University of Toronto
Department of Economics

Working Paper 335

Endowments, Coercion, and the Historical Containment of Education

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September 12, 2008

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Current version: September 2008

First version: May 2007

Abstract: Distinguishing the role of coercive labor and political institutions from the effects of economic inequality levels and populations' ethno-linguistic compositions in explaining the diverging patterns of development across the Americas has remained a challenging task. This paper examines whether the incentives for elite groups to enforce coercive labor and political institutions, holding other factors constant, inhibited economic development by restricting the provision of public schooling. Using 19th-century micro data from municipalities in Puerto Rico, and exploiting variation in the suitability of coffee cultivation across regions and the timing of the nineteenth century coffee boom, we find that coffee-region local governments allocated more public resources to enforce coercive labor measures and repress revolutionary movements, as documented by greater expenditures targeted towards the enforcement of coercive contracts and the size of military and government-backed paramilitary forces. These local governments also allocated fewer resources towards the provision of primary schooling - a decline of 40 percent in the provision of public primary schools and a decline in literacy rates of 25 percent. These findings are consistent with models of factor price manipulation and political repression under elite-controlled non-democratic regimes, in which the returns to labor are depressed as a result of the extraction of rents from peasants' wages and literacy-based voting rights are restricted through limited access to schooling.

* A previous version of the paper was titled "Political Institutions, Labor Coercion, and the Emergence of Public Schooling: Evidence from the 19th Century Coffee Boom." I appreciate the many discussions with Dwayne Benjamin, Loren Brandt, and Carlos Serrano, as well as helpful comments by Daron Acemoglu, Stanley Engerman, Berta Esteve-Volart, Fred Finan, Price Fishback, Deepak Lamba-Nieves, Naomi Lamoreaux, Ted Miguel, Peter Morrow, Francisco Moscoso, Petra Moser, Nathan Nunn, James A. Robinson, Jean Laurent Rosenthal, Guido Tabellini, Dan Trefler, and seminar participants at Arizona, UCLA, Toronto, and York, the Canadian Economics Association 2007 Meetings, the Canadian Institute for Advanced Research Spring 2008 Meetings, the LACEA Political Economy Group 2008 Meetings, and the SITE 2008 Summer Meetings. I am especially grateful to Miguel Vega, Angel Ríos and the personnel at the Puerto Rico Collection of the University of Puerto Rico-Río Piedras Library, as well as María Isabel Rodríguez, José Charón, and the personnel at the Puerto Rico General Archives for their assistance and support throughout. Emilú Berríos De León, Enrique Bobonis, Aileen Cardona, Nicole Díaz, Jonatham Quiñones Roque, Evangelina Pérez, and Waldemar Pérez provided superb research assistance. Antonio González's ArcGIS expertise proved of invaluable assistance. Research support from the All-UC Group in Economic History, the University of Toronto Connaught Fund, and SSHRC is gratefully acknowledged. I am responsible for any errors.

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I. Introduction

Scholarly debates on comparative economic development, which seek to explain why incomes per capita across the globe diverged substantially during the past two centuries, have centered on the roles played by factors such as countries' geographic characteristics, institutional configurations, populations' ethnic and linguistic compositions, and their investments in human capital in explaining the patterns and timing of this divergence (Maddison, 2001). In the case of the American experience, a growing consensus asserts that development trajectories resulted from differences in economic inequality which emerged during the colonial period and persisted throughout the 19th and 20th centuries. These theories maintain that initial conditions or factor endowments (e.g., geography and labor endowments) were a central determinant of countries' initial land and/or wealth distributions, and that the latter led to differences in the formation and persistence of political and economic institutions, such as the extension of voting rights and constraints on government rent-seeking activities (Acemoglu, Johnson, and Robinson, 2001; Engerman and Sokoloff, 1997), the provision of growth-generating public goods, such as schooling (Engerman, Mariscal, and Sokoloff, 2002; Galor, Moav, and Vollrath, 2008), and the development of taxation systems (Sokoloff and Zolt, 2005), thus affecting countries' long-run economic performance.

A re-emerging challenge to the economic inequality view claims that the disparities in economic development resulted from differences in the degree of political inequality and the nature of political competition across countries, as exemplified by the levels of political enfranchisement, the extent of violent conflict among groups within society, and the entrenchment into power of elite groups (e.g. Acemoglu et al, 2008; Besley and Persson, 2008). For instance, Acemoglu (2006) asserts that inefficient economic institutions such as coercive labor regulations that promoted factor price manipulation (i.e. wage depression) may have been instituted by governing elites to redistribute rents away from poor and middle-classes, particularly during periods of high product/commodity prices. Consistent with this argument, studies have established a negative relationship between measures of current economic development and historical prevalence of slave use across U.S. states and counties (Mitchener and McLean, 2003; Lagerlöf, 2005) as well as across British colonies in the Caribbean (Nunn, 2008). Nugent and Robinson (2005) argue that the structure of landownership across coffee-growing countries in the Americas – and thus economic inequality – was shaped by the legal environment determining access to land and the existence of coercive institutions, which in turn resulted from differences in the extent of militarization of governments across countries. Establishing the relevance of these competing groups of theories has nonetheless remained a challenging task, due to the difficulties in distinguishing the role of coercive political and labor institutions from the potential effects of economic inequality, as well as

alternative explanations such as the potential long-run effects of populations' ethno-linguistic and religious composition.[1]

This paper uses coffee booms in a quasi-experimental setting to examine whether changes in the incentives for elite groups to enforce coercive labor and political institutions inhibited economic development, by limiting the provision of efficiency-enhancing local public goods. We do so by exploiting a case study – local governments in 19th-century Puerto Rico – combining unique individual and municipality-level micro data with variation in the economic incentives for coffee cultivation across municipalities. In particular, variation in the strength and direction of Trade Winds currents towards the west-central and east-central regions of the island lead to annual precipitation levels to be higher in the former than in the latter region (90 inches and 74 inches of rainfall, respectively). This distinction is crucial for coffee cultivation, since coffee requires cool temperatures and annual precipitation levels greater than 80 inches for high yields.[2] Additionally, these regions were first colonized during the late 18th century, and it was not until the various international coffee booms – especially from the 1860s onwards – that the high precipitation West-Central region municipalities diverged from the East-Central ones, arguably as a result of differences in these geographic factors so influential for coffee cultivation. Finally, from a purely technological perspective, there are disincentives to establish coffee plantation economies, as there are constant (or even decreasing) returns to scale in coffee cultivation.[3] We thus compare municipalities whose geography made them well-suited for coffee to those better suited for the cultivation of food crops, preceding and during the 1860-1890s coffee boom, to examine whether the greater incentives for coffee cultivation in the western region promoted the enforcement of coercive labor and political institutions, which may have resulted in a lower quality of local governments during the late nineteenth century.

Our results support the factor price manipulation and coercive underdevelopment hypotheses. We find that the otherwise similar coffee-region municipal governments were more likely to use resources to enforce coercive measures, as documented by a higher share of the population officially classified under a coerced-laborer categorization, greater expenditures in the rural police, and the larger size of government-supported paramilitary forces – organizations used to enforce mandatory employment contracts and the control of peasant revolutionary movements, respectively. In addition, we document that the provision of public primary schooling was restricted in these municipalities, as measured by an immense 40 percent

[1] A number of competing explanations concentrate on differences in legal systems (La Porta et al., 1999), contemporaneous effects of the tropical disease burden on health and development (Bloom and Sachs, 1998), selective migration of colonizers (with varying levels of human and social capital) into different countries (Glaeser et al. 2004), and differences in the ethnic and religious composition of populations across regions (Easterly and Levine, 1997).

[2] According to various historical accounts, this was a major factor in the establishment of the coffee industry in the former region and the production of food crops (e.g., plantains, corn, rice, yams) in the latter (Bergad, 1983; Cabrera Collazo, 1988; Picó, 1987).

[3] See Berry and Cline (1979), Binswanger and Ronsenzweig (1986), Binswanger, Deininger, and Feder (1986).

relative decline in the number of schools per capita and comparably large relative declines in literacy rates of approximately 25 percent.

The richness of the data also enables us to distinguish our explanation from the traditional factor endowment hypothesis and other competing theories of the determinants of long-run development. This first hypothesis asserts that certain geographic endowments could have generated the incentives for the establishment of plantation economies, partly due to economies of scale in the cultivation and distribution of export crops. The resulting difference in economic inequality would thus influence the degree of political inequality, the formation of domestic political and economic institutions, and the quality of local governments across municipalities (e.g. Engerman and Sokoloff, 2000). However, we use unique land registry data for the periods preceding and during the peak of the coffee boom to show that the coffee region did not experience a disproportionately greater concentration of land among landowners relative to the comparison group of municipalities. We also present evidence that helps us rule out other competing explanations of our main results, such as differences in natives' migration patterns across regions, in the ethno-linguistic composition of local populations, and in the extent of the tropical disease burden across municipalities. In summary, our findings point to the incentives of elites under a non-democratic political system to create and maintain a coercive regime as the main mechanism for the apparent divergence in local governments' policy choices.

The paper is structured as follows: Section II gives a detailed description of the geographic and political economy context, which will assist us in formalizing the empirical tests to be presented below. Sections III and IV respectively describe the data used in the analysis and discuss the empirical strategy. The central empirical results of the paper, the pieces of evidence supporting the identifying assumptions, and robustness tests are presented in Section V. Section VI discusses the relevance of alternative explanations. The paper concludes with a brief discussion.

II. Physical Geography and Context in Nineteenth Century Puerto Rico

II.A. Early Colonial History, Physical Geography, and the 19th Century Coffee Boom

Colonized by the Spanish in 1493, Puerto Rico remained a backwater to the Spanish colonial empire during the sixteenth through eighteenth centuries. Its population and economic activity, concentrated in the coast until the early nineteenth century, initially consisted of gold mining during the 1510s-1550s (Sued Badillo, 2001), followed by sugar cane and ginger cultivation during the 1550s-1650s, and cattle farming and leather product manufacturing during the 1650s-1800s (Moscoso, 1999). The island remained sparsely populated and concentrated in coastal areas until the late 1700s, when European immigration, African immigration (i.e. slave labor), and internal growth led to substantial increases in the

island's population and a slow displacement of cattle ranchers and small peasants to the interior (Scarano and Curtis-White, 2005).

The international coffee boom, which initiated in the late eighteenth century, led to an increase in coffee cultivation and processing in Puerto Rico during various extended periods of time throughout the nineteenth century (Topic, 1998).[4] However, the size of the coffee industry remained small throughout the first six decades of the nineteenth century. The volume of coffee exports revolved around a five-year average in the 9.8-13.0 million pounds range during 1828-1864 (Figure 1). Economic interest and activity would concentrate in the growing sugar industry, especially throughout the 1820s and early 1830s, and again during the early 1870s (Bergad, 1983; Scarano, 1984). But starting in the 1860s, coffee exports would drastically increase, stimulated by price rises in the international coffee market.[5] By 1881, Puerto Rican coffee exports had risen 227 percent from 1871 to 47.2 million pounds, and reached a peak of 58.0 million pounds during 1896, a fivefold increase from the late 1850s export volume levels (Figure 1).

Throughout the second half of the nineteenth century, coffee cultivation was concentrated in the region most conducive to its cultivation – the West-Central region of the island.[6] The central municipalities east of Ciales specialized in the cultivation of food crops for the domestic market as well as cattle ranching (Seda Prado, 1996; Picó, 2007). The geographic concentration of the coffee industry is not surprising, as the island's physical geography greatly influenced the establishment of the coffee industry in the West-Central region.

Figure 2 shows a precipitation map of Puerto Rico using estimates from data for the years 1971-2000 (National Weather Service, 2007). Clearly, average annual precipitation is highest in the West-Central region of the island, followed by the East-Central region. This pattern is strongly influenced by the speed and direction of the Alizé Trade Winds, in combination with topographic differences across regions. The Trade Winds, coming from the northeast and north-northeast directions, influence the island's distribution of rainfall by generating greater precipitation in the western region of the island. This led to annual precipitation levels to be higher in this region (90.2 inches) relative to the East-Central region (74.1 inches), as measured using data from 1899 until the 1920s (Table 1, Panel A). Based on cumulative monthly precipitation averages, the West-Central region surpasses a threshold level of 80 inches of precipitation during the month of October, whereas precipitation in the East-Central region does not reach this threshold level, on average. This distinction is crucial for coffee cultivation, since coffee

[4] Abbad y Lasierra (1788) had noted coffee's role in the contraband trade with foreigners in the 1770s. The stimulus provided by the rise in international coffee prices after the Haitian revolution led to the general expansion of coffee cultivation, particularly in coastal municipalities (Bergad, 1983; Ledrú, 1863). However, by the first decade of the nineteenth century, the boom conditions of the 1790s subsided as new world market supplies satisfied the demand created by the decline of Haitian exports.

[5] Coffee trees require five to seven years after planting to achieve high coffee bean yields. It comes as no surprise that the surge in coffee exports thus follows the increase in coffee prices by approximately seven years.

[6] The West-Central region encompasses the municipalities of Adjuntas, Ciales, Jayuya (part of Utuado at the time), Lares, Las Marías, Maricao, San Sebastián, Utuado, and Yauco

trees require high annual precipitation levels for high yields; coffee tree leaves are prone to attacks by the coffee leaf miner in areas with annual precipitation levels below 80 inches (Roberts, 1941). According to various historical accounts, this was a major factor in the establishment of the coffee industry in the former region and the production of food crops (e.g., plantains, corn, rice, yams) and cattle ranching in the latter (Bergad, 1983; Cabrera Collazo, 1988; Picó, 1987).

Municipalities in the West-Central region also favor coffee cultivation as a result of their cooler temperatures (with an average minimum temperature of 63.2 ºF) relative to the East-Central region (66.7 ºF), as coffee trees produce higher yields in cooler climates (the difference is significant at 95 percent confidence, Panel A). Apart from these differences in wind and precipitation patterns, municipalities in the Central Mountain Range are very similar in terms of the remaining geographic characteristics (except for the fact that the West-Central region has a higher degree of terrain ruggedness, a factor potentially inhibiting the development of export-oriented agriculture due to higher transportation costs).[7]

Data from a population and economic census of 1828 already shows the increasingly marked differences in coffee cultivation and processing during the period. Coffee production, measured in 'quintales' (1 'quintal' ≈ 100 pounds) per 'cuerda' (1 'cuerda' ≈ 0.97 acre) of agricultural land, was twice as high in the West-Central region relative to the East-Central region (Table 1, Panel B). The facilities for the processing of coffee beans were also concentrated in the high rainfall region; western municipalities had 2.5 coffee mills whereas municipalities in the eastern region only had 0.1 mills, on average (Panel B). However, official overall taxable wealth and production levels, although probably unreliably measured, did not vary significantly across regions during this time period (Panel B).

The historiographic evidence also indicates that the agricultural organization in both regions consisted mostly of small peasants preceding the coffee boom (Bergad, 1983; Picó, 1979; Picó, 2007; Seda Prado, 1996). The available data on the distribution of socio-economic and demographic groups is consistent with this assessment (Table 1, Panel C). The reported distribution of sharecroppers, slaves, and free blacks and mulattos was, on average, equally distributed across regions (Panel A, rows 1-4). Finally, also suggestive of the similitude during the early and mid-19th century is the lack of difference in crude mortality and birth rates. According to the Córdova Report to the Spanish Crown (see the discussion below), both regions experienced similar crude birth rates (57.8 and 54.6, respectively) and crude death rates (23.1 and 23.2, respectively) during 1828 (Panel C, rows 6-7).

Localities in both regions were relatively sparsely populated preceding the coffee boom (Figure 3). Population sizes were in the 3,900-5,200 range of averages in the coffee-growing region and in the 2,500-3,100 range in the food crops region during this earlier period, as measured in the 1824, 1828, and

[7] Measures of geological determinants of crop-specific agricultural productivity at the municipality-level (i.e. soil pH and permeability) also indicate that the West-Central region is more suitable for coffee cultivation than the East-Central region (Acevedo and Gierbolini, 1982; Gierbolini 1982a,b; Boccheciamp, 1982a,b; P.R. Government Planning Board).

1846 censuses (the mean differences are not statistically significant). To the extent that population levels of the municipalities serve as proxy for the level of aggregate economic performance during this period, there is a substantial divergence in aggregate material prosperity across regions during the 1860s-1890s.[8] Population levels became 160 percent higher on average in the coffee region relative to the comparison group of municipalities (the difference is significant at 95 percent confidence levels). Also, the correlation of municipality-level population sizes and the historical levels of average annual rainfall also indicate that rainfall levels become an important determinant of economic prosperity during the second half of the century. There correlation is small and insignificant during years 1824 and 1828, but the correlation becomes positive and significant from 1846 onwards.[9] These patterns suggest that preceding the first coffee boom the two regions were similar and had similar development trajectories, but eventually diverged during once coffee prices increased dramatically during the 1850s.

The divergence in the degree of economic prosperity is mirrored by differences in the intensity of coffee cultivation across regions by the end of the nineteenth century. By 1896, 12.3 percent of all land (including forests and pasture) in the West-Central region was under coffee cultivation, relative to only 4.1 percent of land in the East-Central region. Moreover, the relationship between annual precipitation levels and the extent of coffee cultivation, unconditionally as well as conditional on other geographic determinants of coffee suitability, is quite strong. Figure 4 plots sample means-adjusted residuals from a multivariate regression of the share of agricultural land under coffee cultivation (conditioning on the municipality average annual maximum and minimum temperatures, mean altitude, mean degree of ruggedness (gradient), and distance to the nearest port) on mean-adjusted residuals of annual precipitation levels on the same set of conditioning variables. The figure clearly shows the positive association between municipalities' annual precipitation levels at the turn of the century and the agricultural land under coffee cultivation. Moreover, the figure shows the relatively higher distribution of rainfall in coffee region relative to food crops region municipalities.[10]

Table 2 presents estimates of the linear relationship between the level of rainfall and coffee cultivation in 1896 on one hand and the conditional regional differences in coffee cultivation in 1896 on the other. The estimates of the unconditional relationship indicate that municipalities with annual rainfall levels 10 inches higher had, on average, a 4.4 percentage points (67 percent) higher share of agricultural land under coffee cultivation (column 1). Conditioning on the geographic controls, the relationship remains significant at 3.8 percentage points (58 percent; column 2). We also take into account that the suitability of coffee cultivation may be non-linearly determined by higher rainfall and cooler

[8] For a discussion on the validity of measures of population density as proxy for economic prosperity, see Acemoglu, Johnson, and Robinson (2002) and references therein.
[9] Estimates available from the author upon request.
[10] The relationship is robust to the inclusion of the municipalities of Las Marías and Maricao, located in the West-Central region.

temperatures, and thus include an interaction term between the annual rainfall measure and a variable indicating whether the municipality experienced higher than average minimum temperatures. The relationship remains quite strong – municipalities with 10-inches higher precipitation and lower-than-average minimum temperature levels experienced a 2.2 percentage point (34 percent) higher share of agricultural land under coffee cultivation (significant at 90 percent confidence; column 3), whereas those with higher precipitation levels but higher-than-average minimum temperatures experienced no disproportionate difference in the share of land under coffee cultivation. Estimates of this relationship are also robust to using the sub-sample of municipalities with land distribution data, which will be an important component of the robustness analysis (see Section VI) (column 4).

Estimates of the analogous relationship using the coffee region indicator as the explanatory variable of interest also show a robust relationship. The unconditional correlation indicates that coffee region municipalities indeed had an 8.2 percentage points (125 percent) higher share of land under coffee cultivation in 1896 (column 5). The analogous estimates conditioning on the other geographic variables show a correlation of 7.6 percentage points (116 percent) (column 6). Finally, models allowing for an interaction between the coffee region and higher-than-average minimum temperature indicators also show that municipalities in the coffee region with particularly low temperatures experienced a higher concentration of coffee cultivation (8.9 percentage points, or 136 percent) whereas those with higher-than-average temperature levels only experienced a 3.0 percentage point higher share of land under coffee cultivation (45 percent, statistically insignificant) (column 7). This relationship is robust to using the sub-sample of municipalities with land distribution data (column 8). Note that the geographic clustering of coffee cultivation was maintained well into the mid-twentieth century (Roberts, 1941).

II.B. Local De Jure Institutions and Municipal Government Activities [11]

This subsection provides a summary of local government political and economic institutions, policies, and activities throughout the 19th century. This will help us generate hypotheses regarding the expected impact of the coffee boom on local government policy choices based on recent contributions in political economy theory.

Municipal governments carried out a wide range of activities in nineteenth century Puerto Rico, from the collection of property and excise taxes to the allocation of municipal resources for the provision of local public goods (i.e. construction and administration of primary schools, supervision of public works projects and maintenance, public health and hospital administration), the administration of the municipal police, and the enforcement of various state-level regulations.

[11] This section draws primarily on the detailed descriptions of Bergad (1983), Coll y Toste (1909), Flores Collazo (1991), Osuna (1949), and Trías Monge (1980).

The local government executive was composed of ordinary mayors ('alcaldes ordinarios') and council members ('regidores'). The number of mayors varied by the size of the municipality; small municipalities had a single mayor and larger ones two. Mayors were elected by the local council members or named by the Governor for short terms. If elected, their designation was usually subject to confirmation by the Governor. The size of the local council body usually fluctuated between four and six for towns and villages, eight or more in cities. Members were initially named by the King and/or provincial authorities.[12,13]

Municipal governments in Puerto Rico were the only government jurisdiction in which natives gained a certain degree of political representation until the turn of the century. The voting rights of a subset of the population were gradually extended at the end of the colonial period, first during a short period in 1812-14 and again during the last third of the nineteenth century, following Spain's Glorious Revolution of 1868, at which time adult males gained greater political participation in municipal government affairs. Under the new regime, council members were elected by eligible voters, defined as males, 21 years of age or older, who were literate, with a minimum residence period in the municipality of two years, and who paid a minimum amount (25 pesetas) of income and/or property taxes annually, or who were municipal government employees or professionals.[14] Council members would in turn provide a short list of candidates to the Governor for the positions of mayor and lieutenant mayor. The Governor had the power to name individuals for these positions; he also had the capacity to name other individuals outside the short list (including non-residents of the municipality) for these executive positions, as well as the power to destitute these.

In practice, the mayor and members of the municipal boards thus enjoyed a significant degree of control over municipal activities, which in combination with the very limited degree of accountability to the majority of the local population, provided these figures with significant leeway in terms of the administration of the local territories. That said, all municipal statues, as well as municipal government budgets, were subject to confirmation and approval by the provincial government.

Municipal authorities thus had a degree of de jure and de facto power over three dimensions of crucial importance in promoting or inhibiting their development: the allocation of land property rights, the

[12] Through the "Sistema de Capitulaciones", ,conquistadores were initially given the rights to name mayors and council members.

[13] In addition to mayors and council members, municipal governments were comprised also of other municipal civil employees: the lieutenant mayor ('heraldo'); the local finances official, in charge of the inspection of weights and measures; the bailiff; the general solicitor or lawyer of the city; the butler (guard of civic property); the notary public; and the district mayors or commissioners (magistrates of police for rural districts). In many municipalities, the council members and mayors assumed the functions of some of these positions.

[14] Until the approval of the Bill of Autonomy of 1898, the municipal regime was governed mainly by the laws of August 20th 1870 and December 16th, 1876, which governed Spanish municipal life until the liberal reforms of 1880 and 1885, and following the restoration of monarchic rule in Spain, by the Royal Decree of May 14th, 1878. The latter rules included important modifications to the previous legislation which provided greater influence to the provincial government in municipal affairs.

provision of primary schooling, and the control over the municipal police, an important body for purposes of enforcing coercive measures against landless peasants.

The Allocation of Land Property Rights

Although peripheral to areas affected by the sugar cane boom of the 1820s and 1830s, land speculation was initially an important element for many early settlers in the central region. The high fertility of mountain land had significant economic potential if infrastructural links were developed to facilitate exports. For this reason, coastal entrepreneurs continually sought grants for "*terrenos baldíos"* (government-owned lands) in the region, or purchased undeveloped land at low prices. The establishment of legal titles to land seems to have grown considerably between 1836 and 1848, a period coinciding with the complete dissipation of *baldíos*. The concern for legal titles coincided precisely with the appearance of immigrant merchants in the West-Central and East-Central regions, since this group provided investment capital and credit to peasants.[15]

Municipal government authorities had substantial influence over the distribution of lands ownership. The provincial-level ,commission entitled with the power to grant *baldíos* to individuals requesting them, usually asked for the recommendation of the municipal government on the desirability of granting land to particular individuals, which could favor members of the local elite to the detriment of the popular classes. A second mechanism arguably utilized by local governments was through the administration of judicial procedures. Since the mayor and other local officials carried out local judiciary duties over land titling, land rental and debt contracts disputes, this provided a legal mechanism for municipal governments to favor the preferences of local elite groups. Third, local governments were entitled to expropriate land from any individual who could not pay his respective property tax burden. Finally, since the levying of property taxes was carried out at the local level, the mayor and other members of the Municipal Property Tax Board could impose an effectively regressive property tax system, by disproportionately decreasing the property tax burden of large landowners – Municipal Board members, municipal government employees, and other prominent figures in particular – relative to those of small and medium-landowners (Bergad, 1983; Casanova, 1984). This had two important effects: raising the cash generation needs of squatters and small landowners by imposing tax obligations would make these groups more willing to work for wages as day laborers during peak seasons. Also, the tax measures could promote the redistribution of land from smaller to larger farmers. Importantly, the historiographic literature has not shown evidence of any differential enforcement of these measures across the central regions throughout the nineteenth century.

Enforcement of Coercive Labor Laws and Political Repression

[15] Formal titles were critical for the provision of credit; transactions involving land transfers, debt, and mortgages rose notably in the early 1840s (Bergad, 1983; Scarano, 1984).

In 1849, the provincial government established a General Landless Peasants' Law ("*Ley General de Jornaleros"*), which entailed a series of measures intended to control the mobility and work activities of landless peasants and small landowners, particularly in coastal areas – due to scant labor supply in the sugar industry. The law established a legal category of "*jornaleros"*, composed of all male individuals who could not prove land ownership or did not own more than two *"cuerdas"* of land and had no professional skill. Those classified as *jornaleros* were forced to seek employment on legally titled farms where employers were empowered to record work schedules, behavior, and insular movement in small passbooks ("*libretas"*) to be carried at all times by the *jornalero* population (Bergad, 1983; p. 92). A second measure carried out by the provincial government involved restrictions on peasants' geographic mobility (Picó, 1979; Figueroa, 2005). This measure imposed strong restrictions on inter-municipality migration, requiring authorization from municipal authorities for peasants to migrate across municipalities. These respectively measures *(i)* artificially increased the pool of laborers to work in large and middle-sized farms, and *(ii)* generated monopsony power for employers, by inhibiting the geographic movement of *jornaleros* across municipal jurisdictions. Both measures were considered to depress the returns to labor.

Municipal authorities were assigned the vigilance and enforcement of these measures, which lasted until 1873.[16] Bergad (1983) documents that in the municipality of Lares, in the heart of the coffee region, the enforcement was influenced substantially by product and labor market conditions at the local level, following the increase in coffee cultivation in the 1860s. Picó (1979) describes how the enforcement of the passbook system by municipal authorities – the district mayors or commissioners and the vagrancy councils (*'Junta de Vagos y Amancebados'*) – took place in the West-Central municipality of Utuado. According to the law's dispositions, any landless peasant (*"jornalero"*) found without a labor contract would be denounced as vagrant by the district commissioner; three denunciations would entail prison time in the capital. Municipalities prepared censuses of landless peasants for the enforcement of these regulations and, in the cases of Lares and Utuado, there is significant documentation of individuals spending prison time in San Juan as a result of the vagrancy law (Picó, 1979; Bergad, 1983). On the other hand, Picó (2007) documents that in the East-Central municipality of Cayey, although "…during some years certain rigor in controlling the conduct of landless peasants was observed […], it was quite rare that "jornaleros" from Cayey would be sent to "La Puntilla" [the San Juan prison]."

[16] As Laird Bergad documents, "[c]lose supervision and rigorous vigilance were practiced by the local authorities. The *libreta* of José de Dios López, a twenty-year-old *jornalero* living in barrio Pezuela, noted six different prison sentences for various offenses including public drunkenness, failure to carry his *libreta*, bad conduct, and breaking a work contract. Most of these sentences were from fifteen to thirty days in the *presidio correccional*. Similar indications of strict enforcement were found in the notations for many of the *jornaleros*." (Bergad, 1983; pp. 122-123)

Municipal governments undertook policing and law enforcement duties, as evidenced by the duties of district commissioners. Additionally, law enforcement increased particularly with the formation of police corps in the mid-1860s – the municipal urban and rural police corps – partly in charge of enforcing these mandatory labor contracts and migration restrictions. Following various law enforcement reforms in the 1870s, the provincial government further decentralized both the financing and the organization of local police forces to a great extent, allowing the administration of municipal police forces to be based on the needs and economic capacity of local governments (Flores Collazo, 1994).

In addition to the municipal police, the threat of a separatist movement following the *Grito de Lares*—a major liberal pro-independence revolutionary attempt which originated in the West-Central region—induced members of the landowning classes to take arms and aid military forces in protecting the regime and maintaining public order (Bergad, 1983; Moscoso, 2003). Importantly, the political cleavages leading to the Lares insurrection were primarily class-based. As noted by Bergad (1980): "… the leaders of the insurrection were all coffee farmers. The working men who seized Lares were all coffee pickers. And those arrested by the revolutionaries were the major coffee merchants and creditors of the town."[17]

As a result, and promoted by the provincial authorities in 1869, a volunteer-based paramilitary group composed of large landowning family members organized itself at the municipality level as the Volunteer Corps (Rosado Brincau, 1891).[18] Also in 1869, the Provincial Government created the Provincial Civil Guard, which replaced a militia based on draft by lottery (Flores Collazo, 1994). We will thus examine the extent to which efforts at enforcing measures against unprivileged and violent opposition groups could have varied across municipalities, as evidenced by differential efforts at the local level in establishing these coercive forces.

The Provision of Public Primary Schooling

Provincial governments throughout the 19th century provided very limited regulation and promotion of public primary education in the Island until the last three decades of the nineteenth century (Coll y Toste, 1909; Osuna, 1949; Cuesta Mendoza, 1974). Although there were various attempts at establishing an island-wide (albeit limited) public school system from the 1820s onwards, these plans did not fully materialize until 1865, following the end of the U.S. Civil War and threats of political unrest throughout the remaining Spanish colonies.

[17] For a contrarian view, see Moscoso (2003).

[18] Volunteer Corps members had to satisfy certain eligibility requirements: (i) Spanish citizenship or naturalization, (ii) no criminal record, (iii) generate earnings and/or have an 'honorable' occupation, and (iv) own sufficient resources to support their activities in the Corps. The economic resources requirement was most significant, since the State did not incur expenditures on personnel or military equipment for volunteers. (It would do so following the Volunteer Corps reorganization of 1886, at which point volunteers would be compensated for their time in the Corps at times forces had to be mobilized. Members would be compensated based on the salary scales of the Spanish military in the island (Rosado Brincau, 1891, in Flores Collazo, 1994)). In addition, the eligibility requirement arguably had the intention of promoting the selection of individuals that supported the conservative pro-Spanish regime.

During this period of threats of civil unrest caused by discontent with the Spanish regime, the central government instituted in 1865 a number of reforms to promote the establishment of a public primary school system.[19] Under this legislation, public schools were defined as those supported wholly or in part by public or charitable funds or other funds destined for public education. Importantly, the founding, financing, and management of schools continued under the responsibility of municipal governments, although guidelines from the central government were provided as to the need for primary schools in each municipality (based on data from the 1860 population census). However, numerous historians have documented the opposition of municipal governments to such legislation, as well as the heterogeneity in the founding and management of public primary schools across municipalities during the last third of the nineteenth century (Osuna, 1949; De la Rosa Martinez, 1980; Astacio Rivera, 1991; Colón Ramírez, 1994). The operation of the educational system would continue in this manner, with minor reforms, until the end of the nineteenth century, with the U.S. invasion of Puerto Rico during the 1898 Spanish-Cuban-American War. We will thus examine the extent to which the provision of public schooling could have varied across municipalities.

II.C. Implications of Export Commodity Boom for Political and Economic Development

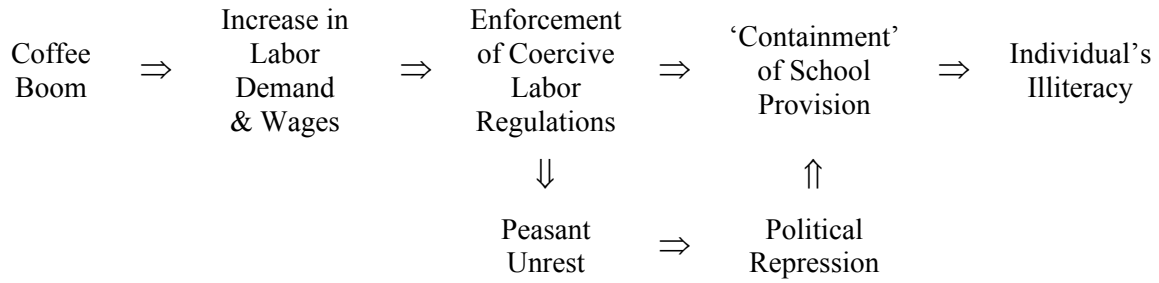
A number of recent contributions in political economy theory allow us to formalize various predictions of the export commodity boom in terms of its effects on the enforcement of coercive regulations, political repression, and the provision of public schooling.

Acemoglu (2006) asserts that, in political regimes under the absolute political control of the elite, inefficient economic institutions that promote factor price manipulation (i.e. wage depression) may be instituted to redistribute rents away from poor and middle-classes to governing elites. Also, a large literature in the theory of violent conflict asserts that, especially in the context of political institutions under the control of elite groups, labor coercion may induce a greater likelihood of revolution from working class and middle-class groups and a response in terms of political and violent repression by governing classes (e.g. Acemoglu and Robinson, 2005). Moreover, these political dynamics may be most prevalent during periods of primary commodity booms, as these increase the resource rents available to the state (Besley and Persson, 2008). Although these models have not generated a direct link between these dynamics and the provision of public goods, these may result in a more limited use of public resources for the provision of efficiency-enhancing public goods, such as public schooling. Finally, explanations analogous to that of Bourguignon and Verdier (2000), in which political elites may have the incentive to restrict educational access to prevent effective democratization (under electoral rules with

[19] This education law, the Organic Decree of June 10, 1865, instituted a number of reforms to rationalize the curriculum, standardize the system of public primary education, to promote the training and qualification of teachers. However, according to education historians, the legislation was implemented with very limited success.

educational or wealth requirements for political participation), may have constrained the emergence of a public school system in the coffee region during this time period.

Based on these premises, the theoretical pathways can be schematically summarized as follows:



These are the main predictions examined in the empirical analysis. Specifically, we examine whether municipalities located in regions with a greater suitability for coffee cultivation (i.e. the coffee region) were more likely to develop during the 19th century coffee boom coercive labor systems in which government resources were disproportionately used for the enforcement of coercive labor contracts, whether this influenced the extent of violent conflict and repression across municipalities, and thus limited the provision of public primary education.

III. Data Description

We employ a unique array of data to help us establish in detail many of the reduced-form relationships under scrutiny. In addition to the geographic, agricultural production, and overall economic activity data summarized above (Tables 1 and 2) (see Data Appendix for details), we collected a unique set of population socio-economic outcome variables for the late nineteenth and early twentieth century period. We use the Public Use Micro-Sample (PUMS) of the 1910 Puerto Rico Population Census, which provides us with demographic and socio-economic information for a representative sample of individuals (Palloni, Winsborough, and Scarano, 2006) (Table 3, Panel A, row 1). These data allow us to examine alternative hypotheses about the nature of the local population's differences in literacy and other socio-economic outcomes. In particular, since the 1910 PUMS reports the individual's age and his/her municipality of residence, we are able to match, under certain assumptions, individuals' personal information to the municipality where he or she was eligible to attend school for cohorts of school-eligible individuals preceding and during the coffee boom. Interestingly, note that literacy rates for individuals age 20-49 years in 1899 (ages 30-59 years at the time of the 1910 Census) were quite low in the region, averaging 16.2 percent in this population (row 1). This literacy rate was low in comparison to other Caribbean and American countries during the period (Engerman, Mariscal, and Sokoloff, 2002).

We also use other literacy and socio-economic outcomes data available at the municipality level from the 1899 Puerto Rico Census of Population (carried out by the U.S. military following the end of the Hispanic-Cuban-American War), which include adult males' literacy rates and secondary school completion rates, the proportion of households with access to sanitation-related local public goods (i.e., sewage, potable water, waste management), and adult males' labor force participation and occupational structure (Table 3, Panels A and E). The educational and occupational outcomes data are also available by native-born status and, among natives, by racial group (not shown in the table). Additionally, the Report of the P.R. Census of Population to the U.S. War Department also presents municipality-level data on the yearly number of births and deaths in each municipality for the period 1888-1898. These data, in combination with population counts from the 1899 Census, allows us to construct basic demographic rates – yearly crude birth and death rates – for this period (see summary measures for these demographic variables in Table 3, Panel A).

We also collected administrative data from multiple primary and/or administrative sources to measure the provision of public elementary schooling across municipalities: the number of primary schools in each municipality for 1828, 1866, 1876-77, and 1897, as well as the number of secondary schools in each municipality in 1897 (see Data Appendix for details). Since we do not have data on the number of school-aged children in each municipality for each time period, we normalize the school availability by the corresponding municipality-level population sizes, except for 1897, where we also normalize the provision of public primary schools by the number of 10-19 year old children in the municipality in 1899 (Table 3, Panel B).[20] Note that approximately only 8 percent of children in the municipality had access to public primary schools at the turn of the century.[21]

To measure the extent of labor coercion across municipalities, we collected data from the 1867 Census of Puerto Rico (at the peak of the first coffee boom, and just preceding the 1868 revolutionary attempt, the *"Grito de Lares"*) on the number of *jornaleros* in each municipality (Table 3, Panel C) (Gaceta de Puerto Rico, 1868c). We also use the per capita value of municipal government resources assigned to the rural and urban police personnel from municipal budgets data for the 1865-66 fiscal year (Panel C). To measure the extent of post-conflict repression, we also coded information on the distribution across municipalities of Volunteer Corps units in 1886 and those of the Provincial Civil Guard in 1876 (Panel C) (Rosado Brincau, 1891; Molinero y Gómez Cornejo, 1879). The Volunteer Corps data represent the share of individuals in a company which are assigned to a specific municipality.

[20] We also employ data on the cumulative number of teachers certified by the San Juan Bishopric during 1805-1848 (Coll y Toste, 1909), although these are not reported in the tables.

[21] Under the conservative assumption that a public primary school could hold 100 students (since the anecdotal evidence is that these held up to 50 students), 0.80 schools per thousand children would imply 8 seats per 100 school-aged children. Making these assumptions more stringent would reduce the estimated mean capacity of the school system in the central municipalities.

The Provincial Civil Guard data represent the number of men assigned to a municipality. See the Data Appendix for a detailed description of the construction of these variables.

We also employ a variety of explanatory variables to demonstrate that our results are not driven by differences in other potential geographic determinants of agricultural productivity, (i.e., terrain grade, altitude, distance to the coast and ports) as well as other alternative factors that may help explain the differences in local institutional formation and policy choices. For instance, municipal governments' budget expenditures data for the 1890s helps us assess the extent to which municipal governments allocated resources differently across budgetary lines during this latter period (Table 3, Panel D). The 1828 Population Census municipality-level data includes detailed demographic information, such as the racial and gender composition of the population, the extent of the slave population, and basic demographic counts which allow us to construct crude birth and death rates – discussed above. These data are used to assess the pre-boom composition of municipalities (Córdova, 1831-33). Analogous data, in addition to occupational distribution summary statistics for both native and foreign adult individuals, are available from the 1899 Census of Population (Table 3, Panels E and F).

Finally, we collected data on the distribution of land ownership at the municipality level from two sources: the cadastral (land census) data collected by the provincial government for tax purposes at one point in time during the 1840s-early 1860s period (preceding the coffee boom), and the actual property tax registers of the 1890s. Tax records contain information on the location, owners, and size of every plot in each municipality during these time periods; we collected the census of land plots for each municipality in the 1840s-60s period and a 25 percent sample of plots for the 1890s period. For each municipality at each date, we construct the land plot-size ownership Gini coefficient among landed individuals. Since we also have data on the number of landless households in the 1899 census, we construct a measure of the overall land Gini coefficient for this period. The average land Gini among landowners remains quite stable over this thirty-year period, as it is 0.65 during both the pre-boom and the peak of the boom period of the 1890s.

IV. Research Design

The identification strategy consists of comparing the municipalities with greater precipitation and lower minimum temperatures – located in the West-Central region – to those with lower precipitation levels and higher minimum temperatures – located in the East-Central region of the island. Comparing the mean differences in municipality-level outcomes across regions with these geographic characteristics, preceding and during the export commodity boom, allows us to identify the effects of these geographic endowments on the provision of public schooling, the literacy rates of the local populations, and on other

relevant political economy outcomes. The specific models that we estimate depend on the availability of data across municipalities and over time.

To measure the impact of the coffee boom on the provision of public primary schooling, we estimate the following differences-in-differences model:

$$(1) \qquad y_{mt} = \theta\, Post_t * G_m + \beta_1 G_m + \beta_2 X_m + \gamma_t + \alpha_{(m)} + \varepsilon_{mt},$$

where y_{mt} is the number of schools per thousand individuals in each municipality m in time period t; G_m is either an indicator variable for municipalities in the coffee region, or the continuous measure of average annual precipitation; $Post_t$ is an indicator variable for the coffee-boom time periods (i.e. 1867, 1876, and 1897); X_m are the remaining municipality-level geographic controls; γ_t are period fixed-effects; and ε_{mt} is the disturbance term; these latter are allowed to be correlated at the municipality level. In comparable specifications, we also include municipality fixed effects (α_m), which allow us to control for all fixed unobserved determinants of public school provision in each municipality. Since we control for fixed effects for each municipality and each period, the effect of the coffee boom is identified by the change in the municipalities with precipitation levels or other geographic endowments more suitable for coffee cultivation, relative to other municipalities, in 1867 or later relative to 1828. Our procedure produces intention-to-treat effects, as we estimate the reduced form effects of being in a coffee-suitable municipality during the nineteenth-century coffee boom.[22]

To measure the impact of the coffee boom on adult literacy rates, we exploit the variation in literacy rates of native-born individuals in different birth cohorts living in different municipalities at the time of the 1910 Population Census. In our analysis, we compare cohorts of individuals who were of schooling-age during the coffee boom (born during the 1871-1885 period; ages 25-39 years in 1910) across municipalities with different endowment levels, relative to individuals in birth cohorts who would have been above school-age during the coffee boom (born during the 1851-1870 period; ages 40-59 years in 1910).[23] We estimate the following differences-in-differences model:

$$(2) \qquad y_{imc} = \theta\, Young_c * G_m + \beta_1 G_m + \beta_2 X_{icm} + \gamma \mathrm{Young}_c + \alpha_{(m)} + \varepsilon_{mc},$$

where y_{imc} is a literacy indicator for individual i in birth cohort c in municipality m; $Young_c$ is an indicator variable for being in the school-age cohort-group (as defined above); X_{icm}, are individual-level gender, native-status, and race controls, as well as a linear and quadratic term on the individual's age; G_m, α_m, and

[22] An alternative empirical strategy would be to implement an IV approach, in which the possibly endogenous explanatory variable of interest would be a measure of coffee cultivation in each municipality during each time period. This variable would be instrumented with the $Post_t * G_{mt}$ variable(s). Unfortunately, we do not have period-specific measures of the extent of coffee cultivation, and thus cannot perform this alternative empirical approach.

[23] The empirical methodology closely follows Duflo (2001), who implements a similar strategy to identify the effects of a primary school construction program on adult men's school attainment and wages in Indonesia.

ε_{mc} are defined as above. Disturbance terms are allowed to be correlated at the municipality level. We also allow in some specifications for a differential effect in municipalities with above-average and below-average minimum temperature levels, to allow for more heterogeneity in the suitability of coffee.[24]

Our research design relies on the assumption that, in the absence of a boom to coffee prices, municipalities with different precipitation and temperature patterns (or municipalities in both West-Central and East-Central regions), would have experienced similar trajectories. Although this identifying assumption is not directly testable, the available evidence supports it. Population trends, baseline mortality rates, baseline differences in public school provision, and pre-boom trends in the literacy rates of the population were quite similar during the first half of the century, suggesting that these municipalities experienced equivalent development trajectories until the 1860s-90s. In addition, the comparison of these groups of municipalities allows us to avoid confounding with other potential geographic determinants of agricultural productivity, (i.e., terrain grade, altitude, distance to the coast and ports) as well as with other alternative factors that may help explain the differences in local *de facto* institutional formation and policy choices, such as the degree of ethnic and racial heterogeneity across municipalities and the extent of the tropical disease burden. We discuss these potential threats to validity in the alternative explanations section (Section VI).

Finally, in assessing the labor coercion and repression mechanisms, since we only have cross-sectional data on each one of these measures, we estimate cross-sectional regression models which account for the influence of other geographic determinants of coffee cultivation, public goods provision, and literacy outcomes, in the following way:

$$y_m = \theta\, G_m + \beta\, X_m + \varepsilon_{mc}, \tag{3}$$

where all municipality-level variables are defined as above. As we will see in the empirical results section, the available cross-sectional comparisons seem to provide consistent estimates of the impacts of the coffee boom on these multiple outcomes.

V. Empirical Results

[24] Since the exogenous variation is at the municipality-cohort level and the timing of the "treatment" (i.e. the coffee boom) coincides across municipalities, we also estimate models aggregating the data into 48 municipality-birth cohorts cells (two cells per municipality) and estimate the analogous differences-in-differences model:

$$y_{mc} = \theta\, Young_c * G_m + \beta_1 G_m + \beta_2 X_m + \gamma \mathrm{Young}_c + \alpha_{(m)} + \varepsilon_{mc},$$

where y_{mc} is the cohort-group literacy rate for cohort c in each municipality m; $Young_c$, G_m, X_m, α_m, and ε_{mc} are cohort-group averages of the variables defined above. Disturbance terms are allowed to be correlated at the municipality-cohort group level. This empirical strategy follows the advice of Bertrand, Duflo, and Mullainathan (2004) to compute standard errors to address both within municipality-year correlation across observations, as well as serial correlation within municipalities across time, for cases with a small number of treatment groups. Estimates from these alternative models are presented in Appendix Table A3.

V.A. Provision of Public Primary Schooling

In this subsection, we investigate whether the coffee boom influenced municipal governments' provision of public primary schooling. To get an understanding of the timing of the divergence, Panel A of Figure 5 illustrates the average time path of public school provision in each region and the average difference across regions. The figure plots the unadjusted mean number of schools per capita (per thousand individuals) in the coffee region (represented by the solid brown line) and in the food crops/cattle-ranching region (represented by the dashed green line), in each time period, as well as the mean difference across regions (represented by the solid red line with circles) and the confidence interval of the estimated difference (represented by the thin dashed lines).

The average number of public schools per thousand individuals in 1828, at around 0.023 in the coffee region and 0.053 in the food crops region, was similar preceding the coffee boom (the difference of 0.030 is not significant at conventional significance levels). In contrast, by the coffee boom periods of 1867 and 1876, there is a substantially lower number of public primary schools per capita in the coffee region (0.33 in 1867, 0.36 in 1876) relative to the food crops region (0.61 in 1867, 0.57 in 1876). The respective mean differences of 0.28 and 0.21 schools per capita (46 and 37 percent) are significant at 95 percent confidence (Figure 5, Panel A). The upward trend in public schools provision in the coffee region by the 1897 time period dampens the difference in provision to 0.10 schools per thousand individuals (18 percent; statistically insignificant at conventional confidence levels). However, this convergence seems to be the result of changes in the demographic composition of municipalities across regions. The average number of schools per thousand children in 1897 is 0.663 in the coffee region, 26 percent lower than the average level of provision in the food crops region (the difference is significant at 95 percent confidence; Table 3, Panel B).

To assess the robustness of the results to the alternative identification strategy, Panel B of Figure 5 illustrates the correlation of public school provision with the level of rainfall in each municipality during each available time period (represented by the solid red line with circles) and the confidence interval of the correlation (represented by the thin dashed lines). Again, the relationship indicates no correlation between annual rainfall levels and the number of elementary public schools per capita preceding the coffee boom, whereas the correlation becomes large and significant during the mid and late-nineteenth century time periods.

Table 4 provides a basic quantification of the relationships depicted in Figure 5. The estimation results are from a series of models based on equation (1), where the dependent variable is the number of public primary schools per thousand individuals in the municipality in each time period. The specifications reported in the first two columns utilize the annual rainfall-post period interaction as the 'treatment' measure, assuming a homogeneous effect of the program across post-boom time periods and

excluding municipality fixed effects. Estimates which exclude geographic characteristics controls indicate that municipalities with 10 in. higher annual rainfall levels experienced a reduction in the provision of schools of 0.070 per thousand individuals (17 percent; significant at 99 percent confidence; column 1). Including other geographic controls reduces the point estimate of the impact to 0.065 schools (16 percent) per thousand individuals (significant at 99 percent confidence; column 2).

Analogous models in columns 3 and 4, which allow for period-specific treatment effects, provide a similar picture to the relationship shown in Figure 5. The effects, including and excluding geographic controls respectively, are greater and statistically significant for years 1867 (0.082-0.084 fewer schools per thousand, or 20-21 percent) and 1876 (0.119-0.130 fewer schools per thousand, or 29-31 percent), whereas the estimated impacts are smaller and insignificantly different from zero for the 1897 period. F-tests of joint significant of the effects indicate that these are robust (p-values are 0.002 and 0.004 in columns 3 and 4, respectively). To further check robustness, we estimate the pooled treatment effect model controlling additionally for the black/mulatto population share in year 1899 (since this share is *lower* in the coffee region municipalities, and could potentially lead to an underestimate of the impact of the coffee boom on public goods provision) and find largely similar results, with an estimated reduction of 0.060 schools per thousand individuals (significant at 95 percent confidence; column 5). Specifications which include municipality fixed effects show stronger reductions in the provision of public primary schools: municipalities with 10 in. higher annual rainfall reduced the provision of primary schools by 0.072 schools per thousand (18 percent; column 6) and the time pattern of the effects is immutable to the inclusion of municipality fixed effects (column 7).

The last three columns of Table 4 report results from specifications using the coffee region-post period interaction as the 'treatment' measure. Estimates including geographic controls indicate that municipalities in the coffee region experienced a substantial relative reduction in the provision of schooling of 0.177 schools per thousand individuals (43 percent; significant at 99 percent confidence; column 8). The period-specific differences suggest that the impact of the coffee boom was largest during the 1867 period (0.257 schools per thousand, or 63 percent), followed by the 1876 period (0.146 schools per thousand, or 36 percent), and the smallest and least precisely estimated impact during the 1897 period (0.125 schools per thousand, or 31 percent) (column 9). The F-test of joint significant of these effects indicates that these are robust (p-value = 0.015). Finally, we further check robustness by including a specification of the pooled treatment with municipality fixed effects, which give estimates of strong reductions: municipalities in the coffee region experienced a decrease of 0.167 schools per thousand individuals (41 percent) during the coffee boom period (column 10).

The evidence on the number of primary schools in 1897, which we also normalize by the number of children in the municipality to take into account differences in the distribution of the population of

children across municipalities, indicates a similar pattern.[25] Although the West-Central region had on average 2.75 more schools than East-Central region municipalities (significant at 99 percent confidence, not reported in the tables), this was mostly driven by the region's larger population. In fact, coffee region municipalities in 1897 had 0.23 fewer schools per thousand children (26 percent) than food crops region municipalities (significant at the 95 confidence level; not reported in the tables).

Finally, note that the secondary/post-primary schools in 1897 were located in the seven major municipalities of the Island, all in the major coastal cities – there was no provision of secondary schooling in the central municipalities during this time period.[26] This evidence is consistent with the hypothesis that local governments in the coffee region provided lower levels of primary schooling than those governments in the food crops region, but offered no differential access to higher education during this period of divergent development.[27] In the following subsection, we present evidence on how these municipality-level differences in the provision of public schooling related to the educational outcomes of these populations.

V.B. Adult Literacy

In this subsection, we investigate whether the coffee boom, by reducing municipal governments' provision of public primary schooling, inhibited individuals' human capital accumulation as measured by their levels of literacy. Again, to understand the timing of the divergence, and also to assess the validity of our research design, we make our empirical model more flexible by allowing for potential effects among each exposed cohort as well as for those cohorts not exposed to schooling during the coffee boom. This can be done by generalizing the empirical model (2) presented above, where we allow each cohort to have a (smoothed) potential effect, as following:

$$y_{imc} = \alpha_m + \gamma_c + \sum_c (G_m \times d_c)\theta_c + \varepsilon_{imc}, \quad (4)$$

where y_{imc} is a variable indicating the literacy (1/0) of individual i from cohort c residing in municipality m; d_c is a variable that indicates whether the individual is in the two-year birth cohort group 1851-52, 1852-53, …, 1885-86; and the other variables are defined as above. Each θ_c coefficient can be interpreted as the (moving average) effect of residing in a higher-rainfall municipality on a given cohort. This specification allows us to assess whether individuals in older school-ineligible cohorts have different

[25] Unfortunately, we do not have data on the number of children in each municipality for years 1828 or 1876-77, which would allow us to normalize the primary schooling supply measure to the target population for these earlier periods.

[26] The secondary schools were located in San Juan (the capital), Humacao, Guayama, Ponce, Mayaguez, Aguadilla, and Arecibo; coastal municipalities whose economies depended mostly on sugar cane production and international trade.

[27] Also, there is no evidence that the provision of private secular or religious schooling were higher in the coffee region, based on data on the number of private schools in 1866 and the cumulative number of teachers assigned by the San Juan Bishopric during the 1805-48 period. Estimates are available from the author upon request.

literacy levels across municipalities with differing rainfall levels, and whether the effects of the coffee boom are increasing in the years of exposure for younger cohorts.

Figure 6 illustrates the cohort-specific rainfall correlation estimates (θ_c) from equation (4) (represented by the solid line with circles) and the 95 percent confidence intervals (represented by the dashed lines). The coefficient estimates in this model fluctuate around zero for cohorts born between 1850 and 1872 (except for the cohort born during the 1856 cholera epidemic in Puerto Rico); they increase in absolute value and fluctuate around 0.25-0.50 percentage points for individuals born between 1873 and 1885. Among the latter age groups, the coefficient estimates are significantly different from zero, showing suggestive evidence of the expected impacts resulting from the coffee boom. The literacy rates differences seem to be strongest for cohorts born following the institutionalization of the politically coercive regime of 1869-1874 (during the post-*Grito de Lares* repression). In summary, the control experiment and flexible analysis show evidence in favor of our research design.

Table 5 provides a summarized quantification of the relationships depicted in Figure 6. The main estimation results are from a series of models based on equation (2). The main specifications use the annual rainfall-school-eligible cohort interaction as the 'treatment' measure, assuming a homogeneous effect of the program across post-boom cohorts. Benchmark estimates that include individual characteristics controls but exclude geographic characteristics controls or municipality fixed effects indicate that literacy rates were 1.74 percentage points (10 percent) lower among younger cohorts in municipalities with 10 in. higher annual rainfall levels (significant at 99 percent confidence; column 1). Estimates from models including geographic controls or municipality fixed effects indicate approximately equivalent effects (1.73 and 1.69 percentage points, respectively), and the level of precision remains approximately unchanged (both estimates significant at 99 percent confidence; columns 2 and 3).[28]

There are substantial differential literacy effects by individuals' gender (columns 4-5). Among male individuals, the coffee boom led to a substantial 2.47 percentage points (11 percent) decrease in literacy rates in municipalities with 10 in. higher annual rainfall levels (significant at 95 percent confidence; column 4), whereas the effects among females was substantially smaller at 0.99 percentage points (8 percent; significant at 95 percent confidence; column 5).[29] Although these gender-specific

[28] Differences across municipalities seem to be concentrated among native-born whites. The estimates indicate that literacy rates were 1.79-1.86 percentage points (10.2-10.6 percent) lower among native-born whites in municipalities with 10-inches higher rainfall (significant at 90 percent confidence; not reported in the tables). In contrast, the estimated impacts for blacks and mulattoes lie in the 0.21-0.31 (0.9-1.4 percent) range and are statistically indistinguishable from zero (not reported in the tables). These differential impacts by racial categories may be partly explained by the effective segregation of the public school system by race throughout the Spanish colonial period (Osuna, 1949; Bobonis and Toro, 2007).

[29] Gender-specific estimates from specifications which include municipality fixed effects indicate a decrease in literacy rates of 2.22 percentage points (10 percent; significant at 95 percent confidence) among males and a decrease in literacy rates of 1.07 percentage points (8 percent; significant at 95 percent confidence) among females, in municipalities with 10 in. higher annual rainfall levels (not reported in the tables).

effects are precisely estimated, we cannot reject at conventional confidence levels that the differential effect for males is significantly different from zero (p-value = 0.22).

To further check robustness, we also estimate models restricting the sample to individuals residing in municipalities along the West-Central/East-Central region border, municipalities which show a substantial discontinuity in the suitability for coffee cultivation and in the actual levels of coffee cultivation by the end of the century. The estimated effects along the border municipalities is substantial – a 3.48 percentage points (23 percent) relative decrease in literacy rates in municipalities with 10 in. higher annual rainfall levels (significant at 95 percent confidence; column 6). We also estimate various specifications which allow for a differential impact for municipalities with above-average and below-average minimum temperature levels (to account for additional suitability for coffee cultivation, see discussion in Section II.A), by including additional interaction terms with an above-average minimum temperature level indicator (columns 7-8). The differential impacts go in the expected direction: literacy rates are 2.79 percentage points (16 percent) lower for individuals living in high-rainfall and cooler temperature municipalities (significant at 99 percent confidence; column 7). Once more, estimates from models including municipality fixed effects do not significantly change the magnitude or precision of the estimate (2.67 percentage points, or 15 percent; significant at 99 percent confidence; column 8). However, analogous homogeneous effect estimates using the coffee region-young cohort indicator interaction show limited evidence of explicit effects of growing up in the West-Central during the coffee boom on individuals' literacy rates (column 9).

The evidence is mostly consistent with the hypothesis that local governments in municipalities most suitable for coffee cultivation provided lower levels of primary schooling than those in municipalities less suitable for coffee, only after the onset of the nineteenth-century coffee boom, resulting in lower literacy rates for the local population. Additionally, the evidence on differential gender effects is indicative of a possible electoral mechanism at play. Because electoral rules conditioned voting rights based on gender, literacy, and wealth (i.e. taxation) requirements, political elites may have had a greater incentive to restrict educational access among males to prevent effective democratization. Since younger males had literacy rates of approximately 25 percent on average across regions – similar to the 30 percent landed share of the population (in 1897) and plausibly close to the share of male individuals with sufficient wealth to qualify to vote based on the taxation requirement – the evidence suggests that constraints on educational access would have been especially effective in curtailing the extension of voting rights of these poorer disenfranchised segments of the population. In contrast, since it was less likely that females would gain electoral rights, elites would have had a lower incentive to limit this group's access to primary schooling. These patterns are also consistent with the differential effects across municipalities with varying levels of political enfranchisement (see Section V.C below).

V.C. Use of Local Resources for Coercion of Labor and Political Repression

In this subsection, we examine whether in addition to the potential disincentives to provide efficiency-enhancing public goods such as schooling, elite-dominated municipal governments employed resources to enforce coercive labor and political institutions. In assessing the evidence for these mechanisms, since we only have cross-sectional data on each one of these measures, we estimate simple cross-sectional regression models as in equation (3), also allowing for heterogeneous impacts for municipalities with above-average or below-average minimum temperature levels.

Labor Coercion

A disproportionate number of *jornaleros* resided in coffee-region municipalities by the year 1867, during the early stages of the nineteenth century coffee boom (Table 6). The estimate from a specification with regression-adjustment for other geographic characteristics suggests that the *jornalero* share of the population was 3.1 percentage points larger in coffee-region municipalities, relative to those in the food crops region (column 1). However, despite the fact that this estimate represents a 33 percent difference in the extent of *jornaleros*, it is not statistically significant at conventional confidence levels. Models which allow for heterogeneous responses by minimum temperature levels show that the effects are concentrated in those municipalities in the coffee region with below-average minimum temperatures (7.9 percentage points, or 85 percent; column 2). The relationship is somewhat dampened and loses precision once we include a geographic control for distance to the nearest port city (6.1 percentage points, or 66 percent; column 3). Interestingly, we measure this occupational distribution at the peak of the first 1860s coffee boom, in the year preceding the *Grito de Lares* revolt by small and middle-scale coffee owners, *jornaleros*, and certain segments of the local and national elites (Bergad, 1983). This evidence is consistent with the historiographic evidence showing that a certain degree of land grabs by middle and large-scale landowners, with the assistance of local government leaders and the local judiciary, generated a landless peasant group to work as laborers in the increasingly profitable coffee plantations (see discussion in Section II.B above) (Bergad, 1983; Picó, 1979). However, this evidence is also consistent with selective migration of individuals with limited resources to work in the coffee industry. We will deal with this concern in the assessment of alternative explanations. Finally, the correlation with the municipality-level rainfall levels is small and indistinguishable from zero (column 4).

Local governments in the coffee region also allocated a disproportionate amount of resources to the enforcement of the coercive labor system, as measured by the per capita rural/urban police personnel expenditures in 1865-66, during the peak of the *libreta* system (Table 6, columns 5-8). The benchmark regression-adjusted estimates suggest that these per capita expenditures were 0.005 escudos (20 percent)

greater in coffee region relative to food crops region municipalities (column 5).[30] Once more though, this estimate is not statistically significant at conventional confidence levels. Models allowing for heterogeneous responses by minimum temperature levels indicate that the effects are concentrated in those municipalities especially suitable for coffee cultivation (0.036 escudos per capita, or 144 percent; column 6). In this case, the relationship is stronger in magnitude when we include a geographic control for distance to the nearest port city (0.038 escudos per capita, or 152 percent; column 7). That said, the correlation with the municipality-level rainfall levels is small and indistinguishable from zero (column 8).

Urban and rural police personnel expenditures constituted 1.8 percent of central region local governments' total expenditures (on average), and this share was significantly larger in coffee region municipalities (3.2 percentage points, standard error 1.3, regression not shown).[31] Also, although these differences in policing expenditures may have been driven by greater needs for crime-related policing in the coffee region, the available evidence suggests that this was not the case. Expenditures in security police per capita during 1865-66 are similar, on average, across coffee and food crops region municipalities (regressions not shown). Moreover, the available budget data from the 1890s period, approximately 20 years after the elimination of the *libreta* system, shows that west-central or higher annual rainfall municipalities did not allocate more resources towards urban and rural police personnel by this time period (Table 6, columns 9-12). In sum, this quantitative evidence points to the hypothesis suggested by the historiographic evidence, that the extent of enforcement of the various measures of labor coercion – the 'libreta' system and migration restrictions – varied significantly across coffee and food crops regions during the time that this labor contracting enforcement system was legal.

Political Repression

As discussed in the historical context section (Section II.B), we examine whether the allocation of paramilitary and security forces was driven by the differential threat of conflict in coffee region municipalities. Based on our measure of the distribution of Provincial Civil Guard members assigned to each municipality in 1876, our benchmark estimates suggest that forces were disproportionately concentrated in coffee region municipalities – an imprecisely estimate difference of 5.2 units (71 percent) across West-Central and East-Central region municipalities (Table 7, column 1). Again, larger and more precisely estimated impacts are found in West-Central region municipalities with low minimum temperatures – the point estimates indicate differences of 8.4 units (113 percent) and 11.8 units (160 percent) for this subgroup (columns 2-3).

[30] The official exchange rate in 1865 was approximately 10 escudos per British pound (Martín Aceña, 1987).
[31] The average share of government expenditures in coastal municipalities, mostly concentrated in the sugar cane industry, was higher (2.4 percent), as the use of coercive labor was even more prevalent in this industry.

Comparable estimates using the distribution of government-backed paramilitary group (Volunteer Corps) units in 1886 as dependent variable suggest that the share of individuals in a company assigned to each municipality was 29.3 percentage points (42 percent) greater in the coffee region relative to the food crops region, but the difference is imprecisely estimated (column 5). Again however, larger impacts are found for West-Central region municipalities with low minimum temperatures – the point estimates indicate differences of 48.9 percentage points (70 percent) and 58.8 percentage points (85 percent) for this subgroup (columns 6-7). Additionally, there is limited suggestive evidence that the Corps' unit headquarters were more likely to be located in municipalities in the coffee region, although the coefficient estimates are imprecisely estimated (column 9-11).[32]

A complementary piece of evidence to examine the political inequality hypothesis is to estimate heterogeneous impacts of the coffee boom on adult literacy rates across municipalities with differing levels of political enfranchisement. Essentially, we separately estimate literacy rate effects models following equation (4) for municipalities with 1885 political enfranchisement below and above the median for all central municipalities; we depict the estimated correlations in Figure 7, Panels A and B, respectively. Although the limited level of political enfranchisement in 1885 (the share of adults with political rights is 19.0 percent, on average) is uncorrelated with municipalities' average rainfall levels and do not differ on average across the two regions, it is a potentially endogenous outcome and is positively correlated with the level of land inequality, population size, and negatively correlated with the average minimum temperature in the municipality (correlations not reported in the tables).

The coefficient estimates on the rainfall-literacy rate correlations for the below median vote share fluctuate around zero for cohorts born between 1850 and 1867 (again, except for the cohort born during the 1856 cholera epidemic in Puerto Rico), and then increase in absolute value and fluctuate around 0.20-0.60 percentage points afterwards (Panel A). Among the latter age groups (until the 1880 birth cohort), the coefficient estimates are significantly different from zero, showing evidence of the expected impacts resulting from the coffee boom. In contrast, the estimates for the above median vote share group of municipalities show no distinctive trend-break in the zero correlation with rainfall levels (except for the 1875-1877 birth cohorts) (Panel B). This evidence is consistent with contexts – as in the U.S. South – where political elites may have had the incentive to restrict educational access to prevent effective democratization (under electoral rules with educational or wealth requirements for political participation), following the onset of commodity booms and the increased threat of revolts (Wright, 1986; Margo, 1990; Bourguignon and Verdier, 2000). We conclude that the evidence jointly points towards class-based social

[32] Estimates using the annual rainfall measure as the main explanatory variable of interest find little evidence of greater resource allocation in higher rainfall municipalities (see Table 7, columns 4, 8, and 12).

conflicts under a non-democratic political regime as the main determinant for the apparent divergence in local governments' policy choices.

VI. Assessment of Alternative Explanations

The scholarly debate has identified multiple other geographic or institutional configurations which may have played a role in explaining the observed patterns. For instance, in addition to the potential role of economic inequality in influencing the emergence of educational systems, other alternatives such as contemporaneous effects of the tropical disease burden on the health of these local populations (e.g. Bloom and Sachs, 1998), selective migration of colonizers with different levels of human and social capital into different regions (Glaeser et al. 2004), or differences in the ethnic and religious composition of populations across regions (e.g. Easterly and Levine, 1997) may have influenced the divergence in educational outcomes. In this section, we present a series of tests of our underlying counterfactual assumptions and show evidence which attempts to rule out these alternative explanations.

Land Inequality

The stark divergence in agricultural production led to small differences in the distribution of land ownership across municipalities. Figure 8 presents kernel density and Lorenz curve estimates of the distribution of individual land ownership among landowners for each region (Panels A and B, respectively). The kernel density estimates suggest that land ownership was only slightly more concentrated in the coffee-growing region relative to the distribution of land ownership in the food crops region, as there is a greater (smaller) share of landowners with very small (large) plots in the latter region relative to the former (Panel A). However, most differences may be explained by the fact that plot sizes were larger on average in coffee-region municipalities (43.9 and 35.4 acres, respectively). The Lorenz curves presented in Panel B suggest that, if anything, inequality in land ownership among landowners was greater in the food crops region than in the coffee region. These distributional differences would suggest that the land tenure structure did not diverge dramatically across regions during the coffee boom.

These patterns are confirmed by comparing municipality-level land inequality levels more systematically across all municipalities in the two regions during the period 1891-94 (Table 8). Estimates of the regression-adjusted differences in the overall land Gini coefficient suggest that the overall level of land inequality was 3.8 percentage points (4.1 percent) higher in the Gini scale in coffee-region relative to food crops-region municipalities, although it is imprecisely estimated (column 1). We find larger differences for West-Central and East-Central region municipalities with low minimum temperatures – the point estimates indicate differences of 6.2 percentage points (6.7 percent) and 7.3 percentage points (7.9 percent) for this subgroup (columns 2-3).

Although the overall land Gini comparisons suggest that stratification increased in the coffee region, the cross-municipality differences are mainly driven by variation in the degree of land concentration among landed individuals, rather than by differences in the share of the landless population across municipalities. Although the average cross-regional difference in the land Gini coefficient among landowners is 3.7 percentage points (4.9 percent), we again find larger differences for West-Central and East-Central region municipalities with low minimum temperatures – the point estimates indicate marginally significant differences of 13.3 percentage points (17.7 percent) and 11.8 percentage points (15.7 percent) for this subgroup (columns 5-7). In contrast, the average proportion of landless households is more similar across regions. The point estimate for the overall difference is an imprecisely estimated 3.8 percentage points (5.5 percent) (column 8), and those for the low minimum temperature subgroups are 4.0 percentage points (5.8 percent) and 10.8 percentage points (15.5 percent), but quite imprecisely estimated (columns 9-10).[33] These comparisons suggest that there were only small increases in inequality in the distribution of land ownership as a result of the coffee boom in the late 1800s, and the changes were not of the sort hypothesized by the factor endowments – economic inequality hypothesis.

Finally, to the extent that inequality in the distribution of land ownership could negatively impinge on the literacy rate of the population, our estimates would be biased upwards. However, similar to existing work comparing historical relationships between land inequality and development outcomes across local jurisdictions (Acemoglu et al., 2008; Nunn, 2008), our estimates show that the partial correlation of inequality in land ownership and literacy, conditional on the reduced-form coffee boom-related effects, is positive (not reported in the tables). Moreover, estimates of the coffee-boom literacy effects from models analogous to equation (2) for the sub-sample of municipalities with 1980s land ownership data, which additionally control for the post-boom overall (or alternatively, landowners') land ownership Gini coefficient and its interaction with the post-boom birth cohort, are even larger in absolute terms, among male individuals in particular (see Appendix Tables A1 and A3, columns 2-4).[34] Based on this analysis we conclude that the evidence is inconsistent with economic inequality as the mechanism explaining these effects.

Racial/Ethnic Fractionalization

African slave populations were concentrated in coastal areas – those areas particularly suited for the production of sugar cane (Scarano, 1984). According to various historians, slave labor was seldom used in the coffee plantations and food crops sector in Puerto Rico (Picó, 1979; Bergad, 1983; Seda

[33] Since the sample of municipalities with land distribution data among landowners is a subset of the overall sample of 23 municipalities, the differences in results may be driven by differences in the sample composition. However, note that the differences in the landless households share are similar for this subset of municipalities (Table 8, column 11).

[34] Although the analogous (land ownership Gini-conditioned) estimates of the effects of the coffee boom on the provision of public primary schooling are somewhat smaller in absolute value, these are still large and precisely estimated (see Appendix Tables A2, columns 2-4).

Prado, 1996). Moreover, the anecdotal evidence is confirmed by the racial composition statistics from the 1928 and 1899 population censuses. Ethnic heterogeneity was actually lower in the high-rainfall coffee region than in the lower-rainfall food-crops growing region. The share of the non-white population (excluding sharecroppers) in 1828 in the coffee and food crops regions were 41 percent and 43 percent respectively, and the slave population was relatively small (8 percent) in both (Table 1, Panel C). By 1899, the black and mulatto population share is substantially and statistically significantly lower in the coffee region than in the food crops region (21.9 and 39.2 percent, respectively) (Table 3, Panel E). Also, Puerto Rico's native indigenous populations were essentially decimated during the 16th century, and these pre-conquest social organizations were destroyed preceding the 19th century. Therefore, to the extent that racial or ethnic fractionalization could have lead to the formation of suboptimal institutions or to the under-provision of public goods (e.g., Easterly and Levine, 1997), it may bias our estimates downwards.[35]

Geographical Sorting of the Native-Born Population and Differential Returns to Schooling

There could have been a high degree of geographic sorting of the population during this period, leading to estimates of differences in literacy outcomes of the population to be driven by individuals' sorting into jurisdictions based on their unobserved characteristics and preferences determining the demand for schooling and literacy rates. For instance, this would be the case if there were a greater demand for unskilled labor in the coffee region (e.g. for coffee picking) relative to the food crops region, causing a disproportionate share of unskilled and perhaps illiterate individuals to sort into the former region. Similarly, these individuals could also demand lower levels of public schooling provision, since the demand for education could have been lower among this population.

It is undoubtedly true that some degree of migration occurred across regions. However, during a significant part of the second half of the century, the central government imposed strong restrictions on inter-municipality migration for the landless population across all regions in the island (to promote the creation of local labor market monopsonies). These measures, enforced by local governments, mitigate concerns of selective sorting, at least of the landless population (Picó, 1979).

Also, to the extent that higher-skilled individuals (or individuals with other unobserved characteristics correlated with schooling levels) were more likely to move or stay away from the coffee region, we should observe differences in the higher education completion rates of natives across the two regions. These should not be directly affected by differences in schooling access because no secondary schools were located in the central region of the island at the time. However, data from the 1899 Census of Population suggests otherwise; higher education completion rates were low in both regions (1.0 percent among native adult males), and there were no significant differences across regions in higher education

[35] All estimates reported in Section V are qualitatively and quantitatively robust to the inclusion of the 1899 black/mulatto population share as an additional control variable. These are available from the author upon request.

completion rates (0.9 and 1.1 percent, respectively; not reported in the tables). As a final point, the literacy rates of 40-49 year old adults, individuals who could have sorted out of the coffee region it this were driven by selective migration due to the lower returns to schooling in coffee cultivation, are not significantly different from zero across higher and lower-rainfall municipalities (see Section V.B). These pieces of evidence jointly support the view that educational group-specific geographic mobility patterns are not driving our results.[36,37]

Immigrants' Location Patterns

Selective migration of foreigners of varying socio-economic status across the regions of the island could have induced differences in the patterns of development, to the extent that immigrants with higher levels of physical and human capital could have migrated to the food crops region. For instance, Bergad (1983) documents that Catalan and Mallorquín families, highly involved in the coffee cultivation and distribution industries, moved into Lares, whereas Corsican families assented in Yauco (also a coffee region municipality). Similar immigration patterns occurred however in East-Central municipalities, as exemplified by the case of Cayey (Picó, 2007). Therefore, another potential piece of evidence in favor of the geographic sorting hypothesis would suggest that foreigners' socio-economic characteristics (i.e., schooling levels) would differ across the coffee and food crops regions. Using 1899 Census data on the municipality-level shares of the foreign adult population and foreigners' literacy rates, we find that foreigners composed 0.6 percent of the population in these regions (on average), and were more likely to reside in the western region by 0.5 percentage points (Table 3, Panel E). However, foreigners' literacy rates were not significantly different across coffee region and food crops region, for all municipalities or for the low minimum temperature subgroup (Table 9, columns 1-5).

Note that the cross-sectional comparison of municipality-level averages in the year 1899 does not drive our lack of negative results. Cross-sectional comparisons of literacy rates for native-born adult males provide similar estimates to those using the difference-in-difference identification strategy employed above (Table 9, columns 6-10). This comparison also helps us corroborate the validity of the cross-sectional comparisons. We thus conclude that, to the extent that economic opportunities could have led to some degree of sorting of the population, this does not seem to drive the differences in the educational status of the native-born population across the two groups of municipalities. This evidence

[36] An additional alternative explanation is that increases in the demand for child labor, particularly in coffee picking, would have increased the opportunity costs of attending school. However, since the coffee boom started in the 1860s, individuals ages 40-49 (and somewhat older), for whom we do not observe significant difference in literacy rates across higher and lower rainfall municipalities, would have also faced these lower returns to schooling.

[37] Finally, to the extent that differential trends in the pre-boom variation in the provision of public schooling capture differential demand for schooling across municipalities based on pre-existing preferences, this does not seem to be driving the literacy results. The analogous (pre-boom schools per capita-conditioned) estimates of the effects of the coffee boom on public school provision and literacy rates are greater in absolute value and precisely estimated, the latter particularly among males (see Appendix Tables A1-A3, columns 5-6).

also suggests that the potential selective migration of foreigners with different levels of human capital across regions recently proposed by Glaeser et al. (2004) may not have been prevalent in this context.

The Tropical Disease Burden and Health Risks

Since Puerto Rico is relatively small and located entirely within the tropics, the magnitude of the tropical disease burden should not vary substantially across regions of the island. Moreover, this assumption is indirectly verifiable, since mortality rates did not vary significantly across municipalities during the early 19th century, preceding the establishment of public health infrastructure during the late 1800s and early 1900s. Estimates of crude death rates from the 1828 Córdova Report indicate that these centered around 23.1 deaths per thousand individuals per year and were not significantly higher in the coffee region (Table 1, Panel C). This evidence, although somewhat crude, provides us with some confidence that there were no significant differences in health risks that could have affected these populations preceding the coffee boom.

In addition, exploiting the crude death rates estimates for the 1828, 1888-1898 period, we assess whether there was a divergence in the health status of the population throughout the coffee boom period (Table 10, Panel A). We find no indirect evidence that governments or individuals in coffee region municipalities were more likely to invest in health or sanitation-based infrastructure or services in substitution of schooling (for instance, to the extent local elites would have preferred to invest in the local population's health to increase the productivity of labor). In fact, differences-in-differences estimates based on equation (1) respectively excluding and including municipality fixed effects suggest there was no overall decrease in crude death rates during the 1888-98 period (Panel A, rows 1-2, columns 1 and 4). Moreover, coffee region municipalities with below-average minimum temperatures experienced a large and statistically significant surge in the crude death rate of 11.5 deaths per thousand individuals (46 percent) during the period (Panel A, row 3, column 4).[38]

Local Government Expenditures and Provision of Other Local Public and Private Goods

We next turn to the evidence regarding households' access to sanitation-related public goods. Since municipal governments were also responsible for the provision of sanitation-related public services (i.e., water access, sewage, solid waste management), we can assess whether there was a differential access to publicly-provided sanitation services and infrastructure (Table 10, Panel B). Using data on the municipality-level proportion of households with access to publicly-provided waste collection services from the 1899 Census, we find in our preferred regression-adjusted specification that households in municipalities with 10 in. higher annual rainfall had on average a 3.5 percentage points (36.5 percent) lower access to public waste collection services (significant at 90 percent confidence) (Panel B, row 1,

[38] This is evidence consistent with health investments being countercyclical and mortality at young ages procyclical to coffee prices (see Miller and Urdinola (2007) for evidence from Colombian municipalities in contemporaneous times).

column 2), although the estimates' prevision are not robust to modifications of the empirical model (Panel B, rows 1-2). Finally, we find that households' access to cesspools was somewhat higher in the coffee than in the food crops region. Estimates suggest that access to cesspools – usually privately owned – was 7.6 percentage points (54 percent) higher in coffee municipalities than food crops municipalities (Panel B, row 3, column 5).[39] Although the relationship is generally imprecisely estimated, we find an 11.8 percentage points (83.7 percent) significantly larger share of households with access to cesspool in coffee region and low-minimum temperature municipalities (Panel B, row 4, column 5). Overall, this evidence provides very limited support for the view that a more limited provision of public-health or sanitation-related public goods would have been an important driver of the diverging patterns in literacy.

We also examine the cross-sectional local governments' budget data for the early 1890s period to assess whether coffee-region governments allocated resources in a manner possibly more beneficial to the interests of local elites (Table 10, Panel C). Interestingly, although coffee region municipalities were arguably wealthier in aggregate terms, per capita budgets were not correlated with annual rainfall levels or were significantly larger among coffee-region municipalities (Panel C, row 1, columns 2 and 5). Also, consistent with the previous results, municipalities allocated fewer resources towards primary schooling, as measured by the public school expenditures per 10-19 year-old child in the municipality (Panel C, rows 2-3), and no fewer resources in health-related expenditures (Panel C, rows 4-5). In particular, municipalities with 10 in. higher rainfall levels allocated 4.2 fewer "*céntimos"* per child (10 percent) in overall school expenditures and 3.4 fewer *céntimos* per child (11 percent) in teacher salary expenditures (both significant at 90 percent confidence; rows 2-3, column 2). Also, point estimates suggest that coffee region municipalities allocated 6.6 fewer *céntimos* per child (16 percent) in overall school expenditures and 5.7 fewer *céntimos* per child (19 percent) than food crops region municipalities, although these are imprecisely estimated (rows 2-3, column 5).

In contrast, we observe that higher annual rainfall and cooler temperature municipalities, conditioning on the altitude, ruggedness, and distance to ports geographic characteristics, allocated more public resources towards public infrastructure, especially road construction and maintenance (Panel C, rows 6-8). Municipalities with 10 in. higher rainfall levels allocated 3.8 more *céntimos* per capita (66 percent) in overall public infrastructure expenditures and 7.7 more *céntimos* per capita (133 percent) if a below-average temperature municipality (the latter significant at 95 percent confidence; rows 6-7, columns 2-3). The estimated effects on roads construction and maintenance expenditures are even stronger; municipalities with 10 in. higher rainfall levels and below-average annual temperature allocated

[39] Unfortunately, we do not have data on the exact proportion of households who privately owned cesspools during this time period, or its distribution across the household wealth distribution within a municipality. Knowledge of this data would allow us to assess whether it was wealthier households, less likely to be credit constrained, who would be able to invest in this infrastructure.

5.8 more *céntimos* per capita (161 percent) in expenditures towards this budget line (significant at 95 percent confidence; rows 8, columns 2-3). The estimates for the regression-adjusted coffee-food crops regions comparisons reflect the same patterns (rows 6-8, columns 5-6). This evidence is consistent with municipal governments substituting resources away from efficiency-enhancing public goods that might be beneficial for a broad cross-section of the population and into public goods more likely to enhance the efficiency of the elites – large landowners and merchants in charge of the transportation of export commodities towards coastal ports.[40]

Political Conflict between Landowners and Industrialists

Political conflict due to the diverging interests of landowners and industrialists could explain the existing results in two ways. First, to the extent that the costs of political repression and coercion were lower in the agricultural sector of the economy relative to the industrial sector, then regions with more prominent agricultural sectors would have been more likely to use repression against labor to maintain political and economic rents (e.g. Acemoglu and Robinson, 2005). Second, landed elites may have blocked school reforms if human capital-promoting reforms adversely affected land rents, thus retarding industrialization and the region's economic development (Galor, Moav, and Vollrath, 2008). To the extent that these incentives were greater in municipalities with higher land values, this could explain the lower provision of growth promoting local public goods.

The latter theory also predicts that the industrialization of the coffee-region municipalities should have been delayed as a result of this conflict, and thus the share of the population in non-agricultural sectors should have been lower in the high-rainfall region relative to the lower-rainfall region. To test this prediction, we compare the adult male populations' occupational distribution across regions using the 1899 Census of Population data. However, using the 1899 census occupational data, we do find that the shares of the adult male population participating in the commercial, manufacturing, or services sectors were similar across regions (Table 10, Panel D). In particular, the difference in the share of the adult male population participating in the agriculture, fishing, or mining sectors (46.5 percent, on average) differs by 1.3 and 1.4 percentage points on average across regions, but is never statistically significant from zero (Panel D, column 4).[41] We conclude that this mechanism is not prevalent in this context.

VII. Conclusion

[40] Interestingly, mayor's salary expenditures are significantly higher in coffee region municipalities by 193.5 pesos per year, or 21 percent given an average salary of 928.6 pesos (significant at 95 percent confidence; not reported in the tables).

[41] Among foreign-born males, however, we do find a significant difference in the occupational sector shares across regions (see Appendix Table A3). This evidence is consistent with the historical evidence that Spanish and other foreigners became the most prominent large landowners in the region (Picó, 1979; Bergad, 1983). Since foreigners constituted at most one percent of the population during the period, we read this as foreigners disproportionately selecting to participate in the agricultural sector in these municipalities rather than as evidence that the agricultural sector was more prominent in the West-Central municipalities.

This paper uses variation in the onset of the nineteenth century coffee industry across municipalities in Puerto Rico to examine whether changes in the incentives for elite groups to enforce coercive labor and political institutions led to a restricted provision of public schooling, arguably one of the most prominent determinants of long-run development throughout the nineteenth and twentieth centuries (Galor, 2005). Our findings indicate that local governments in the coffee-region (1) allocated more public resources to enforce coercive labor measures and for purposes of political repression, and (2) assigned fewer resources towards the provision of primary schooling. This evidence is consistent with models of factor price manipulation and political repression under elite-controlled non-democratic regimes, in which the returns to labor are depressed as a result of the extraction of rents from peasants' wages and literacy-based voting rights are restricted through limited access to schooling.

The study contributes to the growing new comparative development literature by exploring how the establishment of *de facto* coercive labor and political institutions – as distinct from the roles played by economic inequality and populations' ethno-linguistic and religious compositions – crucially affected human capital formation, an important determinant of long-run economic performance during the post-colonial period. Whether a different set of national-level political and governance institutions, such as democratizing and accountability-enhancing institutional reforms imposed from above, would have led to different trajectories in government activities and the level of human and economic development of these jurisdictions remain an important topic for future research.

From a methodological perspective, as emphasized by Pande and Udry (2005), the study exploits the fact that incentives provided by the de jure institutional context varied with individuals and groups' economic and political conditions, to understand the mechanisms through which geographic endowments and de facto institutional differences may have impinged on the American colonies' paths to prosperity. We see this as an important contribution to the current research program that uses micro data-based research to understand in greater detail the determinants of political and economic development during the colonial period and its implications for countries' current economic performance.

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Appendix: Data Sources and Description

Geographic Characteristics:

Average monthly and annual rainfall, 1899-1928 (in.): available at the weather station from Roberts (1941). If there are a non-zero number of weather stations in the municipality, the simple average of precipitation measures is assigned to the municipality. For municipalities with no available weather stations, the simple average of adjacent municipalities' weather measures is assigned to the municipality.

Average altitude (meters), average land gradient (degrees), distance to nearest port (km): GIS data are available from the Government of Puerto Rico Planning Board. Municipality-level averages are constructed using ArcGIS software.

Average maximum and minimum temperature, 1950-2000 (ºC): National Climatic Data Center (NCDC) and non-NCDC data available at The UNC-Chapel Hill Southeast Regional Climate Center. Imputation for municipality-averages following the same algorithm as the one for average monthly and annual rainfall. Link: http://radar.meas.ncsu.edu/climateinfo/historical/historical_pr.html

Coffee Prices, Cultivation and Production; Aggregate Economic Activity:

International coffee prices data: International wholesale coffee export prices are quoted in the UK (London) market, rather than in the domestic one. These data are taken from Sauerbeck, Augustus. "Prices of Commodities and Precious Metals," *Journal of the Statistical Society of London*, vol. 49/3 September 1886 Appendix C, for the years 1860-85. Sauerbeck, A. "Prices of Commodities During the Last Seven Years," *Journal of the Royal Statistical Society*, vol.56/2 June 1893 p.241 ff., for the years 1885-1892. Sauerbeck, A. "Prices of Commodities in 1908," *Journal of the Royal Statistical Society*, 72/1 Mar 1909 for the years 1893-1898.

Number of coffee mills, feet ("pies") of coffee cultivation, coffee production ("quintales"), aggregate private income and wealth: available from Pedro Tomás de Córdova's statistical and qualitative description of geographic and economic conditions across municipalities in the island (Córdova, 1831-33). These data were prepared by municipal governments, as required by the Spanish Crown (and collected by Córdova, an emissary of the Crown) to improve the central government's information regarding economic conditions in the island during a period of Bourbon reforms.

Agricultural land under coffee, sugar cane, tobacco, food crops cultivation; land for pastures, 1896: is available from Henry K. Carroll's report to the U.S. Government on economic conditions in the island following the end of the 1898 Spanish-Cuban-American War (Carroll, 1899). These data on rural lands, as declared by their owners for assessment, is considered to be of reasonable quality, since it was collected by property and income tax collection officials during the end of the Spanish regime.

Socio-Economic Status and Demographic Information:

Total population in 1824, 1828; number of sharecroppers, slaves, free blacks, mulattos, whites, year 1828; number of births, deaths, and marriages, year 1828: available from Córdova (1831-33). Population shares are constructed based on total population in 1828; crude rates are constructed using total population in 1828 as denominator.

Total population in 1846, 1860, 1862, 1865, 1867: available from Gaceta de Puerto Rico (1868a).

Adult literacy rates, English literacy rates, female fertility (number of children ever born), number of surviving children, gender, age (in years), nationality, father's nationality, mother's nationality, municipality of residence: available from Public Use Micro-Sample (PUMS) of the 1910 Puerto Rico Population Census (Palloni, Winsborough, and Scarano, 2006)

School enrollment rates of children ages 6-10 years, literacy rates of children ages 11-20 years, secondary school completion rates of children ages 11-20 years, year 1899; adult males' literacy rates, adult males' secondary school completion rates, by racial category, nationality, year 1899; proportion of households with access to non-educational local public goods (i.e., sewage, potable water, waste management); adult males'

labor force participation and occupational structure, by racial category, nationality, year 1899: available from Academia Puertorriqueña de la Historia ("APH") (2003).

Primary School Provision and Municipal Budget Allocations:

Number of primary schools in the municipality, years 1828, 1866-67, 1876-77, 1897: available respectively in Córdova (1831-33), Gaceta de Puerto Rico (1868b), Ubeda y Delgado (1878), and APH (2003).

Budget-based revenue and expenditure data, year 1866-67 and 1890s (various years): 1866-67 data available from "Resúmen de los Presupuestos Municipales de Gastos e Ingresos de la Isla de Puerto Rico para el año económico de 1866-67.", Archivo Histórico Nacional de Madrid, Fondo de Ultramar. Data includes budget assigned to rural police personnel and materials expenditures as well as public schooling expenditures. Data for 1890s available from Archivo General de Puerto Rico, Fondo de Diputación Provincial.

Share of 'jornaleros' in population, year 1867: available from 1867 Census of Puerto Rico, published in Gaceta de Puerto Rico (1868c).

Military and Paramilitary Forces:

Volunteer Corps (VC) distribution data: Rosado Brinacu (1891) documents the distribution of Volunteer Corps units (companies) across municipalities of the island for the year 1886. Unfortunately, the source does not provide data on the number of men in the VC company in each municipality; it only provides the geographic distribution of VC companies to all municipalities across the island. Therefore, we impute the share of men in a company assigned to each municipality using equal shares for each company. The following information on the 10th VC battalion exemplifies the data available and our imputation method.

Volunteer Corps - 10th Battalion

Company 1 – Municipality of Coamo (Battalion Headquarters) (1 company)

Company 2 – Municipality of Juana Díaz (1 company)

Company 3 – Municipality of Aibonito (1 company)

Company 4 – Municipalities of Barros (0.5 company), Barranquitas (0.5 company)

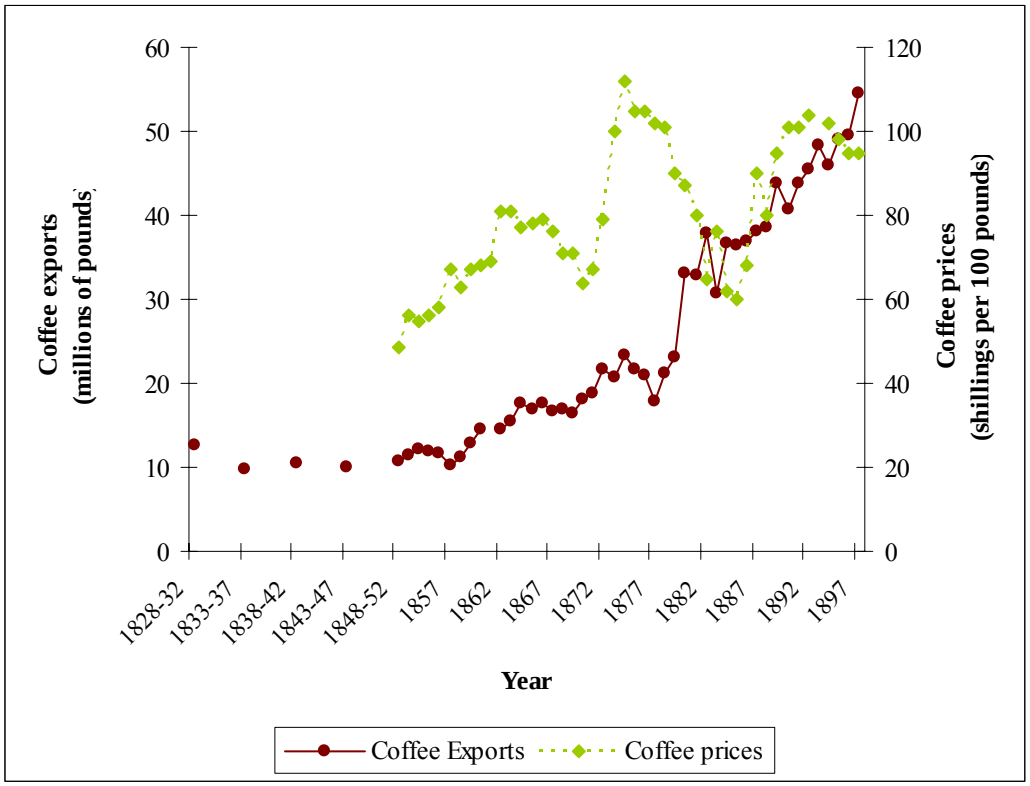
Provincial Civil Guard distribution data: Molinero y Gómez Cornejo (1879) documents an analogous distribution of Civil Guard units (companies) across municipalities of the island for the year 1876. Again, the source does not provide data on the number of men in each municipality. Therefore, we impute the share of men in a company assigned to each municipality using equal shares for each company. In some cases, particular units are assigned to '*barrios*' (municipal districts – smallest administrative unit), and we aggregate the coding at the municipality level.

Land Distribution:

Plot size and owner of each plot for each taxed plot in municipality, for one year in 1845-1860 period: available from cadastral land census or land tax registries, for the following municipalities: Aibonito (cadastre - year 1854), Barranquitas (tax registry - 1846), Caguas (cadastre - 1860), Cayey (cadastre - 1860), Cidra (cadastre - 1860), Comerío ("Sabana del Palmar") (cadastre - 1853), Gurabo (cadastre - 1860), San Lorenzo ("Hato Grande") (cadastre - 1860), Lares (tax registry - 1854), Morovis (cadastre - 1857), Toa Alta (cadastre - 1860), Utuado (cadastre - 1856). Source: Archivo General de Puerto Rico, Fondo: Administración Provincial (Gobernadores Españoles). Land gini coefficient for each municipality constructed from the distribution of plot sizes for each individual owner.

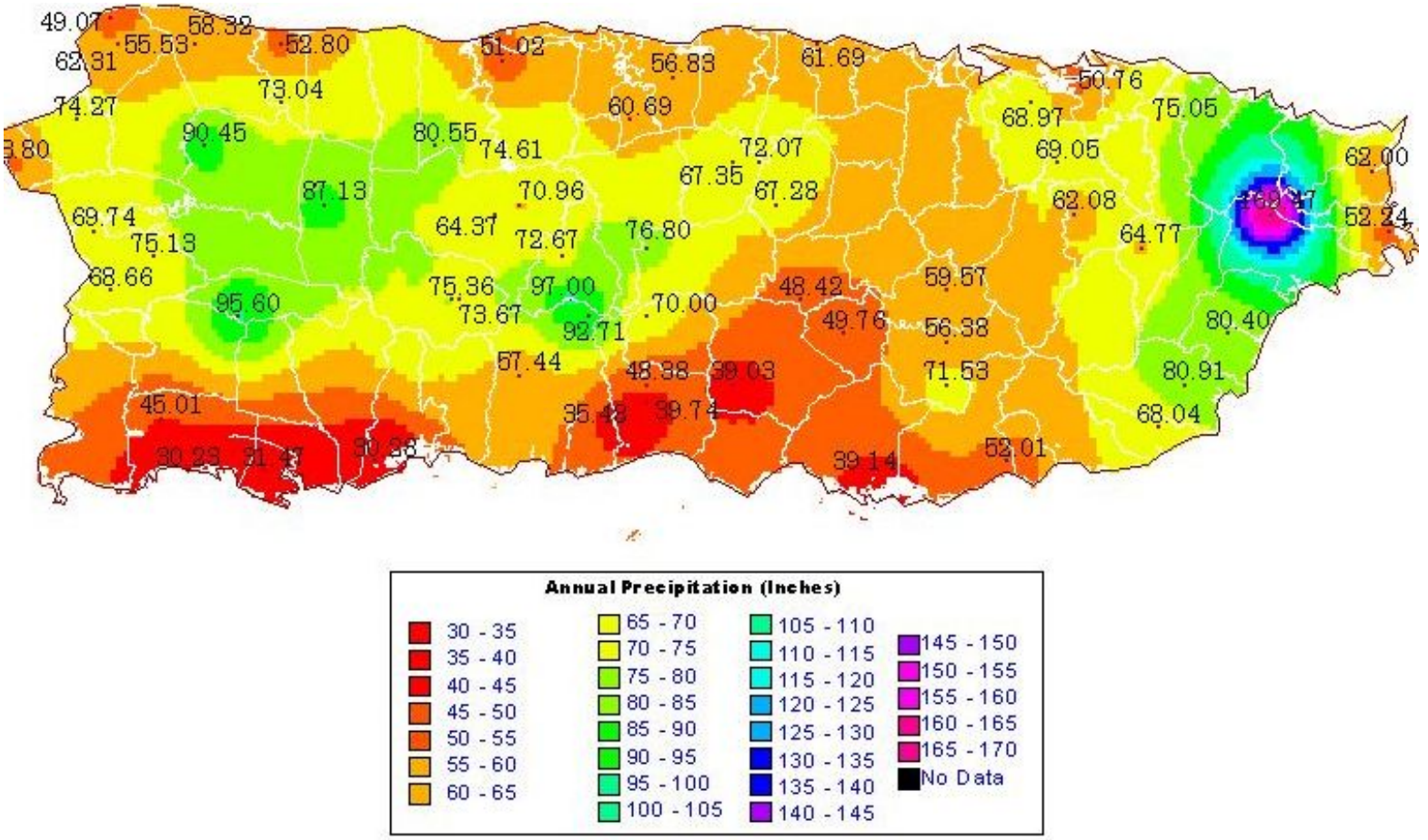
Plot size and owner of each plot for each taxed plot in municipality, for one year in 1891-1894 period: available from cadastral land censuses for all municipalities in center of the island. Source: Archivo General de Puerto Rico, Fondo: Administración Provincial (Gobernadores Españoles). Land Gini coefficient for each municipality constructed from the distribution of plot sizes for each individual owner.

Figure 1: Volume of P.R. Coffee Exports and International Coffee Prices, 1825-1897



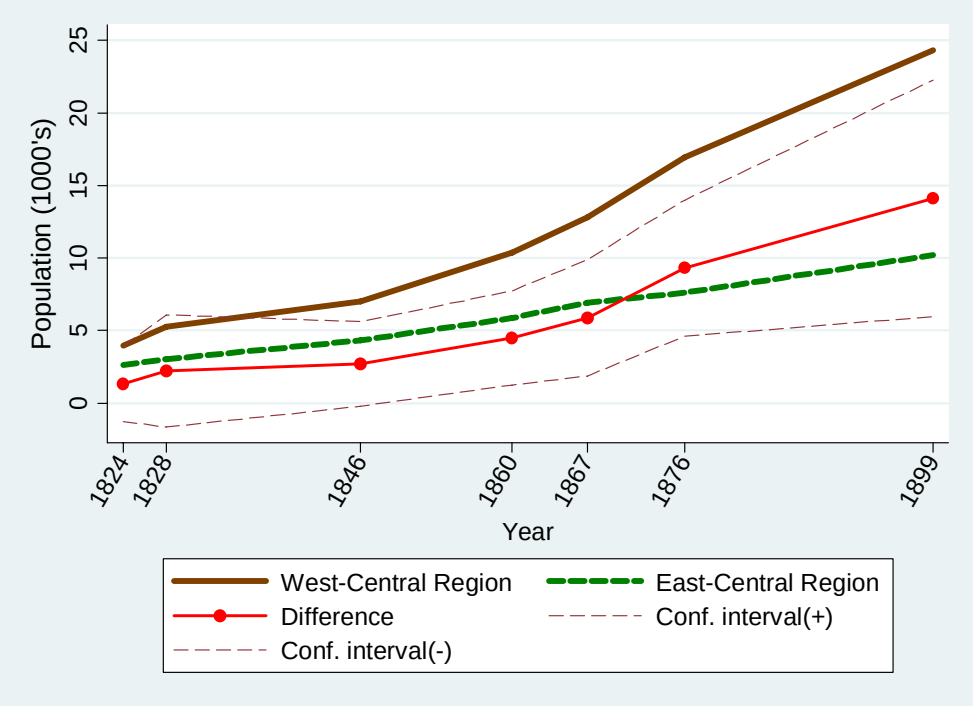
Sources: Coffee exports data – *Boletín Histórico de Puerto Rico,* volume 5, p. 300, averages for the years 1828-32, 1833-37, 1838-42, 1843-47, and 1848-52, available in Dietz (1986); Puerto Rico, Intendencia General de Hacienda, *Balanza Mercantil*, for the years 1853-1860; *Estadística General*, for the years 1862-1898, in Bergad (1983). Wholesale export prices for coffee (quoted in the UK) are taken from Sauerbeck (1886, 1893, 1909). See the data appendix for details.

Figure 2: Mean Annual Precipitation, 1971-2000



Source: National Weather Service (2007).

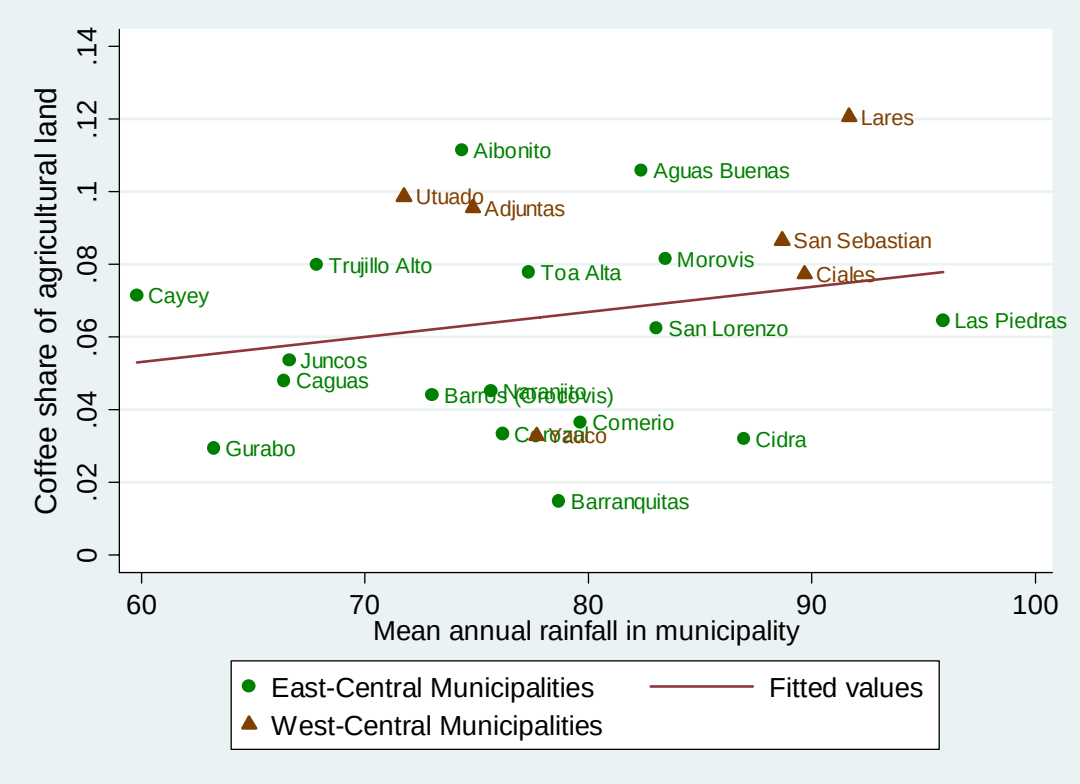
Figure 3: Trends in Municipality-Level Population Sizes throughout the 19th Century



Notes: The figure depicts trends in average population sizes for each region (coffee region = solid brown line; food crops region = dashed green line). Average difference coefficient estimates from OLS regressions, depicted in solid red line with circles, and their 95 percent confidence intervals, depicted in thin dashed lines, are presented.

Sources: Author's calculations from Córdova (1831-33), Gaceta de Puerto Rico (1868a), Ubeda y Delgado (1878), and Census of Porto Rico (1899).

Figure 4: Mean Annual Precipitation Levels and Coffee Cultivation, Year 1896

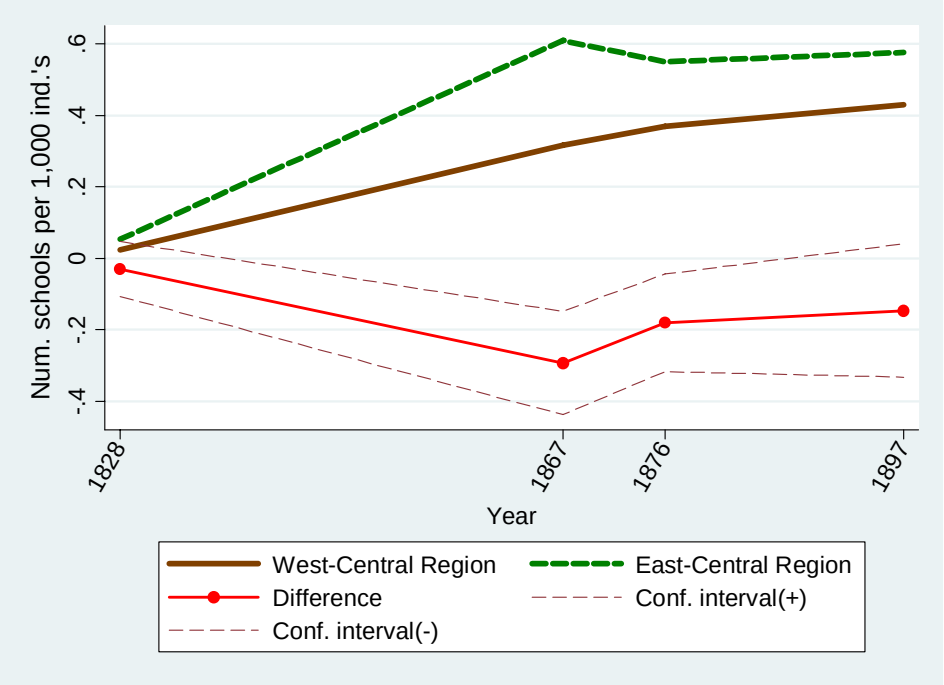


Notes: Each (brown) triangle represents a coffee region municipality and each (green) circle represents a food crops region municipality. Plotted are residuals (adjusted by sample means) from multivariate regression which condition on the following geographic variables: mean annual maximum and minimum temperatures, mean altitude, mean degree of ruggedness (gradient), and distance to the nearest port municipality. Linear fit from OLS regression shown in solid line.

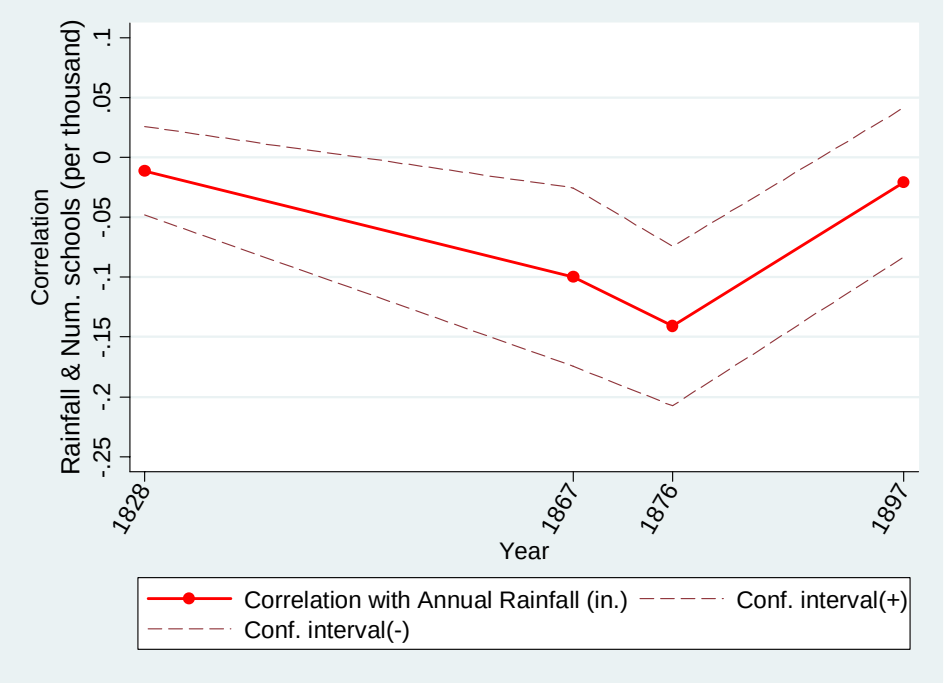
Source: Author's calculations from Carroll (1899) and Roberts (1941). See the data appendix for details on the construction of the variables.

Figure 5: Trends in Access to Public Primary Schooling, throughout the 19th Century

Panel A: Number of Schools per capita (in thousands) and Differences across Regions



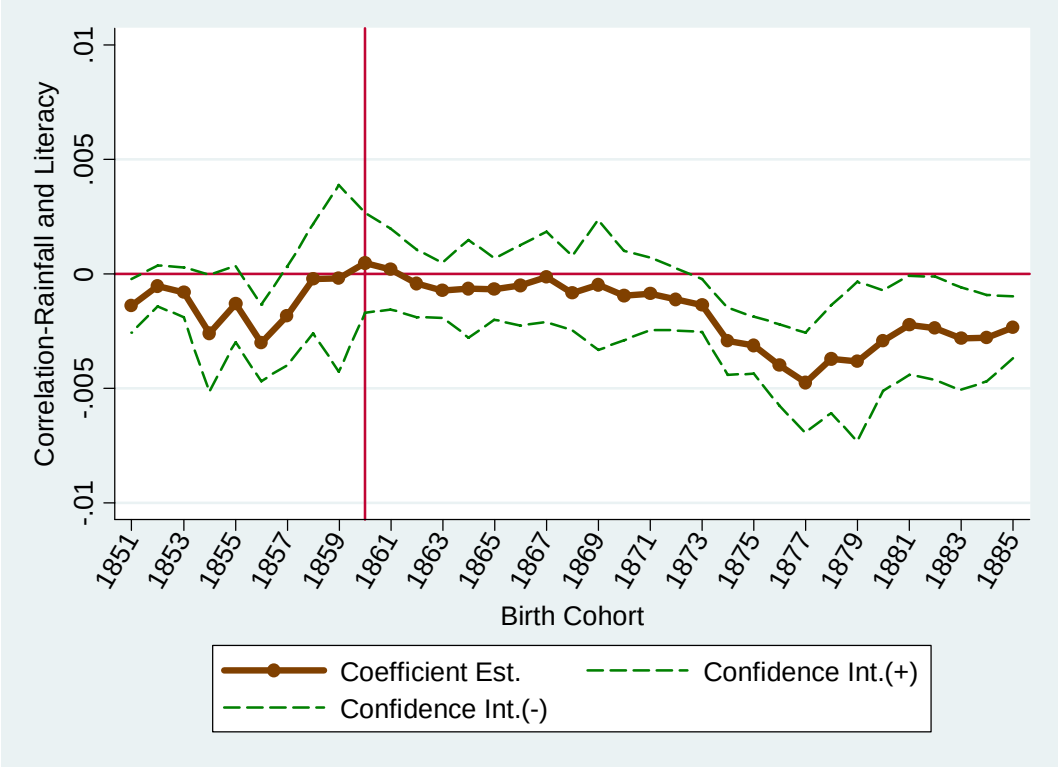
Panel B: Correlation of Number of Schools per capita (in thousands) and Rainfall



Notes: Panel A depicts trends in number of public primary schools per thousand individuals for each region (coffee region = solid brown line; food crops region = dashed green line), and mean differences coefficient estimates from OLS regressions, depicted in solid red line with circles, and their 95 percent confidence intervals, depicted in thin dashed lines, are presented. Panel B depicts OLS coefficient estimates of the number of public primary schools per thousand individuals with the municipalities' mean annual rainfall levels, in each period, and confidence intervals.

Figure 6: Literacy Rates Differences across Municipalities with Varying Rainfall Levels

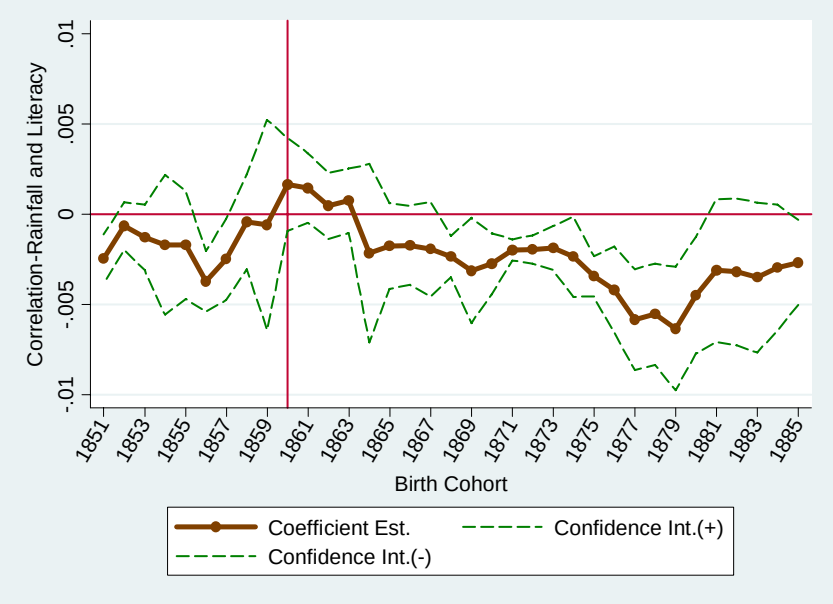
Coefficients-Interaction of Cohort Group Indicators and the Municipality-Level Average Annual Rainfall Levels



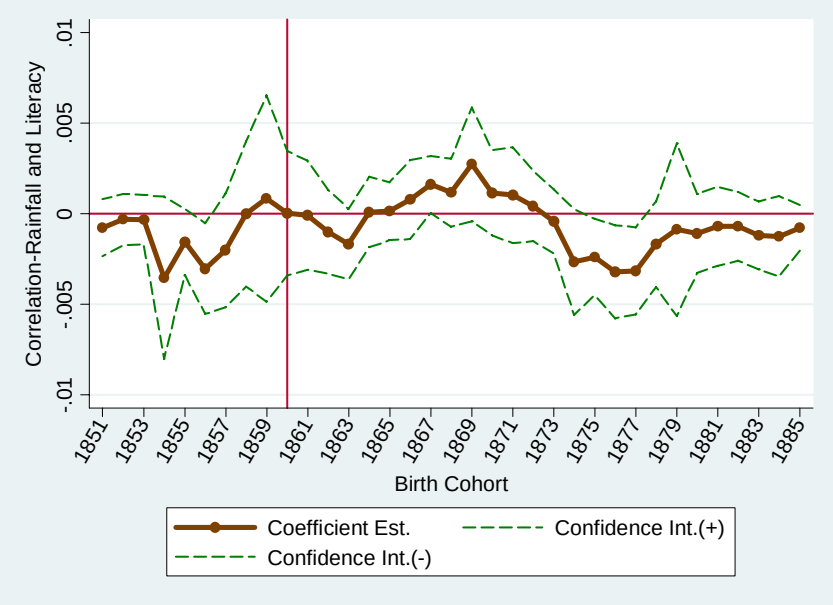
Notes: Values of parameter estimates of cohort-specific correlation with mean annual rainfall in municipality, from OLS regressions and their 95 percent confidence intervals are presented. (Robust standard errors; disturbance terms are allowed to be correlated within municipality, but not across municipalities). Specification includes municipality and year of birth indicator variables.

Figure 7: Literacy Rates Differences across Municipalities with Varying Rainfall Levels, by the Degree of Political Enfranchisement

Panel A: Voting Rights < Median



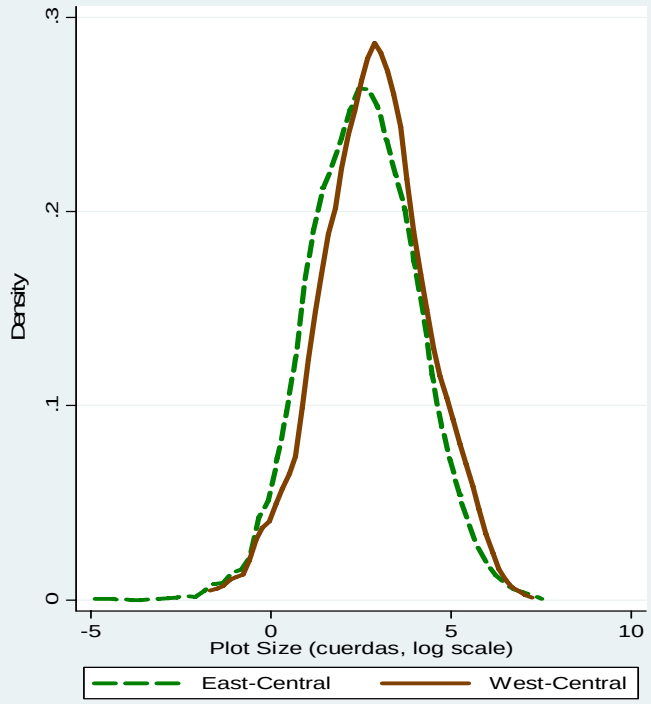
Panel B: Voting Rights > Median



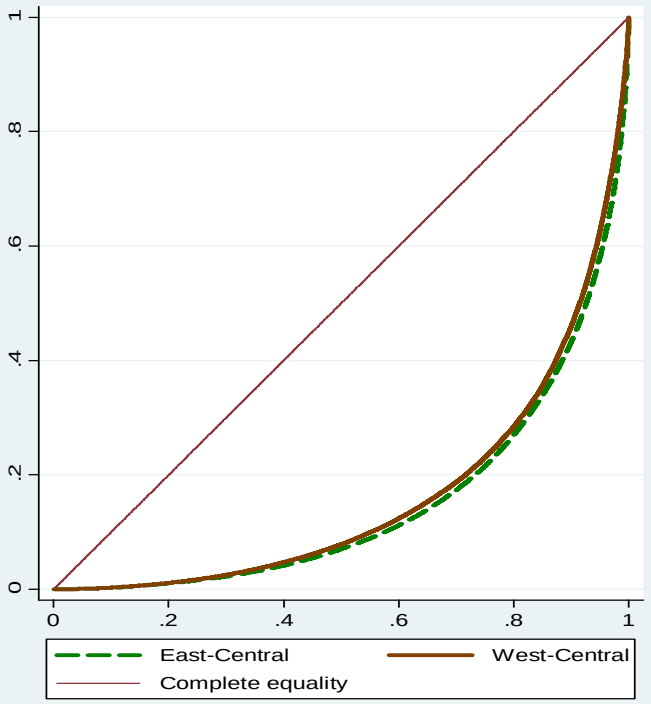
Notes: Values of parameter estimates of cohort-specific correlation with mean annual rainfall in municipality, from OLS regressions and their 95 percent confidence intervals are presented. (Robust standard errors; disturbance terms are allowed to be correlated within municipality, but not across municipalities). Specification includes municipality and year of birth indicator variables.

Figure 8: Distribution of Landholdings across Regions, 1890s

Panel A: Non-parametric kernel densities



Panel B: Lorenz Curves



Notes: Panel A figures present non-parametric kernel density estimates of the distribution of individual land ownership using an Epanechnikov kernel. Panel B presents Lorenz curve of land ownership distribution for each region (coffee region = solid brown line; food crops region = dashed green line). Data are samples from land cadastres for municipalities in West-Central and East-Central regions, varying years (1891-1894).

Table 1: Geographic, Economic and Demographic Characteristics, Mid-Nineteenth Century

	West-Central (Coffee) Region (1)	East-Central (Food crops) Region (2)	Difference (Std. Error) (3)	Corr. w/avg. annual rainfall (4)	N (5)
Panel A: Geographic Characteristics					
Average annual rainfall, 1899-1928 (in.)	90.2	74.1	16.1***	-	26
			(4.2)		
Average altitude (meters)	436.4	331.8	104.7	0.636	26
			(73.7)	(2.797)	
Average land gradient (degrees)	17.6	14.4	3.2**	0.061	26
			(1.3)	(0.054)	
Average maximum temperature, 1950-2000 (ºF)	82.9	84.0	-1.2	0.045	26
			(1.3)	(0.051)	
Average minimum temperature, 1950-2000 (ºF)	63.2	66.7	-3.5***	-0.034	26
			(0.7)	(0.038)	
Distance to nearest port (km)	24.4	26.0	-1.6	0.036	26
			(2.8)	(0.108)	
Panel B: Coffee Cultivation & Production, Year 1828					
Coffee production (quintales)/ land unit (cuerda)	0.071	0.034	0.037	0.000	21
			(0.032)	(0.001)	
Number of coffee mills	0.40	0.06	0.34	0.020**	21
			(0.24)	(0.009)	
Wealth per capita	94.9	109.3	-14.4	0.403	21
			(14.8)	(0.813)	
Value of production per capita	9.5	6.0	3.4	0.040	21
			(1.6)	(0.070)	
Panel C: Socio-Economic and Demographic Characteristics, Year 1828					
Sharecroppers share of the populaion	0.08	0.13	-0.05	-0.0007	21
			(0.03)	(0.0018)	
Slaves as share of total population	0.08	0.08	0.00	-0.0030***	21
			(0.02)	(0.0006)	
Free blacks or mulattos as share of the pop.	0.33	0.35	-0.02	-0.0069	21
			(0.07)	(0.0032)	
Free blacks as share of the population	0.05	0.07	-0.02	-0.0013	21
			(0.02)	(0.0011)	
White pop. share of the total population	0.51	0.44	0.07	0.0156***	21
			(0.08)	(0.0034)	
Crude Birth Rate	57.8	54.6	3.2	0.12	17
			(7.5)	(0.30)	
Crude Death Rate	23.1	23.2	-0.1	0.08	17
			(3.3)	(0.13)	

Notes: Standard errors in parentheses; significantly different from zero at (*) 90%, (**) 95%, (***) 99% confidence. See the data description section and the data appendix for detailed descriptions of the construction of variables used in the analysis.

Table 2: Precipitation Levels, Minimum Temperatures, and Coffee Cultivation in Year 1896

Dependent variable:	Share of agricultural land under coffee cultivation, year 1896							
Sample:	Overall	Overall	Overall	Land Ownership	Overall	Overall	Overall	Land Ownership
	(1) OLS	(2) OLS	(3) OLS	(4) OLS	(5) OLS	(6) OLS	(7) OLS	(8) OLS
Average annual rainfall (in. x 10)	0.0044***	0.0038**	0.022*	0.025*				
	(0.0013)	(0.0014)	(0.011)	(0.014)				
Avg. rainfall (in. x 10) *			-0.025^{+}	-0.030^{+}				
Above average min. temp			(0.016)	(0.019)				
Coffee region indicator					0.082***	0.076***	0.089***	0.093***
					(0.020)	(0.020)	(0.016)	(0.021)
Coffee region inidcator *							-0.059^{+}	-0.064^{+}
Above average min. temp							(0.034)	(0.040)
Geographic Controls	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Mean of dep. variable	0.065	0.065	0.065	0.065	0.065	0.065	0.065	0.065
Observations	23	23	23	19	23	23	23	19
R-squared	0.06	0.70	0.67	0.67	0.48	0.84	0.84	0.84

Notes: Standard errors in parentheses; significantly different from zero at (*) 90%, (**) 95%, (***) 99% confidence. See the data description section and the data appendix for detailed descriptions of the construction of variables used in the analysis.

Table 3: Descriptive Statistics (cont.)

	Mean [Std. Dev.]	West-Central Region	East-Central Region	Difference (Std. Error)
	(1)	(2)	(3)	(4)
Panel A: Educational and Health Outcomes				
Adult Literacy Rate, Mun.-level averages, 1910 PUMS	0.162	0.163	0.161	0.001
				(0.017)
Adult Literacy Rate, Mun.-level averages, 1899 Census	0.186	0.190	0.184	0.006
				(0.013)
Adult Higher Education Completion Rate, 1899 Census	0.0061	0.0062	0.0060	0.0003
				(0.0019)
Crude Mortality Rate, Years 1888-1898	25.9	32.5	22.8	9.7
	[10.8]	[13.0]	[7.8]	(1.3)
Panel B: Local Public Goods Provision				
Public Primary Schools				
Number of schools per 1,000 individuals, year 1828	0.046	0.023	0.053	-0.030
	[0.115]	[0.052]	[0.129]	(0.053)
Number of schools per 1,000 individuals, year 1866-67	0.532	0.327	0.609	-0.282
	[0.237]	[0.098]	[0.229]	(0.098)
Number of schools per 1,000 individuals, year 1876-77	0.506	0.357	0.566	-0.209
	[0.217]	[0.090]	[0.225]	(0.096)
Number of schools per 1,000 individuals, year 1897	0.541	0.471	0.576	-0.105
	[0.170]	[0.216]	[0.137]	(0.072)
Number of schools per 1,000 children, year 1897	0.815	0.663	0.892	-0.229
	[0.238]	[0.221]	[0.212]	(0.093)
Sanitation-based Public &Private Goods, Year 1899				
Prop. households with pub. garbage collection	0.086	0.065	0.096	-0.031
				(0.036)
Prop. households with access to cesspool	0.157	0.192	0.141	0.051
				(0.028)
Panel C: Labor Coercion and Repression Measures				
"Jornalero' Share of Population, Year 1867	0.093	0.119	0.084	0.035
	[0.054]	[0.087]	[0.037]	(0.025)
Rural/Urban Police Personnel Expenditures per capita, Year 1865-66	0.025	0.046	0.017	0.029
	[0.030]	[0.052]	[0.012]	(0.030)
Share of Volunteer Guard Company in Mun.,Year 1886	0.69	0.95	0.59	0.36
	[0.30]	[0.30]	[0.23]	(0.11)
Volunteer Guard Company Headquarters, Year 1886	0.087	0.167	0.059	0.108
	[0.288]	[0.408]	[0.059]	(0.138)
Number of Units in Provincial Civil Guard, Year 1876	10.27	18.69	6.30	12.39
	[15.05]	[25.27]	[2.86]	(6.06)

Notes: Standard deviation in brackets; standard errors in parentheses. See the data description section and the data appendix for detailed descriptions of the construction of variables used in the analysis.

Table 3: Descriptive Statistics (cont.)

	Mean [Std. Dev.]	West-Central Region	East-Central Region	Difference (Std. Error)
	(1)	(2)	(3)	(4)
Panel D: Municipal Budget Allocations, 1890s				
Total expenditures per capita	1.50	1.54	1.49	0.05
	[0.54]	[0.86]	[0.44]	(0.28)
Public school expenditures per 10-19 year-old child	0.411	0.353	0.428	-0.075
	[0.114]	[0.129]	[0.109]	(0.057)
Teacher salary expenditures per 10-19 year-old child	0.308	0.249	0.325	-0.075
	[0.089]	[0.081]	[0.086]	(0.043)
Public medical expenditures per capita	0.142	0.142	0.142	0.000
	[0.052]	[0.069]	[0.049]	(0.027)
Physician salary expenditures per capita	0.090	0.083	0.092	-0.009
	[0.034]	[0.034]	[0.034]	(0.017)
Rural/Urban Police Expenditures per capita	0.017	0.020	0.016	0.004
	[0.022]	[0.022]	[0.023]	(0.011)
Public infratrsucture expenditures per capita	0.116	0.231	0.082	0.149
	[0.123]	[0.208]	[0.061]	(0.055)
Road construction and maintenance expenditures p.c.	0.072	0.144	0.051	0.093
	[0.084]	[0.139]	[0.050]	(0.039)
Mayor's salary expenditures	928.6	1126.0	870.6	255.4
	[189.1]	[247.1]	[126.1]	(80.3)
Panel E: Racial/Ethnic Composition, Year 1899				
White share of overall population	0.651	0.742	0.608	0.134
				(0.066)
White share of native population	0.644	0.732	0.603	0.129
				(0.066)
Foreigner share of overall population	0.006	0.010	0.005	0.005
				(0.002)
Black share of overall population	0.040	0.016	0.051	-0.035
				(0.013)
Mulatto share of overall population	0.297	0.203	0.341	-0.138
				(0.062)
Panel F: Occupational Distribution of Adult Males, Year 1899 (Prop. employed in …)				
Agriculture, fishing, and mining	0.465	0.486	0.455	0.030
				(0.019)
Commerce and transportation	0.026	0.024	0.027	-0.002
				(0.005)
Manufacturing	0.023	0.024	0.022	0.002
				(0.005)
Services (Professional, Domestic & Personal)	0.044	0.045	0.044	0.001
				(0.010)
No lucrative occupation	0.442	0.421	0.452	-0.031
				(0.014)

Notes: Standard deviation in brackets; standard errors in parentheses. See the data description section and the data appendix for detailed descriptions of the construction of variables used in the analysis.

Table 4: The Effects of the Coffee Boom on Public Primary School Provision

Dependent variable:	Number of schools per capita in municipality									
	OLS (1)	OLS (2)	OLS (3)	OLS (4)	OLS (5)	OLS (6)	OLS (7)	OLS (8)	OLS (9)	OLS (10)
Avg. rainfall (in. x 10) * Post-period	-0.070***	-0.065***			-0.060**	-0.072**				
	(0.023)	(0.023)			(0.024)	(0.027)				
Avg. rainfall * Year 1867			-0.084**	-0.082**			-0.091*			
			(0.036)	(0.038)			(0.046)			
Avg. rainfall * Year 1876			-0.130***	-0.119***			-0.137**			
			(0.038)	(0.038)			(0.049)			
Avg. rainfall * Year 1897			-0.010	-0.007			-0.012			
			(0.042)	(0.043)			(0.045)			
Average annual rainfall (in. x 10)	-0.011	-0.013	-0.011	-0.008	0.011					
	(0.020)	(0.029)	(0.019)	(0.029)	(0.018)					
Black/Mulatto Pop. Share, Year 1899					0.433**					
					(0.160)					
Coffee region * Post-period								-0.177***		-0.167**
								(0.057)		(0.067)
Coffee region * Year 1867									-0.257***	
									(0.075)	
Coffee region * Year 1876									-0.146*	
									(0.078)	
Coffee region * Year 1897									-0.125	
									(0.109)	
Coffee region indicator								-0.020	-0.020	
								(0.109)	(0.110)	
Period indicators	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Geographic controls	No	Yes	No	Yes	Yes	No	No	Yes	Yes	No
Municipality fixed effects	No	No	No	No	No	Yes	Yes	No	No	Yes
F-test (p-values)			0.002	0.004			0.019		0.015	
Mean of dep. variable	0.408	0.408	0.408	0.408	0.408	0.408	0.408	0.408	0.408	0.408
Observations	86	86	86	86	86	86	86	86	86	86
R-squared	0.62	0.68	0.65	0.7	0.71	0.76	0.79	0.66	0.67	0.76

Notes: Coefficient estimates from OLS regressions are reported. Robust standard errors in parentheses; disturbance terms are allowed to be correlated within municipalities over time but not across municipalities; significantly different from zero at (+) 85%, (*) 90%, (**) 95%, (***) 99% confidence. Geographic controls are the mean maximum and minimum annual temperature, mean altitude, mean land gradient, and distance to nearest port for each municipality.

Table 5: The Effects of the Coffee Boom on Literacy Rates

Dependent variable:	Cohort-group literacy rates								
Sample:	All OLS (1)	All OLS (2)	All OLS (3)	Males OLS (4)	Females OLS (5)	Border Reg. OLS (6)	All OLS (7)	All OLS (8)	All OLS (9)
Avg. rainfall (in. x 10) * Young cohort	-0.0174***	-0.0173***	-0.0167***	-0.0247**	-0.0099**	-0.0348**	-0.0279***	-0.0267***	
	(0.0058)	(0.0058)	(0.0058)	(0.0110)	(0.0043)	(0.0138)	(0.0079)	(0.0081)	
Avg. rainfall (in. x 10) * Young cohort * Above average min. temp							0.0174*	0.0164+	
							(0.0097)	(0.0098)	
Average annual rainfall (in. x 10)	-0.0152**	-0.0098		-0.0063	-0.0132	0.0071	-0.0052		
	(0.0071)	(0.0096)		(0.0105)	(0.0094)	(0.0055)	(0.0105)		
Young cohort * Above average min. temp							-0.1619**	-0.1525*	
							(0.0762)	(0.0774)	
Avg. rainfall (in. x 10) * Above average min. temp							-0.0075		
							(0.0151)		
Above average min. temp							0.0626		
							(0.1332)		
Coffee region indicator * Young cohort									0.0002
									(0.0202)
Demographic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Geographic controls	No	Yes	No	Yes	Yes	Yes	Yes	No	No
Municipality fixed effects	No	No	Yes	No	No	No	No	Yes	Yes
Mean of dep. variable	0.175	0.175	0.175	0.225	0.126	0.154	0.175	0.175	0.175
Observations	16257	16257	16257	8066	8191	6391	16257	16257	16257
R-squared	0.04	0.05	0.06	0.04	0.03	0.04	0.05	0.06	0.06

Notes: Coefficient estimates from OLS regressions are reported. Robust standard errors in parentheses; disturbance terms are allowed to be correlated across all individuals within a municipality but not across municipalities; significantly different from zero at (+) 85%, (*) 90%, (**) 95%, (***) 99% confidence. Demographic controls include a young (ages 25-39 years in 1910) indicator, a second-order polynomial on age, as well as a female gender indicator, a black/mulatto indicator, and a native-born indicator. Geographic controls are the mean maximum and minimum annual temperature, mean altitude, mean land gradient, and distance to nearest port for each municipality.

Table 6: The Effects of the Coffee Boom on the Enforcement of a Coercive Labor System

Dependent variables:	'Jornalero' Share of Population ----------during *Libreta* system---------- (year 1867)				Rural/Urban Police Personnel Expenditures per capita, ----------during *Libreta* system---------- (year 1865-66)				Rural/Urban Police Personnel Expenditures per capita, ----------post *Libreta* system---------- (1890s)			
	OLS (1)	OLS (2)	OLS (3)	OLS (4)	OLS (5)	OLS (6)	OLS (7)	OLS (8)	OLS (9)	OLS (10)	OLS (11)	OLS (12)
Coffee region indicator	0.031	0.079**	0.061^{+}		0.005	0.036**	0.038*		0.001	-0.002	-0.002	
	(0.040)	(0.034)	(0.042)		(0.018)	(0.015)	(0.019)		(0.025)	(0.035)	(0.037)	
Coffee region indicator *		-0.058	-0.032			-0.041*	-0.044^{+}			0.011	0.009	
Above avg. min. temp		(0.049)	(0.060)			(0.022)	(0.027)			(0.063)	(0.069)	
Above avg. min. temp		0.017	0.012			-0.008	-0.007			-0.001	0.001	
		(0.025)	(0.026)			(0.011)	(0.012)			(0.025)	(0.030)	
Avg. rainfall (in. x 10)				-0.0104				-0.0043				0.0021
				(0.0102)				(0.0059)				(0.0048)
Geographic controls	Yes[1]	Yes	Yes	No	Yes[1]	Yes	Yes	No	Yes[1]	Yes	Yes	No
Distance to port	No	No	Yes	No	No	No	Yes	No	No	No	Yes	No
Mean of dep. variable	0.093	0.093	0.093	0.093	0.025	0.025	0.025	0.025	0.017	0.017	0.017	0.017
Observations	23	23	23	23	23	23	23	23	22	22	22	22
R-squared	0.32	0.37	0.39	0.05	0.56	0.61	0.61	0.03	0.25	0.26	0.26	0.10

Notes: Coefficient estimates from OLS regressions are reported. Standard errors in parentheses; significantly different from zero at (+) 85%, (*) 90%, (**) 95%, (***) 99% confidence. Geographic controls are the mean maximum temperature, an indicator variable for above average mean minimum temperature, mean altitude, mean land gradient, and distance to nearest port for each municipality. 1 = Geographic control for minimum annual temperature is a continuous variable.

Table 7: The Effects of the Coffee Boom on Repression by Local Elites and Governments

Dependent variables:	Number of Units in Provincial Civil Guard, Year 1876				Share of Volunteer Guard (Unit) in Municipality, Year 1886				Indicator for Volunteer Guard Company Headquarters in Municipality, Year 1886			
	OLS (1)	OLS (2)	OLS (3)	OLS (4)	OLS (5)	OLS (6)	OLS (7)	OLS (8)	OLS (9)	OLS (10)	OLS (11)	OLS (12)
Coffee region indicator	5.21	8.37***	11.84***		0.293	0.489**	0.588**		0.072	0.215	0.200	
	(3.13)	(2.55)	(3.03)		(0.208)	(0.169)	(0.210)		(0.252)	(0.210)	(0.265)	
Coffee region indicator *		-6.99*	-11.77**			-0.353	-0.493^{+}			-0.325	-0.304	
Above avg. min. temp		(3.59)	(4.23)			(0.246)	(0.303)			(0.304)	(0.382)	
Above avg. min. temp		1.36	2.05			-0.022	0.002			0.054	0.051	
		(1.77)	(1.69)			(0.126)	(0.131)			(0.156)	(0.165)	
Avg. rainfall (in. x 10)				0.979				-0.023				0.007
				(0.784)				(0.056)				(0.056)
Geographic controls	Yes[1]	Yes	Yes	No	Yes[1]	Yes	Yes	No	Yes[1]	Yes	Yes	No
Distance to port	No	No	Yes	No	No	No	Yes	No	No	No	Yes	No
Mean of dep. variable	7.38	7.38	7.38	7.38	0.695	0.695	0.695	0.695	0.087	0.087	0.087	0.087
Observations	22	22	22	22	23	23	23	23	23	23	23	23
R-squared	0.34	0.48	0.58	0.07	0.38	0.44	0.47	0.01	0.06	0.13	0.13	0.00

Notes: Coefficient estimates from OLS regressions are reported. Standard errors in parentheses; significantly different from zero at (+) 85%, (*) 90%, (**) 95%, (***) 99% confidence. Geographic controls are the mean maximum temperature, an indicator variable for above average mean minimum temperature, mean altitude, mean land gradient, and distance to nearest port for each municipality. 1 = Geographic control for minimum annual temperature is a continuous variable.

Table 8: Differences in the Land Distribution across Coffee and Food-Crops Municipalities, Late 19th Century

Dependent variables:	Overall Land Ownership Gini, 1890s				Land Ownership Gini among Landed Households, 1890s			Share of landless households, Year 1899			
Sample:	Gini Mun.				Gini Mun.			All Mun.	All Mun.	All Mun.	Gini Mun.
	OLS (1)	OLS (2)	OLS (3)	OLS (4)	OLS (5)	OLS (6)	OLS (7)	OLS (8)	OLS (9)	OLS (10)	OLS (11)
Coffee region indicator	0.038	0.062**	0.073**		0.037	0.133*	0.118	0.038	0.040	0.108	0.057
	(0.027)	(0.022)	(0.026)		(0.078)	(0.065)	(0.080)	(0.077)	(0.064)	(0.075)	(0.067)
Coffee region indicator *		-0.020	-0.036			-0.040	-0.020		-0.011	-0.108	
Above avg. min. temp		(0.028)	(0.035)			(0.084)	(0.105)		(0.093)	(0.109)	
Above avg. min. temp		0.004	0.006			0.010	0.007		-0.047	-0.031	
		(0.017)	(0.018)			(0.052)	(0.055)		(0.048)	(0.047)	
Avg. rainfall (in. x 10)				0.0085							
				(0.0074)							
Geographic controls	Yes[1]	Yes	Yes	No	Yes[1]	Yes	Yes	Yes[1]	Yes	Yes	Yes
Distance to port	No	No	Yes	No	No	No	Yes	No	No	Yes	No
Mean of dep. variable	0.920	0.920	0.920	0.920	0.750	0.750	0.750	0.695	0.695	0.695	0.692
Observations	19	19	19	19	19	19	19	23	23	23	19
R-squared	0.61	0.62	0.64	0.07	0.44	0.40	0.40	0.32	0.36	0.45	0.36

Notes: Coefficient estimates from OLS regressions are reported. Standard errors in parentheses; significantly different from zero at (+) 85%, (*) 90%, (**) 95%, (***) 99% confidence. Geographic controls are the mean maximum temperature, an indicator variable for above average mean minimum temperature, mean altitude, mean land gradient, and distance to nearest port for each municipality. 1 = Geographic control for minimum annual temperature is a continuous variable.

Table 9: Native Adults and Foreigners' Literacy Rates across Municipalities, Year 1899

Dependent variable:	Literacy rate, Year 1899									
Sample:	Adult foreigners					Native adult males				
	OLS (1)	OLS (2)	OLS (3)	OLS (4)	OLS (5)	OLS (6)	OLS (7)	OLS (8)	OLS (9)	OLS (10)
Coffee region indicator	0.008	0.013	-0.008			-0.050	-0.025	-0.033		
	(0.057)	(0.046)	(0.058)			(0.045)	(0.038)	(0.048)		
Coffee region indicator *		-0.009	0.021				-0.016	-0.004		
Above avg. min. temp		(0.067)	(0.083)				(0.055)	(0.069)		
Avg. rainfall (in. x 10)				0.0021	0.0022				-0.032**	-0.031**
				(0.0016)	(0.0015)				(0.011)	(0.011)
Avg. rainfall (in. x 10) *					0.000					0.001
Above avg. min. temp					(0.001)					(0.005)
Above avg. min. temp		0.055	0.050		0.075+		-0.001	-0.003		-0.010
		(0.034)	(0.036)		(0.045)		(0.028)	(0.030)		(0.033)
Geographic controls	Yes[1]	Yes	Yes	Yes	Yes	Yes[1]	Yes	Yes	Yes	Yes
Distance to port	No	No	Yes	Yes	Yes	No	No	Yes	Yes	Yes
Mean of dep. variable	0.86	0.86	0.86	0.86	0.86	0.24	0.24	0.24	0.24	0.24
Observations	23	23	23	23	23	23	23	23	23	23
R-squared	0.21	0.31	0.33	0.32	0.41	0.41	0.31	0.33	0.50	0.50

Notes: Coefficient estimates from OLS regressions are reported. Standard errors in parentheses; significantly different from zero at (+) 85%, (*) 90%, (**) 95%, (***) 99% confidence. Geographic controls are the mean maximum temperature, an indicator variable for above average mean minimum temperature, mean altitude, mean land gradient, and distance to nearest port for each municipality. 1 = Geographic control for minimum annual temperature is a continuous variable.

Table 10: Tests of Alternative Mechanisms

	Coefficient Estimates on:							
	Annual Rainfall x Post-Period	Annual Rainfall	Annual Rainfall x Post-Period x High Temp.	Coffee Reg. Indicator x Post-Period	Coffee Reg. Indicator	Coffee Reg. Indicator x Post-Period x High Temp.	Mun. or Fiscal Year FEs	Mean of dep. variable
	----------OLS----------			----------OLS----------				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Crude Death Rates								
Crude Death Rate, Yrs. 1828, 1888-98	-0.07	2.19		9.18	-0.33		No	25.0
	(2.37)	(1.90)		(7.03)	(5.31)			
Crude Death Rate, Yrs. 1828, 1888-98	-2.14			4.51			Yes	25.0
	(1.56)			(6.39)				
Crude Death Rate, Yrs. 1828, 1888-98	-0.89		-2.38	11.49**		-28.39***	Yes	25.0
	(1.95)		(2.94)	(4.82)		(5.51)		
Panel B: Sanitation-based Public & Private Goods, Year 1899								
Prop. HHs with pub. garbage collection		-0.035*			-0.052		No	0.096
		(0.019)			(0.072)			
Prop. HHs with pub. garbage collection		-0.028	-0.008		-0.047	0.056	No	0.096
		(0.019)	(0.009)		(0.075)	(0.109)		
Prop. HHs with access to cesspool		-0.003			0.076		No	0.141
		(0.016)			(0.052)			
Prop. HHs with access to cesspool		0.011	-0.013		0.118**	-0.061	No	0.141
		(0.016)	(0.008)		(0.053)	(0.077)		
Panel C: Municipal Budget Allocations, 1890s								
Total expenditures per capita		-0.174			0.040		Yes	1.50
		(0.171)			(0.661)			
Public school expenditures per (10-19 year old) child		-0.042*			-0.066		Yes	0.411
		(0.023)			(0.065)			
Teacher salary expenditures per (10-19 year old) child		-0.034*			-0.057		Yes	0.308
		(0.017)			(0.049)			

Notes: Coefficient estimates from OLS regressions are reported. Standard errors in parentheses; significantly different from zero at (+) 85%, (*) 90%, (**) 95%, (***) 99% confidence. Geographic controls are the mean maximum temperature, an indicator variable for above average mean minimum temperature, mean altitude, mean land gradient, and distance to nearest port for each municipality.

Table 10: Tests of Alternative Mechanisms (cont.)

	Coefficient Estimates on:							
	Annual Rainfall x Post-Period	Annual Rainfall	Annual Rainfall x Post-Period x High Temp.	Coffee Reg. Indicator x Post-Period	Coffee Reg. Indicator	Coffee Reg. Indicator x Post-Period x High Temp.	Mun. or Fiscal Year FEs	Mean of dep. variable
	----------OLS----------			----------OLS----------				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel C: Municipal Budget Allocations (cont.)								
Public medical expenditures per capita		-0.001			0.012		Yes	0.142
		(0.013)			(0.034)			
Physician salary expenditures per capita		-0.010			-0.022		Yes	0.090
		(0.015)			(0.038)			
Public infrastructure expenditures per capita		0.038			0.172*		Yes	0.116
		(0.035)			(0.080)			
Public infrastructure expenditures per capita		0.077**	-0.120**		0.410**	-0.449	Yes	0.116
		(0.032)	(0.048)		(0.152)	(0.282)		
Road construction & maintenance exp. p.c.		0.058**	-0.073**		0.299**	-0.280	Yes	0.072
		(0.022)	(0.034)		(0.097)	(0.180)		
Panel D: OccupationalDistribution of Adult Males, Year 1899 (Prop. employed in...)								
Agriculture, fishing, and mining		0.013			0.014		No	0.465
		(0.010)			(0.037)			
Commerce and transportation		0.000			0.009		No	0.026
		(0.002)			(0.007)			
Manufacturing		-0.004			0.006		No	0.023
		(0.002)			(0.009)			

Notes: Coefficient estimates from OLS regressions are reported. Standard errors in parentheses; significantly different from zero at (+) 85%, (*) 90%, (**) 95%, (***) 99% confidence. Geographic controls are the mean maximum temperature, an indicator variable for above average mean minimum temperature, mean altitude, mean land gradient, and distance to nearest port for each municipality.

Table A1: Robustness Tests of the Effects of the Coffee Boom on Literacy Rates

Dependent variable:	Coefficient Estimate on Avg. rainfall (in. x 10) * Young cohort interaction					
Sample:	All Mun.	Gini Mun.	Gini Mun.	Gini Mun.	Schools Mun.	Schools Mun.
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: All Individuals						
Demographic and geographic controls	-0.0173***	-0.0225***	-0.0216***	-0.0205***	-0.0232***	-0.0228***
	(0.0058)	(0.0060)	(0.0061)	(0.0057)	(0.0065)	(0.0064)
Dempographic controls and municipality FEs	-0.0167***	-0.0219***	-0.0211***	-0.0198***	-0.0228***	-0.0224***
	(0.0058)	(0.0060)	(0.0060)	(0.0057)	(0.0064)	(0.0064)
Panel B: Males						
Demographic and geographic controls	-0.0247**	-0.0340***	-0.0329**	-0.0306**	-0.0348**	-0.0331**
	(0.0110)	(0.0108)	(0.0116)	(0.0110)	(0.0144)	(0.0136)
Dempographic controls and Municipality FEs	-0.0222**	-0.0322***	-0.0308**	-0.0279**	-0.0318**	-0.0303**
	(0.0105)	(0.0105)	(0.0110)	(0.0105)	(0.0138)	(0.0131)
Panel C: Females						
Demographic and geographic controls	-0.0099**	-0.0112**	-0.0110**	-0.0109**	-0.0115*	-0.0124**
	(0.0043)	(0.0042)	(0.0041)	(0.0042)	(0.0056)	(0.0052)
Dempographic controls and municipality FEs	-0.0107**	-0.0114**	-0.0113**	-0.0114**	-0.0127**	-0.0136**
	(0.0044)	(0.0044)	(0.0042)	(0.0044)	(0.0056)	(0.0053)
Landowners Gini & Young cohort interaction		Yes	No	No		
Overall Gini & Young cohort interaction		No	Yes	No		
1828 Num. schools p.c. & Young cohort interaction					Yes	No
N Municipalities	24	19	19	19	20	20
N Individuals (Panel A)	16257	14098	14098	13345	16257	16257
N Individuals (Panel B)	8066	6983	6983	6983	6628	6628
N Individuals (Panel C)	8191	7115	7115	7115	6717	6717

Notes: Each coefficient estimate is from a separate regression. Coefficient estimates from OLS regressions are reported. Robust standard errors in parentheses; disturbance terms are allowed to be correlated across all individuals within a municipality but not across municipalities; significantly different from zero at (+) 85%, (*) 90%, (**) 95%, (***) 99% confidence. Demographic controls include a young (ages 25-39 years in 1910) indicator, a second-order polynomial on age, as well as a female gender indicator, a black/mulatto indicator, and a native-born indicator. Geographic controls are the mean maximum and minimum annual temperature, mean altitude, mean land gradient, and distance to nearest port for each municipality.

Table A2: Robustness Tests of the Effects of the Coffee Boom on Public Primary School Provision

Dependent variable:	Coefficient Estimate on Avg. rainfall (in. x 10) * Post-Period indicator					
Sample:	All Mun.	Gini Mun.	Gini Mun.	Gini Mun.	Schools Mun.	Schools Mun.
	(1)	(2)	(3)	(4)	(5)	(6)
Geographic controls	-0.065***	-0.048**	-0.045**	-0.062**	-0.077***	-0.068***
	(0.023)	(0.018)	(0.018)	(0.025)	(0.021)	(0.024)
Municipality Fixed Effects	-0.072**	-0.050**	-0.053***	-0.064**	-0.078***	-0.071**
	(0.027)	(0.019)	(0.018)	(0.027)	(0.023)	(0.026)
Landowners Gini & Young cohort interaction		Yes	No	No		
Overall Gini & Young cohort interaction		No	Yes	No		
1828 Num. schools p.c. & Young cohort interaction					Yes	No
N Municipalities	23	19	19	19	21	21
N Observations	86	72	72	72	80	80

Notes: Each coefficient estimate is from a separate regression. Coefficient estimates from OLS regressions are reported. Robust standard errors in parentheses; disturbance terms are allowed to be correlated across all individuals within a municipality but not across municipalities; significantly different from zero at (+) 85%, (*) 90%, (**) 95%, (***) 99% confidence. Demographic controls include a young (ages 25-39 years in 1910) indicator, a second-order polynomial on age, as well as a female gender indicator, a black/mulatto indicator, and a native-born indicator. Geographic controls are the mean maximum and minimum annual temperature, mean altitude, mean land gradient, and distance to nearest port for each municipality.

Table A3: Robustness Tests of the Effects of the Coffee Boom on Literacy Rates, Grouped Data

Dependent variable:	Coefficient Estimate on Avg. rainfall (in. x 10) * Young cohort interaction					
Sample:	All Mun.	Gini Mun.	Gini Mun.	Gini Mun.	Schools Mun.	Schools Mun.
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: All Individuals						
Demographic and geographic controls	-0.0204*	-0.0222*	-0.0124*	-0.0209*	-0.0296**	-0.0294**
	(0.0111)	(0.0125)	(0.0103)	(0.0113)	(0.0137)	(0.0136)
Dempographic controls and municipality FEs	-0.0123	-0.0147	-0.0149	-0.0124	-0.0259**	-0.0260**
	(0.0090)	(0.0112)	(0.0106)	(0.0103)	(0.0100)	(0.0095)
Panel B: Males						
Demographic and geographic controls	-0.0246^{+}	-0.0409**	-0.0420**	-0.0337**	-0.0425**	-0.0403**
	(0.0158)	(0.0165)	(0.0155)	(0.0158)	(0.0195)	(0.0185)
Dempographic controls and Municipality FEs	-0.0230^{+}	-0.0397**	-0.0337**	-0.0318*	-0.0432**	-0.0422**
	(0.0145)	(0.0174)	(0.0158)	(0.0165)	(0.0189)	(0.0176)
Panel C: Females						
Demographic and geographic controls	-0.0150^{+}	-0.0160^{+}	-0.0145^{+}	-0.0183*	-0.0172	-0.0190
	(0.0098)	(0.0100)	(0.0091)	(0.0101)	(0.0141)	(0.0143)
Dempographic controls and municipality FEs	-0.0090^{+}	-0.0100	-0.0084	-0.0122	-0.0128	-0.0146^{+}
	(0.0074)	(0.0071)	(0.0073)	(0.0083)	(0.0095)	(0.0092)
Landowners Gini & Young cohort interaction		Yes	No	No		
Overall Gini & Young cohort interaction		No	Yes	No		
1828 Num. schools p.c. & Young cohort interaction					Yes	No
N Municipalities	24	19	19	19	20	20
N Observations	48	38	38	38	40	40

Notes: Each coefficient estimate is from a separate regression. Coefficient estimates from OLS regressions are reported. Robust standard errors in parentheses; disturbance terms are allowed to be correlated across all individuals within a municipality but not across municipalities; significantly different from zero at (+) 85%, (*) 90%, (**) 95%, (***) 99% confidence. Demographic controls include a young (ages 25-39 years in 1910) indicator, a second-order polynomial on age, as well as a female gender indicator, a black/mulatto indicator, and a native-born indicator. Geographic controls are the mean maximum and minimum annual temperature, mean altitude, mean land gradient, and distance to nearest port for each municipality.