Can Contract Failures Foster Ethnic Assimilation? Evidence from Cochineal in Mexico

Preliminary and incomplete

Alberto Diaz-Cayeros
UCSD

Saumitra Jha*
Stanford GSB

April 4, 2013

Abstract

Under what conditions does exposure to trade lead to coercion and poverty for indigenous communities, and when may it lead to market access, poverty reduction and ethnic assimilation? We explore the role played by contractual incentives generated by inter-ethnic complementarity and costly verifiability in securing long term, sustained gains and engendering ethnic assimilation among indigenous communities involved in the cultivation of one of the world's most valuable traded commodities: cochineal - the "Spanish Red".

We exploit the discontinuous fragility of cochineal with respect to micro-climatic differences during the growing season to identify the effect of a legacy of cochineal production. We find that a legacy of cochineal production lowered the headcount poverty ratio in Mexican municipalities by 0.1– comparable to the entire ten year effect of *Progressa/ Oportunidades*– and raised female literacy by 0.6 percentage points. However, municipalities that once produced cochineal are more unequal, have fewer indigenous households and are less likely to formalize indigenous local government institutions. Further, and unlike non-cochineal producing areas, the *greatest* female literacy and poverty gains occurred in areas where indigenous agents were best able to renege on contracts. Drawing on original historical sources, including a secret handbook for Spaniards bidding for local office, we interpret these results as reflecting inter-ethnic complementarity in trade, and, ironically, *weak* contract enforceability by intermediaries that encouraged direct market access for the indigenous, particularly women.

*Address: *albertod@ucsd.edu; saumitra@gsb.stanford.edu*. We would like to thank Sergio Juarez of the *Nocheztlicalli: Museo Vivo de la Grana Cochinilla* in Oaxaca for sharing his expertise on cochineal cultivation; Jeremy Baskes for sharing some of the original documents he discovered; and Rodolfo Acuna and David Stahle for sharing their tree-ring reconstructions of historical climate. We are also grateful to Avner Greif, Luis Bertola, William Collins, Melissa Dell, Exequiel Ezcurra, Ricardo Fagoaga, Angeles Frizzi, Dorothy Kronick, Jessica Leino, Beatriz Magaloni, Brian Owensby and seminar participants at Stanford, Princeton, the EHA, LSE and UCSD. Katrina Kosec and Peter Schram provided excellent research assistance.

1 Introduction

Poor, disenfranchised or indigenous populations that live in regions with resources that can be extracted for sale on world markets have long been seen as the accursed of globalisation. Indeed, given the often dramatic differences in military and technological capabilities between those seeking 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 (Engerman and Sokoloff, 2000, Acemoglu, Johnson, and Robinson, 2002, Nunn, 2008, Dell, forthcoming).[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 processes of exploitation, such as spices, silkworms, dyes or rubber, have often proved less durable sources of wealth as these processes and goods are replicated elsewhere.[2]

[1]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 in South Asia, see Jha (2008b), and more generally, Jha (2008a).

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 absence elsewhere (Donkin, 1977).

Yet, despite this bleak picture, a common perspective among modern development economists holds that *lack of access* to the market is a key reason for sustained poverty (eg Banerjee and Newman, 1998, McMillan, 2002). Due to geographic remoteness, credit-related poverty traps or explicit ethnic discrimination, among other reasons, 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, then, can poor, indigenous communities sustain long-term gains from world trade? And how does market access shape these communities? In this paper, we explore the role played by contractual incentives generated by non-replicable factors, high risk and differential costs of contract verifiability in securing long term, sustained gains from world trade for indigenous communities and in shaping their degree of ethnic assimilation. 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 late 19th century: the "Spanish Red" dye extracted from the cochineal insect, in varying environments of contractual verifiability. We perform this study in Mexico, a country where indigenous, colonial and modern identities and institutions of governance have co-existed for centuries, and 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 1820, 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. Spanish merchants bid for the right from the Crown to serve as local administrators–or *alcaldes mayores*– allowing them the ability to make classic contract-forwarding agreements, known as *repartimientos de mercancías*– for the cochineal, paying 12 pesos of silver to indigenous cultivators for each pound of cochineal six months in advance. However, despite large fluctuations the spot prices for cochineal in Oaxaca and other towns were often above this (Figure 1), 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.

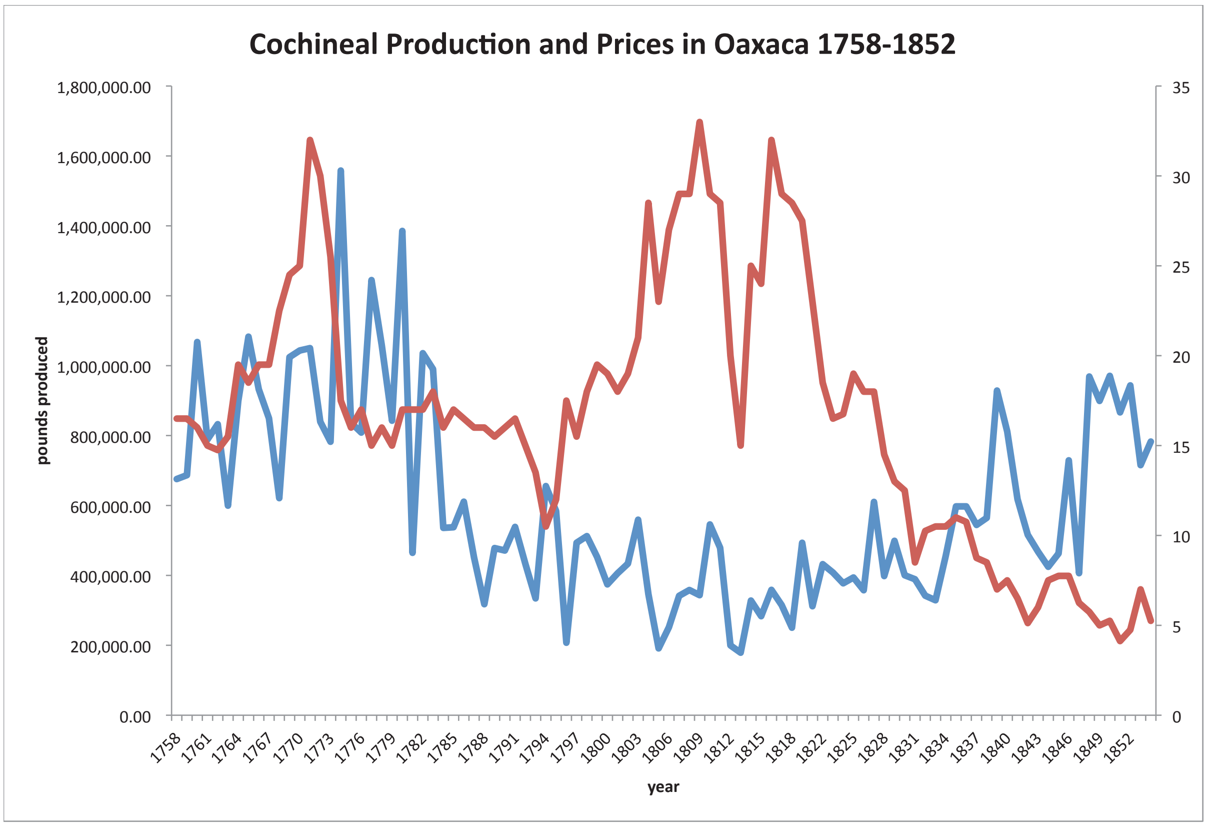


Figure 1: **Trends in Cochineal Price (Red) and Production (Blue) in the Receptoria of Oaxaca:** Source: Dahlgren (1990). Note that prior to Mexican independence (1820), spot prices in Oaxaca often far exceeded the 12 pesos per lb forward contract offered in the repartimiento. Prices spiked during the Seven Years and Napoleonic Wars, when cochineal was prized for the 'redcoats' of British officers.

We first exploit the fragility of cochineal with respect to micro-climatic differences, using the discontinuous propensity to produce cochineal in areas that possess the optimal raising conditions for cochineal to areas just on the other side of these thresholds that lacked the precise combination of precipitation and rainy season temperatures, to identify the effect of historic cochineal production on poverty, female literacy, inequality, indigenous assimilation and the maintenance of *usos y costumbres*– traditional indigenous usages and customs to manage local government. Though cochineal producing pueblos seem not to be very different in their pre-Columbian characteristics, we find that a legacy of cochineal production lowered the headcount poverty ratio in a municipality by around 0.1, a large value comparable to the entire effect of the *Progresa/ Opportunidades* conditional cash transfer program over a ten year period. Furthermore, cochineal production appears to have raised female literacy by a remarkable 0.6 percentage points. Municipalities that contained pueblos that once produced cochineal are significantly more unequal, however, and, actually, on average, have significantly fewer indigenous households, and fewer who are monolingual in an indigenous language. They are less likely to adopt indigenous local government institutions (*usos y costumbres*). Public goods provision is generally as good however, apart from the provision of roads and transport, which is considerably improved in cochineal producing areas.

We next examine how these effects differ among pueblos that were best positioned to renege on contracts- those near to alternative *alcaldia* and thus alternative buyers on the spot market. We find that female literacy rates, poverty reductions and reductions in the adoption indigenous governance institutions are greatest among municipios that are located closer to alternative alcaldia markets.

We interpret these results as reflective of the long-term legacy of the repartimiento contract that underlied cochineal production in the colonial period. 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. However, because of the ability to exercise the "call option", renege on the repartimiento contract and sell in markets when prices were high, the risky nature of cochineal on the upside engendered inequality. Concurrently, Spanish officials had an incentive to build roads to cochineal producing areas to improve the ability to access and monitor valuable goods for which they themselves were providing credit. Despite cochineal production having initially safeguarded indigenous communities from hacienda-isation and homogenization, 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".

However, these average effects mask deep differences that emerge from the contracting environment. In locations where the alcaldia mayores could act as market intermediaries and could enforce contracts, inter-ethnic complementarity remained intact, leading ironically to lower assimilation among cochineal producers close to the alcaldia mayor. In contrast, where the opportunity to renege were higher, cochineal producers had repeated incentives to 'opt out' of the repartimiento, interacting directly with the market and the Spanish world.

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, forthcoming, Alesina, Giuliano, and Nunn, 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) and on ethnic diversity and public goods provision (eg Alesina and La Ferrara, 2005).[To be completed]

Our results also reconcile an important debate among historians of Latin America. The overwhelming majority of historians of the late colonial period of the 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 our knowledge, to document the long term effects of these contractual arrangements on the indigenous communities themselves. Drawing on 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 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 Background: Cochineal and the Repartimiento

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). 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). As a result, from the 16th century to the independence of Mexico in 1820, 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).[3]

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 Figures 2 and 8).

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.[4] Thus, unlike other prized agricultural commodities,

[3]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.

[4]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

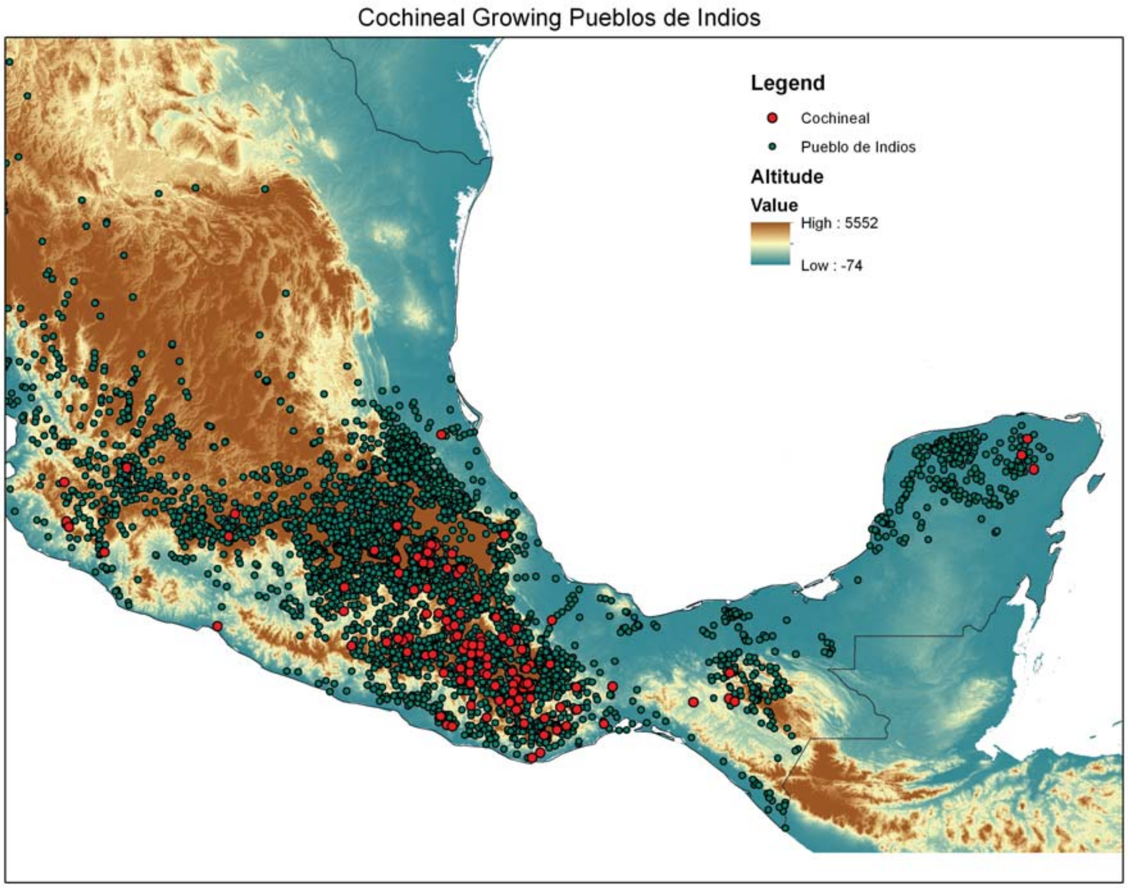


Figure 2: **Cochineal Production among the Pueblos de Indios of New Spain**

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.

in the Canary Islands (Greenfield, 2005).

The 16th century chronicler 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 (Figure 3.)

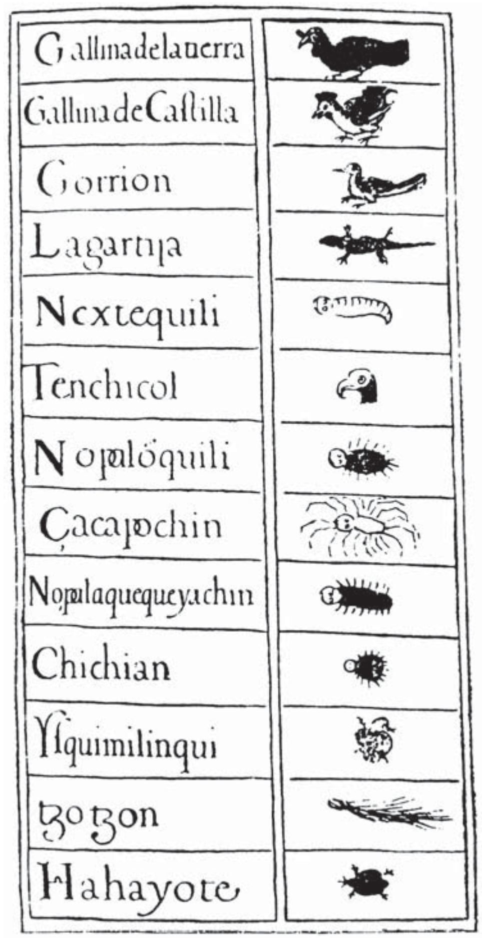


Figure 3: **Enemies of cochineal– Gonzalo Gomez de Cervantes (1599), *La vida económica y social de Nueva España el finalizar el siglo XVI***, reproduced in Donkin (1977)

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, we argue, to provide high-powered incentives, 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.[5]

Indeed, as Figure 4 suggests, by the time of the 1910 Mexico census, though haciendas spread in a number of regions that of indigenous settlement, those that were congenial for cochineal production were noticeably skipped from the encroachment of haciendas.

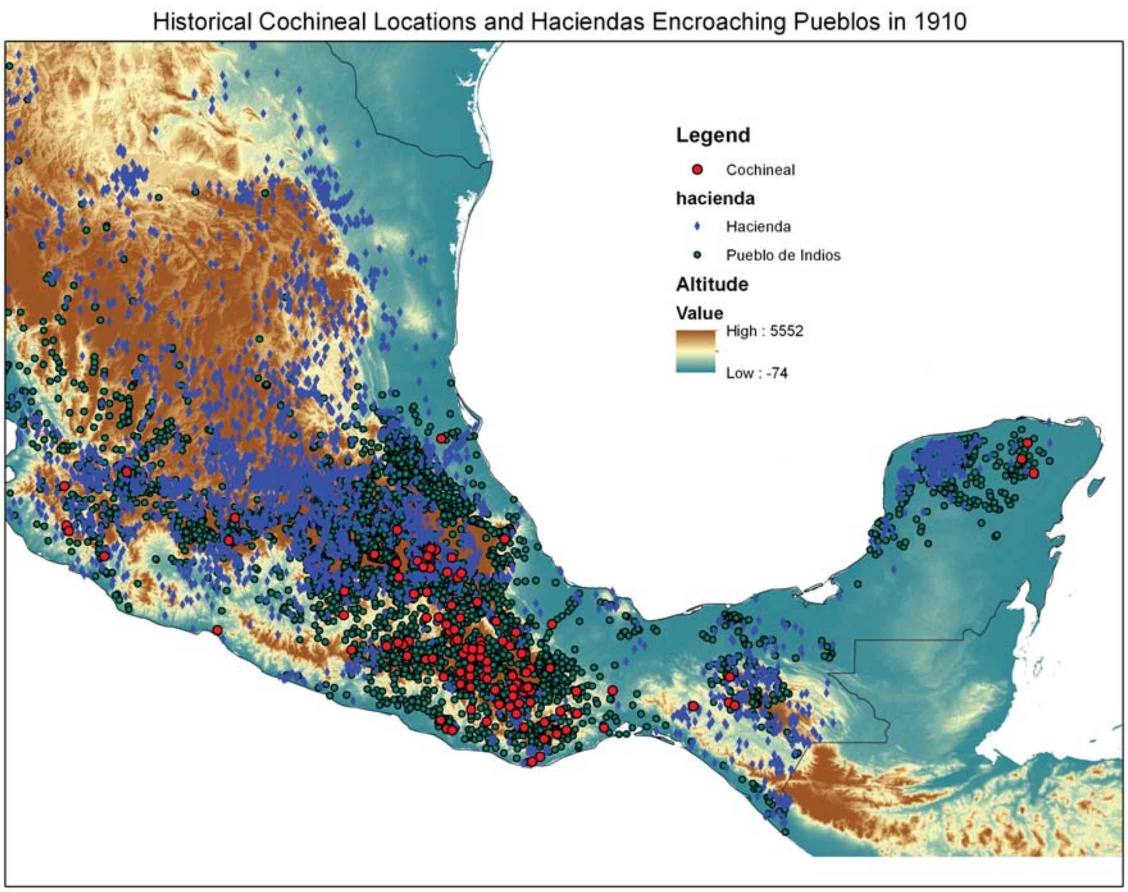


Figure 4: **Hacienda Encroachment on the Pueblos de Indios**

[5]Some haciendas did emerge in the Vale of Oaxaca to cultivate cochineal, but the vast majority of production remained on small plots (Donkin, 1977). *Op cit Taylor.*

These patterns also appear confirmed by historical accounts. 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 ...

A second feature of cochineal production was that it 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). Though indigenous producers did have some initial human capital advantages in raising cochineal, 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.[6] Instead, there appears to have been ethnically-based specialization, with Spanish traders providing credit and access to the world market to Indian producers.

Third, the main contractual form that supported the cochineal industry, the *Repartimiento*, 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 pesos to indigenous producers for each pound of cochineal six months before harvest. This was considered a "fair" price", and did not fluctuate much over time (Baskes, 2000)[62-92] despite large-scale spot price fluctuations (Figure 1).[7] To the extent that

[6]For example, production did move within ethnically very different areas of New Spain, such as between Tlaxcala and Oaxaca, and was later introduced successfully in Guatemala and ultimately the Canary Islands.

[7]Such patterns can also be consistent with optimizing behaviour. See Athey, Bagwell, and Sanchirico

cochineal producers were financed by the repartimiento, then the downside risk, and the exposure to world markets was borne by the alcalde mayor (naturally, when self-financed, the risk was borne by the individual producers). In practice however, when prices for cochineal were high, Indians could 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].

Similarly, in the 1670s, Friar Francisco de Burgoa described the Chontal people of the highlands, reputed 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,

(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.

so elegant, that many wear silk and use silverware [...] ride horses in good saddles..." (Dahlberg, p.19)

Interestingly, the cochineal producers in the towns Baskes mentioned were well-connected either by road or topography to alternative markets, and the Chontal Indians were far from any Alcaldia Mayor, due to their location in the mountains of Oaxaca. Consistent with Figure ??, the combination of cochineal and difficulties in enforcing repartimientos (and not the teachings of the friars, as Burgoa would want us to think in his Chronicle) may have allowed the Chontals to profit more than their counterparts in the seats of Spanish administrative control, where Alcaldes Mayores held firmer control of the indigenous populations.

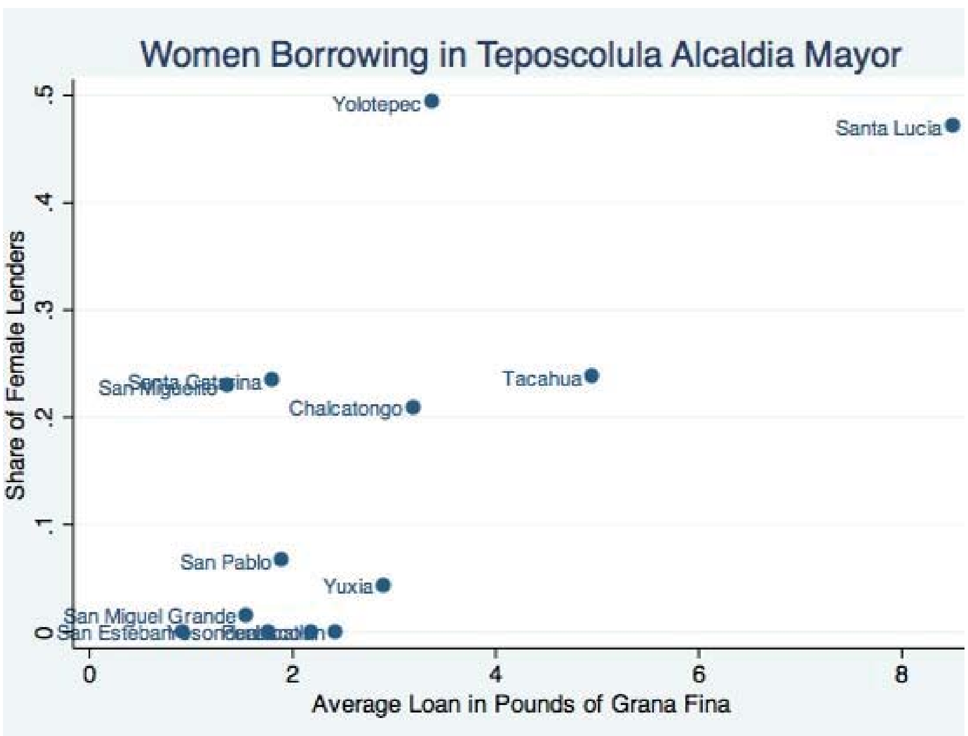


Figure 5: Female cochineal producers and loan sizes in Teposcolula, 17th century

In essence, therefore, the lack of ability to verify negative shocks to production resulted in a contract where members of the indigenous population were insured against world market fluctuations on the downside but possessed a call option through their ability to 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.

Further, cochineal may have had key effects on providing, not just market access, but access for women in particular. Because 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, Giuliano, and Nunn, 2011, Qian, 2008)). 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. In fact, surviving individual loan data, for the Alcalde Mayor of Teposcolula suggests, in a manner intriguingly reminiscent of modern micro-credit, that loans appear to have been larger for cochineal producers that included larger shares of women (Figure 5).

The incentives to communicate and the human capital gained from direct rather than intermediated access to the world market, we suggest, may have played as much, if not a greater role than the wealth from cochineal itself, 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 regions 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. Indeed as Figure 6 suggests, colonial cochineal producers does not appear to show clear differences in two key pre-trend dimensions: in their proximity to pre-Columbian towns or Catholic missions set up at the time of the Conquest - which are arguably good indicators of pre-colonial population concentrations (Diaz-Cayeros, 2010).

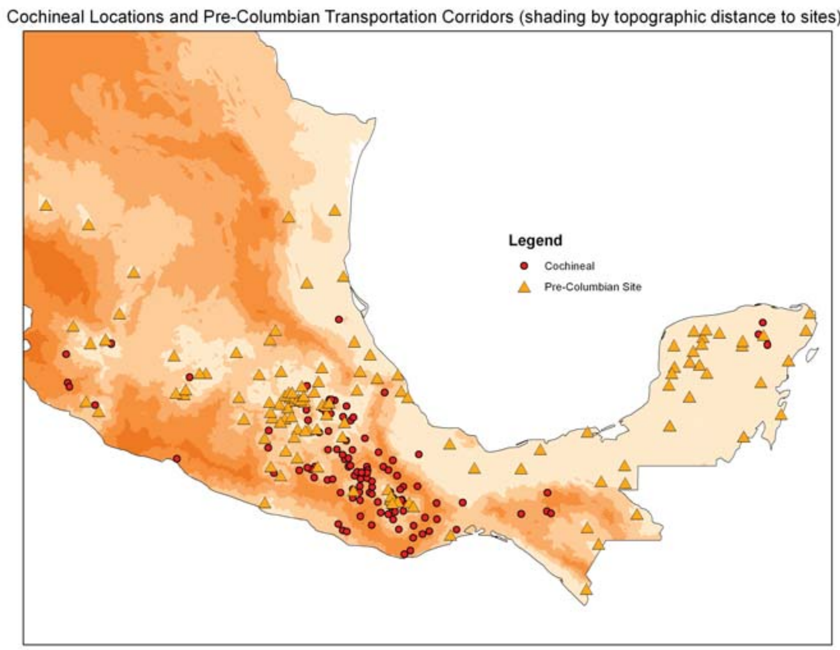
In our benchmark specification, we will run cross-sectional regressions comparing those municipalities that contained Indian pueblos in 1790.

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

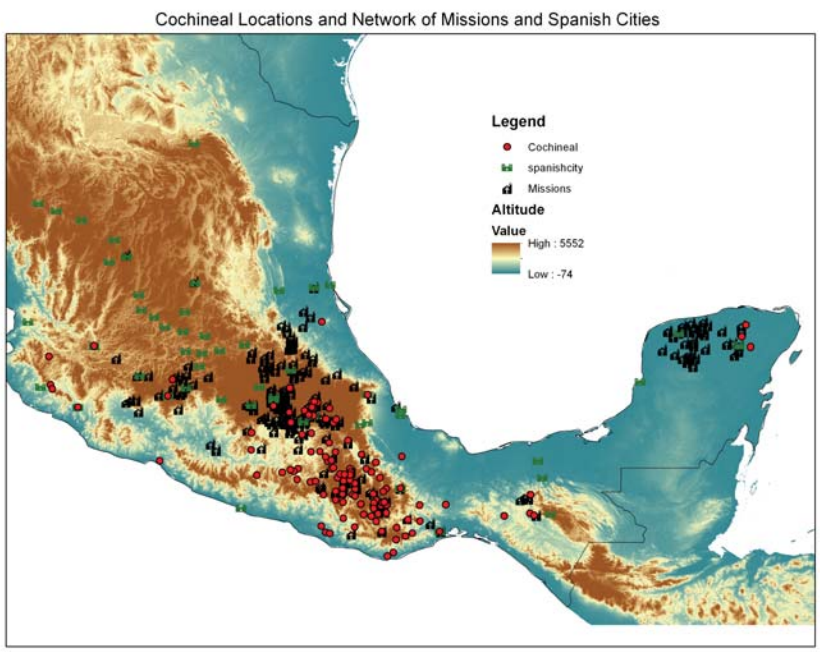
Where y_i is a set of 18th and 21st century measures of poverty, female literacy, ethnic identity and public goods provision as well as whether the municipality has chosen to explicitly adopt traditional governance institutions (*usos y costumbres*). Since only the historically cochineal-growing state of Oaxaca has so far implemented laws recognizing *usos*, we implement these specifications both for all Mexico and 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 (higher order polynomials in latitude, longitude and altitude). $Clim_i$ is a set of climatic conditions– polynomials in temperature and precipitation. We also include X_i- cultural initial conditions which



(a) Heatmap of proximity to pre-Columbian archeological sites



(b) Location of Conquest-Era Missions

Figure 6: **Cochineal Production and Initial Conditions**
Colonial-era cochineal-producing pueblos do not appear to be systematically close to pre-Columbian archaeological sites or to Catholic missions established at the time of the Conquest, both arguably good indicators of pre-Columbian and Conquest-era native population concentrations

include distance to pre-Columbian native population or administrative centres and to Conquest-period missions, which, as just mentioned, are arguably a good measure of the native population at the time of the Conquest. We use robust standard errors.[8]

Though we attempt to identify all cochineal growing areas, there is a possibility that Spanish colonial sources might have underestimated the extent to which cochineal was grown in remote areas. To address this source of bias, we exploit the particular climactic requirements of cochineal to compare areas that happen to be in the optimal growing area for cochineal to generate a fuzzy discontinuity in geographical and climactic spaces.

As mentioned above, cochineal cultivation was highly dependent on favorable 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. frosts and temperatures above 30 C).[9]

The first stage regression is of the following form:

$$Cochineal_i = \zeta OptimalClim_i + + \sum_j^4 \gamma_j Geog_i^j + \sum_j^2 \xi_j Clim_i^j + X_i B + \nu_i \qquad (2)$$

By including the polynomials 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 two cochineal producing regions- Puebla and Tlaxcala- for which reliable tree-ring reconstructions are possible (Figure 7).

[8]Clustering the standard errors at the modern province level does not affect the results substantively, but adds anachronism.

[9]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.)

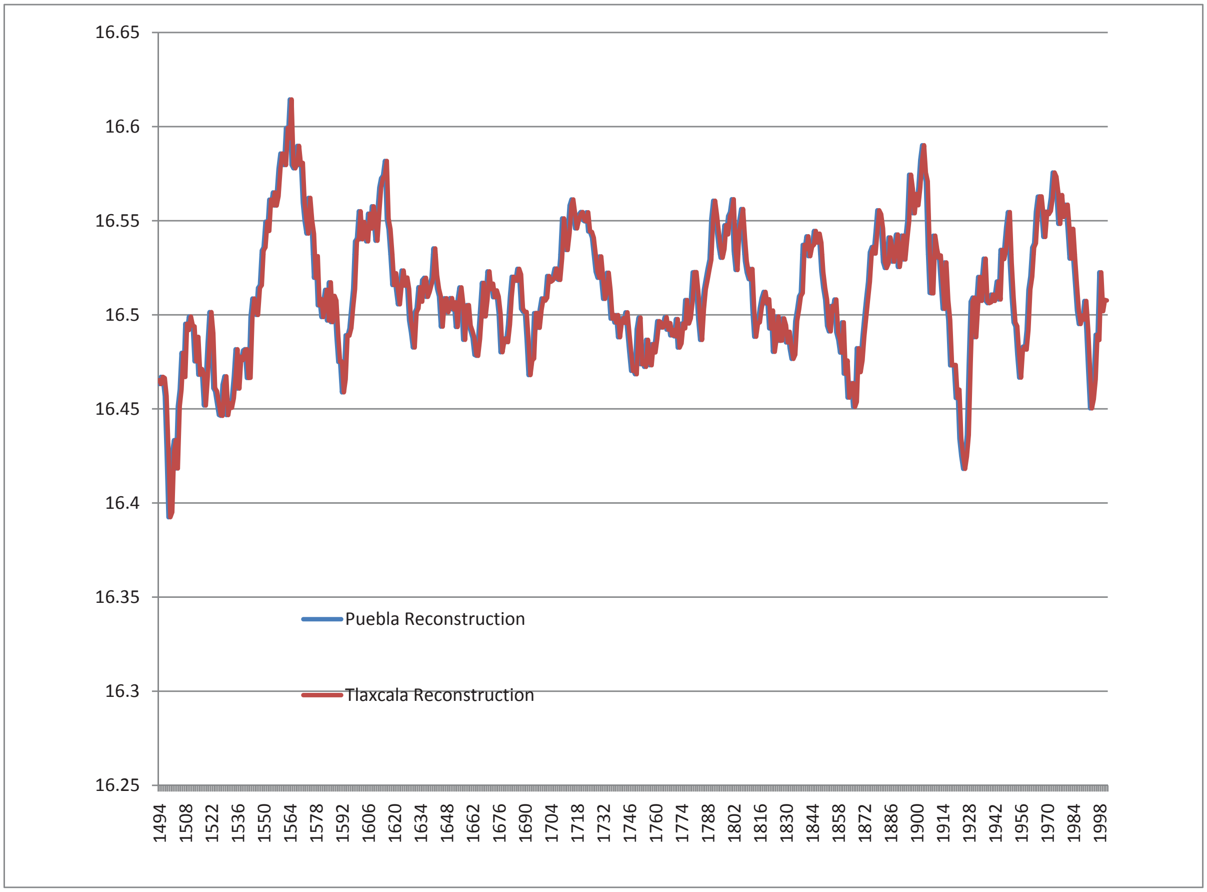


Figure 7: **Temperature fluctuations in Tlaxcala and Puebla over 5 centuries from tree-ring data.**

4 Data

We geographically identify 124 cochineal growing locations using a variety of colonial sources. We relied primarily on the appendix compiled by Donkin (1977), which lists cochineal producing towns on the basis of the *Matricula de Tributos* for the precolonial period; the *Suma de Visitas* for the early 16th century; the *Relaciones Geograficas de Indias* for the late 16th Century; the *Memoriales del Obispo de Tlaxcala* by Alonso de la Mota y Escobar for the 17th century; and B. Dahlgren de Jordan for the 18th century, as well as some additional secondary sources.

We cross-examined this 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 and specific town locations. There was substantial overlap in the two listings.[10]

The sources we have used were explicitly designed by colonial administrators for the purpose of identifying cochineal production and trade.[11] Our data sources thus enable us not only to identify cochineal growing regions, but also the specific century when production was taking place.[12]

We geo-referenced all cochineal locations to their modern locality, using the *Archivo Historico de Localidades* (AHL) produced by the Mexican National Statistical Institute, INEGI.[13] We failed to identify only 3 towns, which are not included in our dataset.

In order to limit the range of our comparisons only to the territorial extent of the settled areas of the New Spain we geographically identify the Indian *pueblos* and Spanish cities (*ciudades* and *villas*) at the end of the colonial period. We take advantage of the georeferenced 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, the end of the colonial period. We matched each of the more than 4500 pueblos to its modern

[10]We did not pursue around two dozen potential locations that are mentioned in AGN documents but are not in the more comprehensive colonial documents. We decided not to invest research resources on archival work for those towns because the AGN documents are most likely mentions in passing of towns that may not be growing cochineal or if they were, they are most likely small villages surrounding the main cochineal growing regions.

[11]For example, the *Matricula de Tributos* is an Aztec document that Cortez seized from Moctezuma, which identifies tributary provinces and towns, specifying cochineal taxed in kind by the Colohua-Mexica Empire. 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.

[12]Some of the *Relaciones Geograficas* of the late 16th century have been lost and that there might be some missing data for relevant growing regions in a given century, but we are quite confident that we have included all the relevant towns where this activity existed in the colonial period, and if there are any missing towns, they are most likely in the immediate vicinity of the ones we have located.

[13]The AHL is a comprehensive geographic gazetteer that includes not only the modern place names, but variations in their spellings as well as brief references to the etymology and history of the towns. Due to changes in spelling and place names, as well as multiple modern possibilities with the same place name, we searched for confirmatory evidence to make sure we have identified the correct locality. For example, there are 10 modern localities in the state of Puebla with the name Acatlan, but we narrowed down the cochineal growing one to Acatlan de Osorio (INEGI code 210030001). Or a misspelled location Ahuatlan, Oaxaca, was identified as Miahuatlan de Porfirio Diaz (200590001).

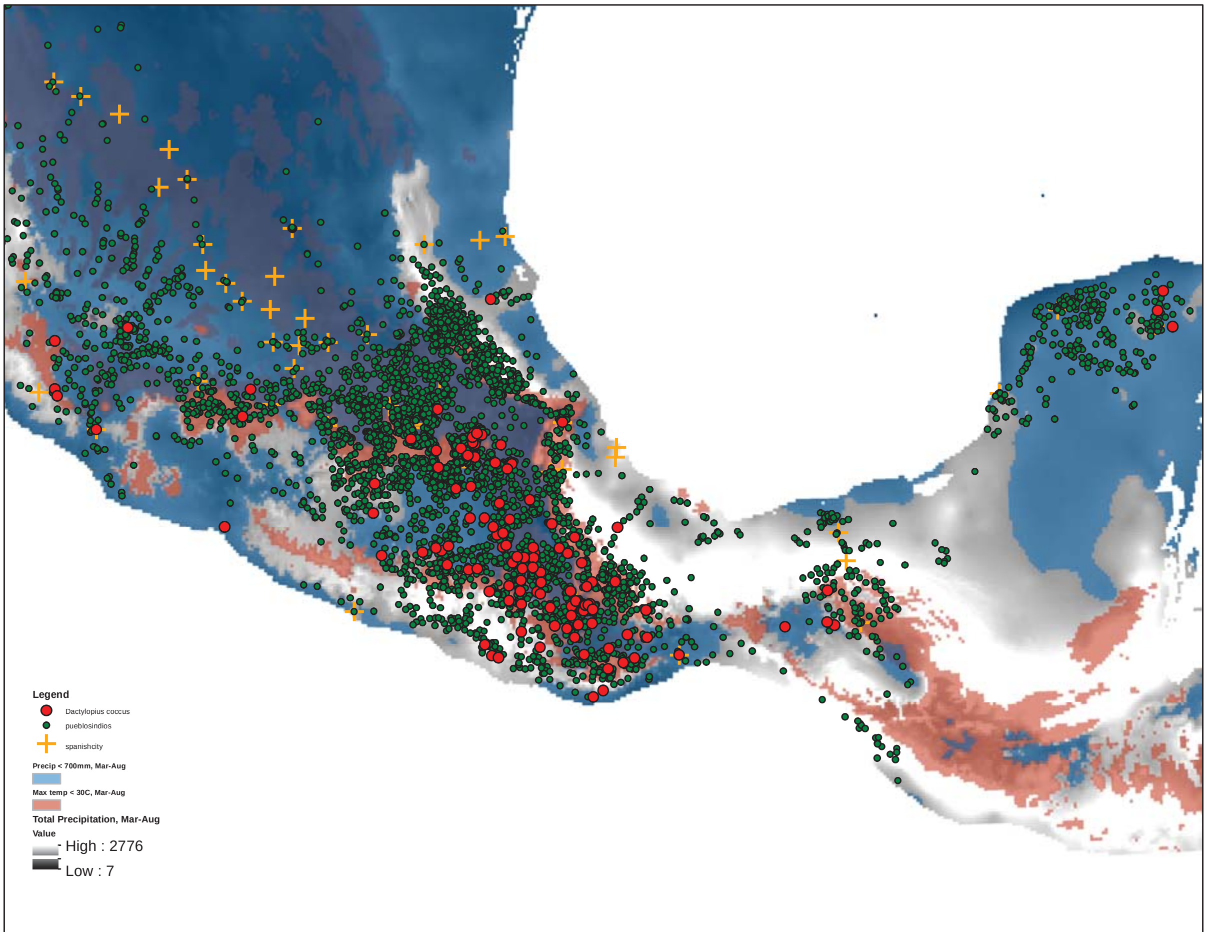


Figure 8: **Optimal growing conditions and cochineal production.** Red dots denote cochineal (*dactylopius coccus*) producing locations in the colonial period. Green dots denote the locations of Indian towns (*pueblos de indios*) that existed in 1790. Darker areas denote higher precipitation. Overlaid purple regions denote areas that satisfied all three climactic conditions for growing cochineal.

locality. Given that there is some uncertainty regarding externalities in the production of cochineal between localities, and that in urban areas pueblos have become part of larger metropolitan areas, we end up using modern municipalities as the geographic units of analysis. Thus, instead of having around 2500 municipalities, we restrict attention to 1700 municipalities that contained colonial-era pueblos de indios (see Figure 2). For further details of the data, please see the Data Appendix.

5 Results

(Figure 8) overlays the conditions for cochineal growing with actual cochineal growing among Indian pueblos, providing the 2-dimensional geographical equivalent of a univariate regression discontinuity plot (Dell, forthcoming). Notice that pueblos that satisfy none of the conditions were very unlikely to produce cochineal, while adding each condition sequentially raises the likelihood of doing so, such that there is an additional, discontinuous benefit from falling the optimal growing area. We can exploit each discontinuity separately as well as combine them into a single "optimal growing region" variable. The results are consistent using either specification, though in what follows we focus on the simple univariate specification.

As Table 1 reveals, the discontinuities in the graphical relationship in geographical space are reflected in multivariate regressions of the propensity to produce cochineal in the colonial period. Notice first that cochineal producing municipalities do not seem to be systematically related to the level of pre-Columbian development and Conquest-era population densities as measured by either proximity to pre-Columbian cities or to monasteries established at the time of the Conquest. However, there is strongly significant and robust positive increase of around 3 to 5 percentage points of the presence of optimal growing conditions for cochineal on whether a pueblo within the municipality was recorded as having grown cochineal in the colonial period (1520-1820) (thus close to the mean propensity to produce cochineal of around 5 percentage points). This is true controlling flexibly (using quadratic and quartic specifications) for latitude, altitude and longitude (Cols 1-9) and comparing municipalities within the same state (Cols 3-5,7-8). Cols 4-9 add polynomial controls for average precipitation and temperature, but do not significantly alter the increase due to optimal growing conditions.[14]

Subsetting the data to those municipalities within 100 km (62 miles) of the optimal

[14] The F-test of the univariate instrument exceeds the Stock-Yogo criteria for weak instruments for a number of specifications.

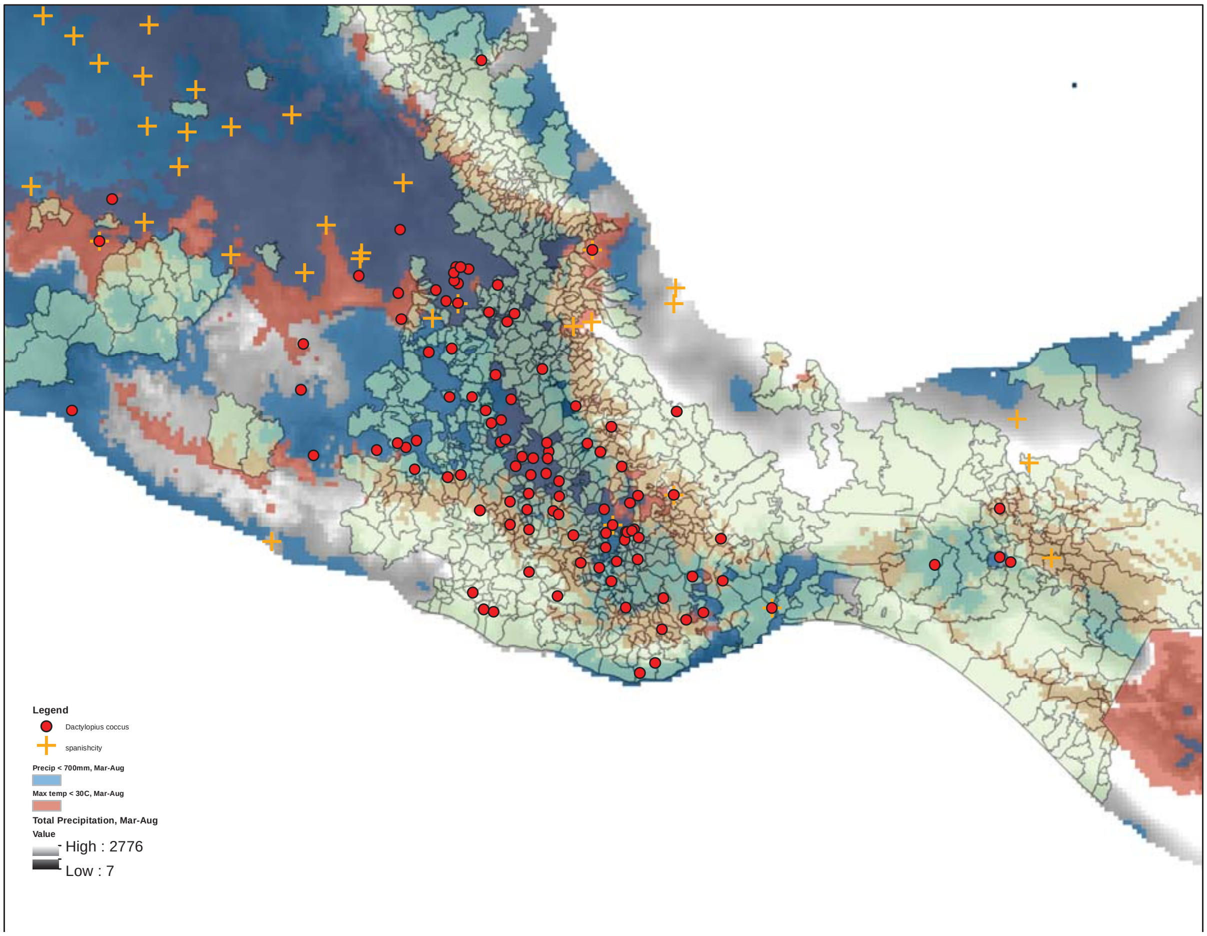


Figure 9: **Cochineal production and poor Southern Mexican municipalities (2001 CIMMYT data).**

growing frontier halves the sample but yields very consistent results (Cols 6-8). Finally comparing only those 451 municipalities within the cochineal-rich state of Oaxaca that once had Indian pueblos raises the effect of the confluence of optimal growing conditions on growing cochineal to around 10 percentage points.

Figure 9 shows an important outcome of interest– those municipalities designated "poor" in 2001 and how they related spatially to the incidence of historical cochineal production and climatic conditions, zooming into 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.

These visible differences are also reflected in the effect of cochineal in reducing head-count poverty ratio by around 10 percentage points and raising female literacy rates 5 percentage points seen in the OLS specifications in Table 2. Observe that these effects are remarkably robust and stable across specifications, including matching in both geographical and climatic space and comparing within municipalities within the same state within 100km and 75km of the optimal growing frontier as well as within the state of Oaxaca (Cols 1-9). The "fuzzy" regression discontinuity results (Cols 9-13) reveal broadly consistent results in sign (and in the most tight comparisons (Cols 12-13), magnitude) for poverty, though the effects are not precisely estimated. At the same time, the equivalent results on female literacy rates are unequivocally significant and robust: female literacy rates in regions that produced cochineal because they happened to fall in the growing region are around 50 percentage points higher than those municipalities just outside the region in both geographical and climate space (Cols 9-13).

The reduction in overall poverty and the rise in female literacy are consistent with two features of the Repartimiento contract that underlied cochineal production– the downside insurance provided by Repartimiento credit to poor farmers by providing a price floor for cochineal, along with the role of cochineal in providing women in particular access to a valued market activity. The relatively greater size of the fuzzy regression discontinuity results are consistent with the possibility that we may be underestimating the location of cochineal growing areas by using the actual mentions in colonial sources.

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

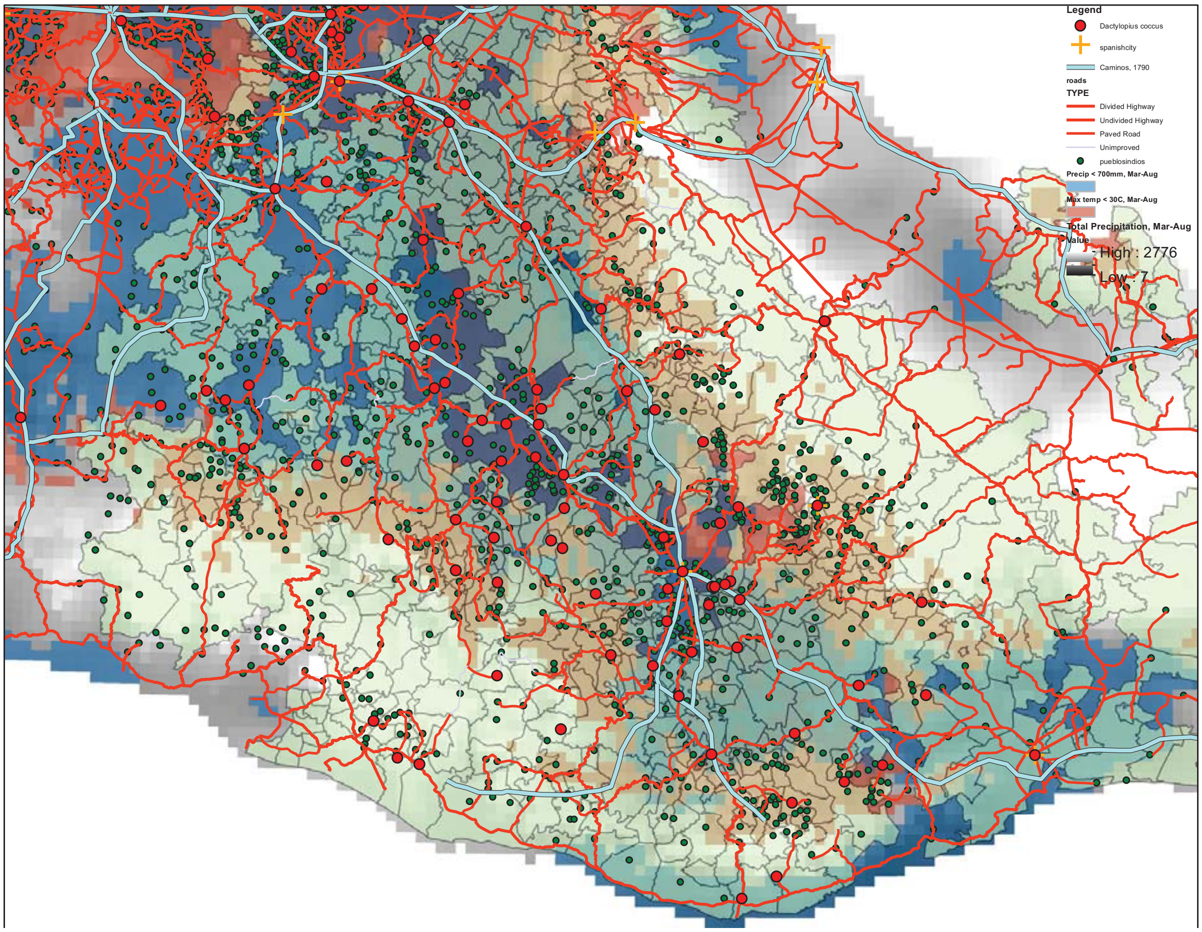


Figure 10: **Cochineal production and the evolution of road networks in Southern Mexico.** The light blue lines denote the road networks of New Spain (1790), as documented by Gerhard (1993). The red lines represent modern roads.

diverse.[15] However, Table 3 shows the effect of a legacy of cochineal production on the proportion of people in a municipality speaking an indigenous language, and decomposing this figure into those that are monolingual and bilingual. A consistent picture emerges– a legacy of cochineal production reduces the proportion speaking an indigenous language by 6 percentage points across OLS specifications. Furthermore, the effect is mainly to reduce the number that are monolingual in an indigenous language in a municipality. Even within poor, ethnically diverse Oaxaca, residents of municipalities who produced

[15]Cross-state evidence shows that these states also show relatively higher incidence of O- blood types, a blood type that is much more common among indigenous Mexicans than among those of Spanish origins.

cochineal as they were on the frontier of the optimal growing region were 0.56 percentage points less likely to be monolingual (Panel C, Col. 13). Paradoxically, 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.

Table 4 suggests two reasons why this might be the case: cochineal producing municipalities are now more unequal (Panel A), and also have greater access to the modern road network (Panel B). Both of these effects are consistent with the Repartimiento contract and the incentives of global trade. The riskiness of cochineal production and the "call option" that allowed cochineal producers to renege on the Repartimiento contract by selling cochineal at the market rate when prices were high is likely to lead to ex post inequality. At the same time, access to cochineal-producing areas was valuable to Spanish local administrators, as this facilitated monitoring of contracts as well as reducing the transportation costs of cochineal production. Since the local administrators were themselves the main financiers of cochineal production, it is likely that the colonial road network adapted itself towards cochineal producing areas. As noted above, cochineal producing pueblos were not any closer on average to pre-Columbian sites. Furthermore, lacking the need to design around Spanish-introduced mules, horses and in fact any pack animal, pre-Columbian roads in Mexico tended to be superceded by a relatively independently-created colonial road network that was built to link the newly-created Spanish *cuidades*. However, Figure 10 shows road networks in 1790 (Gerhard, 1993) and the network of paved roads today. While many Indian pueblos were bypassed, cochineal producing pueblos appear to have been systematic beneficiaries of the expansion of the road network, providing visual confirmation of Table 4(Panel B).

The presence of increased inequality and ease of access to outside opportunities provides an explanation for the decline of indigenous identity and the relative assimilation of cochineal-producing areas, 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. These governance institutions, while potentially playing an important risk-sharing role in many communities, are likely to less important in an environment where Repartimiento contracts for cochineal provided risk insurance (and reduced poverty) instead. On the other hand, increased inequality and ease of mobility is likely to have encouraged the most productive members "opt" out by hispanicizing.[16] Indeed, as Panel C, suggests, cochineal producing municipalities, both exploiting cross-state variation and looking within Oaxaca, were much less likely to opt for formalizing the use of highly redistributive indigenous governance institutions (*usos y costumbres*).

Despite having failed to maintain indigenous governance, as Table 5 reveals, municipalities with a legacy of producing cochineal are at least as good as nearby areas at providing public goods such as water, electricity and drains to their populations. Thus it appears that increased inequalities and the failure to maintain traditional institutions have not had a deleterious effect on these indicators of development.[17]

6 Alcaldia proximity and the sharing of gains from trade

[**this section, in progress**] To support our claims that contract enforceability was crucial 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* we examined in the Phillips Collection (MS 15796) of the New York Public Library. In this section, we will provide a preliminary visual presentation of this evidence.

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

[17] We can assess other mechanisms as well. The results do not appear to be due to land tenure arrangements or uncertainty, such as the hacienda or ejidos (results not shown).

The *Yndize* lists every Alcaldia Mayor ranked by a "class" and including a brief explanation of the production that underpins this ranking.[18]

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.[19]

Figure 11 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 Gerhart. Notice first that the chances that a particular jurisdiction will be considered by the Yndize as 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 are often ranked in a lower class. Figure 12 shows how these relationships predict the extent of widespread poverty in Mexican municipalities in 2000. Interestingly, there appears to be a reversal of fortune in certain jurisdictions. Alcaldia seats that were among the most lucrative for the Spanish have high proportions of the poor today. In contrast, cochineal producers that lay between a number of different alcaldia jurisdictions, even when off the major Spanish roads, actually appear once again as islands of relative affluence.

[18]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.

[19]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.

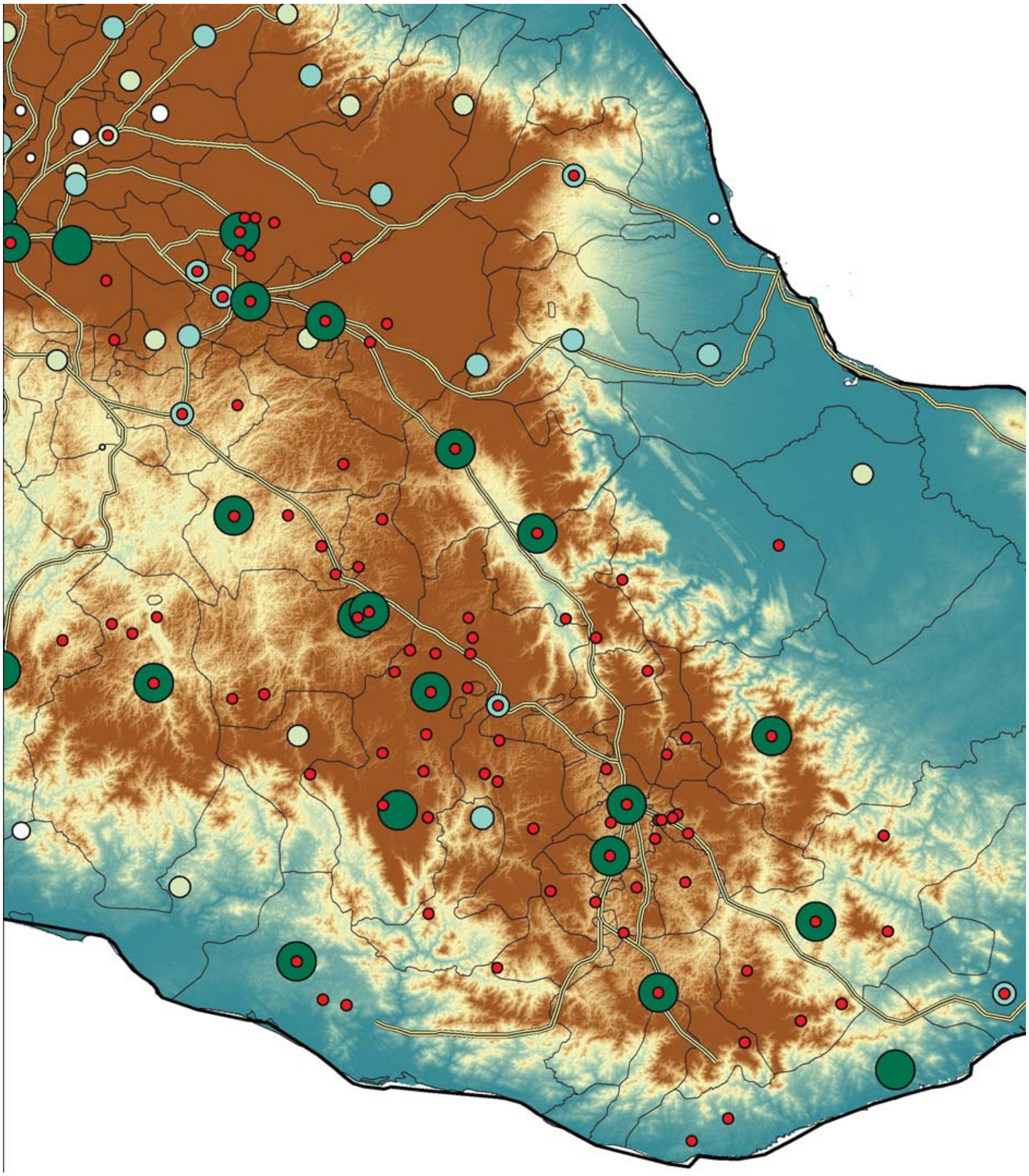


Figure 11: **Alcaldia Mayor and Cochineal Growing Pueblos Locations**:The Alcaldias Mayores are denoted in green, with larger and darker circles for the most lucrative jurisdictions (Class 1) according to the *Yndize*, and a gradually smaller and lighter circles for those alcaldias ranked as being less lucrative. The cochineal growing pueblos are denoted in red.

These results are reflected in Tables 6 and 7. Note that the effect of exposure to trade due to cochineal on contemporary poverty and female literacy rates are greatest where the costs of reneging on contracts was greatest: the distance to the second closest alcaldia market are lowest. The probability of officially adopting indigenous governance institutions (*usos*) are also the most likely to be undermined (Table 8).

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.

While 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

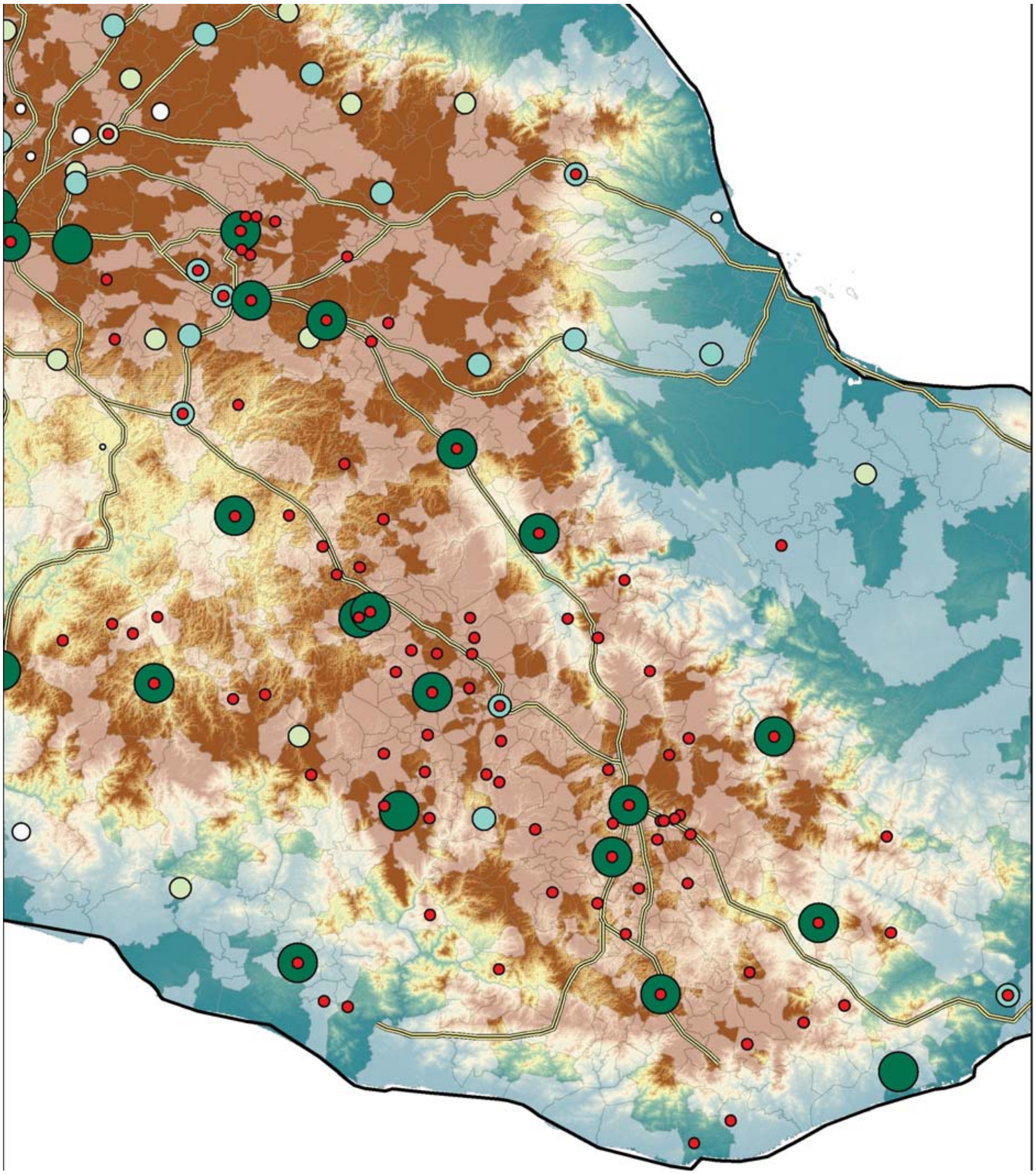


Figure 12: **Cochineal Production in the Colonial Era, Alcaldias Mayores and Poverty in 2000**. The lightly shaded areas are poor municipalities with more than 50 percent of the population in extreme poverty.

demand, opium was a highly lucrative Indian export. 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).

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, 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.

8 Data Appendix

For the vector of geographic conditions we use latitude, longitude and altitude. Longitude and latitude are measured in degrees, calculated at the geographic centroid of each municipality using ArcGIS. Altitude is calculated as the average of each municipality, measured in meters, using the Digital Elevation Model with a horizontal grid spacing of 30 arc seconds (approximately 1 kilometer) produced by the US Geological Survey EROS Data Center.

For the climatic data we have used two distinct data sources. For each municipality we calculated the average rainfall and temperature according, to the official climatology maps of the Mexican National Statistical Office, INEGI. The data was collected from meteorological stations from 1921 to 1975 and processed in 2000. For the monthly data on precipitation we used a 30 arc second resolution database from Worldclim, version 1.4, interpolated by Hijmans, Cameron, Parra, Jones, and Jarvis (2005). The monthly data is calculated for the 1950-2000 period. This monthly data is used to restrict the optimal cochineal growing regions as those that during the main growing season (March to August) are always below 700 mm and did not experience frosts and temperatures above 30 degrees Celsius.

To control for the initial conditions before the colonial period, we have calculated hiker distances to the main archeological sites that were developed before the conquest and the hiker distance to the network of missions established by the Dominican, Augustine and Franciscan religious orders during the 16th century. These topographic distances are averaged over the municipality. Hiker distances are used because the available means of transportation without horses or mules meant that the network of urban settlements and transportation corridors was connected through trails that followed the valleys and areas of relatively easy access. We use the most important archeological sites, which are the 170 sites open to the public.

Given the high mortality that characterized the 16th century we cannot use population headcounts during the first century of contact as a measure of population density or settlement patterns. Those population figures most likely reflect differential mortality rates across pueblos. Instead, we use the network of missions, which gives us a proxy for the population density and the network that connected Indian society before the time of contact. The three religious orders competed during the 16th century seeking to place their missions in the places where they could maximize Christianization and access to Indian communities. The geocoding of missions is made on the basis of the maps provided by Kubler (1948). Details on the calculation of hiker distances, which use the slope of the terrain, can be found in Diaz-Cayeros (2010).

The data used for the contemporary measures of development, ethnic composition, inequality and local public goods provision we calculate the following indicators from official INEGI 2000 census data:

Female literacy rates (*Alfamujeres*): women over 12 years old who cannot read or write. *Indigenous*: percent of municipal inhabitants over 5 years old who speak an indigenous language. *Bilingual*: percent of municipal inhabitants over 5 years old who speak Spanish and an indigenous language. *Monolingual*: percent of municipal inhabitants over 5 years old who speak an indigenous language but do not speak Spanish. *Inequality*: Gini coefficients calculated by Jensen and Rosas (2007) on the basis of the household income reported in the census, measured as multiples of the minimum wage.

Distance to roads is calculated as the Euclidean distance to the main roads as of 2000 from INEGI, calculated with ArcGIS.

Usos y Costumbres is a dummy variables denoting the municipalities that elect mayors through traditional methods instead of partisan elections. The source for this data is the Electoral Institute of Oaxaca.

Poverty headcount ratio (*paliha*) is a poverty headcount at the municipal level calculated by the Mexican Commission for Social Evaluation (CONEVAL) on the basis of a small area estimation using the 2002 income distribution survey (ENIGH) and the 2000 census.

References

Abramitzky, R. (2008): "Limits of Equality: Lessons from the Israeli Kibbutz," *Quarterly Journal of Economics*, pp. 1111–1159.

Acemoglu, D., S. Johnson, and J. A. Robinson (2002): "Reversal of fortune: geography and institutions in the making of the modern world income distribution," *Quarterly Journal of Economics*, 117, 1231–1294.

Alesina, A., P. Giuliano, and N. Nunn (2011): "On the Origin of Gender Roles: Women and the Plough," working paper 17098, NBER.

Alesina, A., and E. La Ferrara (2005): "Ethnic diversity and economic performance," *Journal of Economic Literature*, 43(3), 762–800.

Athey, S. C., K. Bagwell, and C. Sanchirico (2003): "Collusion and price rigidity," *Review of Economic Studies*, forthcoming.

Banerjee, A. V., and A. F. Newman (1998): "Information, the dual economy and development," *Review of Economic Studies*, 65(225), 631–653.

Baskes, J. (2000): *Indians, merchants and markets: a reinterpretation of the Repartimento and Spanish-Indian economic relations in colonial Oaxaca, 1750-1821*. Stanford University Press.

——— (2005): "Colonial institutions and cross-cultural trade: Repartimento credit and indigenous production of cochineal in eighteenth century Oaxaca, Mexico," *Journal of Economic History*, 65(1), 186–210.

Bisin, A., and T. Verdier (2001): "The economics of cultural transmission and the dynamics of preferences," *Journal of Economic Theory*, 97(2), 298–319.

——— (2011): "The Economics of Cultural Transmission and Socialization," in *Handbook of Social Economics*, ed. by J. Benhabib, A. Bisin, and M. O. Jackson, chap. 9. North Holland.

Caplan, K. D. (2010): *Indigenous Citizens: Local Liberalism in Early National Oaxaca and Yucatan*. Stanford University Press, Stanford, CA.

Dahlgren, B., and B. de Jordán (1990): *La Grana Cochinilla*, Instituto de investigaciones anthropológicas. Universidad Nacional Autónoma de México.

Dell, M. (forthcoming): "The Persistent Effects of Peru's Mining Mita," *Econometrica*.

Diaz-Cayeros, A. (2010): "Indian identity, poverty and colonial development in Mexico," Paper presented at Stanford.

Donkin, R. (1977): "Spanish Red: An Ethnogeographical Study of Cochineal and the Opuntia Cactus," *Transactions of the American Philosophical Society*, 67(5), 1–84.

Engerman, S. L., and K. L. Sokoloff (2000): "Institutions, factor endowments and paths of development in the New World," *Journal of Economic Perspectives*, 14(3), 217–32.

Evans, P. (1979): *Dependent Development: The Alliance of Multinational, State, and Local Capital in Brazil*, Princeton paperbacks. Princeton University Press.

Farooqui, A. (2005): *Smuggling as subversion : colonialism, Indian merchants, and the politics of opium*. Lexington Books.

Gerhard, P. (1993): *A guide to the historical geography of New Spain*. University of Oklahoma Press.

Gomez de Cervantes, G. (1599): *La vida económica y social de Nueva España el finalizar el siglo XVI*. 1944 edn.

Greenfield, A. B. (2005): *A Perfect Red: Empire, espionage and the quest for the color of desire*. HarperCollins, New York, 2006 edition edn.

Hart, O., and J. Moore (1990): "Property rights and the nature of the firm," *Journal of Political Economy*, 98, 1119–58.

Hijmans, R., S. Cameron, J. Parra, P. Jones, and A. Jarvis (2005): "Very high resolution interpolated climate surfaces for global land areas," *International Journal of Climatology*, 25, 1965–1978.

Jensen, N. M., and G. Rosas (2007): "Foreign Direct Investment and Income Inequality in Mexico, 1990-2000," *International Organization*, 61(3), 467–487.

Jha, S. (2008a): "A theory of trade, ethnic cronyism and tolerance," Stanford GSB (mimeo).

——— (2008b): "Trade, institutions and religious tolerance: evidence from India," GSB Research Paper 2004, Stanford Graduate School of Business, Stanford CA.

Keay, J. (1991): *The Honourable Company: a history of the English East India Company*. Macmillan, New York, NY.

Kranton, R., and A. Swamy (2008): "Contracts, Hold-Up and Exports: Textiles and Opium in Colonial India," *American Economic Review*, 98(3), 967–89.

Kubler, G. (1948): *Mexican Architecture in the Sixteenth Century*. Yale University Press, New Haven.

Lee, R. (1948): "Cochineal Production and Trade in New Spain to 1600," *The Americas*, 4(4), 449–473.

Marichal, C. (2001): "A forgotten chapter of international trade: Mexican cochineal and European demand for American dyes, 1550-1850," Paper presented to the Conference on "Latin America Global Trade", Stanford.

McMillan, J. (2002): *Reinventing the Bazaar: a natural history of markets*. W.W. Norton & Co., New York.

McMillan, J., and C. Woodruff (1999): "Interfirm relationships and informal credit in Vietnam," *Quarterly Journal of Economics*, 114, 1285–1320.

Munshi, K., and M. Rosenzweig (2009): "Why is mobility in India so low? Social insurance, inequality and growth," working paper 14850, NBER.

Nunn, N. (2008): "The Long Term Effects of Africa's Slave Trades," *Quarterly Journal of Economics*, 123(1), 139–176.

Nunn, N., and L. Wantchekon (forthcoming): "The Slave Trade and the Origins of Mistrust in Africa," *American Economic Review*.

Pastor, R. (1987): *Campesinos y reformas: La mixteca, 1700-1856*. Colegio de Mexico.

Qian, N. (2008): "Missing Women and the Price of Tea in China: The Effect of Sex-Specific Earnings on Sex Imbalance," *Quarterly Journal of Economics*, 123(3), 1251–1285.

Richards, J. F. (2002): "The opium industry in British India," *Indian Economic and Social History Review*, 39, 149–80.

Scott, J. (1985): *Weapons of the weak: everyday forms of peasant resistance*. Yale University Press.

Tanck de Estrada, D. (2005): *Atlas ilustrado de los pueblos de indios : Nueva España, 1800*. Colegio de Mexico.

Wallerstein, I. (1979): *The Capitalist World-Economy*, Studies in Modern Capitalism. Cambridge University Press.

Table 1: **Regression: Cochineal in the colonial period**

Municipalities containing 1790 pueblos only	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
							State FE,	State FE,	Oaxaca
	OLS	OLS	State FE	State FE	State FE	<100km	<100km	<100km	only
Optimal growing conditions in municipality	0.041***	0.047***	0.037***	0.035***	0.031**	0.031*	0.030*	0.037**	0.103**
	[0.014]	[0.014]	[0.014]	[0.013]	[0.014]	[0.017]	[0.017]	[0.018]	[0.042]
Hiker's distance to pre-Columbian sites, 1000km	0.107	0.024	0.070	0.020	0.048	-0.060	0.257	0.189	0.068
	[0.134]	[0.141]	[0.145]	[0.137]	[0.144]	[0.236]	[0.264]	[0.261]	[0.299]
Hiker's distance to monasteries (16C), 1000km	-0.064	-0.016	-0.117	-0.114	-0.181	0.121	-0.373	-0.428	-0.116
	[0.115]	[0.123]	[0.131]	[0.126]	[0.134]	[0.242]	[0.275]	[0.271]	[0.370]
Average precipitation (m)				0.026***	0.026***	0.025	0.032*	0.027*	0.046***
				[0.007]	[0.008]	[0.016]	[0.016]	[0.016]	[0.017]
Average precipitation^2				-0.003***	-0.003***	-0.003	-0.004	-0.003	-0.004*
				[0.001]	[0.001]	[0.003]	[0.003]	[0.003]	[0.003]
Temperature (^{o} C)				0.007*	0.009**	0.009*	0.009*	0.009*	0.018
				[0.004]	[0.004]	[0.005]	[0.005]	[0.005]	[0.012]
Temperature^2				0.000	-0.000*	0.000	-0.000*	0.000	0.000
				[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Quadratic in Lat, Long, Altitude	Y	Y	Y	N	Y	Y	Y	Y	Y
Quartic in Lat, Long, Altitude	N	Y	N	N	N	N	N	Y	N
F-test (Optimal Growing = 0)	9.11	10.91	7.15	6.83	5.37	3.15	3.11	4.38	5.89
Prob>F	0.00	0.00	0.01	0.01	0.02	0.08	0.08	0.04	0.02
Observations	1707	1707	1707	1717	1707	975	975	975	451
R-squared	0.04	0.05	0.05	0.06	0.06	0.06	0.08	0.09	0.05

Sample restricted to municipalities containing 1790 pueblos de los indios. Robust standard errors in brackets; * significant at 10%; ** significant at 5%; *** significant at 1%; Note: ``<100km'' represents those municipalities within 100km of the optimal growing region frontier. This is approx. 62 miles.

Table 2: **Regression: Poverty and Female Literacy**

	(1) OLS, State FE	(2) OLS, State FE	(3) OLS, State FE	(4) OLS, State FE, <100km	(5) OLS, State FE, <75km	(6) OLS, State FE, <100km	(7) OLS, State FE, <75km	(8) OLS, Oaxaca only	(9) 2SLS-RD, State FE	(10) 2SLS-RD, State FE	(11) 2SLS-RD, State FE, <100km	(12) 2SLS-RD, State FE, <75km	(13) 2SLS-RD, Oaxaca only
Panel A: Poverty Headcount Ratio (Paliha)													
Cochineal producer	-0.101***	-0.107***	-0.105***	-0.124***	-0.128***	-0.120***	-0.121***	-0.126***	-0.586*	-0.501	0.034	-0.092	-0.159
	[0.022]	[0.022]	[0.022]	[0.025]	[0.026]	[0.025]	[0.026]	[0.028]	[0.352]	[0.397]	[0.266]	[0.250]	[0.221]
Hiker's distance to pre-Columbian sites, 1000km	0.745***	0.876***	0.741***	1.089***	1.094***	1.101***	1.123***	0.882***	0.693***	0.693***	0.955***	1.027***	0.720***
	[0.105]	[0.104]	[0.104]	[0.177]	[0.185]	[0.181]	[0.189]	[0.156]	[0.128]	[0.120]	[0.192]	[0.193]	[0.156]
Hiker's distance to monasteries (16C), 1000km	1.068***	0.760***	0.947***	0.839***	0.867***	0.854***	0.892***	0.425***	1.032***	0.915***	0.981***	0.936***	0.543***
	[0.101]	[0.102]	[0.107]	[0.200]	[0.209]	[0.204]	[0.214]	[0.162]	[0.132]	[0.144]	[0.236]	[0.238]	[0.189]
Observations	1763	1778	1763	1011	933	1011	933	485	1707	1707	975	902	451
R-squared	0.59	0.59	0.59	0.63	0.63	0.63	0.63	0.31	0.45	0.5	0.63	0.65	0.32
Panel B: Women's literacy rate (Alfa Mujeres)													
Cochineal producer	0.050***	0.052***	0.050***	0.068***	0.066***	0.063***	0.059***	0.061***	1.193***	1.216**	0.572**	0.507**	0.640**
	[0.012]	[0.012]	[0.012]	[0.013]	[0.014]	[0.013]	[0.014]	[0.019]	[0.462]	[0.544]	[0.239]	[0.223]	[0.291]
Hiker's distance to pre-Columbian sites, 1000km	-0.323***	-0.390***	-0.332***	-0.527***	-0.561***	-0.534***	-0.576***	-0.174	-0.338*	-0.328*	-0.579***	-0.581***	-0.111
	[0.077]	[0.073]	[0.077]	[0.130]	[0.131]	[0.133]	[0.133]	[0.135]	[0.183]	[0.183]	[0.204]	[0.191]	[0.215]
Hiker's distance to monasteries (16C), 1000km	-0.517***	-0.346***	-0.435***	-0.166	-0.126	-0.199	-0.159	-0.218	-0.392**	-0.256	-0.02	-0.014	-0.08
	[0.071]	[0.071]	[0.076]	[0.141]	[0.143]	[0.143]	[0.143]	[0.155]	[0.168]	[0.188]	[0.218]	[0.210]	[0.275]
Observations	1763	1778	1763	1011	933	1011	933	485	1707	1707	975	902	451
R-squared	0.48	0.48	0.48	0.48	0.47	0.49	0.48	0.2					
Quadratic in Lat, Long, Altitude	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Quadratic in Precipitation and Temperature	N	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y
Quartic in Lat, Long, Altitude	N	N	N	N	N	Y	Y	N	N	N	Y	Y	N

Sample restricted to municipalities containing 1790 pueblos de indios. Robust standard errors in brackets; * significant at 10%; ** significant at 5%; *** significant at 1%; Note: ``<100km'' (75km) represents those municipalities within 100km (75km) of the optimal growing region frontier. This is approx. 62 miles (47 miles)

Table 3: **Regression: Indigenous Language Use**

	(1) OLS, State FE	(2) OLS, State FE	(3) OLS, State FE	(4) OLS, State FE, <100km	(5) OLS, State FE, <75km	(6) OLS, State FE, <100km	(7) OLS, State FE, <75km	(8) OLS, Oaxaca only	(9) 2SLS-RD, State FE	(10) 2SLS-RD, State FE	(11) 2SLS-RD, State FE, <100km	(12) 2SLS-RD, State FE, <75km	(13) 2SLS-RD, Oaxaca only
Panel A: % speaking an indigenous language													
Cochineal producer	-0.067**	-0.070**	-0.059**	-0.059*	-0.050	-0.052	-0.040	-0.065	-3.568**	-3.584**	-1.735**	-1.460**	-1.460*
	[0.028]	[0.029]	[0.028]	[0.032]	[0.034]	[0.032]	[0.034]	[0.042]	[1.386]	[1.615]	[0.718]	[0.655]	[0.757]
Hiker's distance to pre-Columbian sites, 1000km	0.443**	0.733***	0.499***	0.355	0.529*	0.493	0.701**	0.653**	0.451	0.437	0.809	0.803	0.417
	[0.178]	[0.179]	[0.175]	[0.299]	[0.309]	[0.301]	[0.310]	[0.329]	[0.536]	[0.535]	[0.566]	[0.520]	[0.523]
Hiker's distance to monasteries (16C), 1000km	1.343***	0.643***	1.130***	1.030***	0.824***	0.973***	0.750**	1.455***	0.955*	0.574	0.249	0.246	1.090
	[0.165]	[0.176]	[0.173]	[0.309]	[0.316]	[0.304]	[0.308]	[0.367]	[0.493]	[0.542]	[0.606]	[0.566]	[0.669]
Observations	1763	1778	1763	1011	933	1011	933	485	1707	1707	975	902	451
R-squared	0.42	0.39	0.44	0.34	0.33	0.36	0.35	0.26					
Panel B: % bilingual in Spanish and an indigenous language													
Cochineal producer	-0.038	-0.041*	-0.032	-0.031	-0.027	-0.026	-0.020	-0.033	-2.367**	-2.363**	-1.316**	-1.103**	-0.883*
	[0.024]	[0.025]	[0.024]	[0.027]	[0.029]	[0.028]	[0.030]	[0.034]	[0.940]	[1.091]	[0.558]	[0.509]	[0.516]
Hiker's distance to pre-Columbian sites, 1000km	0.352***	0.562***	0.390***	0.214	0.361	0.311	0.483*	0.567**	0.344	0.338	0.559	0.560	0.370
	[0.131]	[0.134]	[0.130]	[0.236]	[0.245]	[0.238]	[0.247]	[0.245]	[0.360]	[0.358]	[0.433]	[0.401]	[0.354]
Hiker's distance to monasteries (16C), 1000km	0.877***	0.356***	0.731***	0.866***	0.695***	0.831***	0.647***	1.116***	0.616*	0.357	0.263	0.255	0.901**
	[0.116]	[0.125]	[0.121]	[0.243]	[0.250]	[0.240]	[0.244]	[0.264]	[0.331]	[0.362]	[0.464]	[0.435]	[0.447]
Observations	1763	1778	1763	1011	933	1011	933	485	1707	1707	975	902	451
R-squared	0.44	0.41	0.45	0.35	0.34	0.37	0.35	0.25					
Panel C: % monolingual in an indigenous language													
Cochineal producer	-0.028***	-0.028***	-0.026***	-0.027***	-0.022***	-0.025***	-0.020***	-0.031**	-1.164***	-1.183**	-0.400**	-0.346**	-0.560**
	[0.008]	[0.008]	[0.008]	[0.007]	[0.007]	[0.007]	[0.007]	[0.013]	[0.446]	[0.525]	[0.177]	[0.163]	[0.277]
Hiker's distance to pre-Columbian sites, 1000km	0.085	0.164***	0.102	0.125	0.153*	0.165*	0.202**	0.081	0.100	0.092	0.230	0.225*	0.043
	[0.066]	[0.063]	[0.066]	[0.087]	[0.087]	[0.089]	[0.089]	[0.128]	[0.178]	[0.179]	[0.144]	[0.134]	[0.199]
Hiker's distance to monasteries (16C), 1000km	0.445***	0.274***	0.381***	0.167*	0.133	0.143	0.106	0.329**	0.323*	0.205	-0.005	-0.002	0.184
	[0.069]	[0.069]	[0.073]	[0.090]	[0.089]	[0.090]	[0.087]	[0.160]	[0.165]	[0.183]	[0.150]	[0.142]	[0.264]
Observations	1763	1778	1763	1011	933	1011	933	485	1707	1707	975	902	451
R-squared	0.25	0.23	0.26	0.21	0.19	0.23	0.21	0.18					
Quadratic in Lat, Long, Altitude	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Quadratic in Precipitation and Temperature	N	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y
Quartic in Lat, Long, Altitude	N	N	N	N	N	Y	Y	N	N	N	Y	Y	N

Sample restricted to municipalities containing 1790 pueblos de indios. Robust standard errors in brackets; * significant at 10%; ** significant at 5%; *** significant at 1%; Note: ``<100km'' (75km) represents those municipalities within 100km (75km) of the optimal growing region frontier. This is approx. 62 miles (47 miles)

Table 4: **Regression: Inequality and Indigenous Governance**

	(1) OLS, State FE	(2) OLS, State FE	(3) OLS, State FE	(4) OLS, State FE, <100km	(5) OLS, State FE, <75km	(6) OLS, State FE, <100km	(7) OLS, State FE, <75km	(8) OLS, Oaxaca only	(9) 2SLS-RD, State FE	(10) 2SLS-RD, State FE	(11) 2SLS-RD, State FE, <100km	(12) 2SLS-RD, State FE, <75km	(13) 2SLS-RD, Oaxaca only
Panel A: Gini coefficient													
Cochineal producer	0.022***	0.021***	0.021***	0.018***	0.018**	0.019***	0.019***	0.022***	0.278**	0.266*	0.131	0.093	-0.104
	[0.006]	[0.006]	[0.006]	[0.007]	[0.007]	[0.007]	[0.007]	[0.008]	[0.138]	[0.159]	[0.091]	[0.085]	[0.094]
Hiker's distance to pre-Columbian sites, 1000km	-0.104***	-0.116***	-0.113***	-0.046	-0.02	-0.06	-0.041	-0.208***	-0.116**	-0.116**	-0.091	-0.069	-0.239***
	[0.039]	[0.037]	[0.039]	[0.062]	[0.064]	[0.064]	[0.066]	[0.065]	[0.054]	[0.053]	[0.071]	[0.070]	[0.080]
Hiker's distance to monasteries (16C), 1000km	0.191***	0.221***	0.203***	0.273***	0.257***	0.287***	0.276***	0.084	0.218***	0.243***	0.329***	0.314***	0.042
	[0.037]	[0.035]	[0.038]	[0.067]	[0.069]	[0.069]	[0.071]	[0.073]	[0.051]	[0.056]	[0.079]	[0.076]	[0.093]
Observations	1763	1778	1763	1011	933	1011	933	485	1707	1707	975	902	451
R-squared	0.19	0.18	0.19	0.24	0.25	0.25	0.26	0.16					
Panel B: Distance to major 21st century roads (km)													
Cochineal producer	-2.031**	-2.120***	-1.966**	-1.907**	-1.849**	-2.044***	-1.973**	-1.553	-72.917**	-79.774**	-16.054	-8.208	-55.239**
	[0.810]	[0.800]	[0.803]	[0.786]	[0.800]	[0.791]	[0.805]	[1.090]	[30.406]	[38.116]	[12.050]	[11.953]	[25.225]
Hiker's distance to pre-Columbian sites, 1000km	35.639***	42.437***	36.743***	32.037***	31.118***	27.326***	26.362***	78.527***	35.922***	34.979***	27.700***	23.729***	73.168***
	[5.936]	[5.770]	[5.875]	[7.781]	[8.207]	[7.198]	[7.479]	[7.422]	[12.045]	[12.819]	[8.148]	[7.654]	[17.847]
Hiker's distance to monasteries (16C), 1000km	15.449**	9.364	13.981**	18.423**	16.055*	18.298**	15.866*	1.725	7.983	2.352	13.926	17.185*	-11.887
	[6.183]	[6.673]	[6.423]	[8.506]	[8.815]	[8.648]	[9.076]	[10.183]	[11.629]	[13.726]	[10.066]	[10.107]	[23.736]
Observations	1763	1778	1763	1011	933	1011	933	485	1707	1707	975	902	451
R-squared	0.27	0.26	0.27	0.34	0.33	0.38	0.37	0.44					
Panel C: Municipality adopted indigenous local governance institutions (*Usos y Costumbres*)													
Cochineal producer	-0.515***	-0.477***	-0.500***	-0.525***	-0.533***	-0.529***	-0.532***	-0.819***	2.108	1.155	-0.069	0.334	2.682
	[0.149]	[0.154]	[0.149]	[0.183]	[0.193]	[0.184]	[0.194]	[0.222]	[1.677]	[1.720]	[4.017]	[1.322]	[2.282]
Hiker's distance to pre-Columbian sites, 1000km	3.851***	4.226***	3.783***	1.425	1.160	1.432	1.179	7.408***	3.808***	3.833***	1.547	1.356	7.521***
	[0.606]	[0.641]	[0.614]	[1.024]	[1.054]	[1.036]	[1.066]	[1.280]	[0.713]	[0.661]	[1.138]	[1.102]	[1.692]
Hiker's distance to monasteries (16C), 1000km	-1.974***	-1.507**	-1.371**	1.304	1.423	1.189	1.327	-0.319	-1.617***	-1.136*	1.312	1.522	0.939
	[0.565]	[0.598]	[0.576]	[0.987]	[0.976]	[0.974]	[0.958]	[1.315]	[0.625]	[0.594]	[1.859]	[1.023]	[1.924]
Observations	1748	1763	1748	996	919	996	919	485	1692	1692	960	888	451
R-squared	0.73	0.72	0.74	0.77	0.76	0.77	0.76	0.37	0.59	0.68	0.77	0.75	
Quadratic in Lat, Long, Altitude	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Quadratic in Precipitation and Temperature	N	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y
Quartic in Lat, Long, Altitude	N	N	N	N	N	Y	Y	N	N	N	Y	Y	N

Sample restricted to municipalities containing 1790 pueblos de indios. Robust standard errors in brackets; * significant at 10%; ** significant at 5%; *** significant at 1%; Note: ``<100km'' (75km) represents those municipalities within 100km (75km) of the optimal growing region frontier. This is approx. 62 miles (47 miles)

Table 5: **Regression: Local Public Goods**

	(1) OLS, State FE	(2) OLS, State FE	(3) OLS, State FE	(4) OLS, State FE, <100km	(5) OLS, State FE, <75km	(6) OLS, State FE, <100km	(7) OLS, State FE, <75km	(8) OLS, Oaxaca only	(9) 2SLS-RD, State FE	(10) 2SLS-RD, State FE	(11) 2SLS-RD, State FE, <100km	(12) 2SLS-RD, State FE, <75km	(13) 2SLS-RD, Oaxaca only
Panel A: % Households without piped water													
Cochineal producer	-0.009	-0.018	-0.012	-0.035	-0.039	-0.034	-0.039	-0.015	-0.45	-0.213	0.318	0.145	0.068
	[0.022]	[0.022]	[0.022]	[0.024]	[0.026]	[0.024]	[0.026]	[0.034]	[0.358]	[0.385]	[0.294]	[0.263]	[0.302]
Hiker's distance to pre-Columbian sites, 1000km	-0.323**	-0.348***	-0.311**	-0.226	-0.185	-0.233	-0.179	-1.293***	-0.238	-0.232*	-0.288	-0.175	-1.264***
	[0.131]	[0.132]	[0.132]	[0.199]	[0.209]	[0.202]	[0.212]	[0.208]	[0.152]	[0.139]	[0.234]	[0.225]	[0.224]
Hiker's distance to monasteries (16C), 1000km	0.747***	0.586***	0.585***	0.548***	0.547**	0.521**	0.511**	0.436*	0.691***	0.545***	0.734***	0.634***	0.485*
	[0.121]	[0.121]	[0.126]	[0.206]	[0.218]	[0.207]	[0.219]	[0.227]	[0.142]	[0.144]	[0.250]	[0.242]	[0.266]
Observations	1763	1778	1763	1011	933	1011	933	485	1707	1707	975	902	451
R-squared	0.28	0.28	0.29	0.23	0.23	0.24	0.24	0.16	0.1	0.27	0.06	0.19	0.14
Panel B: % Households without electricity													
Cochineal producer	-0.013	-0.018	-0.015	-0.026**	-0.026**	-0.024*	-0.023*	-0.022	-0.048	0.063	0.181	0.101	-0.261
	[0.013]	[0.013]	[0.013]	[0.012]	[0.013]	[0.012]	[0.013]	[0.022]	[0.186]	[0.217]	[0.172]	[0.157]	[0.222]
Hiker's distance to pre-Columbian sites, 1000km	0.186**	0.238***	0.188**	0.388***	0.428***	0.355***	0.399***	-0.01	0.210***	0.222***	0.299**	0.378***	0.009
	[0.078]	[0.074]	[0.078]	[0.112]	[0.117]	[0.110]	[0.115]	[0.131]	[0.081]	[0.081]	[0.132]	[0.126]	[0.165]
Hiker's distance to monasteries (16C), 1000km	0.790***	0.670***	0.706***	0.377***	0.368***	0.405***	0.395***	0.278*	0.785***	0.722***	0.521***	0.464***	0.217
	[0.079]	[0.082]	[0.083]	[0.129]	[0.136]	[0.128]	[0.134]	[0.160]	[0.083]	[0.093]	[0.148]	[0.144]	[0.200]
Observations	1763	1778	1763	1011	933	1011	933	485	1707	1707	975	902	451
R-squared	0.32	0.33	0.34	0.43	0.45	0.45	0.46	0.16	0.33	0.32	0.28	0.4	
Panel C: % Households without drains													
Cochineal producer	-0.072***	-0.076***	-0.076***	-0.094***	-0.099***	-0.086***	-0.088***	-0.096***	0.019	0.061	0.337	0.183	0.126
	[0.023]	[0.023]	[0.023]	[0.027]	[0.028]	[0.027]	[0.027]	[0.032]	[0.345]	[0.415]	[0.340]	[0.315]	[0.312]
Hiker's distance to pre-Columbian sites, 1000km	-0.033	0.091	-0.044	0.447**	0.518**	0.491**	0.578***	-0.470*	0.003	0.007	0.34	0.508**	-0.464*
	[0.147]	[0.142]	[0.148]	[0.203]	[0.212]	[0.207]	[0.216]	[0.244]	[0.146]	[0.145]	[0.245]	[0.233]	[0.252]
Hiker's distance to monasteries (16C), 1000km	1.221***	1.051***	1.153***	0.833***	0.828***	0.809***	0.818***	0.509**	1.225***	1.175***	1.073***	0.969***	0.645**
	[0.133]	[0.134]	[0.141]	[0.237]	[0.248]	[0.241]	[0.252]	[0.257]	[0.141]	[0.160]	[0.289]	[0.283]	[0.287]
Observations	1763	1778	1763	1011	933	1011	933	485	1707	1707	975	902	451
R-squared	0.5	0.49	0.5	0.56	0.56	0.57	0.57	0.17	0.51	0.5	0.46	0.53	0.09
Quadratic in Lat, Long, Altitude	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Quadratic in Precipitation and Temperature	N	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y
Quartic in Lat, Long, Altitude	N	N	N	N	N	Y	Y	N	N	N	Y	Y	N

Sample restricted to municipalities containing 1790 pueblos de indios. Robust standard errors in brackets; * significant at 10%; ** significant at 5%; *** significant at 1%; Note: ``<100km'' (75km) represents those municipalities within 100km (75km) of the optimal growing region frontier. This is approx. 62 miles (47 miles)

Table 6: **Interaction Regressions: Poverty Index**

Poverty Headcount Ratio (Paliha)	(1) State FE	(2) State FE	(3) State FE	(4) State FE <100km	(5) State FE <75km	(6) State FE, Oaxaca
Cochineal Producer	-0.099***	-0.099***	-0.102***	-0.123***	-0.128***	-0.126***
	[0.018]	[0.018]	[0.019]	[0.021]	[0.019]	[0.026]
Log, Distance to Alcaldia	-0.003	-0.003	-0.003	0.006	0.005	0.004
	[0.004]	[0.004]	[0.004]	[0.005]	[0.007]	[0.010]
Log. Distance to 2nd Closest Alcaldia	0.000	0.000	0.000	-0.015**	-0.014	-0.017
	[0.005]	[0.006]	[0.006]	[0.007]	[0.009]	[0.013]
Cochineal x Log. Distance Closest Alcaldia	0.015					
	[0.010]					
Cochineal x Log. Distance 2nd Closest Alcaldia		0.019**	0.021**	0.024**	0.026***	0.024
		[0.008]	[0.008]	[0.009]	[0.009]	[0.018]
Quadratic in Lat, Long Altitude	Y	Y	Y	Y	Y	Y
Quadratic in Temperature & Precipitation	N	N	Y	Y	Y	Y
Observations	1763	1763	1763	1011	933	485
R-squared	0.59	0.59	0.59	0.63	0.63	0.32

* significant at 10%; ** 5%; *** 1%; standard errors clustered at state level (except 6). All interactions demeaned; All regressions include controls for hiker's distances to pre-Columbian sites and monasteries.

Table 7: **Interaction Regressions: Female Literacy**

Female Literacy Rate	(1) State FE	(2) State FE	(3) State FE	(4) State FE <100km	(5) State FE <75km	(6) State FE, Oaxaca only
Cochineal Producer	0.050***	0.049***	0.049***	0.067***	0.065***	0.062***
	[0.010]	[0.010]	[0.010]	[0.008]	[0.008]	[0.019]
Log, Distance to Alcaldia	-0.004**	-0.004**	-0.004*	-0.009***	-0.009**	-0.008
	[0.002]	[0.002]	[0.002]	[0.003]	[0.004]	[0.007]
Log. Distance to 2nd Closest Alcaldia	0.007*	0.007*	0.008*	0.016**	0.016**	0.018*
	[0.004]	[0.004]	[0.004]	[0.006]	[0.007]	[0.009]
Cochineal x Log. Distance Closest Alcaldia	-0.005					
	[0.003]					
Cochineal x Log. Distance 2nd Closest Alcaldia		-0.008**	-0.009***	-0.006	-0.006	-0.018
		[0.003]	[0.003]	[0.005]	[0.005]	[0.013]
Quadratic in Lat, Long Altitude	Y	Y	Y	Y	Y	Y
Quadratic in Temperature & Precipitation	N	N	Y	Y	Y	Y
Observations	1763	1763	1763	1011	933	485
R-squared	0.48	0.48	0.49	0.48	0.47	0.21

* significant at 10%; ** 5%; *** 1%; standard errors clustered at state level (except 6). All interactions demeaned; All regressions include controls for hiker's distances to pre-Columbian sites and monasteries.

Table 8: **Interaction Regressions: Indigenous Goverance**

Adopt Indigenous Governance (Usos)	(1)	(2)	(3)	(4)	(5)	(6)
	State FE	State FE	State FE	State FE, <100km	State FE, <75km	Oaxaca only
Cochineal Producer	-0.108*	-0.111**	-0.106**	-0.099**	-0.098**	-0.170***
	[0.053]	[0.053]	[0.049]	[0.045]	[0.043]	[0.051]
Log, Distance to Alcaldia	0.004	0.004	0.003	0.008	0.007	0.021
	[0.004]	[0.004]	[0.004]	[0.007]	[0.007]	[0.020]
Log. Distance to 2nd Closest Alcaldia	-0.006	-0.006	-0.005	-0.014	-0.014	-0.032
	[0.006]	[0.006]	[0.006]	[0.012]	[0.013]	[0.025]
Cochineal x Log. Distance Closest Alcaldia	0.032**					
	[0.014]					
Cochineal x Log. Distance 2nd Closest Alcaldia		0.016**	0.012**	0.014	0.016	0.016
		[0.006]	[0.005]	[0.010]	[0.011]	[0.035]
Quadratic in Lat, Long Altitude	Y	Y	Y	Y	Y	Y
Quadratic in Temperature & Precipitation	N	N	Y	Y	Y	Y
Observations	1745	1745	1745	993	917	484
R-squared	0.74	0.74	0.75	0.77	0.76	0.31

* significant at 10%; ** 5%; *** 1%; standard errors clustered at state level (except 6). All interactions demeaned; All regressions include controls for hiker's distances to pre-Columbian sites and monasteries.