1.307)	1826
Distance to Bogota (km)	-1.166	(0.710)	1826
Official area (km2)	3.929	(31.614)	1826
Altitude (meters above sea level)	90.194***	(23.293)	1826
Longitude shapefile coordinate	-0.851	(0.708)	1826
Latitude shapefile coordinate	0.370	(0.638)	1826
Avg. monthly rainfall (mm) 1980-2014	-12.677***	(2.003)	1826
Soil fertility index	-0.084**	(0.040)	1826
Primary river density	0.003	(0.009)	1826
Secondary river density	0.004	(0.003)	1826
Tertiary river density	-0.000	(0.002)	1826

Notes: Neighbour-pair fixed effects estimates with robust standard errors clustered by neighbour-pairs.

Secondly, appendix 5 shows the distribution of four key variables: distance to Bogotá, altitude, soil fertility/aptitude, and average monthly rainfall by *encomienda* and non-*encomienda* neighbours. We see that the distribution of distance to Bogotá, soil fertility, and average monthly rainfall are similar in both sets of municipalities; the distribution differs modestly in altitude, with somewhat more neighbours than *encomienda* municipalities at lower altitudes. This follows naturally from the historical settlement pattern in Colombia, where higher-altitude areas were colonized first, and implies that, subject to the controls we use, our neighbour-pairs are well matched. Thirdly, appendix 8 further tests for bias between *encomienda* and non-*encomienda* municipalities by estimating some of our models on increasingly restricted samples of municipalities located within one and one-half standard deviations of the mean of each of these 11 variables. We return to this in more detail below.

Colonial outcomes

The *encomienda* emerged during the conquest and consolidated during the early colonial period. It was a powerful institution, and is likely to have had significant effects on colonial-era development. These effects are likely to have persisted into the long run, well beyond when it began to fade away in the 17th century as the native population plummeted. But testing this empirically is not easy. Fortunately, we have data from the late 1700s on the local state, population, and ethnic composition. For local state capacity, we rely on Durán y Díaz' (1794) survey of the Viceroyalty that provides detailed data on colonial public employees at local, provincial, and central government levels. For local population and ethnic composition, we use Tovar et al.'s (1994) compilation of New Granada censuses and statistics from 1780.

Table 3 presents OLS estimates of the effects of *encomienda* on the variables mentioned above, with dependent variables listed down the left-hand side. Each cell in columns (1), (2) and (3) corresponds to a different regression. Column (1) reports NP-FE estimates (full-model results are in appendix 7). Column (2) reports fixed effects estimates on neighbours-of-neighbours as a robustness check. Our key independent variable is log of tributary natives*,* which captures not only the presence of *encomienda* but also its intensity. All coefficients are statistically significant at the 5% or 1% levels.

Encomienda is associated with a stronger local state, larger population, and a higher white share of the population in the late 18th century. These results imply that the institution of *encomienda* had important effects on key colonial-period outcomes. We test below whether these transformations act as channels of institutional persistence through the 19th and 20th centuries, and into the 21st. Neighbours-of-neighbours estimates are all significant, of the same sign, and around two times larger than NP-FE. We interpret these coefficients as less contaminated by spillovers, and hence as capturing a purer *encomienda* effect. But the high level of significance is somewhat surprising as observations fall by half and the level of matching provided by neighbours-of-neighbours is less precise than that of immediate neighbours.

Table 3: Effects of *encomienda* on colonial outcomes

Dependent variable	(1) **OLS** Neighbour-paired municipalities	(2) **OLS** Neighbour of neighbour-paired municipalities
State presence index, 1794 (0-4 scale)	0.041***	0.072***
	(0.008)	(0.017)
State presence dummy, 1794	0.009**	0.027***
	(0.004)	(0.007)
Log of population, 1780	0.128***	0.226***
	(0.022)	(0.044)
Share of whites in 1780 population	0.003***	0.007***
	(0.001)	(0.001)
# Observations	1938	966 [1]

Notes: Neighbour-pair fixed effect estimates with robust standard errors (parentheses) clustered by neighbour-pairs. Constants and controls not reported. Geographic controls include: soil fertility index, linear distances to department capital and Bogotá, municipal area, altitude above sea level, latitude, longitude, average rainfall 1980-2014, primary, secondary and tertiary river density, soil aptitude for growing potatoes, and soil aptitude for growing maize. All models include geographic controls and department fixed effects. *** p<0.01, ** p<0.05, * p<0.1.

[1] State presence index and state presence dummy models run with 962 observations.

Medium-term outcomes

Claims that *encomienda* affects modern development outcomes would be strengthened by evidence of an effect on intermediate outcomes during the five intervening centuries. Like most developing countries, Colombia collected relatively little data before 1950 and even less before 1900. Fortunately, we have at our disposal data on some socioeconomic variables for the mid-19th and early-20th centuries. Using this evidence, table 4 presents NP-FE estimates comparable to table 3, but for medium-term outcomes from these periods.

Encomienda has a positive, statistically significant relationship with population in 1851, local revenue in 1916, and land value in 1870 (using a smaller number of municipalities). These results point to a persistence of *encomienda* effects on indicators of economic and human development and local state capacity across 150 years. Neighbour-of-neighbour estimates retain their signs in all three cases but lose significance in two. We interpret this as less precise estimates from lower-quality matching and smaller sample sizes.

Table 4: Effects of *encomienda* on medium-term outcomes

Dependent variable	(1) **OLS** Neighbour-paired municipalities	(2) **OLS** Neighbour of neighbour-paired municipalities
Population, 1851 (log)	0.245***	0.032***
	(0.028)	(0.008)
Per capita municipal revenues, 1916 (log)	0.013**	0.013
	(0.005)	(0.009)
Land value, 1870 (log)	0.033**	0.008
	(0.014)	(0.016)
# Observations	1938 [1]	950 [2]

Notes: Neighbour-pair fixed effect estimates with robust standard errors (parentheses) clustered by neighbour-pairs. Constants and controls not reported. Geographic controls include: soil fertility index, linear distances to department capital and Bogotá, municipal area, altitude above sea level, latitude, longitude, average rainfall 1980-2014, primary, secondary and tertiary river density, soil aptitude for growing potatoes, and soil aptitude for growing maize. All models include geographic controls and department fixed effects. *** p<0.01, ** p<0.05, * p<0.1.

[1] Per capita municipal revenues model runs with N=1120; land value model runs with N=374.

[2] Per capita municipal revenues model runs with N=846; land value model runs with N=404.

Main results: Long-run development outcomes

What are the effects of the 16th century *encomienda* on development outcomes in Colombia today? Table 5 presents our benchmark NP-FE estimations, with dependent variables again listed down the left-hand side and other formatting similar to above (full-model results in appendix 7). For ease of presentation, we divide dependent variables into three groups: development, inequality, and local state capacity.

In group 1, five of seven coefficients are statistically significant at the 1% level, and the other two at the 5% level. A greater intensity of *encomienda* five centuries ago is associated with lower current levels of unmet basic needs, infant mortality, and multidimensional poverty, more years of education, higher municipal GDP per capita, larger populations, and a lower share of agriculture in local GDP today. Neighbours-of-neighbours estimates retain their signs and statistical significance in 5 cases, and lose significance in the other two. Where significant, coefficients are between 1.5 and 3.5 times larger than first-neighbour estimates.

The inequality measures of group 2 are all positive and significant. A greater intensity of *encomienda* in 1560 is associated with increasing inequality of plot sizes and values and a greater concentration of land in the hands of the top one percent of landowners. Although such results would seem to flow intuitively from an institution of labour extraction, they do not sit well alongside those of group 1. Neighbour-of-neighbour estimates retain their signs and significance and roughly double in size. Group 3 indicators are also all positive and significant. Greater intensity of *encomienda* 450 years ago is associated with better local fiscal performance, higher tax collections, and greater bureaucratic efficiency. Neighbour-of-neighbour estimates retain signs and significance; two are larger and one remains the same. For all three groups, we interpret larger neighbour-of-neighbour coefficients as capturing a purer *encomienda* effect less contaminated by spillovers, as before, while acknowledging that smaller sample sizes and lower-quality matching increase standard errors.

We then perform an Oster analysis of the degree of bias from unobservables for all the outcomes studied. Figure 2 illustrates results for four important measures of human development, inequality, and modern institutional capacity, in addition to our key indicator of state-building in 1794.[18] Appendix 6 details the method and summarises results for all outcomes across different values of δ. Oster (2019) recommends benchmarks of $\prod = 1.3$ and $\delta = 1$, which we adopt, while further testing for higher and lower values of δ in the interest of robustness. Appendix table A6 shows that 19 of our 20 estimates pass the conservative bar of $|\text{estimate/bias}| \geq 1$, with values that vary between 1.5 and 9, and in three cases range as high as 19, 19 and 236. These results imply that any bias from unobservables is modest compared to the magnitude of our estimated effects of *encomienda* on development. For some outcomes, a pattern of increasing coefficients as controls are added (not shown) further implies that our models are well-specified, and supports claims of causal effects of *encomienda* on development.

[18] Appendix figure A6 provides comparable graphs for the remaining 16 outcomes.

Table 5: Effects of *encomienda* on long-run development, inequality and state capacity

Dependent variable	(1) **OLS** Neighbour-paired municipalities	(2) **OLS** Neighbours of neighbours-paired municipalities
1. Long-run development		
Unsatisfied Basic Needs (UBN), 2005	-0.186**	-0.574***
	(0.0911)	(0.191)
Infant Mortality Rate, 2005	-0.099**	-0.350***
	(0.039)	(0.087)
Multidimensional Poverty Index, 2005	-0.281***	-0.566***
	(0.090)	(0.158)
Years of education, 2005	0.025***	0.036***
	(0.007)	(0.013)
GDP per capita, 2005 (log)	0.013***	-0.007
	(0.004)	(0.008)
Population, 2005 (log)	0.052***	0.112***
	(0.007)	(0.014)
Share of agriculture in GDP, 2015	-0.004***	0.103
	(0.001)	(0.293)
# Observations	1938 [1]	966 [4]
2. Long-run inequality		
Land Gini index by size, 2005	0.004***	0.007***
	(0.001)	(0.001)
Land Gini index by value, 2005	0.003***	0.006***
	(0.001)	(0.001)
Share of land owned by top 1%, 2005	0.004***	0.008***
	(0.001)	(0.001)
# Observations	1776 [2]	770 [5]
3. Long-run local state capacity		
Fiscal performance indicator, 2000-2014	0.168***	0.320***
	(0.036)	(0.072)
Tax collection per capita, 2005 (log)	0.002***	0.002***
	(0.000)	(0.001)
Local bureaucratic efficiency, 2005	0.041***	0.062***
	(0.008)	(0.016)
# Observations	1938 [3]	962

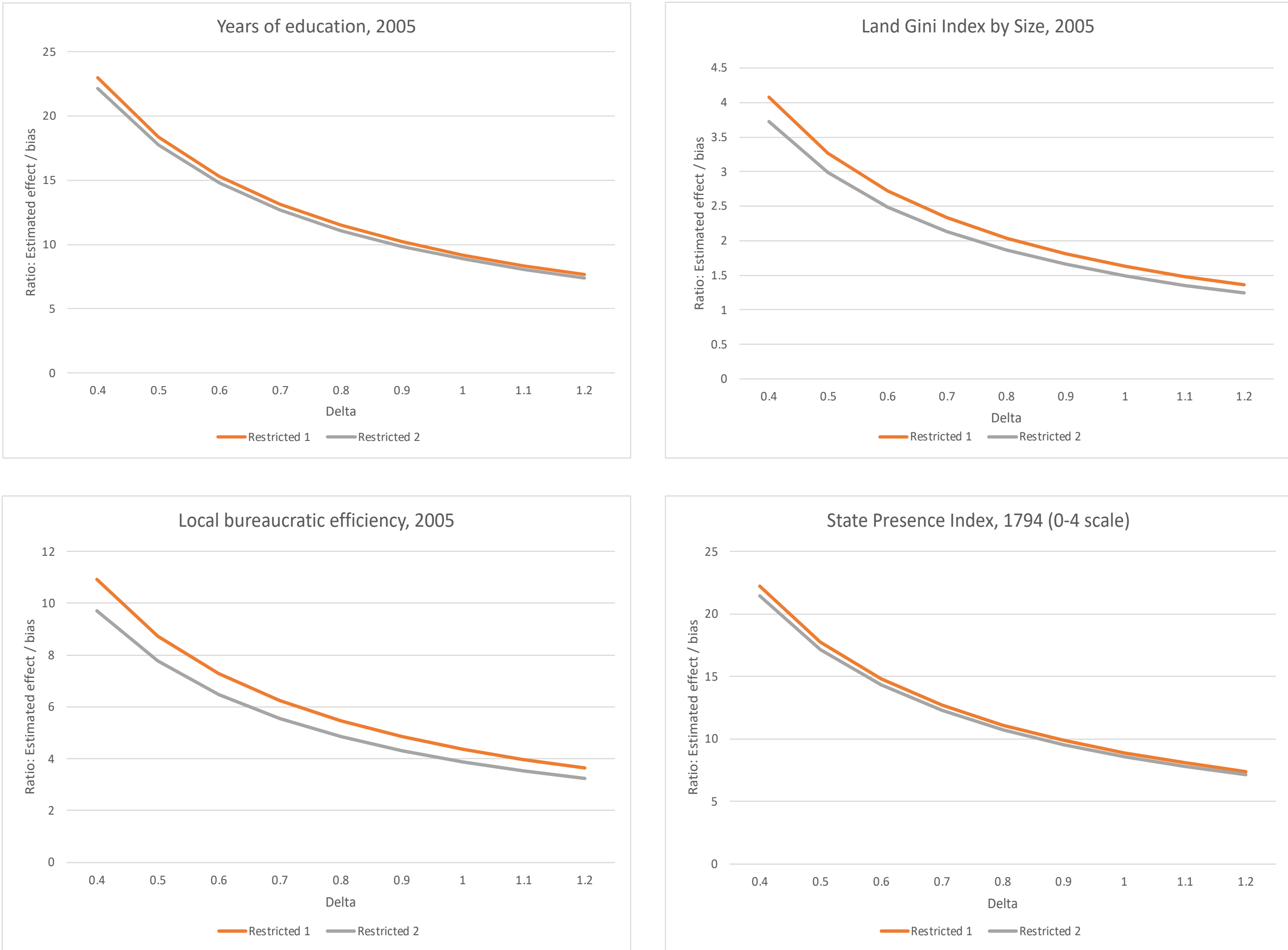
Notes: Neighbour-pair fixed effect estimates with robust standard errors (parentheses) clustered by neighbour-pairs. Constants and controls not reported. Geographic controls include: soil fertility index, linear distances to department capital and Bogotá, municipal area, altitude above sea level, latitude, longitude, average rainfall 1980-2014, primary, secondary and tertiary river density, soil aptitude for growing potatoes, and soil aptitude for growing maize. All models include geographic controls and department fixed effects. *** p<0.01, ** p<0.05, * p<0.1.

[1] UBN model runs with N=1934. [2] Share of land owned by Top 1% model runs with N=1558.

[3] Local bureaucratic efficiency model runs with N=1768. [4] GDP per capita 2005 model runs with N=962. [5] Proportion of land owned by Top 1% runs with N=742. [6] Top 1% model runs with N=814.

[7] Tax efficiency model runs with N=910.

Figure 2: Oster test of bias from unobservables, selected outcomes



Notes: Magnitude of estimated treatment/bias for different values of δ with $R_{max} = 1.3*R_2$. 'Restricted 1' is a short regression controlling for neighbour-pair fixed effects, department, and distances to departmental capitals. The longer 'Restricted 2' includes the preceding and adds controls for altitude, precipitation, distance to Bogotá, latitude, longitude, and soil aptitude for growing maize and potatoes.

Robustness tests

We perform a number of robustness tests. We briefly describe them here, with detailed results provided in appendix 8. Their logic is that underlying locational fundamentals may explain both where natives chose to settle and hence where *encomiendas* were located, as well as modern development outcomes. We test for geographic bias by estimating on sub-samples of municipalities that are increasingly similar to each other. We do this by restricting the sample to municipalities within 1 s.d. of the mean of each of 11 geographic characteristics, and then restrict further to 0.5 s.d. If geographic variation were driving results, we would expect them to weaken and then disappear as geographic variation decreases. Instead our results go through. Coefficients for human development, land inequality, and local institutional development are all significant, most at the 1 percent level, and similar in magnitude to table 5. In sum, estimates in table 5 are robust to 22 samples of Colombian municipalities based on diverse geographic criteria.

Another potential confounder of long-run development outcomes is gold and silver mining, which were important to the colonial and early republican economy. We test for this by restricting the sample to non-*encomienda* controls with high geological potential for either gold or silver deposits. Appendix 8 provides more detail on both the test and results. If mining were actually driving our findings, we would expect to find statistically significant coefficients but with opposite signs. Instead, signs remain the same as in our main results and coefficients are significantly larger across the board. In sum, these results also support our findings. Larger coefficients further suggest that mining was a more purely extractive activity than *encomienda*, leaving less in affected communities in terms of state-building and public goods.

Lastly, we re-estimate all our NP-FE models using robust standard errors corrected for spatial correlation, following the method of Colella et al. (2019). Appendix table A8.4 provides results. Coefficients across all 20 outcome variables are essentially identical, as we would expect. Significance levels fall for some variables but not others. Thirteen coefficients are significant at the 1% level, and three more at 10%. The main indicators that lose significance are historical outcomes between 1794-1916. We interpret this as offering support for our main findings, especially on long-term development outcomes.

5 IV Estimations

A second response to the problem of biased estimators is to find an instrument. We implement this in our NP-FE setup as follows:

$$\begin{aligned} \mathrm{S_g} &= bG_g + c\boldsymbol{x'}_{\boldsymbol{g}} + \zeta_{gi} + \epsilon_g \qquad g \in M \\ \mathrm{S_i} &= bG_i + c\boldsymbol{x'}_{\boldsymbol{i}} + \zeta_{gi} + \epsilon_i \qquad i \in N(g) \end{aligned} \tag{3}$$

where G_τ is our instrument and ϵ_τ is the error term. The second stage estimates β_{IV}:

$$\begin{aligned} \mathrm{y_g} &= \beta_{IV}\widehat{S_g} + \gamma\boldsymbol{x'}_{\boldsymbol{g}} + \zeta_{gi} + v_g \qquad g \in M \\ \mathrm{y_i} &= \beta_{IV}\widehat{S_i} + \gamma\boldsymbol{x'}_{\boldsymbol{i}} + \zeta_{gi} + v_i \qquad i \in N(g) \end{aligned} \tag{4}$$

Historians argue that *encomiendas* were established where natives were settled, implying the presence of unobservables (locational fundamentals) that might persist in the long run, and which might affect current development levels. Recent studies have addressed this problem by instrumenting for indigenous settlements with temperature, rainfall, altitude, and indicators of river density and soil fertility. But these variables are themselves correlated with long-term development outcomes, and so unsuitable for our purposes. Additionally there is a measurement problem: imperial visitors traveling on horseback through the jungles and mountains of Colombia in the 1500s missed some *encomiendas*.[19] Further, *encomenderos* had strong incentives to underreport tributary natives to lower the taxes they paid the Crown. Hence, our data likely undercount the actual number of tributary natives. This would tend to bias OLS estimates downwards (Pischke 2007). IV is a remedy for both problems.

The instrument: Least-cost path of conquest

Our instrument projects the overland routes taken by Spanish explorers as they conquered indigenous populations and established settlements onto Colombia's modern municipal map. Although conquerors did not make detailed maps of their routes (the earliest maps of Colombia date from several decades later; Tovar 1988, IGAC 1996), we can approximate it well using detailed accounts of imperial visitor Tomás López' travels. Visitors were charged with finding and recording information from all Spanish settlements, and the most reliable way to do this in Colombia's difficult terrain was to follow the paths the

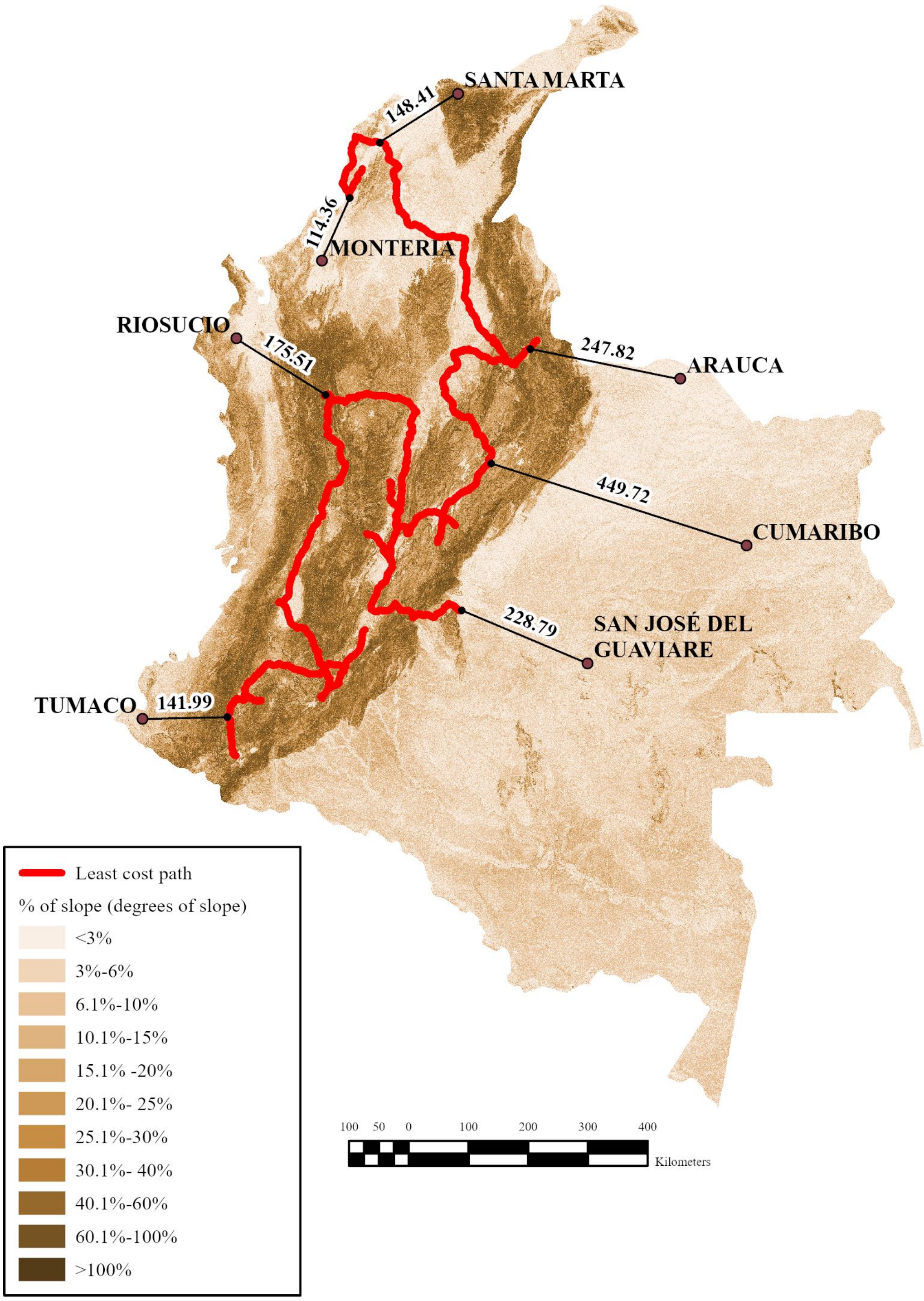
[19] Colmenares (1999) documents evidence of the systematic undercounting of natives during the visit of Ruiz de Orejuela (p.83).

conquerors took. López' narrative provides a detailed account of his journey, from Pasto in the south to María la Baja in the north, including all the settlements he visited and the assets he registered. The original is in the Archive of the Royal Academy of History (Geographical Relations, 46661, 14-IX); we rely on Tovar's (1988) transcription.

The settlements López chronicled correspond to 28 modern municipalities. To estimate his most-likely precise route, we implement a procedure similar to Fajgelbaum and Redding (2022) to find the least-cost path connecting these municipalities, considering elevation, slope, and diverse natural barriers. We use ArcGIS software loaded with IGAC layers of municipal borders and topographical data originating from NASA's 30-meter Digital Elevation Model from the Shuttle Radar Topography Mission (2011). With this information, we plot the least-cost path across 28 municipalities' centroids in the order in which López visited them. We then calculate the distance of all other municipalities in Colombia to the nearest point on this path. Appendix 9 provides more details on the historical record of López' journey, an ordered list of the 28 municipalities, and maps showing (i) the conquerors' original routes as given by Agustín Codazzi (1889), and (ii) the least-cost path we calculated. Figure 3 below summarizes our least-cost route in red, with illustrations of distances from 7 municipalities in different regions of the country to the nearest point on this route.

Our identifying assumptions are that the distance to the least-cost route taken by conquerors to the towns they founded in the 16th century is highly correlated with the location of *encomiendas*, but uncorrelated with other factors that drive modern-day development outcomes. Historical evidence indicates that *encomiendas* underpinned the economies of new Spanish settlements. Throughout New Granada, the standard sequence of conquest was: Spaniards (i) declared a new settlement in a place where natives lived in significant numbers, (ii) founded a *cabildo*, and (iii) used its authority to assign themselves *encomienda* natives (Avellaneda 1995). Indeed, it was the possibility of establishing *encomiendas* that drew Spaniards to settle where they did, as discussed above and in Appendix 2. Hence, proximity to the conquerors' route is a good measure of where *encomiendas* were located. By contrast, distance to a route connecting a series of towns founded in the early 1500s by conquerors on horseback, traversing lands they did not know, is plausibly independent of 21st-century economic, human, and municipal development indicators.

Figure 3: Least-cost estimate of conquerors' route.



Colombia's geography supports the validity of the instrument. The Andes mountain chain, which runs up the western side of South America from southern Chile and Argentina, arrives at Colombia's border with Ecuador and trisects. The three resulting *cordilleras* create a rugged, enormously diverse topography featuring thousands of mountains, valleys, plains, rivers, forests, and other geographic zones with locational fundamentals favourable to agriculture and mining, the mainstays of the Colombian economy during the 16^{th} – 19^{th} centuries. During 300 years of empire, the Spanish settled only a small minority of these zones, leaving many areas with good locational fundamentals untouched by *encomienda.* Hence distance to the route of conquest should be highly correlated with *encomienda*, but uncorrelated with locational fundamentals.

One of the most important potential violations involves mineral deposits, especially gold and silver. The quest for gold and silver motivated many Spanish conquerors, and their exploitation might explain differences in current development outcomes. Hence, we perform a placebo tests, regressing tributary natives and distance to the least-cost path of conquest on municipalities' gold and silver extractive potential, based on detailed environmental and geological data. Results are presented in appendix 10. Gold and silver are statistically insignificant across both models, with and without departmental dummies, for both variables, implying no systematic relationship with tributary natives or our instrument. This supports the instrument's validity.

IV Results

Table 6 provides IV estimates for the same development outcomes discussed above. Across all 20 colonial, medium-term, and long-run outcomes, coefficients have the same signs as OLS; 19 are significant at the 1% level and one is significant at the 5% level. This implies that a greater intensity of *encomienda* five centuries ago is associated with higher state capacity and better economic and human development outcomes during colonial times, the early republic, and the present day. IV results support OLS evidence that *encomienda* is causally related to lower levels of unmet needs, infant mortality, and poverty, more years of education, higher municipal GDP per capita, larger populations, lower agricultural shares in the local economy, greater land inequality, and higher local state capacity today.

Table 6: IV Estimates of colonial, medium-term, and long-run development outcomes

Dependent variable	IV Log tributary natives	1st stage coefficient	1st stage F	Reduced form	N
1. Long-run development					
Unsatisfied Basic Needs (UBN), 2005	-1.906***	-0.861***	184.97	1.642***	1934
	(0.320)	(0.063)		(0.232)	
Infant Mortality Rate, 2005	-0.562***	-0.860***	184.41	0.484***	1938
	(0.101)	(0.063)		(0.083)	
Multidimensional Poverty Index, 2005	-1.687***	-0.860***	184.41	1.451***	1938
	(0.291)	(0.063)		(0.228)	
Years of education, 2005	0.142***	-0.860***	184.41	-0.122***	1938
	-0.023	(0.063)		(0.018)	
GDP per capita, 2005 (log)	0.022**	-0.860***	184.41	-0.019**	1938
	-0.009	(0.063)		(0.008)	
Population, 2005 (log)	0.146***	-0.860***	184.41	-0.126***	1938
	-0.022	(0.063)		(0.018)	
Share of agriculture in GDP, 2015	-0.013***	-0.860***	184.41	0.011***	1938
	(0.003)	(0.063)		(0.003)	
2. Long-run inequality					
Land Gini index by size, 2005	0.008***	-0.868***	165.56	-0.007***	1776
	(0.002)	(0.067)		(0.002)	
Land Gini index by value, 2005	0.008***	-0.868***	165.56	-0.007***	1776
	(0.002)	(0.067)		(0.002)	
Share of land owned by top 1%, 2005	0.008***	-0.882***	159.16	-0.007***	1558
	(0.002)	(0.070)		(0.001)	
3. Long-run local state capacity					
Fiscal performance indicator, 2000-2014	0.364***	-0.860***	184.41	-0.313***	1938
	(0.096)	(0.063)		(0.081)	
Tax collection per capita, 2005 (log)	0.005***	-0.860***	184.41	-0.004***	1938
	(0.001)	(0.063)		(0.001)	
Local bureaucratic efficiency, 2005	0.097***	-0.851***	158.35	-0.083***	1768
	(0.024)	(0.068)		(0.018)	
4. Middle term development outcomes					
Population, 1851 (log)	0.415***	-0.860***	184.41	-0.357***	1938
	(0.087)	(0.063)		(0.073)	
Per capita municipal revenues, 1916 (log)	0.056***	-0.873***	86.41	-0.049***	1120
	(0.019)	(0.094)		(0.015)	
Land value, 1870 (log)	0.130***	-1.321***	62.75	-0.172***	374
	(0.038)	(0.167)		(0.043)	
5. Colonial outcomes					
State presence index, 1794 (0-4 scale)	0.257***	-0.860***	184.41	-0.221***	1938
	(0.026)	(0.063)		(0.020)	
State presence dummy, 1794	0.064***	-0.860***	184.41	-0.055***	1938
	(0.011)	(0.063)		(0.009)	
Population, 1780 (log)	0.888***	-0.860***	184.41	-0.764***	1938
	(0.082)	(0.063)		(0.062)	
Share of white people in 1780 population	0.025***	-0.860***	184.41	-0.021***	1938
	(0.003)	(0.063)		(0.002)	

Notes: NP-FE IV estimates with robust standard errors (parentheses) clustered by neighbour-pairs. Instrument is distance to least-cost path (log). Constants and controls not reported. Geographic controls include: soil fertility index, linear distances to department capital and Bogotá, municipal area, altitude above sea level, latitude, longitude, average rainfall 1980-2014, primary, secondary and tertiary river density, soil aptitude for growing potatoes, and soil aptitude for growing maize. All models include geographic controls and department fixed effects. *** p<0.01, ** p<0.05, * p<0.1.

IV estimates are typically between two and six times larger than OLS (ranging between 1.7 and 10.2). Why this difference? We attribute it to measurement error in the original *encomienda* data. According to Pischke (2007), the difference between IV and OLS estimates increases the larger the difference between false negatives (places with *encomiendas* not registered as having) and false positives (places with *encomiendas* registered as not having) (Pischke 2007; see also Ang 2023). In a country with as difficult a geography as Colombia, and given transportation technologies of the 16th and 17th centuries (horseback and walking), imperial agents likely did not find all the *encomenderos* they set out to count. Agents' objective of taxing *encomenderos'* assets implies a strong incentive for the latter to divert or impede agents. Historical evidence of such attempts is abundant. In 1596 they reached the extreme of angry *encomenderos* convincing the Church to excommunicate *visitador* Egas de Guzman, who aborted his mission and fled back to Spain (Wiesner 2008). Hence our data likely undercounts the actual number of tributary natives in 1560. We would expect such measurement error to lead to attenuation of effects estimated by OLS. IV estimates should pick up encomiendas missing in the historical data, and also account for possible endogeneity issues discussed above. Reduced-form estimates support this interpretation; coefficients closely reproduce the magnitudes of IV estimates and share the same levels of significance.

More robustness tests

The most important source of omitted variable bias is likely to be prehispanic population density. According to Boyd-Bowman (1976), the accumulated Spanish migration to Colombia totalled fewer than 4,000 in 1600, in a large, diverse territory twice the size of Spain. Tovar et al. (1994, relying on López de Velasco's 1584 compendium) put the number of *vecinos* – adult Spanish men – at 2,291 in 1570.[20] If it is true that settlers favoured places with indigenous populations, it is also true that during the first century of colonization they only reached a small fraction of those settlements. In this context, we are confident that our empirical approach as described above is robust to this source of bias. But for the avoidance of doubt, we re-estimate for seven of our most important outcomes controlling for distance to

[20] The historical rule of thumb is to multiply by 3 or 4 to capture Spanish women, children, and others.

the nearest prehispanic settlement, as a proxy for population density. While we would prefer to use population density directly, such data do not exist at the municipal level for Colombia.[21] Appendix 11, columns (2) and (5), shows that results are essentially identical to our main OLS and IV estimates. This is not surprising as the prehispanic settlements control is insignificant in all of the models.

Another source of bias is the Pacific region of Colombia, which has different institutions and a different demographic makeup compared to the rest of Colombia.[22] Are our results robust to excluding this region? Appendix 11, columns (3) and (6) shows that they are. Both OLS and IV results are similar to our main results, retaining signs and magnitudes across the board. For OLS estimates, UBN becomes insignificant, infant mortality and per capita tax collection decrease somewhat in significance (from 1% to 5%), and multidimensional poverty increases in significance (from 5% to 1%). For all IV results, significance levels remain unchanged.

6 Mechanisms

By what mechanism might *encomiendas* in 1560 affect development, inequality, and state capacity outcomes some five centuries later? The historical analysis in section 2 suggests that the presence of *encomiendas* and Spanish *encomenderos* during the colonial period had at least three distinct effects in these areas: a higher share of Spanish descendants (white population), more general population growth, and the construction of local state institutions. Table 3 confirms an empirical effect on all three variables. Other factors might also have mediated such a relationship – interpersonal trust and trust in public institutions, to cite one prominent example (Nunn and Wantchekon 2011). Unfortunately, as for most developing countries, historical data that might allow us to test such pathways is extremely limited for Colombia. Hence we focus on the three transmission channels for which good data exist.

We expect population growth to be positive for development via economies of scale and agglomeration. Early construction of the local state would have provided a crucial head start in public order, justice, protection of property rights, and investment in fundamental public goods like roads, marketplaces, and public hygiene, and so would also have spurred

[21] Maloney and Valencia's (2015) analysis is at the level of 30 Colombian departments. By contrast, all of the analysis in this paper focuses on Colombia's 1100+ municipalities.
[22] We are grateful to an anonymous reviewer for this suggestion.

development. By contrast, we expect larger white populations to have ambiguous development effects: positive through the superior human capital of (some) European settlers, but negative via ethnic segregation, discrimination and exclusion against natives, *mestizos*, and slaves. Our estimations decompose *encomienda's* total effects on medium and long-run outcomes into each one of these three indirect effects, alongside a residual, corresponding to potential channels for which we lack information, which we term the direct effect.

We use the approach of Imai et al. (2011) and Heckman and Pinto (2015) to estimate the weight of each colonial outcome as a mediator for medium and long-run development and inequality, using tributary natives as our *encomienda* treatment variable. Our mechanism specification is:

$$M_{ji} = \alpha + \gamma_j ENCOMIENDA_i + \delta X_i + PAIR_i + \epsilon_i \,, \tag{5}$$

where M_{ji} denotes the intermediate mediator outcome j for municipality i, $ENCOMIENDA_i$ is the distance from each municipality to the conquerors' least-cost route, X_i is the set of control variables, $PAIR_i$ are neighbour-pair fixed effects, and ϵ_i is the error term. We then regress

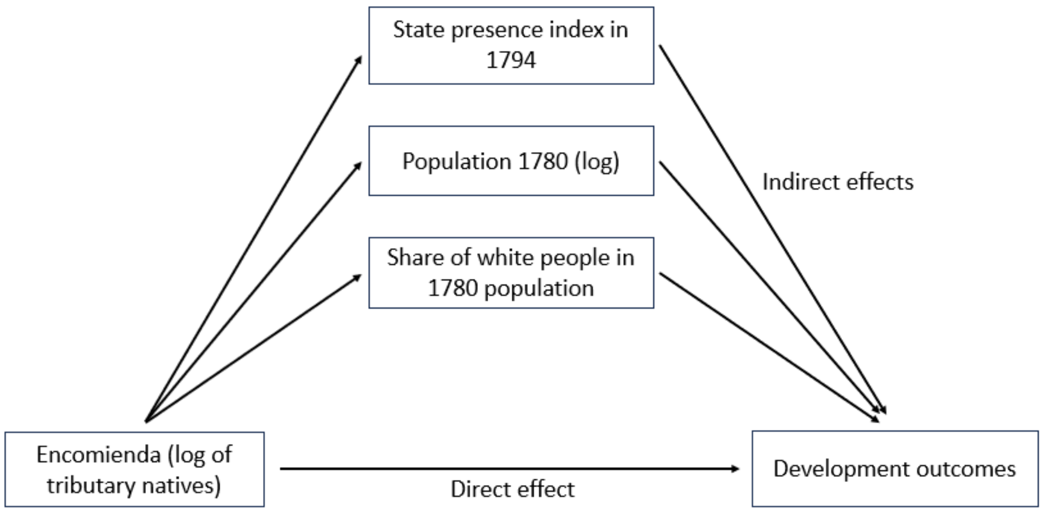
$$Y_i = \alpha + \sum \theta_j M_{ji} + \kappa ENCOMIENDA_i + \delta X_i + PAIR_i + \epsilon_i \,, \tag{6}$$

where Yi are outcomes of interest for municipality i. The explanatory power for each mediator variable j is given by $\gamma_j \theta_j / \beta$, where β represents the total effect of *encomienda* from OLS estimates presented in tables 4 and 5. Coefficient κ captures the effect of *encomienda* on Y_i that is not explained by colonial mediators, and can be expressed as $\kappa = \beta - \sum \gamma j \theta j$. The validity of the mediation analysis hinges on the strong assumption that unmeasured mediators are not correlated with measured mediators. In other words, we assume that coefficients θ_j are unbiased.[23] In our analysis, we include three colonial mediators – local state capacity, local population, and white population share – and assume that no additional mediators that might bias estimators θ_j correlate with the three observed mediators.

[23] Imae et al. (2011) and Heckman and Pinto (2015) call this condition the 'sequential ignorability assumption'. Given observed pretreatment confounders, the treatment assignment (here *encomienda*) is assumed to be ignorable, or statistically independent of potential outcomes and potential mediators. This part of the assumption relies on the exogeneity or unconfoundedness of the variable. A second part of the assumption holds that observed mediators are ignorable given actual treatment status and pretreatment confounders. Imae et al. (2011) and Heckman and Pinto (2015) argue that the second assumption is not testable.

Figure 4 illustrates our mediation exercise. Its logic is to decompose *encomienda's* total effect on development outcomes into three indirect effects via local state presence, population size/agglomeration, and racial composition, and a direct effect. We use data from Durán y Díaz (1794) on colonial employees at the municipal level to construct a local state index that varies from 1 to 4 depending on the number of public local employees in 1794. We code 0 when no employees were reported. We also use data from Tovar et al. (1994) on local population size and racial composition in 1780.

Figure 4: Direct and indirect effects of *encomienda* on development



The four panels in figure 5 illustrate each of the three mediator's share of *encomienda's* total effect on 18 different outcomes variables, plus the direct (residual) effect. In technical terms, figure 5 depicts estimates of $\gamma_j\theta_j/\beta$ and κ/β for long-term and medium-term outcomes with their respective 95% confidence intervals. Our main focus is a comparison of the three indirect historical channels. Detailed results are provided in appendix 12.

Local state capacity in 1794 as mediator

The first thing we see in panel 1 is a larger number of statistically significant effects that are generally larger in magnitude than panels 2 or 3. Eleven of the 16 indirect effects are statistically significant, nine at the 1% and two at the 5% levels. Amongst modern-day development outcomes, local state capacity in 1794 accounts for 51% of *encomienda's* total effect on UBN, 35% of its effect on infant mortality, 27% of its effect on multidimensional poverty, and 34% of its effect on years of education. Historic state capacity also accounts for 22% of *encomienda's* total effect on modern population size, 22% of its effect on agricultural share of GDP, 26% of its effect on fiscal performance, and 16% of its effect on local bureaucratic efficiency. Our mediation estimates are insignificant for per capita GDP and per capita local taxes. With respect to inequality, local state capacity in 1794 accounts for 12% of *encomienda's* total effect on land concentration (top 1%), but is insignificant for land Gini coefficients by size or value. With respect to medium-term outcomes, local state capacity in 1794 accounts for 17% of 1916 local per capita revenue, 20% of 1870 land values, and 24% of local population size in 1851.

The channel that runs through the colonial construction of the local state thus accounts for an important share of *encomienda's* total effects on social development indicators, population size, and local state capacity at the start of the 21st century, as well as a significant share of middle-term outcomes from the late 18th, late 19th and early 20th centuries. These results suggest that early colonial investments in a capable local state persisted over long periods of time. In places where *encomienda* was prevalent, institutional capacity to ensure order and provide key public goods fomented development in ways that explain an important part of the differences in well-being indicators across municipalities today. Lastly, consider for a moment our specific results on fiscal performance and bureaucratic efficiency alongside mixed results for inequality. These suggest that the institutions built by the original *encomenderos* proved good at reproducing their own capacity and defending the position of local elites, even as they did not necessarily foment broad inequality.

1780 population as mediator

The second mediator through which *encomienda* might affect long-run development is colonial population. Spaniards settled where there were *encomiendas*, stimulating population growth of whites and mestizos even as indigenous populations fell everywhere. Panel two shows five of 16 possible indirect effects that are significant. Among modern-day development outcomes, population in 1780 accounts for 30% of *encomienda's* total effect on multidimensional poverty, 19% of its effect on years of education, 15% of its effect on local population size, 13% of its effect on fiscal performance, 18% of its effect on per capita tax collections, and is insignificant for all three measures of inequality. Amongst medium-term outcomes, 1780 population is only marginally significant (10%) for population in 1851, accounting for 5% of the total effect.

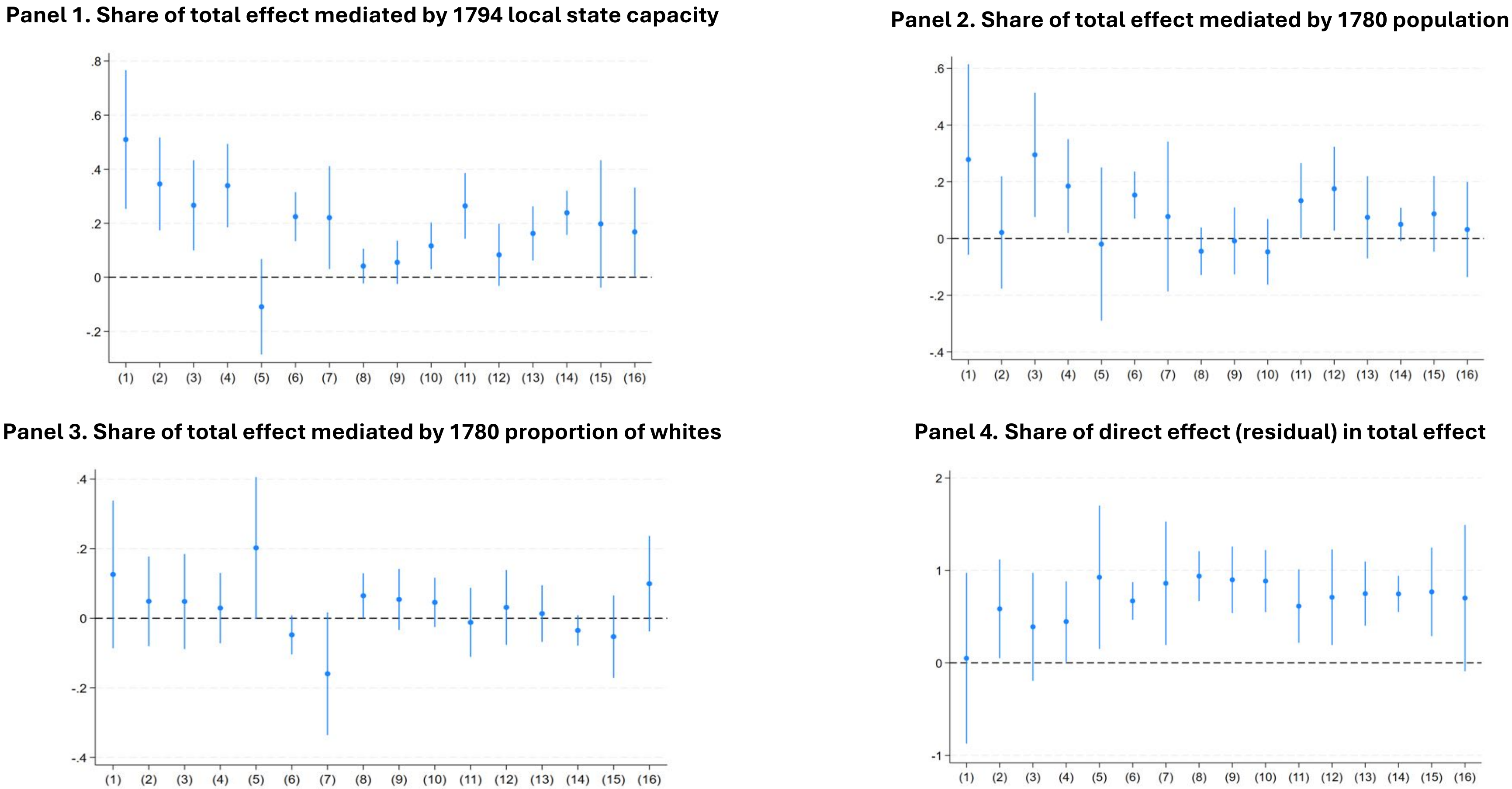
This second mediator thus accounts for a smaller share of *encomienda's* total effects on modern-day institutional, economic and social development indicators, as well as a smaller share of middle-term outcomes from earlier periods, compared to historical local state capacity.

1780 share of whites as mediator

The third mediator through which *encomienda* might affect long-run development is racial composition. Panel 3 shows only one of 16 possible indirect effects that is significant, and three more that are marginally significant (10%). The white share of the 1780 population accounts for 7% of *encomienda's* total effect on the land Gini by size. Marginally significant results include per capita GDP, where the white share of the 1780 population accounts for 20% of *encomienda's* total effect, and population and agriculture's share of GDP, where shares are negative (-5% and -16% respectively). Among medium-term outcomes, no result is significant.

Negative weights imply that a larger white share of the population in 1780 is associated with a smaller population and less agriculture in the local economy today. In sum, the third mediator accounts for a smaller share of *encomienda's* total positive effects on modern-day institutional, economic and social development indicators compared to historical local state capacity.

Figure 5. Mediation results for long-term and medium-term outcomes



Notes: Share of total effect explained by each mediator for outcomes: (1)=UBN 2005; (2)=Infant Mortality Rate 2005; (3)=Multidimensional Poverty 2005; (4)=Years of education 2005; (5)=GDP per capita 2005 (log); (6)=Population 2005 (log); (7)=Share of agriculture in GDP 2015; (8)=Gini Land Size 2005; (9)=Gini Land Value 2005; (10)=Top 1% land ownership 2005; (11)=Fiscal performance 2000-2014; (12)=Tax collection per capita 2005 (log); (13)=Tax efficiency 2005; (14)=Population 1851 (log); (15)=Land value 1870 (log); (16)=Per capita municipal revenues 1916 (log).

Direct effects

Our estimated direct effects correspond to κ/β, representing residual variation not explained through our three mediators. Panel 4 shows 13 of 16 possible direct effects that are significant. Estimated direct effects account for 59% of *encomienda's* total effect on infant mortality, 45% of its effect on years of education, 93% of its effect on per capita GDP, 67% of its effect on modern population, and 86% of its effect on agriculture's share of GDP. With respect to medium-term outcomes, direct effects account for 75% of *encomienda's* total effect on 1851 population, 70% of its effect on local per capita revenues in 1916, and 77% for 1870 land values. Lastly, direct effects account for 94% of *encomienda's* total effects on land inequality by size, 90% of *encomienda's* total effects on land inequality by value, and 89% of its effect on land concentration in the hands of the top 1%. These last results suggest a remarkable persistence of land concentration over 5 centuries in *encomienda* areas of Colombia, broadly echoing Barone and Mocetti's (2016) findings for persistence of economic elites in Florence, Italy over 600 years.

Stepping back from the detail, what is the broad picture that emerges? Like many colonial institutions, *encomienda* was a bundle treatment that combined elements of local institution building, population size, and racial composition. We attempt to disentangle these effects via a mediation analysis. Our results imply that local state capacity in 1794 is the most consistently important of these three effects and has the largest magnitudes. It is statistically significant across more outcome indicators than population or racial composition. Compared to population, its relative effects are larger in 10 outcomes, smaller in one, and roughly equal in one. Compared to racial composition, its effects are larger for 11 indicators, and smaller in one. Hence we surmise that colonial e*ncomienda's* important effects on long-run development, inequality, and state capacity operated more powerfully via its role in building the local state than by spurring population growth, or via the particular way it blended racial groups.

For robustness we conduct a second mediation exercise, this time using our IV results, employing the method of Dippel et al. (2020) to focus on the local state capacity channel. This decomposes the total effects of *encomienda* on modern-day development outcomes into direct effects vs. indirect effects via *encomienda's* contributions to building local state capacity during intervening centuries. Appendix 13 explains the method in detail and provides results. The positive effects of *encomienda* on long-run patterns of development operate primarily through their indirect effects on local state capacity-building during the intervening centuries, which swamp *encomienda's* direct effects. This evidence further buttresses our findings.

7 Conclusions

The Spanish *encomienda* allowed Spanish colonizers to extract labour from natives. It created strong incentives for landlords to over-work natives. Many died as a result, and others fled into the wild to escape it. Guiding off studies of the long-run effects of slavery and extractive or unequal institutions, we might expect *encomienda*-affected areas of Colombia to suffer worse development outcomes today. But the reverse is true. Areas that had *encomiendas* in 1560 show better current levels of economic development, human development, and state capacity. Where *encomienda* was more intense, years of education, municipal GDP per capita, and tax receipts are higher; infant mortality, multidimensional poverty and unsatisfied basic needs are lower; populations are larger; and fiscal performance and bureaucratic efficiency are better. *Encomienda* in the 16th century is also associated with higher inequality in land ownership today. These results are robust to different estimation methods, and survive a battery of robustness tests.

It is not surprising to find that *encomienda* 450 years ago is associated with higher inequality today. But why would municipalities that suffered this particular institution now be more developed? The Spanish conquest destroyed indigenous society and eventually killed off the lion's share of its people. Surveying a *tabula* made *rasa*, Spanish conquerors chose to sow the seeds of what would become the colonial, and then republican, local state in the places they occupied. And they occupied places where they could establish *encomiendas.* They could achieve such ambitious ends because during early colonization, *conquistadores* were powerful men with powerful interests, widely recognized as sources of law and order.

Detailed micro-historical evidence documents that where the Spanish settled, they quickly established *cabildos,* churches, notaries, jails, and other local institutions, and invested time and resources in building them up. Inevitably, many if not most of these resources were extracted from natives. *Encomenderos* monopolized leading offices in these institutions throughout the 1500s and much of the 1600s, and used them to protect their wealth and status in society. The presence of *encomienda* natives thus prompted the inception of a strong local state with capacities in different government tasks, which persisted over time. Where *encomenderos* were missing, by contrast, such powerful rural interests were absent. In those places, the institutions of the local state were founded far later – many well into the 20^{th} century – and invested in much less. Over centuries, absent or less capable local states mobilized fewer resources, invested less in the local economy, and spurred less development than their *encomienda* neighbours.

We test this theory via two mediation exercises on both OLS and IV results, using historical data on populations, their racial composition, and the presence of key institutions of the local state from 1780 and 1794, and find strong support. The estimated impact of *encomienda* on current levels of economic and human development, as well as state capacity, run more strongly via its contribution to building colonial local state institutions than via its effects on population or racial composition. This is particularly notable for education, health, and unsatisfied basic needs, where 34-51% of *encomienda's* total effects are via the building of the historical state. The remarkable consistency of our OLS and IV results across very different kinds of outcomes, multiple levels of analysis, and diverse sample restrictions inspires confidence in the underlying relationship we posit between *encomienda* and development.

The claim that colonial state-building might drive current development outcomes is less surprising when placed in its historical context. Recent research shows significant economic growth and increasing productive sophistication in colonial Colombia. The institutions that *encomienda* helped build, and which our 18^{th} century data capture, presided over significantly more economic and human development during colonial times than is generally assumed. Viewed in this light, it is less surprising that their descendants contribute to greater development today.

Institution-building and public investment might explain why extractive institutions are associated with positive long-term outcomes in Colombia and Java, but negative ones in the Congo and Peru. Both *encomienda* and the Dutch cultivation system resulted in the provision of local public goods that comparable locations lacking them did not receive. By contrast, rubber concessions in the Congo Free State and the *mita* in Peru were more purely extractive institutions unassociated with public investment.

Finally, it is important to note that this study makes no attempt to evaluate the broader effects of Spanish colonialism in Colombia. That would be an inherently speculative question, as there is no plausible counterfactual for what might have happened if the Spanish had never colonized the region. Rather, our aim is to assess whether exposure to one particular, highly extractive institution changed the development trajectory of affected places. The evidence shows that it did, and for the better.

This finding underlines the role of accumulation in long-run development. Areas lacking *encomienda* suffered less extraction by *encomenderos* from the 16th century onwards. But they are worse off today. In areas with *encomienda,* some of the resources extracted were used to build the local state, and a stronger state spurred development. In a modern context, this suggests using democratic, rather than repressive, tools of resource mobilisation to invest in subnational institutions as a means of raising a country's development trajectory.

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Conflict of Interest

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Appendix 1: Example of yearly tribute according to 1555 levy

Community	Tribute[a]		Natives for personal service[b]	Cultivation of Crops[c]		
	Cash	Mantas		Maize	Wheat	Potatoes
Guatavita	2400	240	32	35	8	4
Suesca	682	150	20	8	26	2
Cota	None	400	10	8	8	3

Community	Wood for building				Other	
	Large Beams	Small Beams	Rods	Wood for cooking[d]	Fodder[d]	Deer
Guatavita	15	150	300	4380	3650	24
Suesca	8	80	120	2190	1460	36
Cota	4	40	80	1095	1095	24

Notes: [a] Cash sums were in pesos of 7½ carats. Mantas were square cotton blankets measuring approximately 35” x 35”.

[b] There were three main classes of work for *encomienda* natives: i) communal labour for planting, harvesting and delivery of crops or other goods; ii) livestock and agricultural work to which a certain number of natives were assigned to the *encomendero's hacienda*. In the *encomienda* of Guatavita, 12 natives could be allotted yearly for such work. And iii) work to which a certain number (e.g. 20 in Guatavita) could be allotted, for any job, anywhere (town, *hacienda*, and even far away) the *encomendero* desired.

[c] Crops were reckoned in *fanegas* = about 150 pounds.

[d] Wood and fodder for cooking were measured in *cargas* – bundles measuring 69” in diameter.

In addition to the above, Guatavita had to plant an area of 150 square feet (in the valley of Guachetá) with sugar cane.

Source: Villamarín (1972, p.57)

Appendix 2: Encomienda and the Construction of the Local State in Colonial Tunja[24]

To understand more deeply the roles of *encomiendas*, *cabildos*, and *corregimientos* in the construction of the local state, consider how these factors interacted in one of the most important cities in colonial Colombia, Tunja, during the first century after it was founded. Lying 145 km northeast of Bogotá in one of the wealthiest and most densely populated areas of the highlands, Tunja was the capital of Tunja province during colonial times, and is the capital of the department of Boyacá today. It was founded in August 1539 by Captain Gonzalo Suárez Rendón and a few of the 173 Spaniards who survived an arduous, 11-month expedition of conquest from Santa Marta, south along the Magdalena River and up into the highlands, in which 630 of their comrades died of exposure, hunger, disease, and attacks by indigenous warriors.

The party that thrust south from Santa Marta, as well as two other parties, from Venezuela and Ecuador, that joined them in the Colombian highlands during the following year, were military expeditions of conquest, organized according to military logic, as distinct from groups of colonial settlers seeking to populate the land (Avellaneda 1995). These soldiers and adventurers turned to settlement of necessity, somewhat unexpectedly, when it became clear that their search for a route to Peru and the Pacific had failed, but instead they had found rich lands and large numbers of pliable natives. They sought to stabilize their conquest by settling the land and organizing it in typical Castillian forms. In so doing, they expressed a Spanish imperial belief that populating their new domains was necessary for Christianising natives, and the latter justified conquest (Avellaneda 1995, López de Gómara 1552).

The Spanish who founded Tunja formed a *cabildo* (municipal corporation) on 18 August 1539. As its first act, it declared the settlement of 20 conquerors in the new city. Soon after, it allocated local natives to conquerors in *encomiendas* as reward for their efforts. Other important functions of the *cabildo* include (Wiesner 2008):

1. Regulate property rights.
2. Plan urban development, including construction of buildings, streets, pavements,

[24] This appendix relies extensively on Wiesner's (2008) carefully researched, empirically rich account of Tunja's development in the 16th and 17th centuries.

bridges, aqueducts, and building maintenance.

3. Control and supervise public order.
4. Regulate the supply of essential goods to the city. Collect duties on goods and merchandise. Collect sales tax and revenue from the sale of stamped paper.
5. Regulate property rights over cattle.
6. Control, examine and supervise the city's artisans.
7. Manage public health services and provide for the cleanliness of the city.
8. Issue ordinances and apply them.
9. Act as judge of first instance.
10. Receive and certify the *Corregidor* and his lieutenant; organize public civil and religious celebrations according to custom.
11. Supervise salaries and entitlements.
12. Name sub officials to supervise, e.g., weights and measures of meat and wine.
13. Elect annually the *cabildo* of Villa de Leiva.
14. Represent Spanish residents (*vecinos*) before higher authorities.

The *cabildo* quickly turned its attention to construction, and by 1610 Tunja had 415 buildings, including a town hall, various other municipal buildings, a jail with its chapel, 6 churches, 5 convents, 4 hermitages, a hospital with its church, a windmill, several tanneries and tile factories, and 390+ private houses or huts (Wiesner 2008).

Encomenderos made up about 20% of Tunja's population in the early 1600s. They numbered 79 in 1602, 76 in 1610, and 73 in 1636, falling to 56 in 1690. These numbers refer to Spanish heads of households; a typical *encomendero* household in Tunja consisted of 10-14 people, including family members and live-in servants. They occupied large properties, often compounds with internal courtyards and multiple buildings (Wiesner 2008).

The *cabildo* planned or issued permits for all of this construction, raised funds to build public structures, and regulated private activity in the city as it grew. For example, it managed municipal waste, designating 4 ravines as dumps in 1564, and increasing that number to 6 ravines in 1577. It also managed the *ejido*, a common pasture outside the city, regulating what types and how many of each type of "useful animal", e.g., bulls, cows, goats, sheep, and service horses, were permitted to graze there. Because of its rich agricultural land and large indigenous population, Tunja quickly became a leading Spanish city in terms of economic and social development in colonial Colombia.

Like *cabildos* throughout New Grenada, Tunja's consisted of two kinds of officials. More senior posts were held in perpetuity by local notables, usually *encomenderos*, who effectively purchased them from the Crown. Less senior posts were elected by permanent *cabildo* members; some examples include the weights and measurements officer, various fiscal officers, the protector of natives, and the town crier. Figure A2 provides an organigram with more detail on the structure of local government in Tunja during the 17th century, including how the *cabildo* related to officials of the *corregimiento*.

The power and social pre-eminence that attached to *cabildo* membership were concentrated amongst the so-called 'illustrious citizens' of Tunja, descendants in the main of Spanish conquerors, and most of all amongst the subset of them who were *encomenderos*. This is because the awarding of *encomiendas* and associated distribution of lands implied special political rights that distinguished *encomenderos* from lesser individuals, as legally recognized privileges that were additionally sanctioned by custom. As evidence, consider some of the most important authorities that made up the *cabildo* in the 1500s and 1600s.

The **Governor** ***(Regidor)*** was the most important office in the cabildo. The office conferred both great social pre-eminence and great political power. *Regidor* comes from *regir*, to govern or rule, and hence can be loosely translated as 'city governor'. *Regidores* administered the city, its assets and supplies, ruled over its police and public health services, including the certification of doctors and pharmacists, licensed trading activities, and ensured the defence of Spanish residents' communal rights. The offices of the *regimiento* were the embodiment of the city before the King and before Spanish residents, and were largely monopolized by *encomenderos*. Tunja had 25 *regidores* in its first 100 years. Wiesner (2008) provides detailed information on the occupations of 18 of these: 13 were *encomenderos*, 5 were military captains, and the remaining 7 are unknown. The administrative convenience of 'renunciation' was used to keep the office of *regidor* in the same landowning family through the generations, via either a son re-purchasing his father's renounced title, or straightforward dynastic transfer.

The **Judicial Officer** and **Deputy Judicial Officer** ***(Alcaldes Ordinarios de 1er***

y 2^do^ voto) were charged with administering justice, both civil and criminal. *Alcaldes ordinarios* and their deputies were often referred to popularly as "*los Justicias*" or "*los Jueces*". These were prestigious offices that presided over the *cabildo* during meetings and public celebrations, occupied preferential places during public events, and led city receptions for royal visitors. Much more information on these posts has survived, indicating that all but 2 judicial officers during Tunja's first 100 years, and all but one deputy judicial officer, were *encomenderos.*

The main responsibilities of the **Royal Ensign / Standard Bearer *(Alférez Real)*** were to retain custody of and exhibit royal arms in a show of loyalty and defence of royal honour at any time when this might be called for, including at the cost of the *alférez'* life if required. Although anachronistic-sounding to modern sensibilities, the post carried great prestige and was highly sought-after in the 16th and 17th centuries. Unfortunately, relatively little information on the holders of these posts during this period has survived (Wiesner 2008).

The **Bailiff / Constable *(Alguacil Mayor)***, his lieutenant, and various helpers designated by him, were akin to early police officers, providing public order and law enforcement in the city. We have no information on *alguaciles* during the 1500s, and for only four of the eight *alguaciles* who span the 1600s. Of the latter, one was an *encomenderos* and military captain, and the other 3 were all military captains.

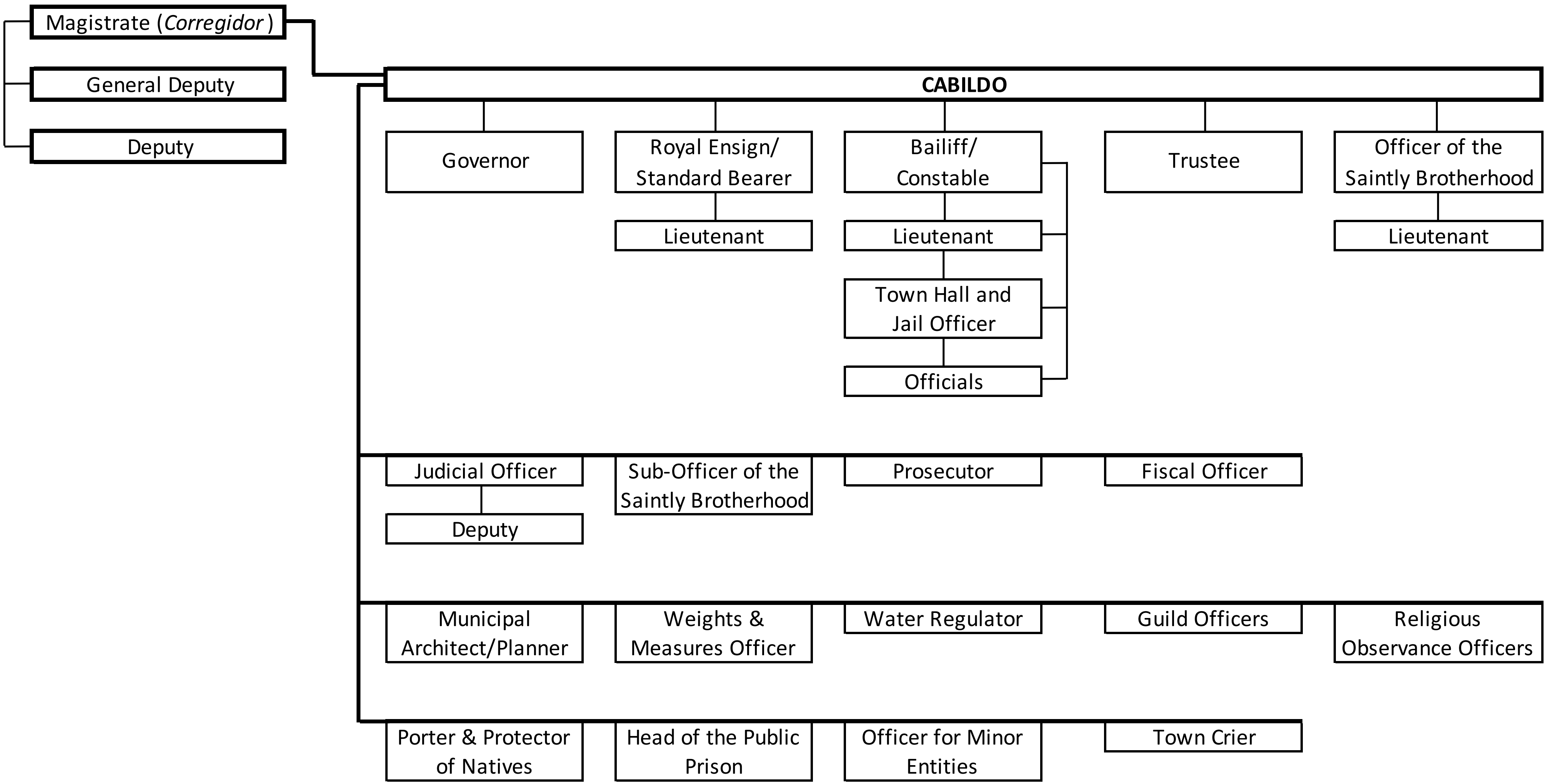
The **Trustee *(Depositario General)*** was the municipal official who held all assets in legal dispute, and for these services charged 2½ percent of their value. Relatively little information on the holders of these posts has survived to the present (Wiesner 2008).

The **Officer of the Saintly Brotherhood *(Alcalde Provincial de la Santa Hermandad)*** presided over an association established by the Catholic monarchs of Spain in 1476 dedicated to punishing highwaymen, bandits, and crimes committed outside the city. We know that at least some of these offices were held by *encomenderos*, but little information on the holders of these posts has survived (Wiesner 2008).

Sub-Officers of the Saintly Brotherhood *(Alcaldes Ordinaries de la Santa Hermandad; Alcaldes Compañeros de la Santa Hermandad)* were lower-level officials who helped their superior officers repress crime outside the city. They had no voice or vote in the *cabildo*, nor rank nor privileges comparable to a *regidor* or judicial officer. Some of these positions were held by *encomenderos,* but notably fewer compared to more powerful positions.

These are most of the most important higher-level *cabildo* officials in Tunja in the 1500s and 1600s listed in Figure A2 below. *Encomenderos'* domination of the *cabildo* is evident, most notably by monopolizing the most important *cabildo* offices that ran the city government, controlled its assets, services and revenues, regulated trade, doctors, pharmacists, and other economic activity, provided justice, and performed important ceremonial and symbolic public functions. It is telling that *encomenderos* were mostly or entirely absent amongst lower-level cabildo offices, such as Fiscal Officers (*Mayordomo de Rentas y Propios*), Weights and Measures Officers and Water Regulators (*Almotacen – Agua*), and Officer for Minor Entities (*Alcalde Pedáneos*). Such posts administered rules, but did not make them, and were overwhelmingly held by former military officials, tradesmen and artisans who did not hold *encomiendas.*

Figure A2: Organigram of Tunja Local Government in the 17th Century



Source: Adapted from Wiesner (2008); our translation.

Appendix 3: Colonial Map of New Grenada in 1538

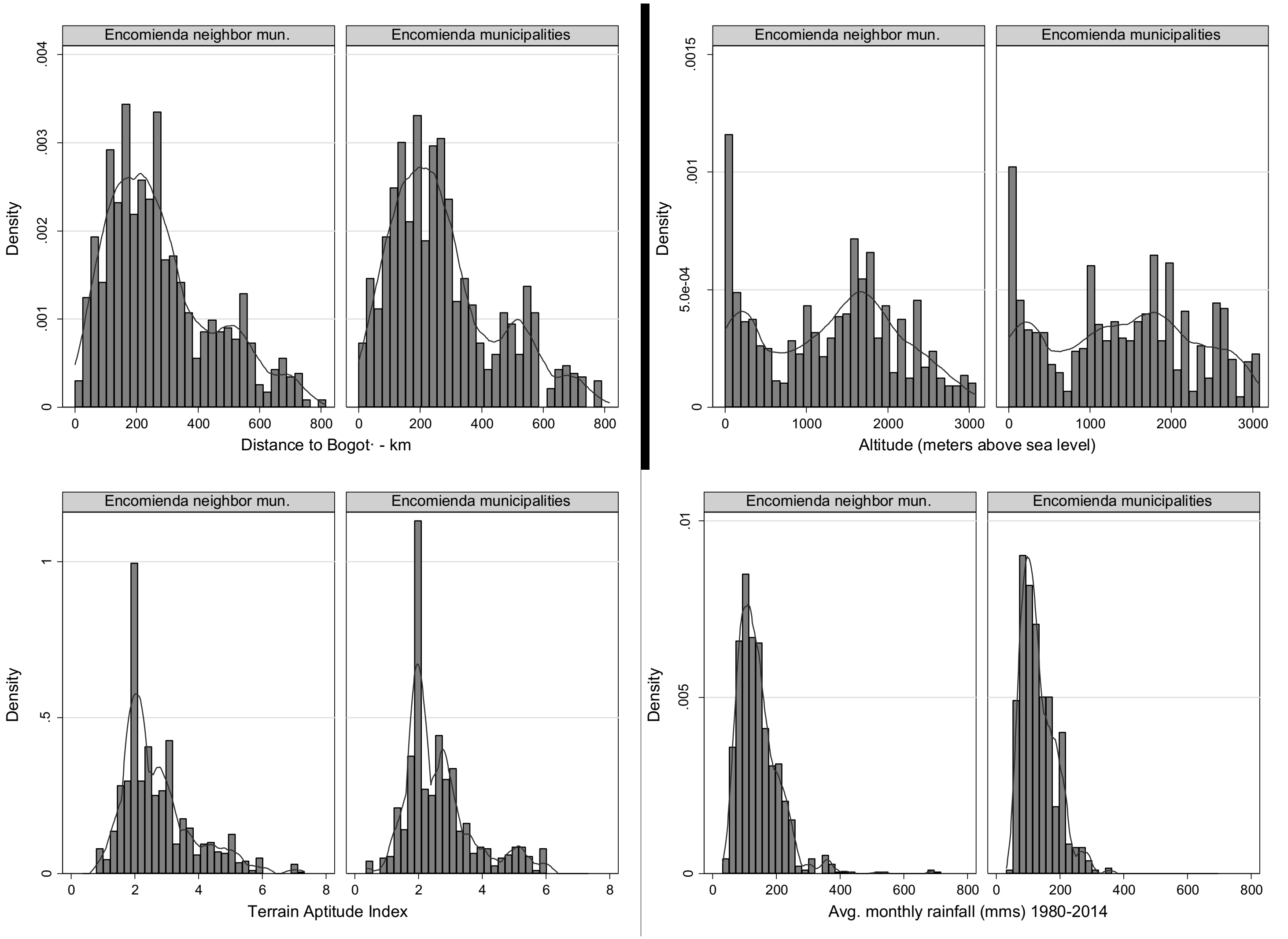
Source: Codazzi (1889). *Atlas Geográfico e Histórico de la República de Colombia.*

Appendix 4: Data summary

	(1)			(2)			(3)			(4)			(2) - (3)		(2) - (4)	
	All Municipalities			*Encomienda*			No *Encomienda*			No *Encomienda* Neighbours			Diff. in		Diff. in	
Variable	**Obs**	**Mean**	**Std. Dev.**	**Obs**	**Mean**	**Std. Dev.**	**Obs**	**Mean**	**Std. Dev.**	**Obs**	**Mean**	**Std. Dev.**	**means**	**Std. Err.**	**means**	**Std. Err.**
Encomienda related																
Tributary natives	1122	310.857	2309.038	296	1178.318	4385.737	826	0.000	0.000	450	0.000	0.000	1,178***	254.700	1,178***	254.700
Tributary natives (log)	1122	1.524	2.665	296	5.777	1.529	826	0.000	0.000	450	0.000	0.000	5.777***	0.089	5.777***	0.089
Distance to least-cost path (log)	1122	10.123	1.714	296	9.352	2.143	826	10.399	1.436	450	10.095	1.257	-1.046***	0.134	-0.743***	0.138
Colonial outcomes																
State presence dummy, 1794	1098	0.428	0.495	296	0.480	0.500	802	0.409	0.492	450	0.440	0.497	0.071**	0.034	0.040	0.037
State presence index, 1794 (0-4 scale)	1086	0.552	0.851	296	0.736	1.018	790	0.483	0.769	450	0.529	0.818	0.254***	0.065	0.208***	0.071
Population, 1780 (log)	756	1.083	2.694	296	1.451	3.092	460	0.847	2.376	450	0.865	2.399	0.604***	0.211	0.585***	0.212
Share of white people in 1780 population	1122	0.017	0.072	296	0.033	0.093	826	0.012	0.062	450	0.021	0.083	0.021***	0.006	0.012*	0.007
Medium-term outcomes																
Population, 1851 (log)	1088	5.206	3.456	296	6.219	3.435	792	4.828	3.389	450	4.013	3.926	1.391***	0.233	2.206***	0.272
Per capita municipal revenues, 1916 (log)	688	-0.399	0.712	242	-0.450	0.673	446	-0.372	0.731	273	-0.441	0.736	-0.078	0.055	-0.009	0.062
Land value, 1870 (log)	796	11.395	0.984	256	11.623	1.048	540	11.287	0.934	326	11.396	0.934	0.335***	0.077	0.226***	0.083
Long-run development outcomes																
Unsatisfied Basic Needs (UBN), 2005	1122	45.137	21.026	296	39.947	17.975	826	46.997	21.727	450	43.339	18.843	-7.050***	1.289	-3.392**	1.371
Infant mortality rate, 2005	1122	24.404	9.982	296	21.489	6.623	826	25.449	10.750	450	23.546	8.340	-3.961***	0.537	-2.057***	0.550
Multidimensional poverty index, 2005	1122	69.599	16.397	296	65.067	16.180	826	71.224	16.177	450	69.496	15.392	-6.157***	1.095	-4.429***	1.188
Years of education, 2005	1122	7.091	1.127	296	7.404	1.167	826	6.979	1.092	450	7.046	1.036	0.425***	0.078	0.358***	0.084
Municipal GDP per capita, 2005 (log)	1122	15.516	0.745	296	15.570	0.653	826	15.496	0.775	450	15.478	0.750	0.073	0.047	0.091*	0.052
Population, 2005 (log)	1122	9.524	1.103	296	9.680	1.318	826	9.467	1.010	450	9.458	0.977	0.213**	0.084	0.222**	0.089
Share of agriculture in GDP, 2005	1122	28.820	20.715	296	26.509	18.991	826	29.648	21.248	450	31.432	20.964	-3.139**	1.328	-4.923***	1.481
Land Gini index by size, 2005	952	0.686	0.112	284	0.726	0.091	668	0.669	0.117	407	0.680	0.108	0.056***	0.007	0.045***	0.008
Land Gini index by value, 2005	985	0.661	0.108	285	0.682	0.080	700	0.653	0.116	416	0.659	0.100	0.029***	0.006	0.023***	0.007
Top 1% land ownership, 2005	932	0.207	0.084	284	0.232	0.091	648	0.196	0.078	401	0.202	0.077	0.035***	0.006	0.029***	0.007
Fiscal performance indicator, 2000-2014	1122	60.938	5.660	296	62.226	5.645	826	60.476	5.597	450	60.687	5.094	1.751***	0.381	1.540***	0.407
Tax collection per capita, 2005 (log)	1097	0.062	0.064	296	0.070	0.072	801	0.058	0.060	450	0.056	0.055	0.012**	0.005	0.015***	0.005
Local bureaucratic efficiency, 2005	1037	2.710	1.136	285	2.859	1.213	752	2.654	1.101	422	2.616	1.055	0.205**	0.082	0.243***	0.088
Municipal characteristics																
Distance to department capital (km)	1122	81.325	60.262	296	63.793	43.547	826	87.607	64.083	450	72.663	47.188	-23.81***	3.372	-8.870***	3.369
Distance to Bogotá (km)	1122	321.643	194.754	296	282.759	180.616	826	335.577	197.829	450	296.999	184.478	-52.82***	12.550	-14.24	13.630
Municipal area (km2)	1122	1027.881	2831.668	296	403.166	580.361	826	1251.750	3253.396	450	590.380	1239.029	-848.6***	118.100	-187.2***	67.460
Altitude (meters above sea level)	1122	1116.602	904.441	296	1477.588	931.538	826	987.242	858.899	450	1131.849	826.047	490.3***	61.810	345.7***	66.680
Average monthly rainfall, 1980-2014 (mm)	1122	161.515	93.370	296	125.366	53.717	826	174.470	100.882	450	157.425	90.209	-49.10***	4.697	-32.06***	5.276
Soil fertility index	1120	2.672	1.200	296	2.584	1.130	824	2.703	1.224	450	2.719	1.170	-0.119	0.078	-0.135	0.086
Soil aptitude index for potatoes	1122	0.073	0.145	296	0.114	0.172	826	0.059	0.132	450	0.071	0.139	0.055***	0.011	0.042***	0.012
Soil aptitude index for maize	1122	0.186	0.229	296	0.145	0.221	826	0.201	0.230	450	0.177	0.230	-0.056***	0.015	-0.032*	0.017
Primary river density	1086	0.030	0.100	296	0.033	0.155	790	0.029	0.069	450	0.024	0.081	0.004	0.009	0.009	0.010

Notes: Final two columns present differences in means of previous columns, as indicated. $*$ p $<$ 0.10, $**$ p $<$ 0.05, $***$ p $<$ 0.01

Appendix 5: Balancing Test, Histogram of Covariates



Appendix 6: Estimating bias from unobservables

Following Oster (2019), we assume that the relationship between unobserved variables and treatment can be evaluated by studying the relationship between treatment and observed variables. This is the proportional selection assumption, which holds that

$$\delta \frac{C_{WX}}{V_W} = \frac{C_{W'X}}{V_{W'}}$$

where X is the treatment (*encomienda*), W represents observed variables, W' represents unobserved variables, C is the covariance between (un)observed variables and treatment, and V is the variance of (un)observed variables. δ is the coefficient of proportionality, capturing the degree of selection on unobservables relative to observables. Oster suggests using a value of 1 (proportional selection). We allow δ to vary asymmetrically around 1. This is because given abundant data on Colombian municipal characteristics, we consider it more likely that δ will approach 1 from below, and unlikely that δ would take values much greater than 1.

Consider three models:

i) a hypothetical 'complete' model including all factors affecting outcome Y,

$$Y = \gamma X + W + W' + \varepsilon_{max} \qquad \text{(M-max)}$$

whose R-squared we term R_{max};

ii) model 1, including only subset M of observed variables,

$$Y = \xi X + M + \varepsilon_1 \qquad \text{(M-1)}$$

and whose R-squared is R_1; and

iii) model 2, which includes all observed variables, W,

$$Y = \lambda X + W + \varepsilon_2 \qquad \text{(M-2)}$$

and whose R-squared is R_2. The method proceeds by examining how coefficients and R-squared values change between models 1 and 2 as we add additional controls.

We calculate the magnitude of bias, B, related to unobservables as,

$$B(\delta) = \delta \frac{(\xi - \lambda)(R_{max} - R_2)}{R_2 - R_1}.$$

There are various conceivable methods for obtaining R_{max}. We adopt Oster's suggestion of defining $R_{max} = argmin(\Pi R_2, 1)$ and assigning a value of 1.3 for Π.

Our short model 1 includes only departmental and neighbour-pair fixed effects and a polynomial of distance to the departmental capital. The latter is important because departmental capitals were mostly founded at or near prehispanic population centres, and hence this variables captures indigenous population patterns. Our long model 2 includes all of the preceding plus additional geographic controls like distance to Bogotá, altitude, precipitation, latitude, longitude, gold and silver deposits, and soil aptitude for growing maize and potatoes.[25]

We then calculate the ratio of our estimated effects to estimated biases for all values of δ between 0.4 and 1.2. Its interpretation is as follows. For values of $\delta = 1$, a ratio of |coefficient/bias| = 1 implies that there would have to be as many unobserved variables as there are observed variables in the model for our estimates to be fully counteracted by bias. This test is conservative and hence demanding.

Table A6 summarises our results for all 20 outcome variables for three values of δ; figure A6 provides graphs for the remaining outcomes not depicted in the main text (figure 2). The absolute value of the ratio is comfortably greater than 1 for all values of δ, for all outcomes but one. Only for the proportion of land owned by the top 1% of landowners does the ratio dip below 1, implying that bias from unobservables might dominate our estimated effects. For other development outcomes, using Oster's benchmark of $\delta = 1$, the absolute value of the ratio varies between 1.5 and 9, and for three variables reaches extremes of 19, 19 and 236. These results imply that any bias from unobservables is modest compared to the magnitude of our estimated effects of *encomienda* on development.

It is additionally interesting that for several outcomes, such as multidimensional poverty, GDP/capita, and the land Gini, $\lambda > \xi$.[26] This is the opposite of the more usual case, where the addition of controls drives a coefficient towards zero. It implies that counteracting biases are being removed, our full (long) model estimates are well-specified and precise, and supports our claims of a causal effect of *encomienda* on development outcomes.

[25] Both species originate in the Americas.

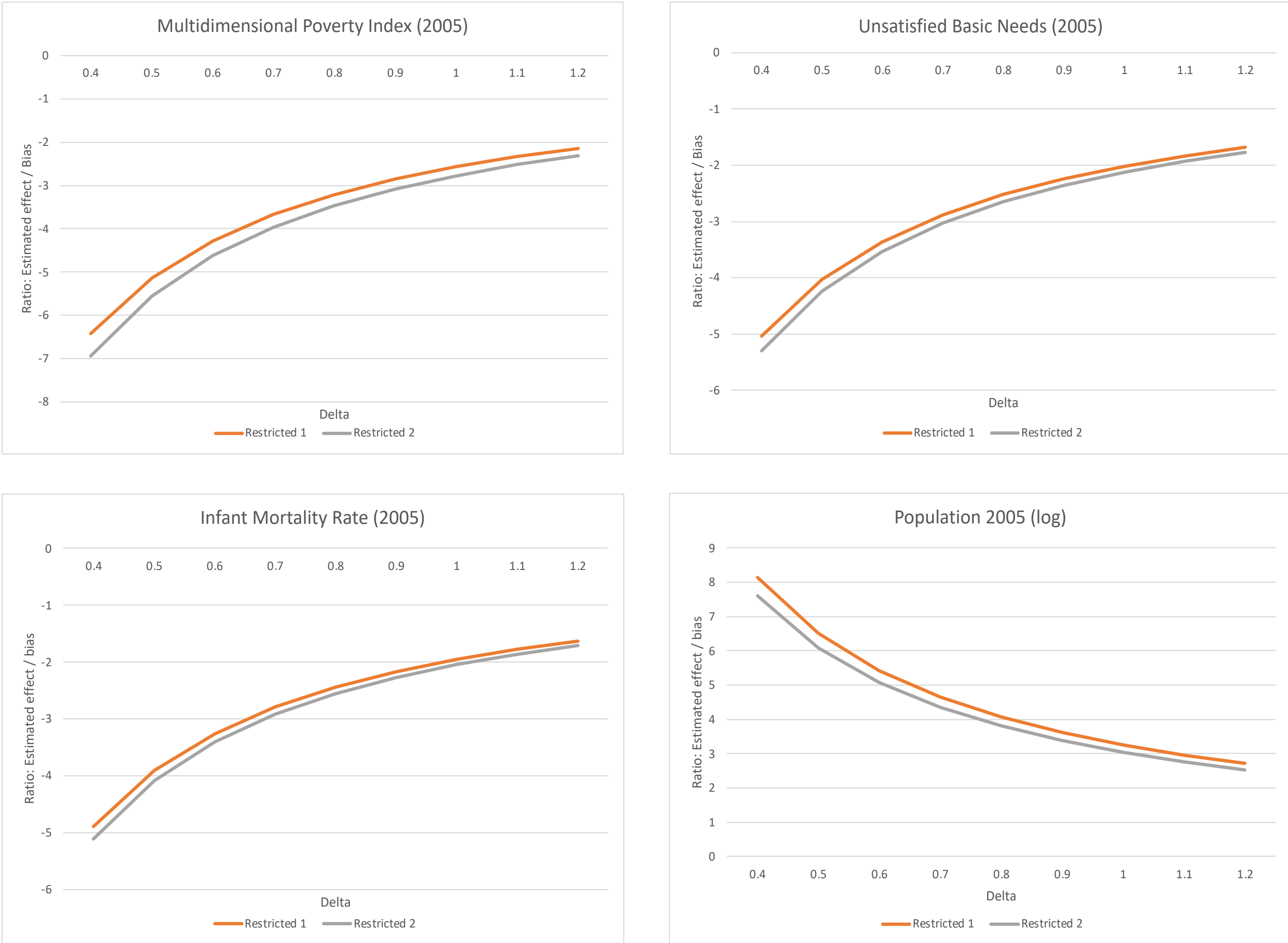
[26] Results omitted in the interest of brevity.

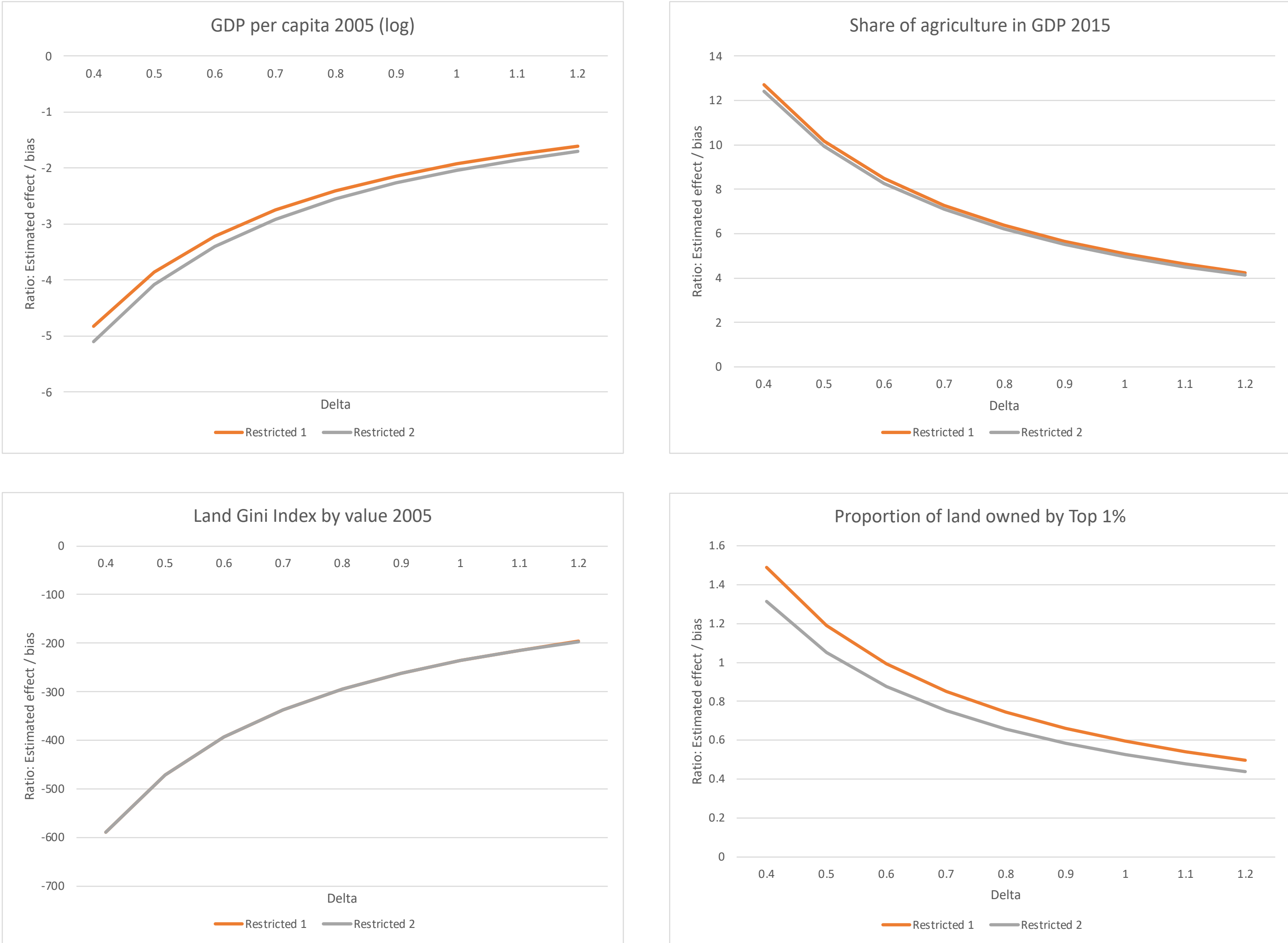
Table A6: Magnitude of estimated treatment/bias, $R_{max} = 1.3*R_2$

Delta	0.75		1		1.25	
Variable	Restricted 1	Restricted 2	Restricted 1	Restricted 2	Restricted 1	Restricted 2
Unsatisfied Basic Needs (UBN), 2005	-2.689	-2.825	-2.016	-2.118	-1.613	-1.695
Multidimensional Poverty Index, 2005	-3.423	-3.699	-2.567	-2.774	-2.054	-2.219
Infant Mortality Rate, 2005	-2.607	-2.726	-1.955	-2.045	-1.564	-1.636
Years of education, 2005	12.251	11.823	9.188	8.868	7.350	7.094
GDP per capita, 2005	-2.571	-2.721	-1.928	-2.041	-1.543	-1.633
Population, 2005 (log)	4.340	4.058	3.255	3.044	2.604	2.435
Share of agriculture in GDP, 2015	6.784	6.613	5.088	4.960	4.070	3.968
Proportion of land owned by Top 1%, 2005	0.794	0.701	0.596	0.526	0.477	0.420
Land Gini Index by value, 2005	-314.347	-314.508	-235.760	-235.881	-188.608	-188.705
Land Gini Index by size, 2005	2.175	1.989	1.631	1.491	1.305	1.193
Fiscal performance indicator, 2000-2014	6.528	6.232	4.896	4.674	3.917	3.739
Tax collection per capita, 2005 (log)	-25.448	-25.798	-19.086	-19.349	-15.269	-15.479
Local bureaucratic efficiency, 2005 (log)	5.821	5.175	4.366	3.881	3.492	3.105
Population, 1851 (log)	26.086	25.756	19.564	19.317	15.651	15.454
Per capita municipal revenues, 1916 (log)	-2.735	-3.025	-2.052	-2.269	-1.641	-1.815
Land value, 1870 (log)	3.635	2.342	2.726	1.756	2.181	1.405
State presence index, 1794 (0-4 scale)	11.840	11.439	8.880	8.579	7.104	6.863
State presence dummy, 1794	4.725	3.983	3.544	2.987	2.835	2.390
Population, 1780 (log)	-10.405	-10.666	-7.804	-8.000	-6.243	-6.400
Share of White people in 1780 population	3.760	3.795	2.820	2.846	2.256	2.277

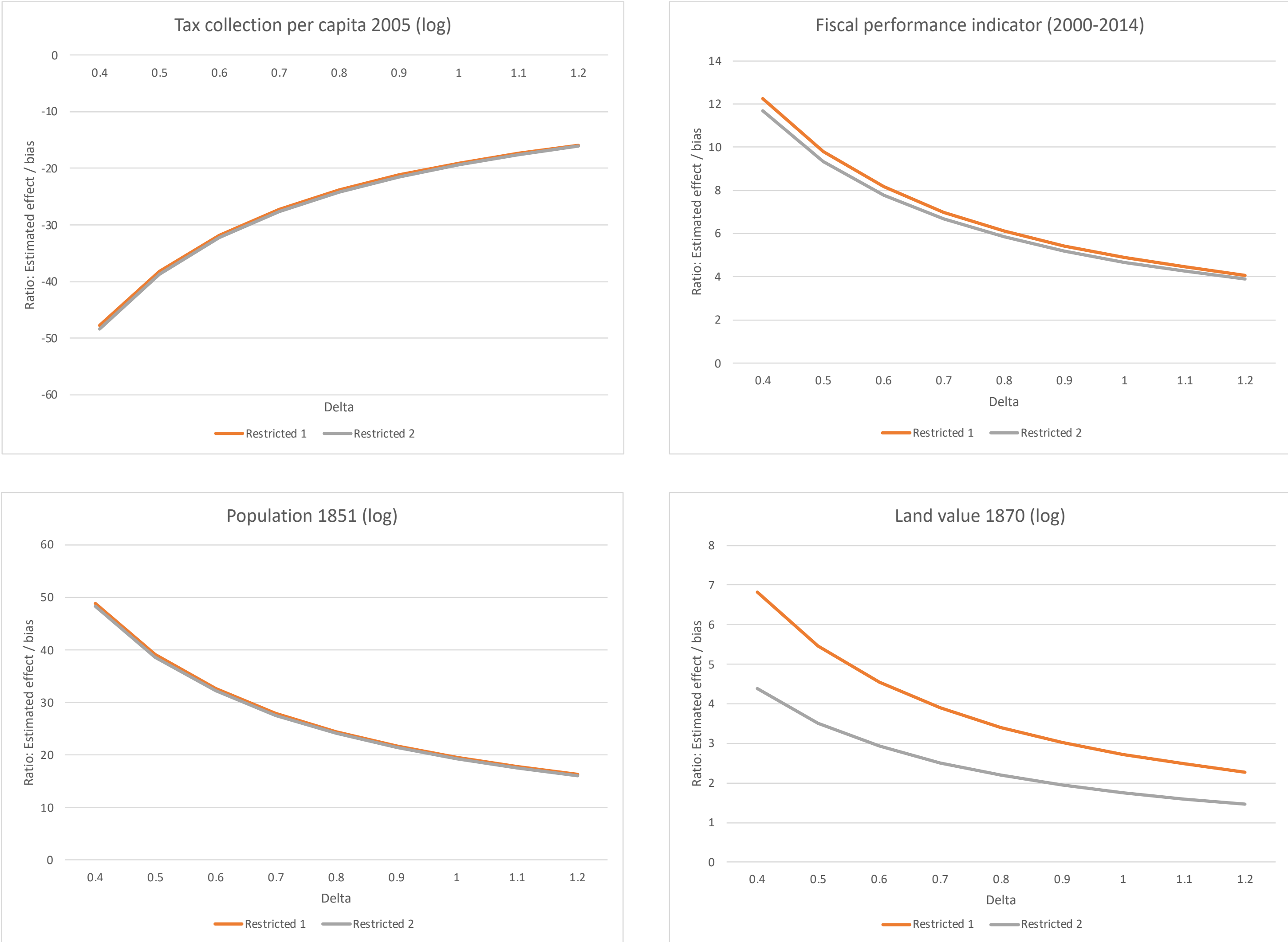
Notes: Table reports the ratios of estimated effect / bias resulting from Oster (2019) test with different sets of restricted controls and different values of δ. 'Restricted 1' controls for neighbour-pair fixed effects, department, and distances to departmental capitals. 'Restricted 2' includes the preceding and adds altitude, precipitation, distance to Bogotá, latitude, longitude, and soil aptitude for growing maize and potatoes.

Figure A6: Oster test of bias from unobservables, remaining outcomes

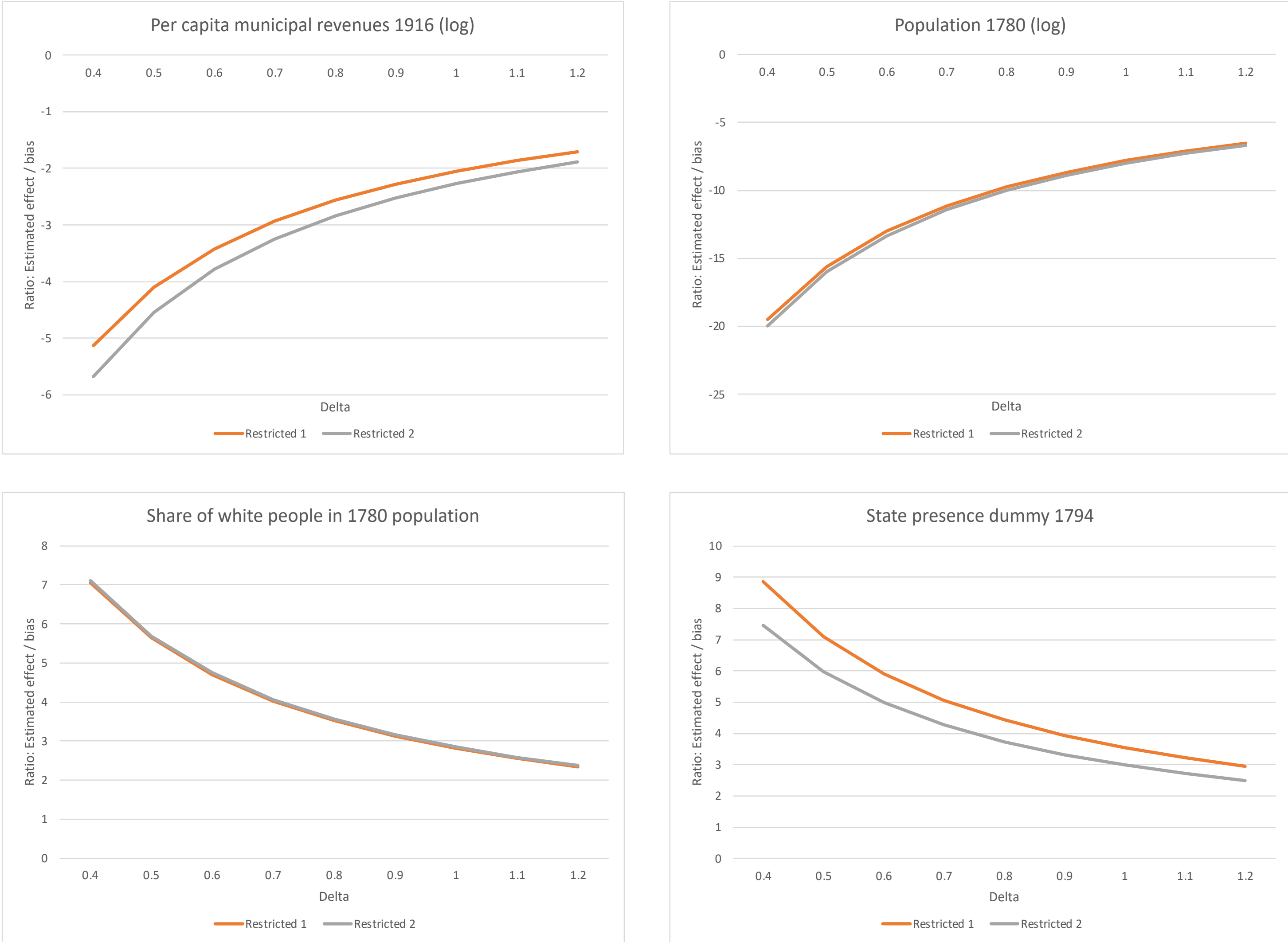




N.B. Restricted 1 is hidden behind Restricted 2.



Tax collection per capita 2005 (log)
Ratio: Estimated effect / bias
Delta
Restricted 1
Restricted 2
Fiscal performance indicator (2000-2014)
Ratio: Estimated effect / bias
Delta
Restricted 1
Restricted 2
Population 1851 (log)
Ratio: Estimated effect / bias
Delta
Restricted 1
Restricted 2
Land value 1870 (log)
Ratio: Estimated effect / bias
Delta
Restricted 1
Restricted 2



Notes: Magnitude of estimated treatment/bias for different values of δ with $R_{max} = 1.3*R_2$. 'Restricted 1' controls for neighbour-pair fixed effects, department, and distances to departmental capitals. 'Restricted 2' adds additional geographic controls for altitude, precipitation, distance to Bogotá, latitude, longitude, and soil aptitude for growing maize and potatoes.

Appendix 7: Full-model results, effects of encomienda on development, inequality and state capacity

NP-FE (OLS)

VARIABLES	(1) Unsatisfied Basic Needs (UBN) 2005	(2) Infant Mortality Rate 2005	(3) Multidimensional Poverty Index 2005	(4) Years of education 2005	(5) GDP per capita 2005 (log)	(6) Population 2005 (log)	(7) Share of agriculture in GDP 2015	(8) Land Gini index by size 2005	(9) Land Gini Index by value 2005	(10) Share of land owned by Top 1% 2005	(11) Fiscal performance indicator 2000-2014	(12) Tax collection per capita 2005 (log)	(13) Local bureaucratic efficiency 2005	(14) Population 1851 (log)	(15) Per capita municipal revenues 1916 (log)	(16) Land value 1870 (log)	(17) State presence index 1794 (0-4)	(18) State presence dummy 1794	(19) Population 1780 (log)	(20) Share of white people in 1780 population
Tributary natives (log)	-0.186**	-0.0996**	-0.281***	0.0249***	0.0127***	0.0519***	-0.00364***	0.00428***	0.00313***	0.00367***	0.168***	0.00163***	0.0415***	0.245***	0.0126**	0.0332**	0.0414***	0.00903**	0.128***	0.00311***
	(0.0911)	(0.0393)	(0.0896)	(0.00662)	(0.00382)	(0.00691)	(0.00132)	(0.000688)	(0.000621)	(0.000655)	(0.0359)	(0.000484)	(0.00774)	(0.0280)	(0.00533)	(0.0145)	(0.00791)	(0.00400)	(0.0217)	(0.000803)
Distance to dept. capital (km)	0.500***	0.149***	0.676***	-0.0631***	0.00181	-0.0613***	0.00768***	-0.000663	-0.000589	-0.000980**	-0.0993***	-0.00147***	-0.0343***	-0.0858***	-0.0205***	0.00508	-0.0287***	-0.00612**	-0.0993***	-0.00219***
	(0.0676)	(0.0292)	(0.0655)	(0.00519)	(0.00230)	(0.00600)	(0.00124)	(0.000517)	(0.000462)	(0.000467)	(0.0271)	(0.000307)	(0.00554)	(0.0184)	(0.00549)	(0.0201)	(0.00576)	(0.00261)	(0.0176)	(0.000502)
Distance to dept. capital (km) ^ 2	-0.00385***	-0.000943***	-0.00561***	0.000541***	-3.12e-05	0.000507***	-7.27e-05***	1.75e-06	1.26e-06	5.55e-06	0.000577**	1.25e-05***	0.000220***	0.000736***	0.000259***	-0.000232	0.000244***	4.29e-05	0.000928***	2.26e-05***
	(0.000769)	(0.000327)	(0.000750)	(6.19e-05)	(2.76e-05)	(6.38e-05)	(1.48e-05)	(5.93e-06)	(4.99e-06)	(5.47e-06)	(0.000275)	(3.11e-06)	(5.98e-05)	(0.000197)	(6.74e-05)	(0.000294)	(6.63e-05)	(3.16e-05)	(0.000188)	(5.55e-06)
Distance to dept. capital (km) ^ 3	8.49e-06***	1.99e-06*	1.36e-05***	-1.41e-06***	8.49e-08	-1.27e-06***	1.85e-07***	-7.43e-09	1.53e-09	-1.21e-09	-8.17e-07	-2.92e-08***	-3.80e-07**	-2.36e-06***	-8.95e-07***	5.16e-07	-6.52e-07***	-1.39e-07	-2.50e-06***	-6.51e-08***
	(2.41e-06)	(1.04e-06)	(2.48e-06)	(2.18e-07)	(9.58e-08)	(2.14e-07)	(5.17e-08)	(2.09e-08)	(1.63e-08)	(1.83e-08)	(8.21e-07)	(9.62e-09)	(1.92e-07)	(6.33e-07)	(2.54e-07)	(1.16e-06)	(2.13e-07)	(1.08e-07)	(5.79e-07)	(1.76e-08)
Distance to Bogotá (km)	0.147	-0.0122	0.187*	-0.00767	-0.000999	-0.00194	-0.000323	0.00121	0.000917	-0.000315	0.0136	-0.000354	-0.00653	-0.0730**	0.00369	0.00487	-0.00443	-0.00182	0.0161	0.000248
	(0.111)	(0.0476)	(0.0988)	(0.00749)	(0.00415)	(0.00792)	(0.00167)	(0.000752)	(0.000665)	(0.000733)	(0.0412)	(0.000481)	(0.00846)	(0.0296)	(0.00504)	(0.0175)	(0.00886)	(0.00389)	(0.0240)	(0.000957)
Distance to Bogotá (km) ^ 2	-0.000169	7.96e-05	-0.000257	7.67e-06	3.05e-06	-1.10e-05	3.91e-06	-4.64e-06*	-3.93e-06**	3.61e-07	-5.98e-05	4.71e-08	6.93e-06	0.000225***	-1.38e-05	1.26e-05	1.80e-05	1.21e-05	-6.20e-05	-1.30e-06
	(0.000326)	(0.000138)	(0.000272)	(2.26e-05)	(1.14e-05)	(2.44e-05)	(4.69e-06)	(2.44e-06)	(1.97e-06)	(2.17e-06)	(0.000116)	(1.32e-06)	(2.37e-05)	(8.16e-05)	(1.56e-05)	(0.000104)	(2.30e-05)	(1.05e-05)	(6.07e-05)	(2.21e-06)
Distance to Bogotá (km) ^ 3	2.04e-07	2.80e-08	1.77e-07	-1.12e-08	-6.51e-09	6.74e-09	-3.44e-09	3.51e-09	3.21e-09*	-8.95e-10	6.89e-09	-0	-1.50e-08	-2.02e-07***	6.38e-09	-5.27e-08	-2.08e-08	-1.24e-08	5.41e-08	1.07e-09
	(2.86e-07)	(1.24e-07)	(2.35e-07)	(2.09e-08)	(9.23e-09)	(2.29e-08)	(3.95e-09)	(2.27e-09)	(1.72e-09)	(1.86e-09)	(1.04e-07)	(1.16e-09)	(2.00e-08)	(6.67e-08)	(1.53e-08)	(1.83e-07)	(1.87e-08)	(8.77e-09)	(5.21e-08)	(1.67e-09)
Municipal area (km2)	0.00110	0.000494	0.00107**	1.63e-06	2.46e-05	0.000362***	-7.88e-06	1.09e-05**	6.03e-06	2.02e-05***	0.000554**	1.28e-07	0.000321***	0.00101***	6.13e-06	0.00140***	0.000138**	0.000110***	0.000206	2.10e-06
	(0.000757)	(0.000342)	(0.000503)	(3.71e-05)	(3.10e-05)	(7.82e-05)	(1.08e-05)	(5.25e-06)	(4.38e-06)	(5.57e-06)	(0.000215)	(1.99e-06)	(6.27e-05)	(0.000244)	(4.78e-05)	(0.000314)	(5.45e-05)	(2.19e-05)	(0.000172)	(4.02e-06)
Altitude (meters above sea level)	0.00198***	0.000177	0.00348***	-0.000254***	7.47e-05**	1.25e-05	1.50e-05	1.25e-05**	-1.09e-05*	-3.43e-08	-0.000566*	-3.29e-06	-0.000142**	0.000199	-0.000112**	-0.000142	-0.000232***	-5.41e-05*	-0.000121	-8.44e-06
	(0.000743)	(0.000341)	(0.000745)	(5.44e-05)	(3.36e-05)	(5.70e-05)	(1.09e-05)	(5.99e-06)	(6.21e-06)	(5.62e-06)	(0.000315)	(3.65e-06)	(6.46e-05)	(0.000243)	(4.75e-05)	(0.000109)	(5.89e-05)	(3.08e-05)	(0.000164)	(6.69e-06)
Latitude	0.0297	-0.00509	0.0257	-0.00183	-0.00204	-0.00482*	0.000652	-0.000101	-0.000385	9.09e-05	-0.00978	-5.85e-05	-0.00660***	-0.00450	-0.00602***	0.00650	-0.00229	-0.000454	-0.00450	-0.000154
	(0.0271)	(0.0144)	(0.0240)	(0.00193)	(0.00131)	(0.00249)	(0.000493)	(0.000236)	(0.000234)	(0.000212)	(0.00997)	(0.000126)	(0.00241)	(0.00841)	(0.00214)	(0.00592)	(0.00236)	(0.00113)	(0.00663)	(0.000191)
Longitude	-0.0481	-0.00902	-0.0134	0.00108	-0.000773	0.00220	0.000102	-9.96e-05	0.000146	0.000423*	0.0208*	0.000118	0.00253	0.00728	0.00594***	0.00588	0.00239	0.000592	0.00430	0.000214
	(0.0370)	(0.0155)	(0.0268)	(0.00220)	(0.00143)	(0.00229)	(0.000581)	(0.000247)	(0.000228)	(0.000247)	(0.0111)	(0.000134)	(0.00276)	(0.00920)	(0.00186)	(0.00504)	(0.00248)	(0.00115)	(0.00776)	(0.000248)
Average rainfall, 1980-2014	0.00797	-0.00430	0.0186**	-0.00229***	0.000398	-0.000801	0.000291*	-0.000129*	-7.53e-05	-8.68e-05	-0.00890***	-5.36e-05*	-0.00156**	0.00402	-0.000231	-0.000755	-0.000263	-3.85e-06	0.00493**	1.18e-05
	(0.0108)	(0.00532)	(0.00758)	(0.000592)	(0.000509)	(0.000509)	(0.000162)	(7.38e-05)	(6.90e-05)	(8.47e-05)	(0.00266)	(3.20e-05)	(0.000766)	(0.00304)	(0.000694)	(0.00196)	(0.000755)	(0.000380)	(0.00205)	(4.59e-05)
Soil fertility index	-1.257***	-0.182	-0.603	0.0504*	0.0484***	-0.0560*	-0.00144	-0.00758**	-0.00529	0.00142	0.0648	-0.000319	0.0280	0.00534	0.0545**	0.0649	0.0454	0.0162	0.261***	0.00579*
	(0.401)	(0.167)	(0.379)	(0.0293)	(0.0178)	(0.0301)	(0.00606)	(0.00312)	(0.00322)	(0.00301)	(0.155)	(0.00177)	(0.0341)	(0.127)	(0.0272)	(0.0585)	(0.0345)	(0.0167)	(0.0960)	(0.00320)
Primary river density	-2.110	-0.131	-4.090**	0.335***	-0.0150	-0.0140	0.00515	-0.00817	-0.000727	0.0114	0.876	-0.00104	-0.143	0.131	-0.0628	-0.499*	-0.146	-0.0954	0.0556	-3.86e-05
	(1.485)	(0.865)	(1.613)	(0.120)	(0.0602)	(0.118)	(0.0147)	(0.0159)	(0.0133)	(0.0175)	(0.593)	(0.00741)	(0.146)	(0.426)	(0.103)	(0.268)	(0.120)	(0.0676)	(0.325)	(0.00549)
Secondary river density	-0.765	-2.208	-4.015	0.191	0.367	-0.0316	-0.0249	-0.0549	-0.0136	0.0351	-2.421	-0.0260	-0.144	1.612	0.0598	0.490	-0.346	-0.174	-1.241	-0.0374
	(4.435)	(1.651)	(4.086)	(0.284)	(0.256)	(0.249)	(0.0531)	(0.0396)	(0.0331)	(0.0277)	(1.913)	(0.0260)	(0.402)	(1.563)	(0.219)	(1.539)	(0.297)	(0.156)	(1.277)	(0.0392)
Tertiary river density	9.251	7.557*	9.421	-1.067	-1.158**	-1.407*	-0.145	0.0362	-0.0867	-0.0304	4.541	0.142**	-2.033*	-3.780	-0.865*	-4.620***	-0.528	-0.448	1.622	0.0537
	(9.880)	(4.153)	(9.289)	(0.724)	(0.537)	(0.728)	(0.126)	(0.0765)	(0.0676)	(0.0645)	(4.116)	(0.0701)	(1.038)	(3.476)	(0.498)	(1.316)	(0.719)	(0.391)	(2.105)	(0.0831)
Soil aptitude for potatoes	-13.41***	-2.947**	-23.49***	1.452***	0.0625	0.909***	-0.157***	-0.0611**	0.0720***	-0.0464**	5.584***	0.0506**	1.079***	1.369	0.830***	0.804*	0.533*	0.145	0.398	0.0283
	(3.430)	(1.437)	(3.624)	(0.258)	(0.153)	(0.313)	(0.0592)	(0.0268)	(0.0247)	(0.0228)	(1.535)	(0.0205)	(0.304)	(1.079)	(0.189)	(0.435)	(0.308)	(0.158)	(0.813)	(0.0334)
Soil aptitude for maize	-14.03***	-3.742	-8.841*	1.404***	0.404*	1.477***	0.141**	0.0239	0.0702*	-0.0105	4.975**	0.101***	2.000***	2.391	-0.146	3.966***	-0.0217	0.518**	3.248**	0.0482
	(5.272)	(2.401)	(5.253)	(0.389)	(0.217)	(0.405)	(0.0649)	(0.0404)	(0.0377)	(0.0322)	(2.313)	(0.0308)	(0.428)	(1.529)	(0.353)	(0.644)	(0.427)	(0.204)	(1.342)	(0.0454)
Gold potential	6.734	5.506**	-4.753***	0.983***	0.733***	0.707***	-0.166**	0.0361	0.0503**	-0.0991**	-0.412	0.00353	-0.240	-0.189	-0.639***	-0.644**	-0.244	-0.234	-1.111	-0.0133
	(4.205)	(2.465)	(1.792)	(0.231)	(0.203)	(0.130)	(0.0795)	(0.0263)	(0.0225)	(0.0421)	(1.313)	(0.00837)	(0.273)	(1.598)	(0.180)	(0.269)	(0.461)	(0.156)	(0.936)	(0.0157)
Silver potential	-6.158	-4.792*	4.244	-0.899***	-0.873***	-0.688***	0.191**	-0.0572*	-0.0667***	0.0864*	-2.030	-0.0282**	0.102	0.755	0.645***		0.0378	0.188	0.328	0.00285
	(4.409)	(2.585)	(2.588)	(0.279)	(0.217)	(0.209)	(0.0820)	(0.0296)	(0.0252)	(0.0452)	(1.452)	(0.0113)	(0.330)	(1.738)	(0.209)		(0.489)	(0.174)	(1.004)	(0.0190)
Department and neighbor-pair FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	1,934	1,938	1,938	1,938	1,938	1,938	1,938	1,776	1,776	1,558	1,938	1,938	1,768	1,938	1,120	374	1,938	1,938	1,938	1,938
R-squared	0.838	0.819	0.823	0.796	0.792	0.810	0.688	0.706	0.738	0.708	0.734	0.701	0.739	0.666	0.786	0.804	0.632	0.608	0.660	0.615

Notes: Neighbour-pair fixed effects estimates with robust standard errors (parentheses) clustered by neighbour-pairs. *** p<0.01, ** p<0.05, * p<0.1

NP-FE with IV

VARIABLES	(1) Unsatisfied Basic Needs (UBN) 2005	(2) Infant Mortality Rate 2005	(3) Multidimensional Poverty Index 2005	(4) Years of education 2005	(5) GDP per capita 2005 (log)	(6) Population 2005 (log)	(7) Share of agriculture in GDP 2015	(8) Land Gini index by size 2005	(9) Land Gini Index by value 2005	(10) Share of land owned by Top 1% 2005	(11) Fiscal performance indicator 2000-2014	(12) Tax collection per capita 2005 (log)	(13) Local bureaucratic efficiency 2005	(14) Population 1851 (log)	(15) Per capita municipal revenues 1916 (log)	(16) Land value 1870 (log)	(17) State presence index 1794 (0-4)	(18) State presence dummy 1794	(19) Population 1780 (log)	(20) Share of white people in 1780 population
Tributary natives (log)	-1.906***	-0.562***	-1.687***	0.142***	0.0219**	0.146***	-0.0130***	0.00821***	0.00777***	0.00786***	0.364***	0.00483***	0.0973***	0.415***	0.0563***	0.130***	0.257***	0.0637***	0.888***	0.0250***
	(0.320)	(0.101)	(0.291)	(0.0235)	(0.00901)	(0.0222)	(0.00351)	(0.00203)	(0.00203)	(0.00172)	(0.0961)	(0.00122)	(0.0242)	(0.0872)	(0.0188)	(0.0384)	(0.0262)	(0.0109)	(0.0823)	(0.00291)
Distance to dept. capital (km)	0.212**	0.0712**	0.441***	-0.0435***	0.00336	-0.0455***	0.00611***	-3.87e-05	0.000146	-0.000259	-0.0664**	-0.000933***	-0.0248***	-0.0573**	-0.0124*	0.0181	0.00735	0.00304	0.0279	0.00147**
	(0.0837)	(0.0349)	(0.0816)	(0.00685)	(0.00264)	(0.00714)	(0.00147)	(0.000602)	(0.000535)	(0.000594)	(0.0317)	(0.000361)	(0.00687)	(0.0243)	(0.00650)	(0.0194)	(0.00768)	(0.00329)	(0.0240)	(0.000712)
Distance to dept. capital (km) ^ 2	-0.00126	-0.000242	-0.00348***	0.000363***	-4.52e-05	0.000364***	-5.86e-05***	-3.62e-06	-5.06e-06	-7.03e-07	0.000280	7.69e-06**	0.000129*	0.000479**	0.000189**	-0.000361	-8.13e-05	-3.99e-05	-0.000222	-1.05e-05
	(0.000896)	(0.000383)	(0.000859)	(7.15e-05)	(3.03e-05)	(7.11e-05)	(1.66e-05)	(6.46e-06)	(5.52e-06)	(6.42e-06)	(0.000312)	(3.56e-06)	(7.31e-05)	(0.000243)	(7.37e-05)	(0.000301)	(8.65e-05)	(3.74e-05)	(0.000255)	(7.57e-06)
Distance to dept. capital (km) ^ 3	1.02e-06	-2.29e-08	7.45e-06***	-8.96e-07***	1.25e-07	-8.56e-07***	1.44e-07**	7.55e-09	1.92e-08	1.54e-08	3.84e-08	-1.52e-08	-1.16e-07	-1.62e-06**	-7.45e-07***	7.18e-07	2.86e-07	9.94e-08	8.11e-07	3.04e-08
	(2.79e-06)	(1.24e-06)	(2.65e-06)	(2.24e-07)	(1.02e-07)	(2.18e-07)	(5.64e-08)	(2.21e-08)	(1.76e-08)	(2.11e-08)	(9.24e-07)	(1.10e-08)	(2.33e-07)	(7.43e-07)	(2.57e-07)	(1.24e-06)	(2.81e-07)	(1.26e-07)	(7.97e-07)	(2.41e-08)
Distance to Bogotá (km)	0.224*	0.00814	0.248**	-0.0128	-0.00141	-0.00609	8.85e-05	0.00104	0.000722	-0.000513	0.00492	-0.000495	-0.00759	-0.0805***	0.00476	0.0144	-0.0139	-0.00423	-0.0173	-0.000716
	(0.126)	(0.0482)	(0.108)	(0.00824)	(0.00421)	(0.00832)	(0.00176)	(0.000754)	(0.000661)	(0.000748)	(0.0413)	(0.000488)	(0.00848)	(0.0306)	(0.00548)	(0.0172)	(0.0114)	(0.00445)	(0.0358)	(0.00121)
Distance to Bogotá (km) ^ 2	-0.000419	1.29e-05	-0.000460	2.46e-05	4.38e-06	2.59e-06	2.56e-06	-4.14e-06*	-3.35e-06*	1.03e-06	-3.15e-05	5.10e-07	1.12e-05	0.000249***	-1.83e-05	-1.20e-05	4.90e-05*	2.00e-05*	4.77e-05	1.86e-06
	(0.000357)	(0.000138)	(0.000299)	(2.42e-05)	(1.16e-05)	(2.56e-05)	(4.88e-06)	(2.49e-06)	(2.00e-06)	(2.21e-06)	(0.000117)	(1.37e-06)	(2.41e-05)	(8.33e-05)	(1.70e-05)	(0.000101)	(2.91e-05)	(1.16e-05)	(8.80e-05)	(2.88e-06)
Distance to Bogotá (km) ^ 3	4.07e-07	8.26e-08	3.43e-07	-2.50e-08	-7.60e-09	-4.38e-09	-2.34e-09	3.14e-09	2.77e-09	-1.38e-09	-1.63e-08	-3.93e-10	-1.92e-08	-2.22e-07***	1.03e-08	-1.37e-08	-4.62e-08**	-1.88e-08**	-3.55e-08	-1.52e-09
	(3.08e-07)	(1.22e-07)	(2.58e-07)	(2.18e-08)	(9.37e-09)	(2.42e-08)	(4.03e-09)	(2.32e-09)	(1.78e-09)	(1.89e-09)	(1.07e-07)	(1.21e-09)	(2.05e-08)	(6.80e-08)	(1.65e-08)	(1.73e-07)	(2.29e-08)	(9.27e-09)	(6.74e-08)	(2.16e-09)
Municipal area (km2)	0.00213**	0.000771**	0.00192***	-6.84e-05	1.91e-05	0.000306***	-2.28e-06	7.66e-06	2.17e-06	1.57e-05***	0.000437**	-1.79e-06	0.000289***	0.000904***	-4.13e-05	0.000867**	9.69e-06	7.76e-05***	-0.000248	-1.10e-05**
	(0.000865)	(0.000368)	(0.000581)	(4.45e-05)	(3.07e-05)	(7.18e-05)	(1.16e-05)	(5.43e-06)	(4.89e-06)	(5.67e-06)	(0.000220)	(2.14e-06)	(5.85e-05)	(0.000242)	(5.46e-05)	(0.000352)	(6.35e-05)	(2.27e-05)	(0.000187)	(5.47e-06)
Altitude (meters above sea level)	0.00172*	0.000102	0.00325***	-0.000235***	7.62e-05**	2.77e-05	1.35e-05	1.22e-05**	-1.12e-05*	-7.74e-07	-0.000535	-2.78e-06	-0.000157**	0.000227	-0.000148***	-6.04e-05	-0.000197**	-4.53e-05	8.98e-07	-4.92e-06
	(0.000923)	(0.000376)	(0.000873)	(6.71e-05)	(3.38e-05)	(6.50e-05)	(1.13e-05)	(6.10e-06)	(6.29e-06)	(5.75e-06)	(0.000329)	(3.86e-06)	(6.86e-05)	(0.000250)	(5.20e-05)	(0.000132)	(8.72e-05)	(3.46e-05)	(0.000289)	(9.87e-06)
Latitude	0.0253	-0.00625	0.0222	-0.00154	-0.00202	-0.00459*	0.000629	-7.32e-05	-0.000352	7.32e-05	-0.00929	-5.05e-05	-0.00639***	-0.00407	-0.00579***	0.00869	-0.00175	-0.000316	-0.00259	-9.88e-05
	(0.0312)	(0.0151)	(0.0259)	(0.00209)	(0.00130)	(0.00240)	(0.000511)	(0.000237)	(0.000239)	(0.000223)	(0.00993)	(0.000127)	(0.00233)	(0.00858)	(0.00221)	(0.00636)	(0.00301)	(0.00120)	(0.00925)	(0.000274)
Longitude	-0.0783**	-0.0171	-0.0380	0.00312	-0.000611	0.00385	-6.11e-05	-4.92e-05	0.000206	0.000472*	0.0243**	0.000174	0.00368	0.0102	0.00660***	0.00235	0.00615*	0.00155	0.0176*	0.000596*
	(0.0397)	(0.0160)	(0.0291)	(0.00245)	(0.00143)	(0.00239)	(0.000590)	(0.000246)	(0.000230)	(0.000253)	(0.0114)	(0.000146)	(0.00287)	(0.00943)	(0.00201)	(0.00539)	(0.00333)	(0.00131)	(0.0105)	(0.000324)
Average rainfall, 1980-2014	-0.0145	-0.0104*	0.000197	-0.000759	0.000519	0.000435	0.000168	-8.08e-05	-1.81e-05	-1.75e-05	-0.00632**	-1.16e-05	-0.000887	0.00625*	0.000922	0.00352	0.00256***	0.000713*	0.0149***	0.000299***
	(0.0117)	(0.00553)	(0.00816)	(0.000657)	(0.000526)	(0.000623)	(0.000168)	(7.57e-05)	(7.04e-05)	(8.51e-05)	(0.00291)	(3.53e-05)	(0.000843)	(0.00323)	(0.000847)	(0.00240)	(0.000980)	(0.000409)	(0.00309)	(8.32e-05)
Soil fertility index	-1.067**	-0.136	-0.464	0.0389	0.0475***	-0.0654**	-0.000514	-0.00824**	-0.00607*	0.000130	0.0454	-0.000636	0.0286	-0.0114	0.0534*	0.0213	0.0242	0.0108	0.185	0.00362
	(0.488)	(0.183)	(0.454)	(0.0353)	(0.0179)	(0.0329)	(0.00628)	(0.00323)	(0.00337)	(0.00312)	(0.161)	(0.00188)	(0.0353)	(0.130)	(0.0294)	(0.0661)	(0.0445)	(0.0181)	(0.145)	(0.00462)
Primary river density	-2.618	-0.272	-4.519**	0.371**	-0.0122	0.0148	0.00230	-0.00728	0.000321	0.0110	0.936	-5.99e-05	-0.138	0.183	-0.0634	-1.026***	-0.0799	-0.0787	0.287	0.00665
	(2.030)	(0.943)	(1.978)	(0.151)	(0.0621)	(0.139)	(0.0146)	(0.0160)	(0.0135)	(0.0187)	(0.615)	(0.00843)	(0.158)	(0.430)	(0.105)	(0.317)	(0.134)	(0.0695)	(0.404)	(0.0134)
Secondary river density	2.967	-1.204	-0.964	-0.0633	0.347	-0.236	-0.00463	-0.0655	-0.0261	0.0245	-2.847	-0.0330	-0.198	1.244	0.0221	0.467	-0.812*	-0.292	-2.889	-0.0849
	(4.733)	(1.601)	(4.061)	(0.296)	(0.258)	(0.302)	(0.0540)	(0.0407)	(0.0339)	(0.0284)	(1.840)	(0.0246)	(0.391)	(1.594)	(0.237)	(1.477)	(0.466)	(0.191)	(1.806)	(0.0555)
Tertiary river density	2.557	5.759	3.955	-0.612	-1.122**	-1.040	-0.181	0.0639	-0.0541	-0.00322	5.304	0.154**	-2.023**	-3.120	-1.008*	-1.725	0.309	-0.236	4.576	0.139
	(10.47)	(4.117)	(9.646)	(0.729)	(0.535)	(0.847)	(0.136)	(0.0818)	(0.0716)	(0.0686)	(4.120)	(0.0696)	(0.990)	(3.686)	(0.544)	(1.859)	(1.096)	(0.444)	(3.650)	(0.115)
Soil aptitude for potatoes	-17.39***	-4.010**	-26.72***	1.721***	0.0838	1.125***	-0.178***	-0.0522*	0.0826***	-0.0366	6.035***	0.0580***	1.198***	1.758	0.937***	1.105*	1.027**	0.270	2.144	0.0786
	(4.192)	(1.653)	(4.314)	(0.316)	(0.157)	(0.354)	(0.0620)	(0.0280)	(0.0254)	(0.0248)	(1.584)	(0.0201)	(0.311)	(1.111)	(0.182)	(0.583)	(0.461)	(0.179)	(1.502)	(0.0491)
Soil aptitude for maize	-12.68*	-3.365	-7.696	1.309***	0.396*	1.400***	0.149**	0.0229	0.0690*	-0.00844	4.815**	0.0980***	1.859***	2.253	-0.315	4.424***	-0.197	0.474**	2.629	0.0304
	(6.613)	(2.558)	(6.314)	(0.475)	(0.221)	(0.436)	(0.0656)	(0.0431)	(0.0407)	(0.0345)	(2.420)	(0.0334)	(0.445)	(1.522)	(0.393)	(0.756)	(0.522)	(0.218)	(1.696)	(0.0619)
Gold potential	2.894	4.472	-7.895***	1.245***	0.754***	0.918***	-0.187**	0.0484*	0.0648**	-0.0611	0.0267	0.0107	0.0159	0.190	-0.293	-0.584*	0.236	-0.111	0.586	0.0356
	(5.528)	(2.806)	(2.362)	(0.172)	(0.198)	(0.153)	(0.0773)	(0.0258)	(0.0269)	(0.0405)	(1.417)	(0.00826)	(0.278)	(1.696)	(0.257)	(0.309)	(0.602)	(0.191)	(1.487)	(0.0308)
Silver potential	-1.607	-3.564	7.974**	-1.209***	-0.898***	-0.938***	0.216***	-0.0729**	-0.0852***	0.0419	-2.551	-0.0367***	-0.179	0.305	0.221		-0.533	0.0426	-1.688	-0.0552
	(5.868)	(2.927)	(3.209)	(0.258)	(0.212)	(0.244)	(0.0801)	(0.0298)	(0.0302)	(0.0447)	(1.565)	(0.0118)	(0.339)	(1.847)	(0.300)		(0.648)	(0.212)	(1.694)	(0.0384)
Department and neighbor-pair FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Observations	1,934	1,938	1,938	1,938	1,938	1,938	1,938	1,776	1,776	1,558	1,938	1,938	1,768	1,938	1,120	374	1,938	1,938	1,938	1,938
R-squared	-0.157	0.006	0.038	0.087	0.065	0.211	0.072	0.098	0.038	0.063	0.107	0.062	0.182	0.144	0.020	0.213	-0.662	-0.127	-1.089	-0.839

Notes: Neighbour-pair fixed effects estimates with robust standard errors (parentheses) clustered by neighbour-pairs. Instrument is distance to least-cost path (log). *** p<0.01, ** p<0.05, * p<0.1

Appendix 8: Robustness tests

Tables A8.1 and A8.2 estimate four of our dependent variables on samples of municipalities that are within 1 and ½ standard deviation, respectively, of the mean of each of a set of geographic controls. Each cell represents a separate regression on a distinct sample. Hence in column (1) of table A8.1, the coefficient on UBN for municipalities within 1 s.d. of the mean of distance to departmental capital is -1.778, significant at the 1% level. This is similar to our main result of -1.884, also significant at the 1% level. Other coefficients in that column for samples based on municipal area, elevation, rainfall, river density, etc. are all of the same sign, similar magnitude, and are all significant at the 1% level. Figure A8 presents the same results graphically for UBN.

Estimates for plot size Gini (column 2) are of similar sign and magnitude as our main results, and all significant at the 1 percent level. The same is true again for local bureaucratic efficiency (3). Lastly, estimates for municipal tax collections (4) are similar in sign and magnitude to our main results and all significant, mostly at the 1 percent level.

Table A8.2 repeats the exercise, but with more restricted samples of municipalities within ½ standard deviation of the mean of the same 11 geographic variables. The pattern is similar: coefficients retain their sign, although their magnitudes are modestly more dispersed. Thirty-nine of 44 coefficients retain statistical significance, mostly at the 1 percent level. The latter two points are due to lower precision from smaller sample sizes. Stepping back from the detail of these 88 regressions, we interpret the results as strong evidence of the robustness of our main findings.

Table 8.3 reports NP-FE estimates for long-term development outcomes for a restricted sample limited to non-*encomienda* neighbours with high geological potential for either gold or silver deposits. This proxies for mining activities not just during the colonial era, but at any point since then.[27] If mining were actually driving our results, we would expect to find statistically significant coefficients but with opposite signs. Instead, the signs remain the same and coefficient magnitudes are significantly larger across the board. Compared to municipalities with high potential for gold and silver mining, municipalities with *encomiendas*

[27] It is also superior in completeness and reliability to existing data on colonial-era mining.

in 1560 have lower unsatisfied basic needs, infant mortality, and levels of poverty, more years of education, higher per capita GDP, and larger populations. The estimate for agricultural share of GDP is not significant, nor are they for inequality or state-capacity indicators (not reported). We expect significance levels to be lower than our main results because limiting the sample in this way reduces observations greatly, resulting in less-precisely estimated coefficients. In summary, these results support our main findings. They also support the specific intuition that mining was a more purely extractive activity than *encomienda*, leaving less in affected communities in terms of local institutions and public goods.

Table A8.1: Municipalities within 1 s.d. of geographic mean

Geographic controls	IV Unsatisfied Basic Needs 2005 (1)	Obs	IV Terrain Plot Size Gini Index 2005 (2)	Obs	IV Local Bureaucratic Efficiency (3)	Obs	IV Log Tax Collection per capita (4)	Obs
Distance to dept. capital	-1.778***	1,470	0.006***	1,370	0.087***	1,352	0.003***	1,470
	(0.331)		(0.002)		(0.027)		(0.001)	
Distance to Bogotá	-1.613***	1,394	0.007***	1,302	0.089**	1,276	0.003**	1,394
	(0.404)		(0.002)		(0.035)		(0.002)	
Municipal area	-1.672***	1,634	0.008***	1,532	0.093***	1,502	0.004***	1,634
	(0.299)		(0.002)		(0.028)		(0.001)	
Altitude (m above sea level)	-1.742***	1,446	0.007***	1,346	0.087***	1,348	0.004**	1,446
	(0.376)		(0.002)		(0.030)		(0.001)	
Latitude	-1.765***	1,410	0.009***	1,318	0.089***	1,302	0.005***	1,410
	(0.409)		(0.002)		(0.034)		(0.002)	
Longitude	-1.164***	1,340	0.005***	1,258	0.073***	1,242	0.002*	1,340
	(0.290)		(0.002)		(0.024)		(0.001)	
Average rainfall, 1980-2014	-1.922***	1,534	0.008***	1,432	0.103***	1,410	0.005***	1,534
	(0.408)		(0.003)		(0.031)		(0.002)	
Soil fertility index	-1.923***	1,418	0.007***	1,314	0.115***	1,288	0.005***	1,418
	(0.376)		(0.002)		(0.031)		(0.002)	
Primary river density	-1.923***	1,754	0.008***	1,632	0.105***	1,612	0.005***	1,754
	(0.343)		(0.002)		(0.027)		(0.001)	
Secondary river density	-1.903***	1,768	0.008***	1,642	0.104***	1,624	0.006***	1,768
	(0.343)		(0.002)		(0.027)		(0.001)	
Tertiary river density	-2.003***	1,678	0.009***	1,560	0.107***	1,538	0.006***	1,678
	(0.362)		(0.002)		(0.028)		(0.001)	

Neighbour-pair fixed effect estimates with robust standard errors (parentheses) clustered by neighbour-pairs. Constants and controls not reported. Geographic controls include: soil fertility index, linear distances to department capital and Bogotá, municipal area, altitude above sea level, latitude, longitude, average rainfall 1980-2014, primary, secondary and tertiary river density, soil aptitude for growing potatoes, and soil aptitude for growing maize. All models include geographic controls and department fixed effects. *** p<0.01, ** p<0.05, * p<0.1.

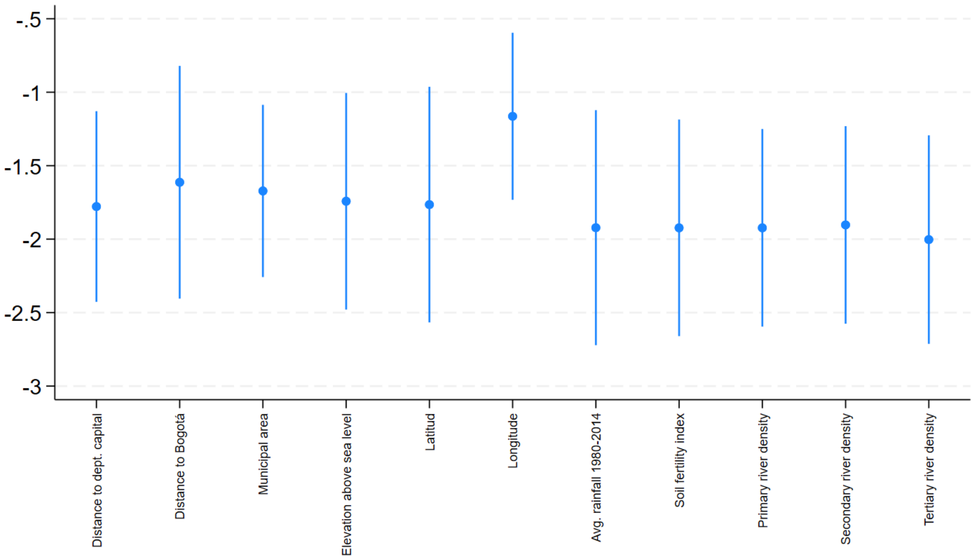
Table A8.2: Municipalities within 0.5 s.d. of geographic mean

Geographic controls	IV Unsatisfied Basic Needs 2005 (1)	Obs	IV Terrain Plot Size Gini Index 2005 (2)	Obs	IV Local Bureaucratic Efficiency (3)	Obs	IV Log Tax Collection per capita (4)	Obs
Distance to dept. capital	-1.465***	1,128	0.007***	1,058	0.063*	1,036	0.003	1,128
	(0.402)		(0.002)		(0.033)		(0.002)	
Distance to Bogotá	-1.436	804	0.002	758	0.028	742	0.004**	804
	(0.877)		(0.003)		(0.049)		(0.002)	
Municipal area	-1.526***	1,406	0.007***	1,316	0.091***	1,304	0.004***	1,406
	(0.310)		(0.002)		(0.027)		(0.001)	
Altitude (m above sea level)	-1.825***	1,098	0.007***	1,032	0.074**	1,020	0.003	1,098
	(0.433)		(0.002)		(0.034)		(0.002)	
Latitude	-1.649**	812	0.008**	758	0.090**	752	0.004***	812
	(0.745)		(0.003)		(0.045)		(0.002)	
Longitude	-1.245***	738	0.007**	690	0.073*	680	0.005***	738
	(0.434)		(0.003)		(0.037)		(0.001)	
Average rainfall, 1980-2014	-1.922***	1,212	0.009***	1,142	0.092***	1,122	0.005***	1,212
	(0.475)		(0.003)		(0.031)		(0.002)	
Soil fertility index	-1.725***	992	0.006**	910	0.129***	902	0.005**	992
	(0.436)		(0.002)		(0.032)		(0.002)	
Primary river density	-2.086***	1,696	0.009***	1,576	0.099***	1,562	0.005***	1,696
	(0.385)		(0.002)		(0.026)		(0.001)	
Secondary river density	-2.272***	1,640	0.007***	1,526	0.125***	1,516	0.006***	1,640
	(0.395)		(0.002)		(0.027)		(0.001)	
Tertiary river density	-1.857***	1,406	0.010***	1,300	0.099***	1,274	0.006***	1,406
	(0.346)		(0.002)		(0.027)		(0.001)	

Neighbour-pair fixed effect estimates with robust standard errors (parentheses) clustered by neighbour-pairs. Constants and controls not reported. Geographic controls include: soil fertility index, linear distances to department capital and Bogotá, municipal area, altitude above sea level, latitude, longitude, average rainfall 1980-2014, primary, secondary and tertiary river density, soil aptitude for growing potatoes, and soil aptitude for growing maize. All models include geographic controls and department fixed effects. *** p<0.01, ** p<0.05, * p<0.1.

Figure A8: Robustness tests for geographically restricted samples

Panel 1: Plot of UBN estimates, municipalities within 1 s.d. of geographic mean



Panel 2: Plot of UBN estimates, municipalities within 0.5 s.d. of geographic mean

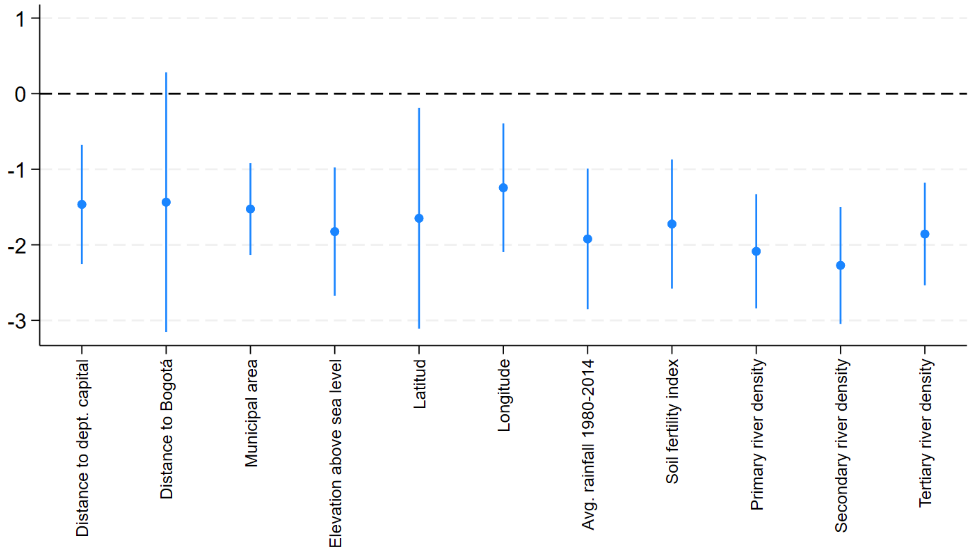


Table A8.3: *Encomienda* vs. mining municipal pairs

Dependent variable	(1) **OLS** Non-*encomienda* municipalities with gold as controls	(2) **OLS** Non-*encomienda* municipalities with silver as controls
Unsatisfied Basic Needs (UBN), 2005	-0.853**	-0.602*
	(0.377)	(0.359)
Infant Mortality Rate, 2005	-0.378**	-0.491***
	(0.157)	(0.158)
Multidimensional Poverty Index, 2005	-0.857*	-0.746
	(0.487)	(0.531)
Years of education, 2005	0.076***	0.073**
	(0.028)	(0.031)
GDP per capita, 2005 (log)	0.074***	0.067***
	(0.022)	(0.023)
Population, 2005 (log)	0.097***	0.136***
	(0.026)	(0.025)
Share of agriculture in GDP, 2015	-0.011	-0.011
	(0.008)	(0.008)
# Observations	166	128

Notes: This table reports neighbour-pair fixed effects estimates with robust standard errors (parentheses) clustered by neighbour-pairs, taking non-*encomienda* municipalities with high geological potential for gold and silver as controls. Geographic controls and constant not reported. Geographic controls include: soil fertility index, linear distances to department capital and Bogotá, municipal area, altitude above sea level, latitude, longitude, average rainfall 1980-2014, primary, secondary and tertiary river density, soil aptitude for growing potatoes, and soil aptitude for growing maize. All models include geographic controls and department fixed effects. *** p<0.01, ** p<0.05, * p<0.1.

Note that gold and silver mining in colonial Colombia were not exogenous to *encomienda*. Mining was a distinct economic activity largely carried out by African slaves in inhospitable areas where Spaniards mostly did not live, whereas *encomienda* relied on natives working the land (including hunting) and as servants in *encomenderos'* households. But gold and silver mines were mostly owned by the same *encomenderos*.

Table A8.4: NP-FE estimates with spatially correlated standard errors

VARIABLES	(1) Unsatisfied Basic Needs (UBN) 2005	(2) Infant Mortality Rate 2005	(3) Multidimensional Poverty Index 2005	(4) Years of education 2005	(5) GDP per capita 2005 (log)	(6) Population 2005 (log)	(7) Share of agriculture in GDP 2015	(8) Land Gini index by size 2005	(9) Land Gini Index by value 2005	(10) Share of land owned by Top 1% 2005
Tributary indios (log)	-0.186*	-0.0996*	-0.281***	0.0249***	0.0127*	0.0519***	-0.00364	0.00428***	0.00313***	0.00367***
	(0.103)	(0.0539)	(0.103)	(0.00932)	(0.00675)	(0.0117)	(0.00236)	(0.00107)	(0.00103)	(0.000624)
Observations	1,936	1,938	1,938	1,938	1,938	1,938	1,938	1,813	1,813	1,668
R-squared	0.839	0.819	0.823	0.796	0.792	0.810	0.688	0.712	0.743	0.736

VARIABLES	(11) Fiscal performance indicator 2000-2014	(12) Tax collection per capita 2005 (log)	(13) Local bureaucratic efficiency 2005	(14) Population 1851 (log)	(15) Per capita municipal revenues 1916 (log)	(16) Land value 1870 (log)	(17) State presence index 1794 (0-4)	(18) State presence dummy 1794	(19) Population 1780 (log)	(20) Share of whites in 1780 population
Tributary indios (log)	0.168***	0.00163***	0.0415***	0.245***	0.0126	0.0332	0.0414***	0.00903	0.128***	0.00311***
	(0.0465)	(0.000589)	(0.0132)	(0.0569)	(0.0103)	(0.0270)	(0.0139)	(0.00696)	(0.0338)	(0.000695)
Observations	1,938	1,938	1,849	1,938	1,438	594	1,938	1,938	1,938	1,938
R-squared	0.734	0.701	0.747	0.666	0.843	0.894	0.632	0.608	0.660	0.615

Notes: Neighbour-pair fixed effects estimates (OLS) with robust standard errors corrected for spatial correlation following Colella et al. (2019). All models run with geographic controls per above and department fixed effects. Distance cut-off beyond which correlation between error terms of two observations is assumed to be zero is 100 km. *** p<0.01, ** p<0.05, * p<0.1.

Appendix 9: Calculating the least-cost path of conquest

Imperial visitor Tomás López' account has a unifying structure that standardizes information for the different jurisdictions he visited, including: identity of the founding conqueror, a description of the local climate, name of the chief or village within the jurisdiction, name of the *encomenderos(s),* total indigenous male population, number of adult indigenous men paying tribute, what different forms tribute took, and the more general extent of vassalage of the indigenous population. The report covers localities within the governorships of Popayán, Cartagena, Santa Marta, and the New Kingdom of Granada.[28] Observations from Santa Marta and Cartagena are less detailed since the natives were in a "state of war" in those regions, as noted by Colmenares (1999) and Herrera (2009). No settlements are recorded in the Amazon region or Pacific coast, as these only emerged in the late 16th and early 17th centuries.

The discrepancies in figure A9.2 below between the conquerors' route according to Codazzi (1889) and our least-cost route are due to: (i) Codazzi's focus on only the most historically important conquerors, leaving aside less prominent figures who also founded *encomiendas*, and (ii) cartographic inaccuracies of the 16th to 19th centuries. Accurate maps of Colombia only became available with the advent of satellite technology in the 20th century. Using these, we can calculate the most likely route incorporating the locations listed below that we know López visited. Codazzi and his predecessors most likely lacked the information required to locate them all accurately on a map, much less plot feasible routes between them. Hence we regard our least-cost path as a better approximation of the true route of the conquerors who founded the *encomiendas* López chronicled than previous versions.

Table A9: Jurisdictions chronicled by Tomás López in 1560, in order visited

Province	Jurisdiction	Founding date	Founder/Conqueror
Popayán	Villa de Pasto	1539	Pedro de Puelles commissioned by Francisco Pizarro
Popayán	Ciudad de Almaguer	1551	Alonso de Fuenmayor

[28] Unlike the first three, the New Kingdom of Granada was not a governorship but a territorial division within the Viceroyalty of Peru.

			commissioned by Francisco Briceño
Popayán	Ciudad de Popayán	1536	Sebastián de Belalcázar commissioned by de Francisco Pizarro
Popayán	Ciudad de San Sebastián de la Plata	1551	Pedro Quintero Príncipe commissioned by Francisco Briceño
Popayán	Ciudad de Timaná	1538	Sebastián de Belalcázar
Popayán	Villa de Neiva	1539	Sebastián de Belalcázar
Popayán	Ciudad de Cali	1537	Lorenzo de Aldana y Sebastián de Belalcázar commissioned by Francisco Pizarro.
Popayán	Ciudad de Cartago	1540	Jorge Robledo commissioned by Francisco Pizarro
Popayán	Ciudad de Anserma	1539	Jorge Roble commissioned by Lorenzo de Aldana
Popayán	Villa de Caramanta	1557	Andrés Gómez Hernández commissioned by Sebastián de Belalcázar
Popayán	Villa de Santa Fe	1541	Jorge Roble commissioned by Lorenzo de Aldana
Popayán	Villa de Arama	1555	Miguel Muñoz commissioned by Sebastián de Belalcázar
New Kingdom of Granada	Ciudad de Ibagué	1550	Andrés López de Galarza commissioned by the New Kingdom of Granada
New Kingdom of Granada	Villa de Mariquita	1549	Francisco Núñez Pedrozo commissioned by the New Kingdom of Granada
New Kingdom of Granada	Villa de Tocaima	1544	Hernán Venegas Carillo commissioned by the New Kingdom of Granada
New Kingdom of Granada	Villa de Zipacón	1555	Gonzalo Jiménez de Quesada
New Kingdom of Granada	Villa de Choachí	1550	Antonio Bermúdez commissioned by Gonzalo Jiménez de Quesada
New Kingdom of Granada	Ciudad de Santafé (Bogotá)	1538	Gonzalo Jiménez de Quesada commissioned by Pedro Fernández de Lugo

New Kingdom of Granada	Ciudad de Tunja	1539	Gonzalo Suarez Rendon commissioned by Gonzalo Jiménez de Quesada
New Kingdom of Granada	Ciudad de Vélez	1539	Diego Barbosa commissioned by Gonzalo Jiménez de Quesada
New Kingdom of Granada	Ciudad de Pamplona	1549	Pedro de Ursúa
Santa Marta	Ciudad de Tamalameque	1544	Lorenzo Martín commissioned by Pedro Fernández de Lugo
Cartagena	Ciudad de Mompox	1537	Alonso de Heredia
Santa Marta	Villa de Tenerife	1543	Francisco Henríquez commissioned by Pedro Fernández de Lugo
Santa Marta	Villa de Malambo	1529	Jerónimo de Melo
Cartagena	Ciudad de Cartagena	1533	Pedro de Heredia
Cartagena	Villa de Santiago de Tolú	1535	Alonso de Heredia y Pedro de Velasco
Cartagena	Villa de María La Baja	1535	Alonso de Heredia

Figure A9.1 Conquerors' routes according to Codazzi (1889)

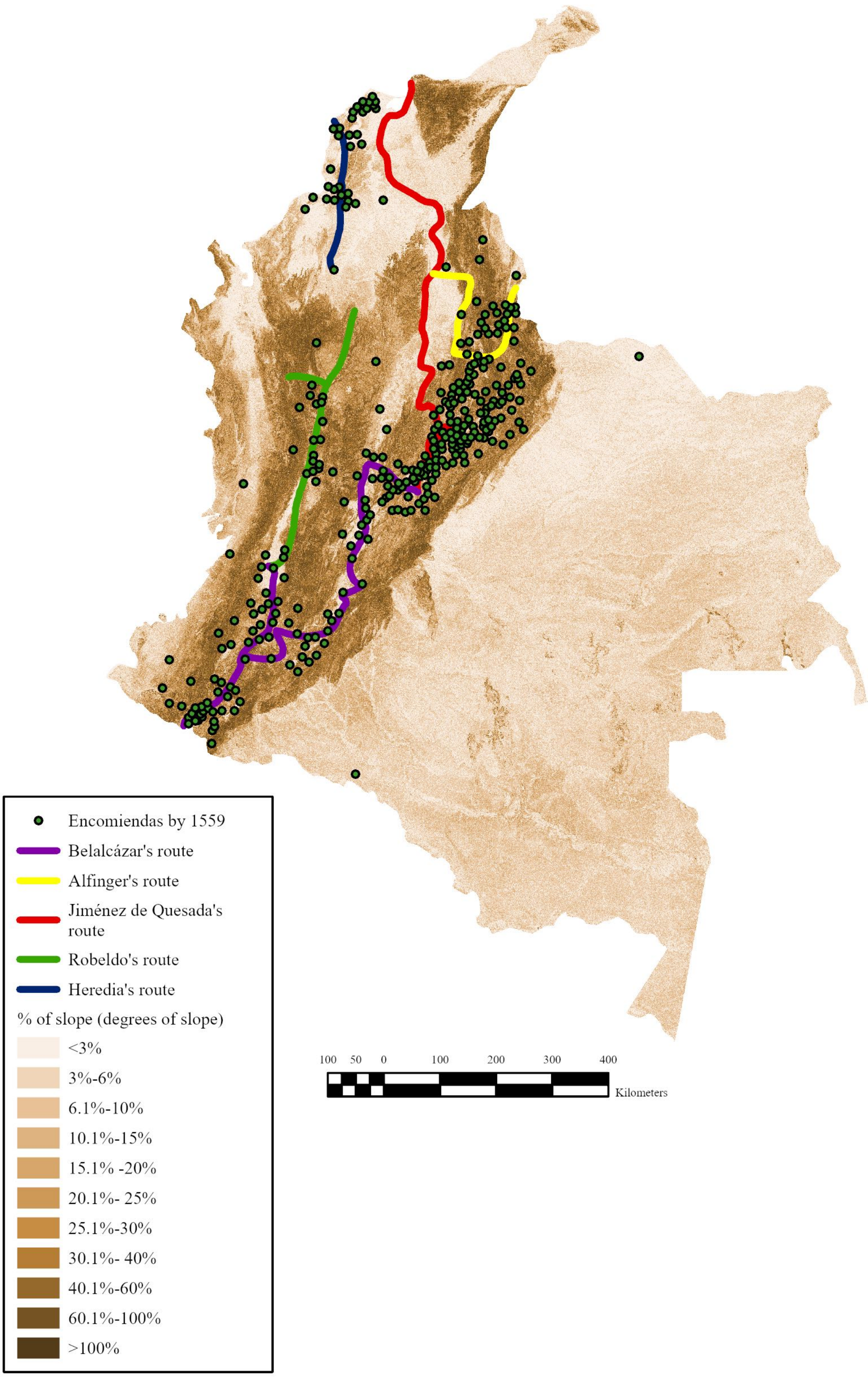
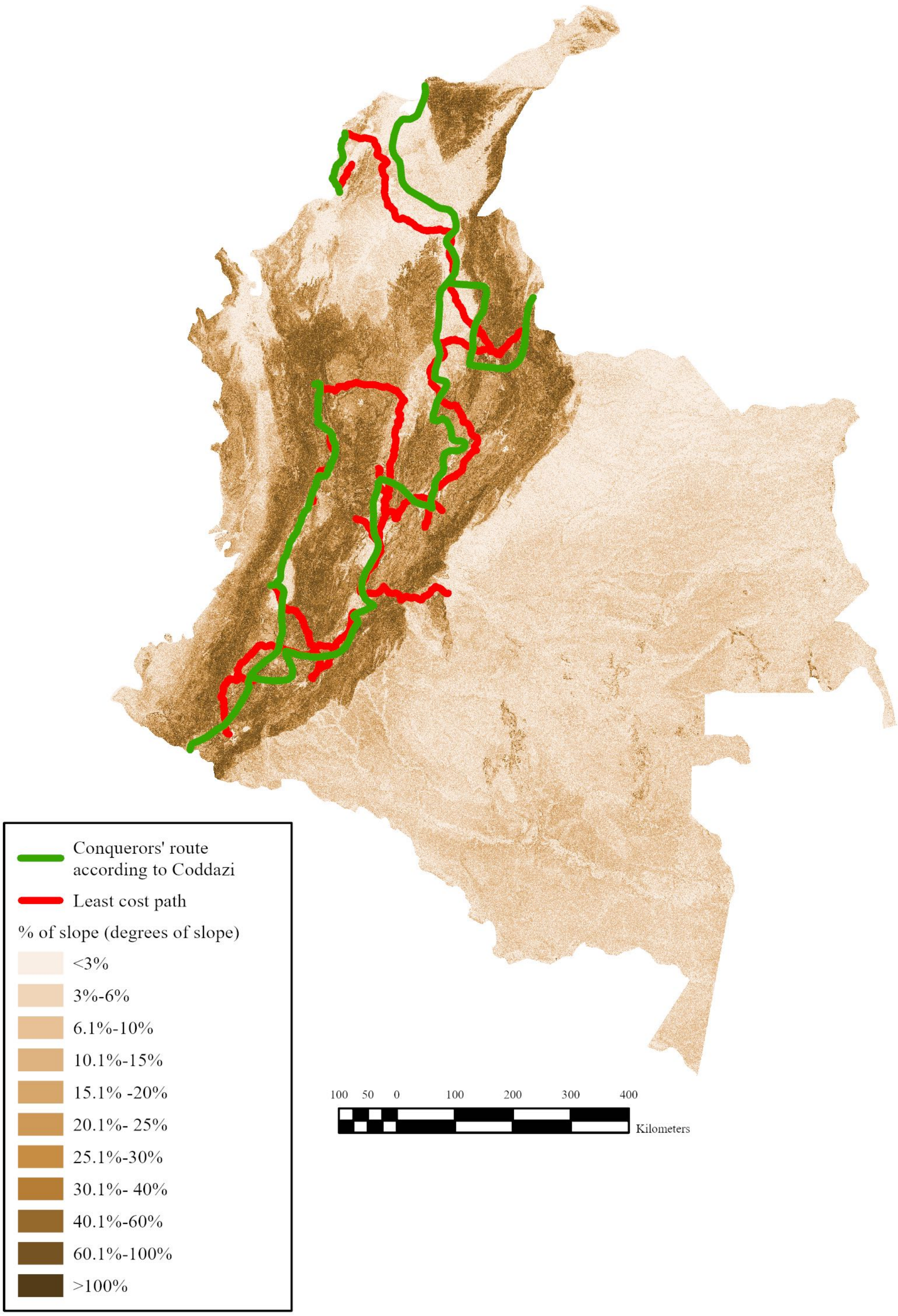


Figure A9.2 Least-cost route calculation compared to Codazzi



Appendix 10: Placebo tests

Figure A10.1: Gold Mining Placebo Test

VARIABLE	Log tributary natives		Log distance to least-cost path	
	(1)	(2)	(3)	(4)
Gold (high geological potential)	-0.153	-0.106	-0.09	-0.016
	(0.191)	(0.245)	(0.156)	(0.137)
Department dummies	NO	YES	NO	YES
Constant	2.894***	2.890***	9.571***	9.565***
	(0.031)	(0.033)	(0.053)	(0.045)
Observations	1938	1938	1938	1938
R-squared	0.0002	0.074	0.0002	0.243

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Figure A10.2: Silver Mining Placebo Test

VARIABLE	Log tributary natives		Log distance to least-cost path	
	(1)	(2)	(3)	(4)
Silver (high geological potential)	0.188	-0.048	-0.418	-0.119
	(0.211)	(0.257)	(0.165)	(0.156)
Department dummies	NO	YES	NO	YES
Constant	2.868***	2.878***	9.592***	9.572***
	(0.030)	(0.031)	(0.053)	(0.045)
Observations	1938	1938	1938	1938
R-squared	0.0002	0.0745	0.003	0.243

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

We follow Bonilla (2020) in using data from the Colombian Geological Service (SGC in Spanish) to identify municipalities' gold and silver extraction potential. SGC (2009) combines information on historic geochemical anomalies with data from on-site sampling and cluster analysis to predict the geochemical anomalies associated with gold and silver deposits.

Appendix 11: More robustness tests – including prehispanic settlements and excluding the Pacific region

Dependent variable	(1) **OLS** **Main results**	(2) **OLS** Prehispanic settlements	(3) **OLS** Excluding Pacific	(4) **IV** **Main results**	(5) **IV** Prehispanic settlements	(6) **IV** Excluding Pacific
Unsatisfied Basic Needs (UBN), 2005	-0.186**	-0.185**	-0.136	-1.906***	-1.915***	-2.013***
	(0.091)	(0.091)	(0.101)	(0.320)	(0.321)	(0.360)
Infant Mortality Rate, 2005	-0.100**	-0.100**	-0.134***	-0.562***	-0.555***	-0.589***
	(0.039)	(0.039)	(0.041)	(0.101)	(0.101)	(0.114)
Multidimensional Poverty Index, 2005	-0.281***	-0.281***	-0.216**	-1.687***	-1.684***	-1.605***
	(0.090)	(0.090)	(0.105)	(0.291)	(0.291)	(0.341)
Years of education 2005	0.025***	0.025***	0.020***	0.142***	0.142***	0.129***
	(0.007)	(0.007)	(0.007)	(0.023)	(0.024)	(0.026)
GDP per capita, 2005 (log)	0.013***	0.013***	0.013***	0.022**	0.022**	0.025**
	(0.004)	(0.004)	(0.004)	(0.009)	(0.009)	(0.010)
Tax collection per capita, 2005 (log)	0.002***	0.002***	0.001**	0.005***	0.005***	0.005***
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
Colonial State Presence, 1794	0.041***	0.041***	0.039***	0.257***	0.258***	0.229***
	(0.008)	(0.008)	(0.009)	(0.026)	(0.026)	(0.029)
Department and pair FE	YES	YES	YES	YES	YES	YES
Distance (km) to nearest prehispanic settlement included as control	NO	YES	NO	NO	YES	NO
Pacific region municipalities excluded	NO	NO	YES	NO	NO	YES
Observations [1]	1938	1938	1596	1938	1938	1596

Notes: Neighbour-pair fixed effect estimates with robust standard errors (parentheses), clustered by neighbour-pair municipalities. Constants and controls not reported. Geographic controls in Columns (1), (3), (4) and (6) include soil fertility index, linear distances to department capital and Bogotá, municipal area, altitude above sea level, latitude, longitude, average rainfall 1980-2014, primary, secondary, and tertiary river density, soil aptitude for growing potatoes, and soil aptitude for growing maize. Columns (2) and (5) add distance to the nearest prehispanic settlement as a control. Columns (4), (5) and (6) instrument using distance to the least-cost path. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

[1] UBN models from Columns (1), (2), (4) and (5) run with 1934 observations. UBN models from Columns (3) and (6) run with 1592 observations.

Appendix 12: Mediation analysis (based on Imai et al. 2011; Heckman and Pinto 2016)

Table A12.1: Medium-term outcomes

	Colonial outcomes (mediators)			Medium-term outcomes		
	(1)	(2)	(3)	(1)	(2)	(3)
Effect decomposition	State presence 1794	Population 1780 (log)	White population proportion 1780	Population 1851 (log)	Per capita municipal revenues 1916 (log)	Land value 1870 (log)
Total effect				0.258***	0.012**	0.052***
				(0.027)	(0.005)	(0.015)
Direct effect	0.045***	0.137***	0.003***	0.193***	0.009*	0.040***
	(0.007)	(0.020)	(0.001)	(0.026)	(0.005)	(0.013)
Share of direct effect in total effect				0.746***	0.701*	0.768***
				(0.100)	(0.404)	(0.244)
Proportion of total effect mediated by population, 1780 (log)				0.050*	0.032	0.087
				(0.030)	(0.086)	(0.068)
Proportion of total effect mediated by state presence index, 1794				0.239***	0.168**	0.198*
				(0.042)	(0.084)	(0.120)
Proportion of Total Effect mediated by share of white people, 1780				-0.035	0.099	-0.053
				(0.022)	(0.070)	(0.060)
Observations	1938	1938	1938	1938	1120	378

Notes: Robust standard errors in parentheses clustered by neighbour-pair municipalities in every model. Effects of *encomienda* in mediators (direct effect in colonial outcomes) applies to all models with 1938 observations, but could vary mildly in models with fewer observations. All models run with neighbour-pair fixed effects, department fixed effects and geographic controls per above. *** p<0.01 ** p<0.05 *p<0.1.

Table A12.2: Long-term outcomes

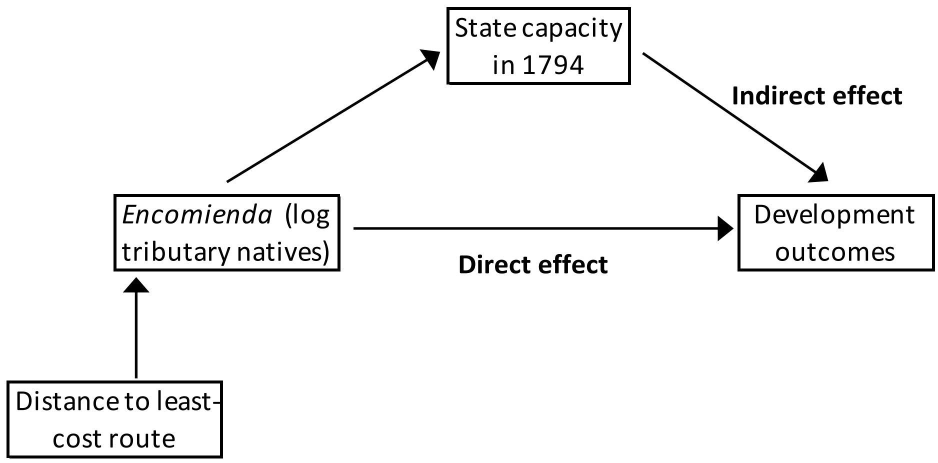
Effect decomposition	(1) UBN 2005	(2) Infant Mortality Rate 2005	(3) Multidimensional Poverty Index 2005	(4) Years of education 2005	(5) GDP per capita 2005 (log)	(6) Population 2005 (log)	(7) Share of agriculture in GDP 2015	(8) Gini Land Size 2005	(9) Gini Land Value 2005	(10) Top 1% land ownership 2005	(11) Fiscal performance indicator 2000-2014	(12) Tax collection per capita 2005 (log)	(13) Tax collecting efficiency of local bureaucracy
	Long term outcomes												
Total effect	-1.178**	-0.141***	-0.276***	0.027***	0.010***	0.059***	-0.004***	0.005***	0.003***	0.004***	0.169***	0.002***	0.042***
	(0.088)	(0.038)	(0.084)	(0.006)	(0.004)	(0.006)	(0.001)	(0.001)	(0.001)	(0.001)	(0.034)	(0.000)	(0.007)
Direct effect	-0.009	-0.082**	-0.108	0.012**	0.009**	0.039***	-0.003**	0.005***	0.003***	0.003***	0.104***	0.001***	0.031***
	(0.087)	(0.038)	(0.082)	(0.006)	(0.004)	(0.006)	(0.001)	(0.001)	(0.001)	(0.001)	(0.034)	(0.000)	(0.007)
Share of direct effect in total effect	0.050	0.585**	0.390	0.447**	0.926**	0.670***	0.861**	0.939***	0.899***	0.885***	0.614***	0.710***	0.749***
	(0.471)	(0.272)	(0.298)	(0.222)	(0.395)	(0.104)	(0.341)	(0.137)	(0.183)	(0.171)	(0.203)	(0.264)	(0.177)
Proportion of total effect mediated by population, 1780 (log)	0.278	0.021	0.295***	0.185**	-0.020	0.153***	0.077	-0.045	-0.008	-0.047	0.133**	0.176**	0.075
	(0.171)	(0.101)	(0.112)	(0.084)	(0.138)	(0.042)	(0.135)	(0.042)	(0.060)	(0.059)	(0.068)	(0.075)	(0.074)
Proportion of total effect mediated by state presence index, 1794	0.510***	0.346***	0.266***	0.339***	-0.109	0.224***	0.221**	0.042	0.055	0.116***	0.264***	0.083	0.162***
	(0.131)	(0.088)	(0.085)	(0.079)	(0.090)	(0.046)	(0.097)	(0.033)	(0.041)	(0.044)	(0.062)	(0.059)	(0.051)
Proportion of Total Effect mediated by share of white people, 1780	0.126	0.049	0.048	0.029	0.202*	-0.048*	-0.160*	0.065**	0.054	0.045	-0.012	0.031	0.013
	(0.108)	(0.066)	(0.070)	(0.051)	(0.104)	(0.029)	(0.090)	(0.033)	(0.045)	(0.036)	(0.051)	(0.055)	(0.041)
Observations	1936	1938	1938	1938	1938	1938	1938	1776	1776	1558	1938	1938	1768

Notes: Robust standard errors in parentheses clustered by neighbouring-pair municipalities in every model. Effects of *encomienda* in mediators (direct effect in colonial outcomes) applies to all models with 1938 observations, but could vary mildly in models with fewer observations. All models run with neighbour-pair fixed effects, department fixed effects and geographic controls per above. *** p<0.01 ** p<0.05 *p<0.1.

Appendix 13: Mediation analysis, Dippel et al.'s (2020) method

Dippel et al.'s (2020) mediation analysis provides a method of instrumenting for both *encomienda* and state presence in the 18th century, and then using both to estimate present-day development outcomes.[29] These nested estimations allow us to decompose the total effects of *encomienda* on modern-day development outcomes into direct effects vs. indirect effects via *encomienda's* contributions to building local state capacity during intervening centuries. The logic behind the mediation exercise is illustrated in figure A13. We use data from Durán y Díaz (1794) on colonial employees, services, assets, taxes and expenditures to code a dummy variable that equals 1 for municipalities where any state agency operated in 1794 and 0 where none did.

Figure A13: Direct and indirect effects of *encomienda* on development



We run two sets of IV regressions using the NP-FE methodology explained above. In the first set of regressions, our independent variable, log tributary natives (S), is instrumented with the distance to the least-cost route (G), and the previous medium-term outcome, state capacity in 1794, is now our mediating variable (C), which becomes the dependent variable.

First Stage: $$S = \beta_1 G + \beta_2 x + \epsilon \quad (13.1)$$

Second Stage: $$C = \alpha_1 \hat{S} + \alpha_2 x + v \quad (13.2)$$

Where $\hat{S}$ stands for the estimated values of S in the first stage.

In the second set of regressions, the mediator C becomes the endogenous variable and

[29] Ang (2023) employs this framework in a comparable way to show that nearly all of *The Birth of a Nation's* effects promoting racist crimes and attitudes in places where the movie was screened are indirect, via its spurring of new KKK chapters in these places.

is instrumented with G. The dependent variable is the outcome of interest (Y), and log tributary natives is included as a control,

First Stage: $$C = \eta_1 G + \eta_2 S + \eta_3 x + \epsilon \tag{13.3}$$

Second Stage: $$Y = \theta_1 \hat{C} + \theta_2 S + \theta_3 + v \tag{13.4}$$

where $\hat{C}$ stands for the estimated values of C in the first stage.

By replacing equation (13.2) into (13.4) we obtain the direct effect θ_2 of having *encomienda* on outcomes Y, and the indirect effect $\theta_1 * \alpha_1$ produced through the mediator. Comparing the magnitude and significance of these two effects reveals the extent to which 16th-century *encomienda* affects modern-day outcomes via the building of local state capacity during intervening centuries.

This method requires strong identifying assumptions: *encomiendas* and long-run outcomes must be exogenous, conditional on historical local-state capacity. More specifically, unobserved confounders related to *encomienda* and intermediate outcomes (historical state capacity) must be independent of confounders that cause the intermediate and final development outcomes. We consider these assumptions plausible in our setting, but acknowledge that they are strong. The method's virtue is that it allows us to unpack the direct and indirect effects of this colonial institution using a single instrument, focusing on the channel that our first mediation analysis found most important.

Table A13 presents results of our mediation exercise for all municipal pairs. Dependent variables are once again listed down the left-hand side. We combine both long-run and medium-term outcomes in one table. Column (1), total effect, repeats IV results from table 6. Columns (2) and (3) decompose those into direct vs. indirect effects. *Encomienda* has a statistically significant total effect for all 16 dependent variables. In 13 of these cases, indirect effects account for the larger share – typically between 2/3 and the entirety of the total effect. This is particularly true of current unsatisfied basic needs, infant mortality, multidimensional poverty and years of education, where the only significant effect is indirect. These results are significant at the 5% and 1% levels throughout.

The extractive, oppressive nature of *encomienda* makes it easy to understand how it might increase inequality directly. But its indirect effects are significantly larger. Our evidence implies that over long periods of time, *encomienda's* dominant effects on inequality operate indirectly, through the institutions of the local state that it helped build.

Table A13: Mediation exercise, all municipal pairs

Dependent variable	Total effect (1)	Direct effect (2)	Indirect effect (3)	F 1st stage (T on Z)	F 2nd stage (M on Z|T)	N
1. Long-run development						
Unsatisfied Basic Needs (UBN), 2005	-1.906***	0.098	-2.005***	180.944	31.114	1934
	(0.224)	(0.109)	(0.379)			
Infant Mortality Rate, (2005)	-0.562***	-0.023	-0.539***	180.401	31.113	1938
	(0.070)	(0.037)	(0.116)			
Multidimensional Poverty Index, 2005	-1.687***	-0.049	-1.638***	180.401	31.113	1938
	(0.203)	(0.094)	(0.334)			
Years of education, 2005	0.142***	0.006	0.136***	180.401	31.113	1938
	(0.016)	(0.007)	(0.027)			
GDP per capita, 2005 (log)	0.022***	0.011***	0.011	180.401	31.113	1938
	(0.006)	(0.003)	(0.007)			
Population, 2005 (log)	0.146***	0.036***	0.110***	180.401	31.113	1938
	(0.016)	(0.006)	(0.023)			
Share of agriculture in GDP, 2015	-0.013***	-0.002*	-0.011***	180.401	31.113	1938
	(0.002)	(0.001)	(0.003)			
2. Long-run inequality						
Land Gini index by size, 2005	0.008***	0.003***	0.005***	161.823	29.524	1776
	(0.001)	(0.001)	(0.002)			
Land Gini index by value, 2005	0.008***	0.002***	0.006***	161.823	29.524	1776
	(0.001)	(0.001)	(0.002)			
Share of land owned by top 1%, 2005	0.008***	0.003***	0.005***	155.371	27.234	1558
	(0.001)	(0.001)	(0.002)			
3. Long-run local state capacity						
Fiscal performance indicator, 2000-2014	0.364***	0.136***	0.229***	180.401	31.113	1938
	(0.067)	(0.028)	(0.079)			
Tax collection per capita, 2005 (log)	0.005***	0.001***	0.004***	180.401	31.113	1938
	(0.001)	(0.000)	(0.001)			
Local bureaucratic efficiency, 2005	0.097***	0.033***	0.064***	154.571	29.855	1768
	(0.017)	(0.007)	(0.020)			
4. Middle term outcomes						
Population, 1851 (log)	0.415***	0.217***	0.198***	180.401	31.113	1938
	(0.061)	(0.020)	(0.067)			
Per capita municipal revenues, 1916 (log)	0.056***	0.011**	0.045**	83.597	11.109	1120
	(0.013)	(0.005)	(0.018)			
Land value, 1870 (log)	0.130***	0.069**	0.061	58.292	1.81	378
	(0.026)	(0.028)	(0.064)			

Notes: Neighbour-pair fixed effect estimates with robust standard errors (parentheses) clustered by neighbour-pairs. Constants and controls not reported. Geographic controls include: soil fertility index, linear distances to department capital and Bogotá, municipal area, elevation above the sea level, latitude, longitude, average rainfall 1980-2014, primary, secondary and tertiary river density, soil aptitude for growing potatoes, soil aptitude for growing maize, and gold and silver potential. All models include geographic controls and department fixed effects.

*** $p<0.01$, ** $p<0.05$, * $p<0.1$.

This mediation analysis argues more strongly still that the positive effects of *encomiendas* on long-run patterns of development operate primarily through their indirect effects on local state capacity-building during the intervening centuries, which swamp *encomiendas'* direct effects. The local presence of agencies of the state during the 18th century explains how *encomiendas* in the 1560s led to improvements in unsatisfied basic needs, infant mortality, years of education, fiscal performance, and tax collections today, but also increased inequality in landholding. Direct effects are, with one exception, smaller in magnitude, and usually much smaller.