

ABSTRACT

Title of Dissertation: CAFFEINATED DEVELOPMENT AND
OTHER ESSAYS IN LATIN AMERICAN
ECONOMIC HISTORY

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Doctor of Philosophy, 2020

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This dissertation consists of three essays. The first one focuses on Colombia after 1850 and measures the impact of the expropriation of Church's assets on political violence. With yearly data on the number of battles per municipality, archival information on the reform, and difference-in-differences, the paper documents a reduction of political violence in places where the Church's assets were expropriated. The paper contests the traditional idea of the expropriation of Church's real estate as a source of political violence. It highlights changes in political competition after the alliance between Conservative factions and the Church was weakened. Specifically, it shows the reduction in political violence was concentrated in municipalities with high political competition and where the Conservative Party was relatively weak.

The second essay studies the effect of the first wave of globalization on developing countries' structural transformation, using data from Colombia's expansion of coffee cultivation. Counties engaged in coffee cultivation in the 1920s de-

veloped a smaller manufacturing sector by 1973 than comparable counties, despite starting at a similar level in 1912. My empirical strategy exploits variation in potential coffee yields, and variations in the probability to grow coffee at different altitudes. This paper argues that coffee cultivation increased the opportunity cost of education, which reduced the supply of skilled workers, and slowed down structural transformation. Using exogenous exposure to coffee price shocks as instrument, I show that reductions in cohorts' educational attainment led to lower manufacturing activity in the long-run. The effect is driven by both a decrease in demand for education and reductions in public goods. Finally, coffee cultivation during the early 20th Century had negative long-run effects on both individual incomes and poverty rates.

The third essay explores how changes in commodities' prices can have differential effects on school enrollment according to characteristics of crop's production functions. It compares schooling outcomes in counties that specialize in sugar (a land intensive crop with economies of scale) or coffee (mostly produced in small farms) in Puerto Rico between 1900 and 1930. Sugar price increases lead to increases in enrollment in sugar counties, while coffee price changes have a negative relationship with enrollment in coffee regions.

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IN LATIN AMERICAN ECONOMIC HISTORY

by

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Dissertation submitted to the Faculty of the Graduate School of the
University of Maryland, College Park in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
2020

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Preface

Countries in Latin America became independent around the same period than British colonies in North America. Though standards of living were relatively similar between them around 1800, Latin America had fallen behind the United States by the beginning of the 20th century (Acemoglu et al., 2002; Prados de la Escosura, 2007). To explain these differences in economic performance, some influential theories propose that the answer lies on the relationship between institutions and factor endowments (geography, climate, etc.). Colonial institutions that persisted over time created an environment that did not promote innovation and investments in physical and human capital (Engerman and Sokoloff, 1997; Acemoglu et al., 2005; Coatsworth, 2008). Other hypothesis, perhaps more popular within Latin America, highlight the interaction between endowments and international trade. The region had a bad draw in what Bulmer-Thomas (2003) calls “the lottery of natural resources” and ended up specializing in primary commodities, neglecting industrialization (Cardoso and Faletto, 1979). Whatever the case may be, these theories are somewhat silent or vague on the specific mechanisms connecting institutions, endowments, and international trade to economic performance over the long run.

This dissertation presents empirical evidence from three different settings to provide nuance and context to development theories about why Latin America fell behind. First, the institutional theory implies that replacing colonial institutions that benefitted a narrow elite for more inclusive ones, though hard, would

have generated incentives to invest and innovate. However, the struggle for institutional change generated widespread political violence in the region during the 19th century. How did Latin American countries move toward more stable polities? Chapter 1 studies a particularly contested institutional change, property rights for the Catholic Church, and suggests that in fact the move towards more stability comes from institutional changes that benefit the elite (an idea related to North, Wallis, and Weingast (2009)). In other words, better outcomes can be achieved even when inclusive institutions are not sustainable.

Second, the dependency theory explains that international trade prevented Latin American countries from industrializing because of incentives to specialize in primary commodities. While this theory emphasizes the role of terms of trade, Chapter 2 explores how abundance of a demanded commodity prevented industrialization through a more fundamental mechanism: reductions in human capital accumulation. Together with Chapter 3, they show that the cost of attending school increased when workers had the option to work in profitable export agriculture sector, especially when crops are amenable to employ child labor.

Though there are some common threads across the three settings, perhaps the most salient common theme between the three chapters is the focus on rigorous empirical work and causal identification. Each of the chapters uses newly digitized historical data and combines them with available data from census of population. Chapter 1 uses archival data and compiles information on political violence at the local level from a book from the early 20th century. For Chapter 2, I digitized early coffee cultivation census and historical census of population. Fi-

nally, Chapter 3 uses data from digitized government reports.

Chapter 1 studies a specific institutional change in late 19th century Colombia: the expropriation of the Catholic Church's real estate in 1861. The Church's land was then sold in auctions, which meant that rich members of society bought it and consolidated their landholdings. Commentators at the time and current day historians thought the expropriation increased political violence through retaliation by Conservative factions allied with the Church against the Liberal government. However, I show that the disentailment reform reduced political violence, especially in counties (*municipios*) where the Conservative party had electoral advantage. I compare counties where the government expropriated at least one of the Church's real estate properties with municipalities where the Church did not own real estate under the mortmain land tenure. Before 1862, political violence evolved similarly in both types of municipalities but in places where the Catholic Church's real estate was expropriated the level of political violence decreased after the disentailment reform. One common theme across Latin American countries during the 19th century was the high frequency of civil wars and political violence. For instance, while the United States had one civil war, Colombia had around 16 (Centeno, 1997). This chapter shows that getting rid of colonial institutions can promote stability precisely because the institutions that replace them are not egalitarian in nature.

Chapter 2 focuses on Colombia's expansion of coffee cultivation during the first two decades of the 20th century. The four-fold coffee production expansion between 1905 and 1921 is comparable to the largest expansion of modern agri-

cultural exports (palm oil in Indonesia (Edwards, 2019)). The main finding is that coffee cultivation had a negative impact on the structural transformation of Colombian counties during the 20th century. However, identifying the causal relationship between coffee cultivation and structural transformation is challenging. For example, regions that had more difficulty importing capital goods might have seen a profitable opportunity in coffee bean production since it was transportable by mules. More generally, counties that would not have developed a strong manufacturing sector in the early 20th century might have taken up coffee cultivation as an alternative. I use two instrumental variables approaches to deal with omitted variable bias problem. The assumption behind both instruments is that climatic conditions specific to coffee trees only affect industrialization through coffee cultivation.

The adoption of coffee cultivation effectively increased land productivity in places used to grow staple goods like beans and corn. Moreover, coffee production was labor-intensive, given the need to pick and classify coffee cherries by hand. Therefore, the expansion of coffee cultivation increased the opportunity cost of education, shifting the type of skills workers accumulated. The chapter shows that in coffee counties, the labor force accumulated less years of education and specialized in agricultural skills, which slowed down the process of industrialization relative to other counties with a higher supply of workers with skills valued outside agriculture.¹ While the capacity to export primary goods to the devel-

¹This argument was made theoretically by Caselli and Coleman II (2001) and Acemoglu and Guerrieri (2008). Recently, Porzio and Santangelo (2019) presented causal evidence across countries and within Indonesia in favor of this mechanism.

oped world was beneficial in the short run, labor-intensive commodities generated strong incentives for households and landowners in developing countries to reduce investments in human capital. Therefore, the supply of non-agricultural workers decreased, causing the process of structural transformation to be slower, and reducing income as a result.

Chapter 2 compares counties that produced an export crop, coffee, with other counties that were not suitable to produce a demanded commodity in international markets. Coffee counties developed a less educated labor force because coffee production increased household's opportunity cost of investing in children's education. However, that might not necessarily be the case for all export crops. Chapter 3 uses data from Puerto Rico between 1900 and 1930 to compare places suitable to produce coffee and places suitable to produce sugar. Both crops have considerably different production functions, especially in terms of economies of scale, that translate into large differences in farm sizes. While coffee cultivation happens in small, family farms, sugar cane cultivation takes place in larger plantations. Exploiting changes in international prices of both crops, Chapter 3 shows that increases in the price of coffee reduce enrollment in schools, in line with the results presented in Chapter 2 for Colombia. Moreover, it shows that when sugar price increases, school enrollment in sugar areas increases as well. In other words, when households get relatively richer because wages are going up driven by international prices, kids are more likely to attend school. Both effects, for coffee and sugar regions, are stronger in rural schools relative to urban ones. Moreover, the effect from coffee prices is as strong for women than for men, but the effect

of sugar prices is concentrated on men's enrollment. That is consistent with the fact that women are employed more in coffee cherries' picking season than in the sugar cane production process.

Acknowledgments

Finishing this dissertation during a global pandemic has been a sobering experience and a reminder of the importance of social science, economic history, and rigorous empirical work. It has also put in serious perspective how privileged I am for being able to do research for a job. That privilege does not come from my own ability or effort. It comes from a long series of lucky events and by invaluable help and support from many people that took a kid from Medellín to graduate from one of the top economics departments in the world.

I would like to thank John Wallis, for his professional guidance, our conversations, but especially for trusting my ability to find answers when others only saw dead ends; Ethan Kaplan, for pushing me to be a much more rigorous economist; and Allan Drazen, for showing me how to be a sharp and constructive critic without losing humor. I also received considerable support from Sebastian Galiani, Felipe Saffie, and Sergio Urzúa, who were always open to new ideas and helped me connect my interest in Latin American economic history with broader topics within the profession. I am also grateful to Cindy Clement, John Shea, Vickie Fletcher, Amanda Statland, and Jessica Gray, for their support during the past six years at the University of Maryland.

I have been lucky to meet several people in the profession who have become important sources of support and guidance. I would like to thank Ran Abramitzky, Gustavo Canavire, Mónica Ospina, Andrés Ramírez Hassan, Jorge A. Tamayo, Felipe Valencia, and especially Pablo Querubín and James Robinson

who unknowingly changed my career path after I took their class in 2013 and have provided me with generous advice over the years.

The contents of this dissertation improved significantly due to discussions with Dan Bogart, Irina España, Leopoldo Fergusson, Martin Fiszbein, Felipe González, Judy Hellerstein, Maria López-Urbe, Javier Mejía, Kris Mitchener, Michele Rosenberg, Jared Rubin, Felipe Sáenz, Fabio Sánchez, Lesley Turner, Juan F. Vargas, and participants at EHA Meetings, Cliometrics, NBER-SI DAE, EH-Clio Lab at PUC Chile, IOEA, LSE-Stanford-Uniandes Latam Development, RIDGE Economic History, and LACEA. I gratefully acknowledge funding for assisting to these conferences from the Gruchy Fellowship in Economics from UMD, the Institute of Humane Studies, and Shealtiel Group.

I would like to thank my grad school family for being the best source of motivation, support, and lively academic discussions. Some of them are part of the UMD Economics community: Prateik Dalmia, Juan Echenique, Camila Galindo-Pardo, Alejandro Graziano, Fernando Saltiel, Matt Staiger, Temp, Cody Tuttle, and Santiago Vélez. Others are not: Christian Gómez, Rafael Hernández, Daniel Pérez, Lizz Reeves, and especially Manuela Vásquez. I thank you all for putting up with my half-baked paper ideas and my inability to complete a fútbol game without a yellow card.

I would not have made it here without my friends from home. They bring me perspective by not caring about rankings or top-5s and are too many to mention by name. Finally, my loving family, who I need to mention by name regardless of how many they are because I am indebted to all of them more than they can

imagine. My siblings: Miguel, Sara, Susana, David, and María, plus Daniel, Santiago, and Pedro, who have also served as outstanding research assistants (though I wonder what says about me as a researcher that none of them decided to study economics). And my parents, Gabriel Uribe and Ana María Castro. This dissertation is dedicated to Hernán Castro, Marielena Mejía, and Rosa García de Uribe (*q.e.p.d.*).

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Chapter 1: Expropriation of Church Wealth and Political Conflict in 19th Century Colombia

Political instability and violence are one of the main causes of Latin America's poor relative economic performance during the nineteenth century. Multiple factions fought constantly over privileges, rights, and resources that became available after independence. Institutional changes shifted the balance between powerful groups that frequently contested established authority (North et al., 2000; Coatsworth, 2008; Centeno, 1997). Among these powerful groups there was the Catholic Church. Politically influential, it also benefited from economic rents defined by the land tenure system established by the Spanish Crown, known as mortmain. Under this system the Church's real estate was inalienable, free of taxes, and owned in perpetuity. In this article, I explore the evolution of political violence after an institutional reform that radically changed the Catholic Church's property rights: the disentailment of mortmain.

I focus on the case of Colombia, which abolished the mortmain institution in 1861 and redistributed the Church's real estate after 1862. Given the Church's influence and wealth, it is possible that the disentailment reform fueled political

A version of this chapter was published in *Explorations in Economic History*, vol. 73, 2019.

instability and violence by generating grievances between Conservative factions allied with the Church and Liberal factions who wanted to reduce the Church's role in society. However, the disentailment reform may have led to less conflict if it helped consolidate "secular" elites or if it generated better economic outcomes. How the expropriation of the Church's real estate in Colombia affected political violence in the second half of the nineteenth century is therefore an empirical question and the main goal of this article.

I estimate the impact of the disentailment reform on political violence using archival records from the reform and a difference-in-differences estimation strategy. Specifically, I compare municipalities (counties) where the government expropriated at least one of the Church's real estate properties with municipalities where the Church did not own real estate under the mortmain land tenure. Before 1862, political violence evolved similarly in both types of municipalities but in places where the Catholic Church's real estate was expropriated the level of political violence decreased after the disentailment reform. The effect is sizable: political violence in the municipalities where Church land was expropriated falls by about 29%. This effect is robust to different specifications, sample restrictions, controls for the dynamics of political conflict, and to various standard error adjustments. Moreover, the disentailment reform had a negative effect on political violence even when focusing exclusively on municipalities where the government expropriated the Church's real estate.

A limitation of my approach is that there are only records of auctions of expropriated properties but no estimates at the local level of the Church's wealth be-

fore 1861. One concern is that the government could have targeted the Church's assets only in certain areas in order to gain political advantage. I use data on the 1856 presidential elections to measure support for the Conservative Party and electoral competition at the municipality level before the disentailment reform. I find no correlation between political forces and the probability or extent of expropriation. Moreover, the average impact of the disentailment reform on political violence hides interesting heterogeneity. First, the disentailment reform had a smaller, but still negative, effect on places where the Conservative Party had widespread support compared to the Liberal party. Second, the reform was more powerful in reducing violence in electorally contested municipalities. Given the dynamics of political competition at the time, these results point to a political explanation of why the redistribution of the Church's real estate had a pacifying effect during the second half of the nineteenth century. Simply, Conservative factions lost most of the appeal to support the Catholic Church's preferred policies, which was the item that led them to compete with Liberal factions the most. In every other dimension, especially in economic policy, there was not much disagreement between the factions. After the Church's real estate was redistributed to other rich members of society, the benefits of having the Church's support diminished, which led to less competition. The decrease in competition did not have much effect in municipalities which were already Conservative strongholds or where elections were not very contested before the 1860s.

There might be other reasons why political violence decreased after the Church's real estate was redistributed. Importantly, the disentailment reform not only auc-

tioned the Church's assets off, but also changed the land tenure system established in the Colonial period to a more modern one. Recent empirical literature has shown that the expropriation of the Church's wealth in Europe had economic consequences in the sixteenth century. The dissolution of monasteries in England (Heldring et al., 2015) and the Holy Roman Empire (Cantoni et al., 2017) affected the long-run allocation of physical and human capital, leading to structural transformation and industrialization. Later on, during the French Revolution, the redefinition of the Catholic Church's property rights also had a positive impact on agricultural productivity and economic performance (Finley et al., 2017). It is plausible that the disentailment reform in Colombia had an effect on political violence through productivity increases. While I do not have data on productivity at the local level, I explore the economic hypothesis by estimating the relationship between political violence and the share of a municipality's area that was expropriated from the Church and changed land tenure system. I do not find empirical support for this relationship. Even though the reform might have had effects on productivity in the long run, the short run effect on political violence does not seem to be driven by changes in the land tenure system.

The redefinition of the Church's property rights was common in Europe and the Americas during late eighteenth- and nineteenth-century. Motivated by the French Revolution and Spain's disentailment reform, most of the countries in Latin America carried out similar reforms in the decades after 1820 (Bazant, 2008). Chile's reform in the 1820s, Mexico's in 1856, and Colombia's in 1861 stand out as important examples because of the central role the Church played in the politics

of these countries. However, most studies of the economic effects of the expropriation of Church wealth in Latin America focus on the revenue collected by governments because that was the most cited motivation for such reforms (Jaramillo and Meisel, 2009; Bazant, 2008). This chapter studies the consequences of the disentailment reform beyond fiscal dimensions.

The effect of land redistribution on violence has been studied both theoretically and empirically, especially for cases where reforms aim at solving the problem of unequal land distribution (e.g., Grossman (1994), Domenech and Herreros (2017)). However, the Colombian disentailment reform did little to improve access to land due to both its focus on revenue collection and the way the auction process took place. Even though there was discussion at the time about using the Church's land to reduce inequality, the reform ended up only redistributing land within elites (Fazio and Sánchez, 2010).

Precisely for that reason, the Colombian disentailment reform has traditionally been viewed as a catalyst of conflict. Shortly after the disentailment decree went into effect, an American diplomat in Colombia wrote: "the war has virtually become one of religion, the Liberals against the Church, and the most intense fanaticism against anything that may be proposed by them." He added, "when I commenced preparing the accompanying papers for the Department [of State], it would have appeared almost certain that the controversies to which they relate would soon involve the unfortunate country in another Civil War" (Shaw, 1941). That notion has been carried on to Colombia's historiography. For instance, Jaramillo and Meisel (2009) claim that the antagonism between the Church and

the Liberal party reached its peak after the 1860s. However, the relationship between the disentailment reform and political violence has not been rigorously explored.

I offer empirical support for a different interpretation: by reducing the economic power of the Church and reallocating its real estate properties, the reform changed the incentive of powerful groups to engage in conflict and helped lessen political violence. In particular, factions organized in the Conservative Party lost rewards from supporting the clergy because the Church was considerably impoverished. Secular elites who purchased the Church's land and increased their landholdings had less incentive to promote and engage in political violence after the reform. Conflict typically increased wages, crowded out production inputs, and made expropriation and pillage more likely (Safford and Palacios, 2002). In other words, the consolidation of landholdings by secular elites may have reduced their interest in violence as a profitable political strategy. This idea is related to the view of how elites allocate rents and privileges to solve the problem of violence (North et al., 2009) and more closely to Bazant's (2008) depiction of Spanish disentailment reform, in which landowners were sympathetic to the Church's causes until they bought its expropriated properties.

1.1 Historical background

After achieving independence in 1819, Colombia experienced a century of political chaos and instability. Several factions competed for legitimate rule through

the electoral process. Between 1830 and 1930, 25 of the 27 presidential elections were highly competitive, constitutional changes were frequent, and violence was embedded in the political process (Posada-Carbó, 1995; Deas, 1996). “The record includes nine national civil wars, local revolts, mutinies and pronunciamientos, material destruction equivalent to several years of economic output, and at least 250,000 deaths due to political violence” (Mazucca and Robinson, 2009). Political factions used violence as a tool to compete for the rents of power (Fergusson and Vargas, 2013).

Several factors contributed to the country’s violent political competition. First, the executive had a considerable discretion to exclude factions from the political arena. It appointed ministers and provincial governors, controlled the military, and could allocate monopoly rights. Second, the country’s geography made it very hard for the State to establish effective control over the territory it claimed. Additionally, the brief experience with dictatorship in the 1820s led to a reduction in the size of the military. Third, it was easy for political factions to raise bands of civilians due to the country’s relative poverty.¹ These guerrilla forces were often larger than the national army (Hartlyn, 1988).

Despite their fierce competition, political factions were relatively similar and homogenous in their socio-economic composition. Hartlyn (1988) defines the parties as “loose confederations of large landowners and merchants who possessed considerable autonomy in their region rather than tightly knit organiza-

¹In 1850, Colombia’s per capita GDP was around 20% of that of the US, while Argentina’s was only 63% and Chile’s 35% of U.S. GDP (Kalmanovitz, 2011; Coatsworth, 2008).

tions.” Safford and Palacios (2002) describe the political elite as, “men who were born into the upper class and/or whose social position was confirmed by marriage, through achievement in education and at the bar, in economic enterprise, or by rising through the ranks of the military or the clergy. Most were university-educated professionals or had military careers; in either case, they were also likely to own land and quite possibly also engage in commerce.” Political factions organized in the 1850s at the national level in the Conservative and Liberal parties. However, the conventional notion of conservatives as landowners and members of the military, and liberals as merchants and lawyers is not useful when describing Colombian political and economic elites.

The similarity between the two parties made it relatively easy to reach agreements over economic policy. Most of the liberal reforms pushed from 1845, such as eliminating state monopolies, instituting civil marriage and universal male suffrage, or shifting tax revenues to regional governments, did not find organized opposition from the Conservative Party. Even the abolition of slavery, which took almost 30 years to complete, was peacefully resolved by compensating slave owners (Tovar, 2007). The relatively peaceful way of undertaking economic reforms led Bushnell (1993) to conclude that “economic policy was not an area of clear-cut differences between the parties.” Political violence frequently took place, not because of the policies that elites took while in power, but because of the winner-takes-all feature of the political process.

An issue that divided political factions was their attitudes toward the Catholic Church. Even though both members of the Liberal and Conservative parties were

practicing Catholics, the latter defended the central role the Church had in preserving social order. Conservative elites viewed the Church as a powerful ally to their causes. The support the Church could bring to the political process was not only ideological but also material, which made Church related political and ideological differences “sharp and strident” after 1850 (Safford and Palacios, 2002, p. 156).

1.1.1 The Catholic Church and Political Violence

During the conquest and colonial periods, especially in the seventeenth century, the Catholic Church received numerous land grants and donations due to its relationship with the Spanish Crown (Coatsworth, 2006). The Church also received pious donations and inherited estates. By the end of the colonial period, it was the largest landowner in the country (Fazio and Sánchez, 2010). Such property was held in mortmain. It was inalienable, not subject to taxes, and owned in perpetuity (Jaramillo and Meisel, 2009). It also held a monopoly on education, controlled tithes, and was so embedded in the bureaucratic structure that becoming a priest was sometimes a young man’s only available option to climb the social ladder. As a consequence, the Catholic Church had an immense influence on Colombian society that persisted after independence.

That influence materialized in different ways. First, local priests were very influential figures in the countryside, able to mobilize the masses against their enemies. Second, assets held in mortmain allowed the Church to generate revenue

and maintain a patron-client network. Third, the Church acted as a monopolist on the market for mortgage loans, which it allocated to “wealthy notables with good political connections” (Coatsworth, 1988). Finally, it was also common for the main political families to have representation in the Catholic Church hierarchy. One of the most striking examples is the Mosquera family. Manuel Jose Mosquera was Bogotá’s Archbishop, while his older brother Tomás Cipriano de Mosquera served as president four times.² The Catholic Church also had representation in the legislative body. In 1834, for instance, one-third of the Senate and one-fourth of the House of Representatives members were priests.

Not only was the Church involved in politics, but it also agitated the masses to violent uprisings even when its direct interests were not threatened. During the 1839-1842 civil war, which was instrumental in the formation of political parties, James Semple, an American diplomat placed in Bogotá, described how:

“The Archbishop issued a proclamation calling on all the faithful, from the highest to the lowest, to turn out and defend the city of the Holy Faith [Bogotá]. A solemn procession was formed, and an oration delivered by one of the most eloquent of the clergy, closing with a prayer to the Virgin Mary to protect the Holy City. This operation had a great effect, many men of all classes went to the barracks and took arms” (Semple to Forthsyte, November 21, 1840, as quoted by Shaw (1941))

The Church also participated directly in violent confrontations. President Mosquera complained to Pope Pius IX about how several priests joined the revolu-

²Banco de la Republica: <http://www.banrepcultural.org/blaavirtual/biografias/mosqtoma.htm>

tion, incited the masses to rebel against the constitutional government, provided funds for weapons, and died in combat while heading guerrilla groups.³ Ortiz (2010) also documents that “parish priests participated in different war activities in almost every region of the country’s interior. Bogotá’s guerrillas recruited 35 priests, while in Antioquia most of the 150 priests preached, helped recruit soldiers, provided support both in kind and in cash to the Conservative troops, and put together relief funds for women and children affected by violence.”⁴

1.1.2 Disentailment reform

General Tomás Cipriano de Mosquera became president after taking over Bogotá in 1861. He was once a conservative figure and had changed political sides several times.⁵ Shortly after taking over the presidency, Mosquera decreed the disentailment of the mortmain. Four sources of motivation were behind the disentailment reform.

First was the pressing fiscal situation due to the accumulation of debt from wars dating back to 1810 (Díaz, 1977). Both Safford and Palacios (2002) and Jaramillo and Meisel (2009) highlight the fiscal motive as being the most important. The latter document how profitable the disentailment reform was for the government despite popular belief at the time. Second, Mosquera’s government wanted retaliation against the Catholic Church for aligning with the Con-

³Credencial Historica Magazine, ed. 153.

⁴The translation is mine.

⁵Allan Burton, a U.S. diplomat in Colombia, commented about President Mosquera: “He was once the idol and worshipper of the very men, or class of men he now pursues, until he saw more inviting fields of ambition among his ancient adversaries.”

servative Party during the war. Third, the government aimed at stimulating local economies by changing the institutional framework under which those properties were owned. Finally, there was the issue of land redistribution. The Secretary of Finance, Rafael Nuñez (1962) wrote: “this is about solving with disentanglement to the greatest extent possible, the arduous and immense problem of the egalitarian distribution of property.”⁶

The 1861 decree created the Disentanglement Agency, which had offices in the different states, and oversaw the operation of public auctions. The decree allowed for payments in bonds, but a minimum of 10% of the property’s value had to be paid in cash. It also tried to divide larger estates into smaller parcels (Fazio and Sánchez, 2010). Finally, to prevent the Catholic Church from hiding its properties, the Disentanglement Agency offered 10% of the property’s value to informants that denounced hidden estates.

Despite the Church’s natural resistance and logistical problems, the disentanglement reform progressed quickly. Figure 1.1 shows the pace of reform. By 1876, the government estimated it was still missing several properties valued in \$247,000 pesos. However, it had already auctioned off properties for roughly \$7 million pesos (Jaramillo and Meisel, 2009). Most of the auctions took place between 1862 and 1868. Seventy-eight percent of the value disentangled from 1862 to 1881 had been auctioned off by 1868. After 1871, disentanglement reform stalled because the remaining estates had low value and the Disentanglement Agency was moved to the Secretary of the Treasury, which had different priorities. Some unsold proper-

⁶Quoted by Fazio and Sánchez (2010)

ties were given to the state governments and the rest was returned to the Church in 1887 after the Concordato deal between the Pope and the Colombian government had been signed. However, the reform was not reversed during the period of Conservative rule (1885-1898). Jaramillo and Meisel (2009) estimate that the government made over \$8 million pesos from disentanglement reform after accounting for the annuity agreed upon with the Holy See.

The pressing fiscal situation was alleviated with the reform, as was the change in property rights and the increase of land circulating in the market. However, the resulting distribution of land was far from democratic. Fazio and Sánchez (2010) show the disentailed real estate had a higher gini coefficient than the lots traded in 1857 in Bogotá. They argue that the auctioned land went to the hands of already powerful elites that consolidated their estates or acquired new ones in different places.

The lower estimates for the value of the reform are around 16% of Colombia's 1860 GDP. As a reference, the Mexican reform undertaken from 1856 to 1875 accounted for 23% of Mexico's GDP. However, Colombia's reform value was thirteen times as large as the central government's revenue, while in Mexico it was only six times as large as federal government expenditures. The Church was stronger and richer in Mexico than in Colombia, but the Colombian government was weaker than Mexico's government (Jaramillo and Meisel, 2009).

1.2 Estimating the Effect of the Disentailment Reform on Political Violence

1.2.1 Data

To estimate the effect of the disentailment land reform on conflict and violence in Colombia I rely on four main data sources. First and foremost, data from the disentailment reform from the Colombian National Archives (Archivo General de la Nacion) (Fazio and Sánchez, 2010). These archives contain information on all the properties that were sold at public auction, including size, value appraised by surveyors, total price paid, buyer's name, and year of purchase. With this source, I build the main independent variable: a dummy that equals one for those municipalities in which land was expropriated from the Church and sold at public auction. I also calculate the extent of the reform by measuring, at the municipality level, the total acreage sold, total revenue collected, as well as the original value appraised by the Disentailment Agency officials. Finally, I calculate the share of the municipality's area that was expropriated from the Church. I use, however, a twentieth century measure of total municipality area, which will lead to measurement error since some municipalities split and transformed their boundaries. To alleviate these concerns, whenever I use the share of total area measure, I will drop out of the sample municipalities with shares higher than the 95th percentile, equivalent to 19.7% of municipality area. In this manner, I omit municipalities where it looks like the Church lost by expropriation more

than 100% of the area in the twentieth century.

Second, I code the information from Riascos Grueso (1950) book “Colombia’s War Geography” to create a yearly panel with the number of battles on each municipality from the late 18th century to 1902. This is the main dependent variable. Notice it is only a measure of political violence, not of the general level of insecurity. Even though Riascos Grueso’s book is the most comprehensive measure of political violence in the nineteenth century, it has not been widely used in the literature.⁷ As a robustness check, and to deal with plausible measurement error, I also use a dummy variable that equals one for each municipality that had a positive number of violent confrontations in a given year. My main sample uses observations from the period between the 1853 and 1886 Constitutions (1854 to 1885), but the results do not change for a sample centered at 1862, or when using all the years from 1850 to 1900.

Third, I use the data from Bushnell (1970) on the 1856 presidential elections to measure political support. Using data from this election is useful for three reasons: (1) it was the first direct presidential election in Colombia; (2) the 1853 Constitution eliminated property and literacy restrictions to vote, extending the franchise to all men older than 21 years old or younger and married; and (3) the turnout for the election was around 41%.

In 1856, the race was decided among three candidates: Mariano Ospina, for the Conservative Party; Manuel Murillo Toro, for the Liberal party; and Tomás C.

⁷To my knowledge, only Fergusson and Vargas (2013) use the same source to study the effect of increasing the size of the franchise in political violence.

de Mosquera, as an independent candidate representing his own National Party. The election was won by the Conservative Party, and represented a relatively peaceful transition of power from Liberal rule. Ospina won the election with 47% of total votes. Murillo came in second place with 37.3% and Mosquera received 14.5%.⁸

I also calculated the level of political competition using an index ranging from 0, where one candidate gets all the votes, to 1, where the two first candidates split the votes evenly (Fergusson and Vargas, 2013). Let v_i^1, v_i^2 be respectively the vote shares of the winning candidate and the runner up in municipality i . The political competition index is given by:

$$PoliticalCompetition_i = 1 - \left(\frac{v_i^1 - v_i^2}{v_i^1 + v_i^2} \right)$$

Notice it does not provide information on which party was relatively stronger. It only measures how competitive the elections were, with 1 being the most competitive.

Finally, I collected geographic and historical information for each municipality from the Municipalities Panel dataset from Universidad de los Andes' Center for Economic Development Studies (CEDE). In particular, I collected measures of altitude, soil quality, distance to the department's capital, distance to the main food market, and distance to Bogotá, as well as indicators for indigenous population after 1535, and for Spanish settlements from 1510 to 1561. I use these as

⁸The remaining votes (1.2%) were cast for "other candidates."

control variables.

1.2.2 Measuring the Disentailment Reform

The Colombian National Archives hold a rich section on the disentailment reform. The General Office for Disentailed Estates had agents in the largest cities, and their records contain useful information on the process of the reform. However, there were not preliminary estimates of the total amount of the Church land at the municipality level (there were some at the state level), so the main measure of disentailment is based only on the outcome of the reform, aggregating at the municipality level the total value and area disentailed.

The Church had accumulated properties over the years, and it was willing to defend its property rights (Díaz, 1977; Coatsworth, 2006). Therefore, the reform's outcome, measured either by total area or value, is not only a function of land the Church had, but also of the capacity it had to hide or deter the government from knowing exactly what it did own. In other words, there is non-random measurement error in the continuous assessments of the reform (area or value). It is not random because it is correlated with the capacity of the Church to hide its estates, which at the same time can be conceived as influencing the level of political violence.

To alleviate measurement error in this sense, I focus on a discrete measure of the reform: a dummy variable that equals one if at least one of the Church's properties had been expropriated in a given municipality. In other words, even

though the total value of the mortmain disentailed per municipality may be systematically biased by the Church's relative power, I assume the Church did not own land in mortmain in any municipality with no records of the disentailment reform.

The assumption is plausible for two reasons: one, the incentives the government offered to informants (Jaramillo and Meisel, 2009); and two, the government's ability to expropriate Church property in each municipality should increase according to the amount of land owned by the Church. To put it differently, the systematic measurement error may exist in the intensive margin of the reform, but not on the extensive margin.

Table 1.1 compares municipalities with reform to those without the reform on several dimensions. First, notice they differ in the expected ways. Property held in mortmain was a legacy of the Spanish empire. Therefore, the Catholic Church held land in places that were founded earlier and where it was more likely to find indigenous groups, which is in the temperate areas, high in the Andes mountains, and closer to Bogotá (Acemoglu and Robinson, 2012).

However, the two groups do not differ in other geographical variables, such as the distance to the department's capital or the soil quality index. Using data from the 1856 elections, I find that the Conservative Party had a higher vote share where the Church had estates, but the average level of political competition was not different between the two groups of municipalities.

Figure 1.2 presents additional evidence that the geographical variation of reform obeys factors other than political competition. It divides municipalities in

deciles according to the Conservative Party 1856 vote share, and shows that the share of “treated” municipalities does not increase systematically with Conservative Party support. For instance, municipalities in the third decile of conservative vote share were as likely to be treated as municipalities where 100% of the votes went to the conservative candidate (tenth decile). A similar conclusion can be drawn from Figure 1.3 for the case of political competition.

In order to explore more rigorously the correlates of disentailment reform, Table 1.2 shows the results for regressions on both the intensive (columns 1 and 2) and extensive (column 3) margins of reform. When I include all relevant covariates to try to explain what type of municipalities experienced the disentailment reform, I find a robust correlation among the following factors: foundation year (older municipalities, with greater exposure to the colonial economy); distance to Bogotá (municipalities closer to the colonial center, where Spanish first settled in large numbers); and amount and value of more land expropriated and the probability of being treated. These relationships hold even when I focus only on treated municipalities in columns 4 and 5.

Interestingly, there is not a robust relationship between political indicators before the reform and the extent of the disentailment reform. As further evidence of this finding, consider Figures 1.4 and 1.5. They show the intensive margin of reform, amount of area expropriated, only for treated municipalities. There does not exist a relationship between political support for the Conservative Party before the 1860s and the location or severity of the expropriation of the Church’s real estate.

1.2.3 Empirical strategy

To estimate the effect of the disentailment reform on political conflict I exploit the geographic variation of the reform and its timing in a difference-in-differences setting. I compare the change in political violence, before and after 1862, in municipalities where the Church's real estate was expropriated with that of municipalities where the Church did not own land in mortmain. The main specification is given by:

$$B_{it} = \gamma(d_t^{1863} * DR_i) + \sum_{j=1}^K \beta_j(x_i^j * d^{1863}) + \delta_i + \delta_t + \epsilon_{it} \quad (1.1)$$

Where B_{it} is the number of battles in year t in municipality i ; DR_i is an indicator equal to one if there was a record of the disentailment reform in municipality i , d_t^{1863} is a dummy variable equal to one from the year of the first recorded purchase onwards, $X_i = [x_i^1, \dots, x_i^K]$ is a set of controls, δ_t is a full set of year fixed effects, and δ_i is a set of municipality fixed effects⁹, to control for both national trends in conflict and common factors at the municipality level, respectively. The coefficient of interest is γ .

X_i include municipalities characteristics, in particular: distance to Bogotá and the State's capital, altitude, soil quality index, an indicator for the location of indigenous groups around 1540, and an indicator of early Spanish settlements (1510 to 1560). To control for the level of political partisanship that may drive political violence I also include the Conservative party vote share in the 1856 presi-

⁹The results are the same when I used a full set of province fixed effects.

dential election.

Given the time invariant differences between places that received the reform and those which did not, I include a set of interactions between the control variables in X_i and the dummy for the post period of the reform. In this fashion, I flexibly control for the concern that the underlying (observable) characteristics in X_i may be driving the results and not the treatment indicator. In particular, I control for the 1856 election results, to account for underlying ideology and relative power of both parties.

I also estimate Equation 1.1 changing the dummy variable DR_i for various continuous measures of the success of the reform: total amount of land, total value of the land, and share of the municipality's area that was disentailed. This last "intensive margin" measure has to be taken with a grain of salt. I use as a denominator the municipality's area in 1980, which is the earliest measure of total area I have. Therefore, the measure would be inaccurate for the youngest municipalities, whose boundaries were not well defined in the 1860s. This is the best I can do, given data availability.

Finally, as the level of violence is serially correlated for each municipality, unless otherwise noted, I estimate standard errors clustered at the municipality level.

1.3 Disentailment Reform Contributed to Reduce Political Violence

The basic logic of the empirical strategy is to compare the change in the level of violence before and after the disentailment reform between municipalities where the Church's real estate was expropriated and municipalities where the Church did not own properties in mortmain. Figure 1.6 shows the raw data for comparison, where indeed it appears that after the disentailment reform, the level of violence fell by a greater amount in the municipalities where properties were taken away from the Catholic Church and sold at public auction. Figure 1.7 shows the residual level of violence after controlling for municipality characteristics and municipality and year fixed effects. Here it is even clearer that municipalities where the Church's real estate was expropriated became more peaceful after 1863 when compared to control municipalities.

The difference in the level of conflict can only be interpreted as being generated by the disentailment reform under the assumption that, absent the reform, political violence in treated municipalities would have followed a similar path than in control municipalities (Angrist and Pischke, 2008a). While this is impossible to prove definitively, the figures also show that the trends in political conflict between municipalities in which the reform took place and those in which it did not were relatively similar before 1863.

The raw data for Figures 1.6 and 1.7 provide a first pass test on the parallel trends assumption. However, I test it more formally following Autor (2003). In

particular, I estimate:

$$B_{it} = \delta_m + \delta_t + \sum_{t=0}^m \gamma_{-t} DR_i + \sum_{t=0}^q \gamma_{+t} DR_i + \sum_{j=1}^K \beta_j (x_i^j * d^{1863}) + \epsilon_{it} \quad (1.2)$$

If the trends on political violence before the reform are not different between the treatment and control group, the coefficients for the years leading to the reform should not be statistically different, but the coefficients on the years after the reform should be¹⁰. It is a validation of the interpretation of the main results as coming from the disentailment reform and not from chance or mean regression.

The negative effect of the disentailment reform is sizable: it represents a decrease of 29% of the average number of battles per year in the municipalities that received the reform. It is also robust to the inclusion of controls. Table 1.3 presents the main results. I estimate Equation 1.1 adding controls step by step. In every column, standard errors are clustered at the municipality level. The coefficient of interest, γ , is the interaction between a dummy variable equal to one for treated municipalities and a dummy variable equal to one for the period after 1862. It is negative and significant at the 95% level in all the specifications, including column 5 where several controls for differential trends after the reform were included. Another way to understand the results is to recognize that results in column 5 are the numbers underlying Figure 1.6.

To corroborate these results, I performed a placebo test where I estimated the

¹⁰A graphic representation of this test is presented in Appendix A.2.

equation in column 5 from Table 1.3 as if the reform had taken place in different years. If there were differential changes in political violence between municipalities that experienced disentailment reform and those that did not during years when the reform did not take place, that would cast serious doubt on the conclusion that the reduction in violence was due to the disentailment reform and not to other factors. Figure 1.8 plots the coefficient point estimate and the clustered standard error for the placebo regressions. The coefficient is only statistically significant for the year the reform took place and two or three years later (depending on the significance level used).

So far I have only used the extensive margin definition of the reform. This analysis lumps into one category municipalities where the Church owned little real estate and others where it had large landholdings. If disentailment reform had an impact on political violence because it weakened the Church's status, we should see a more pronounced effect on municipalities where the Church was hit the hardest. Table 1.4 reproduces the estimation of Equation 1.1, replacing the dummy variable of the reform for a continuous measure of the extent of the disentailment reform. Columns 1 and 4 use the natural log of the total area disentailed, columns 2 and 5 use the natural log of the total appraisal of the properties disentailed, and columns 3 and 6 use the share of land expropriated from the municipality. While columns 1, 2, and 3 use the whole sample of municipalities, assigning the value of zero to those that did not have records of the reform, columns 4, 5, and 6 restrict the sample to those which had records of the reform.

The results for the area and value expropriated accord with those in Ta-

ble 1.3. The take-away is in the same direction: where the reform had a stronger impact on the Church's estates, political violence decreased faster. This is true even when considering only "treated" municipalities. However, I do not find a significant effect using as an intensive measure of the reform the share of the municipality's area expropriated. Moreover, when I consider only treated municipalities, the coefficient changes its sign, from negative in column 3 to positive in column 6.

Results in Table 1.4 help to alleviate concerns about measurement error for the treatment variable expressed in section 1.2.2. However, the dependent variable, political violence, may suffer from measurement error since it was coded using historical accounts of political violence in the nineteenth century. In Table 1.5, I compare the results when measuring political violence using the number of battles (column 1) or simply an indicator variable equal to one for years when there was a positive number of battles (column 2). Results in column 2 show that after 1863 the probability of an event of political violence dropped considerably for municipalities where the Church's real estate was expropriated compared to municipalities where the disentailment reform had no impact.

I selected the main period of analysis based on Colombian political history, however, I could have chosen the time frame in many different ways. In columns 3 and 4 of Table 1.5, I show the results are robust to changes in the sample years. Column 1 shows the main results for comparison. Column 3 extends the period to cover the second half of the nineteenth century, but leaves out the period from 1899 to 1902, where the longest civil war took place. Results in column 4 use a 25

year sample period centered at 1863. The effect of disenfranchisement reform on political violence remains negative and significant. Finally, capital cities from the nine states may be different in many regards to the typical municipality, from population density to political activity. Therefore, I estimate the main results removing them from the sample in column 5 and find capital cities do not drive the main results.

Given the yearly nature of the data and the nature of political conflict, I extend the main results to account for the dynamics of conflict in Table 1.6. Column 1 reproduces the main results for comparison. In column 2 I control for lagged violence and show that political conflict is not serially correlated once I control for year fixed effects, as can be seen from the coefficient on the first lag. In columns 3 and 4, I flexibly control for interactions of the treatment variable (Disenfranchisement) with different years around (column 3) and after (column 4) disenfranchisement reform took place (Mora and Reggio, 2012). The coefficient remains negative and statistically significant in column 4, but is not significant in column 3, although the interaction with the previous year dummy is now significant.

Showing that serial correlation of political violence is not strong is important since Bertrand et al. (2004) raise concerns about the calculation of standard errors in difference in differences settings when the dependent variable is serially correlated. Even though this is not the case for the number of battles, I perform two of their suggested corrections for calculating standard errors more accurately.

First, I collapse the data in two periods, before (1854 to 1862) and after (1863 to 1885) disenfranchisement reform, and replicate the analysis from Table 1.3. Table 1.7

shows the results for two different measures of violence: the average of the number of battles per year (columns 1, 2, and 3) and the share of years with at least one battle (column 4). The coefficient remains negative, statistically significant, and shows the same magnitude.¹¹

Second, I simulate the empirical distribution of γ by randomizing both the year of the reform and the municipalities that were treated. Then I estimate $\hat{\gamma}$ from Equation 1.1. Figure 1.9 shows the empirical distribution when I randomize year and treatment 5,000 times. The empirical p-value is 0.0013. In Figure 1.10, I show the empirical distribution when I only randomize treatment, but not the reform year (N=800). The empirical p-value is smaller than 3%. The vertical line in both graphs shows where $\hat{\gamma}$ lies in the distribution.

1.3.1 Political Competition as an Explanation for the Negative Effect of Disentailment Reform in Political Violence

Political violence in Colombia decreased in places where the Church had properties, compared to places where it did not after the government expropriated them and auctioned them off. Even focusing only on places where Church holdings were expropriated, the disentailment reform had a more negative effect in violence where the Church held more land. It is important to analyze why that was the case.

First, the historical evidence for the Church's direct participation in violence

¹¹As a final check, Appendix A.1 compares the standard errors under three different clustering methods: (1) by municipality, (2) two-way year \times municipality, and (3) by province using wild-bootstrap.

(Ortiz and Javier, 1840; Ortiz, 2010) points to one potential explanation: when the clergy lost economic power, it reduced its direct participation in political violence. Second, the disentailment reform also changed the property rights regime to which Church estates had obeyed. These changes might have shaped the incentive structure, increasing productivity and economic performance. This channel would be consistent with evidence from Europe presented by Heldring et al. (2015) and Finley et al. (2017). While the “economic performance” channel is plausible, Figures 1.6 and 1.7 show an immediate negative effect of disentailment reform. One could argue that it might take some time for productivity to increase and for the people to enjoy a higher standard of living that would lead to lower levels of political violence.

In order to explore the economic performance mechanism, columns 3 and 6 of Table 1.4 introduce a continuous measure of the reform: the share of the municipality’s area that was expropriated from the Church. If the economic channel were very important, the disentailment reform would have had more impact on places where a higher share of their land changed land tenure systems. Results in Table 1.4 do not support this hypothesis. When I consider the whole sample, the coefficient of the interaction between the extent of the reform and the post-period (column 3) is negative and larger than when I measure the reform using total area (column 1), but the standard errors increase even more, making it not statistically significant. Interestingly, when I focus only on “treated” municipalities (column 6), the coefficient has the opposite sign and is not statistically significant. If there is an economic performance effect, it might not be the main explanation to the

rapid decrease in violence in places where the Church lost most of its economic power.

Given the historical context presented in section 1.1, another potential explanation comes from the patterns of political competition between elite groups, specifically, the political parties. Given their similar economic composition (Safford and Palacios, 2002), the Liberal and Conservative parties disagreed the most with respect to the Church's role in society. It is plausible that, as soon as the Church lost its economic power, the Conservative Party lost some of its incentive to support the causes that made them compete with the Liberal Party the most.

In the main results from column 5 of Table 1.1, there is an evident difference of the effect of the reform between very conservative and very liberal places. Overall, consider two municipalities, one where the Conservatives won all the votes in 1856 and the other where the Conservative Party got zero votes. If both municipalities were treated, the reform had a negative effect on the former one that is only 19.6% of the reform's effect on the latter one. In places where the Conservative Party had great support, the fact that the Church's real estate was expropriated did not significantly change the dynamics of violent political competition. However, where the Conservative Party did not enjoy great support, once the Church becomes weaker, violence diminishes sharply.

In Table 1.8, I present evidence that argues for more in-depth study of the relationship between political competition and the effects of disentanglement reform. Column 1 shows the main results for comparison. Column 2 uses the triple interaction between Conservative support, post period, and the indicator for the

disentailment. These results corroborate the idea that the reform's effect on the Conservative Party's strongholds was very mild. A simpler way to show this is to split the sample in two according to Conservative support. Column 6 only considers municipalities where the Conservative Party got more than 43% of the votes (the median vote share). For that group the reform did not impact political violence. Column 7 considers the other 297 municipalities. The Liberal Party was stronger there, and the reform had a strong negative impact on political violence. It is important to remember that these results are not coming from a differential incidence of the reform according to political support (see Figures 1.2 and 1.4 and Table 1.2). The Church was as likely to have estates that were expropriated in Conservative as in Liberal municipalities.

Not only was the negative effect concentrated in more Liberal places, it was also concentrated in politically contested municipalities, that is, in municipalities where the Liberal and Conservative parties split the votes relatively evenly. Column 3 shows the result from adding a triple interaction between political competition and the dummies for the post-period and treatment groups. Columns 4 and 5 indicates the same results in a simpler way. The negative effect of the disentailment reform is only present in places with a political competition index above the median (column 3). Again, Figures 1.3 and 1.5 and Table 1.2 show that politically contested municipalities were as likely to be part of the "treatment group" as non-contested places.

Interestingly, the effect of disentailment reform on municipalities where political competition was low can be seen as indirect evidence favoring political

rather than economic mechanisms. In other words, in places with low political competition, the land tenure system also changed. If the economic mechanism was the main driver, there should also be an effect in those places.

The disentailment reform weakened the Catholic Church considerably. I argue that it led to a change in the dynamics of political competition in Colombia, where Conservative factions did not have a strong incentive to keep backing the Church politically since the Church had less to offer them in terms of economic support. As a consequence, the level of political violence decreased in places where the Church was weakened. I showed that this effect was weaker for Conservative strongholds and for municipalities with very low political competition.

1.4 Conclusion

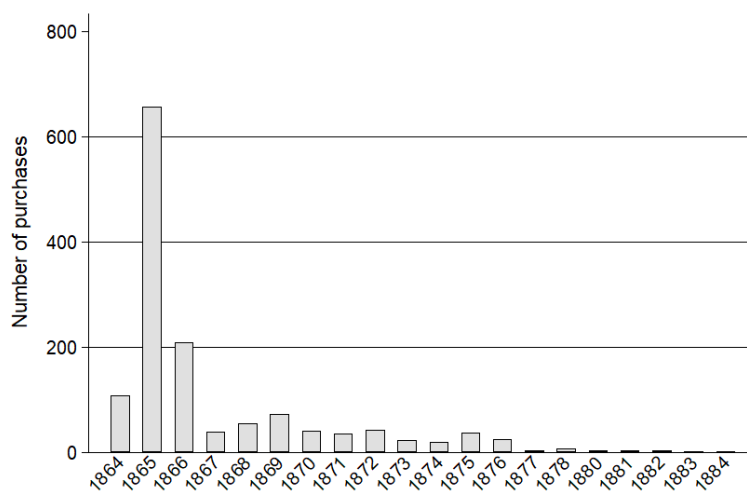
Not only in Colombia was violence endemic to the system. Countries throughout Latin America “virtually collapsed under the weight of what historians refer to as ‘state building’” during the nineteenth century (North et al., 2000). In order to solve the problem of violence, elites had to develop ways to distribute rents to generate a more peaceful equilibrium. Political rules, tax systems, trade policies, labor contracts, and land property rights, which were changing constantly at the time, are examples of how contentious issues could either enhance stability or promote violence. This chapter illustrates how institutional changes like disentailment reform can be used as natural experiments to study civil war and the process of state building in Latin America.

In this chapter, I explore one particular reform that was common in the region, the disentailment of mortmain land, using data from Colombia. Contrary to some traditional interpretations of the disentailment reform, I show political violence decreased after the government expropriated the Church's assets and distributed them among other powerful members of the society. The negative effect of the reform was stronger in municipalities with high political competition or low support for the Conservative Party. These results do not imply that the Church ceased to be involved in the political process. Rather, they point out that the relationship between Conservative factions and the Church was weakened, leading to less political violence.

Other countries in the region experienced similar reforms. As the Colombian experience shows, these reforms might have led to consolidate secular elites and reduce the direct involvement of the Catholic Church in political conflicts. As long as expropriating the Church's properties or other institutional reforms had an impact on the formation political coalitions, they could contribute to reduce violence and conflict. Given that civil wars and instability hurt long run economic growth (Blattman and Miguel, 2010), this is an important research agenda for understanding Latin American development during the nineteenth century and afterwards.

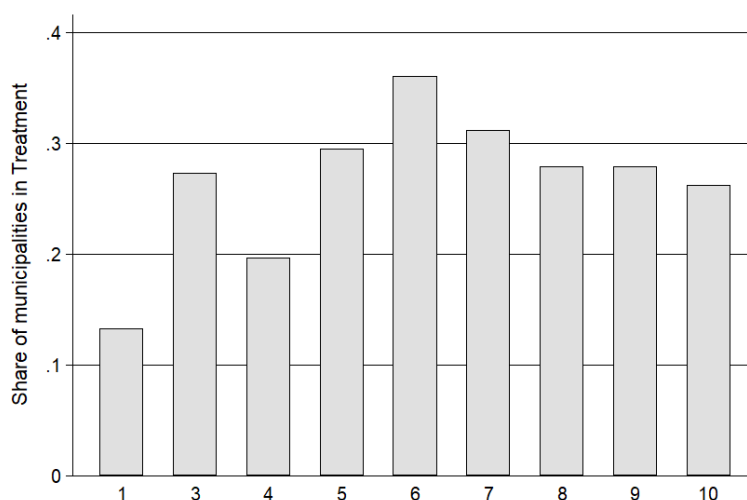
Figures and Tables

Figure 1.1: Number of purchases per year



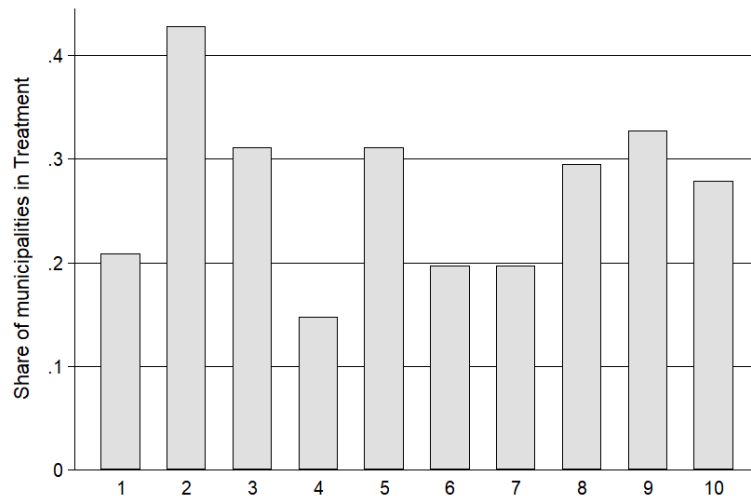
Note: The figure shows the number of purchases of disentailed property by year, from 1864 to 1884. Source: Fazio and Sánchez (2010).

Figure 1.2: Share of municipalities with disentailed property by decile of Conservative party vote share



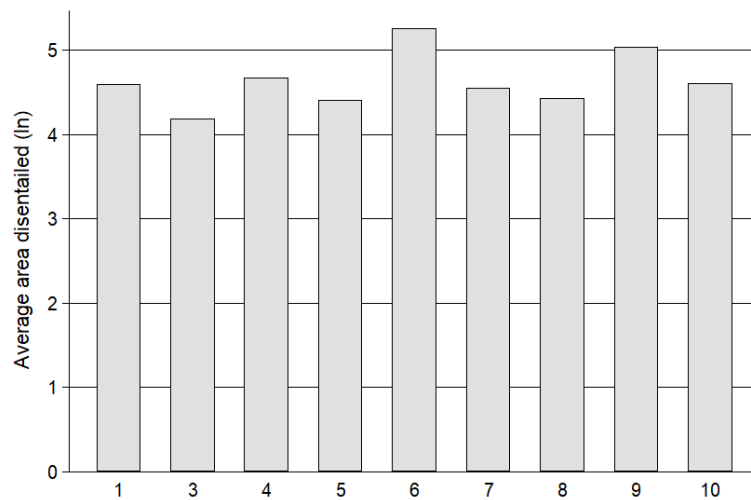
Note: the figure plots the share of municipalities, in each decile of Conservative vote share in 1856, which belong to the *treatment* group, i.e. municipalities where the Church's real estate was expropriated. The Conservative party registered more than 99% of the votes in the 10th decile and 0% of the votes in the first decile.

Figure 1.3: Share of municipalities with disentailed property by decile of political competition



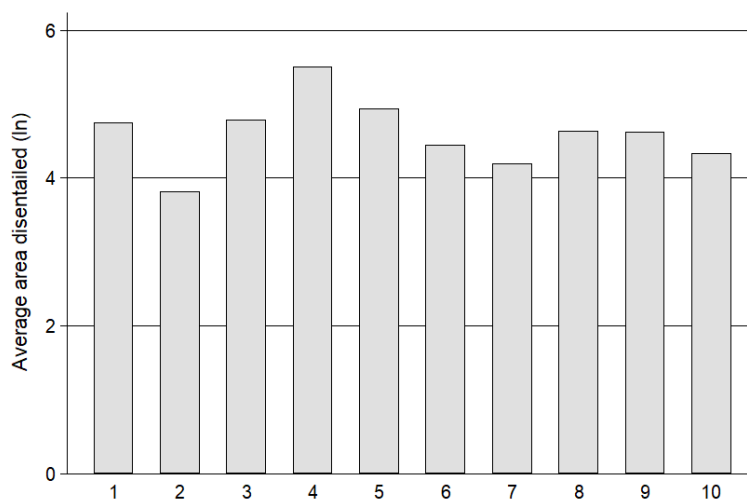
Note: the figure plots the share of municipalities, in each decile of the measure of political competition, which belong to the *treatment* group, i.e. municipalities where the Church's real estate was expropriated. Elections in municipalities in the 10th decile were the most competitive.

Figure 1.4: Average area disentailed in *treated* municipalities by decile of Conservative vote share



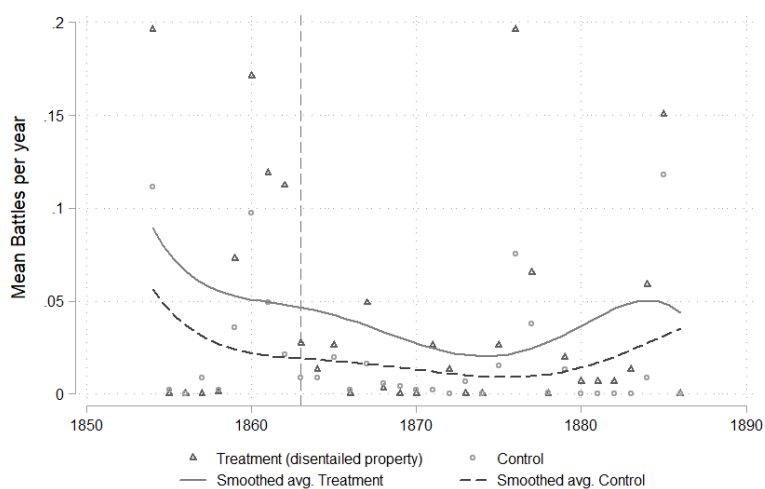
Note: the figure plots the average area disentailed in treated municipalities in each decile of Conservative vote share in 1856. The Conservative party registered more than 99% of the votes in the 10th decile and 0% of the votes in the first decile.

Figure 1.5: Average area disentailed in *treated* municipalities by decile of political competition



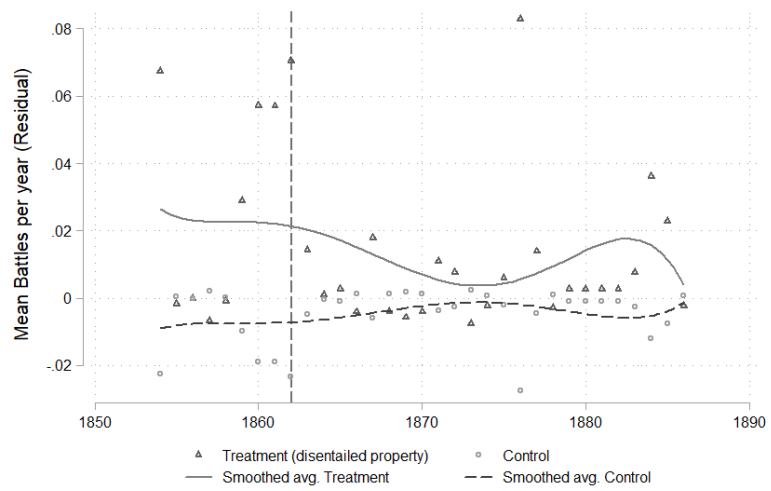
Note: the figure plots the average area disentailed in treated municipalities in each decile of the measure of political competition. Elections in municipalities in the 10th decile were the most competitive.

Figure 1.6: Average battles per year by Disentailment Reform status



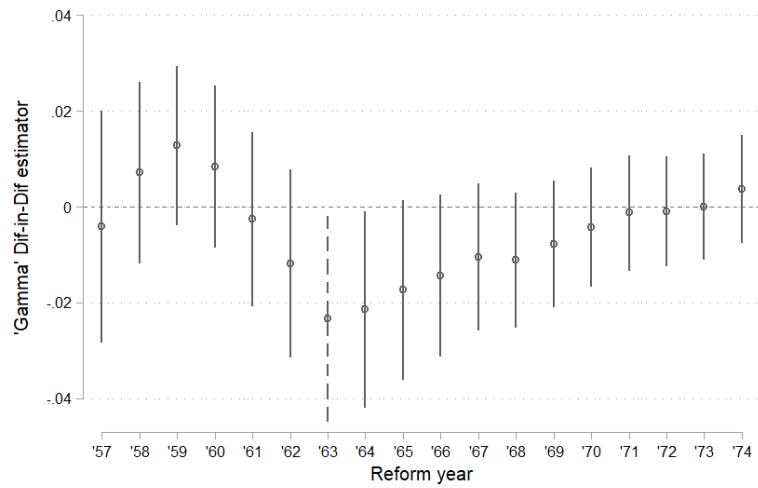
Note: The figure plots the average number of battles per year by disentailment status. The triangles represent municipalities where the Church's real estate was expropriated (*treated*), while the circles represent the *control* group. Similarly, the lines show a fifth degree local polynomial smoothing. The dashed line belongs to the *control* group.

Figure 1.7: Residual average battles per year by Disentailment Reform status



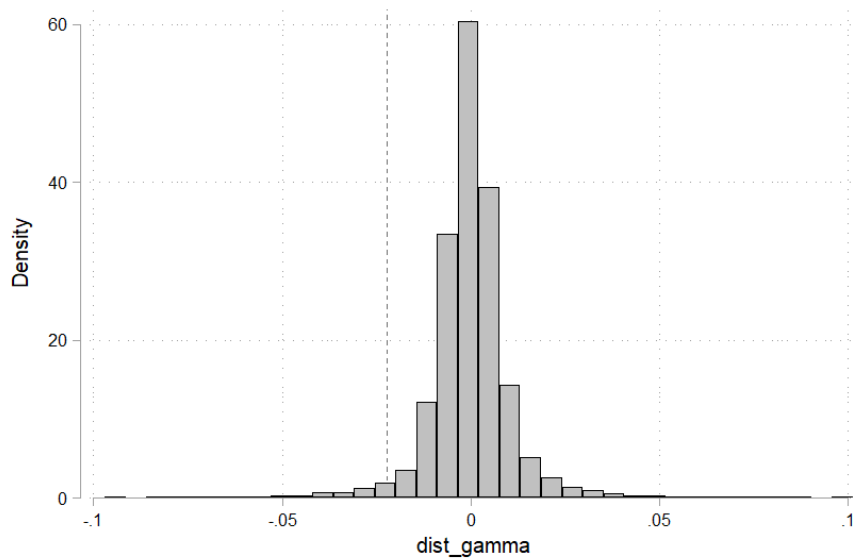
Note: The figure plots the average of the residuals after regressing the number of battles per year on year fixed effects and a vector of controls interacted with a dummy equal to one after 1962. Controls include: area, altitude, distance to Bogotá, distance to the department capital, a dummy for indigenous population in 1550, a dummy for Spanish occupation in 1550, and a soil quality index. The triangles represent the average residual for municipalities where the Church's real estate was expropriated (*treated*), while the circles represent the average for the *control* group. Similarly, the lines show a fifth degree local polynomial smoothing. The dashed line belongs to the *control* group.

Figure 1.8: Placebo test: diff-in-diffs estimator (γ in eq. 1.1) by cut-off year



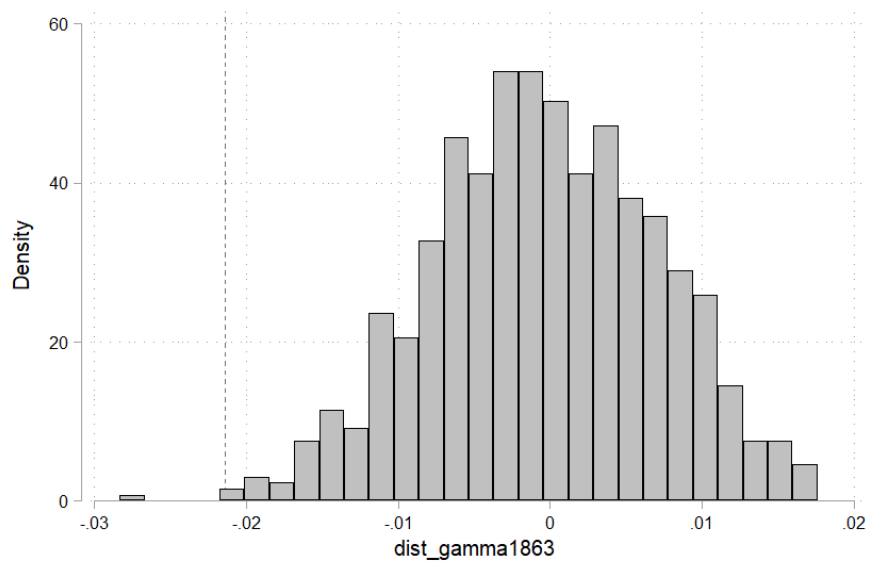
Note: the figure plots the coefficient of interest in equation 1.1, γ , and its confidence interval when varying the year t from 1857 to 1874. The coefficient of interest comes from the interaction between a dummy variable equal to 1 for the *treatment* group and a dummy variable equal to 1 from year t onwards. Each point in the figure represents a different regression. The dashed line highlights the “true” year of the reform (the period after 1862), it is equivalent to the coefficient in column (6) from table 1.3.

Figure 1.9: Empirical distribution of γ in eq. 1.1 when randomizing treatment units and year



Note: the figure is based on regressions of the number of battles per year on an interaction between an indicator of treatment and an indicator for the period after the reform as indicated in equation 1.1. I jointly randomized both of these indicators within my sample. That is, I randomly chose a group of 149 municipalities as treated and one year as the reform year, and I estimated $\hat{\gamma}$. I repeated these steps 5,000 times. The figure plots the distribution of the estimates, and the vertical line shows the value of the coefficient when using the actual treatment group and year. 2.98% of the estimated coefficients are smaller than the “true” coefficient.

Figure 1.10: Empirical distribution of γ in eq. 1.1 when randomizing treatment units



Note: the figure is based on regressions of the number of battles per year on an interaction between an indicator of treatment and an indicator equal to 1 from 1863 onwards, as indicated in equation 1.1. I randomly chose a group of 149 municipalities as treated, and estimated $\hat{\gamma}$. I repeated these steps 5,000 times. The figure plots the distribution of the estimates, and the vertical line shows the value of the coefficient when using the actual treatment group. 0.13% of the estimated coefficients are smaller than the “true” coefficient.

Table 1.1: Comparison of Municipalities without and with Disentailment

Variable	Control		Treatment		Control-Treatment t-statistic
	N	Mean SE	N	Mean SE	
<i>Dependent variable</i>					
Battles per year (1854-1885)	14,624	0.021 0.152	4,896	0.043 0.237	
<i>Municipality characteristics</i>					
Foundation year	448	1833.634 100.740	149	1759.698 115.844	7.467
Altitude (mts over sea level)	448	1219.337 931.986	149	1796.718 2096.082	-4.621
Distance to Bogota (km)	448	338.366 188.670	149	195.817 131.057	8.559
Indigenous population (1535-1540) [dummy]	448	0.482 0.500	149	0.584 0.495	-2.157
Spanish occupation (1510-1560) [dummy]	448	0.438 0.497	149	0.624 0.486	-3.995
Distance to Department Capital (km)	448	71.983 48.306	149	71.293 45.416	0.153
Distance to main market (km)	448	111.825 73.228	149	99.611 49.387	1.897
Soil erosion index (2005)	448	1.990 1.070	149	2.060 1.098	-0.689
<i>Long run outcomes</i>					
Land owned by religious groups (2005, hm2)	384	22.642 108.965	146	21.346 61.630	0.136
Public land (2005, hm2)	384	7658.755 58672.713	146	5294.451 33109.284	0.460
Land inequality (2005)	428	0.713 0.091	147	0.707 0.095	0.750
La Violencia (fights between 1948-1953) [dummy]	448	0.116 0.321	149	0.134 0.342	-0.589
Land disputes (1901-1931) [dummy]	448	0.121 0.326	149	0.087 0.283	1.114
Land disputes (1901-1917) [dummy]	448	0.167 0.374	149	0.121 0.327	1.359
<i>Vote share 1856 elections</i>					
Conservative (Mariano Ospina)	448	0.434 0.399	149	0.531 0.374	-2.616
Liberal (Manuel Murillo)	448	0.355 0.361	149	0.390 0.353	-1.043
Independent (Tomas C. Mosquera)	448	0.211 0.340	149	0.078 0.182	4.546
Political competition	448	0.326 0.316	149	0.363 0.333	-1.221

Note: Control: No records of disentailed property. Treatment: Records of disentailed property

Table 1.2: Correlates of the disentailment reform

Dependent variable: Sample:	(1) Area exprop.	(2) Appraisal All	(3) Treatment=1	(4) Area Treated (Disentailment=1)	(5) Appraisal Treated (Disentailment=1)
Cons. Vote share	-0.1325 (0.253)	-0.2132 (0.352)	-0.0354 (0.046)	-0.1402 (0.618)	0.3238 (0.450)
Political Comp. Index	0.0781 (0.283)	0.2711 (0.395)	0.0443 (0.051)	-0.5035 (0.623)	-0.0392 (0.454)
Foundation year	-0.0036*** (0.001)	-0.0063*** (0.001)	-0.0007*** (0.000)	-0.0014 (0.002)	-0.0037*** (0.001)
Area	-0.0073 (0.094)	0.0075 (0.132)	0.0001 (0.017)	-0.1818 (0.245)	-0.0801 (0.178)
Altitude	-0.0279 (0.066)	0.0315 (0.091)	0.0056 (0.012)	-0.3483* (0.201)	0.1546 (0.147)
Distance to Dept. Capital	-0.0785 (0.091)	-0.1311 (0.127)	-0.0098 (0.017)	-0.0620 (0.176)	-0.1702 (0.128)
Distance to Bogota	-0.8806*** (0.137)	-1.3468*** (0.191)	-0.1659*** (0.025)	-0.3479 (0.253)	-0.3467* (0.184)
Spanish ocup. 1560=1	0.4025** (0.198)	0.6180** (0.276)	0.0711** (0.036)	0.5131 (0.456)	0.3576 (0.332)
Indigenous pop. 1534=1	0.0930 (0.190)	0.1094 (0.264)	0.0185 (0.034)	-0.0321 (0.429)	-0.1028 (0.312)
R2	0.1532	0.2030	0.1781	0.0432	0.1532
Municipalities	610	610	610	153	153

This table shows some correlates of the extent of disentailment reform. The dependent variables are: Area expropriated (in log) (columns 1 and 4), total value as appraised by the Disentailment Agency (in log) (columns 2 and 5), and a dummy equal to 1 for municipalities where the Church's real estate was expropriated (column 3). Columns 1, 2, 3 consider the full sample, imputing a value of zero on the dependent variable for control municipalities. Columns 4 and 5 focus only on treated municipalities.

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

Table 1.3: Difference-in-differences estimator: Effect of the disentailment reform on political violence

	(1)	(2)	(3)	(4)	(5)
Dependent variable:			# Battles per year		
Sample years:			1854-1885		
d^{1863}	-0.0149*** (0.003)		-0.0149*** (0.003)		
Disentailment	0.0356*** (0.011)	0.0356*** (0.011)			
$d^{1863} \times$ Disentailment	-0.0221** (0.009)	-0.0221** (0.009)	-0.0221** (0.009)	-0.0221** (0.009)	-0.0214** (0.011)
$d^{1863} \times$ Cons. vote share					0.0172** (0.008)
$d^{1863} \times$ Control					X
Municipality FE			X	X	X
Year FE		X		X	X
R2	0.0061	0.0505	0.0861	0.1305	0.1385
N	22,048	22,048	22,048	22,048	19,104
Municipalities	689	689	689	689	597

Standard errors clustered at the municipality level in parentheses. The dependent variable is the number of battles per year, built from Riascos Grueso (1950). *Disentailment* is a dummy variable equal to 1 for municipalities where the Church's real estate was expropriated. d^t is a dummy equal to 1 for years $\geq t$. *Conservative vote share (1856)* is the share of total votes won by Mariano Ospina, the Conservative party candidate in the 1856 presidential election. Control variables are defined at the municipality level and include: altitude, total area of the municipality, distance to the State's capital (log), distance to Bogota (log), distance to the closest main market (log), a dummy indicating early indigenous settlements (by 1534), a dummy indicating early Spanish settlements (by 1560), and soil quality index.

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

Table 1.4: Continuous measures of the disentailment reform

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:						
Sample years:						
Sample:		All			Disentailment=1	
Cons. vote share x d^{1863}	0.018** (0.008)	0.017** (0.008)	0.018** (0.009)	0.021 (0.024)	0.026 (0.023)	0.023 (0.025)
d_{1863} x ln(Area Disent.)	-0.004*** (0.002)			-0.003 (0.004)		
d_{1863} x ln(Appraisal)		-0.003*** (0.001)			-0.011* (0.006)	
d_{1863} x Share of Mun. Area			-0.033 (0.092)			0.037 (0.127)
d^{1863} x Control	X	X	X	X	X	X
Municipality FE	X	X	X	X	X	X
Year FE	X	X	X	X	X	X
R2	0.139	0.139	0.135	0.169	0.171	0.166
N	19,104	19,104	18,880	4,768	4,768	4,544
Municipalities	597	597	590	149	149	142

Standard errors clustered at the municipality level in parentheses. The dependent variable is the *number of battles per year*, built from Riascos Grueso (1950). *Disentailment* is a dummy equal to 1 for municipalities where the Church's real estate was expropriated. *Area Disent.* and *Appraisal* are, respectively, the natural log of one plus the total size in hectares and total value in pesos of the properties expropriated from the Church in the disentailment reform. *Share Mun. Area* is the total area disentailed divided by the municipality's area (note: the denominator is the area measured in 2005, not in the 1860s. Therefore, I drop out of the sample municipalities with a share higher than the 95 percentile of the distribution of share, as explained in section 1.2.2). *Conservative vote share (1856)* is the share of total votes won by Mariano Ospina, the Conservative party candidate in the 1856 presidential election. Control variables are defined at the municipality level and include: altitude, total area of the municipality, distance to the State's capital (log), distance to Bogota (log), distance to the closest main market (log), a dummy indicating early indigenous settlements (by 1534), a dummy indicating early Spanish settlements (by 1560), and soil quality index.
 * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 1.5: Robustness checks

	(1)	(2)	(3)	(4)	(5)
Dependent variable	# Battles	$1(Battles > 0)$	# Battles	# Battles	# Battles
Sample years	1854-1885	1854-1885	1850-1898	1850-1875	1854-1885
Sample municipalities	All	All	All	All	No capitals
d^{1863} x Disentailment	-0.0214** (0.011)	-0.0208** (0.009)	-0.0167** (0.007)	-0.0221** (0.009)	-0.0219** (0.009)
d^{1863} x Cons. vote share	0.0172** (0.008)	0.0054 (0.008)	0.0120** (0.006)	0.0185** (0.007)	0.0174** (0.008)
d^{1863} x Control	X	X	X	X	X
Municipality FE	X	X	X	X	X
Year FE	X	X	X	X	X
r2	0.1385	0.1420	0.1162	0.1302	0.1338
N	19,104	19,104	28,656	15,522	18,848
Municipalities	597	597	597	597	589

Standard errors clustered at the municipality level in parentheses, at the province level in brackets. The dependent variable is either the number of battles or a dummy equal to 1 for years with a positive number of battles ($1(Battles > 0)$), built from Riascos Grueso (1950). *Disentailment* is a dummy variable equal to 1 for municipalities where the Church's real estate was expropriated. d^t is a dummy equal to 1 for years $\geq t$. *Conservative vote share (1856)* is the share of total votes won by Mariano Ospina, the Conservative party candidate in the 1856 presidential election. Control variables are defined at the municipality level and include: altitude, total area of the municipality, distance to the State's capital (log), distance to Bogota (log), distance to the closest main market (log), a dummy indicating early indigenous settlements (by 1534), a dummy indicating early Spanish settlements (by 1560), and soil quality index.

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

Table 1.6: Robustness checks: Dynamics

	(1)	(2)	(3)	(4)
Dependent variable:		# Battles per year		
Sample years:	1854-1885			
# Battles (t-1)		0.012 (0.018)		
# Battles (t-2)		-0.056*** (0.012)		
# Battles (t-3)		-0.042** (0.017)		
d^{1860} x Disentailment			-0.000 (0.047)	
d^{1861} x Disentailment			0.018 (0.041)	
d^{1862} x Disentailment			-0.075* (0.042)	
d^{1863} x Disentailment	-0.021** (0.011)	-0.022** (0.011)	-0.013 (0.017)	-0.032** (0.015)
d^{1864} x Disentailment			0.002 (0.019)	0.002 (0.019)
d^{1865} x Disentailment			-0.009 (0.016)	-0.009 (0.016)
d^{1866} x Disentailment			0.029 (0.021)	0.029 (0.021)
R2	0.139	0.142	0.140	0.139
N	19,104	19,104	19,104	19,104
Municipalities	597	597	597	597

Standard errors clustered at the municipality level in parentheses. The dependent variable is the *number of battles per year*. *Disentailment* is a dummy equal to 1 for municipalities where the Church's real estate was expropriated. d^t is a dummy equal 1 for years $\geq t$. All results include: interaction between controls and d^{1863} , and municipality and year fixed effects. Control variables are defined at the municipality level and include: 1856 presidential elections Conservative vote share, altitude, total area of the municipality, distance to the State's capital (log), distance to Bogota (log), distance to the closest main market (log), a dummy indicating early indigenous settlements (by 1534), a dummy indicating early Spanish settlements (by 1560), and soil quality index.

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

Table 1.7: Only one pre and post period

Dependent variable:	(1)	(2)	(3)	(4)
	<i>Average # of battles per year</i>			<i>% of years with at least one battle</i>
Sample years:	<i>Pre= 1854-1862; Post= 1863-1885</i>			
Post=1	-0.015*** (0.004)	-0.015*** (0.003)	0.084 (0.057)	0.098** (0.040)
Disentailment	0.036*** (0.006)			
Post x Disentailment	-0.022** (0.009)	-0.022** (0.009)	-0.024** (0.010)	-0.023*** (0.008)
Constant	0.031*** (0.003)			
Post x Control			X	X
Municipality FE		X	X	X
R2	0.046	0.717	0.731	0.782
N	1,378	1,378	1,350	1,350
Municipalities	689	689	597	597

Standard errors clustered at the municipality level in parentheses. The dependent variable for columns (1), (2), and (3) is the *average number of battles per year*. The dependent variable for column (4) is the *percentage of years with at least one battle*. Both are built from Riascos Grueso (1950). There are two periods for each municipality, the pre-period goes from 1854 to 1862 and the post-period is from 1863 to 1885. *Post* is a dummy variable equal to 1 for the post-period. *Disentailment* is a dummy variable equal to 1 for municipalities where the Church's real estate was expropriated. d^t is a dummy equal to 1 for years $\geq t$. Control variables are defined at the municipality level and include: altitude, total area of the municipality, distance to the State's capital (log), distance to Bogota (log), distance to the closest main market (log), a dummy indicating early indigenous settlements (by 1534), a dummy indicating early Spanish settlements (by 1560), and soil quality index.

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

Table 1.8: Mechanisms

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent variable:	# <i>Battles per year, 1854-1885</i>						
Sample	Political Comp.						
	All						
				High	Low	Conservative	Liberal
$d_{1863}^1 \times$ Disentailment	-0.021** (0.010)	-0.030* (0.017)	-0.001 (0.011)	-0.035** (0.015)	-0.000 (0.012)	-0.002 (0.009)	-0.038** (0.019)
$d_{1863}^1 \times$ Cons. vote share	0.017** (0.008)	0.013 (0.009)	0.015* (0.008)	0.005 (0.018)	0.021** (0.010)	0.044** (0.019)	-0.048 (0.046)
$d_{1863}^1 \times$ Cons. vote share x Disent.		0.017 (0.022)					
$d_{1863}^1 \times$ Pol. Comp.			-0.004 (0.010)				
$d_{1863}^1 \times$ Pol. Comp. x Disent.			-0.055** (0.025)				
$d_{1863}^1 \times$ Control	X	X	X	X	X	X	X
Municipality FE	X	X	X	X	X	X	X
Year FE	X	X	X	X	X	X	X
R2	0.139	0.139	0.139	0.161	0.110	0.128	0.153
N	19,104	19,104	19,104	9,536	9,568	9,600	9,504
Municipalities	597	597	597	298	299	300	297

Standard errors clustered at the municipality level in parentheses. The dependent variable is the *number of battles per year*, built from Riascos Grueso (1950). *Political Competition* is measured using an index distributed between 0 and 1, where 0 means one candidate got all the votes and 1 means the candidates split the votes perfectly. Columns (4) and (5) use, respectively, municipalities where Political Competition was higher and lower than the median. Columns (6) and (7) use, respectively, municipalities where the Conservative candidate's vote share was higher and lower than the median. *Disentailment* is a dummy variable equal to 1 for municipalities where the Church's real estate was expropriated. d^t is a dummy equal to 1 for years $\geq t$. *Conservative vote share (1856)* is the share of total votes won by Mariano Ospina, the Conservative party candidate in the 1856 presidential election. Control variables are defined at the municipality level and include: altitude, total area of the municipality, distance to the State's capital (log), distance to Bogota (log), distance to the closest main market (log), a dummy indicating early indigenous settlements (by 1534), a dummy indicating early Spanish settlements (by 1560), and soil quality index.

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

Chapter 2: Caffeinated Development: Exports, Human Capital, and Structural Transformation in Colombia

The first wave of globalization at the dawn of the 20th century allowed countries that had not yet industrialized to expand their agricultural production to supply world demand (O'Rourke and Williamson, 2002). Were these export opportunities leveraged for expanding the industrial sector? Or, on the contrary, did those places focus on agriculture and delay industrialization? Whether the rise in agricultural exports helped the development of manufacturing and services -the process of structural transformation- is a central question on development economics and has been debated for decades (Rosenstein-Rodan, 1943; Lewis, 1955; Schultz, 1964; Kuznets, 1966). Theoretical contributions highlight potential mechanisms in both directions.¹ The debate has influenced political views about globalization as well as trade and industrial policy in developing countries since the post-war period (Cardoso and Faletto, 1979; Wallerstein, 2011). But the direction of the change in structural transformation resulting from the expansion of agricultural exports is context-specific and, ultimately, an empirical question.

¹The direction may depend on the degree of trade openness (Matsuyama, 1992), income elasticity of demand for manufacturing goods (Murphy et al., 1989), changes on terms of trade (Prebisch, 1950), depth of linkages with the rest of the economy (Hirschman, 1958), or features of crops' production function (Engerman and Sokoloff, 1997; Vollrath, 2011).

This chapter provides new evidence on the effect of the first wave of globalization on developing countries' processes of structural transformation on the long run. Specifically, I study the effect of Colombia's expansion of coffee cultivation on industrialization and economic development.² A long peaceful period after 1902 and the construction of the Panama Canal in 1914 allowed the country to increase its participation in global trade by introducing a new labor-intensive crop, coffee, to areas mostly used to produce maize, beans, and other staples for local consumption (Parsons, 1949). Colombia's broken geography generated a set of local economies relatively isolated from one another and comparable in terms of size and population. Rich variation in climatic conditions within the country provides a good setting to study how the opportunity to produce an agricultural export good impacted long-run development.

This chapter shows the expansion of coffee cultivation deterred industrialization. Counties producing coffee beans around 1920 developed a weaker manufacturing sector through the 20th century. Though manufacturing employment in 1912 was at similar levels in coffee-cultivating counties and non-coffee-cultivating counties, the expansion of agricultural exports had a negative and sizable effect on manufacturing employment in 1938, 1973, and 2005, reaching its peak in 1973. By 2005, coffee cultivation's effect on manufacturing employment had halved, which follows the pattern of Colombia's structural transformation established in Figure 2.1. Consequently, I show that counties producing coffee beans around 1920

²The four-fold coffee production expansion between 1905 and 1921 is comparable to the largest expansion of modern agricultural exports (Palm oil in Indonesia (Edwards, 2019)).

had lower population density and higher poverty rates as of 2005.

Identifying the causal relationship between coffee cultivation and structural transformation is challenging. Counties that would not have developed a strong manufacturing sector through the 20th century could have taken up coffee cultivation as an alternative. For instance, regions that had more difficulty importing capital goods might have seen a profitable opportunity in coffee bean production since it was transportable by mules. What would appear to be a negative effect of coffee bean cultivation on industrialization, could, in fact, be driven by geography or location.

In this chapter, I exploit two different sources of variation related to climatic conditions to address endogeneity concerns. The assumption behind both instruments is that climatic conditions specific to coffee trees only affect industrialization through coffee cultivation. The first instrument for 1920 coffee cultivation is the average potential coffee yield from FAO's Global Agro-Ecological Zones project. FAO-GAEZ estimates potential coffee bean yields at a high-resolution level using a combination of local climatic conditions and coffee's growth cycle. The second instrument exploits a discontinuous reduction in the probability that a county grew coffee trees at 2,400 meters above sea level (7,874ft). The discontinuity is explained by both low temperatures in counties above the altitude threshold and the dissemination of information regarding coffee cultivation in the late 19th century. Optimal temperatures to grow coffee trees ranged between 16 and 24 degrees Celsius (60 to 75 degrees Fahrenheit). Given Colombia's tropical location, the temperature bandwidth mapped directly to an altitude bandwidth between 400

and 2,400 meters. Moreover, 19th century pamphlets promoting coffee cultivation explicitly identified towns just below and just above the upper altitude threshold as a reference due to lack of easily available thermometers³ (Saenz, 1892). This fuzzy regression discontinuity strategy compares counties with average altitudes higher and lower than 2,400 meters. The main specification restricts the sample to include counties above 1,800 meters to guarantee an equal number on each side of the threshold.

The expansion of coffee cultivation in Colombia was effectively a land-augmenting technical change. A simple two-sector model with land-augmenting productivity can explain employment reallocation from manufacturing into agriculture, as Bustos et al. (2016) show using data from Brazil after 1990. However, a theory that explains coffee's negative effect on manufacturing employment must also account for the fact that around 80% of Colombia's labor force was employed in agriculture in 1912. It must explain the differential evolution of industrialization between coffee and non-coffee counties. Such a theory would apply more generally to developing countries during the first wave of globalization, before the proliferation of industrialization.

Using historical and present-day data at the local level, the empirical specifications compare structural transformation patterns throughout the 20th century between places that did and did not produce coffee beans around 1920. This approach is relevant for two reasons: first, Colombian counties during the early 20th century are characterized by low labor mobility and connected product mar-

³As illustrated in Figure 2.6.

kets. Since they behave as small open economies, empirical evidence from local units can be tied to insights from theoretical models (e.g. Foster and Rosenzweig (2004), Bustos et al. (2016) and Fiszbein (2017)). Second, it highlights the distributional consequences of trade across local economies within countries. Though these consequences are well documented for late 20th century globalization (Autor et al., 2016; Goldberg and Pavcnik, 2007), evidence is scarce for the early 20th century. If the effect of trade on structural transformation depends on an economy's stage of development, evidence from more recent periods might not be as informative.

Given coffee's labor-intensive production function, the expansion of coffee cultivation increased the opportunity cost of education. Therefore, the supply of skilled workers in coffee-cultivating counties increased at a slower pace relative to other counties, which in turn slowed growth in the manufacturing sector. The argument connecting human capital and structural transformation is formalized explicitly by Caselli and Coleman II (2001) and indirectly by Acemoglu and Guerrieri (2008). Porzio and Santangelo (2019) use data across countries and within districts in Indonesia to provide causal evidence of the positive role of schooling in industrialization through increases in availability of workers for non-agricultural sector. This chapter adds to the empirical evidence on supply-side mechanisms, specially related to education, as mediators in the process of industrialization.

Two pieces of evidence support the human capital mechanism. First, the difference in manufacturing employment between coffee and non-coffee counties is concentrated in sectors intensive in human capital, classified according to Ci-

ccone and Papaioannou (2009). Second, I present difference-in-differences evidence from comparing adults in the 1973 census of population born between 1902 and 1952. Different cohorts were exposed to different world coffee prices while they were of school age, which determined the opportunity cost of dropping out of school. Cohorts born in coffee counties and exposed to higher coffee prices during school age accumulate fewer years of education by 1973.

These results contribute to a growing empirical literature on how export booms reduce human capital accumulation (e.g. Bobonis and Morrow (2014); Atkin (2016); Sviatschi (2018)). Moreover, they complement Carrillo (2019), who finds a negative, though smaller, effect of coffee price shocks on education using data from the second half of the 20th century⁴ This chapter looks at coffee price shocks during the first half of the century, when industrialization first spread, and focuses on coffee cultivation's effect on structural transformation.

The fact that coffee cultivation leads to lower levels of education could be a consequence of both household decisions and changes in supply of schooling. For instance, landowners in coffee regions might oppose the construction of schools or limit funding to existing ones in order to guarantee supply of agricultural workers (Galor et al., 2009; Galiani et al., 2008). I leverage data on county level land inequality between coffee farms to provide suggestive evidence of both education supply and demand channels. In other words, coffee-bean-producing counties develop a less skilled labor force due to individual's decisions to drop out of

⁴The effect I present in this chapter is almost twice as large as Carrillo (2019) findings. The difference might be due to reduction in transportation costs, changes in education's rate of return or better enforcement of child labor and mandatory elementary school laws between the first and second half of the century.

school and a lower number of schools per capita by 1951.

Coffee price shocks also had a negative direct effect on employment in manufacturing in 1973. The share of the labor force employed in manufacturing in 1973 is lower for cohorts born in coffee counties who were exposed to higher coffee prices during school age. The effect is similar in magnitude to the effect on education. Mediation analysis Dippel et al. (2019b) suggests around 70% of the effect of 1920 coffee cultivation on 1973 manufacturing employment is mediated by the effect of coffee cultivation on education. This result is only suggestive of the importance of the effect because it relies on one strong assumption: the sources of omitted variable bias present when estimating coffee's effect on cohort's education are identical to the ones that would bias the estimation coffee's effect on cohort's employment in manufacturing.

Finally, this chapter explores other potential mechanism cited in the Colombian economic history literature: linkages between coffee cultivation and manufacturing (e.g. Ocampo (1984)). I exploit variation within coffee-bean-producing counties in terms of linkages with non-agricultural sectors by exploring one crucial stage in coffee bean exports: threshing, or removing the husk from the coffee bean. Threshing machines needed reliable energy sources that were also useful for manufacturing activities. Since they were imported from Britain, the presence of threshing machines also signals connection with international trade. Threshing also benefited smelting businesses that provided parts to constantly repair them. I find, however, that the effect of 1920 coffee cultivation on manufacturing employment in 1973 does not depend on the presence of threshing machines.

Stronger linkages do not prevent coffee cultivation from having a negative effect on structural transformation.

This chapter contributes to the empirical literature on the effect of agriculture on structural transformation and local development through productivity increases (Foster and Rosenzweig, 2004; Hornbeck and Keskin, 2015; Moscona, 2018; Bustos et al., 2016) or other factors (Fiszbein, 2017; Droller and Fiszbein, 2019). By highlighting human capital as a relevant mechanism, my findings relate to studies looking at differences in living standards at the subnational level that result from productivity gaps between agricultural and non-agricultural employment (Acemoglu and Dell, 2010; Gennaioli et al., 2013; Gollin et al., 2014; Herrendorf and Schoellman, 2018).

This chapter's argument about the role of human capital on the onset of industrialization in developing countries complements scholarship about Europe's Industrial Revolution (Galor and Moav, 2004; Squicciarini and Voigtländer, 2015; Franck and Galor, 2017; de la Croix et al., 2018). Similarly, this chapter fits in with recent works on Latin American economic history which highlight the role of human capital in the process of structural transformation either directly (Valencia Caicedo, 2019) or indirectly (Perez, 2017). This chapter adds to the study of the adoption of coffee cultivation in Colombian history. As (McGreevey, 1971, p. 198) put it: "No other substantive economic change in Colombian economic history can have been of such overriding social importance." This chapter brings comprehensive data and modern econometrics to an old debate in Colombian economic history. It revisits an established literature studying the relationship

between coffee cultivation and industrialization that mostly rely on comparative studies or time series data. The next section describes this literature in more detail.

Afterwards, I turn to the empirical analysis. Section 2.2 describes the main datasets used in later sections. Section 2.3 presents main correlations between coffee cultivation and structural transformation. It also discusses the main obstacles for identification and presents the empirical strategies used in Section 2.4. Sections 2.5 and 2.6 discuss potential mechanisms. Finally, 2.7 discusses the long term effects of coffee cultivation on income and urbanization.

2.1 Exports and Structural Transformation in Colombia

Countries in Latin America started their processes of industrialization around the first two decades of the 20th century. There was considerable heterogeneity in the path and timing of structural transformation across the region (Salvucci, 2006; Duran et al., 2017). While some countries like Argentina or Mexico had developed manufacturing industry by 1900, smaller countries struggled to consolidate industrial activities (Williamson, 2011). Development economists and economic historians have argued that differences in the features of the export sector help to explain the diverse experiences with industrialization. What Bulmer-Thomas (2003) called “the lottery of commodities” has explanatory power to understand the development of manufacturing in the region.

Demand for commodities from the world economy might help develop the non-export economy through increases in income that increase demand for lo-

cally produced manufacturing. This is more likely to happen if the export sector benefits a large fraction of the population and if transportation costs for imported manufactured goods are high (Murphy et al., 1989; Matsuyama, 1992). Additionally, different export products had different degrees of connection with other economic activities. Linkages or complementarities of exports are cited as a reason for successful development of manufacturing (Bulmer-Thomas, 2003; Hirschman, 1958).

These conditions were not met, for instance, for crops like bananas, produced in enclaves with limited population, or for mining activities performed in isolation from the main centers of population Bulmer-Thomas (2003). On the contrary, successful episodes of industrial growth, like Argentina around 1900, have traditionally been explained by the presence of agricultural activities like wheat or the exporting of processed meat that were not available in other countries in the region. Recent empirical evidence by Droller and Fiszbein (2019) support the hypothesis that linkages in agricultural activities generate industrial growth.

Colombia did not consolidate its export sector until coffee cultivation took off around 1910. During the 19th century gold was consistently the main export, with a couple of short experiments with tobacco and quinine (Ocampo, 1984). Even though coffee was relatively new in the country, a long period of peace after 1902 and two coffee price booms (1906 and in the 1920s) allowed coffee to grow until it represented more than 80% of exports by 1940 (Nieto Arteta, 1971). Coincidentally, manufacturing took off around the 1930s. It had been relegated to cottage industry during the first two decades of the century, but more modern es-

tablishments appeared during the 30s and 40s (Ocampo and Montenegro, 2007).

Historians and economic historians have interpreted this coincidence in timing as evidence of the causal positive effect of coffee cultivation on the development of manufacturing, though the claim has been subject to extensive debate.⁵ Some features of coffee cultivation fit the two theories explained above. Coffee directly employed 18% of the labor force at its peak (McGreevey, 1971). Moreover, its production and exporting connected an extensive area and required machinery and manufacturing products like sacks.

Proponents of the positive link between coffee cultivation and manufacturing back their claims with time series or Department level data. In this chapter I collect a wealth of historical data at both the county and individual level to empirically estimate the connection between coffee cultivation and structural transformation.

2.1.1 Coffee in Colombia: Historical Background

Colombia went from producing around 230 thousand bags per year in 1900 to 3.2 million in 1932. Figure 2.1a shows the evolution of exports during the first half of the 20th century. At the end of the 19th century, the Eastern part of the

⁵Some version of this claim is discussed in the main economic history textbooks. The argument starts with Ospina Vásquez (1955) and Parsons (1949). McGreevey summarizes the argument saying: “the rapid growth of a new export product raised income levels and generated new demands for imported and locally produced goods of all kinds” (McGreevey, 1971, p.198). Brew (1973), Nieto Arteta (1971) and Palacios (2002) studied coffee cultivation and its social impacts to Colombia’s and Antioquia’s societies. Arango (1981) focused exclusively on the direct connection between coffee and manufacturing. Bejarano (1980) summarizes the literature up to 1980 and Ocampo and Botero (2000), Ocampo (2015) discuss new developments from the past 40 years. More modern literature on Colombia’s industrialization downplays the role of coffee cultivation using network data on entrepreneurs and elite members (Mejia, 2018).

country produced most of the coffee. The crop made its way to Colombia's West and South West in the first two decades of the 20th century, well after the frontier closed (Parsons, 1949). By 1930, the East only produced around 30% of total coffee exports.

Early adopters of the crop wrote several pamphlets around 1880 to inform potential investors of the opportunities that coffee cultivation provided. Those pamphlets were collected in the book *Memorias sobre el cultivo del cafeto* (Saenz, 1892). They provide information about the different features of coffee's production function at the turn of the 20th century. In this chapter, I highlight four of them.

First, producing coffee was labor intensive. Coffee trees had two large crops during the year, but it was possible to collect coffee cherries all year round. Even when labor was not required to pick the cherries, coffee farms demanded constant labor for other purposes like weeding, pruning, and pest control. Second, the pamphlets highlighted that a lot of the tasks involved in the collection and classification of coffee were ideal for children. I argue in this chapter that those two features of coffee production function shaped incentives to accumulate human capital and ultimately affected coffee counties' process of structural transformation and development.

Third, the production of coffee required heavy machinery to remove the final grain for exporting from its husk. This process known as threshing⁶ used imported machines, generally owned by farmers' cooperatives. Not every coffee

⁶In Spanish: *trilla*.

producing county had threshing machines. They were in strategic locations, not necessarily in the main production centers. In this chapter, I argue coffee cultivation in counties with threshing machines had stronger linkages to the non-export economy. I use this fact to test whether the effect of coffee cultivation on manufacturing depended on linkages.

Finally, coffee was ideally produced at medium altitude. Those pamphlets consistently pointed out that coffee could be produced between 24 and 16 degrees Celsius (76 to 60 Fahrenheit). Given that climate in Colombia is determined by altitude, early coffee adopters provided reference points in terms of altitude to decide which terrains were feasible to produce the crop. Figure 2.6 shows one of those instances. It highlights that coffee could be produced near Rionegro, located at an altitude of 2,200 meters, but could not be produced near Sonsón or Santa Rosa, at altitudes of 2,500 and 2,450 meters respectively. In general, authors of the pamphlets recognized there was an altitude bandwidth inside which coffee cultivation was suitable. I use the upper threshold of the bandwidth in order to identify the causal effect of coffee cultivation on structural transformation.

2.2 Data

The empirical analysis spans several decades and uses information from various sources. Moreover, as this chapter estimates the effect of exports on local development, it is crucial to consistently define the unit of observation. Colombia's population was distributed in 18 *Departamentos* during most of the 20th century.

There were also a handful of *Intendencias*, where population density was lower and most of the land was unsettled. The country's smallest political divisions are *municipios*, equivalent to US counties. They were generally comprised of a town (*Cabecera*) and a rural area. I refer to them as "counties." They are the main unit of observation, as each one of them represents a local economy.

I digitized county-level data from Colombia's first coffee census (published in 1927) and 1912 and 1938 census of population. Additionally, I use 1945 First Census of Manufacturing. I match 1927, 1938, and 1945 counties to the set of 741 counties reported in 1912 Census. Whenever I could not match by name, I used historical sources to match a county created after 1912 to its "parent" 1912 county. This procedure yields a set of 734 counties with observations in 1912, 1927, 1938, and 1945. Figure 2.7 shows population patterns in 1912 and highlights the main sample.

I also use 1973 and 2005 Census of Population, available from IPUMS International (Ruggles et al., 2003). IPUMS homogenizes counties over time by merging small counties in terms of population and pooling them together into larger units. I call those units "IPUMS-county". There are 564 in 2005 Census. The average IPUMS-county contains 1.9 actual counties (*municipios*). However, 57% of IPUMS-counties only contain one actual county. 84.4% of IPUMS-counties contain one or two actual counties. Moreover, out of the 564 counties, only 495 counties can be traced to be part of a 1912 county. The other 69 counties are located in land that was colonized after 1950.

For each set of results, I explicitly define the unit of observation it uses, be-

tween counties and IPUMS-counties. I do this for two reasons: first, counties better represent local economies for the first part of the 20th century. I use IPUMS-counties for results for the second half of the 20th century, where larger units capture better the idea of a local economy. Second, even though there are some differences, there is significant overlap between both definitions. Results using counties look qualitatively similar as those using IPUMS-counties, but since the sample size is smaller, power tends to be lower.

Coffee cultivation before 1920

I measure coffee cultivation at the beginning of the 20th century with the number of coffee trees used in production by county. This measure comes from the first coffee producers' census: Monsalve's 1927 book, "Colombia Cafetera." Monsalve was an agricultural engineer who led Colombia's Propaganda and Information Office between 1920 and 1924. During that period, he surveyed coffee farms around the country and put together a 950-page book describing Colombia's coffee industry. In 1924, Colombia's government bought the book's rights. The goal was to promote coffee exports by "distributing the book to foreign markets, giving it out for free to public offices, and charging only the production cost to private individuals." Since coffee trees take around 5 years to start producing coffee cherries, the number of coffee trees registered in Monsalve's census is likely to represent trees that were planted in the 1910s, even though the book was eventually published in 1927. Therefore, I interpret the number of coffee trees as

a measure of early exposure to coffee cultivation. For robustness, I also use the extensive margin, a dummy equal to one for counties with a positive number of coffee trees planted before 1924.

The average county had 427 thousand coffee trees, equivalent to around 95 hectares, but the distribution is skewed to the left. 43% of counties had no early coffee production. 50% of counties had less than 20,000 trees, which is equivalent to less than half a hectare. These figures show how even though coffee was taking off during 1910s and 20s, it still represented a small share of counties' land. For instance, Fredonia (Antioquia) had the largest number of coffee trees used for production in 1920. Its 8.3 million trees were equivalent to 1,800 hectares or 7% its total area. As a comparison, using data from 2005 coffee census, 22% of counties use more than 7% of their area to produce coffee. Chinchina (Caldas) was the county with highest concentration of coffee trees in 2005. It devoted 44% of its area to the crop.

I use the coffee census to measure land inequality between coffee landowners. I calculate the ratio between the average and the median farm for each county with a positive number of coffee trees. This ratio was 1.9 for the average coffee county. Appendix B.1 describes the calculation in more detail. A typical coffee county had around 85 coffee farms and 5,600 inhabitants in 1912. A typical farm had 10 to 30 thousand trees. At a rate of $\frac{2}{3}$ pounds per tree per year, a typical coffee farm could produce between 110 and 330 60-pound bags per year.

Economic structure

I measure population, population in the labor force, and shares of labor force employed in manufacturing, agriculture, and services in 1912, 1938, 1973, and 2005. I digitized 1912 and 1938 Census of Population at the county level. I aggregated IPUMS International's Census samples (Ruggles et al., 2003) to build measures at the county level for 1973 and 2005. Additionally, I estimated shares of population who could read and write (1912, 1938, 1973, and 2005), average years of schooling of adult population by county (1973 and 2005), and created household income measures using Filmer and Pritchett (2001) methodology to summarize information about housing quality and durable goods (1973 and 2005).

1912 and 1938 Census of Population provide headcounts for different "Professions and Occupations" at the county level. 1912 census counted the "Active Population" and divided it between occupations.⁷ I consider Agriculture as the combination between Agriculture and Cattle Raising. Manufacturing sector is given by the "Crafts and Manufacturing" category, while Services adds up Liberal Professions, Commerce, and Transportation. 1938 Census was also a series of headcounts at the county level, but the division between occupations was more detailed. Occupations were divided between Primary Production, Transformation Industries, Services, Liberal Activities, and Other. I define Agriculture as Primary Production employment not in "Extractive Activities" such as mining.

⁷1912 Occupations are: Liberal Professions, Arts, Crafts and Manufacturing, Priests and Nuns, Public Employees, Military, Policemen, Agriculture, Cattle Raising, Commerce, Transportation, and Domestic Employees.

Manufacturing employment is given by employment in Transformation Industries excluding “Construction and Buildings” Finally, Services is its own category formed by Transportation, Commerce, and Banking subdivisions.

I build measures of economic structure at the county level for 1973 and 2005 using individual level data from IPUMS International. To make it comparable with 1912 and 1938 figures, I calculate share of population in the labor force. Then I build counts of people employed in Agriculture, Manufacturing, and Services to calculate shares of labor force employed in each category. Additionally, I focus on population between 18 and 65 years old to estimate household income measures. I follow Filmer and Pritchett (2001) and use the first vector out of a Principal Component Analysis using information on housing quality (roof and floor materials, number of rooms, connection to electricity and sewage) as well as durable goods consumption (washing machine, radio, refrigerator). Throughout the calculations explained in this paragraph, I weight individuals according to their sample weight provided by IPUMS. Further details are explained in Appendix B.1.

A different measure of economic structure comes from Colombia’s First Manufacturing Census in 1945. This Census measures more established type of manufacturing than using data from employment out of Census of Population. Plants with five or more employees provided information about employment, wages, and financial status (Santos Cardenas, 2017). The census contains information for 458 municipalities. It divides the establishments in 15 different sectors. Following Ciccone and Papaioannou (2009) and Valencia Caicedo (2019), I classified

the sectors in three groups according to their human capital requirements (high, medium, low). I measure the share of population working in industrial establishments with five or more employees, as well as shares of employment in each of the three human capital groups. I interpolate 1938 and 1951 census of population to obtain 1945 population data at the county level.

Human capital

The main measure of human capital comes from 1973 Census of Population. This is the first available census with individual-level data that reports county of birth. I use this information to build a panel at the gender by cohort by county-of-birth level for individuals born between 1900 and 1951. That is cohorts that are between 73 and 21 years old in 1973. I measure cohorts' average year of schooling, share of cohort-county-of birth who is literate, and occupations shares of the labor force as well as labor force participation information and average household income.

I combine 1973 cohort by county-of-birth panel data with information about international coffee prices. I assign to each cohort the series of real international coffee prices in Colombian pesos before they turn 18 years old. I use nominal exchange rate between Colombian pesos and US dollars and Colombia's price index before 1972 (GRECO, 2002) to estimate real international coffee prices between 1900 and 1972.

Additionally, I calculate literacy rates at the county level from 1912, 1938,

and 1951 Census of Population. The 1951 population census also reported the number of schools per county.

County Characteristics

Finally, I compile a set of county fixed characteristics from different sources. I calculate 1912 counties and IPUMS-counties' area and average altitude using GIS software and shape files with current counties' boundaries. Similarly, I calculate average terrain ruggedness using Nunn and Puga (2010) data. To estimate connection to markets, I measure Euclidean distance from each county centroid to Bogota, the Department's capital, and the second largest town in 1912 different than the Department's capital. Climatic data comes from Dube and Vargas (2013), who calculate long term averages of rainfall and temperature. As measures of state capacity and institutions, I use an indicator for whether each county had Native communities in 1560 (Acevedo and Bornacelly, 2014) and the number of land disputes between 1901 and 1931 from LeGrand (1986).

2.3 Coffee Cultivation and Structural Change in Colombia

This section presents evidence of the negative relationship between coffee cultivation and structural transformation for Colombian counties. It documents the correlation between coffee cultivation at the beginning of the 20th century and labor force participation, employment in manufacturing and employment in agriculture during different years throughout the century.

The main specification is given by the following equation:

$$y_m^j = \beta \text{CoffeeTrees}_m^{1920} + \theta \mathbf{X}_m + \delta_d + \epsilon_m \quad (2.1)$$

Where y_m^j is an outcome for county m measured in year j . Outcomes are share of labor force employed in manufacturing and agriculture as well as share of population in the labor force. \mathbf{X}_m is a vector of county-level controls including population (log), a dummy variable for Department's capitals, linear distance to Department's capital, and distance to closest largest county other than the capital. δ_d are Department fixed effects and ϵ_m is the error term. β is the coefficient on coffee cultivation, measured as log of one plus the number of coffee trees in county m around 1920.

Counties adjacent or close to one another might have similar shocks. In order to account for correlated shocks across space, I adjust standard errors using arbitrary clustering as proposed by Colella et al. (2019), who build on Conley (1999) to adjust for spatial correlation in 2SLS settings. My preferred specification allows for decaying correlation between errors of units inside a circle with 100km radius.⁸ This distance allows the spatial cluster drawn around each county to include close to 30 other counties. Moreover, 100km is roughly half of the distance between Bogota and Medellin, Colombia's two largest cities.⁹

Table 2.1 shows the relationship between coffee cultivation and the outcomes

⁸I implement it using the `acreg` command in Stata, version Beta June 2019 (1.0.1) (Colella et al., 2019). Results are similar using 50km and 200km distance cut-offs.

⁹Another possibility would be to cluster standard errors on arbitrary squares from a grid overlaid on Colombia's map (Bester et al., 2011; Bazzi et al., 2017). Results are qualitatively similar.

of interest in 1973 using several specifications. 1973 is a relevant year since around this time employment in manufacturing peaked in the country. Panel A focuses on the share of labor force employed in manufacturing, Panel B, on the share of labor force employed in agriculture, and Panel C, on the share of adult population in the labor force. Column 1 shows results only controlling for population and subsequent columns expand controls to include geographic characteristics and Department fixed effects. Starting in Column 4, I remove counties containing the Department capital from the sample. Those counties are less likely to grow coffee and tend to be more urban, which could drive the results. My preferred specification is given by Column 4. It includes geographic controls and Department fixed effects but exclude counties containing capitals. In Columns 5 and 6, I present differential results for men and women.

Coefficients on 1920 coffee cultivation are stable across different specifications. In general, an increase of 1% in the number of coffee trees is associated with a decrease of 0.4 percentage points in 1973 manufacturing employment share and with an increase of 0.6 percentage points in 1973 agricultural employment share. These changes are equivalent to, respectively, -2% and 1.6% with respect to the means of 19.8% and 37%. Additionally, the correlation with labor force participation is not different from zero.

These correlations mask some interesting heterogeneity across gender. The relationship between coffee cultivation and men's employment in both manufacturing and agriculture is stronger than for women. However, on average women report lower levels of participation in the labor force and lower levels of employ-

ment in agriculture. This could be measurement error if domestic labor is not registered properly on the census.

I repeat the analysis using data from 1912, 1938, and 2005. Figure 2.2 plots OLS estimates of the correlation between coffee cultivation in 1920 and employment in manufacturing and agriculture. All estimates are equivalent to Column 4 of Table 2.1. The correlation starts out very small for 1912, only a decade after the beginning of the expansion of coffee cultivation. For manufacturing it decreases (becomes more negative) throughout the century, peaking in 1973 and increasing (but still negative) in 2005. For agriculture the peak happens faster, with correlations in 1938 and 1973 being almost identical.

Results discussed so far come from Census of Population. They include self-reported occupation and lump together all types of manufacturing activity. In order to isolate the effect of coffee cultivation during the early 20th century on structural transformation, I look at data from Colombia's first manufacturing census, collected in 1945. It surveyed establishments with more than five employees. It is therefore a measure of more modern type of manufacturing. Using the same specification described above, I focus on two different outcomes: employment and number of establishments per county. I measure each outcome in logs and divided by total population. Table 2.2 shows correlations using the same structure as Table 2.1.

Panels A and B show the negative correlation between coffee cultivation in 1920 and manufacturing employment in large establishments in 1945. Panels C and D show the negative correlation between coffee cultivation in 1920 and the

number of industrial establishments. The correlation is not driven by the main centers of industrial production. Column 4 does not include Departments' capitals and shows almost identical results than Column 3, which does include large cities. Panels A and C measure dependent variables in logs, while Panels B and D measure them as shares of population and are therefore more relevant to interpret. An increase of 1% in the number of coffee trees in 1920 is correlated with a reduction of 0.03 industrial workers per 100 inhabitants in 1945. This is around 6% with respect to the mean. Similarly, a 1% increase in the number of coffee trees in 1920 is correlated with a reduction of 0.02 industrial establishments per 1,000 inhabitants in 1945. That is equivalent to around 5% with respect to the mean.

In the remaining parts of this section, I discuss why these correlations, while illustrative, cannot be considered causal and propose different instrumental variable strategies to estimate the effect of coffee cultivation on structural transformation.

2.3.1 Empirical Strategy

The negative correlation between coffee cultivation in early 20th century and employment in manufacturing later in time could be the result of omitted county-level characteristics that deterred the rise of manufacturing and at the same time encouraged production of coffee. For instance, counties with a poor geographic location might have a hard time importing capital goods to set up manufacturing firms, which might drive them to take up economic activities that suffer less from

transportation costs. One of such activities at the beginning of the 20th century was coffee production. Coffee was suitable to be transported by mules, which were ideal to overcome Colombia's difficult geography. Under that scenario, a negative correlation between coffee and structural transformation might be driven by geography rather than by the expansion of the export sector.

Another story with similar implications would be one where the only counties which produce coffee are those with low domestic market access, since coffee was primarily exported, while manufacturing entrepreneurs located close to main population centers. One could also be worried coffee counties start out the 20th century with lower levels of public goods or lower state capacity, given the colonization patterns described in Section 2.1. With these ideas in mind, the previous OLS results controlled for geographic characteristics intended to capture market access and exposure to the State. I showed the negative correlation between coffee production and manufacturing did not change when those controls were included. Moreover, the correlation did not change when biggest population centers were excluded from the sample.

Finally, while I am estimating the effect of the exposure to the expansion of coffee cultivation on structural transformation, my measure of coffee cultivation is taken from the 1920s and potentially suffers from measurement error. For instance, some counties might have expanded coffee cultivation in the 1920s when prices were relatively high but went back to a lower level after the Great Depression. To partially deal with measurement errors concerns, Appendix B.3 reproduces the main analysis using only the extensive margin of coffee cultivation- i.e.

a dummy equal to one for counties with more than one coffee tree in 1920.

Before turning to the main empirical strategies, Figure 2.3 illustrate some of the dimensions over which coffee counties differed from the rest. The figure plots standardized coefficients (and 95% confidence intervals based on robust standard errors) out of OLS regressions of variables in y-axis over a dummy for coffee counties. In 1912, coffee counties were, on average, more literate and employed a higher share of labor force in agriculture, however there were no differences in the share of labor force employed in manufacturing or the level of population density, which might alleviate some of the concerns described above.

Geographically, however, there are considerable differences between the two groups of counties. Specifically, coffee counties are located at a higher altitude and their terrain is considerably more rugged. They are closer to Colombia's capital, Bogota, and to the Department capital. Interestingly, there are no differences in terms of patterns of colonization on average. Coffee counties are as likely as other counties to have had presence of native population when the Spanish arrived around 1560. Places with native population were generally settled first, while the frontier around 1600 took at least two centuries to be settled. Finally, there were around the same number of land disputes during the first three decades of the 20th century, which might be indicative of the security of property rights and the quality of institutions at the time.

These results highlight that features related to transportation costs and geography, rather than market access or state presence, are the main source of omitted variable bias. To deal with it, I exploit two exogenous sources of variation in a

county's suitability for growing coffee. The main idea is that by exploiting coffee suitability, I isolate the effect of coffee exporting on structural transformation, rather than the effect of location or transportation costs.

Climate and Attainable Yields

The first source of variation is given by local climatic conditions that make some counties more productive at growing coffee. I use two different but related approaches. First, I use data from FAO's Global Agro-Ecological Zones project (FAO-GAEZ). The project produces information on maximum attainable yields for different crops at high geographical resolution by combining data on climate and crop-specific features. These potential yields do not depend on actual production and are calculated for different levels of inputs. I use rain-fed Coffee Maximum Attainable Yield with intermediate inputs and aggregate it to the county level using area-weighted averages. Then I normalize yields from 0 to 100 by dividing by the maximum value. Figure 2.4 shows the variation on the instrument across the country.

The first stage equation is given by:

$$\text{CoffeeTrees}_m^{1920} = \gamma_1 \text{Pot.Yield}_m + \xi \mathbf{X}_m + \mu_d + \phi_m \quad (2.2)$$

Where Pot.Yield_m is FAO maximum attainable yield and μ_d is a set of Department fixed effects.

Second, I follow Dube and Vargas (2013) and instrument coffee cultivation

with long term averages of rainfall and temperature levels at the county level. In theory, these two approaches are identical to one another with the only difference that the rainfall and temperature instrument does not rely on a climatic model like the one used to calculate attainable yields. The first stage is given by:

$$\text{CoffeeTrees}_m^{1920} = \theta_1 \text{rain}_m + \theta_2 \text{temp}_m + \theta_3 \text{rain}_m \times \text{temp}_m + \psi \mathbf{X}_m + \mu_d + \xi_m \quad (2.3)$$

Fuzzy Regression Discontinuity in Altitude

The previous approach is useful to isolate coffee cultivation motivated by productivity reasons. However, since it only uses climatic conditions some of the concerns about location and geography might still apply. In other words, the IV strategies described above could compare counties with high suitability located close to the ocean with places in the interior with the same climate. Therefore, I introduce another identification strategy that does not rely directly on weather. The strategy isolates more comparable counties in terms of geographic characteristics.

Figure 2.5 plots $\text{CoffeeTrees}_m^{1920}$ for counties in different altitude bins. The figure focuses on counties above 1,800 meters above the sea level. The vertical line is located at 2,400 meters. The slope of coffee cultivation is negative below the 2,400 meters cut-off and flat above. Moreover, there is a downward jump at 2,400m of altitude. Around that altitude temperature at nights gets sufficiently cold that coffee does not grow as well as a couple hundred meters below. The discontinuity might also be due to information pamphlets distributed by late 19th

century investors who were aiming at getting more landowners into the coffee business. These recommendations, compiled in the book *Memorias sobre el cultivo del Café* (Saenz, 1892), provided temperature bounds for the optimal production of the crop. In the 19th century those bounds were between 24 and 16 degrees Celsius. Since temperature in Colombia is driven by altitude, temperature bounds translate directly into altitude bounds between 400 and 2,400 meters above the sea level. Moreover, some of the pamphlets directly provided information on altitude and temperature of specific towns to make it easy for landowners to figure out whether their land was located inside the altitude bandwidth.

Figure 2.6 shows one of those instances in a pamphlet written by Mariano Ospina Rodriguez in 1880. Ospina was Colombia's president in 1857 and is considered one of the pioneers of coffee cultivation in Colombia. He started growing coffee in his family's farm well before the expansion in the first two decades of the 20th century.

From Figure 2.5, some counties below the threshold did not grow coffee in the 1920s and some counties above the threshold had a positive number of coffee trees. Therefore, the setting is not one of a sharp regression discontinuity. Rather, I use the discontinuous fall in the probability of growing coffee in 1920 as an instrument for actual coffee cultivation. In other words, I instrument $CoffeeTrees_m^{1920}$ with a dummy variable equal to one for counties above the altitude threshold and a simple polynomial in altitude. This allows for coffee cultivation to fall with altitude and even for the slope to change below and above the threshold. Identification comes from a discontinuous jump at the threshold.

In this fuzzy regression discontinuity design (FRDD) (Angrist and Pischke, 2008b), the first stage is given by:

$$\text{CoffeeTrees}_m^{1920} = \alpha_1 \text{above}_m + \alpha_2 \text{altitude}_m + \alpha_3 \text{above} \times \text{altitude}_m + \nu_d + \xi_m \quad (2.4)$$

Where *above* is a dummy variable equal to one for counties above 2,400 meters of altitude. *Altitude* enters the equation centered at 2,400 meters, both linearly and interacted with *above*.

The benefits of using fuzzy regression discontinuity design are evident once we compare counties above and below the threshold. Figure 2.8 plots coefficients from OLS regressions of variables on the y-axis on *above_m* dummy variable. Most of the coefficients are very close to zero, with the exceptions of literacy rate in 1912 and terrain ruggedness (both lower for counties above). Altitude is higher by construction.

Notice, however, that those means test are not necessarily all that is needed for using the fuzzy regression discontinuity as instrument for coffee cultivation. Importantly, the identifying assumption is that no other factor should change discontinuously at 2,400 meters. Only the probability of growing coffee. To test for discontinuities in other county characteristics, Table 2.3 shows the results from OLS estimation using specifications identical to equation 2.4, but plugging in as dependent variable all the factors represented in Figure 2.8. There are no discontinuities for most characteristics. For manufacturing employment in 1912, the coefficient on *above* is marginally significant and on the opposite direction than

expected: places above, which do not grow coffee, employ a slightly lower share of population in manufacturing in 1912.

The two different approaches (IV and FRDD) present a clear trade-off. While IV strategies (FAO data and rainfall, temperature polynomial) use all the available counties, the FRDD strategy potentially gives a more reliable estimate since it uses very comparable “treatment” and “control” groups. Figure 2.7 illustrate the trade-off in terms of sample size. Figure (a) shows the 759 counties populated in 1928 and classify them by the number of coffee trees per square kilometer. Figure (b) highlights counties above 1,800 meters of altitude and classifies them by their location with respect to the altitude threshold.

2.4 The Effect of Coffee Cultivation on Structural Transformation

This section estimates how exposure to coffee exports at the beginning of the 20th century shaped local development and structural transformation in Colombian counties. Using a sample of 550 IPUMS-counties, I document a sharp pattern of divergence in economic structure between coffee producer counties and other counties. In particular, the share of employment in manufacturing increased faster during the first part of the 20th century, up to 1973, in counties which did not produce coffee. Meanwhile, counties which produced coffee remained mostly specialized in agriculture. I focus first on results using 1973 Census of Population. Then I show how did coffee cultivation affect economic structure at various periods during the century. The following section expands on an important mecha-

nism to explain this divergence: human capital accumulation. Finally, Section 2.7 estimates the long-term impact of coffee cultivation on income and urbanization.

Coffee cultivation during the early 20th century had a negative and sizable effect on structural transformation throughout the century. Results from Table 2.4, Panel A show an increase of 10% in the number of coffee trees planted before 1920 led to a reduction of around 0.05 percentage points in the share of labor force employed in manufacturing in 1973. This effect is equivalent to a reduction of 0.2% with respect to the average county. To put it differently, going from the median level of coffee cultivation to the 75th percentile in 1920 would decrease the 1973 share of labor force working in manufacturing by 1.6 percentage points or 8% relative to the mean. Going from the median level to the 99th percentile would decrease manufacturing employment by 15.2% relative to the average county.

Panel B shows the positive effect of coffee cultivation on agricultural employment. An increase of 10% in coffee cultivation prior to 1920 would increase employment in agriculture in 1973 by 0.08 percentage points, or 0.21% relative to the mean of 37% of the labor force. The estimated magnitude of these effects is the same regardless of the method used to instrument for coffee cultivation before 1920. Column 2 shows results using FAO coffee attainable yields. Column 3 shows results using a simple polynomial in rainfall and temperature. Results from these two methods are expected to be similar since they use the same set of counties and exploit the same source of variation (climate). Column 4, however, restricts the sample to counties with average altitude higher than 1,800 meters and instruments coffee cultivation using the fuzzy regression discontinuity approach.

In other words, the set of counties “treated” by coffee availability are between 1,800 and 2,400 meters above the sea level. The fact that the results are similar between columns 2 and 3 and column 4 is evidence that the average treatment effect of coffee on structural transformation might be homogeneous, at least on dimensions related to altitude, market access, and transportation costs.

The effect of coffee cultivation on structural transformation in terms of employment could be driven by differences in labor force participation. I alleviate those concerns first by measuring employment as shares of labor force. More importantly, Panel C shows coffee cultivation had no significant effect on labor force participation. Even for the case where there is a statistically significant positive effect, it is tiny. Column 2 in Panel C implies that an increase of 10% on the number of coffee trees planted before 1920 would increase labor force participation in 1973 by 0.07% with respect to the mean. This effect is at least an order of magnitude smaller than the effects in Panels A and B for employment by sector.

The estimates discussed above rely on exogenous variation provided by three different sets of instruments. Panel D presents evidence on the relevance of the three sets of instruments. It regresses the log of one plus the number of coffee trees in 1920 on coffee attainable yield (column 2), on a polynomial on rainfall and temperature (column 3), and on altitude, a dummy equal to one for counties above 2,400 meters of altitude, and an interaction between the “above” dummy and altitude (column 4). All instruments are significant and sizable. Moreover, the table also shows the F statistic for the excluded instruments on each one of the first stages. I do not find evidence of weak instruments.

The effect of coffee exports on employment by sector varied through the century, as Figure 2.9 shows. The figure complements Figure 2.2 by adding IV estimates from 2SLS using attainable yields from FAO (like Column 2 in Table 2.1) and FRDD estimates (like Column 4). In 1912, there was no difference in sectoral employment between coffee counties and non-coffee counties. In other words, there was no effect of potential to cultivate coffee on the share of labor force employed in manufacturing, though there was some small positive effect on agriculture. By 1938, the effect became large and significant. It was negative for manufacturing and positive for agriculture. This effect remained through 1973, as explained earlier. Employment in manufacturing peaked in the country in the 1970s. After that most of the population shifted to services. Consequently, the effect of coffee cultivation in 1920 on manufacturing employment in 2005 is smaller, though significant.

In addition to using data collected from employees, coming out of Census of Population, I use data from employers from Colombia's first manufacturing census from 1945. After the rapid growth in manufacturing in the 1930s, the country surveyed all industrial establishments with more than five workers. It is therefore a more formal sample of manufacturing establishments which might provide more information on the effect of coffee cultivation on the process of structural transformation.

Table 2.5 estimates the effect of early coffee cultivation on industrial employment and the number of industrial establishments in 1945. Column (1) reproduces results from Table 2.4, Column 4, Panels B and D as reference. Columns 2

to 4 follow the same order than results presented in Table 2.4. Once again, results across different instruments have similar magnitudes and directions despite their underlying differences in sample size and composition.

An increase of 10% on coffee trees in 1920, decreases the number of industrial establishments with more than five employees in 1945 by 1.7% with respect to the mean (Panel B). It would also decrease the share of population working in industrial establishments by 0.08 percentage points, or 16% with respect to the mean. Panel D presents the three different first stage estimations. All specifications instrument coffee cultivation with instruments that are not weak. Importantly, Column 4 shows evidence of the negative discontinuous jump in the probability of growing coffee above 2,400 meters of altitude.

2.5 Channel: Human Capital

Colombia's first manufacturing census provides a good setting to study whether human capital had something to do with the effect of coffee cultivation on manufacturing. I adapt Ciccone and Papaioannou (2009) classification for industrial sectors in the United States to the Colombian context and divide 15 sectors compiled by 1945 Census into three groups according to their human capital intensity. High human capital sectors include Beverages, Instruments, Arts (Printing), and Chemicals. Medium human capital sectors include Tobacco, Minerals, chapter, Rubber, and Metal. Finally, Low human capital sectors include Leather, Textiles, Clothes, Wood, and Food. I use specification given by equation 2.1 for employ-

ment and number of establishments in each of the three groups. I plot the coefficients on coffee cultivation and their standard errors. Coefficients come from a 2SLS estimation using Coffee attainable yields from FAO as an instrument, like Table 2.5, Column 2.

Figure 2.10 shows the effect of coffee cultivation in 1920 on (a) employment in manufacturing and (b) number of industrial establishments in 1945 by human capital intensity. While there is not a difference between coffee and non-coffee counties in terms of employment in more basic sectors like textiles or food, the largest difference shows up for sectors with high intensity of human capital. In other words, the effect coffee cultivation has on structural transformation seems to be concentrated in activities that require a more educated labor force.

This evidence goes in line with the hypothesis described above and the models introduced by Porzio and Santangelo (2019) and Caselli and Coleman II (2001). Figure 2.11 complements the insight from the previous evidence. It shows the difference between coffee and non-coffee counties in terms of education of the labor force in 1973. Each point represents the difference in average number of years of schooling in coffee counties minus the average number of years of schooling in non-coffee counties for people born in each cohort. Though it only shows data for cohorts born from 1900 onward, there is a clear trend: the labor force in coffee counties becomes relatively less educated in the first decades of the 20th century. This reduction in the level of education seems to be negatively correlated with the pattern of coffee production shown by the short-dashed line.

Using individual level data from 1973 Census of Population, I show that in

fact coffee cultivation reduced schooling and made the labor force more biased toward staying in agriculture. Therefore, manufacturing appeared in counties which did not produce coffee.

Empirical Strategy

The 1973 Census of Population allows me to observe in which county and year of birth for a 10% sample of Colombians. People born in the first half of the 20th century in counties suitable to produce coffee were more exposed to the first large scale exporting industry in the country. For them, the opportunity cost of attending school was higher. Moreover, the specifics of coffee's production function discussed on section 2.1 increased parent's opportunity cost of sending their children to school. These incentives away from education were potentially stronger during years when the coffee price was higher.

I test these hypotheses by estimating the effect of coffee price during school age on kids' education and occupation as adults. I estimate the following equation:

$$y_{mcg} = \beta \text{CoffeeTrees}_m^{1920} * \text{Price}_c^{5,16} + \delta_g + \delta_m + \delta_c + \epsilon_{mcg} \quad (2.5)$$

Where y_{mcg} is average education or occupation outcome for gender g , cohort c , born in county m . The coefficient of interest is β , which captures the effect of coffee price shocks between a given cohort is 5 and 16 years old. $\text{Price}_c^{5,16}$ is average log real coffee price in New York between years $c + 5$ and $c + 16$. $\delta_g, \delta_m, \delta_c$ are gender, county, and cohort fixed effects. The unit of observation is a gender by county-of-

birth by cohort cell. Each cell is weighted by the inverse of its variance.

Comparable with the empirical strategies described in section 2.3, I instrument Coffee trees₁₉₂₀ using three different instrumental variables: coffee attainable yield, rainfall and temperature polynomial, and a fuzzy regression discontinuity in altitude.

2.5.1 Growing Up During Coffee Price Booms Reduces Schooling and Employment in Manufacturing for Cohorts Born in Coffee Counties

Table 2.6 shows the effect of coffee price shocks on educational attainment in 1973. Panel A measures coffee shocks as the interaction between the number of coffee trees in 1920 and the log average coffee price between a cohort is 5 and 16 years old. Panel B changes the number of coffee trees by a simple dummy equal to one for counties with some coffee cultivation in 1920. Column 1 presents the OLS results. Columns 2 to 4 show results from instrumenting coffee shocks using the variables detailed in Panel C. Interpretation of results in Panel B is more straightforward. For simplicity, I discuss results from instrumenting coffee shocks with attainable yields interacted with average school age price (Column 2): cohorts exposed to average coffee price 10% higher, born in coffee counties accumulate 0.7% fewer years of education. Another way to put it would be to compare 1910 and 1940 cohorts. The latter cohort experienced average coffee prices during school age 140% higher than the former due to differences on coffee prices. Therefore,

the cohort born in 1940 acquired on average 9% fewer years of education.

Panel C shows the reduced form, that is the effect of the instrument on average years of education. Interestingly, even though the second stage is not significant and small for column 4, the reduced form shows a coefficient with a very similar magnitude than the 2SLS results for columns 2 and 4, Panel B, but with the opposite sign, as expected. Counties above the threshold did not produce coffee and therefore are not hit by shocks to prices.

Table 2.7 shows related results but looking at economic occupation and income. In general, children born in coffee counties during periods with high coffee prices not only accumulated less human capital but also were less likely to work in manufacturing as adults. Take the result from Panel A, Column 2. Comparing again cohorts born in 1910 and 1940, the latter cohort is almost 10% less likely to work in manufacturing due to the availability of coffee cultivation that made that individual drop out of school.

Similarly, though less precisely estimated, I find a positive effect of coffee shocks during school age on the probability of employment in agriculture as adults. Finally, in Panel C, I show that cohorts born in coffee counties, exposed to higher coffee prices during school age have lower household income, as measured by the first vector out of a Principal Component Analysis on a matrix of house characteristics and durable goods.

Notice the decline in manufacturing employment is very similar than the decline in schooling. Since schooling decisions are taken earlier (or simultaneously) than occupation decisions, I explore the effect of coffee shocks on employment in

manufacturing that is channeled through education by doing a mediation analysis proposed by Dippel et al. (2019b). In other words, I estimate the effect of a cohort's schooling on the share of its members working in manufacturing in 1973 by instrumenting education using the interaction term between coffee attainable yields and average prices during school age, conditional on coffee shocks (dummy for coffee interacted with average coffee prices during school age). This approach provides an idea of how much of the effect of coffee prices on occupation is acting through human capital accumulation and what fraction is going through other channels. Specifically, I estimate the following equation:

$$\text{Occup.}_{mcg} = \beta_1 \text{Education}_{mcg} + \alpha \text{CoffeeTrees}_m^{1920} * \text{Price}_c^{5,16} + \delta_g + \delta_m + \delta_c + \epsilon_{mcg} \quad (2.6)$$

And instrument schooling using the following equation:

$$\begin{aligned} \text{Education}_{mcg} = \gamma_1 \text{Attn. Yield}_m * \text{Price}_c^{5,16} + \theta \text{CoffeeTrees}_m^{1920} * \text{Price}_c^{5,16} + \dots \\ \delta_g + \delta_m + \delta_c + \mu_{mcg} \end{aligned} \quad (2.7)$$

This approach, however, relies on one very strong assumption: the concerns about endogeneity between coffee shocks and manufacturing are the same as the concerns about endogeneity between coffee shocks and schooling (Dippel et al., 2019a). Using this approach, the total effect is given by table 2.7. The share of the effect of coffee shocks on manufacturing that goes through schooling decisions

is between 80% and 96%.¹⁰ The share of the effect depends on the measure of education used (cohort's average years of education or literacy rate) and on the measure of coffee cultivation (continuous or dummy). Again, these results only hold under the assumption about the sources of endogeneity being the same when estimating the effect of coffee shocks on education than when estimating the effect of coffee shocks on occupation.

2.5.2 Supply and Demand of Schooling

So far, I have showed evidence on the negative effect of coffee cultivation on education and manufacturing employment. My main conjecture is that coffee cultivation increases opportunity cost of attending school. Differences in the opportunity cost of schooling generates differences in cohorts' levels of education. As a consequence, counties producing coffee developed lower supplies of non-agricultural workers. According to Caselli and Coleman II (2001) and Porzio and Santangelo (2019), these differences shaped the process of structural transformation by reducing the availability of skilled workers for manufacturing.

In the past section I showed evidence that cohorts exposed to higher coffee prices acquired lower levels of education. However, these effects of coffee cultivation and shocks on education could come from both supply and demand. One potential explanation is that people's demand for schooling goes down with the possibility of producing coffee. However, another possibility is that simply the supply of schooling in coffee counties goes down when prices go up with respect

¹⁰Detailed results in Appendix B.2.

to non-coffee counties. This might occur if, for instance, landowners benefit from lower wages and a readily available labor force (Galor et al., 2009; Galiani et al., 2008).

To explore the sources of differences in schooling between coffee and non-coffee counties, I exploit historical data on land inequality using the First Coffee Census. I observe the mean and median farm size in terms of coffee trees for each county with positive number of coffee trees in 1920. My conjecture is that in places with higher land inequality within coffee landowners, the higher the market power of landowners. This would have two consequences: first, they would have perhaps more political power to block funding and construction of schools. Second, they could potentially behave like a monopsony and wages would not be as responsive to changes in international price as counties with lower inequality. In other words, if the effect of coffee shocks on education is stronger for counties with high inequality than for those with low inequality, that would be suggestive of the effect of coffee on education being mainly driven by supply of schooling.

Table 2.8 shows the effect of coffee shocks on schooling, literacy, employment in manufacturing, employment in agriculture, and household income in 1973 for different samples. Column 1 shows the full sample for comparison. Column 2 restricts the analysis only to counties with at least one coffee tree in 1920. Column 3 and 4 splits the sample on Column 2 according to the median of the level of land inequality (mean/median farm).

The negative effect of coffee shocks on education and income and the positive effect on employment in agriculture are concentrated in counties with low

land inequality within coffee landholders. This result is consistent with the hypothesis that the effect of coffee cultivation on education is coming from changes in the demand for education. Of course, this is only suggestive evidence given that differences in inequality might be correlated with some of the forces behind differences in education or occupation.

I explore data on the number of schools per 10,000 inhabitants in 1951 to get at more direct evidence on the effect of coffee cultivation on the provision of education. Unfortunately, that is the only year with readily available information on provision of education at the local level for the first half of the 20th century. Table 2.9 shows the effect of coffee cultivation on the number of schools, instrumenting coffee cultivation with FAO attainable yields data. Panel A measures coffee cultivation with a dummy variable. Column 1 shows OLS results while Column 2 shows 2SLS results from using the full sample. Coffee counties have 1.05 less schools per 10,000 inhabitants than non-coffee counties in 1951. This effect is equal to 135% of the mean of 0.64 schools per 10,000 inhabitants on average. From Panel B, an increase of 10% in the number of coffee trees decreases the numbers of schools per 10,000 inhabitants in 1%. Moreover, the effect has relatively the same magnitude when focusing only on counties with some coffee cultivation (Column 3). But perhaps it is more interesting that the negative effect of coffee cultivation in 1920 on the number of schools in 1951 is only present and stronger (thought only significant at 15%) for counties with high levels of inequality.

In other words, these results taken together suggest that the negative effect of coffee cultivation on human capital and structural transformation comes both

from supply and demand of education. On one hand, coffee counties have fewer schools, especially in high inequality counties, where landowners have more power to block schooling and guarantee a higher supply of agricultural workers. On the other hand, coffee shocks have a stronger negative impact in counties with low inequality, where landowners have potentially less power to fix wages they fluctuate more with international prices.

2.6 Channel: Linkages

I have discussed evidence of the effect of coffee cultivation on industrialization focusing on the role of human capital accumulation, which increased the supply of non-agriculture workers in counties not suitable to produce coffee. One concern is that the effect is coming from counties isolated from the rest of the economy. In that scenario places with coffee cultivation should be better off specializing on coffee in the long run even if they end up being poorer than other counties because they would not develop manufacturing otherwise.

Though this concern is alleviated by the comparison between coffee and non-coffee counties in Figure 2.3, I explore if the effect of coffee cultivation varies with respect to how connected with other sectors in the economy a county is. One way I can study the level of linkages is by using the presence of threshing machines in some counties. Threshing is the last process coffee cherries undergo before being exported. It is a process through which by tumbling in a large machine, coffee cherries lose their covering husk or *pergamino*. These machines were used by

owners of different farms, required heavy machinery, and expertise. Therefore, counties with this part of the coffee industry are potentially more connected with other sectors. For example, through transportation networks, through workers who can operate the machines, or banks who can fund their purchase, and so on.

Out of the 710 counties, 440 had some coffee cultivation in 1920. Around 120 coffee counties also had threshing establishments. These counties had around 0.4 machines per farm. The county with the highest number of machines had 65.

I estimate separate coefficients for the effect of producing coffee without a threshing machine and producing coffee with threshing machines. I argue the difference between both would give an estimate of the effect of linkages if the only difference between counties with and without threshing is the fact that some have linkages. Table 2.10 shows the results. Columns 1 and 2 replicate OLS and 2SLS estimates from section 2.4. Columns 3 and 4 split the dummy for coffee cultivation in 1920 in two, according to their linkages. I find that the effect is very close to one another. If anything, the effect of coffee on manufacturing for counties with threshing machines is larger. The fact that threshing may not be exogenous should give us pause to put too much weight on the coefficients.

2.7 Long Term Effects on Urbanization and Income

Finally, I replicate the main results using household income data for 2005 adults and counties' poverty rate as calculated by the Social Prosperity Department. Table 2.11 show the main results for all the different instruments for coffee

cultivation. An increase in the number of coffee trees in 1920 by 10% would increase poverty rate of a county in 2005 by 10% increases poverty rate in 2005 by 0.1% with respect to the mean. In other words, going from the median level of coffee cultivation in 1920 to the 75th percentile would increase a county's poverty rate in 2005 by 3.1%.

2.8 Concluding Remarks

This chapter illustrate how the opportunity to trade certain agricultural commodities had negative effects on structural transformation and development in the long run. Using data from Colombian counties, it shows that counties producing coffee in 1920 had slower growth in manufacturing sector than other comparable counties. Coffee cultivation had a negative long-run effect on income and poverty rates. Additionally, this chapter provides empirical support to Caselli and Coleman II (2001) theory about supply-side mechanisms behind structural transformation. In particular, it highlights that slower growth in the supply of skilled workers can also slow down structural transformation. Given coffee's labor intensive production function, this chapter complements evidence from Carrillo (2019) about the negative effect of coffee cultivation on human capital accumulation.

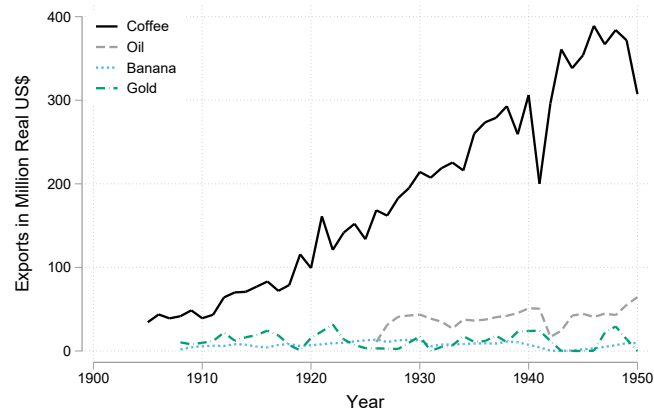
The evidence discussed in this chapter suggests evaluating the effects of the first wave of globalization depends on the context. Specifically, it depends on features of commodities' production function which shape incentives to accumulate human capital and select high productivity occupations. Countries which

exported more than one important agricultural product might be ideal settings to sort out which features of commodities' production functions mediate the effect of agricultural exports on structural transformation.

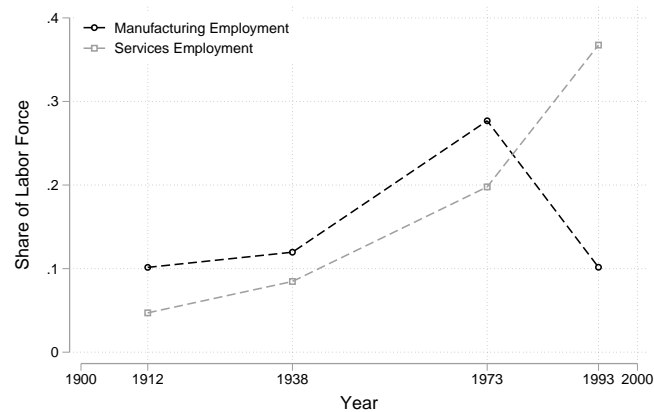
Figures

Figure 2.1: Patterns of Coffee Exports and Manufacturing in Colombia

(a) Value of Main Exports



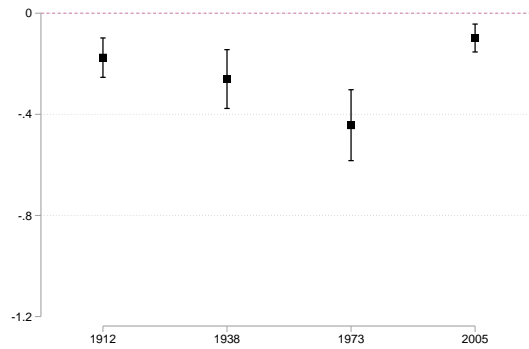
(b) Employment in Manufacturing and Services (% of labor force)



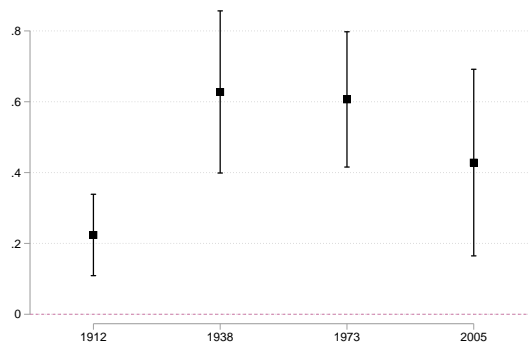
Note: Figure 2.1a shows the real value of Colombia's main exports in 1951 US dollars. It uses data from GRECO (2002). Figure 2.1b shows shares of labor force employed in manufacturing and services. It uses data from Census of Population. 1912 and 1938 Census were digitized for this chapter. 1973 and 1993 Census are available in IPUMS-international.

Figure 2.2: Correlation Coffee Cultivation and Structural Transformation

(a) Dep. Variable: Manufacturing Employment (% of Labor Force)

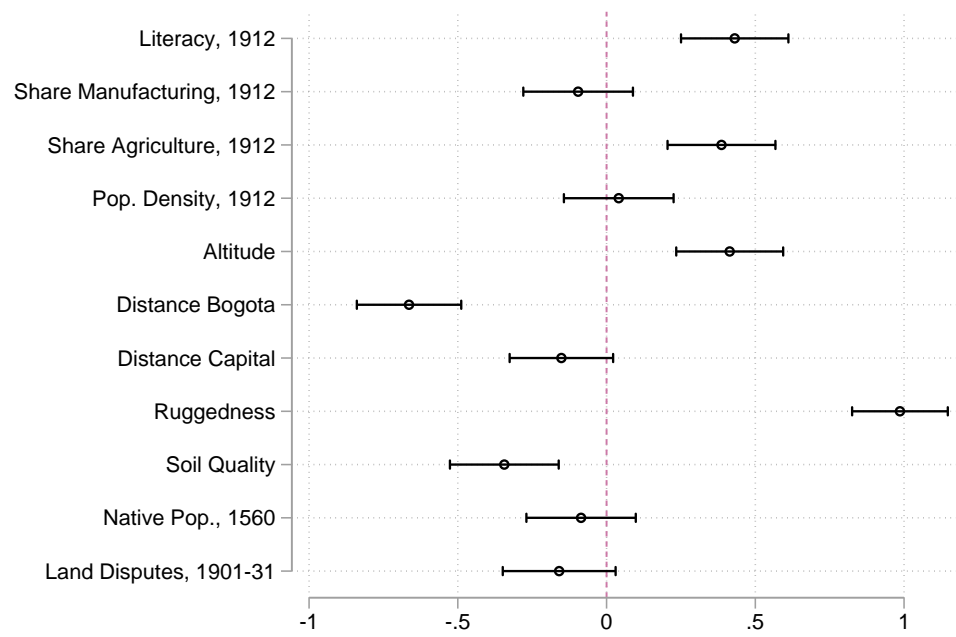


(b) Dep. Variable: Agricultural Employment (% of Labor Force)



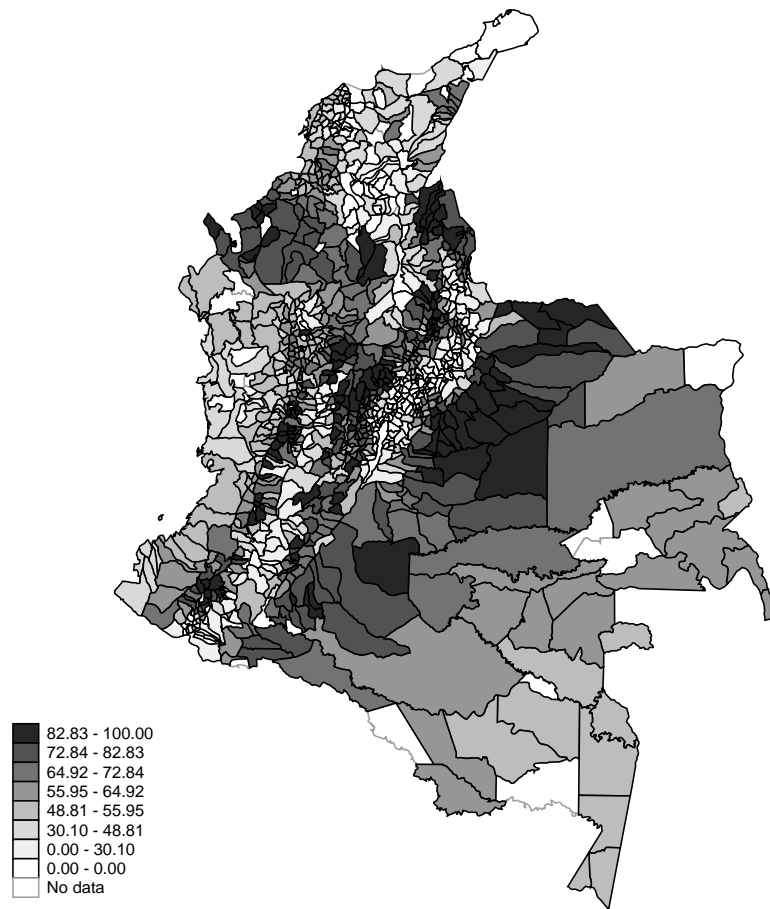
Note: The figures plot the coefficients of the relationship between coffee cultivation in 1920 and employment shares in manufacturing and agriculture during the 20th century. Estimates control for gender and Department fixed effects and geographic controls. Capital cities are excluded. Lines represent 95% confidence intervals based on Conley (1999) standard errors as described in section 2.3.

Figure 2.3: Coffee vs. Non-Coffee Counties Comparison



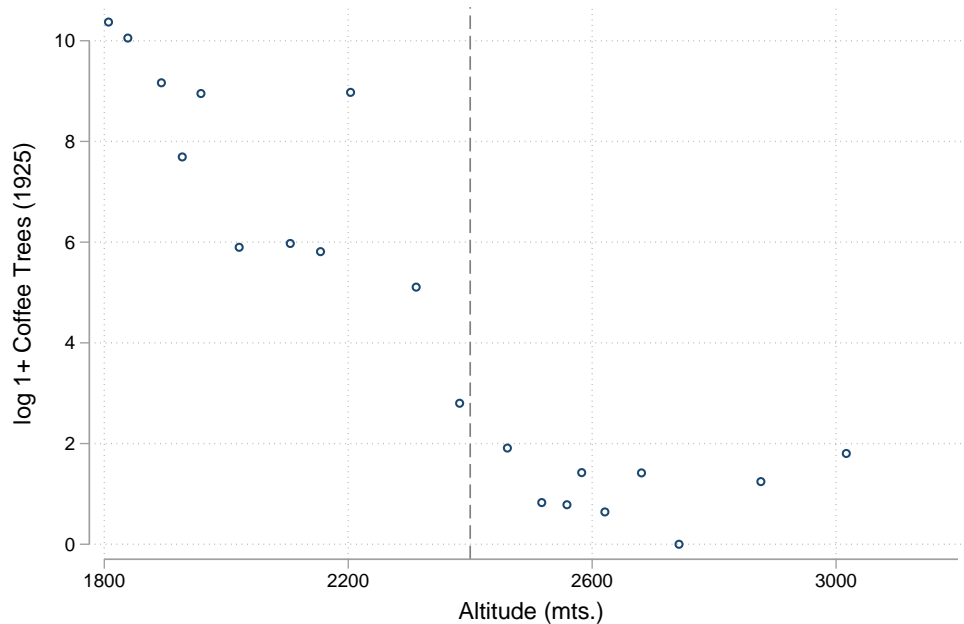
Note: Figure plots standardized coefficients on an indicator variable equal to one if the county had some coffee trees in 1920. Dependent variables are detailed on the vertical axis. For instance, the first coefficient means coffee counties had higher literacy rate in 1912 on average than non-coffee counties. Lines represent 95% confidence intervals based on robust standard errors.

Figure 2.4: Coffee Potential Yield



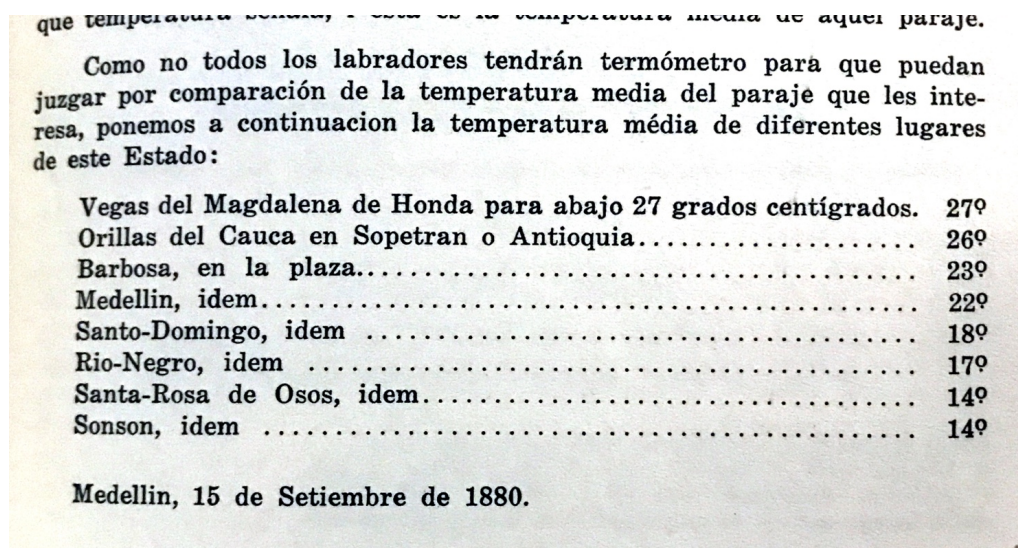
Note: Map shows the average maximum attainable yield at the county level using data from FAO-GAEZ. Yields are estimated using rain-fed conditions with intermediate level of inputs. Darker shades represent higher yields.

Figure 2.5: Discontinuity in the Probability of Coffee Cultivation at 2,400mts



Note: Figure plots average log of one plus number of coffee trees for counties grouped in equal sized bins in terms of altitude. The figure is restricted for counties above 1,800 meters above sea level.

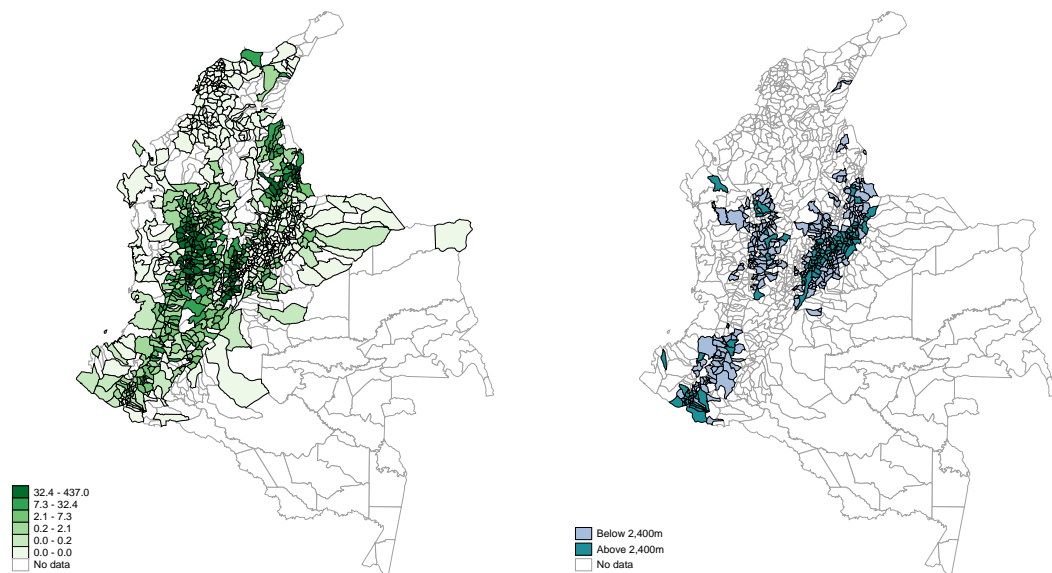
Figure 2.6: Coffee Promotion Pamphlet, 1880



Note: Excerpt of a pamphlet promoting coffee cultivation written by Mariano Ospina in 1880. Ospina suggests coffee grows in places at or below 17 degrees celsius and then benchmarks that temperature with different towns. Rio-negro is located at 2,200 meters and average temperature was 17 degrees. Santa-Rosa de Osos and Sonson are located at 2,500 and 2,450 meters of altitude, respectively.

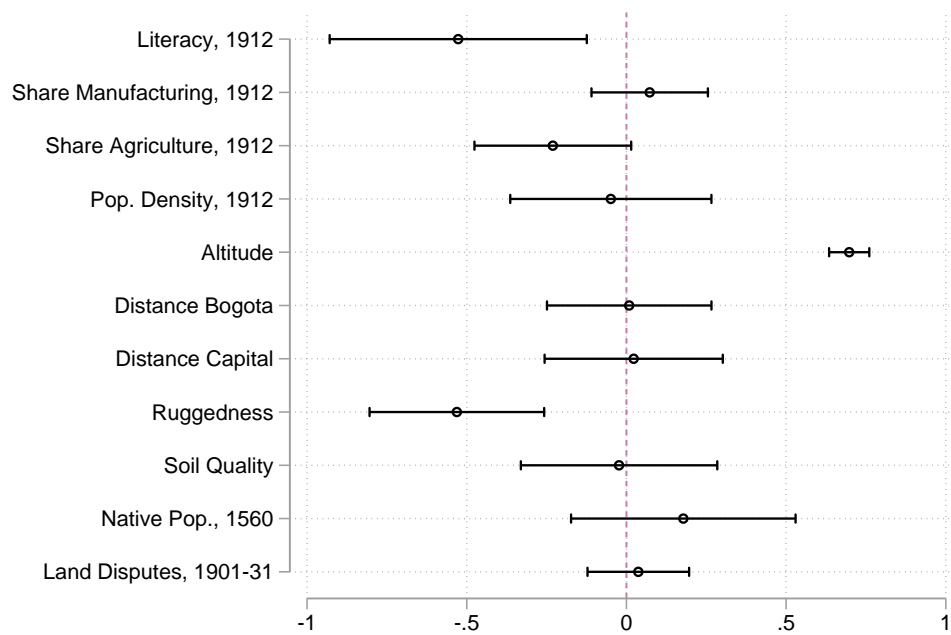
Figure 2.7: Counties in IV and FRDD Samples

- (a) IV Sample: Counties by Coffee trees per sq. km, 1920 (b) FRDD Sample: Counties above 1.8km by Side of Discontinuity



Note: The maps illustrate the main samples used in each empirical strategy. Figure (a) shows the number of coffee trees per square km in 1920 for counties with positive population in 1912. Figure (b) shows counties above 1,800 meters classified by whether or not they are above 2,400 meters. Both maps use current county borders.

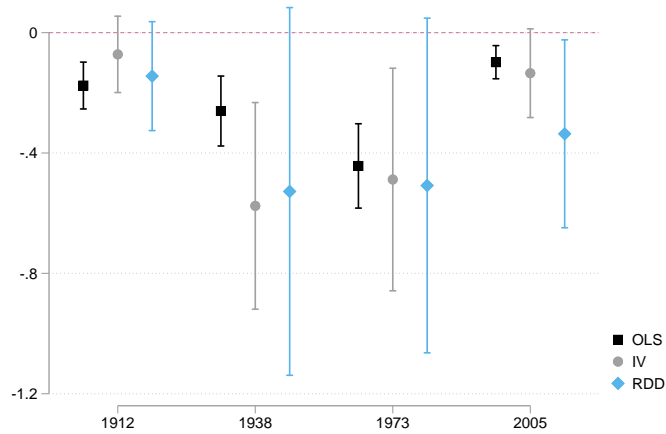
Figure 2.8: Comparison Counties Above and Below 2,400 mts. of Altitude



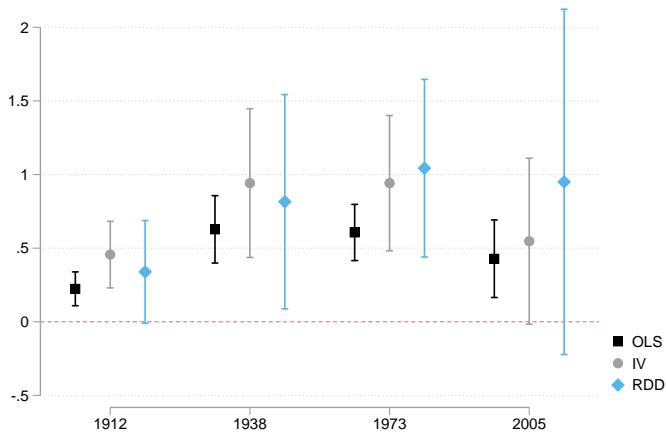
Note: Figure plots standardized coefficients on an indicator variable equal to one if for counties with altitude higher than 2,400 meters. Dependent variables are detailed on the vertical axis. For instance, the first coefficient means counties above 2,400 meters had lower literacy rate in 1912 on average than counties between 1,800 and 2,400 meters of altitude. Lines represent 95% confidence intervals based on robust standard errors.

Figure 2.9: The Effect of Coffee Cultivation on Structural Transformation

(a) Dep. Variable: Manufacturing Employment (% of Labor Force)

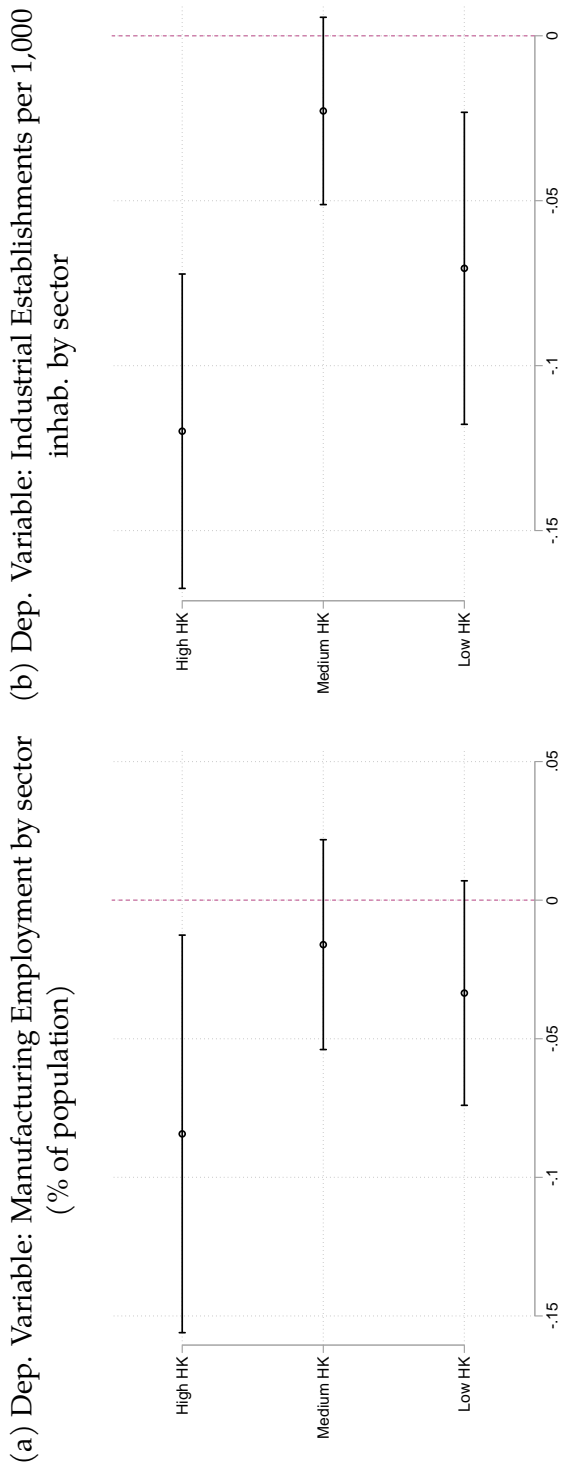


(b) Dep. Variable: Agricultural Employment (% of Labor Force)



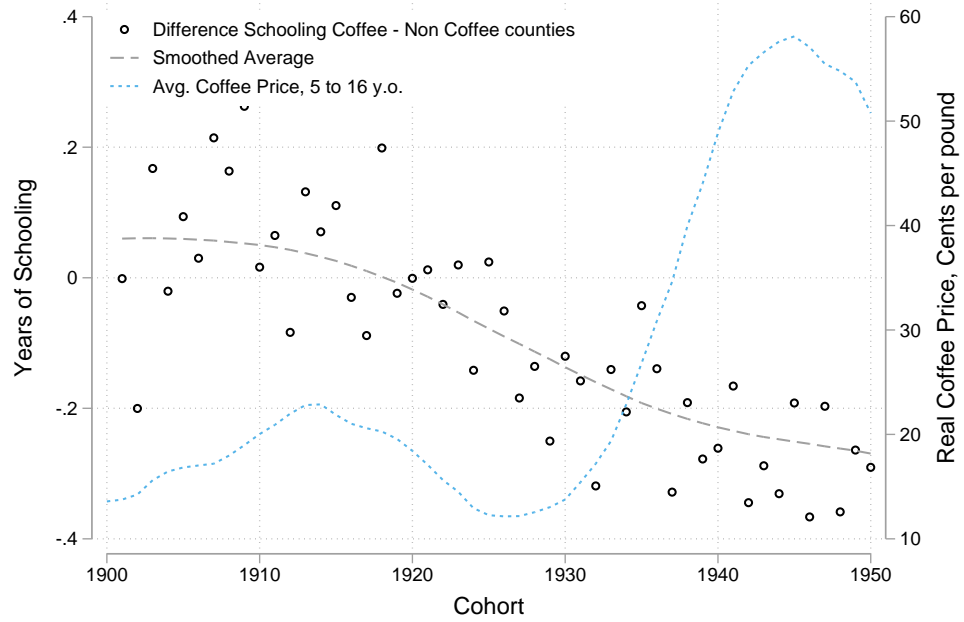
Note: The figure illustrate the effect of coffee cultivation on employment in manufacturing and agriculture for different years. Squares represent estimates coming from OLS regressions. Circles represent estimates from 2SLS regressions using coffee potential yields as instrument for coffee cultivation in 1920. Diamonds display estimates using fuzzy regression discontinuity in altitude, focusing on counties above 1.8km of altitude. All specifications control for gender and Department fixed effects and geographic controls. Capital cities are excluded. Lines represent 95% confidence intervals based on Conley (1999) standard errors, as described in section 2.3.

Figure 2.10: Effect of Coffee Cultivation on Industrialization by Human Capital Requirements in 1945



Note: Each circle represents the coefficient of log coffee trees in 1920 (a) industrial employment and (b) industrial establishments in 1945. Each subfigure shows three different models, one for each group of industrial sectors according to their human capital intensity (high, medium, low). Coefficients stem from a 2SLS regression where log coffee trees is instrumented by coffee attainable yields. All specifications control for population in 1938 (log), distance to department's capital, distance to second largest market, and Department fixed effects. All specifications exclude capital cities. Lines represent 95% confidence intervals based on Conley (1999) standard errors, as described in section 2.3.

Figure 2.11: Differences in Cohorts' Schooling between Coffee and Non-Coffee Counties



Note: The circles show differences in average schooling in coffee counties and non-coffee counties for individual cohorts born in 1900 and 1950, using data from 1973 Census of Population. The long dashed line shows the smoothed average over time of schooling differences. The short dashed line (right axis) plots the average real coffee price between 5 and 16 years old for each cohort born between 1900 and 1950.

Tables

Table 2.1: Coffee Cultivation and Economic Structure, 1973

	(1)	(2)	(3)	(4)	(5)	(6)
Sample restriction:					Men	Women
Panel A:	<i>Dep. var.: Share of Labor Force in Manufacturing, 1973</i>					
log Coffee trees ₁₉₂₀	-0.002*** (0.001)	-0.002*** (0.001)	-0.004*** (0.001)	-0.004*** (0.001)	-0.006*** (0.001)	-0.003*** (0.001)
Mean Dep. Var.	0.201	0.201	0.201	0.198	0.191	0.205
r2	0.082	0.104	0.201	0.198	0.387	0.279
Panel B:	<i>Dep. var.: Share of Labor Force in Agriculture, 1973</i>					
log Coffee trees ₁₉₂₀	0.005*** (0.001)	0.005*** (0.001)	0.006*** (0.001)	0.006*** (0.001)	0.011*** (0.002)	0.002* (0.001)
Mean Dep. Var.	0.363	0.363	0.363	0.370	0.635	0.108
r2	0.763	0.765	0.795	0.804	0.443	0.335
Panel C:	<i>Dep. var.: Share of Population in Labor Force, 1973</i>					
log Coffee trees ₁₉₂₀	-0.001* (0.0003)	-0.000 (0.0003)	-0.000 (0.0003)	-0.000 (0.0003)	0.002*** (0.0004)	-0.002*** (0.0006)
Mean Dep. Var.	0.531	0.531	0.531	0.530	0.891	0.169
r2	0.967	0.967	0.973	0.974	0.294	0.540
Counties	563	563	563	550	548	548
Geo Controls		X	X	X	X	X
Department FE			X	X	X	X
Capitals	X	X	X			

Note: Each Panel estimates the correlation between coffee trees in 1920 and measures of economic structure in 1973. All specifications control for population in 1973 (log). Geo controls include: distance to department's capital, distance to second largest market, and a dummy for capital cities. Conley (1999) standard errors as described in section 2.3 in parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 2.2: Coffee Cultivation and Manufacturing in 1945

	(1)	(2)	(3)	(4)
Panel A:	<i>log Industrial workers, 1945</i>			
log Coffee trees ₁₉₂₀	-0.034*** (0.011)	-0.057*** (0.012)	-0.065*** (0.015)	-0.066*** (0.015)
r2	0.343	0.395	0.443	0.360
Panel B:	<i>Industrial workers per 100 inhab., 1945</i>			
log Coffee trees ₁₉₂₀	-0.011 (0.010)	-0.023** (0.009)	-0.034*** (0.011)	-0.033*** (0.011)
Mean Dep. Var.	0.553	0.553	0.550	0.495
r2	0.059	0.093	0.120	0.074
Panel C:	<i>log Industrial Establishments, 1945</i>			
log Coffee trees ₁₉₂₀	-0.023*** (0.006)	-0.031*** (0.006)	-0.033*** (0.008)	-0.033*** (0.008)
r2	0.378	0.443	0.489	0.359
Panel D:	<i>Industrial Establishments per 1,000 inhab., 1945</i>			
log Coffee trees ₁₉₂₀	-0.019*** (0.005)	-0.023*** (0.006)	-0.022*** (0.008)	-0.022*** (0.008)
Mean Dep. Var.	0.431	0.431	0.429	0.397
r2	0.050	0.090	0.154	0.096
Counties	734	734	730	707
Geo controls		Y	Y	Y
Dept. FE			Y	Y
Dept. Capitals	Y	Y	Y	

Note: Each Panel presents the correlation between coffee trees in 1920 and some measure of industrial activity in 1945. All specifications control for population in 1938 (log). Geo controls include: distance to department's capital, distance to second largest market, and a dummy for capital cities (except for column (4) where capitals are excluded). Conley (1999) standard errors as described in section 2.3 in parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 2.3: Test for Other Discontinuities

Dep. Variable:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Literacy Rate	From 1912 census: Employment in Manufact.	Employment in Agricult.	Population Density	Bogota	Distance to... Dept. Cap.	Geographic controls Terrain Ruggedness	Soil Quality	Native Pop. in 1560=1	Land Disputes
Altitude > 2,400m	-0.034 (0.045)	-0.016* (0.009)	-0.031 (0.025)	-15.047 (10.969)	-92.356* (51.295)	24.137 (15.493)	-0.263 (0.385)	0.447 (0.382)	0.314 (0.190)	-0.086 (0.065)
F-stat	2.508	2.809	1.815	0.818	2.293	1.421	6.537	0.700	1.905	1.285
r ²	0.055	0.061	0.040	0.019	0.050	0.032	0.131	0.016	0.042	0.029
Counties	134	134	134	134	134	134	134	131	134	134

Note: The table tests for discontinuous jumps in counties' characteristics at 2,400 meters. It shows results from regressing dependent variables on a dummy equal to one for counties above 2,400 meters over the sea level, altitude, and altitude \times dummy for altitude > 2,400m. Results restrict the sample to counties above 1,800 meters. See appendix B.1 for variables definitions. Standard errors clustered at 60-by-60 miles grid squares in parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 2.4: Effect of Coffee Cultivation on Structural Transformation, 1973

Estimator:	(1)	(2)	(3)	(4)
	OLS		2SLS	
Panel A, Dep. var.: <i>Share of Labor Force in Manufacturing, 1973</i>				
log Coffee trees ₁₉₂₀	-0.004*** (0.001)	-0.005*** (0.002)	-0.006*** (0.001)	-0.005* (0.003)
Mean Dep. Var.	0.198	0.198	0.196	0.205
r2	0.198	0.103	0.087	0.159
Panel B, Dep. var.: <i>Share of Labor Force in Agriculture, 1973</i>				
log Coffee trees ₁₉₂₀	0.006*** (0.001)	0.008*** (0.003)	0.009*** (0.002)	0.010*** (0.003)
Mean Dep. Var.	0.370	0.371	0.377	0.397
r2	0.804	0.795	0.804	0.833
Panel C, Dep. var.: <i>Share of Population in Labor Force, 1973</i>				
log Coffee trees ₁₉₂₀	-0.000 (0.0003)	0.004*** (0.0011)	-0.001 (0.0008)	0.000 (0.0013)
Mean Dep. Var.	0.530	0.530	0.528	0.521
r2	0.974	0.970	0.978	0.983
Panel D, First Stage		<i>Dep. var.: log Coffee trees₁₉₂₀</i>		
Coffee attainable yield (FAO)		0.062*** (0.009)		
Rainfall			0.015*** (0.002)	
Temperature			1.208*** (0.139)	
Rainfall × Temperature			-0.001*** (0.000)	
Altitude > 2,400m				-2.150* (1.172)
F-stat Excluded Inst.		51.761	30.675	43.183
r2		0.508	0.546	0.617
Observations	1,100	1,096	1,056	270
Counties	550	548	528	135

Note: This table shows the effect of coffee cultivation on structural transformation using data at the IPUMS-county level. Column (1) shows OLS results (equivalent to Table 2.1, Column 4). Columns (2) to (4) of Panels A, B, and C show results from 2SLS using instruments detailed in Panel D. Column (4) instruments coffee cultivation using altitude, a dummy equal to one for counties above 2,400 meters of altitude (*Altitude > 2,400m*), and an interaction between both. All specifications control for population in 1973 (log), gender fixed effects, distance to Department's capital, distance to second largest market, and Department fixed effects. Conley (1999) standard errors as described in section 2.3 in parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 2.5: 1945 IV

	(1)	(2)	(3)	(4)
Estimator:	OLS		2SLS	
Panel A:	<i>Industrial workers per 100 inhab., 1945</i>			
log Coffee trees ₁₉₂₀	-0.033*** (0.011)	-0.080** (0.035)	-0.050* (0.027)	-0.088*** (0.029)
Mean Dep. Var.	0.495	0.495	0.467	0.399
r2	0.074	0.022	0.029	0.038
Panel B:	<i>Industrial Establishments per 1,000 inhab., 1945</i>			
log Coffee trees ₁₉₂₀	-0.022*** (0.008)	-0.071*** (0.020)	-0.061*** (0.020)	-0.084*** (0.031)
Mean Dep. Var.	0.397	0.397	0.400	0.505
r2	0.096	-0.034	-0.006	0.003
Panel C: First Stage	<i>Dep. var.: log Coffee trees₁₉₂₀</i>			
Coffee attainable yield (FAO)		0.065*** (0.007)		
Rainfall			0.010*** (0.001)	
Temperature			0.970*** (0.101)	
Rainfall × Temperature			-0.000*** (0.000)	
Altitude > 2,400m				-2.335** (1.098)
F-stat excluded inst.		97.464	35.960	31.581
r2		0.570	0.585	0.426
Counties	707	706	689	250

Note: This table shows the effect of coffee cultivation on on some measure of industrial activity in 1945 using data at the county level. Column (1) shows OLS results (equivalent to Table 2.2, Column 4). Columns (2) to (4) of Panels A and B show results from 2SLS using instruments detailed in Panel C. Column (4) instruments coffee cultivation using altitude, a dummy equal to one for counties above 2,400 meters of altitude (*Altitude > 2,400m*), and an interaction between both. All specifications control for population in 1938 (log), distance to department's capital, distance to second largest market, and Department fixed effects. All specifications exclude capital cities. Conley (1999) standard errors as described in section 2.3 in parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 2.6: Effect of Coffee Price Shocks on Schooling by Cohort, 1973

Estimator:	(1)	(2)	(3)	(4)
Dep. Variable	Average Years of Education, 1973			
Panel A: <i>Continuous measure Coffee, 1920</i>				
log Coffee trees ₁₉₂₀ × Price _c ^{5,16}	-0.007*** (0.002)	-0.017*** (0.006)	-0.022*** (0.005)	-0.003 (0.009)
F-stat Excluded Inst.		131.886	60.195	17.244
A-R p-value		0.002	0.000	0.233
Panel B: <i>Discrete measure Coffee, 1920</i> (Coffee trees ₁₉₂₀ > 0) × Price _c ^{5,16}				
	-0.099*** (0.032)	-0.238*** (0.078)	-0.293*** (0.065)	-0.032 (0.114)
F-stat Excluded Inst.		97.286	54.511	14.941
A-R p-value		0.002	0.000	0.233
Panel C: <i>Reduced Form</i>				
Coffee attainable yield × Price _c ^{5,16}		-0.0018*** (0.0006)		
Rainfall × Price _c ^{5,16}			-0.4147*** (0.0879)	
Temperature × Price _c ^{5,16}			-0.0270*** (0.0068)	
Rain. × Temp. × Price _c ^{5,16}			0.0156*** (0.0038)	
Altitude > 2,400m × Price _c ^{5,16}				0.2597* (0.1436)
Altitude × Price _c ^{5,16}				-0.0003 (0.0003)
Altitude > 2,400m × Altitude × Price _c ^{5,16}				-0.0002 (0.0004)
<i>N</i>	44,826	44,826	43,072	10,300
Counties	431	431	414	98
Mean Dep. Variable	2.881	2.881	2.873	3.131

Note: This table estimates the effect of coffee price shocks on schooling using data at the gender × cohort × county-of-birth level, for cohorts born between 1901 and 1951. The dependent variable for all specifications is average years of education. Panel A shows results measures coffee in 1920 with a continuous variable. Panel B measures coffee in 1920 with a dummy variable. Price_c^{5,16} is log average real coffee price for cohort *c* between 5 and 16 years old. Column (1) shows OLS results. Columns (2) to (4) of Panels A and B show results from 2SLS using instruments detailed in Panel C. Panel C shows reduced form estimates. All specifications control for gender, cohort, and county-of-birth fixed effects. F statistic from Kleinberg and Paap tests and p-values from Anderson and Rubin tests are presented to test for weak instruments. Cohorts born in capital cities are excluded. Standard errors clustered at the county-of-birth level in parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 2.7: Effect of Coffee Price Shocks on Economic Structure and Income, 1973

	(1)	(2)	(3)	(4)
Estimator:	OLS		2SLS	
Instrument		Attn Yield	Rain x Temp	FRDD
Panel A: Dependent Variable: <i>Share of Cohort Employed in Manufacturing, 1973</i>				
(Coffee trees ₁₉₂₀ > 0) × Price _c ^{5,16}	-0.004 (0.005)	-0.027** (0.012)	-0.009 (0.010)	-0.037** (0.016)
Mean Dep. Variable	0.259	0.258	0.258	0.268
F-stat Excluded Inst.		96.135	53.614	14.569
A-R p-value		0.018	0.001	0.019
Panel B: Dependent Variable: <i>Share of Cohort Employed in Agriculture, 1973</i>				
(Coffee trees ₁₉₂₀ > 0) × Price _c ^{5,16}	0.003 (0.004)	0.012 (0.010)	0.015* (0.009)	0.001 (0.013)
Mean Dep. Variable	0.311	0.311	0.313	0.293
F-stat Excluded Inst.		96.135	53.614	14.569
A-R p-value		0.230	0.107	0.978
Panel C: Dependent Variable: <i>Household Income, 1973</i>				
(Coffee trees ₁₉₂₀ > 0) × Price _c ^{5,16}	-0.022 (0.018)	-0.117*** (0.045)	-0.100*** (0.034)	-0.036 (0.062)
Mean Dep. Variable	-0.192	-0.191	-0.193	0.035
F-stat Excluded Inst.		97.255	54.535	14.941
A-R p-value		0.009	0.000	0.790
<i>N</i>	37,416	37,325	35,804	8,743
Counties	359	358	344	84

Note: This table estimates the effect of coffee price shocks on economic structure and income in 1973 using data at the gender x cohort x county-or-birth level, for cohorts born between 1901 and 1951. The dependent variable is given at the top of each panel. (Coffee trees₁₉₂₀ > 0) is a dummy equal to one for counties with a positive number of coffee trees in 1920. Price_c^{5,16} is log average real coffee price for cohort *c* between 5 and 16 years old. Column (1) shows OLS results. Columns (2) to (4) show results from 2SLS using instruments detailed at the top of the table. Column (2) uses coffee attainable yields from FAO. Column (3) uses a polynomial on rainfall and temperature. Column (4) uses a fuzzy regression discontinuity design (FRDD) on altitude. All specifications control for gender, cohort, and county-of-birth fixed effects. Cohorts born in capital cities are excluded. Standard errors clustered at the county-of-birth level in parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 2.8: Coffee Shocks and Structural Transformation by Inequality

	(1)	(2)	(3)	(4)
Sample Counties:	All	Coffee trees > 0	Low Ineq.	High Ineq.
Panel A, Dep. Var.: <i>Average Years of Schooling, 1973</i>				
log Coffee trees ₁₉₂₀ × Price _c ^{5,16}	-0.0073*** (0.0025)	-0.0005 (0.0106)	-0.0159 (0.0144)	0.0220 (0.0161)
Mean Dep. Var.	2.8814	2.9576	2.9311	3.0287
Panel B, Dep. Var.: <i>Literacy Rate, 1973</i>				
log Coffee trees ₁₉₂₀ × Price _c ^{5,16}	-0.2351*** (0.0418)	-0.6238*** (0.1658)	-1.0410*** (0.2184)	0.1914 (0.2839)
Mean Dep. Var.	72.7947	75.7333	75.1425	77.3802
Panel C, Dep. Var.: <i>Share of Cohort Employed in Manufacturing, 1973</i>				
log Coffee trees ₁₉₂₀ × Price _c ^{5,16}	-0.0003 (0.0004)	0.0009 (0.0013)	0.0016 (0.0019)	0.0010 (0.0024)
Mean Dep. Var.	0.2586	0.2600	0.2518	0.2661
Panel D, Dep. Var.: <i>Share of Cohort Employed in Agriculture, 1973</i>				
log Coffee trees ₁₉₂₀ × Price _c ^{5,16}	0.0004 (0.0003)	0.0021* (0.0012)	0.0037** (0.0016)	-0.0010 (0.0024)
Mean Dep. Var.	0.3106	0.3135	0.3180	0.3062
Panel E, Dep. Var.: <i>Average Household Income, 1973</i>				
log Coffee trees ₁₉₂₀ × Price _c ^{5,16}	-0.0023* (0.0014)	-0.0100* (0.0057)	-0.0173** (0.0085)	0.0089 (0.0079)
Mean Dep. Var.	-0.1918	0.0334	-0.0080	0.1374
<i>N</i>	37,416	22,973	10,963	10,495
Counties	359	220	112	108

Note: This table shows correlations between coffee price shocks and outcomes in 1973 using data at the gender × cohort × county-of-birth level. It uses different county samples. Column (1) uses all counties. Column (2) restricts to counties with some coffee trees in 1920. Columns (3) and (4) restrict the sample further to coffee counties with lower and higher (respectively) land inequality than the median coffee county. All specifications control for gender, cohort, and county-of-birth fixed effects. Cohorts born in capital cities are excluded. Standard errors clustered at the county-of-birth level in parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 2.9: Effect of Coffee Cultivation on Number of Schools, 1951

	(1)	(2)	(3)	(4)	(5)
Dep. Variable:	Schools per 10,000 inhabitants, 1951				
Sample:	All counties				
Estimator:	OLS	2SLS			
Coffee trees ₁₉₂₀ > 0	-0.436** (0.176)	-1.053** (0.415)			
Counties	491	476			
Mean Dep. Var.	0.678	0.643			
F-stat Excluded Inst.		49.871			
r ²	0.154	-0.018			
Sample:	All counties		Coffee trees > 0	Low Ineq.	High Ineq.
Estimator:	OLS	2SLS	2SLS	2SLS	2SLS
log Coffee trees ₁₉₂₀	-0.036** (0.014)	-0.073** (0.029)	-0.089 (0.084)	0.015 (0.079)	-0.341 (0.214)
Counties	491	476	316	147	167
Mean Dep. Var.	0.678	0.643	0.627	0.530	0.715
F-stat Excluded Inst.		72.457	37.934	35.803	8.747
r ²	0.155	0.008	0.019	0.028	-0.105

Note: The tables shows the effect of coffee cultivation on the number of schools per 10,000 inhabitants in 1951 using data at the IPUMS-county level. All specifications estimated using 2SLS instrument coffee cultivation with Coffee Attainable Yields from FAO. Coffee trees₁₉₂₀ > 0 is a dummy equal to one for counties with positive number of coffee trees in 1920. Column (3) restricts the sample to only counties with coffee cultivation in 1920. Columns (4) and (5) further divide coffee counties by level of land inequality. All specifications control for population in 1951 (log), distance to Department's capital, distance to second largest market, and Department fixed effects. Conley (1999) standard errors as described in section 2.3 in parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 2.10: Linkages in Coffee Production and Structural Transformation, 1973

Dep. Variable:	(1)	(2)	(3)	(4)
	Share of Labor Force in Manufacturing, 1973			
Panel A:	<i>OLS and Second Stage</i>			
Estimator:	OLS	2SLS	OLS	2SLS
Coffee trees ₁₉₂₀ > 0	-0.049*** (0.009)	-0.069** (0.027)		
Coffee trees ₁₉₂₀ > 0, No Threshing			-0.042*** (0.009)	-0.064* (0.034)
Coffee trees ₁₉₂₀ > 0, Threshing			-0.068*** (0.011)	-0.071*** (0.023)
N	1,100	1,096	1,100	1,096
Counties	550	448	550	448
r ²	0.192	0.092	0.197	0.096
F-stat Excluded Inst. <i>Threshing = No Threshing?</i> (<i>F-stat</i>)		38.546	6.799	11.769
			0.205	
Panel B:	<i>Reduced Form</i>			
Coffee attainable yield (FAO)		-0.0003** (0.0001)		-0.0002* (0.0001)
Coffee attainable yield (FAO) × Threshing				-0.0004** (0.0002)
N		1,096		1,096
Counties		448		448
r ²		0.17183		0.17641

Note: This table shows the effect of coffee cultivation and coffee threshing on share of labor force employed in manufacturing (1973) using data at the IPUMS-county level. Column (1) shows OLS results (equivalent to Table 2.1, Column 4). "Coffee trees₁₉₂₀ > 0, (No) Threshing" is a dummy equal to one for counties with positive number of coffee trees in 1920 and (no) threshing machines in 1920. All specifications control for population in 1973 (log), gender fixed effects, distance to Department's capital, distance to second largest market, and Department fixed effects. Conley (1999) standard errors as described in section 2.3 in parenthesis.

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

Table 2.11: Effect of Coffee Cultivation on Long Term Income, 2005

Estimator	(1)	(2)	(3)	(4)
Instrument:	OLS	Att. Yields	2SLS Rain × Temp.	FRDD
<i>Panel A: Poverty Rate, 2005</i>				
log Coffee trees ₁₉₂₀	0.003*** (0.001)	0.005** (0.002)	0.005*** (0.001)	0.003 (0.003)
Mean Dep. Var.	0.520	0.519	0.519	0.473
r ²	0.701	0.374	0.349	0.226
<i>Panel B: Average Household Income, 2005</i>				
log Coffee trees ₁₉₂₀	-0.031*** (0.009)	-0.002 (0.035)	-0.059*** (0.012)	-0.054** (0.021)
Mean Dep. Var.	-0.367	-0.359	-0.369	-0.068
r ²	0.670	0.410	0.411	0.492
<i>N</i>	472	464	449	91
F stat Excluded Inst.		12.117	20.931	12.479

Note: This table shows the effect of coffee cultivation on 2005 poverty and income using data at the IPUMS-county level. Poverty rate comes from DANE. Household income is calculated from a principal components analysis using household characteristics and durable goods, as described in 3.1 Column (1) shows OLS results. Columns (2) to (4) show results from 2SLS using instruments detailed at the top of the table. All specifications control for population (log), distance to Department's capital, distance to second largest market, and Department fixed effects. Conley (1999) standard errors as described in section 2.3 in parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Chapter 3: Commodities' Production Function and Human Capital Accumulation: Evidence from Early 20th Century Puerto Rico

Countries rich on natural resources tend to be poor because short term gains from exploiting those resources tend to crowd out productive investments that are associated with long-term growth. That general statement has been studied at different levels, from Innis (1999) staple growth theory to Engerman and Sokoloff (1997) "endowments" hypothesis. The relationship between resource richness and growth was exacerbated by international trade that pushed towards specialization to exploit precisely those natural resources (Stokey, 1991; Galor, 2005). Among the potential explanations lies the role of human capital accumulation. For rural households, the possibility to work at primary sector increases the opportunity cost of investing in education, which is productive in the long run (Porzio and Santangelo, 2019). That effect can be especially strong when international demand for primary products generates increases in crops' prices. However, those price increases can also make budget constraints less binding for rural households, allowing them to invest in the education of their children. When does

This chapter is a short version of a paper with the same title, joint with Matthew Curtis (UC Davis).

the opportunity cost effect dominates the income effect is a relevant question for both current social policy and our understanding of how endowments historically affected the development process.

In this chapter, we show that the effect of changes in commodity prices on the process of human capital accumulation depends on features of crops' production function. We use data from Puerto Rico at the beginning of the 20th century, which provides us with a compelling case study for three reasons. First, the island's geography is such that by 1900 different parts of the island specialized in either sugar or coffee production (see Figure 3.2). The first one is characterized by strong economies of scale which generated larger farms than the second one, which is produced in small family farms (Bobonis and Morrow, 2014). Second, farmers in the island are price takers in the coffee and sugar markets, which allow us to use changes in the international world price of both commodities as measure of changes in income. Finally, because the United States colonized Puerto Rico in 1899 the island counts with better historical information than other similar countries. For this chapter, we use decennial Census of population (1910, 1920, and 1930). Moreover, we digitize a series of detailed yearly reports from the island's appointed Governor to the President of the United States.

The Governor reports include detailed information on enrollment in public schools and area cultivated by crop for the 76 *municipios* (counties). We use them to build a panel database of counties between 1907 and 1920, which allow us to compare how school enrollment responded to increases in crop's prices in a county that specializes in sugar production versus one that specializes in coffee

production and viceversa. Additionally, we use census data to provide an alternative measure of schooling. Importantly, since one of the main goals of the US government in the island was to increase education (Bobonis and Toro, 2007), census data does not rely on official reporting from bureaucrats in the island in charge of the school system to the central government.

In sugar counties, increases in the price of sugar led to increases in enrollment rates. However, increases in the price of coffee reduced school enrollment in counties that specialize in the crop. Why did increases in agricultural income have such different effects on investments in human capital? We propose it is due to the differences between sugar and coffee production function that lead to income effect of higher prices dominating in sugar areas, while the labor effect dominates for coffee areas. Sugar farms tend to be large plantations with a lot of workers and considerable economies of scale in land. When prices increase, workers involved in sugar production have higher wages so they can afford to send their children to school. While this effect also happens in coffee areas, coffee farms tend to be smaller farms with no economies of scale. Moreover, coffee is more amenable for child labor than sugar, since it requires to pick the cherries as opposed to cut the sugar cane, an activity more suitable for adult males. Therefore, when coffee prices increase, the opportunity cost for a family of not sending their children to school also increases. This chapter points out that this effect dominates for coffee areas, while the income effect dominates for sugar areas.

We provide more support for this hypothesis by showing that the effect is concentrated in rural schools, as opposed to grade schools. One way to interpret

this result is that children going to rural schools are from families involved in the primary sector and therefore they are the most affected by changes in prices. Additionally, we use census data from 1910, 1920 and 1930 and show the main results also hold when looking at data reported by households and not by the government. Importantly, the effect of coffee prices on enrollment is stronger for women than for men while the effect of sugar price shocks on women is essentially zero. Since women participate directly in coffee collection and cultivation but less so in the process of sugar production, this result provides support to the main hypothesis.

Our results are consistent with Bobonis and Morrow (2014) evidence for Puerto Rico in the mid-nineteenth century. Using a similar empirical strategy, they find coffee price shocks have a negative effect on literacy rates when no coercive institutions exist. In this chapter we observe schooling directly, as opposed to literacy rates, and we compare coffee areas with areas specialized in sugar production. The fact that coffee is a labor-intensive crop that generates negative effects on schooling is not unique to Puerto Rico. It has been explored, for instance, for Colombia by Carrillo (2019) and Uribe-Castro (2020). Moreover, Franck and Gallor (2017); Atkin (2016) also propose that economic activities that increase the opportunity cost of acquiring education can shift the population outside of human capital accumulation, leading to lower rates of industrialization. Finally, this chapter is related to a literature on how products' production functions shape economic performance over time through many channels other than education (Droller and Fiszbein, 2019; Dell and Olken, 2020; Vollrath, 2011)

While the results presented in this chapter are suggestive, more work is required to rule out alternative hypothesis. Importantly, the Governor reports include information on the number of teachers and schools per county and year. We plan to digitize these data to rule out that the differential effects of price shocks on enrollment depend on some way of government intervention, for instance providing more schooling in sugar areas than in coffee ones.

3.1 Data and Empirical Strategy

This chapter uses information about Puerto Rican counties (*municipios*) during the first three decades on the 20th century. It collects data from several sources, most importantly from a series of reports to the President of the United States, written by the Governor of Puerto Rico from 1901 until 1920. In the reports, the Governor accounted for the fiscal situation on the island and documented a wide set of issues at the county level. The reports are rich in terms of topics, ranging from crime and social order to taxation. In this chapter, we focus on education data, digitizing a yearly panel of enrollment totals for different types of schools. We also use data from the reports on cultivated land by crops to measure local economic activity. Finally, we use data on census of population samples in 1910, 1920, and 1930. This section describes the data collected and explains how it is used to estimate the effect of commodity price shocks on human capital accumulation.

Commodities and Endowments

From the reports, we extract information on total cultivated area allocated to different crops every year. The main crops produced are coffee, sugar, tobacco, cotton, and fruits (mostly oranges and pineapples). Though there is some year to year variation, the rank of each county's most important crop does not change over the years. For the most important crops, coffee and sugar, Figure 3.6 compares the share of cultivated land allocated to each crop in 1910 and 1920. Evidently, the observations are close to the 45-degree line for both crops. Counties that by 1920 had a large share of their productive land used for coffee production, also had a proportionally large share in 1910.

Figure 3.1 illustrates why there is such a persistence in the crop mixture. Counties located in the central and western parts of the island have a mixture of high elevation (Figure 3.1a) and high average rainfall (Figure 3.1b) that make them suitable to grow coffee trees. The lowlands in the east and south-west parts of the island have better suitability for planting sugar cane, as can be seen in Figure 3.1d.

However, even counties that are primarily producing sugar, also have some coffee production. Figure 3.2 shows the mix between coffee and sugar cane plantations for counties in 1920. The horizontal and vertical dashed lines show the averages for each crop. That is, dots to the right of the vertical line have more area cultivated in sugar cane than the average county in 1920. Dots above the horizontal dashed line have more area cultivated in coffee trees than the average

county. Moreover, with circles we show counties that were above average in terms of coffee cultivation at least twice in 1901, 1910 and 1920. Similarly, squares denote counties that were above average in terms of sugar cane cultivation in at least two years. We will refer to these two groups of counties as Coffee and Sugar counties, respectively, as seen in the figure. Finally, there are some counties that either do not have any of the crops or that are hard to classify using the quick rule of thumb described above. We will refer to those counties as “Ambiguous” and they are represented by diamonds in the figure. Figure 3.3 shows the geographic location of Coffee and Sugar counties.

Education data

We build a yearly panel at the county level with total enrollment in elementary and secondary schools. Starting on 1907, the reports provide information on the number of students in every county that were enrolled in a public school by March 1. During the first few years of our sample, the reports focus on “Common” schools, divided in “Graded” and “Rural” schools. After 1912, the reports also include information on enrollment in secondary schools. For some years, the data is disaggregated at the race and gender level.

Census data

We use the census of population samples for 1910, 1920, and 1930 available in IPUMS-International (Ruggles et al., 2003). Since the data is at the individual

level, we aggregate it at the county level to generate population counts for different characteristics. We collect information on total population, urban shares, labor force participation rate, literacy rate, school attendance, number of farm owners, and occupations. Table 3.2 illustrates some characteristics of Puerto Rican counties taken from the 1910 Census of population. In terms of occupation, 1910 and 1920 census contain information on the share of working age population employed in coffee and sugar production, as well as the number of coffee and sugar farm owners. The table illustrates in which dimensions Coffee and Sugar counties differ.

Crucially, we calculate population of school age as the number of people between 5 and 15 years old. We use these to calculate enrollment rates. We do so by linearly interpolating between census to get the number of kids between 5 and 15 years old every year. For years before the 1910 Census we extrapolate using the rate of growth of school age population between 1910 and 1920. We follow the same interpolation process for total population and urban population.

Since we can measure school enrollment rates using the census in 1910, 1920, and 1930, we compare them with the enrollment rates for elementary school collected from reports. For both census there is a strong, positive correlation, though enrollment rates from the Governor reports are generally lower because they only focus on elementary school.

Other Geographic Characteristics

We compile geographic information at the county level from two different sources. From the United States Geological Survey we collect information on average altitude (Figure 3.1a). We also use information on latitude and longitude to calculate distance of each county to San Juan, the capital and largest city, located in the northeast. and Mayaguez, the largest eastern city and a major port. Finally, we use data from weather stations available from the National Oceanic and Atmospheric Administration on average yearly precipitation between 1981 and 2010. We further averaged the measures from the stations contained on each county. Since 34 counties do not have their own weather station, we averaged measures from stations within 20 km radius, weighting then inversely according to distance to the county's centroid.

3.1.1 Empirical Strategy

To explore the effect of commodity prices, we estimate the following model for two sets of measures of school enrollment take from two sources (Governor reports and Census of Population):

$$y_{ct} = \beta_t + \delta_s p_t^s \times \text{sugar}_c + \delta_c p_t^c \times \text{coffee}_c + \alpha X_{ct} + \alpha Z_c + \epsilon_{ct} \quad (3.1)$$

Where y_{ct} is a measure of schooling for county c on year t . The coefficients of interest are δ_j . Those are coefficients on interactions between a dummy equal

to one for county specialized in crop j (sugar or coffee) and p_t^j , crop j 's international price. The specification includes year fixed effects (β_t), controls for the shares of cultivated land devoted to coffee and sugar in 1920 (Z_c), and a series of time varying controls (X_{ct}) comprised of logs of total population, school age population, and urban population. In order to use the full sample from the Governor reports, we interpolate population figures linearly between census. If some county has missing population number for one or more of the years for which we have enrollment data, we assume population growth would have been equal to the average population growth and impute those figures.

To capture schooling, we use two different measures: total enrollment in logs and total enrollment divided by the number of people of school age. For data from the Governor reports, we can also disaggregate total enrollment into "Graded" and "Rural" schools. The main sample consists of 76 counties between 1907 and 1920. Census data does not have detailed information on type of school but it allow us to differentiate enrollment by gender. The census sample consists on 76 counties and three years: 1910, 1920, 1930.

Finally, for all specifications we cluster standard errors at the county level to account for serial auto-correlation within counties.

3.2 Results

Crops' Production Functions

The idea that coffee and sugar cane cultivation have very different production functions is easily shown combining the data described above. Table 3.1 shows several characteristics of crops, averaging at the county level for all counties, counties that specialize in coffee, and counties that specialize in sugar (columns 1 to 3, respectively). It shows the number of acres dedicated to coffee and sugar cane cultivation on average from the reports, the number of farm owners, and the number of workers, both coming from the 1910 census.

Three statistics help drive home the point that sugar production has more economies of scale and therefore is produced in large farms, with lower demand for child labor. First, the number of workers per farm in sugar plantations is between 5 and 9 times larger, on average, than in coffee farms. Additionally, the size of farms is considerably larger in sugar plantations than in coffee plantations.

Some caveats apply when interpreting these figures. First, if sugar workers are exclusively working in sugar farms while coffee farmers are working in coffee and other sectors, or if women work more informally, the numbers may be biased downwards for coffee workers but not for sugar. Second, we assume the number of farms is equal to the number of farm owners in the census. However, that might not be true. One single farm owner can own several properties. If that is more likely to happen in the sugar sector, where there are more economies of

scale, than in the coffee sector, that would bias the interpretation of these table upwards. That is, we would be overestimating the number of farm owners.

3.2.1 Commodity Price Shocks and School Enrollment

The behavior of coffee and sugar prices shown in Figure 3.2, together with 3.5 provides the main intuition for the preliminary results discussed on this chapter. The latter figure shows the enrollment rate (removing within-year averages) for sugar and coffee counties. The enrollment rate decreased for coffee counties right around 1910, when the real coffee price was increasing, and it came back down at the end of the period. The following analysis formalizes this insight and translates it into regression form, depicted in Equation 1.

Tables 3.3 and 3.4 have the same basic layout. The dependent variable is total enrollment (log), for columns (1) to (3), and total enrollment divided by the number of people between 5 and 15 years old, for columns (4) to (6). Different panels considers different dimensions of total school enrollment. In Table 3.3, Panel A shows enrollment in all schools, while Panels B and C use enrollment in only rural and urban schools, respectively.

Two main takeaways come out of Table 3.3: first, on average, increases in sugar prices had a positive effect of enrollment in sugar counties, while the opposite seems to be true for coffee counties (negative or zero effect). Second, most of the effect is driven by rural schools, which are arguably the most exposed to changes in crop's prices.

The first takeaway can be confirmed moving to Table 3.4. Changes in sugar prices are positively associated with increases in enrollment in sugar counties. At the same time, positive changes in the coffee price are associated with a reduction in enrollment rates. However, given the reduction on sample size, none of the effects are statistically significant.

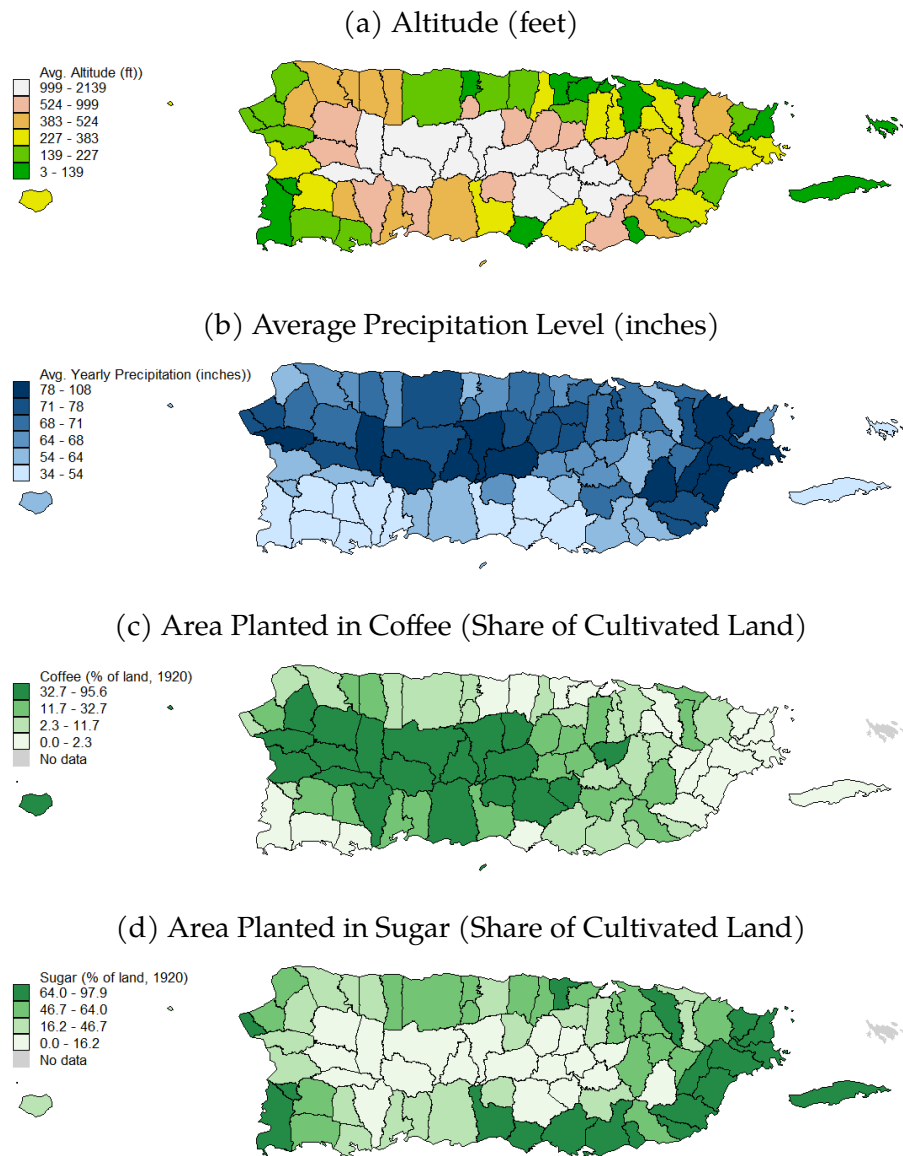
3.3 Conclusions

This chapter shows preliminary evidence that the effect of changes in commodity prices on the process of human capital accumulation depends on specific features of crops' production function. For crops with more economies of scale, larger and fewer farms, increases in crop's price can translate into more schooling since rural household do not have a strong incentive on using family or child labor. However, for labor intensive crops with limited economies of scale, increases in price might increase the opportunity cost of education, leading to lower enrollment rates.

Future work will collect more years of information from the Governor Reports to fully exploit the increase in coffee prices during the 1920's. Moreover, we will collect information on the supply of education for each county (number of school building and teachers). Having these data will allow us to support our hypothesis that the difference between coffee and sugar counties' responses to increases in prices is not driven by the response, for instance, by the government funding less schools in some counties but not in others.

Figures

Figure 3.1: Weather, Geography, and Main Crops



Note: Data comes from USGS, NOAA, 1920 Puerto Rico Governor report to the President of the US..

Figure 3.2: Sugar and Coffee Areas by County



Note: Data comes from 1920 Puerto Rico Governor report to the President of the US.

Figure 3.3: Location of Coffee and Sugar Counties

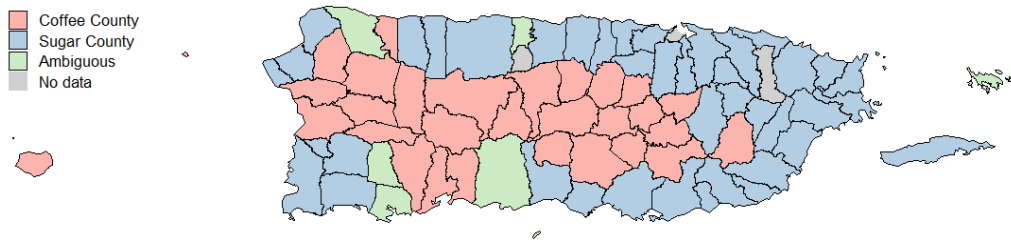
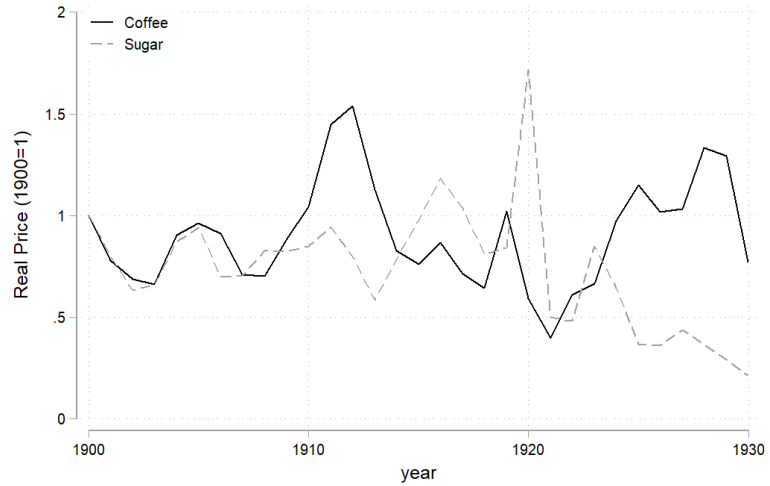
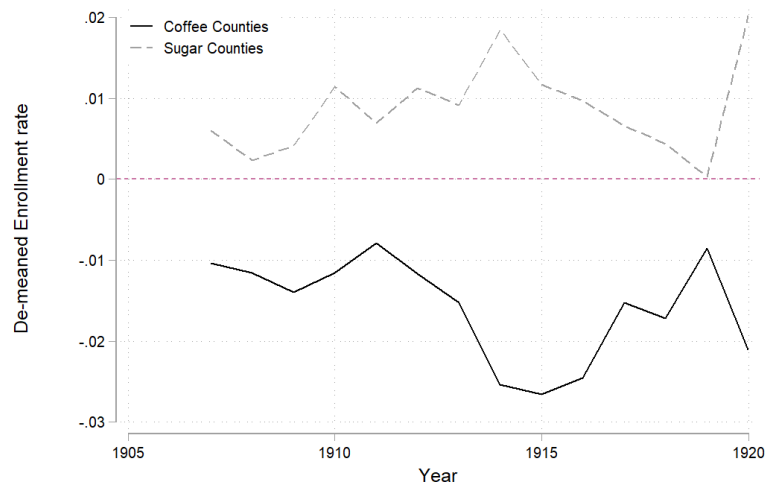


Figure 3.4: Real Coffee and Sugar Prices (1900=1)



Source: Jacks (2019).

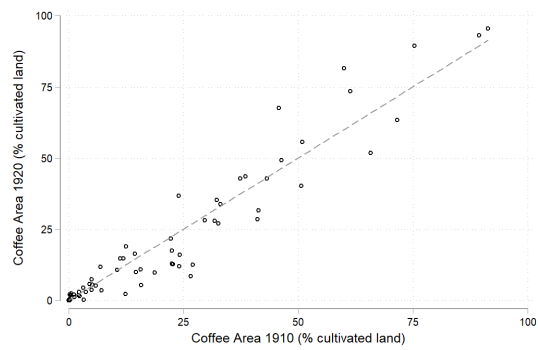
Figure 3.5: Enrollment Rates in Public Schools by Type of County



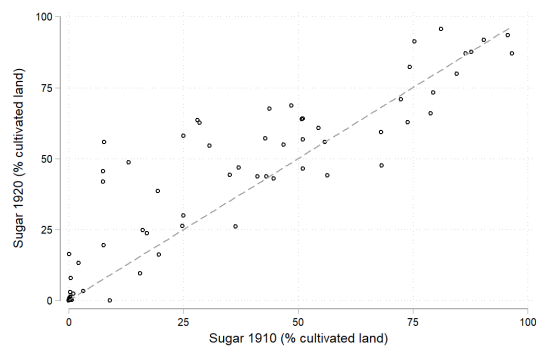
Note: Average enrollment rate by type of county between 1907 and 1920. Total enrollment comes from Governor Reports. School age population comes from 1910 and 1920 Census of Population.

Figure 3.6: Land Allocated to Coffee and Sugar as Share of Cultivated Land, 1910 and 1920

(a) Coffee

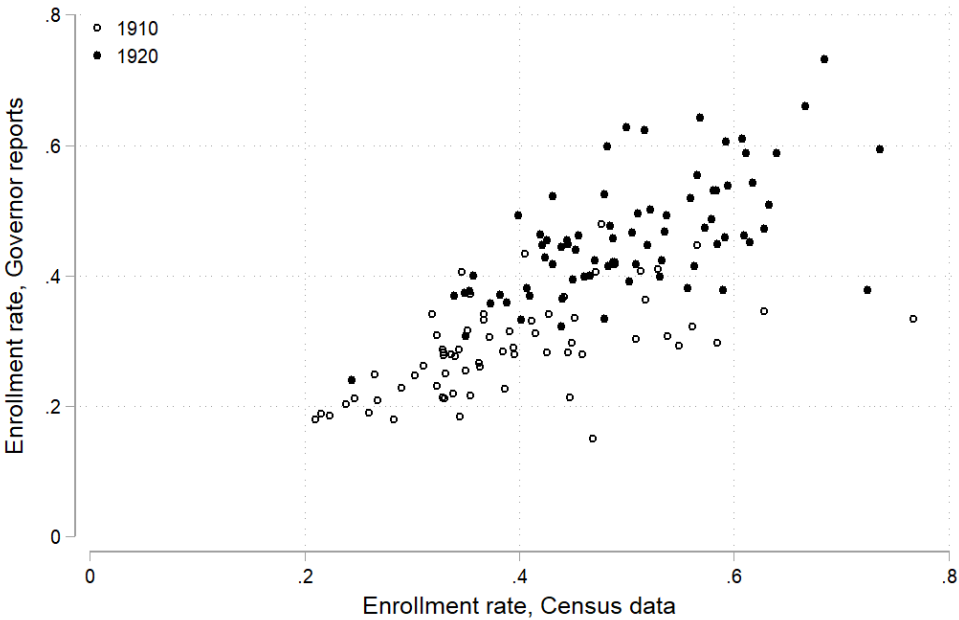


(b) Sugar



Note: Share of cultivated land in coffee and sugar as a share of total cultivated land in 1920. Source: Governor Reports, 1920.

Figure 3.7: Comparing Enrollment Data from Reports and Census



Tables

Table 3.1: Average Crops' Characteristics: Coffee and Sugar Production 1910.

Measure	Crop	(1) All Counties	(2) Coffee Counties	(3) Sugar Counties
Land (Acres)	Coffee	2,274.4 (3,589.0)	4,756.6 (4,610.2)	595.7 (928.7)
	Sugar	2,671.4 (2,972.8)	799.5 (1,565.7)	4012.6 (2689.7)
Farm Owners	Coffee	78.53 (135.4)	155.6 (178.4)	26.39 (52.87)
	Sugar	72.94 (90.39)	26.73 (47.75)	112.1 (101.7)
Workers	Coffee	479.9 (887.4)	970.6 (1156.4)	124.6 (290.8)
	Sugar	1,189.1 (1,199.7)	398.5 (571.8)	1734.7 (1038.1)
Workers per Farm	Coffee	5.282 (3.662)	5.574 (2.780)	3.935 (3.912)
	Sugar	33.94 (52.76)	19.19 (21.01)	34.94 (46.30)
Workers per Acre	Coffee	0.206 (0.383)	0.167 (0.114)	0.235 (0.510)
	Sugar	1.649 (5.080)	3.008 (7.836)	0.739 (0.992)
Acres per Farm	Coffee	38.29 (36.56)	43.80 (35.50)	28.39 (37.42)
	Sugar	77.61 (153.6)	30.32 (28.07)	85.80 (159.6)
Counties		68	26	36

Note: The table presents cross-county means and standard deviations (in brackets) for different crops' characteristics in 1910. Land acres comes from Governor Reports. Number of Farm owners and number of Workers comes from the census of population. Workers per Farm is equal to the number of workers over the number of farm owners. More details in section 3.1.

Table 3.2: Descriptive Statistics: 1910 Census and Governor Reports

	(1)		(2)		(3)		Source
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	
Enrollment rate, Census data	0.39	0.11	0.35	0.08	0.41	0.09	1910 Census
Enrollment rate, Governor reports	0.29	0.07	0.28	0.06	0.30	0.08	Governor Reports
Literacy rate	0.23	0.09	0.20	0.06	0.23	0.06	
Population (thousands)	17.13	12.85	16.20	9.52	15.58	8.49	
Urban share	0.21	0.17	0.14	0.10	0.23	0.14	
Black share	0.36	0.15	0.27	0.13	0.42	0.14	1910 Census
Labor Force Participation	0.61	0.04	0.59	0.03	0.62	0.04	
Women's Labor Force Participation	0.21	0.07	0.19	0.06	0.22	0.06	
Employment in Manufacturing	0.08	0.06	0.05	0.03	0.09	0.06	
Livestock Heads (thousands)	3.23	2.08	2.09	1.39	4.11	2.12	Gov. Reports
<i>Coffee Cultivation</i>							
Coffee (% of cultivated area)	22.22	23.37	45.02	21.03	7.47	8.37	Gov. Reports
Employment (share work age pop.)	0.05	0.10	0.11	0.13	0.01	0.02	
# Coffee Farm Owners	78.53	135.40	155.58	178.42	26.39	52.87	1910 Census
Workers per farm owner	5.28	3.66	5.57	2.78	3.94	3.91	
<i>Sugar Production</i>							
Sugar Cane (% of cultivated area)	34.60	30.95	8.75	12.45	55.97	24.97	Gov. Reports
Employment (share work age pop.)	0.15	0.12	0.04	0.06	0.23	0.10	
# Sugar Cane Farm Owners	72.94	90.39	26.73	47.75	112.08	101.71	1910 Census
Workers per farm owner	33.94	52.76	19.19	21.01	34.94	46.30	
# Refinery Workers	8.09	13.77	3.85	9.09	11.11	16.52	
<i>Geographic Characteristics</i>							
Avg. Elevation (ft)	552.46	549.32	1091.68	570.44	239.23	133.77	USGS
Avg. Yearly Precipitation (inches)	67.39	15.40	68.74	12.87	68.32	16.83	NOAA
Distance to San Juan (km)	59.11	31.88	62.99	29.13	54.00	32.89	USGS
Distance to Mayaguez (km)	81.34	47.00	61.17	34.59	96.36	47.47	USGS
Counties	76		28		41		

Note: The table shows descriptive statistics from 1910 census and other sources. It divides the sample in three groups: Full Sample, only Coffee, and only Sugar counties according to details in section 3.1.

Table 3.3: Effect of Coffee and Sugar Income on Total Enrollment (Governor Reports)

Dependent Variable:	(1)	(2)	(3)	(4)	(5)	(6)
	(log) Total Enrolled			Enrollment rate		
<i>Panel A: All Common Schools</i>						
Sugar Price × Sugar County	0.171** (0.076)		0.170*** (0.061)	0.055** (0.026)		0.059*** (0.022)
Coffee Price × Coffee County		-0.078 (0.087)	-0.001 (0.075)		-0.016 (0.028)	0.011 (0.025)
Mean Dep. Var.	7.267	7.267	7.267	0.348	0.348	0.348
R2	0.919	0.918	0.919	0.721	0.717	0.722
<i>Panel B: Only Rural Schools</i>						
Sugar Price × Sugar County	0.385*** (0.134)		0.488*** (0.168)	0.067*** (0.025)		0.075*** (0.023)
Coffee Price × Coffee County		0.035 (0.147)	0.257 (0.187)		-0.014 (0.026)	0.020 (0.026)
Mean Dep. Var.	6.809	6.809	6.809	0.286	0.286	0.286
R2	0.713	0.705	0.723	0.629	0.619	0.629
<i>Panel B: Only Graded Schools</i>						
Sugar Price × Sugar County	0.007 (0.094)		-0.004 (0.099)	-0.013 (0.014)		-0.020 (0.017)
Coffee Price × Coffee County		-0.026 (0.105)	-0.027 (0.112)		-0.009 (0.014)	-0.018 (0.017)
Mean Dep. Var.	6.120	6.120	6.120	0.119	0.119	0.119
R2	0.895	0.895	0.895	0.733	0.734	0.738
Observations	983	983	983	983	983	983
Years	1907 to 1920					
Counties	76					

Note: The sample is an unbalanced yearly panel for 76 counties between 1907 and 1920. Dependent variable for columns (1) to (3) is total enrollment per year (log) and for columns (4) to (6) is total enrollment divided by school age population (between 5 and 15 years old). Coffee and Sugar Prices are measured as log of real price. All specifications control for share of cultivated land allocated to coffee and sugar. Population controls include: total population, urban population and school age population (all in logs). Standard errors clustered at the county level in brackets.
 * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

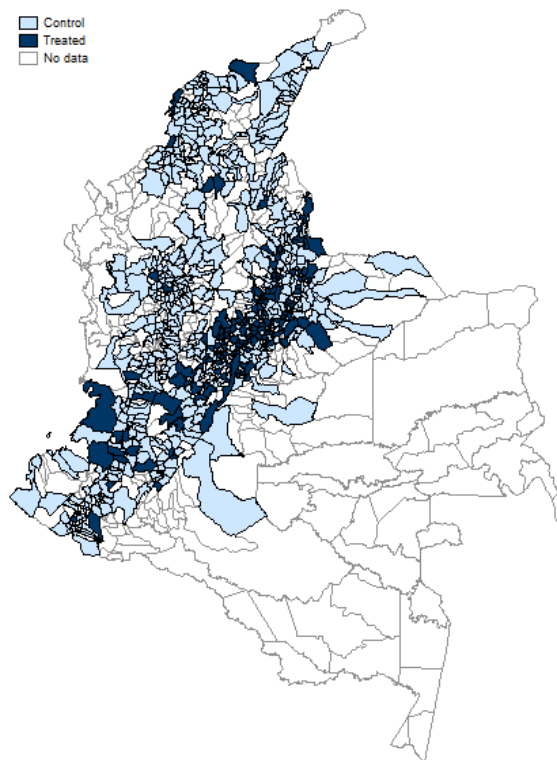
Table 3.4: Effect of Coffee and Sugar Income on Total Enrollment (Census Data)

Dependent Variable:	(1)	(2)	(3)	(4)	(5)	(6)
	(log) Enrollment			Enrollment rate		
<i>Panel A: Total Enrollment</i>						
Sugar Price × Sugar County	0.088 (0.060)		0.053 (0.063)	0.030 (0.026)		0.014 (0.028)
Coffee Price × Coffee County		-0.235* (0.126)	-0.214* (0.128)		-0.104* (0.055)	-0.099* (0.056)
Mean Dep. Var.	7.611	7.611	7.611	0.443	0.443	0.443
R2	0.894	0.894	0.895	0.334	0.337	0.338
<i>Panel B: Women's Enrollment</i>						
Sugar Price × Sugar County	0.098 (0.081)		0.051 (0.083)	0.017 (0.031)		-0.001 (0.033)
Coffee Price × Coffee County		-0.310* (0.166)	-0.290* (0.168)		-0.112* (0.063)	-0.112* (0.065)
Mean Dep. Var.	6.803	6.803	6.803	0.410	0.410	0.410
R2	0.853	0.853	0.853	0.337	0.340	0.340
Observations	217	217	217	217	217	217
Years	1910, 1920, 1930					
Counties	76					

Note: The sample is an unbalanced panel for 76 counties in 1910, 1920, 1930 census of population. Dependent variable for columns (1) to (3) is number of people attending school (log) and for columns (4) to (6) is number of people attending school divided by school age population (between 5 and 15 years old). Coffee and Sugar Prices are measured as log of real price. All specifications control for year fixed effects, share of cultivated land allocated to coffee and sugar in 1920, and a vector of population controls that includes: total population, urban population and school age population (all in logs). Standard errors clustered at the county level in brackets. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

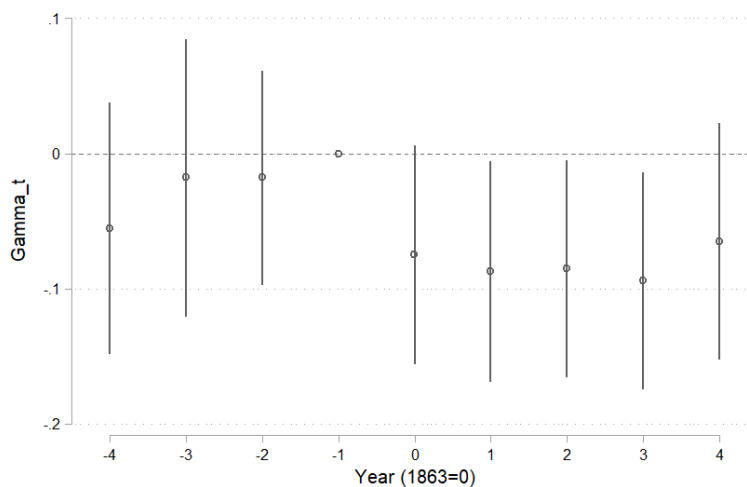
Appendix A: Appendix to Chapter 1

Figure A.1: Map of the main sample



Note: the map shows the geographical distribution of the main sample using current municipality boundaries. Lighter municipalities belong to the control group, darker, to the treatment group, and blank municipalities are not on my sample, that comes from Bushnell (1970) 1856 elections data.

Figure A.2: Parallel trends assumption test



Note: the figure is based on a regression of the number of battles per year on the interaction between a dummy equal to 1 for the *treatment* group and dummies equal to 1 for each year t from 1854 to 1885, as noted in equation 1.2. The figure shows the interactions' coefficients and their standard error. Year 0 is 1863, where the period after the reform started.

Table A.1: Standard errors: different clustering methods

Dependent variable:	(1)	(2)	(3)	(4)
	Coefficient	# Battles per year (1854-1885)		
		Standard errors clustered at		
		Municipality	Year*Municipality	Province
$d^{1863} \times$ Disentailment	-0.021	(0.0104)	(0.0141)	[0.0103]
$d^{1863} \times$ Cons. vote share	0.017	(0.0083)	(0.0113)	[0.078]
Number of Clusters		597	32 x 597	22
$d^{1863} \times$ Control	X			
Municipality FE	X			
Year FE	X			
R2	0.139			
N	19,104			
Municipalities	597			

Columns (2) and (3) report, in brackets, standard errors clustered at municipality level and two-way year*municipality, respectively. Column (4) reports, in square brackets, the p-value corresponding to the F-statistic estimated using wild bootstrap. The dependent variable is the *number of battles per year*, built from Riascos Grueso (1950). *Disentailment* is a dummy variable equal to 1 for municipalities where the Church's real estate. d^t is a dummy equal to 1 for years $\geq t$. *Conservative vote share (1856)* is the share of total votes won by Mariano Ospina, the Conservative party candidate in the 1856 presidential election. Control variables are defined at the municipality level and include: foundation year, altitude, total area of the municipality, distance to the State's capital (log), distance to Bogota (log), distance to the closest main market (log), a dummy indicating early indigenous settlements (by 1534), a dummy indicating early Spanish settlements (by 1560), and soil quality index.

Appendix B: Appendix to Chapter 2

B.1 Data Appendix

Outcome Variables

Share of population in labor force: 1912 and 1938 census already included these numbers for every county. For 1973 and 2005 census, I calculate the county-level number of adults between 18 and 65 years old who answered affirmatively to the question about labor force participation. I then divide by total population, taken from each census.

Share of labor force employed in manufacturing and agriculture: for 1912 and 1938 census already included the number of people by occupation. For 1973 and 2005, I use the ISCO-68 3 code classification of occupation to identify worker's employment sector in three broad categories: Agriculture (Occupations in the 600 ISCO-68 code), Manufacturing (Occupations in the 700 ISCO-68 code except for "Miners and quarrymen" (711) and "Mineral and stone treaters" (712). Occupations in the 800 code and from codes 901 to 989 (inclusive)), and Services (Occupations in the 400 and 500 ISCO-68 code).

Number of manufacturing establishments per capita: Number of manufacturing establishments with more than 5 employees divided by population in 1945. From 1945 Industrial Census (Santos Cardenas, 2017). I interpolate county level population using data from 1938 and 1951 census of population.

Share of population employed in industrial establishments: Number of workers in manufacturing establishments with more than five employees divided by population in 1945. From 1945 Industrial Census (Santos Cardenas, 2017). I interpolate county level population using data from 1938 and 1951 census of population.

Human capital: I measure education in 1973. I use two variables available for individuals older than 5 years old. Literacy: a dummy equal to one if the individual can read and write, zero otherwise. Years of schooling: Highest year of education completed by the individual. Ranges from 0 to 18. I then aggregate at the county-of-birth x cohort level using population weights.

Household income: I calculate a measure of income for households in 1973

and 2005. I extract the first vector of a principal components analysis on a series of variables containing information on house quality. I use data on household characteristics to build a measure of household wealth. They are:

Electricity: a dummy equal to one if the dwelling is connected to electricity. Sewage: a dummy equal to one if the dwelling is connected to a drainage sewer system. Water supply: a dummy equal to one if the dwelling is connected to piped water supply. Toilet: a dummy equal to one if the dwelling has either flush toilet or latrine. Floor material: a dummy equal to one if the dwelling's floors are made of cement, tile, brick, wood, or plastic. It equals zero if the dwelling has unfinished or no floor. Roof material: a dummy equal to one if the dwelling's roof is made of reinforced concrete or clay tile. It equals zero if the roof is made of zinc, tin, thatch, or discarded material. Rooms per person: number of rooms the household uses divided by the number of people in the household.

Poverty rate: share of households living below poverty line in 2005. From Acevedo and Bornacelly (2014).

Coffee Cultivation

The census was part of a larger project, the book "Colombia Cafetera" by Dario Monsalve, commissioned by Colombia's Department of Commerce to promote coffee exports abroad. The book includes general information about the country, infographics, pictures, and a detailed account of coffee farms at the municipality level. I digitized information on farms' names, owners when available, and size, measured by the number of coffee trees used in production. For some of the smaller plantations, the census does not include the owner's name. For some counties, there are only counts of small farms and their size. In some rare cases, the census pools together an unknown number of plantations in a single category ("Some" or "Varias" in Spanish). The documentation on how the census was collected is not very comprehensive and I cannot say with confidence why some counties report their information pooling the smaller farms in this fashion.

Figure B.1 shows the census records for the municipality of Anzá in the department of Antioquia, an instance where the three ways of reporting the information appear. Overall, the census reports information for 37,689 farms, containing 242 million coffee trees.

I use the 1928 coffee census records to build four measures at the county level. First, the total land used for coffee plantations, which is simply the sum of the individual farms' sizes. Second, the total number of farms. I measure this in two different ways to deal with the pooled category "Some:" one, assuming "Some" is equal to one farm (lower bound), and two: assuming the farms are equal to the smallest plantation in the county for which I have information (upper bound). Using the example from figure B.1, the number of farms in "Some" will be, respectively, 1 and 10. Third, the number of farms allows me to measure the average and the median farm in every county. Finally, I calculate the Gini coefficient at the county level.

Ideally, I would like to use the information on the owners' name, because

there are instances where the same name appears as the owner of more than one plantation. There are, however, two obstacles for doing so. One, naming conventions in Colombia use two last names system. The first last name is the father's first last name, and the second last name is the mothers' first last name. However, the data only includes one last name. Since last names in Colombia are very common, I might identify two different people with the same name as the same individual. Two, as pointed out above, there are a significant number of farms for which I do not know the owner's name. For the time being, I will assume the number of plantations is equal to the number of owners in order to calculate two measures of Gini coefficient, one for every estimate for the number of owners.

Figure B.1: Example from 1928 Coffee Census (Municipality of Anza, Department of Antioquia)

10. ANZA

Quicinó	Dimas Navarro.	30,000
El Zarzal.	Lisandro Sánchez.	16,000
Guayabal	Efraín Jaramillo.	15,000
Peñitas.	Castor Caro.	14,000
Los Llanos	Antonio J. Holguín.	13,000
Pajal.	Antonio M. Sánchez.	8,000
El Zarzal.	Heliodoro Ruiz.	8,000
Guayabal.	Germán Jaramillo.	8,000
Los Llanos	Luciano Bravo.	8,000
»	Secundino Holguín.	5,500
Olivares	Juan Hernández.	5,000
Moral	Bautista Holguín.	5,000
Los Llanos	Manuel Zapata.	3,000
Guamal.	Antonio M. Velásquez.	3,000
Malpaso	Ignacio Ramírez.	3,000
La Cordillera.	Marco A. Muñoz.	1,500
Las Lomitas	Juan González.	1,500
Quinamá	Serafín Moreno.	1,500
»	Eliseo Jaramillo.	1,500
Camposalegre	Ignacio Trujillo.	1,500
El Guineo	Dolores Enríquez.	1,400
25 plantaciones de 1,000 cafetos		25,000
1 menores de 1,000 cafetos.		925
6 plantaciones de 800 cafetos.		4,800
5 » de 500 »		2,500
4 » de 350 »		1,400
9 » de 200 »		1,800
11 » de 100 »		1,100
Varias. » de Varias		1,000

Note: Columns correspond to: Plantation name, owner's name, number of trees.

B.2 Supporting Results

Table B.1: 1945 IV by sector

Dependent Variable:	(1)	(2)	(3)	(4)	(5)	(6)
	Industrial workers per 100 inhab., 1945			Industrial Establishments per 1,000 inhab., 1945		
Instrument for Coffee	Yields	R × T.	FRDD	Yields	R × T	FRDD
Panel A: High Human Capital Sectors						
log Coffee trees ₁₉₂₀	-0.084** (0.037)	-0.051*** (0.011)	-0.061** (0.026)	-0.120*** (0.024)	-0.115*** (0.021)	-0.044 (0.032)
Mean Dep. Var.	0.057	0.057	0.073	0.066	0.067	0.104
r2	-0.032	0.016	-0.002	-0.140	-0.119	0.067
Panel B: Medium Human Capital Sectors						
log Coffee trees ₁₉₂₀	-0.016 (0.019)	-0.011 (0.023)	-0.056 (0.036)	-0.023 (0.014)	-0.009 (0.012)	-0.024 (0.029)
Mean Dep. Var.	0.106	0.102	0.077	0.047	0.046	0.035
r2	0.024	0.021	0.009	0.030	0.030	0.036
Panel C: Low Human Capital Sectors						
log Coffee trees ₁₉₂₀	-0.034 (0.021)	-0.021 (0.014)	-0.066** (0.028)	-0.070*** (0.024)	-0.061** (0.024)	-0.083*** (0.031)
Mean Dep. Var.	0.332	0.307	0.249	0.284	0.287	0.366
r2	0.013	0.016	0.032	-0.023	-0.004	-0.000
Counties	706	689	250	706	689	250

Note: Table shows effects of coffee cultivation on industrial employment and number of establishments in 1945 by sector, according to Human Capital requirement. Columns (1) and (4) use Coffee attainable yields from FAO as instrument for coffee cultivation in 1920. Columns (2) and (5) use a polynomial on rainfall and temperature. Columns (3) and (6) use a fuzzy regression discontinuity design (FRDD) on altitude. All specifications control for population in 1938 (log), distance to department's capital, distance to second largest market, and Department fixed effects. All specifications exclude capital cities. Conley (1999) standard errors as described in section 2.3 in parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table B.2: Effect of Coffee Price Shocks on Economic Structure, 1912, 1938, and 2005

Year: Estimator: Instrument	(1)	(2)		(3)		(4)		(5)		(6)		(7)		(8)		(9)
	OLS	1912 2SLS	Attn. Yield	2SLS	FRDD	OLS	2SLS	FRDD	Attn. Yield	2SLS	FRDD	OLS	2SLS	Attn. Yield	2SLS	FRDD
log Coffee trees ₁₉₂₀	-0.002*** (0.001)	-0.002*** (0.001)	-0.001 (0.001)	-0.003*** (0.001)	-0.006*** (0.003)	-0.003*** (0.001)	-0.006*** (0.003)	-0.005*** (0.002)	-0.006*** (0.003)	-0.006*** (0.003)	-0.005*** (0.002)	-0.001*** (0.000)	-0.001*** (0.000)	-0.001 (0.001)	-0.003** (0.002)	-0.003** (0.002)
Mean Dep. Var. r ²	0.035 0.204	0.034 0.029	0.033 0.001	0.097 0.450	0.096 0.025	0.097 0.450	0.096 0.025	0.137 0.013	0.096 0.025	0.137 0.013	0.137 0.013	0.024 0.128	0.024 0.128	0.024 0.046	0.034 0.087	0.034 0.087
Panel B, Dep. Var.: Share of Labor Force Employed in Agriculture																
log Coffee trees ₁₉₂₀	0.002** (0.001)	0.002 (0.002)	0.003** (0.002)	0.006*** (0.002)	0.008*** (0.003)	0.006*** (0.002)	0.008*** (0.003)	0.008** (0.003)	0.008*** (0.003)	0.008*** (0.003)	0.008** (0.003)	0.004*** (0.001)	0.004*** (0.001)	-0.011 (0.007)	-0.011 (0.006)	0.009 (0.006)
Mean Dep. Var. r ²	0.172 0.218	0.172 0.033	0.167 0.071	0.825 0.267	0.825 0.073	0.825 0.267	0.825 0.073	0.798 0.039	0.825 0.073	0.825 0.073	0.798 0.039	0.205 0.476	0.205 0.476	0.205 0.315	0.257 0.408	0.257 0.408
Observations	719	698	245	713	695	713	695	250	695	250	12.331	934	934	898	182	182
F stat Excluded Inst.		28.638	11.645		35.752		35.752							12.706	39.242	39.242

Note: This table presents supporting results for figure 2.9. It shows the effect of coffee cultivation on structural transformation using data at the IPUMS-county level. Columns (1) (4) and (7) show OLS results (equivalent to Table 2.1, Column 4). Columns (3) (6) and (9) instrument coffee cultivation using altitude, a dummy equal to one for counties above 2,400 meters of altitude ($Altitude > 2,400m$), and an interaction between both. All specifications control for population (log), gender fixed effects, distance to Department's capital, distance to second largest market, and Department fixed effects. Conley (1999) standard errors as described in section 2.3 in parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table B.3: Balance Tests

Dep. Variable:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	Literacy Rate	From 1912 census: Employment in Manufact.	Employment in Agricult.	Population Density	Altitude (km)	Bogota	Distance to... Dept. Cap.	Terrain Ruggedness	Soil Quality	Native Pop. in 1560=1	Land Disputes
Panel A:											
Coffee trees ₁₉₂₀ > 0	0.044*** (0.009)	-0.005 (0.005)	0.036*** (0.009)	1.308 (2.999)	0.352*** (0.078)	-123.438*** (16.602)	-7.793* (4.543)	1.284*** (0.107)	-0.392*** (0.106)	-0.043 (0.047)	-0.060* (0.036)
Mean Coffee trees ₁₉₂₀ = 0	0.108	0.035	0.120	29.332	1.001	375.607	72.661	1.360	3.021	0.562	0.225
r ²	0.043	0.002	0.034	0.000	0.040	0.101	0.006	0.229	0.027	0.002	0.006
Counties	494	494	494	494	494	494	494	492	489	494	494
Panel B:											
Altitude > 2,400m	-0.054** (0.021)	0.004 (0.004)	-0.022* (0.012)	-1.561 (5.089)	0.593*** (0.027)	1.624 (24.200)	1.169 (7.239)	-0.691*** (0.180)	-0.026 (0.177)	0.089 (0.089)	0.014 (0.030)
Mean Counties Below	0.181	0.030	0.162	40.287	2.040	216.503	65.683	3.072	2.298	0.488	0.024
r ²	0.048	0.005	0.025	0.001	0.785	0.000	0.000	0.101	0.000	0.008	0.002
Counties	134	134	134	134	134	134	134	134	131	134	134

Note: Panel A shows results from regressing dependent variables on a dummy equal to one for counties with positive Coffee Trees in 1925. Panel B shows results from regressing dependent variables on a dummy equal to one for counties above 2,400 meters over the sea level, restricting the sample to counties above 1,800 meters. Panel B restrict the sample to counties above 1,800 meters. See appendix B.1 for variables definitions. Conley (1999) standard errors as described in section 2.3 in parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table B.4: Coffee Shocks and Structural Transformation by Inequality

	(1)	(2)	(3)	(4)	(5)
	OLS	2nd. Stage	OLS	2nd. Stage	Red. Form
Panel A, Dep. Var: Sh. Cohort Employed in Manufacturing, 1973					
Avg. Years of Schooling	0.0032** (0.0015)	0.1244* (0.0636)			
Literacy Rate			0.0006*** (0.0001)	0.0065** (0.0027)	
Coffee yield \times Price ^{5,16} _c					-0.0002** (0.0001)
Mean Dep. Var.	0.2587	0.2586	0.2585	0.2585	0.2585
F-stat Excluded Inst.		8.2063		10.6217	
A-R test p-value		0.0179		0.0177	
Panel B, Dep. Var: Sh. Cohort Employed in Agriculture, 1973					
Avg. Years of Schooling	-0.0478*** (0.0013)	-0.0558 (0.0440)			
Literacy Rate			-0.0018*** (0.0001)	-0.0029 (0.0021)	
Coffee yield \times Price ^{5,16} _c					0.0001 (0.0001)
Mean Dep. Var.	0.3092	0.3105	0.3096	0.3110	0.3110
F-stat Excluded Inst.		8.2063		10.6217	
A-R test p-value		0.2308		0.2305	
<i>N</i>	37,558	37,269	37,558	37,269	37,269
Counties	361	358	361	358	358

Note: This table shows the effect of education on occupation in 1973, instrumenting education using coffee prices during school age for cohorts born between 1901 and 1951. It uses data at the gender \times cohort \times county-of-birth level. All specifications control for gender, cohort, and county-of-birth fixed effects. Cohorts born in capital cities are excluded. Standard errors clustered at the county-of-birth level in parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

B.3 Robustness Checks

Table B.5: Measuring 1920 Coffee Cultivation with Extensive Margin

Year:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Instrument	1912		1938		1973		2005	
	Attn. Yield	FRDD	Attn. Yield	FRDD	Attn. Yield	FRDD		
Panel A, Dep. Var.: Share of Labor Force Employed in Manufacturing								
Coffee trees ₁₉₂₀ > 0	-0.010 (0.011)	-0.018 (0.012)	-0.076** (0.033)	-0.059** (0.026)	-0.069* (0.038)	-0.063* (0.036)	-0.019 (0.013)	-0.040** (0.019)
Mean Dep. Var.	0.035	0.033	0.096	0.137	0.198	0.205	0.025	0.034
Panel B, Dep. Var.: Share of Labor Force Employed in Agriculture								
Coffee trees ₁₉₂₀ > 0	0.050*** (0.015)	0.045** (0.018)	0.108*** (0.039)	0.092** (0.038)	0.111** (0.044)	0.133*** (0.032)	-0.157 (0.105)	0.151* (0.075)
Mean Dep. Var.	0.239	0.218	0.825	0.798	0.377	0.397	0.210	0.257
Panel C, Dep. Var.: Labor force participation								
Coffee trees ₁₉₂₀ > 0	-0.0020 (0.0250)	-0.0064 (0.0178)	0.0405 (0.0311)	0.0219 (0.0236)	0.063*** (0.023)	0.002 (0.013)	-0.050 (0.053)	-0.041 (0.035)
Mean Dep. Var.	0.411	0.382	0.551	0.587	0.530	0.521	0.571	0.596
Counties	719	245	713	250	547	135	467	141
F stat Excluded Inst.	26.182	11.019	31.436	11.523	14.542	12.244	11.014	9.203

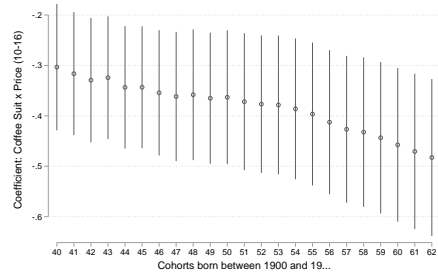
Note: This table presents the effect of coffee cultivation on structural transformation over the 20th century using a discrete value equal to 1 for counties with positive coffee production in 1920, 0 otherwise. Columns (1) (3) (5) and (7) instrument coffee cultivation using attainable coffee yields. Columns (2) (4) (6) and (8) instrument coffee cultivation using altitude, a dummy equal to one for counties above 2,400 meters of altitude ($\text{Altitude} > 2,400m$), and an interaction between both. All specifications control for population (log), gender fixed effects, distance to Department's capital, distance to second largest market, and Department fixed effects. Conley (1999) standard errors as described in section 2.3 in parenthesis. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

B.3.1 Sensitivity to Excluding Younger Cohorts

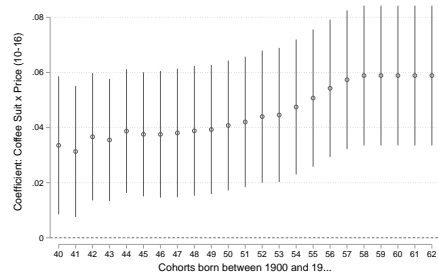
In order to test the sensibility of results to specific cohorts, I estimate results presented in Section 2.5.1 removing different cohorts a at a time. The following graphs show estimates of β from equation 2.5 including cohorts up to years depicted in the x-axis. The preferred specification includes cohorts between 1902 and 1052.

Figure B.2: Sensitivity of results to different cohorts in sample

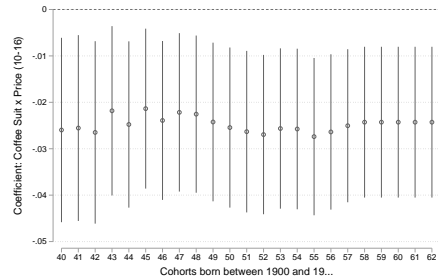
(a) Years of Schooling



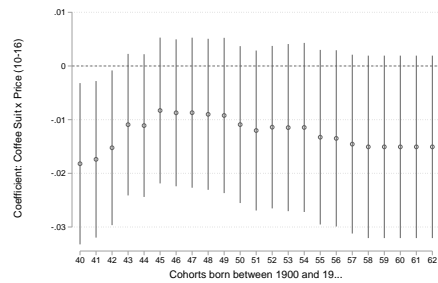
(b) Agriculture 1973



(c) Manufacturing 1973



(d) Labor force participation



Note: the scaling of the y-axis differs for all the figures.

Bibliography

- Acemoglu, D. and Dell, M. (2010). Productivity Differences between and within Countries. *American Economic Journal: Macroeconomics*, 2(1):169–188.
- Acemoglu, D. and Guerrieri, V. (2008). Capital Deepening and Nonbalanced Economic Growth. *Journal of Political Economy*, 116(3):32.
- Acemoglu, D., Johnson, S., and Robinson, J. A. (2002). Reversal of fortune: Geography and institutions in the making of the modern world income distribution. *The Quarterly journal of economics*, 117(4):1231–1294.
- Acemoglu, D., Johnson, S., and Robinson, J. A. (2005). Institutions as a fundamental cause of long-run growth. *Handbook of economic growth*, 1:385–472. Publisher: Elsevier.
- Acemoglu, D. and Robinson, J. A. (2012). Why nations fail: the origins of power, prosperity and poverty. *Crown, New York*.
- Acevedo, K. M. and Bornacelly, I. D. (2014). Panel Municipal del CEDE. Technical Report 012223, Universidad de los Andes - CEDE.
- Angrist, J. D. and Pischke, J.-S. (2008a). *Mostly harmless econometrics: An empiricist's companion*. Princeton University Press.

- Angrist, J. D. and Pischke, J.-S. (2008b). *Mostly harmless econometrics: An empiricist's companion*. Princeton University Press.
- Arango, M. (1981). *Café e industria, 1850-1930*.
- Atkin, D. (2016). Endogenous Skill Acquisition and Export Manufacturing in Mexico. *American Economic Review*, 106(8):2046–2085.
- Autor, D. H. (2003). Outsourcing at will: The contribution of unjust dismissal doctrine to the growth of employment outsourcing. *Journal of labor economics*, 21(1):1–42.
- Autor, D. H., Dorn, D., and Hanson, G. H. (2016). The China shock: Learning from labor-market adjustment to large changes in trade. *Annual Review of Economics*, 8:205–240.
- Bazant, J. (2008). *Alienation of Church Wealth in Mexico: Social and Economic Aspects of the Liberal Revolution 1856-1875*, volume 11. Cambridge University Press.
- Bazzi, S., Fiszbein, M., and Gebresilasse, M. (2017). Frontier Culture: The Roots and Persistence of "Rugged Individualism" in the United States. Technical Report w23997, National Bureau of Economic Research, Cambridge, MA.
- Bejarano, J. A. (1980). Los estudios sobre la historia del café en Colombia. *Cuadernos de economía*, 1(2):115–140.
- Bertrand, M., Duflo, E., and Mullainathan, S. (2004). How much should we

- trust differences-in-differences estimates? *The Quarterly journal of economics*, 119(1):249–275.
- Bester, C. A., Conley, T. G., and Hansen, C. B. (2011). Inference with dependent data using cluster covariance estimators. *Journal of Econometrics*, 165(2):137–151.
- Blattman, C. and Miguel, E. (2010). Civil war. *Journal of Economic literature*, 48(1):3–57.
- Bobonis, G. J. and Morrow, P. M. (2014). Labor coercion and the accumulation of human capital. *Journal of Development Economics*, 108:32–53.
- Bobonis, G. J. and Toro, H. J. (2007). Modern colonization and its consequences: the effects of US educational policy on Puerto Rico’s educational stratification, 1899-1910. *Caribbean Studies*, 35(2):31–76. Publisher: Instituto de Estudios del Caribe.
- Brew, R. (1973). The economic development of Antioquia from 1850-1920.
- Bulmer-Thomas, V. (2003). *The economic history of Latin America since independence*. Cambridge University Press.
- Bushnell, D. (1970). Elecciones presidenciales colombianas, 1825-1856. *Compendio de estadísticas históricas en Colombia*. Bogotá: Universidad Nacional de Colombia.
- Bushnell, D. (1993). *The making of modern Colombia: A nation in spite of itself*. Univ of California Press.

- Bustos, P., Caprettini, B., and Ponticelli, J. (2016). Agricultural Productivity and Structural Transformation: Evidence from Brazil. *American Economic Review*, 106(6):1320–1365.
- Cantoni, D., Dittmar, J., and Yuchtman, N. (2017). Religious competition and reallocation: The political economy of secularization in the protestant reformation. Technical report, National Bureau of Economic Research.
- Cardoso, F. H. and Faletto, E. (1979). *Dependency and development in Latin America (Dependencia y desarrollo en América Latina, engl.)*. Univ of California Press.
- Carrillo, B. (2019). The Value of Time and Skill Acquisition in the Long Run: Evidence from Coffee Booms and Busts. *Journal of Labor Economics*. In Press.
- Caselli, F. and Coleman II, W. J. (2001). The U.S. Structural Transformation and Regional Convergence: A Reinterpretation. *Journal of Political Economy*, 109(3):584–616.
- Centeno, M. A. (1997). Blood and debt: War and taxation in nineteenth-century latin america. *American Journal of sociology*, 102(6):1565–1605.
- Ciccone, A. and Papaioannou, E. (2009). Human Capital, the Structure of Production, and Growth. *The Review of Economics and Statistics*, 91(1):66–82.
- Coatsworth, J. H. (1988). Patterns of rural rebellion in latin america: Mexico in comparative perspective. *Riot, Rebellion, and Revolution: Rural Social Conflict in Mexico*, pages 21–62.

- Coatsworth, J. H. (2006). Political economy and economic organization. *The Cambridge Economic History of Latin America*, 1:237–73.
- Coatsworth, J. H. (2008). Inequality, institutions and economic growth in latin america. *Journal of Latin American Studies*, 40(03):545–569.
- Colella, F., Lalive, R., Sakalli, S. O., and Thoenig, M. (2019). Inference with Arbitrary Clustering. SSRN Scholarly Paper ID 3449578, Social Science Research Network, Rochester, NY.
- Conley, T. G. (1999). GMM estimation with cross sectional dependence. *Journal of Econometrics*, 92(1):1–45.
- de la Croix, D., Doepke, M., and Mokyr, J. (2018). Clans, Guilds, and Markets: Apprenticeship Institutions and Growth in the Preindustrial Economy. *The Quarterly Journal of Economics*, 133(1):1–70.
- Deas, M. (1996). The role of the church, the army and the police in colombian elections, c. 1850–1930. In *Elections Before Democracy: The History of Elections in Europe and Latin America*, pages 163–180. Springer.
- Dell, M. and Olken, B. A. (2020). The development effects of the extractive colonial economy: The Dutch cultivation system in Java. *Review of Economic Studies*, page 51.
- Díaz, F. D. (1977). *La desamortización de bienes eclesiásticos en Boyacá*, volume 12. Universidad Pedagógica y Tecnológica de Colombia, Secretaría de Investigaciones y Extensión Universitaria.

- Dippel, C., Ferrara, A., and Heblich, S. (2019a). ivmediate: Causal mediation analysis in instrumental variables regressions.
- Dippel, C., Gold, R., Heblich, S., and Pinto, R. (2019b). Mediation Analysis in IV Settings With a Single Instrument.
- Domenech, J. and Herreros, F. (2017). Land reform and peasant revolution. evidence from 1930s Spain. *Explorations in Economic History*, 64:82 – 103.
- Droller, F. and Fiszbein, M. (2019). Staple Products, Linkages, and Development: Evidence from Argentina. Technical Report 0898-2937, National Bureau of Economic Research.
- Dube, O. and Vargas, J. F. (2013). Commodity Price Shocks and Civil Conflict: Evidence from Colombia. *The Review of Economic Studies*, 80(4):1384–1421.
- Duran, X., Musacchio, A., and Paolera, G. d. (2017). *Industrial Growth in South America: Argentina, Brazil, Chile, and Colombia, 1890–2010*. Oxford University Press.
- Edwards, R. B. (2019). Export agriculture and rural poverty: evidence from Indonesian palm oil.
- Engerman, S. L. and Sokoloff, K. L. (1997). Factor endowments, institutions, and differential paths of growth among new world economies. In Haber, S., editor, *How Latin America Fell Behind: Essays on the Economic Histories of Brazil and Mexico, 1800-1914*. Stanford University Press.

- Fazio, A. and Sánchez, F. (2010). Educational effects of 19th century disentanglement of catholic church land. *Journal of Iberian and Latin American Economic History*, pages 1–27.
- Fergusson, L. and Vargas, J. F. (2013). Don't make war, make elections-franchise extension and violence in XIXth-century Colombia. *Documento CEDE*.
- Filmer, D. and Pritchett, L. H. (2001). Estimating Wealth Effects without Expenditure Data-or Tears: An Application to Educational Enrollments in States of India. *Demography*, 38(1):115–132.
- Finley, T., Franck, R., and Johnson, N. (2017). The effects of land redistribution: evidence from the French Revolution. *Working paper*.
- Fiszbein, M. (2017). Agricultural Diversity, Structural Change and Long-run Development: Evidence from the U.S. Working Paper 23183, National Bureau of Economic Research.
- Foster, A. D. and Rosenzweig, M. R. (2004). Agricultural Productivity Growth, Rural Economic Diversity, and Economic Reforms: India, 1970–2000. *Economic Development and Cultural Change*, 52(3):509–542.
- Franck, R. and Galor, O. (2017). Technology-Skill Complementarity in Early Phases of Industrialization. Technical Report w23197, National Bureau of Economic Research, Cambridge, MA.
- Galiani, S., Heymann, D., Dabús, C., and Tohmé, F. (2008). On the emergence

- of public education in land-rich economies. *Journal of Development Economics*, 86(2):434–446.
- Galor, O. (2005). The Demographic Transition and the Emergence of Sustained Economic Growth. *Journal of the European Economic Association*, 3(2-3):494–504. Publisher: Oxford Academic.
- Galor, O. and Moav, O. (2004). From Physical to Human Capital Accumulation: Inequality and the Process of Development. *The Review of Economic Studies*, 71(4):1001–1026.
- Galor, O., Moav, O., and Vollrath, D. (2009). Inequality in Landownership, the Emergence of Human-Capital Promoting Institutions, and the Great Divergence. *Review of Economic Studies*, page 37.
- Gennaioli, N., La Porta, R., Lopez-de Silanes, F., and Shleifer, A. (2013). Human Capital and Regional Development. *The Quarterly Journal of Economics*, 128(1):105–164.
- Goldberg, P. K. and Pavcnik, N. (2007). Distributional Effects of Globalization in Developing Countries. *Journal of Economic Literature*, 45(1):39–82.
- Gollin, D., Lagakos, D., and Waugh, M. E. (2014). The Agricultural Productivity Gap. *The Quarterly Journal of Economics*, 129(2):939–993.
- GRECO (2002). *El crecimiento económico colombiano en el siglo XX*. Banco de la República.

- Grossman, H. I. (1994). Production, appropriation, and land reform. *The American Economic Review*, 84(3):705–712.
- Hartlyn, J. (1988). *The politics of coalition rule in Colombia*. Cambridge University Press.
- Heldring, L., Robinson, J. A., and Vollmer, S. (2015). Monks, gents and industrialists: The long-run impact of the dissolution of the English monasteries. Technical report, National Bureau of Economic Research.
- Herrendorf, B. and Schoellman, T. (2018). Wages, Human Capital, and Barriers to Structural Transformation. *American Economic Journal: Macroeconomics*, 10(2):1–23.
- Hirschman, A. O. (1958). *The strategy of economic development*. Yale University Press.
- Hornbeck, R. and Keskin, P. (2015). Does Agriculture Generate Local Economic Spillovers? Short-Run and Long-Run Evidence from the Ogallala Aquifer. *American Economic Journal: Economic Policy*, 7(2):192–213.
- Innis, H. A. (1999). *The fur trade in Canada: An introduction to Canadian economic history*. University of Toronto Press.
- Jacks, D. S. (2019). From boom to bust: a typology of real commodity prices in the long run. *Cliometrica*, 13(2):201–220.
- Jaramillo, R. L. and Meisel, A. (2009). Más allá de la retórica de la reacción. análisis

- económico de la desamortización en Colombia, 1861-1888. *Revista de Economía Institucional*, 11(20):45–81.
- Kalmanovitz, S. (2011). *Nueva historia económica de Colombia*. Taurus.
- Kuznets, S. (1966). *Modern economic growth: findings and reflections*. Nobel foundation.
- LeGrand, C. (1986). *Frontier expansion and peasant protest in Colombia, 1850-1936*. University of New Mexico Press.
- Lewis, A. (1955). *The Theory of Economic Development*. Allen and Unwin, London.
- Matsuyama, K. (1992). Agricultural productivity, comparative advantage, and economic growth. *Journal of Economic Theory*, 58(2):317–334.
- Mazzuca, S. and Robinson, J. A. (2009). Political conflict and power sharing in the origins of modern Colombia. *Hispanic American Historical Review*, 89(2):285–321.
- McGreevey, W. P. (1971). *An economic history of Colombia, 1845-1930*. Cambridge University Press.
- Mejia, J. (2018). Social networks and entrepreneurship. evidence from a historical episode of industrialization.
- Mora, R. and Reggio, I. (2012). Treatment effect identification using alternative parallel assumptions. Technical report, Universidad Carlos III Madrid, Working paper.

- Moscona, J. (2018). Agricultural development and structural change, within and across countries.
- Murphy, K. M., Shleifer, A., and Vishny, R. (1989). Income Distribution, Market Size, and Industrialization. *The Quarterly Journal of Economics*, 104(3):537–564.
- Nieto Arteta, L. E. (1971). *El café en la sociedad colombiana*.
- North, D. C., Summerhill, W., and Weingast, B. R. (2000). Order, disorder and economic change: Latin america vs. north america. In de Mesquita, B. and Root, editors, *Governing for prosperity*. Yale University Press, New Haven.
- North, D. C., Wallis, J. J., and Weingast, B. R. (2009). *Violence and social orders: a conceptual framework for interpreting recorded human history*. Cambridge University Press.
- Nunn, N. and Puga, D. (2010). Ruggedness: The Blessing of Bad Geography in Africa. *The Review of Economics and Statistics*, 94(1):20–36.
- Ocampo, J. A. (1984). The Colombian Economy in the 1930s. In Thorp, R., editor, *Latin America in the 1930s: The Role of the Periphery in World Crisis*, St Antony's Series, pages 117–143. Palgrave Macmillan UK, London.
- Ocampo, J. A. (2015). *Café, industria y macroeconomía: ensayos de historia económica colombiana*. Fondo de Cultura Económica.
- Ocampo, J. A. and Botero, M. M. (2000). Coffee and the Origins of Modern Economic Development in Colombia. In Cárdenas, E., Ocampo, J. A., and Thorp,

- R., editors, *An Economic History of Twentieth-Century Latin America: Volume 1 The Export Age: The Latin American Economies in the Late Nineteenth and Early Twentieth Centuries*, pages 55–84. Palgrave Macmillan UK, London.
- Ocampo, J. A. and Montenegro, S. (2007). *Crisis mundial, protección e industrialización*. Editorial Norma.
- O'Rourke, K. H. and Williamson, J. G. (2002). When did globalisation begin? *European Review of Economic History*, 6(1):23–50.
- Ortiz, L. J. (2010). *Obispos, clérigos y fieles en pie de guerra: Antioquia, 1870-1880*. Universidad de Antioquia.
- Ortiz, L. J. and Javier, L. (1840). Guerras civiles e iglesia católica en Colombia en la segunda mitad del siglo XIX. *Grupo de Investigación Religión, Cultura y Sociedad*. *Ganarse el cielo defendiendo la religión. Guerras civiles en Colombia*, 1902.
- Ospina Vásquez, L. (1955). *Industria y protección en Colombia*. Medellín: ESF.
- Palacios, M. (2002). *Coffee in Colombia, 1850-1970*. Cambridge University Press.
- Parsons, J. J. (1949). *Antioqueño colonization in western Colombia*. University of California Press.
- Perez, S. (2017). Railroads and the rural to urban transition: Evidence from 19th-century Argentina. Technical report, University of California, Davis.
- Porzio, T. and Santangelo, G. (2019). Does Schooling Cause Structural Transformation? In *Barcelona GSE Forum Working Paper*.

- Posada-Carbó, E. (1995). Civilizar las urnas: conflicto y control en las elecciones colombianas, 1830-1930. *Boletín Cultural y Bibliográfico*, 32(39):3–25.
- Prados de la Escosura, L. (2007). When did Latin America fall behind? In *The decline of Latin American economies: Growth, institutions, and crises*, pages 15–58. University of Chicago Press.
- Prebisch, R. (1950). The economic development of Latin America. *ECLAC Thinking, Selected Texts (1948-1998)*. Santiago: ECLAC, 2016. p. 45-84.
- Riascos Grueso, E. (1950). Geografía guerrera colombiana. Cali: Imprenta Bolivariana.
- Rosenstein-Rodan, P. N. (1943). Problems of Industrialisation of Eastern and South-Eastern Europe. *The Economic Journal*, 53(210/211):202–211.
- Ruggles, S., King, M. L., Levison, D., McCaa, R., and Sobek, M. (2003). IPUMS-international. *Historical Methods: A Journal of Quantitative and Interdisciplinary History*, 36(2):60–65.
- Saenz, N. (1892). *Memoria sobre el cultivo del cafeto*. Imprenta de la Luz.
- Safford, F. and Palacios, M. (2002). *Colombia: Fragmented land, divided society (Latin American histories)*. Oxford Univ. Press, Oxford.
- Salvucci, R. (2006). Export-Led Industrialization. In Bulmer-Thomas, V., Coatsworth, J., and Cortes-Conde, R., editors, *The Cambridge Economic History of Latin America*.

- Santos Cardenas, D. (2017). From Skirts to Slacks: Female Workers and Wage Gap in the Colombian Industry in 1945. SSRN Scholarly Paper ID 3040722, Social Science Research Network, Rochester, NY.
- Schultz, T. W. (1964). *Transforming traditional agriculture*. Yale University Press.
- Shaw, C. (1941). Church and state in colombia as observed by american diplomats, 1834-1906. *The Hispanic American Historical Review*, 21(4):577–613.
- Squicciarini, M. P. and Voigtländer, N. (2015). Human Capital and Industrialization: Evidence from the Age of Enlightenment. *The Quarterly Journal of Economics*, 130(4):1825–1883.
- Stokey, N. L. (1991). Human Capital, Product Quality, and Growth. *The Quarterly Journal of Economics*, 106(2):587–616. Publisher: Oxford Academic.
- Sviatschi, M. M. (2018). Making a Narco: Childhood Exposure to Illegal Labor Markets and Criminal Life Paths.
- Tovar, J. A. (2007). *La manumisión en Colombia: 1821-1851: un análisis cuantitativo*. Universidad de los Andes, Facultad de Economía, CEDE.
- Valencia Caicedo, F. (2019). The Mission: Human Capital Transmission, Economic Persistence, and Culture in South America. *The Quarterly Journal of Economics*.
- Vollrath, D. (2011). The agricultural basis of comparative development. *Journal of Economic Growth*, 16(4):343–370.

Wallerstein, I. (2011). *The modern world-system I: Capitalist agriculture and the origins of the European world-economy in the sixteenth century*, volume 1. Univ of California Press.

Williamson, J. G. (2011). Industrial Catching Up in the Poor Periphery 1870-1975. Working Paper 16809, National Bureau of Economic Research.