Conquered but not Vanquished: Complementarities and Indigenous Entrepreneurs in the Shadow of Violence

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Abstract

Under what conditions can members of poor disenfranchised communities survive and even foster entrepreneurship in environments where violence is cheap? How do such conditions alter ethnic identities and political institutions? In this paper, we examine the fortunes of indigenous communities following the Conquest of Mexico. Producers of cochineal dye– New Spain's most valuable processed good- provided a complementary service that was both hard to replicate and to expropriate, due to its fragility and human capital embedded in its production. We exploit micro-climatic variation in cochineal suitability to trace the effects of cochineal production on pre-Columbian communities. We show that cochineal producing settlements not only were more likely to survive the Conquest and colonial era, but exhibited greater capital accumulation on the eve of the Revolution (1910), less support for the hegemonic party thereafter, and more small firm creation, greater benefits for women and the indigenous, its main producers in 2010. However, cochineal producing municipios show greater evidence of cultural assimilation as early as 1790, were more unequal in 2010, and were less likely to adopt highly redistributive indigenous political institutions (usos). We contrast the performance of these municipios with others producing valuable goods that were easy to expropriate, such as gold or silver, and or easy to replicate elsewhere, like cacao. We interpret the effects as reflecting how robust inter-ethnic complementarity permitted the development of indigenous entrepreneurs despite the threat of violent expropriation.

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1 Introduction

Poor, disenfranchised or indigenous populations that live in regions whose resources can be extracted for sale on world markets have long been seen as the accursed of globalisation. Given the often dramatic differences in military and technological capabilities between those seeking

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to acquire geographically-delimited resources and non-elite indigenous populations that inhabit those areas, it is perhaps not surprising that this is the case. Where such groups are able to employ the "weapons of the weak", these usually persist in marginal occupations that have relatively small gains (Scott, 1985). Whether through violent coercion, the generation of inequality that results in oligarchic political arrangements or due to the direct introduction by external actors of extractive institutions, an important body of work suggests that openness to trade can lead indigenous groups to face a long-term future of low growth and stunted development (eg Engerman and Sokoloff, 2000, Acemoglu, Johnson and Robinson, 2002, Nunn, 2008, Dell, 2010a, Bobonis and Morrow, 2014).[1]

A related, but relatively unexplored aspect of the effects of openness on many indigenous communities lies in the replicability of their human capital, intellectual property and natural resources. The ability to replicate and outsource the skilled production of artisanal goods to lower-cost regions of the world has often meant that communities do not benefit from world demand for goods researched and developed by their cultures over centuries. Similarly, the ability of communities to gain from the exploitation of their indigenous biological resources or cultivation processes, such as spices, silkworms, dyes or rubber, have often proved less durable sources of wealth as these are replicated elsewhere.[2]

Yet, despite this bleak picture, a common perspective holds that *lack of access* to the market is a key reason for sustained poverty (eg McMillan, 2002). Due to geographic remoteness, lack of access to credit or social distance, indigenous societies are often particularly perceived to be isolated from the benefits of trade that markets afford. In this view, the problem of underdevelopment is not trade, but its absence.

Under what conditions can poor disenfranchised communities survive and even foster entrepreneurship in environments where trade is possible but violence is cheap? How do such conditions alter ethnic identities and political institutions? In this paper, we examine the resilience of indigenous communities following arguably one of the most traumatic moments in history– the Conquest of Mexico. The Conquest led the indigenous population of Mexico to fall dramatically.[3]. Reconstructing pre-Conquest city-state settlements (*Altepeme*), Diaz-Cayeros, Espinosa-Balbuena, Jha et al. (2022) found that 36% of pre-Hispanic urban centers simply disappeared. Among 1093 towns in the historic core, the population dropped from an average 2,377 inhabitants to 430 in 1570 – further declining to 128 by 1646. Although new settlements were also created, and some existing settlements even grew, there is little doubt of the massive

[1]See also Nunn (2014) for a very useful overview. In Latin America, in particular, globalization has been seen through the lens of declining terms of trade for commodities, an unfair international division of labor, a capitalist world system based on coercion or a theory of unequal exchange (eg Evans, 1979, Wallerstein, 1979).

[2]For a description of the desolation of the Spice Islands following the transplantation of the nutmeg, see Keay (1991). On the importance of non-replicable sources of complementarity in supporting a legacy of inter-ethnic tolerance between Hindus and Muslims in South Asia, see Jha (2013), and more generally, Jha (2018, 2022). An irony of being the originating region of biological resources is that the indigenous flora or fauna are often more difficult to cultivate there than in new areas– being indigenous, they also tend to have natural predators that are absent elsewhere (Donkin, 1977).

[3]Estimates for the overall number of deaths differ. Acuna-Soto, Stahle, Therrell, Griffin and Cleaveland (2004) suggest a decline from as high as 30 million in 1518 to 2 million by 1600

demographic shock.

We draw upon a simple theoretical framework, adapted from and complementing Jha (2018, 2013), to emphasize the importance of two conditions under which vulnerable, relatively immobile ethnic groups may benefit from exposure to world trade: the presence of a non-replicable and non-expropriable source of inter-ethnic complementarity and the presence of costs to monitoring effort that enables vulnerable individuals to shirk.[4] Satisfying these conditions may permit otherwise vulnerable individuals to accumulate primitive physical capital, even in environments where they would otherwise be easy targets for expropriation. They further provide additional incentives for engaging in other forms of investments in cultural dimensions that reduce the costs of cross-ethnic interaction and facilitate finding alternative trading partners from the other group that can improve their share of the gains from exchange. Taken together, the development of wealth and human capital conducive to trade can help foster the development of groups of 'indigenous capitalists' even in environments of extreme vulnerability.

In contrast, in societies that violate these conditions– i.e. where ethnic groups compete, where the source of the vulnerable group's complementarity can be violently seized (eg physical capital), easily replicated (eg low skilled human capital), or where the effort of members of the vulnerable group can be easily observed and sanctioned through violence – exposure to higher world demand through openness to world trade may lead vulnerable communities to be more prone to ethnic conflict and expropriation and may be less conducive to their long-term development.

We examine in particular the long term effects on indigenous populations of cultivating one of the world's most valuable traded commodities up until the early 19th century: the *Spanish Red* dye extracted from the cochineal insect, in exogenously varying environments of global demand, credit, and contractual verifiability. We perform this study using novel historical data drawn from a range of primary and secondary sources in Mexico, a country where indigenous, colonial and modern identities and institutions of governance have coexisted for centuries, and which thus provides a useful laboratory for understanding the long-term effects of trade on indigenous communities.

From the sixteenth century to the independence of Mexico in 1821, cochineal was the most valuable processed good exported to Spain from the Indies, second in value only to silver and gold. Indigenously domesticated in New Spain, the extreme fragility of domesticated cochineal with respect to weather, temperature and precipitation meant not only that cochineal remained a New Spanish monopoly, despite numerous attempts by British and French spies to smuggle live insects abroad, but also that high powered incentives were required to cultivate the insect, leaving cochineal production in the hands of indigenous peasant producers, particularly women. Following independence from Spain in 1821, Mexico lost its monopoly on cochineal, and falling demand due to changing European fashion tastes and the development of synthetic dyes in late

[4]Technically, two actions are *complements* if 1) adopting one does not preclude adopting the other, and 2) whenever it is possible to implement them separately, the sum of each return cannot be greater than doing them together.

1880s rang a deathknell for the industry.

In our companion paper (Diaz-Cayeros et al., 2022), we both reconstruct the population change of individual indigenous settlements in the historic core of Mexico in the colonial era, and show that those producing cochineal at the time of the Conquest were more likely to survive. In this paper, we examine the effects of expansion in this industry during the colonial period, the contracting that took place during that time as well as the long-term effects on contemporary human development.

We exploit the discontinuous fragility of cochineal with respect to micro-climatic differences during the growing season to identify the long-term effects of cochineal production among municipios that housed indigenous populations in the pre-Columbian period. We first show that the micro-climatic conditions for producing cochineal– which favors arid micro-climates in the growing season– are unrelated (in fact, if anything, negatively correlated) with the suitability for maize, the staple crop, which we show was a major determinant of pre-Columbian population concentrations, and also a major driver of subsequent differences in wealth and human development. Yet, despite these adverse conditions, and despite the end of cochineal production with the development of synthetic dyes beginning in the 1880s, we find that municipios that produced cochineal had a lower share of their populations in extreme poverty in 2010 by 5 percentage points. These gains were particularly accentuated on the income and educational attainment of indigenous households and educational attainment and labour force participation among women, who were among its major cultivators. However, cochineal producing municipios show greater evidence of ethnic assimilation were more unequal in 2010, and, in the state of Oaxaca, were less likely to adopt indigenous governance institutions– or *usos y costumbres*. Within Oaxaca, they also show greater concentrations of private sector firms, and greater valued added by them. These economic differences are paralleled with political differences: cochineal-producing municipios were less likely to house core supporters for the hegemonic party, the PRI, between 1970- 1988, and were more likely to turnout and vote against the PRI in the critical transitional election of 2000 that instituted democracy. We contrast the performance of these municipios with the negative patterns in pre-Columbian municipios that produced expropriable goods, such as gold or silver, and an indigenously developed but replicable good– cacao.

We exploit evidence both cross-sectionally and across time to shed light on the mechanism. We show that the differences between cochineal producing and other municipios pre-date Mexico's Revolution in 1910. Erstwhile cochineal producing municipios display greater shares of households living in *ranchos*– private farms– and semi-urban localities, and appear to have been better able to resist the spread of haciendas. In our companion paper (Diaz-Cayeros et al., 2022), we push the comparisons further to the point of the Conquest itself, exploiting novel hand-collected pre-Conquest and Conquest-era data, including from the *Matricula de Tributos* (ca 1521) and the *Suma de Visitas* (ca 1548), we find that indigenous settlements that produced cochineal at the time of the Conquest faced a five times lower hazard of disappearing each year during the colonial period, were 13 percentage points more likely to continue to exist in 1790 and enjoyed populations 1.7 times greater at the end of the colonial period. We now examine entrants in the colonial market as well. Consistent with the combination of inter-ethnic complementarities and opportunities to defect in supporting indigenous entrepreneurship, we show that cochineal producing municipios do best among those that had access to alternative Spanish markets.

We interpret these results as reflective of two related phenomena. First, we argue that inter-ethnic complementarities in human capital and trade networks helped secure primitive capital for early cochineal producers and provided the possibility of surplus from inter-ethnic exchange subsequently as well. By providing access to world markets and downside insurance, Spanish traders provided members of poor indigenous communities, particularly women, a means to benefit from world trade and to engage in market activity, leaving a beneficial legacy both on poverty reduction and on women's opportunities. Second, the Repartimiento contract in the colonial period provided a means of beneficial credit provision for cochineal production, but the gains were shaped by the ability of the indigenous to renege. Further, because of the ability to renege on the Repartimiento contract and sell in markets when prices were high, the risky nature of cochineal on the upside engendered inequality. Increased inequality and access to market opportunities appears to have later undermined traditional (largely redistributive) political institutions by leading first the richer and most mobile members to opt out and "hispanicize".

Thus, part of the reason that indigenous communities appear poor in Latin America and other areas may be not solely about colonial predation, but instead because their most successful members chose to opt out and assimilate. And market access, engendered both by inter-ethnic complementarity but ironically also by *weak* contract enforcement by the colonial state may have played an important role in the process of poverty reduction and the undermining of indigenous institutions.

Along with links to important works on colonial legacies and market access in development already mentioned, our paper builds on key literatures on cultural transmission (eg Bisin and Verdier, 2001, 2011, Nunn and Wantchekon, 2011), on ethnic identity and insurance (eg Abramitzky, 2008, Munshi and Rosenzweig, 2009), on contract enforcement (eg Kranton and Swamy, 2008, McMillan and Woodruff, 1999), on gender roles (Qian, 2008, Alesina, Giuliano and Nunn, 2011) and on ethnic diversity and public goods provision (eg Alesina and La Ferrara, 2005).[5]

Important work on urbanization by Maloney and Valencia Caicedo (2016) points out that

[5] The paper naturally also builds upon a body of work, following Acemoglu, Johnson and Robinson (2001) that focuses on the institutions established by the colonial state as a key driver of reversals of fortune in contemporary development. Research by Dell (2010b) on the impact of extractive institutions like the Mit'a in Peru has been followed by contributions highlighting the differential legacy of various institutions, including missions in Paraguay (Valencia Caicedo, 2019) and Mexico (Waldinger, 2017); gold mining and sugar plantations in Brazil (Naritomi, Soares and Assunção, 2012), sugar more generally (Dippel, Greif and Trefler, 2016) and plantations in Indonesia (Dell and Olken, 2020). We complement these works by focusing on indigenous responses and outcomes. For example, we complement work by Huillery (2009) and Huillery (2010) that finds that colonial public investments in West Africa mitigated a reversal of fortune for pre-colonial societies. We find similar effects from a different channel– inter-ethnic complementarities arising from indigenous human capital– and in a different context.

large cities in Latin America, such as Mexico City, were built upon areas of past indigenous settlement, like Tenochtitlan. As a result of these large agglomerations, regional pre-Columbian population densities in Latin America are positively correlated with contemporary income.[6]

In contrast to that work, however, we seek to highlight the effects from a different channel– inter-ethnic complementarities arising from indigenous human capital. By exploiting local comparisons based upon micro-climatic differences in cultivation we are analyzing the incentives and outcomes of indigenous populations rather than colonists when they enjoyed differential degrees of bargaining power. In this sense our work is more related to contributions related to mechanisms deterring violence against minorities more generally (e.g. Jha, 2013, 2018, Jedwab and Moradi, 2016, Becker, Boeckh, Hainz and Woessmann, 2016, Grosfeld, Sakalli and Zhuravskaya, 2019).[7]

We first provide some necessary background on cochineal. We next discuss our empirical strategy, and show the long-term effects of cochineal on modern development, and its disproportionate effects on women's literacy and labour force participation, and indigenous identity choices. We then attempt to parse the mechanisms through which this persistence may have occurred. We first compare the effects over time, comparing those that produced cochineal in the pre-colonial period to those that produced it before and after the colonial-era Bourbon reforms that restricted credit, and after Independence at differing degrees of proximity to pre-colonial trade networks and access to colonial era alternative markets. We next examine the effects on intermediate and alternative explanations over time, including the shares of populations in 1910 (prior to the Revolution) that had remained in pueblos, had moved to private farm (ranchos), haciendas and urban areas, and the population, and the population shares of Indians and Spaniards in municipios in 1790. We conclude by discussing the broader implications and parallels for other indigenous communities around the world, including in South Asia.

[6]Within contemporary Mexico Alix-Garcia and Sellars (2020) have shown that the basic patterns of cities remained unchanged throughout the demographic collapse, the war of independence and the revolution. In this sense, our work is related to recent contributions seeking to shed light on the role of systems of direct and indirect governance and rule on the survival of indigenous communities in colonial Mexico (Garfias and Sellars, 2020, 2021).

[7]Our results also reconcile an important debate among historians of Latin America. The overwhelming majority of historians of the late colonial period of New Spain see the *Repartimiento de mercancías* as a system of forced sales in which Indians were compelled by the coercive authority of the Alcaldes Mayores (who concentrated both judicial and executive authority among the Indian towns in New Spain) (Pastor, 1987, Caplan, 2010). In an important re-assessment, Jeremy Baskes (2000)(2005) instead takes a New Institutional Economics view, arguing that colonial institutions like the *Repartimiento* actually were efficient means to balance monitoring and risks. However there has been hitherto no attempt, to the best of our knowledge, to document the long term effects of these contractual arrangements on the indigenous communities themselves. We find that cochineal producers following the banning of the Repartimiento became poorer and more indigenous, consistent with the value of Repartimiento credit in mitigating indigenous poverty traps. Further, drawing upon historical sources, including a secret handbook for Spaniards bidding for local office, the *Yndize de todos los Goviernos, Corregimentos y Alcadias mayores que contiene la Governacion del Virreynato de Mexico*, we are able to parse the gains to the Spaniards and non-Spaniards and argue that the extent of contract enforceability can reconcile why, in areas that the alcaldes found it easy to monitor, they intermediated with the market, and the indigenous remained relatively isolated and poor. However, it was where monitoring was difficult and alternative markets more accessible, that the indigenous could capture some of the gains from world trade. It was both these profits and the human capital gained through market exposure, we argue, that has had lasting effects on patterns of poverty, female literacy and patterns of ethnic assimilation and indigenous governance visible in Mexico today.

2 Robust Complementarities in Cochineal Production

From the conquest of Mexico until the development of synthetic dyes in the late 1880s, cochineal was the best source of red dye known to the West, and was highly prized in the production of textiles, of which dyeing could constitute close to 40% of the overall cost (Marichal, 2001) (please see Figure 5 for a time line of major political events and world prices). Crimsons and reds in particular were highly prized as colours denoting status, both among the church and among royalty. Cochineal-dyed textiles, further, were ten to twelve times more brilliant and remained fast compared to those of the known alternatives derived from madder and the also-rare Mediterranean kermes (Lee, 1948, Marichal, 2001).[8]

As a result, from the sixteenth century to the independence of Mexico in 1821, cochineal was also the most valuable processed good exported to Spain from the Indies, second in value only to silver and gold. The average exports of cochineal between 1580-1600 were worth 550,000 pesos, close to 9% of the value of the silver exports from New Spain (Lee, 1948). At its peak in 1771, cochineal had risen to be worth more than 4,200,750 pesos (Baskes, 2000).[9]

Fine cochineal – *la grana cochinilla fina*– was thus a highly prized commodity in world trade. However, the domesticated cochineal insect also had one key distinguishing feature from other types of agricultural or mineral commodity: it was extremely fragile. Unlike wild cochineal (*cochinilla silvestre*), fine cochineal only survived in regions with particular combinations of precipitation, heat and cold. A sudden rain, frost or elevation in temperature could kill the entire harvest (Donkin, 1977). Cochineal production spread across Indian pueblos that enjoyed optimal growing conditions (see Figure 1).

The fragility of cochineal had two effects: first, despite numerous attempts by Spain's rivals– England and France– it proved very difficult to transplant and replicate in experimental farms outside of New Spain.[10] Thus, unlike other prized agricultural commodities, such as Brazilian rubber, Chinese silkworms or Indian indigo, cochineal was secure from world competition and continued to prove a lucrative (New) Spanish monopoly for two hundred and fifty years. Its fragility made cochineal much less transplantable and much more localized in its production, in this sense, more like mineral resources than many agricultural goods.

Second, because of its fragility, cochineal differed from mineral resources in that it was both highly risky and required great care and attention to cultivate. Domesticated cochineal had to be 'seeded' onto the paddles of the opuntia cactus. Immobile and virtually defenseless itself, cochineal had also to be shielded from many potential threats. The sixteenth century chronicler

[8] This difference was so stark that the brilliance of the cochineal-dyed redcoats of British officers relative to footsoldiers in the American Revolution, made them obvious targets for Patriot sharpshooters. In this way, cochineal could be credited with helping to secure American independence (Greenfield, 2005).

[9] This price is based on the market price of cochineal in Oaxaca, near the main production areas of cochineal. Naturally, European prices would be considerably higher.

[10] French spies attempted to smuggle live cochineal to Haiti, while the English made similar attempts at establishing cochineal plantations in India, but the cochineal insects were not to survive sea-borne transplantation until the independence of Mexico and successful attempts by Spaniards to raise cochineal in the Canary Islands (Greenfield, 2005).

of New Spain, Gonzalo Gomez de Cervantes devoted several sections to cochineal, listing the "enemies" that ranged from wild cochineal and other insects to the *gusano tolero* worm, and chickens and other birds that required constant vigilance (see Figure A1.1.)

We argue that the fragility of cochineal led both to the need for high-powered incentives to care for the crop, as well as a basic problem of moral hazard: it was difficult for a principal to verify whether a cochineal crop had been destroyed due to lack of effort, had been secretly sold on the market due to high prices or had been lost due to the multiple natural threats that cochineal faced.

There were a number of institutional responses to this contracting environment. First, cochineal production was left almost overwhelmingly in the hands of indigenous producers in areas that were otherwise marginal to agriculture (Marichal, 2001, Greenfield, 2005, Donkin, 1977, Baskes, 2000). On the eve of the Conquest, these indigenous producers enjoyed human capital advantages in raising cochineal and a history of long-distance trade that may have allowed a window of opportunity for primitive capital accumulation. While the Conquest would not only lead to a loss of indigenous political control but also led to widespread depopulation due to disease and exploitation (Diaz-Cayeros et al., 2022), cochineal became potentially highly renumerative due to global demand for those indigenous populations already well-positioned to produce and market it, allowing the possibility of the accumulation of primitive capital. This capital likely took not just the role of wealth with which to finance other activities but also specific investments in dimensions that facilitated assimilation, like language and cultural tastes deriving from new incentives for direct trade with the Spanish.[11]

Further, cochineal arguably is likely to have had particular influence in providing, not just market access, but access for women in particular. Cochineal could be produced in small plots near the home, and though it was labour-intensive, it did not require large degrees of animal or human motive power (in a manner arguably similar to that of the hoe relative to the plough and the cultivation of tea (Alesina et al., 2011)). This provided particular possibilities for women and children to engage in this lucrative activity, and indeed women and children were often heavily involved in the cultivation of cochineal (see Figure A1.1[b]).

[11] For a model of cultural investments in securing trust, see for example, Athey, Calvano and Jha (2015). For example, in the 1670s, Friar Francisco de Burgoa described the Chontal people of the highlands, reputed once to be a wild and unruly people:

> Today this nation is the most relaxed and rich in the [Oaxaca] Province, because . . . cochineal is produced in great abundance; so silver coins in the thousands enter this towns and [the Indians] all dress in the Spanish cloths, so elegant, that many wear silk and use silverware . . . [and] ride horses in good saddles . . . (Dahlgren and de Jordán, 1990)[p.19].

Though cochineal production did benefit from specialized knowledge of processes to keep the insects alive, the fact that production moved relatively easily between regions and across ethnolinguistic boundaries among the native populations over time suggests that these initial human capital advantages were not impossible to replicate, particularly for the relatively-technically advanced Europeans. For example, production did move within ethnically very different areas of New Spain, such as between Nahuatl-speakers in Tlaxcala and Zapotecs and Mixtecs in Oaxaca, and was later introduced successfully in Guatemala and ultimately the Canary Islands (see also Figure 4). Yet, it appears the costs of replication were sufficiently high that initial inter-ethnic complementarities instead appeared to have engendered ethnically-based specialization, with Spanish traders providing credit and access to the world market to Indian producers.

Both human capital gained from direct rather than intermediated access to the world market as well as actual wealth, we suggest, may have played a role in engendering ethnic assimilation (both through language acquisition and the breakdown of local indigenous governance institutions) and, ultimately, in reducing poverty.

3 Empirical Strategy

In our empirical analysis, we will compare municipios that possessed the optimal growing conditions for cochineal to those that otherwise were very similar to examine the effects of cochineal in both geographical and climate space. We seek to identify the effect of past cochineal production on contemporary measures of poverty, inequality, ethnic assimilation, and the maintenance of traditional institutions. To do this, we will make two types of comparison. First we will match cochineal producing areas to non-producing areas in terms of their geography, in terms of climate, and both. The identifying assumption is that the choice to produce cochineal in pueblos that are very close by to one another in either (or both) geographic or climatic spaces was not shaped by unobserved initial differences that also affect subsequent economic and political development.

In our benchmark specification, we will run cross-sectional regressions of the following form.

$$y_i = \beta Cochineal_i + \sum_j^4 \gamma_j Geog_i + \sum_j^2 \xi_j Clim_i + X_i B + \epsilon_i \tag{1}$$

Where y_i is a set of 18th and 21st century measures of poverty, female literacy, ethnic identity and public goods provision as well as whether the municipality has chosen to explicitly adopt traditional governance institutions (*usos y costumbres*). Since only the historically cochineal-growing state of Oaxaca has so far implemented laws recognizing *usos*, we implement these specifications in Oaxaca only.

Cochineal is a measure of whether any pueblo within the municipality once produced cochineal. We exploit a number of primary and secondary sources to identify the locations of cochineal production, including a comprehensive search of all documents in the *Archivo General de Nueva España* in Seville and the *Archivo General de la Nacion* in Mexico City (please see data section).

$Geog_i$ is a vector of geographical initial conditions (quadratics in latitude and longitude and a linear term in altitude).[12] $Clim_i$ is a set of climatic conditions– linear (and in some specifications, quadratic) controls for average temperature and precipitation. In some specifications, we also include X_i- cultural initial conditions which include distance to pre-Columbian native population or administrative centres and our predicted pre-Hispanic road network. We use robust standard errors, clustered at the relevant historic political unit– the subdelegacion.[13]

[12] Using a quadratic term for altitude does not affect the results.

[13] Though the process of assignment to treatment is microclimatic and thus at the level of locality, we cluster

It may be the case that cochineal production may have occurred in locations that were favourable for contemporary development for other reasons. As mentioned above, cochineal cultivation was highly dependent on specific climactic conditions. During the main growing season of March-August, the cochineal had to be protected from precipitation (below 700mm was best) and large temperature variations (i.e. no frosts or lows (<4 C), and temperatures above 30 C).[14]

The first stage regression is of the following form:

$$Cochineal_i = \zeta OptimalClim_i + \sum_j^4 \gamma_j Geog_i^j + \sum_j^2 \xi_j Clim_i + X_i B + \nu_i \tag{2}$$

By including the linear (and quadratic terms) in geographical and climactic space, we are essentially exploiting the discontinuity in the propensity to produce cochineal in some microclimates compared to others that are right next to each other. While we should be using historical climate, average temperatures have largely been preserved over the last four centuries at least in one cochineal producing region- Puebla- for which reliable tree-ring reconstructions are possible (Figure A1.4).

4 Data

In an exhaustive search of primary and secondary sources, we found 611 mentions of cochineal. These fell within 81 modern municipios.[15] In addition, we provide a higher level of disaggregation, by separating the footprint of the more than 5 thousand modern urban settlements (defined as those *localidades* with more than 5000 inhabitants), within every municipality, and almost 17000 internally homogeneous rural areas (AGEBS), as defined by Mexican rural census tracts. To construct the cochineal production dataset we initially relied on a detailed appendix, compiled by Donkin (1977), listing 215 cochineal producing towns on the basis of the most important existing sources.[16]

We carefully examined all of these original archival sources from the initial list for any

at the subdelegacion level to account for potential misallocation of cochineal production to specific locations in the historical sources. Our results are robust to alternative levels of clustering, as well as using corrections recommended by Colella, Lalive, Sakalli and Thoenig (2019).

[14]Secondary sources do differ on the precise cutoffs– we follow Lee (1948). The ideal conditions for cochineal are 25C with very low precipitation (we thank Sergio Juarez, one of the two remaining modern producers of cochineal in Oaxaca, for this observation.)

[15]We are using the 2010 municipal division, with 2457 jurisdictions.

[16]These include the *Matricula de Tributos* for the precolonial period; the *Suma de Visitas* for the early sixteenth century; the *Relaciones Geograficas de Indias* for the late sixteenth century; the *Memoriales del Obispo de Tlaxcala* by Alonso de la Mota y Escobar for the seventeenth century; and Dahlgren and de Jordán (1990) for the eighteenth century. The *Suma de Visitas* of 1548 was a census collected for tributary purposes, at a time when Indian tribute was paid in kind, which allows for the identification of cochineal tribute paying places. The *Relaciones Geograficas* was a census ordered by Phillip II, explicitly asking (question 28) to report "the mines of gold, silver and other metals, and dyes that may exist in the town or its surroundings". Dahlgren and de Jordán (1990)'s source is the customs report of the port of Veracruz, identifying the producing towns of cochineal exported during the late 18th century.

errors or omissions. We cross-examined the list by searching all *grana* and *cochinilla* mentions in Mexico's National Archives (the *Archivo General de la Nacion*, AGN), where we found 154 documents containing references to cochineal with specific town locations providing 127 additional mentions.[17] Our data sources enable us not only to identify cochineal growing regions, but also the specific century when production was taking place. And for some areas of the country, our ledgers and plantings data allow us to know the detailed location of cochineal production at an incredibly low resolution, including villages barely a few kilometers apart from each other.[19]

We geo-referenced these cochineal locations to their modern locality, using the modern Censuses (2010 and 2020) and the *Archivo Historico de Localidades* (AHL) produced by the Mexican National Statistical Institute, INEGI. To ensure that we are not relying on an anachronistic definition of territorial extents for the permanently settled areas of New Spain at the time of the conquest and in the early colonial period, we used the *Suma de Visitas de los Pueblos* of 1548 (del Paso y Troncoso, 1905, García Castro, 2013) to locate pre-Columbian settlements. Despite the massive mortality experienced by indigenous communities in the 16th century, the georeferenced towns in the *Suma* ensure that we identify the effects of cochineal production in the city states at the moment of the conquest, that then gave way to Encomiendas, Corregimientos, Pueblos de Indios, and eventually modern municipalities (for a more extensive discussion see Diaz-Cayeros et al. (2022). These city states in the *Suma* provide a well defined space for our estimations including, we argue, all relevant political and economic activity units that existed in the territorial landscape of New Spain at the beginning of the colonial era.

We also assess our comparisons limiting the data only to the territorial extent of the settled areas of New Spain at the end of the colonial period. This is done by geographically identifying the Indian *pueblos* and Spanish cities (*ciudades* and *villas*). We use an Atlas produced by Dorothy Tanck de Estrada (2005), who geocoded the full range of Spanish cities and *pueblos de indios* in New Spain at around 1790, after the Bourbon reforms at the end of the colonial period. We matched each of the more than 4500 pueblos to their modern locality.

It is important to note that most cochineal producers exist since the very early colonial period. 57 municipios housed cochineal locations prior to 1548, of which 28 were mentioned in the *Matricula de Tributos*, and others also likely reflect production prior to the Spanish

[17]We also added 104 locations from other secondary sources, relying particularly on Coll-Hurtado (1998) for the Oaxaca area. In addition, we used detailed archival records from the six known surviving ledgers that contain 880 cochineal contracts from Oaxaca to add 78 precise locations within some of the most important growing regions.[18] An additional 86 precise locations were obtained from a 1600 document listing nopal plantings in the Cholula-Puebla area (Ruz Barrio and García-Morís, 2018). There is substantial overlap in the various listings. The archival sources we have used were explicitly designed by colonial administrators for the purpose of identifying cochineal production and trade, so we are confident that our effort provides an exhaustive list in terms of not missing any significant cochineal production location.

[19]In terms of the temporal coverage, we might note that some of *Relaciones Geograficas* of the late sixteenth century were lost, so there might be some missing observations for the late 16th century. Nonetheless, we are quite confident that our other sources from the earliest colonial period allow us to include all the relevant towns where cochineal activity existed. And due to the climatic conditions discussed below, missing towns, if there are any, would be located in the immediate vicinity of the towns we have accurately located.

conquest. 62 municipios housed cochineal producers between the colonial period of 1550 and 1650, a period that encompassed the 'Great Death' epidemics, in which an estimated 7-17 million indigenous peoples died. Cochineal production rebounded with 118 municipios producing cochineal between 1650 and the Bourbon Reforms in 1786, which banned the Repartimiento contracts. 49 municipios produced cochineal between the Bourbon Reforms and Mexican Independence in 1821, with only 8 municipios producing cochineal after independence, 1821-1900, and only one before the industry died out completely in 1928. As Figure 5 suggests, there is continuity in production over time, but with relatively few new locations entering into production at any given time. When they do, new cochineal locations appear to develop in response to spikes in world prices.

Overlaying the optimal conditions for cochineal growing with actual cochineal production (see Figure 1) provides a 2-dimensional geographical equivalent of a univariate regression discontinuity plot (Dell, 2010a). Regions that satisfy none of the climatic conditions were very unlikely to produce cochineal, while adding each condition sequentially raises the likelihood of doing so, such that there is an additional, non-linear, discontinuous benefit from falling within the optimal growing area. The optimal growing region appears to particularly effective at predicting longer spans of cochineal production over time. This is particularly useful as we are interested in long-term persistence, and expect stronger effects for those with more *intense* treatment. We define *core* producing municipios as those that have at least two mentions of cochineal prior to 1891, and will use these 98 locations to study the long-term effects of cochineal, before exploiting the more extensive set of municipios to examine variation over time.[20]

[20]Localities with historic cochineal production tend to be within or fall within the same municipio as areas that enjoy the optimal growing conditions. This is consistent with the phenomenon, recorded by the famed contemporary traveller and geographer, Alexander Von Humboldt (1814), who described how indigenous communities made the 'cochineal travel', moving it to nearby areas to exploit temporarily better conditions. As Humboldt (1814)[pp.77-78] writes:

> The Indians who cultivate the cochineal and who go by the name of *nopaleros*, especially those who live round the town of Oaxaca, follow a very ancient and a very extraordinary practice, that of *making the cochineal travel* (emphasis in original). In that part of the torrid zone, it rains in the plains and valleys from May to October, while in the chain of neighbouring mountains called *Sierra de Istepeje*, the rains are only frequent from December to April. In place of preserving the insect in the rainy season in the interior of their huts, the Indians place the mother-cochineals, covered with palm-leaves by beds in baskets made of very flexible claspers. These baskets (*canastos*) are carried by the Indians on their backs as quickly as possible to the mountains of Istepeje, above the village of Santa Catalina, at nine leagues distance from Oaxaca. The mother cochineals produce their young by the way. On opening the *canastos* they are found full of young *coccus*, which are distributed on the nopals of the *sierra*. They remain there till the month of October when the rains cease in the lower regions. The Indians then return to the mountains in quest of the cochineal for the purpose of replacing it in the nopaleries of Oaxaca. The Mexicans in this way withdraw the insects from the pernicious effects of the humidity in the same manner as the Spaniard travels with his merinos from the cold.

5 Results

Appendix Table 1.1 provides summary statistics, comparing the 81 municipios with two or more mentions of cochineal prior to 1891 to other municipios, as well as comparing only municipios that contained indigenous populations prior to 1548. Cochineal producing municipios tend to attain a cochineal suitability index of 0.90 on average, relative to 0.77 for other municipios, suggesting the importance of attaining virtually all conditions during the growing season for actual cochineal production. In contrast, consistent also with Figure 3, cochineal producing municipios tend to be relatively unsuitable for maize production, the key staple and determinant of population in pre-colonial Mexico, and, if anything, tend to be somewhat further away from Tenochtitlan, the pre-colonial imperial capital.

As Table 1 confirms these relationships. Going from satisfying none of the discontinuous micro-climatic conditions for cochineal production to all increases the probability of a municipio producing cochineal in any municipio by between 0.042-0.063, relative to the mean probability of around 0.033 (Cols 1-4). This is true both comparing municipios on average (Col 1), including polynomial controls for longitude, latitude and altitude (Col 2), adding polynomial controls for temperature and precipitation (Col 3), and comparing municipios within the same modern state (Col 4). The effect of cochineal suitability increases to 0.068 when we restrict the comparison to municipios within 50km of the optimal growing region (Col 5), and increases even further, to 0.078 and 0.157 respectively, when we restrict the sample to municipios that contained Indian populations in the late colonial period (Col 6) and before and during the Conquest (Col 7).[21] In contrast, other climatic and geographic conditions are not robustly correlated with cochineal production, particularly after controlling for state fixed effects. In fact, if anything, cochineal producing municipios tend to be somewhat less suitable for maize production and relatively far from Tenochtitlan / Mexico City, both factors that would likely impede, rather than accelerate development.

Figure 6 shows an important outcome of interest– the percentage of extreme poor in a municipio in 2010 (based upon local thresholds necessary to sustain basic nutrition- see Appendix 2) and how they related spatially to the incidence of historical cochineal production and climatic conditions, zooming in on the poorer regions of Southern Mexico. Notice that there are visible and striking differences among neighbouring municipalities, with similar climatic conditions, that were considered poor and non-poor. Cochineal producing municipalities often appear as islands of non-poverty in a relatively poor part of the country. In fact, municipios that enjoyed optimal growing conditions for cochineal but did not enjoy a legacy of production do not appear any richer than other municipios.

The visible differences between cochineal producing municipios and others are also reflected in Table 2 which examines the effect of cochineal in reducing the proportion of households under extreme poverty (as measured by a nutritional minimum.) A legacy of cochineal production

[21] The F-test of the univariate instrument exceeds the Stock-Yogo criteria for weak instruments across specifications.

reduces the extreme poverty rate by about 4-5 percentage points across the OLS specifications, relative to an average poverty rate of about 32%. These effects tends to strengthen in magnitude across specifications when consider all municipios in Mexico, even as the R^2 increases substantially from 0.45 to 0.59 (Cols 1-3), suggesting that the effects can be considered lower bounds (Oster, 2014). This is true, beginning with a basic comparison controlling for polynomials in temperature, precipitation, latitude, longitude and altitude (Col 1) and then matching along other pre-conditions, including distance to Tenochtitlan, and the Coast, the presence of a Conquest-era pueblo, suitability for maize, and the presence of seams of gold or silver (Col 2), comparing municipios within modern Mexican states (Col 3). The effects remain robust to restricting the sample to within 50 km of the optimal growing region (Col 4), to municipios which contained indigenous pueblos in 1790 (Col 5), and to only those municipios which contained pre-Columbian populations at the eve of the Conquest (Col 6). The IV results are greater in magnitude, consistent with the possibility that those cochineal producers who produced because they enjoyed beneficial climatic conditions for cochineal production enjoyed greater benefits than producers in sub-optimal environments.

The Table also sheds light on other useful comparisons. In contrast to cochineal production, areas conducive for producing valuable trade goods that were easy to expropriate, such as gold or silver, and or indigenously developed goods that were easy to replicate elsewhere, like cacao, show very different poverty profiles. Each additional 1000sqkm of gold or silver seams in a municipio raises the extreme poverty rate by 0.23 percentage points, and 0.42 percentage points among pre-Columbian municipios. Further, municipios that produced cacao close to the time of the Conquest appear to have no long-term benefits. It is also useful to note that maize suitability, which is inversely related to cochineal suitability, not only was a major driver of historic population concentrations, but also appears to be strongly correlated with reductions in modern nutritional poverty as well. Municipios further away from Tenochtitlan (and thus Mexico City) also tend to be poorer, though the cochineal effect is robust to controlling for these factors. Appendix Table A1.3 shows that the differences in the legacy of cochineal and the production of other commodities are also visible in household wealth, as measured by the first principal component of the proportion of households over a range of durable assets and in a broader governmental index of social deprivation.

Thus, despite cochineal being no longer produced, its production appears to have durable effects on reducing poverty, even compared to commodities such as gold, silver and cacao, that have continued to enjoy large market demand. This, we argue, is consistent with the development of human capital and a change in cultural norms. If, this is the case, however, we should expect the gains to be accentuated among those that were most advantaged by cochineal production– women and the indigenous in particular. Table 3 shows that a history of cochineal production not only increases the modern female employment rate by around 5 pp (relative to a mean of 24.4%), but also reduces the gap between men and women in employment (by around 2-3pp, relative to a mean gap of 50%). Once again, these effects compare favourably to municipios with gold or silver seams or municipios that produced cacao prior to the Conquest, which were exposed to trade, but where women did not enjoy advantages. In areas with gold or silver, female employment rates are considerably lower and the gap between men and women is higher, while the employment gap also tends to be higher in cacao producing areas as well.

Female employment rates may reflect deprivation rather than development if women who might otherwise choose not to enter the work force are being compelled to do so, but as Table A1.2 suggests, a cochineal legacy not only increases female employment rates, it also reduces female adult illiteracy rates by around 3.3 pp (relative to an average of 16%). The gap in illiteracy rates between men and women is also lower (by 1.5 pp relative to an average of 5%).

Historians have hypothesised that the small-scale cultivation of the cochineal and the fact that land under cochineal production was mainly in the hands of indigenous producers in the colonial period has had lasting effect on the maintenance of indigenous identity and institutions (Greenfield, 2005, Baskes, 2000). Indeed, Oaxaca, Puebla and Tlaxcala, three major cochineal producing states, are also among the most ethnically diverse. Yet as Figure 4 suggests, even within these areas, cochineal producing municipios seem to be relative areas of ethnic assimilation, rather than distinctiveness.

Table 4 shows the effect of a legacy of cochineal production on the proportion of people in a municipality self-identifying as indigenous, the proportion bilingual in Spanish and an indigenous language, and those that are monolingual. A consistent picture emerges– a legacy of cochineal production reduces the proportion self-ascribing as indigenous by 5 percentage points (relative to a mean of 24.8%), and also lowers the proportions that are monolingual by 1.6pp (relative to 3%) and bilingual by about 5pp (relative to 15.6%). Thus, the residents of cochineal-growing lands, despite having been left in the hands of indigenous producers in the colonial period, have *fewer* residents that maintain a distinct indigenous linguistic identity. In contrast, the production of other historically valued commodities does not appear to lead systematically to ethnic assimilation.

If, as we argue, cochineal producing communities decided to 'opt in' to Hispanicization, then we should expect that the process should continue until individuals were close to indifferent between remaining indigenous and becoming Hispanicized. In contrast, if the lower proportions of indigenous in cochineal producing municipios reflects immigration by Spanish speakers and the marginalization or exploitation of indigenous communities, we should expect the indigenous to be worse off, and to be left behind relative to Spanish speakers. As Table 5 reveals, human development among the indigenous that remain in cochineal municipalities is significantly higher on average, and the indigenous are both relatively more educated and earn higher incomes than indigenous elsewhere. In contrast, the indigenous in mining areas have *lower* incomes and suffer in terms of human development, consistent with processes of exploitation and marginalization.

Table 6 unpacks this further, examining the gap between indigenous and non-indigenous human development (Panel A), and overall income inequality, as measured by the gini coefficient (Panel B). Notice that communities with Conquest-era pueblos tend to be more unequal, and tend to show greater gaps between the indigenous and non-indigenous in their human development. Controlling for and even comparing among these municipios, cochineal producers are also more unequal in terms of their overall gini coefficients; however the gap between indigenous and non-indigenous is not greater. Thus, the inequalities that emerge appear to be mainly *within ethnic groups*. In contrast, mining municipios tend to have much greater inequality and greater between-ethnic group differences. Cacao producers once again provide an intermediate case.

If, as we argue, these differences reflect entrepreneurial capital, they should be reflected in direct measures of private sector activity. Table 7 shows that in 2008, cochineal producing municipios in Oaxaca had a greater number of private firms per capita (Panel A). This does not just reflect fragmentation. Firms in erstwhile cochineal producing municipios also have reveal greater valued added in the private sector and their firms possessed a greater value of fixed assets (net of depreciation) per capita (Panel C).

The presence of increased inequality and outside opportunities generated by entrepreneurial capital provides an explanation for the decline of indigenous identity and the relative assimilation of cochineal-producing areas, particularly when combined with a third factor– that those that committed to maintaining an indigenous identity also were more likely to have pay into often highly redistributive indigenous governance institutions. Increased inequality and ease of mobility is likely to have encouraged the most productive members "opt" out by hispanicizing.[22] Indeed, Table 8 suggests, cochineal producing municipalities, again looking within Oaxaca, were much less likely to opt for formalizing the use of highly redistributive indigenous governance institutions (*usos y costumbres*) when such reforms were permitted at the end of the 1990s.

Indigenous capital and entrepreneurship may also reduce the extent of dependence on clientelistic policies and political parties. Table 9(A) examines the determinants of core support for the hegemonic party, the PRI, over the period 1970-1988, based upon the measure developed by Diaz-Cayeros 2016.[23] As the table reveals, cochineal producers are less likely to support the hegemonic party, the PRI over the period 1970-1988. In contrast, mining municipios are more likely to be centers of PRI support. Panels B and C look at the crucial election of 2000, which led to the transition to multi-party democracy. Cochineal producing municipios enjoyed greater proportions of voter turnout (by around 2pp, relative to a mean of 34%) (Panel B) but voted in lower proportions for the PRI, by around 6pp (relative to a mean of 50%.[24] In Appendix Tables A1.5, A1.6, A1.7 and A1.8, we confirm that, even looking at the level of urban-localities and rural census tracts, within municipios, we find that cochineal production reduces the share of individuals monolingual in an indigenous language in 2020, as well as specifically benefiting

[22]This logic has clear parallels to the decision of productive members to opt out of the highly-redistributive Israeli Kibbutz (see Abramitzky (2008)).

[23]It is the municipio intercept from a regression that partials out the variation in PRI support over time, thereby removing electoral waves.

[24]In this instance, there is a caveat: the point estimates of the IV results differ according to the subsample from the OLS results, with the sample of pre-Columbian municipios mirroring the OLS results, while the results across all municipios are in the opposite direction.

women's education, employment and shrinking the employment gap with men.

6 Tracing the Mechanism over Time

So far we have established that municipios that produced cochineal, both relative to others close by, and due to the presence of optimal growing conditions, appear to have beneficial development outcomes, particularly for women, and also display a legacy of greater ethnic assimilation, higher inequality and the undermining of indigenous governance institutions. We now unpack the mechanism, examining in particular how pre-determined access to pre-Columbian trade networks, and exogenous political changes in demand (with the development of trans-Atlantic markets for cochineal during the colonial period, and the demise following Independence with the loss of the New Spanish monopoly and development of synthetic dyes) the availability of credit (with the establishment of and subsequent banning of the Repartimiento system following the Bourbon Reforms) and the freedom to trade that was the obverse of the Reforms, influenced cochineal production.

Table 10 shows how the impact of a cochineal legacy on modern indicators of poverty, the male-female employment gap, and the indigenous HDI differs among municipios that produced cochineal at different times. As the results suggest, interestingly, across these indicators, the major beneficiaries in terms of development outcomes where actually cochineal producers who were active around the time of the Conquest itself. Long-term gains also reassert themselves following the Bourbon reforms that ended the Repartimiento. These differences raise the intriguing possibility that cochineal played a key role early in the development of the colonial state, and that indigenous producers benefited from trans-Atlantic demand most when they already had the know-how to both produce and trade the commodity themselves.

In contrast, all things being equal, those that persisted in cochineal production following Independence, when a combination of lowered demand and external competition reduced the profitability of the industry, actually appear to slightly worse off than otherwise similar towns. Further, producers of cochineal the colonial period prior to the Bourbon reforms, when cochineal producers who lacked such indigenous capital were dependent on credit and trade intermediation by Spanish Alcaldes Mayores do not show clear benefits. We will return that period in the next section when we examine geographical determinants of contractual bargaining. We now focus on understanding the differential fortunes of cochineal-producing pueblos at the time of the Conquest relative to others.

6.1 Haciendas and Urbanization pre-Revolution

As in any study seeking to show meaningful effects from the distant past on contemporary choices and outcomes, it is helpful to examine whether evidence of capital accumulation and assimilation are evident at intervening points in history, and to assess whether alternative mechanisms might be at play. For example, it may be that the mechanism through which cochineal has an effect is through post-Revolution political institutions and policies. Alternatively, rather than the development of indigenous capital, another possibility that might explain the effects of cochineal is that to provide the high-powered incentives necessary for its care, residual claims (and ownership of the means of production) were left in the hands of the cultivators (as in Hart and Moore (1990)). Thus rather than becoming vertically integrated in large *hacienda*-style plantations, cochineal-growing areas were left in the hands of small individual peasant producers.[25]

In contrast, cacao cultivation benefited from scale, and could be worked with slave labour, though may have been less profitable than silver mines.[26]

Table 11 exploits data hand-collected from the pre-revolution (1910) census on the population shares in each municipio that lived in traditional pueblos, in haciendas, in relatively capital-intensive farms or "ranchos", and in urban areas. Notice that, that cochineal producing municipios were relatively more likely to be urbanized as early as 1910. Further, consistent with the idea that pre-Columbian cochineal producers accumulated capital, 4-5% more residents of pre-Columbian cochineal municipios lived in ranchos. These municipios also show a relative decline in the populations living in traditional pueblos and, comparing across all Mexico, in haciendas (Cols 1-3). Municipios in mining regions also showed declines in pueblos, but these Indian pueblos appear to have been relatively more likely to be incorporated in haciendas. Once again, cacao producers appear as an intermediate case.

6.2 The Limits of Contracting: Reneging in the Colonial Period.

A further potential opening for the indigenous came from the limits of contract enforceability. As the colonial state expanded, the main contract-forwarding agreements that supported the cochineal industry, the *Repartimientos de mercancías*, had the *potential* for being a relatively effective method of balancing risks (Baskes, 2005). The standard contract was for the local Spanish official, the *alcalde mayor*, having bid for the position and accumulated funding from Spanish merchants, to advance 12 reales (1.5 pesos) to indigenous producers for each pound of cochineal six months before harvest. This was considered a "fair" price, and did not fluctuate

[25] Some haciendas did emerge in the Vale of Oaxaca to cultivate cochineal, but the vast majority of production remained on small plots (Donkin, 1977). According to Donkin (1977)[28]:

> *Hacendados* were discouraged by the uncertainties of production and the sharp variations in prices, by the number of field laborers required, particularly at certain times of the year; and by the rather complex preparation of *grana fina* for the market. At the same time, larger holdings brought little saving in time and effort. The industry was peculiarly dependent on the skill and patience of individual workers, qualities generally encouraged by the prospect of personal gain ...

[26] For example, in 1707, a Jesuit priest reported the following "All the cacao haciendas have been supplied with goods and provisions and even though one slave was sold, three were bought. The cacao haciendas have provided– as appears in the books during the 26 years that we have them– with 319 cargas [140,360 lbs a year]. After the cacao [beans] have been cleaned and we deduce the cost of shipment [having to transport the beans] more than 40 leagues– and we profit around 4500 pesos. ... This is the actual situation of this College, so now Your Lordship knows about it and ... and not [believe] what they are saying around there because they think that because we have cacao we have a Potosi [the famous silver mine]. (Cabezon, 2009)"

much over time (Baskes, 2000)[62-92] despite large-scale spot price fluctuations (Figure 5).[27] To the extent that cochineal producers were financed by the Repartimiento, then the downside risk, and the exposure to world markets was borne by the alcalde mayor.[28] However, despite large fluctuations, the spot prices for cochineal in local centers such as Manhuitlan and Spanish cities such as Antequera (modern Oaxaca City) were often many times higher than this (Figure 5 and A1.2), opening up the possibility that indigenous cultivators would renege on their contracts and sell the crop on the spot market. Since the *alcalde mayor* had judicial and coercive power within his jurisdiction, these opportunities were particularly accentuated among cochineal producers that had better geographical access to alternative markets. Indeed, when prices for cochineal were high, Indians did sell in the spot markets and claim that their harvests were destroyed. In his study of the cochineal contract, Jeremy Baskes documents that this practice appears to have been fairly common. For example, the alcalde mayor of Nexapa (1752) lamented:

> that when market prices dropped he had no difficulty collecting the cochineal owed to him, but that when prices were high debtors sold their stuff to traveling merchants or in Antequera [modern Oaxaca City] and later claimed to him that they lost their harvests. The same was claimed by the alcalde mayor of Villa Alta, who in 1770 was unable to collect his cochineal debts from the Indians of his district because, as he testified to the Viceroy, the prevailing high prices had led debtors to renege on their contracted obligations and sell their output elsewhere. In 1784, the alcalde mayor of Zimitlan-Chichicapa also noted the propensity of Indians to abandon their obligations and sell elsewhere when prices rose. Arij Ouweneel noted that the Indians of Puebla also "developed a flair for the market" and bypassed their Repartimiento debts to the official when market prices rose…" (Baskes, 2000)[77]

.

In essence, therefore, the lack of ability to verify negative shocks to production resulted in a contract where members of the indigenous population enjoyed a put option that insured them against world market fluctuations on the downside but could also renege on contracts, claim that the cochineal was destroyed and instead sell on the open market. This maintained the high-powered incentives necessary for cultivating a risky crop, even among the risk-averse poor. However, these contractual arrangements likely benefited those members of the indigenous community who were most able to defect across jurisdictions and thus interact directly with the market.

[27] Such patterns can also be consistent with optimizing behaviour. See Athey, Bagwell and Sanchirico (2003) for a theory of why price rigidity and 'escape clauses' that allow individuals to defect on the equilibrium path can be optimal when maintaining cooperation among firms with fluctuating public cost signals and the potential for moral hazard.

[28] Naturally, when self-financed by already possessing primitive capital, the risk and returns were borne by the individual producers.

To support our claims that contract enforceability may have been important in shaping who gained from exposure to world demand for cochineal, we use a remarkable manuscript document, the *Yndize de todos los Goviernos, Corregimentos y Alcadias mayores que contiene la Governacion del Virreynato de Mexico* available in the Phillips Collection (MS 15796) of the New York Public Library.

The *Yndize* lists every Alcaldia Mayor ranked by a "class" and including a brief explanation of the production that underpins this ranking.[29]

There is only one known handwritten copy of this document, and from some comments regarding the excesses of the Viceroy (in places like Mexico City, Jalapa and Otumba, where the author mentions the disgrace of the Alcalde having to spend money for entertaining the lavish Court), it seems clear that this document was not meant to be read by the Crown, and it is likely that this served as instead as a piece of insider intelligence used by well-informed merchant consortia in bidding for the most lucrative alcaldia mayor positions.[30]

Figure A1.3 shows the core areas of cochineal production in Southern Mexico together with the location of the seats of the Alcaldes Mayores in 1777, and the contemporary road network mapped by Gerhard (1993). Notice first that the chances that a particular jurisdiction will be considered by the Yndize to be in the first rank, and worth bidding the highest amounts, is strongly related to the presence of cochineal producers nearby. Interestingly, however, cochineal producing alcaldias that are *well-connected* by the road network to alternative alcaldia locations appear to be ranked in a lower class. Table 13 predicts the Yndize rank of the closest alcaldia mayor to a municipio based upon cochineal production but also its proximity to that alcaldia *and* to the nearest alternative market.[31] Notice that alcaldias with municipios that are nearer by on average are ranked better (lower) by the Yndize correspondent, those whose

[29]The anonymous author claims to have held several Repartimientos, relying always on first hand accounts for his compilation. Fagoaga (2010) has carefully reconstructed the sources of the *Yndice*, noting that it takes a classification from a Real Cedula of 1767 ordering to rank Alcaldias Mayores by 3 classes. He also notes, and shows in a map, that the farther away Alcaldias were less desirable according to these classes. Fagoaga shows that the anonymous author probably used the "secret" maps that accompanied the King's Cosmographer Villasenor y Sanchez's widely read compilation, *Theatro Americano* (1748), which eventually became the basis for the Bourbon reform that created the division of the colony into Intendancies.

[30]Crown clerks ensured that documents would be safeguarded with one copy in the New Spain, and the original sent to Seville. We searched both the Archivo General de la Nacion in Mexico and the Archivo General de Indias in Seville failing to find any additional copy.

[31]Recall that our standard errors are clustered at the subdelegacion level - which is just another name for an alcaldia's jurisdiction.

constituent municipios that are close to an alternative market (either another alcaldia mayor or a Spanish city) also improve their rank. In contrast, municipios with cochineal producers in the colonial period that are proximate to the alcaldia seat lower (i.e. improve) its Yndize rank significantly, while proximity to alternative markets lowers their rank even more. This appears consistent with the combination of complementarity and inter-jurisdictional competition, with the possibility for reneging improving the bargaining power for the indigenous.

7 Conclusion

World trade has not treated most indigenous communities well. The members of such communities often number among the poorest and most vulnerable. Despite the benefits that world trade should confer in principle, the conditions under which indigenous communities with replicable human capital or expropriable resources can benefit over the long term from openness to trade have not been adequately explored. In this paper, we provide an example where contract failures have helped indigenous communities succeed in wresting a share of the gains from trade over more than two centuries, leaving a lasting legacy of reduced poverty and improved female literacy. However, the resulting access to the market appears to have changed the communities themselves, providing individuals human capital and opportunities that appear to have undermined local indigenous governance institutions and encouraged broader assimilation. In this way, successful and sustained gains from trade may have led indigenous communities to cease being indigenous. The relationship between indigenous identity and poverty visible throughout Latin America then may be due in part to the "opting out" of those successful at securing the gains from globalization.

The fragility of cochineal provided the possibility of large-scale gains from world trade to the communities of New Spain, with the ability to verify and enforce contracts shaping whether the indigenous or the Spaniards were the key beneficiaries from exposure to the world market. This is not, however, just a New Spanish story. In South Asia, too, a product in high demand overseas– opium– seems to have had differential effects on communities depending on the ability of the British East India Company, and later the British Raj, to enforce contracts and extract the gains from trade. Due to Chinese demand, opium was a highly lucrative Indian export.[32]

In areas where the territory and ports– particularly Calcutta– were under the direct control of the Company, such as Bihar and the Eastern United Provinces, the East India Company experimented with a number of different contracting arrangements, including contract-forwarding, before settling upon a system based upon monitoring and monopoly production in two factories, located at Patna and Ghazipur (Kranton and Swamy, 2008). The East India Company, its successor, the Raj, and their intermediaries were the main beneficiaries.

But, the Raj was only able to monopolize production and supply in the East of the country. In Central and Western India, Indians in ninety Native States were able to produce, and smuggle, opium beyond the borders of British control to Karachi (in then independent Sind) and to Portuguese Daman. To compete and channel the opium trade through its own ports, the British sold a discounted "pass" that permitted native opium to be exported through Bombay. Indeed, the opium trade may have played a key role in the primitive capital accumulation of two Indian emergent trading communities, the Marwaris (of Marwar and Shekhawati, on the opium trade route to Sind), and the Parsis, as well as the emergence of Bombay as a commercial center, based in large part on indigenous capital, that would play a key role in India's independence movement (Farooqui, 2005). In both the New World and the Old, gains from world trade, inter-ethnic complementarities in production and weakness of contract enforcement appears to have led not to indigenous groups cursed by globalization but to the emergence of indigenous capital and capitalists.

[32]In 1880, the government estimated that a chest of opium produced at a cost of Rs. 390 fetched an average price of Rs. 1392 in Calcutta's auctions (Richards, 2002). Opium exports represented 31% of India's export revenues in the 1850s, and its peak in the 1870s was worth an average of Rs. 119,489,000 a year (Richards, 2002).

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Table 1: **Regression: Determinants of Cochineal Production**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Sample	All	All	All	All	<50km	Pueblos 1790	Pueblos <1548
Cochineal Suitability Index: 0-1	0.042***	0.069***	0.058***	0.063***	0.068***	0.078***	0.157***
	(0.011)	(0.019)	(0.018)	(0.019)	(0.021)	(0.023)	(0.048)
Area of municipio (10000sqkm)		0.002	-0.010	-0.004	0.001	-0.001	0.018
		(0.006)	(0.008)	(0.004)	(0.007)	(0.020)	(0.115)
Altitude (1km)		-0.075***	-0.067**	-0.003	-0.004	-0.013	-0.120
		(0.026)	(0.027)	(0.035)	(0.057)	(0.063)	(0.175)
Altitude (1km)^2		0.018	0.025*	0.016	0.016	0.020	0.060*
		(0.014)	(0.014)	(0.016)	(0.021)	(0.022)	(0.031)
Average temperature (C)		0.039*	0.045**	0.035	0.049	0.043	0.090*
		(0.022)	(0.022)	(0.024)	(0.032)	(0.032)	(0.048)
Average temperature (10 C)^2		-0.109**	-0.120**	-0.073	-0.110	-0.090	-0.210*
		(0.049)	(0.046)	(0.051)	(0.070)	(0.072)	(0.122)
Cumulative precipitation (m)		-0.023	-0.046	-0.007	-0.004	-0.006	-0.134
		(0.028)	(0.029)	(0.033)	(0.039)	(0.041)	(0.088)
Cumulative Precipitation (m)^2		0.004	0.008	0.000	-0.002	-0.000	0.023
		(0.006)	(0.007)	(0.008)	(0.010)	(0.009)	(0.018)
Maize Suitability Index 0-1			-0.041*	-0.030	-0.040*	-0.033	-0.014
			(0.022)	(0.020)	(0.023)	(0.025)	(0.061)
Cacao Producer 1548			0.027	0.026	0.033	0.035	0.033
			(0.032)	(0.034)	(0.040)	(0.037)	(0.044)
Area Au/Ag Seams (10^5 sqkm)			0.008	-0.003	-0.026	-0.048	0.250
			(0.037)	(0.025)	(0.036)	(0.059)	(0.237)
Log. dist. Coast (km)			-0.003	-0.003	-0.011	-0.006	-0.001
			(0.004)	(0.004)	(0.009)	(0.006)	(0.014)
Log. dist Tenochtitlan (km)			0.017***	0.004	0.001	0.004	0.029
			(0.005)	(0.011)	(0.013)	(0.013)	(0.028)
Pueblo <1548			0.081***	0.090***	0.093***	0.092***	
			(0.018)	(0.020)	(0.021)	(0.021)	
Mean (dependent variable)	0.033	0.033	0.033	0.033	0.040	0.044	0.088
SD	0.179	0.179	0.179	0.179	0.195	0.204	0.283
F (instrument)	15.37	13.64	10.40	10.69	10.51	11.26	10.61
Prob>F	0.000	0.000	0.001	0.001	0.001	0.001	0.001
Quadratic Controls for Long, Lat.	No	Yes	Yes	Yes	Yes	Yes	Yes
Modern State Fixed Effects	No	No	No	Yes	Yes	Yes	Yes
Observations	2,456	2,456	2,456	2,456	1,966	1,813	615
R-squared	0.006	0.056	0.097	0.117	0.117	0.119	0.226

This table shows coefficients from an OLS regression on an indicator variable for whether a municipio housed two or more mentions of Cochineal production prior to 1891. An observation is a municipio with robust standard errors clustered at the colonial subdelegacion level. Column 5 restricts the sample to municipios within 50km of areas with optimal growing conditions for Cochineal, Column 6 to municipios that contained pueblos de indios ca 1790 and Column 7 to municipios that contain towns mentioned in the Matricula de Tributos (ca 1522), Suma de Visitas (ca 1548) or other eve of Conquest sources .
*** p<0.01, ** p<0.05, * p<0.1

Table 2: **Regression: % in Extreme Poverty 2010**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Estimator	OLS	OLS	OLS	OLS	OLS	OLS	IV-2SLS	IV-2SLS
Sample	All	All	All	<50km	Pueblos 1790	Pueblos <1548	All	Pueblos <1548
Mean (Extreme Poverty Share 2010)	*31.91*	*31.91*	*31.91*	*33.27*	*34.45*	*32.21*	*31.91*	*32.21*
SD	*19.08*	*19.08*	*19.08*	*19.22*	*19.05*	*17.97*	*19.08*	*17.97*
Core Cochineal producer	-2.878*	-4.227**	-4.834***	-5.471***	-4.551**	-5.109**	-82.630*	-35.441*
	(1.733)	(1.754)	(1.829)	(1.815)	(1.874)	(2.336)	(42.258)	(19.454)
Cacao producer 1548		1.791	0.690	1.177	0.573	-1.269		-1.733
		(2.085)	(1.544)	(1.838)	(1.755)	(1.611)		(1.745)
Gold/Silver Seams(10^5 sqkm)		24.373**	13.682*	19.476**	-3.812	42.140		49.540*
		(9.715)	(8.182)	(9.645)	(15.120)	(28.910)		(29.027)
Maize Suitability Index 0-1		-23.604***	-19.084***	-20.730***	-21.228***	-18.265***		-18.876***
		(3.319)	(3.343)	(3.538)	(4.067)	(3.581)		(4.152)
Log. dist. Coast (km)		0.632	1.070*	0.716	1.218*	1.418		1.131
		(0.671)	(0.576)	(0.939)	(0.723)	(0.971)		(1.141)
Log. dist Tenochtitlan (km)		1.778*	2.926	4.792**	3.988*	5.224**		6.067***
		(0.944)	(1.884)	(1.914)	(2.050)	(2.207)		(2.335)
Pueblo <1548		-0.760	-0.775	-0.661	-1.332			
		(1.070)	(0.889)	(0.899)	(0.957)			
Geographical & Climatic Quadratics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Modern State Fixed Effects	No	No	Yes	Yes	Yes	Yes	No	Yes
Observations	2,456	2,456	2,456	1,966	1,813	615	2,456	615
R-squared	0.449	0.512	0.594	0.597	0.585	0.644		

This table shows the OLS and IV-2SLS coefficients on historic cochineal production prior to 1891 of the share of Mexicans in extreme (nutritional) poverty in 2010. An observation is a municipio with robust standard errors clustered at the colonial subdelegacion level. All regressions control for quadratic polynomials in latitude, longitude, altitude, mean temperature and cumulative precipitation. Column 4 restricts the sample to municipios within 50km of areas with optimal growing conditions for Cochineal, Column 5 to municipios that contained pueblos de indios ca 1790 and Column 6 to municipios that contain towns mentioned in the Matricula de Tributos (ca 1522), Suma de Visitas (ca 1548) or other eve of Conquest sources. Columns 8-9 show IV results using cochineal suitability as an instrument for cochineal production. *** p<0.01, ** p<0.05, * p<0.1

Table 3: **Regression: Female Employment 2010**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Estimator	OLS	OLS	OLS	OLS	OLS	OLS	IV-2SLS	IV-2SLS
Sample	All	All	All	<50km	Pueblos 1790	Pueblos <1548	All	Pueblos <1548
Female Employment Rate: *Mean*	*0.244*	*0.244*	*0.244*	*0.246*	*0.246*	*0.257*	*0.244*	*0.257*
SD	*0.102*	*0.102*	*0.102*	*0.105*	*0.104*	*0.104*	*0.102*	*0.104*
Core Cochineal producer	0.049***	0.053***	0.053***	0.057***	0.051***	0.046***	0.589**	0.152
	(0.010)	(0.010)	(0.009)	(0.010)	(0.010)	(0.016)	(0.242)	(0.134)
Cacao producer 1548		0.016	-0.002	-0.002	-0.000	0.012		0.013
		(0.016)	(0.012)	(0.016)	(0.011)	(0.013)		(0.012)
Gold/Silver Seams(10^5 sqkm)		-0.151***	-0.089**	-0.088*	-0.040	-0.158		-0.184
		(0.051)	(0.043)	(0.051)	(0.070)	(0.154)		(0.150)
R-squared	0.177	0.252	0.309	0.328	0.331	0.417		
Male-Female Employment Gap: *Mean*	*0.498*	*0.498*	*0.498*	*0.498*	*0.495*	*0.491*	*0.498*	*0.491*
SD	*0.123*	*0.123*	*0.123*	*0.123*	*0.126*	*0.119*	*0.123*	*0.119*
Core Cochineal producer	-0.036***	-0.038***	-0.025**	-0.027**	-0.022**	-0.030	-0.738**	-0.129
	(0.013)	(0.013)	(0.011)	(0.012)	(0.011)	(0.019)	(0.305)	(0.143)
Cacao producer 1548		0.022	0.045***	0.052***	0.040***	0.018		0.016
		(0.017)	(0.015)	(0.020)	(0.015)	(0.016)		(0.015)
Gold/Silver Seams(10^5 sqkm)		0.218***	0.167***	0.230***	0.039	0.108		0.132
		(0.072)	(0.056)	(0.056)	(0.091)	(0.202)		(0.205)
R-squared	0.249	0.276	0.366	0.390	0.388	0.399		
Geographical & Climatic Quadratics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Initial Conditions Controls	No	Yes	Yes	Yes	Yes	Yes	No	Yes
Modern State Fixed Effects	No	No	Yes	Yes	Yes	Yes	No	Yes
Observations	2,456	2,456	2,456	1,966	1,813	615	2,456	615

This table shows the OLS and IV-2SLS coefficients on historic cochineal production prior to 1891 of the female employment rate and the male-female employment gap. An observation is a municipio with robust standard errors clustered at the colonial subdelegacion level. All regressions control for quadratic polynomials in latitude, longitude, altitude, mean temperature and cumulative precipitation. Column 2 adds controls for maize suitability, cacao producer 1548, gold/silver seams, pueblo<1548, log.dist. Tenochtitlan and the Coast. Column 4 restricts the sample to municipios within 50km of areas with optimal growing conditions for Cochineal, Column 5 to municipios that contained pueblos de indios ca 1790 and Column 6 to municipios that contain towns mentioned in the Matricula de Tributos (ca 1522), Suma de Visitas (ca 1548) or other eve of Conquest sources. Columns 8-9 show IV results using cochineal suitability as an instrument for cochineal production. *** p<0.01, ** p<0.05, * p<0.1

Table 4: **Regression: Indigenous Identity 2010**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Estimator	OLS	OLS	OLS	OLS	OLS	OLS	IV-2SLS	IV-2SLS
					Pueblos	Pueblos		Pueblos
Sample	All	All	All	<50km	1790	<1548	All	<1548
Proportion Self-Identifying as Indigenous 2010 (Mean = 0.248, SD=0.355)								
Core Cochineal producer	0.045	0.001	-0.056**	-0.071***	-0.069***	-0.053	-1.994*	-0.446
	(0.042)	(0.042)	(0.025)	(0.027)	(0.025)	(0.043)	(1.113)	(0.402)
Cacao producer 1548		0.018	-0.036	-0.029	-0.023	-0.050		-0.056
		(0.042)	(0.035)	(0.039)	(0.038)	(0.036)		(0.038)
Gold/Silver Seams(10^5 sqkm)		-0.050	-0.151	-0.111	-0.360	0.042		0.137
		(0.191)	(0.097)	(0.122)	(0.222)	(0.450)		(0.450)
Pueblos <1548		0.061***	0.022	0.020	0.008			
		(0.022)	(0.015)	(0.015)	(0.016)			
R-squared	0.340	0.398	0.539	0.520	0.541	0.590		
Proportion Monolingual in an Indigenous Language 2010 (Mean = 0.031, SD = 0.088)								
Core Cochineal producer	-0.011	-0.017	-0.016*	-0.016*	-0.017*	-0.026***	-1.123***	-0.443***
	(0.011)	(0.012)	(0.009)	(0.010)	(0.009)	(0.010)	(0.423)	(0.163)
Observations	2,456	2,456	2,456	1,966	1,813	615	2,456	615
R-squared	0.209	0.237	0.277	0.306	0.299	0.413		
Proportion Bilingual in Indigenous Language and Spanish 2010 (Mean=0.156, SD = 0.245)								
Core Cochineal producer	0.031	0.001	-0.040**	-0.052**	-0.049**	-0.039	-0.910	-0.079
	(0.029)	(0.030)	(0.020)	(0.020)	(0.019)	(0.034)	(0.695)	(0.284)
R-squared	0.300	0.362	0.497	0.488	0.498	0.561		
Geographical & Climatic Quadratics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Initial Conditions Controls	No	Yes	Yes	Yes	Yes	Yes	No	Yes
Modern State Fixed Effects	No	No	Yes	Yes	Yes	Yes	No	Yes
Observations	2,456	2,456	2,456	1,966	1,813	615	2,456	615

This table shows the OLS and IV-2SLS coefficients on historic cochineal production prior to 1891 of measures of the proportion of indigenous in a municipio based upon self-ascription (A), monolingualism (B), and bilingualism (C). An observation is a municipio with robust standard errors clustered at the colonial subdelegacion level. All regressions control for quadratic polynomials in latitude, longitude, altitude, mean temperature and cumulative precipitation. Column 2 adds controls for maize suitability, cacao producer 1548, gold/silver seams, pueblo<1548, log.dist. Tenochtitlan and the Coast. Column 4 restricts the sample to municipios within 50km of areas with optimal growing conditions for Cochineal, Column 5 to municipios that contained pueblos de indios ca 1790 and Column 6 to municipios that contain towns mentioned in the Matricula de Tributos (ca 1522), Suma de Visitas (ca 1548) or other eve of Conquest sources. Columns 8-9 show IV results using cochineal suitability as an instrument for cochineal production. *** p<0.01, ** p<0.05, * p<0.1

Table 5: **Regression: Indigenous HDI, Income and Education 2005**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Estimator	OLS	OLS	OLS	OLS	OLS	OLS	IV-2SLS	IV-2SLS
Sample	All	All	All	<50km	Pueblos 1790	Pueblos <1548	All	Pueblos <1548
Indigenous Human Development Index (UNDP 2005) (Mean = .698, SD = 0.082)								
Core Cochineal producer	0.017**	0.023***	0.025***	0.027***	0.024***	0.034***	0.259	0.056
	(0.008)	(0.007)	(0.007)	(0.007)	(0.007)	(0.009)	(0.164)	(0.086)
Cacao producer 1548		0.006	-0.001	-0.008	-0.009	0.000		0.001
		(0.011)	(0.008)	(0.010)	(0.008)	(0.008)		(0.007)
Gold/Silver Seams(10^5 sqkm)		-0.112	-0.070	-0.127*	-0.050	-0.539***		-0.543***
		(0.081)	(0.079)	(0.069)	(0.111)	(0.167)		(0.162)
R-squared	0.354	0.403	0.536	0.563	0.522	0.593		
Indigenous Income Index (Mean = 0.739, SD= 0.107)								
Core Cochineal producer	0.021	0.030***	0.033***	0.036***	0.033***	0.049***	0.322*	0.088
	(0.013)	(0.011)	(0.009)	(0.010)	(0.009)	(0.014)	(0.190)	(0.106)
Cacao producer 1548		0.005	-0.008	-0.013	-0.011	-0.018		-0.017
		(0.014)	(0.010)	(0.012)	(0.010)	(0.012)		(0.011)
Gold/Silver Seams(10^5 sqkm)		-0.167**	-0.132**	-0.163**	-0.160	-0.369*		-0.376**
		(0.077)	(0.057)	(0.064)	(0.104)	(0.197)		(0.187)
R-squared	0.424	0.494	0.638	0.644	0.613	0.636		
Indigenous Education Index (Mean= 0.590, SD=0.113)								
Core Cochineal producer	0.029**	0.033**	0.031**	0.031**	0.029*	0.039***	0.318	0.083
	(0.012)	(0.013)	(0.014)	(0.015)	(0.014)	(0.013)	(0.246)	(0.141)
Cacao producer 1548		0.006	-0.001	-0.015	-0.011	0.008		0.009
		(0.015)	(0.012)	(0.015)	(0.012)	(0.011)		(0.011)
Gold/Silver Seams(10^5 sqkm)		-0.047	-0.008	-0.061	0.073	-0.593***		-0.601***
		(0.117)	(0.110)	(0.105)	(0.150)	(0.217)		(0.213)
R-squared	0.237	0.257	0.385	0.389	0.396	0.483		
Geographical & Climatic Quadratics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Initial Conditions Controls	No	Yes	Yes	Yes	Yes	Yes	No	Yes
Modern State Fixed Effects	No	No	Yes	Yes	Yes	Yes	No	Yes
Observations	1,610	1,610	1,610	1,247	1,320	485	1,610	485

This table shows the OLS and IV-2SLS coefficients on historic cochineal production prior to 1891 of the UNDP indigenous human development index in 2005, and its component broken down into income and education. These indices were only calculated for municipios with at least X indigenous residents. An observation is a municipio with robust standard errors clustered at the colonial subdelegacion level. All regressions control for quadratic polynomials in latitude, longitude, altitude, mean temperature and cumulative precipitation. Column 2 adds controls for maize suitability, cacao producer 1548, gold/silver seams, pueblo<1548, log.dist. Tenochtitlan and the Coast. Column 4 restricts the sample to municipios within 50km of areas with optimal growing conditions for Cochineal, Column 5 to municipios that contained pueblos de indios ca 1790 and Column 6 to municipios that contain towns mentioned in the Matricula de Tributos (ca 1522), Suma de Visitas (ca 1548) or other eve of Conquest sources. Columns 8-9 show IV results using cochineal suitability as an instrument for cochineal production. *** p<0.01, ** p<0.05, * p<0.1

Table 6: **Regression: Inequality 2000-05**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Estimator	OLS	OLS	OLS	OLS	OLS	OLS	IV-2SLS	IV-2SLS
Sample	All	All	All	<50km	Pueblos 1790	Pueblos <1548	All	Pueblos <1548
Indigenous HDI Gap 2005 (Mean = 0.042, SD = 0.049)								
Core Cochineal producer	0.008	0.006	0.008	0.007	0.009*	0.010	-0.082	0.017
	(0.005)	(0.006)	(0.005)	(0.005)	(0.005)	(0.008)	(0.102)	(0.092)
Cacao producer 1548		-0.004	-0.002	-0.002	0.003	-0.001		-0.001
		(0.007)	(0.006)	(0.008)	(0.007)	(0.008)		(0.007)
Gold/Silver Seams(10^5 sqkm)		0.078	0.037	0.100*	0.003	0.395***		0.394***
		(0.077)	(0.075)	(0.060)	(0.103)	(0.149)		(0.144)
Pueblo <1548		0.009**	0.008**	0.008**	0.006			
		(0.004)	(0.003)	(0.003)	(0.004)			
Observations	1,610	1,610	1,610	1,247	1,320	485	1,610	485
R-squared	0.086	0.104	0.203	0.195	0.225	0.231		
Gini Coefficient 2000 (Mean =0.475, SD = 0.064)								
Core Cochineal producer	0.023***	0.018***	0.018***	0.016***	0.019***	0.017**	0.168	0.197**
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.008)	(0.164)	(0.100)
Cacao producer 1548		0.001	0.007	0.003	0.010	0.007		0.010
		(0.008)	(0.008)	(0.010)	(0.008)	(0.008)		(0.010)
Gold/Silver Seams(10^5 sqkm)		0.161***	0.088**	0.126***	0.078	0.376***		0.332***
		(0.050)	(0.045)	(0.048)	(0.062)	(0.127)		(0.128)
Pueblo <1548		0.005*	0.007**	0.009***	0.006**			
		(0.003)	(0.003)	(0.003)	(0.003)			
Observations	2,423	2,423	2,423	1,947	1,801	611	2,423	611
R-squared	0.115	0.151	0.225	0.192	0.219	0.272		
Geographical & Climatic Quadratics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Initial Conditions Controls	No	Yes	Yes	Yes	Yes	Yes	No	Yes
Modern State Fixed Effects	No	No	Yes	Yes	Yes	Yes	No	Yes

This table shows the OLS and IV-2SLS coefficients on historic cochineal production prior to 1891 on different measures of inequality: (A) the difference between the UNDP indigenous and non-indigenous human development index in 2005 (the sample is limited to municipios with at least X indigenous residents). (B) is the Gini coefficient in 2000. An observation is a municipio in 2000 with robust standard errors clustered at the colonial subdelegacion level. All regressions control for quadratic polynomials in latitude, longitude, altitude, mean temperature and cumulative precipitation. Column 2 adds controls for maize suitability, cacao producer 1548, gold/silver seams, pueblo<1548, log.dist. Tenochtitlan and the Coast. Column 4 restricts the sample to municipios within 50km of areas with optimal growing conditions for Cochineal, Column 5 to municipios that contained pueblos de indios ca 1790 and Column 6 to municipios that contain towns mentioned in the Matricula de Tributos (ca 1522), Suma de Visitas (ca 1548) or other eve of Conquest sources. Columns 8-9 show IV results using cochineal suitability as an instrument for cochineal production. *** p<0.01, ** p<0.05, * p<0.1

Table 7: **Regression: Private Firm Activity per capita 2008**

	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) IV-2SLS	(6) IV-2SLS	(7) IV-2SLS
Sample	All	All	>50km	Pueblos <1548	All	All	Pueblos <1548
(A) Number of private firms per capita							
Core Cochineal producer	0.012***	0.011***	0.012**	0.017	0.153***	0.044	0.027
	(0.004)	(0.004)	(0.004)	(0.010)	(0.035)	(0.038)	(0.019)
Cacao 1548		0.004	0.004	0.007		0.005	0.006
		(0.007)	(0.007)	(0.010)		(0.007)	(0.009)
Gold/Silver Seams(10^5 sqkm)		-0.066	-0.004	-0.572		-0.184	-0.660
		(0.244)	(0.247)	(0.524)		(0.320)	(0.536)
Pueblo < 1548		-0.001	-0.001			-0.008	
		(0.004)	(0.004)			(0.006)	
R-squared	0.183	0.191	0.192	0.256			
(B) Net value added by private firms per capita							
Core Cochineal producer	1.280**	1.337*	1.630**	0.863	5.385	0.084	0.446
	(0.580)	(0.686)	(0.671)	(0.780)	(4.296)	(6.007)	(2.781)
R-squared	0.070	0.101	0.108	0.186	-0.030	0.099	0.184
(C) Total Net Value of Fixed Assets owned by private firms per capita							
Core Cochineal producer	4.149**	4.335**	4.939**	1.309	6.275	24.582	-0.975
	(1.684)	(1.992)	(2.085)	(1.066)	(6.758)	(26.781)	(4.286)
R-squared	0.061	0.073	0.076	0.237	-0.001	-0.020	0.225
Geographical & Climatic Quadratics	Yes	Yes	Yes	Yes	No	Yes	Yes
Initial Conditions Controls	No	Yes	Yes	Yes	No	Yes	Yes
Modern State Fixed Effects	Oaxaca	Oaxaca	Oaxaca	Oaxaca	Oaxaca	Oaxaca	Oaxaca
Observations	570	570	537	157	570	570	157

This table shows the OLS and IV-2SLS coefficients on historic cochineal production prior to 1891 of measures of private firm activity in Oaxacan municipios in 2008. An observation is a municipio with robust standard errors clustered at the colonial subdelegacion level. All regressions control for quadratic polynomials in latitude, longitude, altitude, mean temperature and cumulative precipitation. Column 2 adds controls for maize suitability, cacao producer 1548, gold/silver seams, pueblo<1548, log.dist. Tenochtitlan and the Coast. Column 3 restricts the sample to municipios within 50km of areas with optimal growing conditions for Cochineal, Column 4 to municipios that contain towns mentioned in the Matricula de Tributos (ca 1522), Suma de Visitas (ca 1548) or other eve of Conquest sources. Columns 5-7 show IV results using cochineal suitability as an instrument for cochineal production. *** p<0.01, ** p<0.05, * p<0.1

Table 8: **Regression: Formalized Indigenous Political Institutions (*usos y costumbres*) 2000**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Estimator	OLS	OLS	OLS	OLS	OLS	IV-2SLS	IV-2SLS
				Pueblos	Pueblos		Pueblos
Sample	All	All	<50km	1790	<1548	All	<1548
Core Cochineal producer	-0.235***	-0.228***	-0.212***	-0.219***	-0.311***	-0.333	-1.066***
	(0.041)	(0.042)	(0.040)	(0.040)	(0.066)	(0.409)	(0.336)
Cacao producer 1548		-0.162**	-0.214**	-0.226**	-0.180*		-0.206**
		(0.072)	(0.089)	(0.088)	(0.097)		(0.101)
Gold/Silver Seams(10^5 sqkm)		-7.534*	-5.997	-6.904*	0.455		7.780
		(3.924)	(4.017)	(3.889)	(6.060)		(8.049)
Municipio contains town pre-1550		-0.004	-0.005	0.000			
		(0.034)	(0.031)	(0.034)			
Observations	570	570	537	498	157	570	157
R-squared	0.336	0.372	0.300	0.353	0.485		
Geographical & Climatic Quadratics	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Initial Conditions Controls	No	Yes	Yes	Yes	Yes	No	Yes
Modern State Fixed Effects	Oaxaca	Oaxaca	Oaxaca	Oaxaca	Oaxaca	Oaxaca	Oaxaca

This table shows the OLS and IV-2SLS coefficients on historic cochineal production prior to 1891 on an indicator for whether a Oaxacan municipios formally adopted usos y costumbres (indigenous governance institutions). An observation is a municipio with robust standard errors clustered at the colonial subdelegacion level. All regressions control for quadratic polynomials in latitude, longitude, altitude, mean temperature and cumulative precipitation. Column 2 adds controls for maize suitability, cacao producer 1548, gold/silver seams, pueblo<1548, log.dist. Tenochtitlan and the Coast. Column 3 restricts the sample to municipios within 50km of areas with optimal growing conditions for Cochineal, Column 4 to municipios that contain towns mentioned in the Matricula de Tributos (ca 1522), Suma de Visitas (ca 1548) or other eve of Conquest sources. Columns 5-7 show IV results using cochineal suitability as an instrument for cochineal production. *** p<0.01, ** p<0.05, * p<0.1

Table 9: **Regression: Political Support for the Hegemonic Party [PRI] 1970-2000**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Estimator	OLS	OLS	OLS	OLS	OLS	OLS	IV-2SLS	IV-2SLS
					Pueblos	Pueblos		Pueblos
Sample	All	All	All	<50km	1790	<1548	All	<1548
A. Index of Core Support for Hegemonic Party (PRI) 1970-88 (Mean=0.474, SD = 0.377)								
Core Cochineal producer	-0.037	-0.039	-0.116***	-0.114***	-0.109***	-0.133***	0.653	0.188
	(0.041)	(0.043)	(0.034)	(0.035)	(0.036)	(0.046)	(0.776)	(0.484)
Cacao producer 1548		-0.041	-0.063*	-0.059	-0.031	-0.051		-0.046
		(0.045)	(0.034)	(0.045)	(0.043)	(0.043)		(0.044)
Gold/Silver Seams(10^5 sqkm)		0.416**	0.314**	0.121	0.694***	0.309		0.230
		(0.194)	(0.138)	(0.163)	(0.229)	(0.414)		(0.398)
R-squared	0.159	0.178	0.381	0.413	0.386	0.430		
B. Voter Turnout in 2000 Elections (Mean=0.344, SD =0.084)								
Core Cochineal producer	0.010	0.017**	0.018**	0.020***	0.018**	0.018*	0.295**	0.065
	(0.008)	(0.008)	(0.007)	(0.007)	(0.007)	(0.010)	(0.144)	(0.073)
Cacao producer 1548		-0.009	-0.004	-0.016	-0.002	-0.005		-0.004
		(0.010)	(0.009)	(0.010)	(0.009)	(0.009)		(0.008)
Gold/Silver Seams(10^5 sqkm)		-0.081	-0.094**	-0.149***	-0.040	-0.179		-0.191*
		(0.050)	(0.038)	(0.036)	(0.050)	(0.116)		(0.115)
R-squared	0.298	0.333	0.446	0.391	0.481	0.490		
C. PRI Vote Share 2000 Elections (Mean=0.498, SD=0.145)								
Core Cochineal producer	-0.019	-0.027	-0.046***	-0.050***	-0.039***	-0.060***	0.542*	-0.071
	(0.017)	(0.016)	(0.015)	(0.015)	(0.015)	(0.023)	(0.321)	(0.151)
Cacao producer 1548		-0.003	-0.014	-0.012	-0.016	-0.028**		-0.028**
		(0.015)	(0.010)	(0.012)	(0.012)	(0.012)		(0.012)
Gold/Silver Seams(10^5 sqkm)		0.168**	0.139**	0.096	0.150	0.476**		0.478***
		(0.083)	(0.063)	(0.072)	(0.105)	(0.183)		(0.179)
R-squared	0.099	0.147	0.320	0.327	0.341	0.431		
Geographical & Climatic Quadratics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Initial Conditions Controls	No	Yes	Yes	Yes	Yes	Yes	No	Yes
Modern State Fixed Effects	No	No	Yes	Yes	Yes	Yes	No	Yes
Observations	2,424	2,424	2,424	1,948	1,801	611	2,424	611

This table shows the determinants of an index of core support for the hegemonic party, the PRI, between 1970-1988 (from Diaz-Cayeros et al 2016), and the turnout and vote share of the PRI in the pivotal 2000 elections that ended the hegemony. An observation is a 2000 municipio. Standard errors are clustered at the colonial subdelegacion level. All regressions control for quadratic polynomials in latitude, longitude, altitude, mean temperature and cumulative precipitation. Column 2 adds controls for maize suitability, cacao producer 1548, gold/silver seams, pueblo<1548, log.dist. Tenochtitlan and the Coast. Column 4 restricts the sample to municipios within 50km of areas with optimal growing conditions for Cochineal, Column 5 to municipios that contained pueblos de indios ca 1790 and Column 6 to municipios that contain towns mentioned in the Matricula de Tributos (ca 1522), Suma de Visitas (ca 1548) or other eve of Conquest sources. Columns 8-9 show IV results using cochineal suitability as an instrument for cochineal production. *** p<0.01, ** p<0.05, * p<0.1

Table 10: **Regression: Did the Timing of Cochineal Production Matter?**

	(1)	(2)	(3)	(4)	(5)	(6)
Estimator	OLS	OLS	OLS	OLS	OLS	OLS
					Pueblos	Pueblos
Sample	All	All	All	<50km	1790	<1548
Extreme Poverty: Cochineal producer: pre-Conquest (<1550)	-3.344	-3.361	-4.882**	-4.044*	-4.397**	-4.894**
	(2.242)	(2.199)	(2.122)	(2.087)	(2.082)	(2.467)
Colonial (1550-1786)	2.500	1.240	1.173	0.474	1.293	0.157
	(1.880)	(1.662)	(1.730)	(1.754)	(1.806)	(1.483)
post- Bourbon Reforms (1786-1821)	-2.251	-3.959*	-4.122*	-4.374**	-4.262*	-7.044***
	(3.270)	(2.331)	(2.258)	(2.161)	(2.177)	(2.520)
post- Independence (1821-1900)	-5.659*	-3.471	-3.135	-2.210	-3.399	-4.814
	(3.102)	(3.735)	(3.899)	(4.249)	(4.159)	(2.953)
R-squared	0.450	0.512	0.594	0.597	0.586	0.650
M- F Employment Gap: Cochineal producer: pre-Conquest (<1550)	-0.031***	-0.035**	-0.034***	-0.029**	-0.029**	-0.025
	(0.012)	(0.014)	(0.012)	(0.012)	(0.012)	(0.022)
Colonial (1550-1786)	-0.010	-0.011	0.001	-0.003	0.000	-0.007
	(0.013)	(0.013)	(0.012)	(0.014)	(0.012)	(0.018)
post- Bourbon Reforms (1786-1821)	-0.084***	-0.090***	-0.076***	-0.078***	-0.074***	-0.021
	(0.021)	(0.022)	(0.019)	(0.019)	(0.019)	(0.021)
post- Independence (1821-1900)	0.065	0.062	0.051	0.083*	0.057	0.017
	(0.042)	(0.044)	(0.049)	(0.044)	(0.048)	(0.046)
R-squared	0.257	0.285	0.372	0.396	0.395	0.397
Observations	2,456	2,456	2,456	1,966	1,813	615
Indigenous HDI 2005: Cochineal producer- pre-Conquest (<1550)	0.010	0.012	0.021**	0.018*	0.020**	0.023**
	(0.010)	(0.009)	(0.010)	(0.009)	(0.010)	(0.010)
Colonial (1550-1786)	-0.003	0.000	-0.000	0.004	-0.000	0.007
	(0.006)	(0.006)	(0.007)	(0.007)	(0.007)	(0.008)
post- Bourbon Reforms (1786-1821)	0.008	0.016	0.015	0.019	0.015	0.021
	(0.014)	(0.013)	(0.014)	(0.014)	(0.014)	(0.013)
post- Independence (1821-1900)	0.004	-0.003	0.000	-0.012	0.001	0.006
	(0.022)	(0.024)	(0.025)	(0.025)	(0.026)	(0.033)
R-squared	0.353	0.402	0.535	0.562	0.521	0.590
Observations	1,610	1,610	1,610	1,247	1,320	485
Geographical & Climatic Quadratics	Yes	Yes	Yes	Yes	Yes	Yes
Initial Conditions Controls	No	Yes	Yes	Yes	Yes	Yes
Modern State Fixed Effects	No	No	Yes	Yes	Yes	Yes

This table shows the OLS coefficients of different outcomes on dummies for historic cochineal production in different periods. An observation is a municipio with robust standard errors clustered at the colonial subdelegacion level. All regressions control for quadratic polynomials in latitude, longitude, altitude, mean temperature and cumulative precipitation. Column 2 adds controls for maize suitability, cacao producer 1548, gold/silver seams, pueblo<1548, log.dist. Tenochtitlan and the Coast. Column 3 restricts the sample to municipios within 50km of areas with optimal growing conditions for Cochineal, Column 4 to municipios that contain towns mentioned in the Matricula de Tributos (ca 1522), Suma de Visitas (ca 1548) or other eve of Conquest sources. *** p<0.01, ** p<0.05, * p<0.1

Table 11: **Regression: Not just a post-Revolution story: Population Shares prior to the Revolution (1910)**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Estimator	OLS	OLS	OLS	OLS	OLS	OLS	IV-2SLS	IV-2SLS
					Pueblos	Pueblos		Pueblos
Sample	All	All	All	<50km	1790	<1548	All	<1548
Share Urban/ Semi-Urban 1910 (Mean = 0.174, SD= 0.279)								
Cochineal producer- pre-Conquest (<1550)	0.193***	0.184***	0.201***	0.185***	0.195***	0.232***	4.645	0.448
	(0.043)	(0.044)	(0.043)	(0.044)	(0.043)	(0.069)	(3.031)	(0.802)
Cacao producer 1548		-0.029	-0.015	-0.026	-0.003	-0.010		-0.017
		(0.027)	(0.022)	(0.024)	(0.026)	(0.027)		(0.039)
Gold/Silver Seams(10^5 sqkm)		-0.166	0.136	0.240**	0.027	-0.154		-0.279
		(0.141)	(0.105)	(0.104)	(0.211)	(0.365)		(0.593)
R-squared	0.187	0.195	0.367	0.416	0.291	0.244		
Share in Ranchos (Small Private Farms) 1910 (Mean = 0.163, SD = 0.232)								
Cochineal producer- pre-Conquest (<1550)	0.024	0.019	0.040**	0.045**	0.048***	0.043**	-0.479	-0.430
	(0.019)	(0.020)	(0.017)	(0.018)	(0.017)	(0.022)	(1.239)	(0.797)
Cacao producer 1548		-0.016	0.015	0.012	0.006	-0.018		-0.003
		(0.030)	(0.023)	(0.031)	(0.024)	(0.024)		(0.034)
Gold/Silver Seams(10^5 sqkm)		0.245	-0.140	-0.191	-0.281	0.219		0.494
		(0.163)	(0.120)	(0.139)	(0.183)	(0.280)		(0.515)
R-squared	0.273	0.306	0.443	0.485	0.491	0.576		
Share in Haciendas 1910 (Mean=0.098, SD=0.174)								
Cochineal producer- pre-Conquest (<1550)	-0.047***	-0.046***	-0.021*	-0.018	-0.005	-0.016	-0.375	0.657
	(0.013)	(0.013)	(0.011)	(0.012)	(0.010)	(0.014)	(0.867)	(0.698)
Cacao producer 1548		0.036	0.028	0.048*	0.022	0.021		0.001
		(0.022)	(0.020)	(0.028)	(0.023)	(0.024)		(0.029)
Gold/Silver Seams(10^5 sqkm)		0.234**	0.292***	0.339***	0.096	0.124		-0.266
		(0.113)	(0.084)	(0.100)	(0.101)	(0.138)		(0.458)
R-squared	0.102	0.123	0.201	0.201	0.286	0.196		
Share in Pueblos 1910 (Mean=0.517, SD=0.390)								
Cochineal producer- pre-Conquest (<1550)	-0.139***	-0.122**	-0.202***	-0.195***	-0.220***	-0.232***	-2.989	-0.901
	(0.047)	(0.049)	(0.046)	(0.048)	(0.043)	(0.071)	(2.930)	(1.225)
Cacao producer 1548		-0.004	-0.047	-0.049	-0.049	-0.008		0.013
		(0.034)	(0.030)	(0.039)	(0.035)	(0.039)		(0.054)
Gold/Silver Seams(10^5 sqkm)		-0.446**	-0.438***	-0.536***	-0.200	-0.418		-0.030
		(0.219)	(0.115)	(0.144)	(0.216)	(0.452)		(0.838)
R-squared	0.323	0.343	0.488	0.541	0.467	0.455		
Observations	2,332	2,332	2,332	1,886	1,753	591	2,332	591

This table shows the OLS and IV-2SLS coefficients on Conquest-era cochineal production on shares of the population that lived in different types of residence in 1910. An observation is a municipio in 1910 with robust standard errors clustered at the colonial subdelegacion level. All regressions control for quadratic polynomials in latitude, longitude, altitude, mean temperature and cumulative precipitation. Column 2 adds controls for maize suitability, cacao producer 1548, gold/silver seams, pueblo<1548, log.dist. Tenochtitlan and the Coast. Column 4 restricts the sample to municipios within 50km of areas with optimal growing conditions for Cochineal, Column 5 to municipios that contained pueblos de indios ca 1790 and Column 6 to municipios that contain towns mentioned in the Matricula de Tributos (ca 1522), Suma de Visitas (ca 1548) or other eve of Conquest sources. Columns 8-9 show IV results using cochineal suitability as an instrument for cochineal production. *** p<0.01, ** p<0.05, * p<0.1

Table 12: **Regression: Surviving the Conquest**

Outcome	Pueblos 1790		Spanish Villa/Ciudad 1790		
	(1)	(2)	(3)	(4)	(5)
Sample	All	Pueblo<1548	All	Pueblo 1790	Pueblo<1548
Mean (DV)	0.738	0.914	0.023	0.025	0.036
SD	0.44	0.281	0.153	0.156	0.186
Cochineal producer- pre-Conquest (<1550)	0.071***	0.034*	-0.006	-0.002	0.010
	(0.022)	(0.019)	(0.018)	(0.018)	(0.025)
Maize Suitability Index 0-1	0.047	0.033	0.048***	0.028	0.067*
	(0.061)	(0.092)	(0.017)	(0.018)	(0.040)
Cacao producer 1548	-0.001	0.058	0.009	0.020	-0.004
	(0.042)	(0.047)	(0.017)	(0.019)	(0.019)
Gold/Silver Seams(10^5 sqkm)	-0.343*	-0.040	0.342**	0.196	-0.181
	(0.189)	(0.429)	(0.148)	(0.211)	(0.405)
Log. dist. Coast (km)	0.030**	0.030	-0.009**	-0.002	-0.016
	(0.013)	(0.027)	(0.004)	(0.005)	(0.015)
Log. dist Tenochtitlan (km)	-0.048	-0.014	-0.013	-0.019	-0.047
	(0.036)	(0.025)	(0.012)	(0.014)	(0.034)
Pueblo <1548	0.129***		0.022**	0.014	
	(0.021)		(0.010)	(0.009)	
Observations	2,456	615	2,456	1,813	615
R-squared	0.354	0.280	0.059	0.085	0.097
Full Controls and State Fixed Effects	Yes	Yes	Yes	Yes	Yes

Table 13: **Regression: Gains to the Spanish [Yndize Rank 1-6], 1777**

OLS	(1)	(2)	(3)	(4)	(5)
Sample [Municipios in Subdelegaciones 1790]	All	All	All	>100km	>50km
Cochineal producer- pre-Conquest (<1550)	-0.120	0.004	0.022	0.027	0.045
	(0.093)	(0.087)	(0.074)	(0.074)	(0.075)
Cochineal producer- colonial (1550-1786)	-0.478	-0.206	0.061	0.043	-0.007
	(0.314)	(0.258)	(0.261)	(0.261)	(0.286)
Coch. 1550-1786 x Log. dist alternative mkt	-0.033	-0.134*	-0.178***	-0.174***	-0.170**
	(0.097)	(0.069)	(0.063)	(0.062)	(0.067)
Coch. 1550-1786 x Log. dist Alcaldia	0.153**	0.143**	0.119**	0.123**	0.139**
	(0.065)	(0.062)	(0.057)	(0.055)	(0.060)
Log. dist. alternative market	0.032	0.128**	0.140***	0.142***	0.106*
	(0.086)	(0.061)	(0.053)	(0.053)	(0.057)
Log. dist. Alcaldia seat	-0.122*	-0.081	-0.063	-0.070	-0.065
	(0.068)	(0.061)	(0.057)	(0.055)	(0.059)
Maize Suitability Index 0-1		-0.828**	-0.654***	-0.705***	-0.826***
		(0.319)	(0.232)	(0.237)	(0.255)
log. dist. Veracruz kms		-0.701**	-0.834***	-0.697***	-0.553***
		(0.338)	(0.232)	(0.212)	(0.194)
Log. dist. Coast (km)		-0.167**	-0.069	-0.122**	-0.163**
		(0.080)	(0.053)	(0.061)	(0.074)
Log. dist Tenochtitlan (km)		-0.762***	-0.762***	-0.715***	-0.709***
		(0.246)	(0.260)	(0.261)	(0.261)
F (cochineal vars.)	3.405	4.589	3.862	4.112	3.432
Prob>F	0.0116	0.00187	0.00574	0.00390	0.0112
Observations	1,502	1,502	1,502	1,465	1,362
R-squared	0.264	0.382	0.477	0.483	0.506

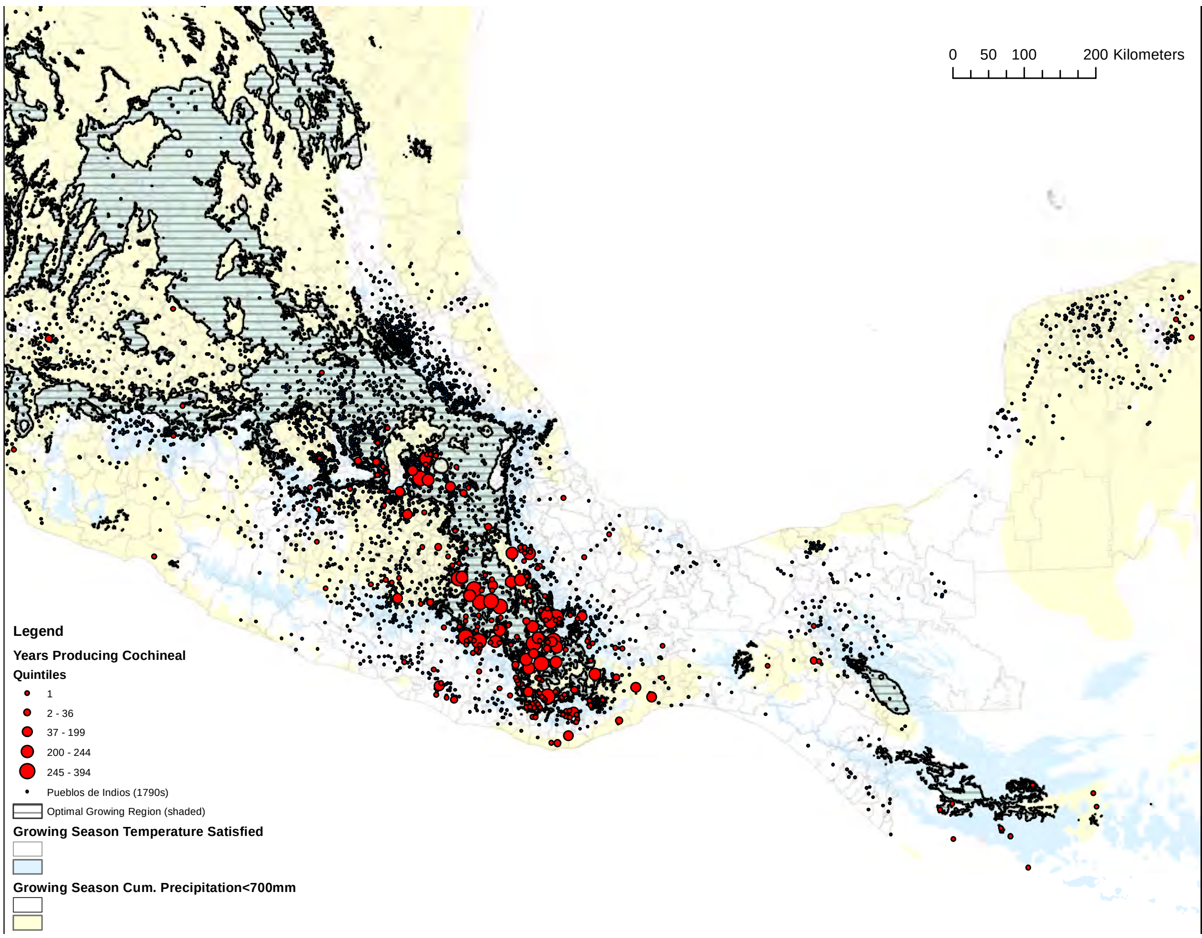

Figure 1: **Optimal growing conditions and cochineal production.** Red dots denote cochineal (*dactylopius coccus*) producing locations, with the size indicating the length of years between the first and last mention in our sources. Blue dots denote the locations of Indian towns (*pueblos de indios*) that existed in 1790. Hashed areas denote those that satisfied all climactic conditions for growing cochineal.

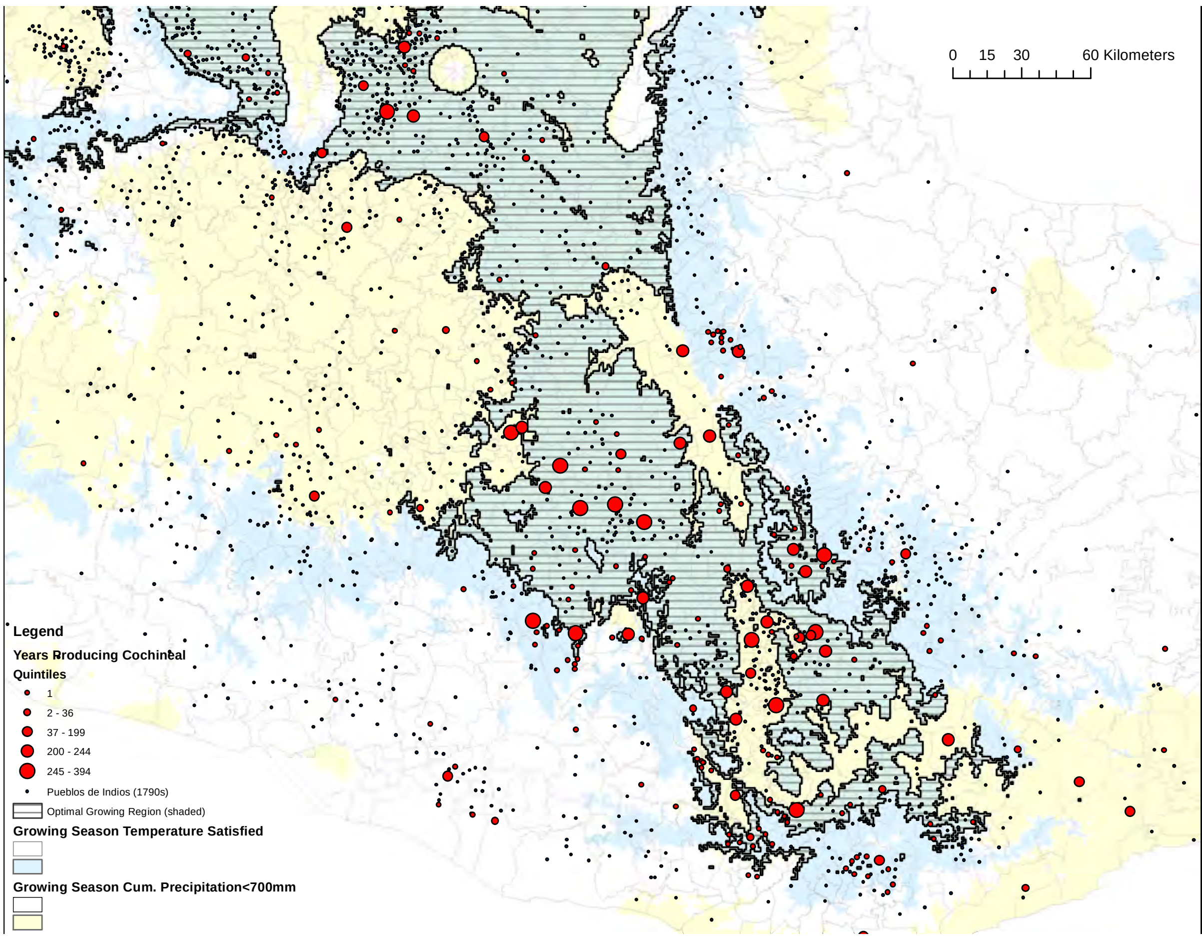

Figure 2: **Optimal growing conditions and cochineal production– Southern Mexico.** Red dots denote cochineal (*dactylopius coccus*) producing locations, with the size indicating the length of years between the first and last mention in our sources. Blue dots denote the locations of Indian towns (*pueblos de indios*) that existed in 1790. Hashed areas denote those that satisfied all climactic conditions for growing cochineal. Notice that localities with historic cochineal production tend to be within or fall within the same municipio as areas that enjoy the optimal growing conditions. This is consistent with the phenomenon, recorded by Humboldt (1814) of indigenous communities making the 'cochineal travel': moving it to nearby areas to exploit temporarily better conditions

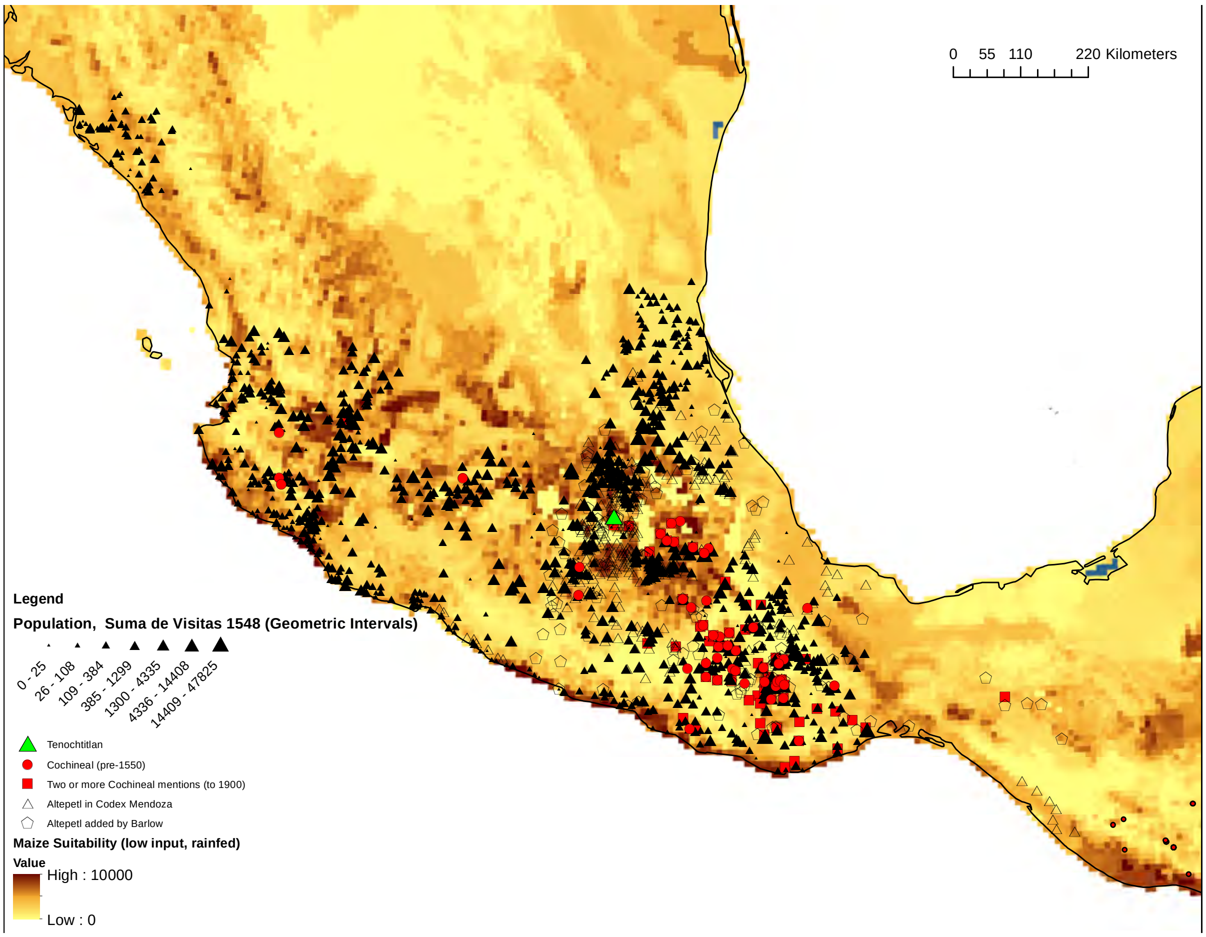

Figure 3: **Cochineal Production, Maize Suitability and Pre-Columbian Settlement Patterns.**

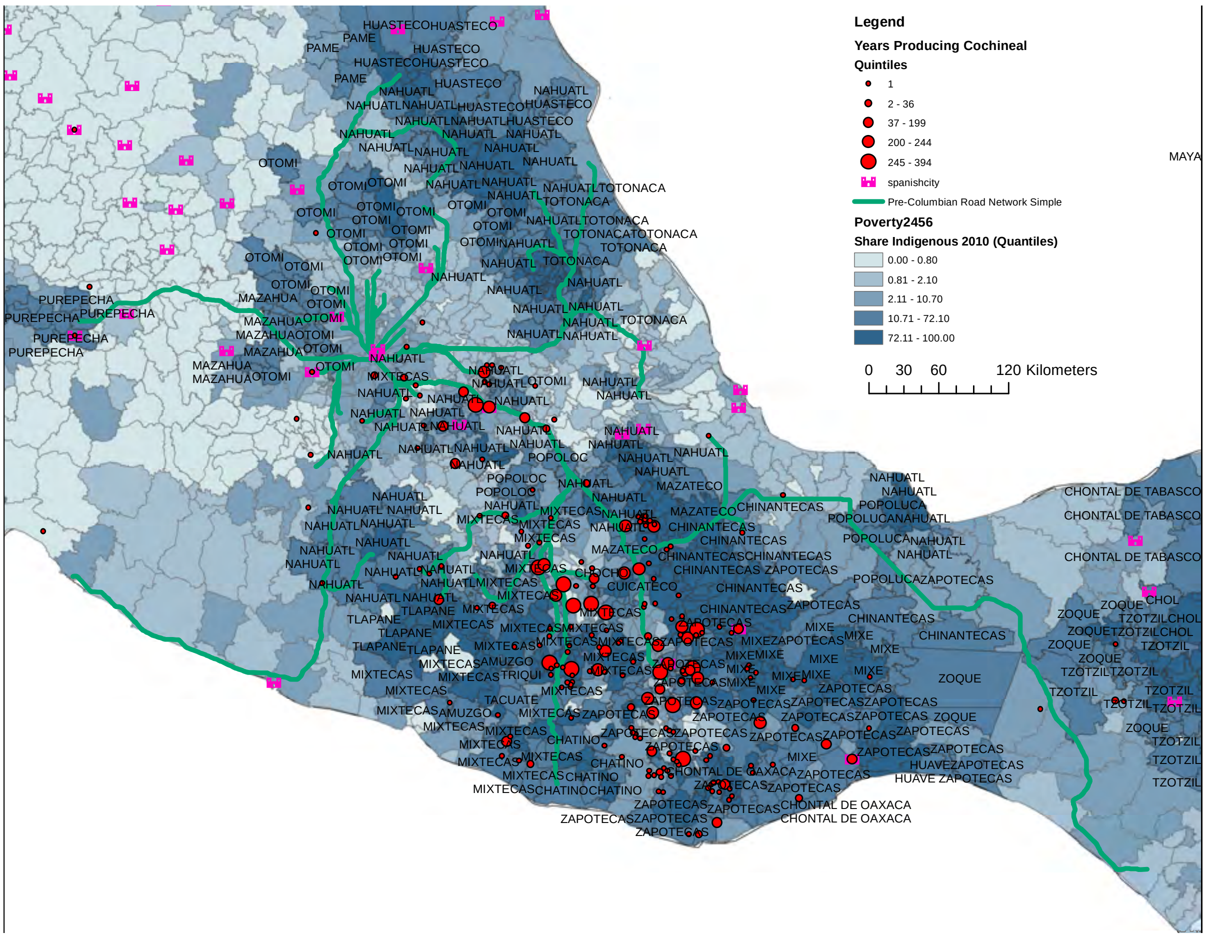

Figure 4: **Historic cochineal production and shares of indigenous speakers in 2000.** The shading shows quintiles in the share of the population who speak an indigenous language. Municipios with greater than 10% indigenous have their chief language labelled. Notice that areas with histories of pre-colonial and colonial cochineal production, particularly those located close to the pre-Hispanic road network, appear to be have lower share of indigenous. Further, notice that cochineal production historically spread across ethnolinguistic boundaries, encompassing Zapotecs, Mixe, Mixtecs and Nahuas, among others.

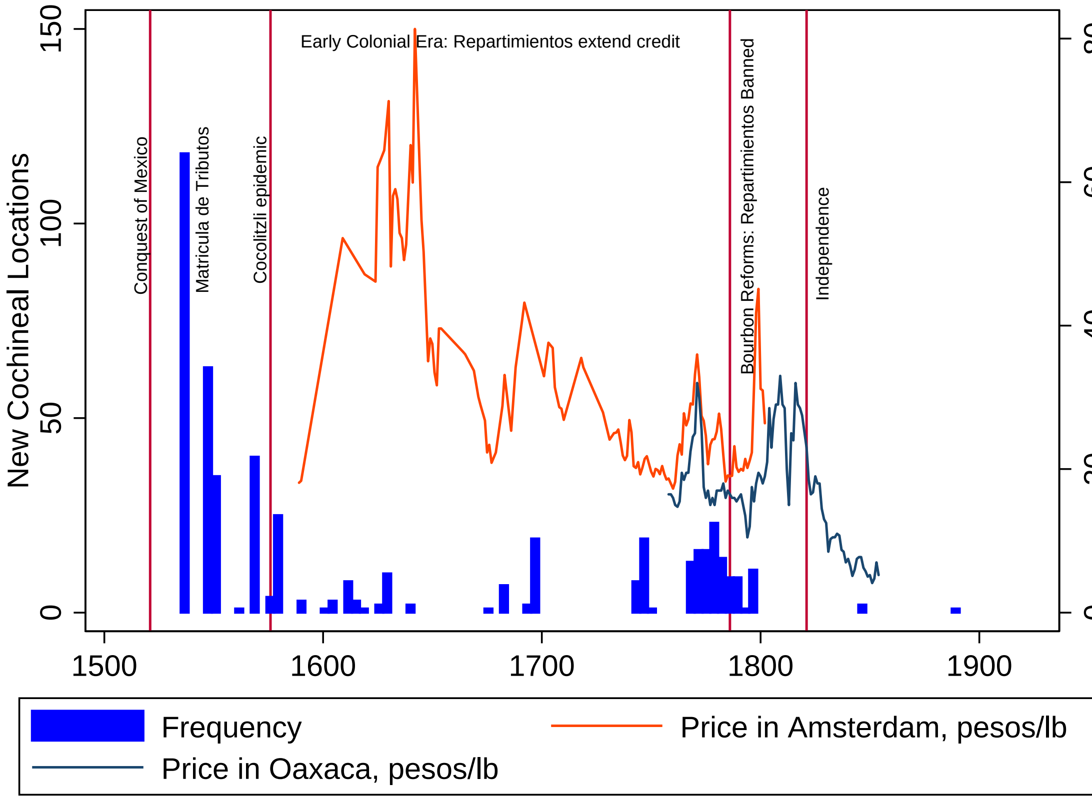

Figure 5: **New Cochineal Locations and Prices over Time** Source: own data, Dahlgren and de Jordán (1990) and Posthumus. Many Cochineal producers predate the Spanish conquest, having been recorded in the *Matricula de Tributos* (1535)– the tribute roll of the Aztecs. New cochineal locations appear to develop in response to spikes in world prices. Note that prior to Mexican independence (1821), spot prices in Oaxaca often far exceeded the 12 reales (1.5 pesos) per lb forward contract offered in the Repartimiento. Amsterdam prices spiked during the Spanish-Dutch war (until 1648), the Seven Years and Napoleonic Wars, when cochineal was prized for the 'redcoats' of British officers. Cochineal prices fell after independence with very little further expansion.

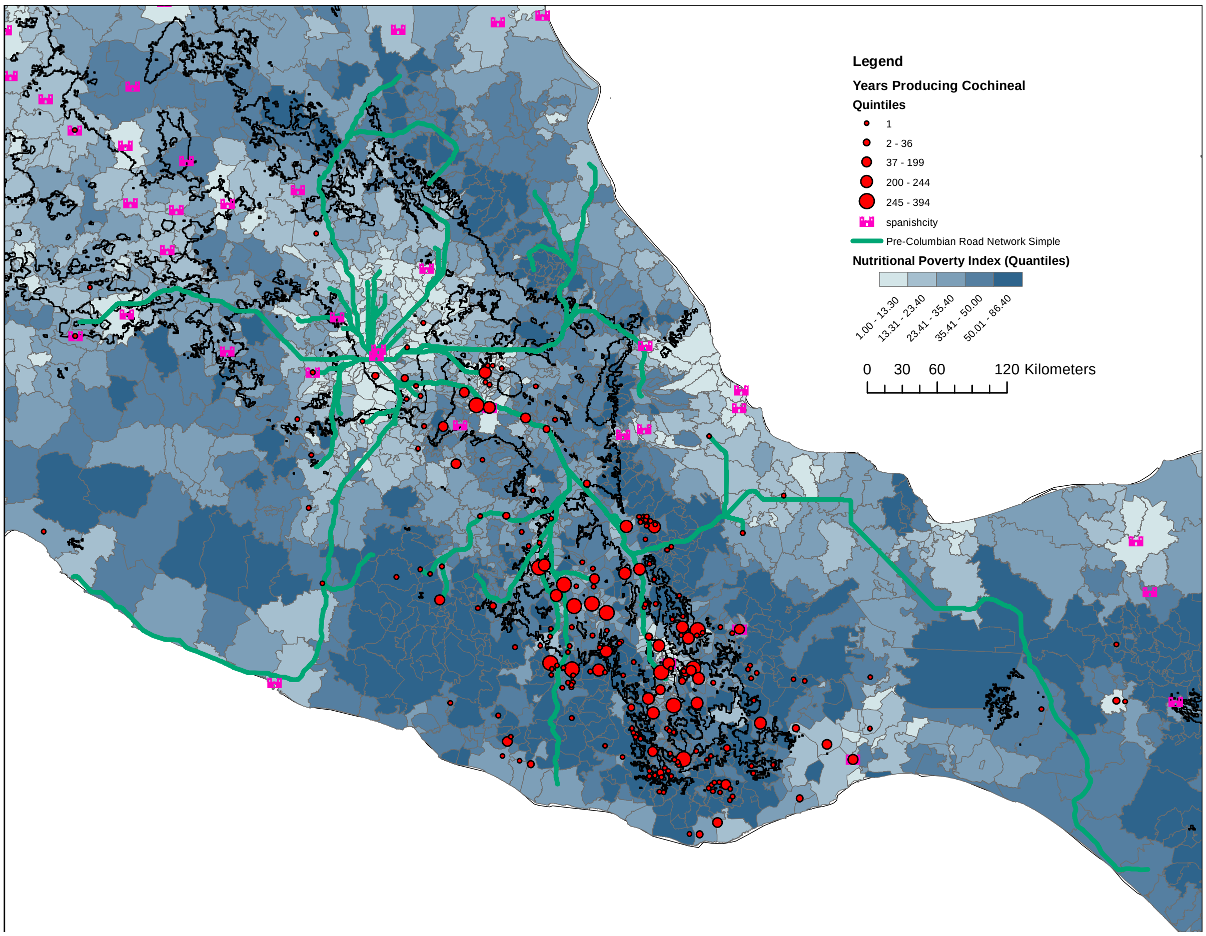

Figure 6: **Historic cochineal production and poverty in 2010.** The shading shows quintiles in the share of the population who cannot afford 2200 (rural) or 2000 (urban) daily calories based upon the 2010 census living standards surveys (source: CONEVAL). Notice that the optimal growing region does not appear conducive to less poverty on its own, but areas with histories of pre-colonial and colonial cochineal production, particularly those located close to the pre-Hispanic road network, appear to be less poor in 2010.

Table A1.1: **Summary Statistics by Cochineal Production**

	All Municipios				Municipios with Pueblos < 1548			
	Others		Cochineal Prod.		Others		Cochineal Prod.	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Cochineal Suitability Index [0-1]	0.771	0.322	0.904	0.192	0.763	0.344	0.912	0.183
Area of municipio (10000sqkm)	0.082	0.214	0.026	0.025	0.057	0.082	0.033	0.026
Northing (km)	-2.854	4.446	-1.323	1.442	-3.775	2.752	-1.452	1.616
Easting (km)	9.110	3.826	6.069	1.230	8.044	1.904	6.214	1.381
Altitude (1km)	1.362	0.841	1.693	0.624	1.395	0.791	1.612	0.696
Average temperature (C)	19.802	4.069	18.915	3.321	20.102	3.960	19.277	3.688
Cumulative precipitation (m)	1.056	0.613	0.967	0.431	1.148	0.580	0.934	0.430
Maize Suitability Index 0-1	0.312	0.208	0.290	0.205	0.368	0.215	0.321	0.202
Area Au/Ag Seams (10^5 sqkm)	0.015	0.048	0.003	0.007	0.011	0.030	0.004	0.008
Cacao Producer 1548	0.038	0.192	0.074	0.264	0.162	0.369	0.111	0.317
Log. dist. Coast (km)	4.441	1.421	4.378	1.237	4.307	1.522	4.264	1.466
Log. dist Tenochtitlan (km)	5.731	0.949	5.616	0.648	5.269	0.968	5.553	0.738
Pueblos <1548	0.236	0.425	0.667	0.474	1.000	0.000	1.000	0.000
Observations	2,375		81		561		54	

Table A1.2: **Regression: Female Illiteracy 2010**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Estimator	OLS	OLS	OLS	OLS	OLS	OLS	IV-2SLS	IV-2SLS
Sample	All	All	All	<50km	Pueblos 1790	Pueblos <1548	All	Pueblos <1548
Female Illiteracy Rate: *Mean*	*0.164*	*0.164*	*0.164*	*0.171*	*0.181*	*0.166*	*0.164*	*0.166*
SD	*0.118*	*0.118*	*0.118*	*0.122*	*0.121*	*0.111*	*0.118*	*0.111*
Core Cochineal producer	-0.021	-0.026*	-0.033***	-0.036***	-0.031**	-0.039***	-0.543*	-0.102
	(0.015)	(0.014)	(0.013)	(0.013)	(0.013)	(0.013)	(0.281)	(0.101)
Cacao producer 1548		-0.004	-0.011	-0.006	-0.009	-0.016		-0.017*
		(0.011)	(0.009)	(0.011)	(0.011)	(0.010)		(0.010)
Gold/Silver Seams(10^5 sqkm)		0.013	-0.021	-0.016	-0.086	0.253*		0.269*
		(0.053)	(0.039)	(0.045)	(0.086)	(0.150)		(0.149)
R-squared	0.408	0.456	0.538	0.536	0.508	0.561	-0.183	0.248
Male-Female Illiteracy Gap: *Mean*	*0.052*	*0.052*	*0.052*	*0.057*	*0.061*	*0.051*	*0.052*	*0.051*
SD	*0.123*	*0.123*	*0.123*	*0.060*	*0.059*	*0.050*	*0.123*	*0.050*
Core Cochineal producer	-0.005	-0.007	-0.013**	-0.015***	-0.014**	-0.015*	-0.137	0.005
	(0.006)	(0.006)	(0.005)	(0.006)	(0.006)	(0.008)	(0.130)	(0.045)
Cacao producer 1548		-0.001	-0.005	-0.002	-0.005	-0.005		-0.004
		(0.005)	(0.005)	(0.007)	(0.005)	(0.007)		(0.007)
Gold/Silver Seams(10^5 sqkm)		-0.002	-0.020	-0.023	-0.043	0.093		0.088
		(0.024)	(0.016)	(0.021)	(0.033)	(0.066)		(0.066)
R-squared	0.464	0.493	0.566	0.566	0.529	0.561	0.306	0.150
Observations	2,456	2,456	2,456	1,966	1,813	615	2,456	615

This table shows the OLS and IV-2SLS coefficients on historic cochineal production prior to 1891 of the female illiteracy rate in 2010 (for those 15+) and the male-female illiteracy gap. An observation is a municipio with robust standard errors clustered at the colonial subdelegacion level. All regressions control for quadratic polynomials in latitude, longitude, altitude, mean temperature and cumulative precipitation. Column 2 adds controls for maize suitability, cacao producer 1548, gold/silver seams, pueblo<1548, log.dist. Tenochtitlan and the Coast. Column 4 restricts the sample to municipios within 50km of areas with optimal growing conditions for Cochineal, Column 5 to municipios that contained pueblos de indios ca 1790 and Column 6 to municipios that contain towns mentioned in the Matricula de Tributos (ca 1522), Suma de Visitas (ca 1548) or other eve of Conquest sources. Columns 8-9 show IV results using cochineal suitability as an instrument for cochineal production. *** p<0.01, ** p<0.05, * p<0.1

Table A1.3: **Regression: Household Wealth and Social Deprivation 2010**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Estimator	OLS	OLS	OLS	OLS	OLS	OLS	IV-2SLS	IV-2SLS
Sample	All	All	All	<50km	Pueblos 1790	Pueblos <1548	All	Pueblos <1548
Household Asset Index (1st PC): *Mean*	*0.000*	*0.000*	*0.000*	*-0.165*	*-0.364*	*0.018*	*0.000*	*0.018*
SD	*2.601*	*2.601*	*2.601*	*2.690*	*2.627*	*2.617*	*2.601*	*2.617*
Core Cochineal producer	0.186	0.523**	0.810***	0.960***	0.814***	0.910**	5.961	0.442
	(0.289)	(0.258)	(0.234)	(0.239)	(0.234)	(0.396)	(5.093)	(2.440)
Cacao producer 1548		0.123	0.314*	0.379	0.289	0.458**		0.451**
		(0.279)	(0.182)	(0.249)	(0.223)	(0.210)		(0.205)
Gold/Silver Seams(10^5 sqkm)		-0.449	0.162	0.586	0.483	-7.031*		-6.917*
		(1.427)	(0.979)	(1.138)	(1.881)	(3.738)		(3.672)
R-squared	0.344	0.444	0.584	0.605	0.606	0.642		
Index of Social Deprivation: *Mean*	*0.000*	*0.000*	*0.000*	*0.067*	*0.154*	*0.042*	*0.000*	*0.042*
SD	*1.000*	*1.000*	*1.000*	*1.021*	*1.013*	*0.996*	*1.000*	*0.996*
Core Cochineal producer	-0.083	-0.163*	-0.254***	-0.305***	-0.254***	-0.252**	-3.472	-0.465
	(0.092)	(0.088)	(0.072)	(0.075)	(0.074)	(0.117)	(2.134)	(0.997)
Cacao producer 1548		0.011	-0.052	-0.007	-0.042	-0.135		-0.138
		(0.123)	(0.082)	(0.101)	(0.092)	(0.092)		(0.089)
Gold/Silver Seams(10^5 sqkm)		1.086	0.582	0.693	0.053	3.241*		3.293*
		(0.682)	(0.504)	(0.546)	(1.002)	(1.766)		(1.754)
R-squared	0.379	0.439	0.563	0.584	0.553	0.634		
Observations	2,456	2,456	2,456	1,966	1,813	615	2,456	615

This table shows the OLS and IV-2SLS coefficients on historic cochineal production prior to 1891 of the first principal component of municipio averages of the following household asset measures in 2010: average occupants per room, % with dirt floor, toilet, radio, tv, refrigerator, washing machine, car, computer, telephone and cell phone. In the projection, higher indicates more wealth. Panel B provides an Index of Social Deprivation (IRS) calculated by CONEVAL. It includes household assets and access to services. An observation is a municipio with robust standard errors clustered at the colonial subdelegacion level. All regressions control for quadratic polynomials in latitude, longitude, altitude, mean temperature and cumulative precipitation. Column 2 adds controls for maize suitability, cacao producer 1548, gold/silver seams, pueblo<1548, log.dist. Tenochtitlan and the Coast. Column 4 restricts the sample to municipios within 50km of areas with optimal growing conditions for Cochineal, Column 5 to municipios that contained pueblos de indios ca 1790 and Column 6 to municipios that contain towns mentioned in the Matricula de Tributos (ca 1522), Suma de Visitas (ca 1548) or other eve of Conquest sources. Columns 8-9 show IV results using cochineal suitability as an instrument for cochineal production. *** p<0.01, ** p<0.05, * p<0.1

Table A1.4: **Regression: Public Goods 2010**

	(1)	(2)	(3)	(4)	(5)	(6)
Estimator	OLS	OLS	OLS	OLS	IV-Wald	IV-LIML
Sample	All	All	All	<50km	All	<50km
Panel A: Index of Lack of Public Goods						
Cochineal Producer	0.082	-0.061	-0.190**	-0.275***	-25.689***	-4.863
	(0.125)	(0.119)	(0.092)	(0.092)	(8.993)	(3.625)
Rainfed Minimal Input Maize Suit. Index 0-1		-1.001***	-0.351	-0.521*		-0.693*
		(0.302)	(0.295)	(0.299)		(0.371)
Rainfed Minimal Input Cacao Suit. Index 0-1		-2.285***	-1.699**	-1.539*		-1.276
		(0.547)	(0.789)	(0.911)		(1.038)
Area with Gold or Silver Seams (10000sqkm)		3.211***	1.840**	1.955**		1.914*
		(1.195)	(0.870)	(0.967)		(1.009)
Log. dist. simple pre-Hispanic road network (k		-0.064*	0.006	-0.011		-0.047
		(0.036)	(0.038)	(0.039)		(0.059)
R-squared	0.160	0.219	0.343	0.373		
Mean of Dependent Variable	0.000	0.000	0.000	0.010	0.000	0.010
SD	1.377	1.377	1.377	1.406	1.377	1.406
Panel B Components: Coefficent of Cochineal on:						
% Without Sewers	2.202	-0.905	-4.385*	-5.882**	-183.475	-80.848
	(3.177)	(3.191)	(2.601)	(2.487)	(119.369)	(63.330)
R-squared	0.145	0.246	0.400	0.428		
% Without Water	-0.356	-1.388	-1.260	-2.344	-423.960***	-25.148
	(2.214)	(2.070)	(2.162)	(2.218)	(135.956)	(46.586)
R-squared	0.224	0.245	0.302	0.275		
% Without Electricity	0.003	-0.000	-0.004	-0.005*	-0.780***	-0.183*
	(0.004)	(0.004)	(0.003)	(0.003)	(0.240)	(0.110)
R-squared	0.123	0.157	0.265	0.276		
Geographical and Climatic Controls	Yes	Yes	Yes	Yes	No	Yes
Controls for Dist. Coast and Tenochtitlan	No	Yes	Yes	Yes	No	Yes
Modern State Fixed Effects	No	No	Yes	Yes	No	Yes
Observations	2,456	2,456	2,456	1,966	2,456	1,966

Panel A shows the determinants of the first principal component of the lack of three locally provided public goods among households in municipio, including the % Without Access to Sewers, Water and Electricity. Panel B shows the coefficient of cochineal production on each component. An observation is a municipio. Standard errors are clustered at the colonial subdelegacion level. All regressions except Column 5 include the following Geographical and Climatic Controls: Area of the Municipio, Quadratics in Longitude, Latitude and Altitude, Cumulative Precipitation and Average Temperature. Columns 2-4, 6 add controls for Log. Distance to the Coast and to Tenochtitlan. Columns 4 and 6 subset the sample to those within 50 km of an area with optimal growing conditions for cochineal.

Table A1.5: **Regression (AGEB-Localidad 2020): Share Monolingual in an Indigenous Language**

VARIABLES	(1) OLS All	(2) OLS <50km	(3) OLS Historic Core	(4) IV All	(5) IV Historic Core
Core cochineal producer	-0.005**	-0.002	-0.004**	-0.382*	-0.343**
	(0.002)	(0.002)	(0.002)	(0.201)	(0.166)
Maize Suitability Index 0-1	-0.010*	-0.003	-0.004	-0.002	0.003
	(0.005)	(0.004)	(0.002)	(0.008)	(0.006)
Cacao producer <1548	-0.029*	-0.034	-0.030***	-0.037**	-0.037**
	(0.016)	(0.025)	(0.011)	(0.017)	(0.016)
Gold/Silver seams	-0.006	-0.017	-0.010	-0.017	-0.011
	(0.029)	(0.017)	(0.015)	(0.031)	(0.021)
Log. dist. Tenochtitlan (km)	0.020**	0.017**	0.014**	0.032**	0.033**
	(0.009)	(0.008)	(0.007)	(0.013)	(0.015)
Log. dist. coast (km)	-0.002*	-0.018**	-0.001	-0.001	-0.001
	(0.001)	(0.007)	(0.001)	(0.001)	(0.001)
Settlement <1548	-0.000	-0.002	-0.000	0.036*	0.033**
	(0.001)	(0.002)	(0.001)	(0.020)	(0.016)
Observations	17,162	9,268	10,934	17,162	10,934
R-squared	0.674	0.772	0.712		
Geographic and Climatic Polynomials	Yes	Yes	Yes	Yes	Yes
Municipio Fixed Effects	Yes	Yes	Yes	Yes	Yes
Mean (dependent variable)	0.0139	0.0157	0.0108	0.0139	0.0108
Anderson-Rubin F-test				5.576	10.33

Each observation is an urban locality/ rural census tract (AGEB-Localidad). The outcome is the share that is monolingual in an indigenous language in 2020. Geographic and Climatic controls include linear and quadratic terms for latitude, longitude, altitude, cum. precipitation and mean temperature. All regressions include municipio fixed effects. Standard errors are clustered at the municipio level. *** p<0.01, **

Table A1.6: **Regression (AGEB-Localidad 2020): Women's Education Years**

VARIABLES	(1) OLS All	(2) OLS <50km	(3) OLS Historic Core	(4) IV All	(5) IV Historic Core
Core cochineal producer	0.811***	0.541***	0.567***	12.021*	10.207**
	(0.097)	(0.111)	(0.102)	(6.376)	(4.983)
Maize Suitability Index 0-1	1.098***	0.693***	0.683***	0.854***	0.495**
	(0.153)	(0.152)	(0.154)	(0.236)	(0.220)
Cacao producer <1548	-0.102	0.340	0.830***	0.136	1.012**
	(0.291)	(0.506)	(0.317)	(0.390)	(0.429)
Gold/Silver seams	-3.028***	-2.561**	-3.474***	-2.703***	-3.464***
	(0.904)	(1.167)	(1.164)	(0.929)	(1.138)
Log. dist. Tenochtitlan (km)	-2.324***	-2.387***	-2.308***	-2.652***	-2.829***
	(0.479)	(0.574)	(0.527)	(0.567)	(0.643)
Log. dist. coast (km)	-0.199***	0.053	-0.206***	-0.214***	-0.217***
	(0.066)	(0.210)	(0.065)	(0.068)	(0.074)
Settlement <1548	0.338***	0.409***	0.373***	-0.732	-0.557
	(0.046)	(0.057)	(0.045)	(0.622)	(0.491)
Observations	17,162	9,268	10,934	17,162	10,934
R-squared	0.548	0.671	0.659		
Geographic and Climatic Polynomials	Yes	Yes	Yes	Yes	Yes
Municipio Fixed Effects	Yes	Yes	Yes	Yes	Yes
Mean (dependent variable)	7.272	7.440	7.359	7.272	7.359
Anderson-Rubin F-test				4.757	7.202

Each observation is an urban locality/ rural census tract (AGEB-Localidad). The outcome is the average years of education for women in 2020. Geographic and Climatic controls include linear and quadratic terms for latitude, longitude, altitude, cum. precipitation and mean temperature. All regressions include municipio fixed effects. Standard errors are clustered at the municipio level. *** p<0.01, ** p<0.05, * p<0.1

Table A1.7: **Regression (AGEB-Localidad 2020): Women's Employment**

VARIABLES	(1) OLS All	(2) OLS <50km	(3) OLS Historic Core	(4) IV All	(5) IV Historic Core
Core cochineal producer	0.042***	0.022***	0.027***	0.591	0.478
	(0.007)	(0.008)	(0.008)	(0.533)	(0.460)
Maize Suitability Index 0-1	0.013	0.010	0.002	0.001	-0.006
	(0.015)	(0.015)	(0.015)	(0.020)	(0.018)
Cacao producer <1548	0.004	-0.038	-0.013	0.016	-0.005
	(0.036)	(0.053)	(0.040)	(0.038)	(0.041)
Gold/Silver seams	-0.184	-0.203	-0.198	-0.170	-0.200
	(0.129)	(0.145)	(0.131)	(0.130)	(0.132)
Log. dist. Tenochtitlan (km)	-0.081**	-0.064*	-0.122***	-0.097**	-0.146***
	(0.037)	(0.035)	(0.047)	(0.042)	(0.056)
Log. dist. coast (km)	-0.005	0.011	-0.010	-0.006	-0.011
	(0.006)	(0.020)	(0.009)	(0.006)	(0.009)
Settlement <1548	0.016***	0.019***	0.018***	-0.037	-0.025
	(0.005)	(0.005)	(0.005)	(0.052)	(0.045)
Observations	17,125	9,266	10,929	17,125	10,929
R-squared	0.450	0.560	0.496		
Geographic and Climatic Polynomials	Yes	Yes	Yes	Yes	Yes
Municipio Fixed Effects	Yes	Yes	Yes	Yes	Yes
Mean (dependent variable)	0.362	0.366	0.379	0.362	0.379
Anderson-Rubin F-test				1.310	1.186

Each observation is an urban locality/ rural census tract (AGEB-Localidad). The outcome is the share of female employment. Geographic and Climatic controls include linear and quadratic terms for latitude, longitude, altitude, cum. precipitation and mean temperature. All regressions include municipio fixed effects. Standard errors are clustered at the municipio level. *** p<0.01, ** p<0.05, * p<0.1

Table A1.8: **Regression (AGEB-Localidad 2020): Male-Female Employment Gap**

	(1)	(2)	(3)	(4)	(5)
	OLS	OLS	OLS	IV	IV
VARIABLES	All	<50km	Historic Core	All	Historic Core
Core cochineal producer	-0.053***	-0.028***	-0.033***	-0.688	-0.841
	(0.008)	(0.008)	(0.008)	(0.597)	(0.547)
Maize Suitability Index 0-1	-0.050***	-0.026*	-0.027*	-0.036*	-0.012
	(0.016)	(0.016)	(0.015)	(0.021)	(0.021)
Cacao producer <1548	0.018	-0.024	0.009	0.005	-0.007
	(0.035)	(0.052)	(0.039)	(0.038)	(0.044)
Gold/Silver seams	0.152	0.247*	0.195*	0.136	0.199*
	(0.130)	(0.128)	(0.117)	(0.132)	(0.119)
Log. dist. Tenochtitlan (km)	0.159***	0.120***	0.187***	0.178***	0.231***
	(0.037)	(0.033)	(0.047)	(0.043)	(0.061)
Log. dist. coast (km)	0.005	-0.008	0.011	0.006	0.012
	(0.006)	(0.023)	(0.010)	(0.006)	(0.010)
Settlement <1548	-0.026***	-0.031***	-0.028***	0.035	0.050
	(0.005)	(0.005)	(0.005)	(0.058)	(0.054)
Observations	17,125	9,266	10,929	17,125	10,929
R-squared	0.366	0.486	0.459		
Geographic and Climactic Polynomials	Yes	Yes	Yes	Yes	Yes
Municipio Fixed Effects	Yes	Yes	Yes	Yes	Yes
Mean (dependent variable)	0.390	0.374	0.373	0.390	0.373
Anderson-Rubin F-test				1.430	3.093

Each observation is an urban locality/ rural census tract (AGEB-Localidad). The outcome is the male-female employment gap in 2020. Geographic and Climatic controls include linear and quadratic terms for latitude, longitude, altitude, cum. precipitation and mean temperature. All regressions include municipio fixed effects. Standard errors are clustered at the municipio level. *** p<0.01, ** p<0.05, * p<0.1

(a) Enemies of Cochineal

(b) Women Harvesting Cochineal

Figure A1.1: **Enemies and Cultivators of Cochineal** Cochineal required a lot of care. Women played a key role. Source: Gonzalo Gomez de Cervantes (1599). Memorial de Don Gonçalo Gomez de Cervantes del modo de vivir que tienen los indos, y del beneficio de las minas de la plata, y de la cochinella. Relación de [lo] que toca la Grana Cochinilla. Am2006,Drg.210, Add. Ms. 13964 reproduced with permission from the British Museum.

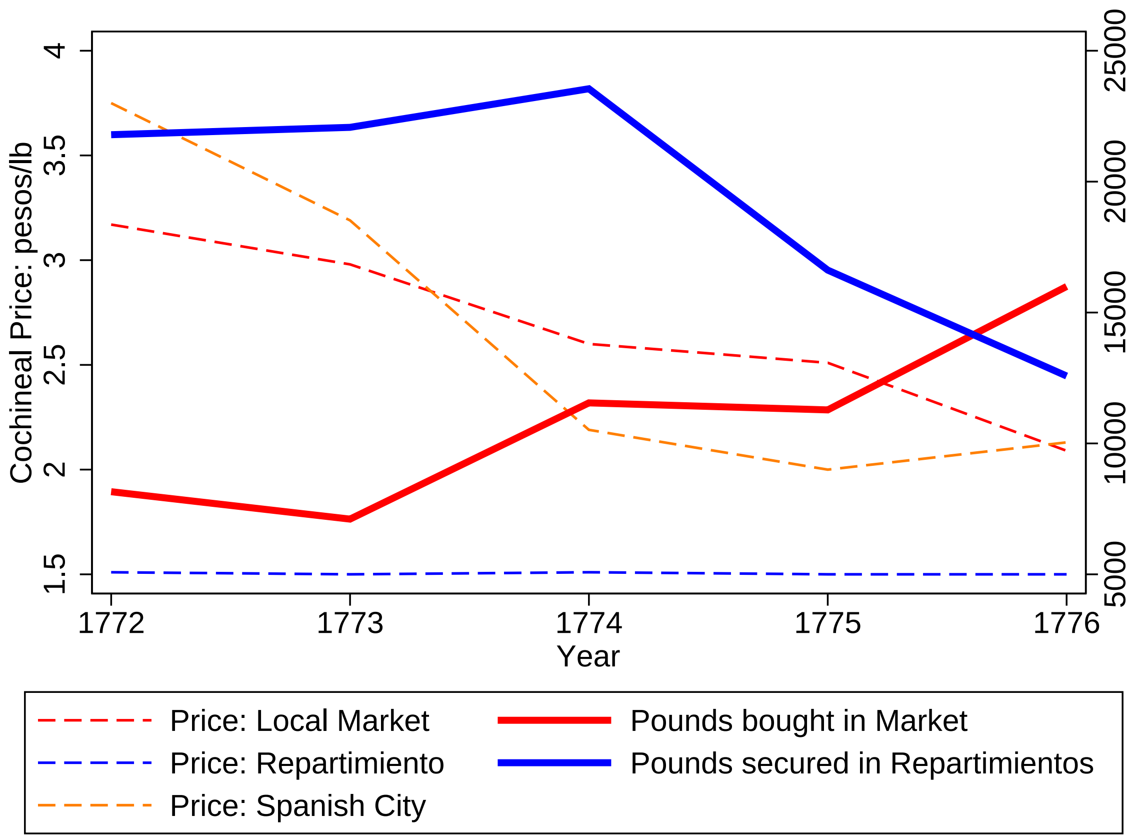

Figure A1.2: **Relative Prices of Cochineal and Procurement by the Alcalde Mayor of Miahuatlan** Source: Baskes. Note that the Repartimiento (forward contract) price offered by the Alcalde Mayor tended to be below the local market price in Miahuatlan and the price in the nearest Spanish city- Antequera. The Alcalde Mayor actively procured similar amounts both through the Repartimientos and the spot market, with the latter responding to falls in prices.

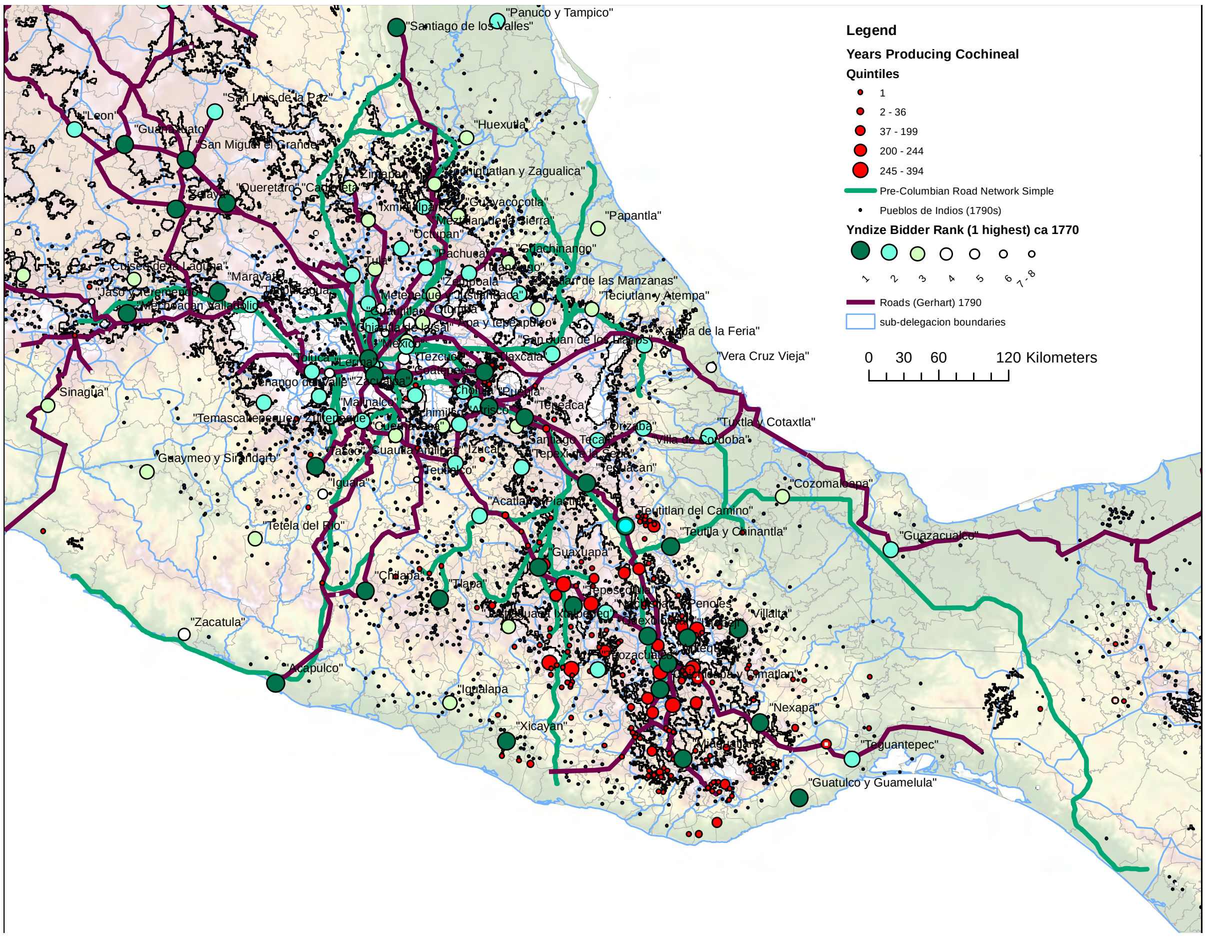

Figure A1.3: **Cochineal production and the late colonial state (ca 1790s)** Colonial Mexico was divided into sub-delegaciones (in blue), each controlled from an Alcalde Mayor. The colours of the seats reflect the ranking from 1-8 of each Alcalde Mayor based upon its perceived value to the Spaniards from a unique data source- the *Yndize de todos los Goviernos*– an anonymous handwritten notebook ca 1777 aimed at informing bidders for the auction of alcaldes mayores how much to bid. The brown lines denote the road networks of New Spain (1790), as documented by Gerhard (1993). Notice that Alcaldes Mayores that control areas of historic cochineal production tend to have dark green (Class 1) rankings.

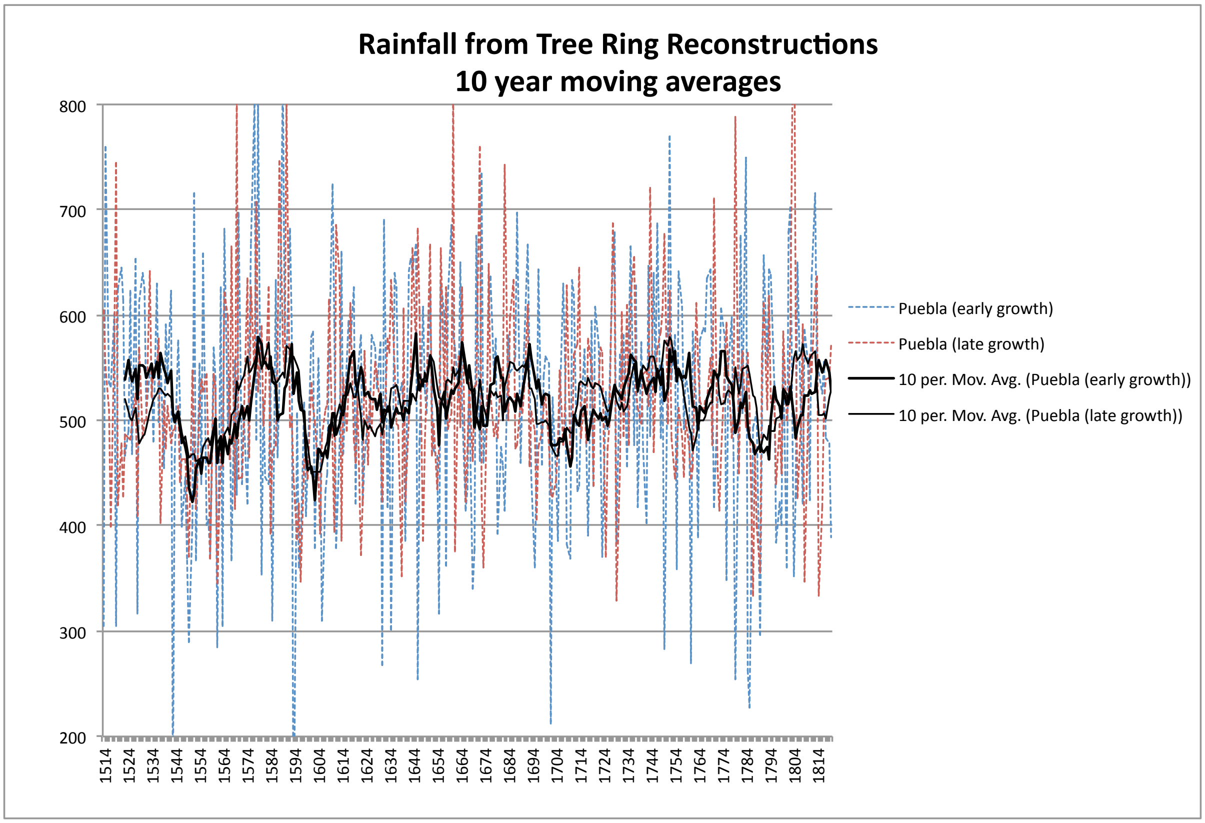

Figure A1.4: **Dendochronology reconstruction of rainfall fluctuations in Puebla over 5 centuries.** Source: Cuauhtemoc La Fragua, Puebla Douglas Fir at 3154 m Altitude. Tree ring reconstructions are not available for tropical areas, because only trees from temperate zones can be dated accurately. However, a very long reconstruction of 500 years is available for central Mexico in a high altitude region very close to the core area of cochineal cultivation. It is clear from the climate reconstruction that rainfall fluctuated during the colonial period, with sharp declines reflecting droughts in the middle and the last years of the16th century, and the beginning and the 90s in the 18th century. Despite those fluctuations, climate has remained within a range of variation that allows us to use data from the 20th century meteorological stations, to create an estimation of the microclimates where cochineal could grow during the whole colonial period.