Colonialism's Detrimental Effects on Contemporary Poverty in Puerto Rico[*]

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Abstract

Scholars debate the role of historical institutions in explaining contemporary underdevelopment. This paper utilizes data on 171 sugar plantations established across Puerto Rico by 1873, and economic indicators in the twenty-first century to measure the impact of colonialism on contemporary economic outcomes in Puerto Rico. Inspired by the economic literature on the long-term effects of extractive institutions, I argue that historical extractive institutions in Puerto Rico fundamentally shape its economic conditions today. Empirically, I find that these colonial institutions persist to this day. Citizens in towns that had sugar plantations are poorer today.

Key Concepts: sugar plantations, wealth, poverty, extractive institutions, colonialism.

1 Introduction

In this paper, I analyze the long-run effect of sugar plantations established by 1873[1] on contemporary economic outcomes in Puerto Rico. In order to do so, I combine historical and contemporary data, similar to Dell (2010), Nunn and Wantchekon (2011), Soares et al. (2012), Michalopoulos and Papaioannou (2013), and Fujiwara et al. (2017). Broadly speaking, this constitutes an attempt to estimate the persisting effect of colonial institutions on contemporary underdevelopment. More specifically, this constitutes an attempt to look at the effect of sugar plantations on wealth and poverty in Puerto Rico.

This paper represents a contribution to the literature of extractive institutions. Mining in Latin America[2], the extraction of natural resources in Africa[3], the Transtlantic slave trade, and the plantation agriculture[4] in the Caribbean are all examples of these extractive institutions (Acemoglu et al., 2002). In this particular case, Puerto Rico's environmental and agricultural conditions were highly favorable for the extractive institution of plantation agriculture. These labor-intensive institutions fomented the Transatlantic slave trade. This led the island to produce around five percent of the world's sugar output (Scarano, 1984), where enslaved labor was responsible for about 80 percent of the island's total output (Scarano, 1977).

For the most part, the elite along with the slaves settled around the coasts, especially around Mayaguez[5], Ponce and Guayama[6] because of the favorable soil and climate conditions (Scarano, 1977) altering the demographic constitution of these communities. The purpose of the plantations was to produce, and a primordial role of it was to organize the life of everyone who participated in it. Therefore, all the social, cultural, economic and political aspects took place within the context of the landowner, and future institutions remained marked by the upheaval of social organization and economic and institutional rigidity of the plantations.

These institutions, as in most colonies, were designed to ensure the control of the slaves by the colonial elite. As Acemoglu et al. (2002) mentioned: Caribbean colonies were controlled by a small elite[7]. The colonial elite therefore was able to extract much of the profits of the colony. Puerto Rico's experience is aligned with Acemoglu et al. (2002) claim that the key source of the institutional deficiencies that have inhibited growth

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[1]Slavery was abolished in 1873 in Puerto Rico.
[2]Mainly copper, iron ore, and gold.
[3]These include diamons, petroleum, metals, among others.
[4]Usually sugar and coffee.
[5]Located in the west coast.
[6]Both located in the southern coast.
[7]Spaniards in the case of Puerto Rico.

and development can be found in the political economy of conquest and enslavement, and Nunn (2008) claim that the more slaves the country had, the worse the current economy is. This is why it makes sense that the sugar plantations in Puerto Rico may have altered the living standards of these communities today.

Certainly, we can point towards historical institutions in their important role determining the shape of contemporary institutions (Nunn, 2008) due to the idea that institutions persist over time (Acemoglu and Robinson, 2008). Latin American countries are an example of institutional persistence over time. They underwent drastic political reforms such as independence in the early nineteenth century, but the economic institutions have remained unchanged.

I focus on one specific historical institution in a particular country: sugar plantations in Puerto Rico such as Dell (2010) work on Peru and Bolivia, Banerjee and Iyer (2005) work on India and Fujiwara et al. (2017) work on Brazil. The main reason of my choice of Puerto Rico has to do with the sources. I was able to collect meaningful economic indicators in the twenty-first century, and the location and founding date of sugar plantations established by 1873. Moreover, this case is particularly interesting right now because Puerto Rico is United States' colony[8] which makes it an interesting case when evaluating the colonial experience. It is not the same studying what it was a colony than looking at the effects of a colonialism that it is still somehow present.

Formally, Puerto Rico is a commonwealth of the United States. Puerto Rico is under the jurisdiction of the United States federal courts. Puerto Rico is represented in the United States Government by a Resident Commissioner, a non-voting member of the United States House of Representatives. According to the United Nations, the Department of Justice concluded in 1959 that Puerto Rico was a territory of the United States and was fully subject to congressional authority under the territorial clause of the United States Constitution.

In order to observe the effect of sugar plantations on contemporary economic outcomes, I assume that there are no differences within Puerto Rico before the Spanish conquest led by Christopher Columbus in 1492. I focus on sugar plantations established on the island before 1873 because during this year the Spaniard government abolished slavery (Scarano, 1977). Pagan (1902) provides a list of all the sugar plantations ever established on the island, along with their location, founding date, and acreage dedicated to the production of sugar. It is thanks to Pagan (1902) that I am able to create an inventory with all of the sugar plantations

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[8]The US colonial possessions include the Virgin Islands, Guam, American Samoa, and the Northern Mariana Islands.

that were up and running before 1873 since Pagan (1902) seems to be the only historical work that possesses all of this information before the twentieth century.

I begin by estimating the sugar plantations impact on living standards today. To be precise, an instrumental variables estimation measures the effect of sugar plantations on annual household income and poverty rate in 2016, 2012, 2008, 2004, and 2000[9] in contiguous Puerto Rico. I specify contiguous Puerto Rico because I purposely left out the islands Culebra and Vieques due to markedly different colonial and military experiences. At the same time, both islands together contain less than half a percent of the entire population of Puerto Rico (US Census Bureau, 2010). Therefore, this decision should not affect my results.

Skeptic readers might worry about migration affecting the results. However, this may minimize the impact of sugar plantations on economic standards today, thus strengthening my analysis. This study is key for academics and policy-makers that are trying to understand how institutions persist over time, and to be able to design appropriate interventions that promote a level playing field. This paper proceeds as follows. Section 2 talks about the history of Puerto Rico, particularly the Spaniard conquest, the sugar market, and the slave trade. Section 3 explains the data I utilize for this work. Section 4 presents the research methodology. Section 5 provides the results. Section 6 adds some policy implications, and section 7 concludes.

2 Historical Background

2.1 Sugar Production

Puerto Rico was part of the Spanish empire from 1493 to 1898, when the island became a possession of the United States as a result of the Spanish-American War. During most of the time under Spanish rule, the Puerto Rican economy relied on sugar and coffee production. Like most of the Caribbean colonies, Puerto Rico was a major world producer of sugar (Scarano, 1984). However, it was during the first half of the nineteenth century when Puerto Rico became a sugar producer of global importance (Cubano, 1999). It was then that Puerto Rico witnessed growth that placed them second[10] in sugar production in the New World (Figueroa, 2005). Sugar became the principal export of the island (Scarano, 1977). The economy of Puerto

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[9]Every four years in the twenty-first century in order to provide robust results.

[10]Cuba held the first place.

Rico consisted of large-scale sugar production (Via et al., 2011). The transformation of the enslaved labor was the primary mechanism that allowed for this transformation (Pico, 2000). I utilize sugar plantations that were already functioning in 1873 in order to capture the most potent effects of the colonial experience present in the apogee of the sugar sector. Puerto Rico's sugar production was largely undertaken through slave labor and as such, the island witnessed a declining international sugar market in the mid-nineteenth century due to the abolition of slavery (Figueroa, 2005), (Scarano, 1977).

2.2   Slavery

The creation of sugar plantations spurred the growth of the slave trade across the Atlantic. As crops expanded demand for slave labor increased. The production of sugar on the island was heavily dependent on slave labor until the abolition of slavery in Puerto Rico in 1873 (Figueroa, 2005), (Scarano, 1977). It is imperative to distinguish the abolition of slave trade in 1845 with the abolition of slavery in 1873. Moreover, these years differ for other countries. For example, Mexico abolished the slave trade in 1824, and abolished slavery in 1829. Colombia abolished the slave trade in 1821, and slavery in 1852[11] (Andrews, 2004). Most Latin American countries started with the abolition of the slave trade, followed by the abolition of slavery (Fujiwara et al., 2017).

Between the fifteenth and the eighteenth centuries, more than 12 million slaves were exported from Africa to different destinations in the New World (Fujiwara et al., 2017). Highly active slave trade meant expanding sugar output for the colonial elite (Curtis and Scarano, 2011). It was widely known that slaves constituted most of the workers based at the sugar plantations (Scarano, 1984). As such, slavery was extremely important for their success (Cubano, 1999). This is precisely what we witness during the apogee of the slave trade in the first half of the nineteenth century. It is only natural that public opinion reflected a strong association between slavery and the sugar plantations (Scarano, 1977). Scarano (1984) found a correlation of 0.92, reflecting a strong positive relationship, between the development of sugar plantations and slavery (Via et al., 2011). Therefore, the location of these sugar plantations may explain demographic and institutional differences in Puerto Rico observed today. Due to this massive importation of Africans, Puerto Rico's racial composition was noticeably altered (Curtis and Scarano, 2011). Now, because sugar plantations were mostly located in coastal areas, it makes sense why African ancestry decreases with distance from these coastal

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[11]Brazil was the last Latin American country to abllolish slavery in 1888.

areas (Via et al., 2011).

Puerto Rico had around 19,000 slaves and 221,000 residents in 1815[12], and around 40,000 slaves and 350,000 population residents in 1834[13] (Scarano, 1984), (Turnbull, 1840). The slave population was growing faster than the total population. Cruelty was a dominant characteristic of the sugar plantations (Scarano, 1984), (Acemoglu et al., 2005). After 1845, the slave population started to decline causing the sugar plantations to look to freemen labor until a complete restructuring of the labor scheme occurred in 1873 (Scarano, 1977). The abolition of slavery harmed the colonial elite economic interests by curbing economic growth which they benefited from exclusively (Scarano, 1977).

2.3   Spain's Policies

The explicit purpose of the colonies was to provide resources to the metropolis. Governments expanded their empires by settling on countries that promised profitability and imposing their economic and political order there at will. The Kingdom of Spain took advantage of the favorable conditions[14] in Puerto Rico and Cuba to undermine their losses of other colonies they lost to independence in the New World. This had a profound effect on the developing history of these islands through its effect on cultural and political institutions. One example are the policies pursued by the Spanish empire that fomented the production of sugar in Puerto Rico (Cubano, 1999). The Cedula de Gracias, a decree passed in 1815 opened all ports to trade, it abolished taxes and duties, and it fomented immigration (Scarano, 1977), (Scarano, 1984). By effectively removing all barriers to plantation development, the Spanish managed to stimulate the corresponding plantation economies by decreasing business costs. Moreover, Spain reinforced the military unit in Puerto Rico which supplied the capital needed for the exportation of sugar (Curtis and Scarano, 2011). This conglomeration of factors created incentives for Europeans to move to the island to establish sugar plantations with the capital and slaves present (Scarano, 1977). Europeans, mainly from Catholic countries such as France, Corsica and Germany, constituted the vast majority of the Puerto Rican planter class, i.e. colonial elite (Scarano, 1984). Therefore, the growth of the sugar industry concentrated economic power in few hands, which is Acemoglu et al. (2002) definition of an extractive institution.

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[12]Nine percent of the population was constituted by African slaves.
[13]11 percent of the population was constituted by African slaves.
[14]Weather, soil, "uneducated" population, among others.

Historical data demonstrates that the Cedula de Gracias had an impact on sugar exports as cuerdas[15] dedicated to sugar cane grew from 5,765 to approximately 9,000 from 1812 to 1823 (Scarano, 1984). This massive production, which was around five percent of the world's output, was mainly sent to the United States where the island sold more than 75 percent of its sugar (Scarano, 1984). Puerto Rico was producing an average of 23 percent as much as sugar as Cuba between 1838 and 1842 (Scarano, 1984). This boom of the sugar plantations caused differences within Puerto Rico. For the most part, the elite settled around the coasts, especially around Ponce and Guayama, because soil and climate were ideal for sugar production (Scarano, 1977). For example, by 1828, Mayaguez in the west coast, and Guayama and Ponce in the southern coast produced more than half of the sugar output of the entire island (Figueroa, 2005), (Scarano, 1977). The minimal use of land in non-coastal municipalities, such as Utuado and Morovis (Pico, 2000), allows us to promote the notion of divergent histories between non-sugar plantations districts and sugar plantations districts.

3 Data

I combine historical and contemporary data. The US Census Bureau provides annual household income, and poverty rate for each municipality. Additionally, Pagan (1902) provides a list of all the sugar plantations established on the island along with its founding date, location, and production level. Lastly, Abbad y Lasierra (1866) provides data for the eighteenth century. It includes agricultural data and economic indicators.

3.1 Economic Indicators Data

The US Census Bureau American Fact Finder tool provides annual household income, and poverty rate for the 78 towns on the island. However, I utilize 76 of them because I purposely left out the islands Culebra and Vieques due to markedly different colonial and military experiences. Culebra and Vieques are small islands to the east of contiguous Puerto Rico.

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[15]1 cuerda = 0.97 acre

3.2   Sugar Plantations Data

Pagan (1902) provides a list of all the sugar plantations ever established on the island, along with its location, foundation date, and acreage dedicated to the production of sugar. It is thanks to Pagan (1902) that I am able to create an inventory with all of the sugar plantations that were up and running by 1873. Since Pagan (1902) seems to be the only work that possesses all of this information, I am therefore adopting it as the most reliable source of information available. Pagan (1902) provided me with the tools needed to create a dataset that contains the latitude, longitude, total acreage dedicated to sugar production, and name of the plantation.

3.3   Pre Sugar Plantations Data

Abbad y Lasierra (1866) presents an overview of Puerto Rico's geography and economy in the eighteenth century. It is one of the earliest works that contains valuable data of Puerto Rico. Abbad y Lasierra was a Spaniard friar analyzing the island in order to go back to Madrid with statistics about Puerto Rico. Friars were known for encouraging the general population to convert to Christianity, and to attend mass, and other Christian rites and ceremonies. In Mexico, friars' estimates placed total conversions at 9,000,000 by 1543 (Early, 1994). The friars followed the conquistadores in the emerging of these new territories in the New World[16].

3.4   Summary Statistics

Combining the three data sets of economic indicators in the twenty-first century, sugar plantations in the nineteenth century, and pre sugar plantations in the eighteenth century looks like:

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[16]See Early (1994) for more information on the role of friars in the New World.

Table 1 - Summary Statistics

Municipality	Estates 1776	Whites Population 1776	Sugar Plantations 1873	Household Income 2000-16	Poverty Rate 2000-16
Aguada	229	1,852	6	13,684	56
Aguadilla	106	732	3	14,086	52
Anasco	339	1,364	3	15,081	49
Arecibo	343	1,887	6	14,856	51
Bayamon	130	507	2	17,286	46
Cabo Rojo	228	891	8	15,529	47
Caguas	48	219	0	19,107	43
Cayey	38	170	0	18,882	43
Coamo	158	1,272	2	14,178	55
Fajardo	108	591	8	18,461	42
Guayama	209	1,064	10	14,548	53
Guaynabo	103	331	0	31,673	28
Humacao	167	583	4	16,427	49
Isabela	130	1,016	1	13,480	55
Loiza	91	247	4	18,606	45
Manati	73	2,086	2	14,309	54
Mayaguez	3,382	1,063	13	15,105	48
Moca	221	932	1	13,114	55
Ponce	561	1,372	5	15,377	53
Rincon	175	892	2	14,874	51
San German	744	3,232	19	13,292	54
San Juan	183	437	1	25,339	33
San Sebastian	150	537	0	11,913	58
Toa Alta	179	722	0	17,755	48
Toa Baja	162	499	4	22,709	37
Utuado	410	640	0	13,106	57
Vega	205	489	4	16,211	49
Yauco	109	674	4	12,985	57

4   Research Methodology

Institutional and behavioral path dependence suggest that the right unit of analysis is the local community (Acharaya et al., 2018). Institutional path dependence posits that institutions become self-reinforcing (Acharaya et al., 2018). Similarly, behavioral path dependence states that ideas are passed down from generation to generation, encouraged by families and local institutions (Acharaya et al., 2018). For instance, those who currently live in an area that was once home to a sugar plantation are more likely to have linkages to such past[17]. This explains why our unit of analysis is indeed the local town[18]. Puerto Rico contains 78 towns. However, I utilize 76 of them because I purposely left out the islands Culebra and Vieques due to markedly different colonial and military experiences[19]. Therefore, I possess 76 observations for the economic indicators in the twenty-first century.

Nevertheless, the 76 observations had to be disaggregated to 28 observations. The instrument is the number of estates established by 1776. A estate is a large piece of landed property. The number of municipalities in the eighteenth century was smaller than the amount of municipalities today. As a result, the 76 towns today had to be annexed to correspond with the 28 towns established back then.

4.1   Instrumental Variable Estimation

I utilize an instrumental variables estimation in order to control for omitted variable bias. The dependent variable is economic standards today, the independent variable is the number of sugar plantations established by 1873, and the instrument is the number of estates established by 1776. There is no need to worry about reverse causation since sugar plantations functioned before the economic indicators today. Therefore, it is not reasonable for these economic outcomes to affect sugar plantations in the nineteenth century.

We want to estimate the effect of sugar plantations established by 1873 on income and poverty today. However, the effect of third variables may confound our comparison of economic standards across cities. This is way I utilize an instrumental variables estimation. In order for this analysis to be valid the number of estates in 1776 must affect the number of sugar plantations in 1873, and the number of estates in 1776 should

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[17]See Acharaya et al. (2018) for more information on institutional persistence.
[18]Municipality and town are synonyms in Puerto Rico.
[19]By definition, these islands make Puerto Rico an archipielago.

not be related to economic outcomes today, except for their effect through the number of sugar plantations in 1873.

The condition that the number of estates in 1776 affects the number of sugar plantations in 1873 is called the first stage. The condition that the number of estates in 1776 does not affect economic outcomes today beyond their effect on the number of sugar plantations in 1873 is called exclusion restriction. If both the first stage and the exclusion restriction hold, the number of estates in 1776 is a valid instrument for the number of sugar plantations in 1873[20].

4.2   First Stage

The first stage attempts to look at the effect of the number of estates in 1776 on the number of sugar plantations in 1873. In this case, per usual, I need to include additional variables in the regression in order to make the instrument plausible. The additional regressor is called an exogenous regressor. As a result, the equation looks like:

$$Plantations_i = \alpha + \beta Estates_i + \gamma White_i + \epsilon \qquad (1)$$

The dependent variable, $Plantations_i$, counts how many sugar plantations were established by 1873 in a particular town. The main independent variable $Estates_i$ counts the number of estates established by 1776 in a particular town. I utilize estates established by 1776 in order to meet temporal priority. According to Pagan (1902) the first sugar plantation was established around 1790. This instrument makes sense because Spaniards are more likely to take control of established infrastructure where they could easily develop their sugar plantations. Some sugar plantations used to be estates (Pagan, 1902). At the same time, I include an additional variable in the regression in order to make the instrument plausible. The exogenous regressor is $White_i$, which measures the number of Caucasian residents. This makes sense because they were the ones that set up the sugar plantations.

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[20]See Angrist and Pischke (2009) for more information on instrumental variables estimation.

4.3 Exclusion Restriction

The exclusion restriction attempts to look at the null effect of the number of estates in 1776 on economic outcomes in the twenty-first century. The dependent variable takes the form of annual median household income and poverty rate. As a result, the equations look like:

$$Income_{it} = \alpha + \beta Estates_i + \gamma Age_{it} + \epsilon \tag{2}$$

$$Poverty_{it} = \alpha + \beta Estates_i + \gamma Age_{it} + \epsilon \tag{3}$$

The dependent variables are $Income_{it}$ and $Poverty_{it}$. $Income_{it}$ is annual household income in a given town in 2000, 2004, 2008, 2012, and 2016. $Poverty_{it}$ is poverty rate in a given town in 2000, 2004, 2008, 2012, and 2016. The main independent variable $Estates_i$ counts the number of estates established by 1776 in a particular town. At the same time, I include an additional control in the regression in order to make the regression plausible. The control is Age_i, which is the average age in a given town.

4.4 Second Stage

If the first stage and the exclusion restriction hold, then we have the second stage of the instrumental variable estimation[21]. The second stage should look similar to the exclusion restriction. Although, in this case, we have $\widehat{Plantations}_i$ as the independent variable.

$$Income_{it} = \alpha + \beta \widehat{Plantations}_i + \gamma Age_{it} + \epsilon \tag{4}$$

$$Poverty_{it} = \alpha + \beta \widehat{Plantations}_i + \gamma Age_{it} + \epsilon \tag{5}$$

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[21]Contigent on first stage and exclusion restriction results.

Similarly, the control and the dependent variables are the same as in the case of the exclusion restriction. However, the independent variable $\widehat{Plantations_i}$ is the result of the first stage after computing the fitted values. Therefore, β in these regressions is the causal estimate of interest.
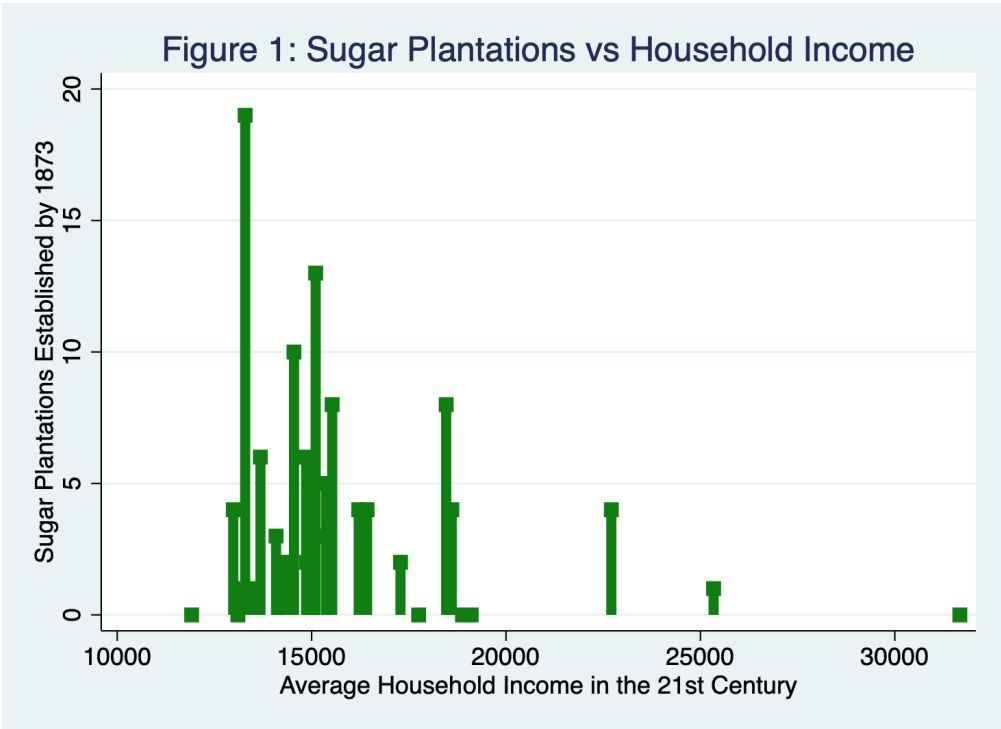
5   Results

5.1   Ad Hoc Results

Figure 1^{22} depicts a negative relationship between the number of sugar plantations established by 1873 (y-axis), and the current average household income (x-axis). The more sugar plantations a municipality had in the nineteenth century, the lower the average household income is in the twenty-first century. Each bar represents a municipality in Puerto Rico.

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[22]In this case, household income is the average of 2000, 2004, 2008, 2012, and 2016 in a given town.
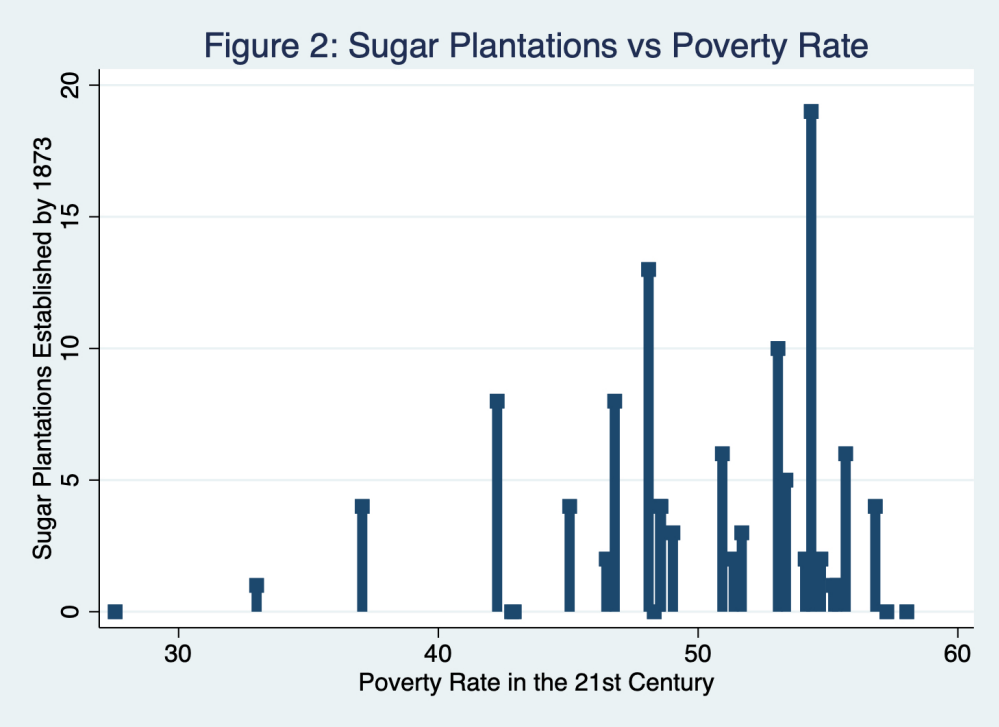
Figure 2: Sugar Plantations vs Poverty Rate

Figure 2[23] depicts a positive relationship between the amount of sugar plantations established by 1873, and the poverty rate in the twenty-first century. The more sugar plantations a municipality had in the nineteenth century, the higher the poverty rate is in the twenty-first century. These figures highlight the persistent effects of sugar plantations on contemporary economic outcomes in Puerto Rico.

[23]In this case, poverty rate is the average of 2000, 2004, 2008, 2012, and 2016 in a given town.

5.2   First Stage Results

Table 2 - First-Stage for Plantations Established by 1873 with Additional Controls

Estancias pre-1776	0.003***
	(0.000)
White Population pre-1776	0.004**
	(0.001)
R^2	0.557
$F_{2,25}$	47.87
Observations	28

Robust standard errors in parentheses

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

Table 2 depicts the first stage of the instrumental variable estimation. First of all, the F statistic is greater than 10. Moreover, $\beta \neq 0$ and it is significant at the 99% level in equation (1). On average, 321 estates[24] are associated with one more sugar plantation[25] in 1873. Therefore, the instrument satisfies the first stage.

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[24] The average number of estates in 1776 is 321.
[25] The average number of sugar plantations in 1873 is 4.

5.3 Exclusion Restriction Results

Table 3 - Exclusion Restriction for Median Household Income and Poverty Rate with Additional

Controls

	2016	2012	2008	2004	2000
	(1)	(2)	(3)	(4)	(5)
Panel A: Exclusion Restriction for Median Household Income					
Estates pre-1776	-1.38	-1.28	-1.21	-0.92	-0.94
	(0.868)	(0.927)	(0.959)	(0.732)	(0.598)
Age	211.92	422.24	407.85	193.42	776.34
	(211.92)	(709.65)	(658.57)	(380.99)	(587.42)
R^2	0.037	0.040	0.038	0.030	0.153
Panel B: Exclusion Restriction for Poverty Rate					
Estates pre-1776	0.001	0.001	0.001	.001	0.001
	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)
Age	-0.463	-0.911	-0.784	-0.506	-2.104**
	(0.979)	(0.968)	(0.979)	(0.672)	(0.981)
R^2	0.019	0.041	0.036	0.032	0.216
Observations	28	28	28	28	28

Robust standard errors in parentheses

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

Table 3 depicts the exclusion restriction of the instrumental variable estimation for annual household income in Panel A, and poverty rate in Panel B. These results measure the effect of estates established by 1776 on wealth in different years in the twenty-first century. None of the coefficients are statistically significant at the 90% level. Therefore, the instrument satisfies the exclusion restriction which makes it a valid instrument. As a result, we are able to move to the second stage of the instrumental variable estimation.

5.4 Second Stage Results

Table 4 - Two-Stage Least Squares for Median Household Income and Poverty Rate with

Additional Controls

	2016	2012	2008	2004	2000
	(1)	(2)	(3)	(4)	(5)
Panel A: Two-Stage Least Squares for Median Household Income					
Plantations pre-1873	-643.13**	-651.68**	-615.39**	-496.44**	-352.76**
	(249.49)	(260.55)	(255.94)	(224.19)	(135.54)
Age	394.31	562.73	464.93	263.05	742.71
	(647.54)	(675.38)	(606.05)	(352.54)	(535.59)
R^2	0.213	0.207	0.187	0.173	0.246
Panel B: Two-Stage Least Squares for Poverty Rate					
Plantations pre-1873	0.998**	1.028**	1.037**	0.889**	0.676**
	(0.429)	(0.446)	(0.425)	(0.414)	(0.275)
Age	-0.795	-1.193	-0.929	-0.659	-2.074**
	(0.903)	(0.892)	(0.902)	(0.611)	(0.896)
R^2	0.193	0.220	0.205	0.177	0.298
Observations	28	28	28	28	28

Robust standard errors in parentheses

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

Table 4 depicts the second stage for annual household income in Panel A, and poverty rate in Panel B. These results measure the effect of sugar plantations established by 1873 on wealth and poverty in different years in the twenty-first century. Sugar plantations seem to have a negative effect on income, and a positive effect on poverty rate. These results support the theory that institutional deficiencies that have inhibited growth can be found in the political economy of conquest and enslavement (Acemoglu et al. 2002). On average, sugar plantations in 1873 are responsible for a loss of 14 percent of annual household income[26] in a given municipality. At the same time, they are responsible for 9,024 poor citizens[27] in a given year per municipality.

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[26]Average annual household income in the twenty-first century is $16,449.16 in a given municipality.

[27]Average population in the twenty-first is 119,218 citizens in a given municipality, and average poverty rate is 48.8 percent.

6   Policy Implications

This paper confirms the relationship between history and present. The data supports my hypothesis that sugar plantations, persisting through their effect on institutions, impact the living standards of contemporary communities. This demonstrates that the structure of these communities has persisted throughout time. Sugar plantations still impact the economic environment on the island. This analysis presents an opportunity to create an intervention which attempts to improve the communities marginalized by the impact of the sugar plantations. These outcomes have clear policy implications. The people of Puerto Rico need to know that the effects of colonial institutions persist to this day in order to develop policies to reduce colonialism's detrimental effects. More investment in remedial public good provisions should be directed towards these marginalized communities.

7   Conclusion

By exploiting exogenous variation in the assignment of sugar plantations, I identify their persistent effect on economic indicators. An instrumental variable estimation indicates that the long-run impact of a single sugar plantation, on average, lowers annual household income by $552, and increases a town's current poverty rate by an entire percentage point. These results indicate that towns with sugar plantations have historically been marginalized. At the same time, it offers an explanation for the lack of convergence between the United States and Puerto Rico economic and living standards. Overall, towns that had sugar plantations are poorer today. Sugar plantations are responsible for the loss of 14 percent of annual household income per municipality, and for 9,024 citizens that have become poor in a given year per municipality.

8   References

Abbad y Lasierra, Inigo. (1866). Historia geografica, civil y natural de la Isla de San Juan Bautista de Puerto Rico. Puerto Rico: Imprenta y Libreria de Acosta.

Acemoglu, Daron, Simon Johnson, and James A. Robinson. (2002). "Reversal of Fortune: Geography and

Institutions in the Making of the Modern World Income Distribution." Quarterly Journal of Economics, 117, 12311294. [1863,1865]

Acemoglu, Daron, James A. Robinson. (2008). "Persistence of Power, Elites, and Institutions." American Economic Review, 98: 1, 267-293.

Acharya, A., M. Blackwell, and M. Sen. (2018). "Deep Roots: How Slavery Still Shapes Southern Politics." Princeton Press.

Andrews, George Reid. (2004). "Afro-Latin America, 1800-2000." Oxford University Press.

Angrist, J., and Pischke, J. (2009). Mostly Harmless Econometrics: An Empiricist's Companion. Princeton University Press.

Banerjee, A., and Iyer, L. (2005). "The Legacy of Colonial Land Tenure Systems in India." American Economic Review Vol. 95, No.4, 1190-1213.

Cubano, Astrid. (1999). El azucar en Puerto Rico, Siglo XIX: Fuentes y Problemas.

Curtis, K., and Scarano, F. (2011). "Puerto Rico's Population Padrones, 17791802." Latin American Research Review, Vol. 46, No. 2.

Dell, M. (2010). "The Persistent Effects of Peru's Mining Mita." Econometrica, Vol. 78, No.6, 1863-1903.

Early, J. (1994). "Friars and Indians: The Architecture of Evangelism." The Colonial Architecture of Mexico. Albuquerque: University of New Mexico Press.

Figueroa, L. (2005). "Sugar, Slavery and Freedom in Nineteenth-Century Puerto Rico." The University of North Carolina Press.

Fujiwara, T., Laudares, H., and Valencia, F. (2017). "Tordesillas, Slavery and the Origins of Brazilian Inequality."

Michalopoulos, Stelios and Elias Papaioannou. (2013). "Pre-Colonial Ethnic Institutions and Contemporary African Development." Econometrica 81(1): 113-152.

Nunn, N. (2008). "The Long-Term Effects of Africas Slave Trades." Quarterly Journal of Economics, 123, 139176. [1863,1865]

Nunn, Nathan and Leonard Wantchekon. (2011). "The Slave Trade and the Origins of Mistrust in Africa." American Economic Review 101(7):3221-3252.

OPEN Puerto Rico. (2017). Municipal Financial Health Index.

Pagan, L. (1902). Biografia de las Riquezas de Puerto Rico.

Pico, F. (2000). "Los irrespetuosos." Ediciones Huracan, Inc.

Scarano, F. (1977). "Slavery and Free Labor in the Puerto Rican Sugar Economy: 1815-1873."

Scarano, F. (1984). "Sugar and Slavery in Puerto Rico: The Plantation Economy of Ponce, 1800-1850."

Soares, Rodrigo R, Juliano J Assuncao, and Tomas F Goulart. (2012). "A note on slavery and the roots of inequality." Journal of Comparative Economics 40 (4): 565580.

Turnbull, D. (1840). "Travels in the West: Cuba; with notices of Porto Rico, and the slave trade."

Via M, Gignoux CR, Roth LA, Fejerman L, Galanter J, Choudhry S, et al. (2011). History Shaped the Geographic Distribution of Genomic Admixture on the Island of Puerto Rico. PLoS ONE 6(1): e16513. https://doi.org/10.1371/journal.pone.0016513