Multinationals and Development: Evidence from the United Fruit Company in Costa Rica

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Abstract

We analyze the impact of large-scale FDI on economic development by considering an agricultural multinational with well-defined boundaries: the enclave of the United Fruit Company (UFCo) in Costa Rica from 1889 to 1984. We implement a geographic regression discontinuity design that exploits a quasi-random assignment of land, and the availability of restricted microdata georeferenced at the census block level for 1973, 1984, 2000 and 2011. The range covered by the censuses allow us to identify the company's effect during its tenure, and assess its short- and long-run impacts after it stopped production. We find a positive, large and persistent effect on key outcomes in areas where the company operated. Households located in former UFCo lands are less likely of being poor and have a better satisfaction of basic needs (housing, sanitation, education, and consumption capacity). Moreover, we validate our finding using nighttime lights data and conclude that the former UFCo areas are relatively brighter, suggesting a higher level of income and economic activity. We propose that the mechanisms behind our results are investments in physical and human capital carried out by the UFCo, such as sanitary and health programs, housing for its employees, and vocational training.

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"It happened once that someone at the table complained about the ruin into which the town had sunk when the banana company had abandoned it, and Aureliano contradicted him with maturity and with the vision of a grown person. His point of view, contrary to the general interpretation, was that Macondo had been a prosperous place and well on its way until it was disordered and corrupted and suppressed by the banana company..."

Gabriel García Márquez,
One Hundred Years of Solitude

1 Introduction

Multinational companies have been a major driver for the spread of global capitalism. As multinationals grew in number and scale, they began evoking mixed feelings among the general public and policymakers up to become heroes or villains of the globalized economy. However, finding a counterfactual that helps to settle the debate has proven to be a challenge. The first difficulty is that most multinationals do not have a well-defined area of influence. The second challenge is that multinationals do not choose their location randomly, and especially in the case of agricultural companies, they want to exploit the more appropriate land for its interests. We overcome both challenges by studying an agricultural multinational with a well-defined and extensively documented boundary, which was the product of a quasi-random allocation of land.

In particular, we study the case of the United Fruit Company (UFCo) in Costa Rica. Founded in 1899, the UFCo was engaged in the cultivation and commercialization of tropical fruits (primarily bananas). By 1930 the UFCo had become one of the largest multinational corporations in the Western Hemisphere: it owned 3 million acres in Latin America (roughly the size of Connecticut) and controlled approximately 80% of the global banana production. While some commentators have admired the UFCo for transforming jungles into centers of human activity with a well-organized plantation economy, most have accused the UFCo of being responsible for creating "Banana Republics": politically unstable countries dependent on a single exportation product produced by foreign enterprises.

To identify the causal effect of the UFCo on its host country, we use a regression discontinuity (RD) approach. The approach compares units located in a close distance but

on different sides of the UFCo boundary where geographic characteristics are balanced. Our setting is an ideal case-study, as there is historical evidence of a quasi-random assignment of some portion of the land allocated to the UFCo. In 1904 the government issued a decree to clarify differences in the interpretation of the original land concession granted to the company. The decree announced some wastelands as state property, and specified that the property rights over these lands should be sold only to nationals and restricted its use to agricultural colonization. Because at that time the Atlantic Coast of Costa Rica was hardly explored, the drawing of the boundaries was arbitrary and based on salient features of the environment. For example, the decree stipulates among the limits *"an imaginary line from the intersection between Toro Amarillo river with the old railroad up to a point in the coast located five miles northeast from the mouth of Tortuguero river."* (ANCR, 1904, p. 44)

The RD approach requires detailed data to increase the precision of its results. We use restricted access census micro-data available for 1973, 1984, 2000, and 2011; geo-referenced at the census block level. The census block is the smallest territorial division of the country, and although its original purpose to organize census enumeration, in our case the level of disaggregation allows us to compare households in a close distance, including values as small as 1 km. Moreover, given that the multinational operated in Costa Rica from 1899 to 1984, the span of years covered in the census allows us to understand the impact of the company during its tenure, but also to explore the dynamics of these effects; studying short-, medium- and long-run impact on the region's overall development. Both the quasi-random design of the boundary and the availability of disaggregated data are key aspects of our identification strategy. Through the regression discontinuity approach, we compare units located in areas with similar geographic characteristics and who have lived under the same national institutions but exposed differently to a multinational company.

We show that the UFCo had a positive, large and long-lasting impact on the regions where it operated.[1] In particular, in areas where the company was located, we find less poverty and better satisfaction of basic needs (housing, sanitation, education, and consumption capacity). Also, we find a higher luminosity in the former UFCo areas, a proxy

[1]Measured by looking at the economic outcomes of these regions. We do not claim the company had a positive impact on every aspect of life, or for the country as a whole.

for higher levels of income and economic activity. Moreover, we identify investments in physical and human capital carried out by the UFCo, such as hospitals, sanitary programs, and schools, as relevant mechanisms behind our results. The individuals within the former UFCo plantations have more years of schooling and a higher probability of completing primary education.

Moreover, we document how public investment on the region outside the boundary during the company's tenure was significantly higher than on average Costa Rican rural areas, even within the same province. This indicates that our results are unlikely to be driven by lower levels of government spending in the vicinity of the company.

The results of our paper contribute to several strands of the literature. Our paper is related to a growing body of literature which analyzes the long-run impact of historical institutions on economic development (e.g., Banerjee and Iyer 2005; Gennaioli and Rainer 2007; Iyer 2010; Michalopoulos and Papaioannou 2013). Our paper complements this literature by analyzing outcomes during the company's tenure, when the institutions were being formed, along with the short-, medium- and long-run effects of these institutions. Further, while most of the existing literature on the long-run impact of historical institutions on economic development have considered settings where labor was coercive; such as the slave trade (Nunn, 2008), the *mita* system (Dell, 2010), the forced rubber cultivation (Lowes and Montero, 2016), or the Dutch Cultivation System (Dell and Olken, 2017), we study an institution within the context of global free-market capitalism. Moreover, in contrast to most of the literature which has found long-run negative economic impacts due to institutional persistence, in our case, we find a positive effect of the UFCo. Similar to Dell and Olken (2017), who also found a positive effect, in our case the investments carried out by the company can explain the results.

Furthermore, most studies that use microdata have a level of aggregation at the district (e.g., Dell 2010; Dell et al. 2015) or village level (e.g., Lowes and Montero 2016). One exception is Becker et al. (2016), that uses a level of aggregation based on electoral registers or census enumeration areas. However, their dataset is representative only at the national level. In our paper, we use a novel dataset that contains geo-referenced information of the census block where the household is located, collected through several Costa Rican census. This allows us to work with a higher level of disaggregation. This level of disaggregation is

rarely available, especially in developing countries, and is key when performing a geographic RD to precisely identify observations at a nearby distance.

Our paper also speaks to the debate on the effects and spillovers of FDI. Empirical studies of the effects of FDI have produced mixed evidence. While some studies find evidence of FDI being beneficial using macro- and micro-data (e.g., Blomstrom 1986, Blomstrom and Wolff 1989, Lipsey 2002, Smarzynska Javorcik 2004, Harrison and Rodríguez-Clare 2009), others are not so optimistic about these benefits, especially for developing countries (e.g., Aitken and Harrison 1999 , Borensztein et al. 1995, Xu 2000, Alfaro et al. 2003, Alfaro and Charlton 2007). We provide novel micro-evidence of the benefits of large-scale FDI through our historical setting, arguing that even in the case of one of the most controversial multinationals in history we find evidence of positive and persistent effects.

Finally, our paper also contributes to the study of the legacy of the UFCo, one of the largest and more controversial multinationals in history. As the economic importance of the UFCo increased in the host countries, the multinational gained an increasing power to shape their domestic politics. With arms over both economic and political spheres, the UFCo became known as *El Pulpo* (the octopus). Soon *El Pulpo* was a phenomenon hard to ignore for the host countries societies. Therefore, it is not surprising that the company inspired an extensive literature, ranging from fiction works[2] to academic research. Virtually all studies that rely on quantitative data consider the impact of the UFCo at the aggregate level, analyzing national or local trends in productivity, land patterns, export levels, and labor mobility (e.g., Casey 1979; Ellis 1983; Viales 1998; Royo 2009). To the best of our knowledge, our paper is the first analysis of the legacy of the UFCo using microeconomic data to obtain quantitative estimations regarding its impact.

The rest of the paper is organized as follows. Section 2 provides an overview of the historical background. Section 3 includes details of the data used in our analysis. We describe our estimation framework in Section 4. Section 5 includes our results and discussion about the mechanism behind our findings. Finally, Section 6 presents our concluding remarks.

[2]Some examples of fiction works where the UFCo is present are the novels: "Mamita Yunai" by Carlos Luis Fallas, the "Banana Republic Trilogy" ("Strong Wind", "Green Pope", and "The Eyes of the Interred") by Miguel Ángel Asturias, and "One Hundred Years of Solitude" by Gabriel García Márquez.

2 Historical Background

2.1 The United Fruit Company

The United Fruit Company (UFCo) was founded in 1899 after the Tropical Trading and Transport Company merged with the Boston Fruit Company. Each company was engaged in the banana business, and their assets and market share complemented well (Bucheli, 2005, p. 47). On one hand, the Tropical Trading and Transport Company owned railroad networks, plantations in Central America, and served the southeastern market in the United States. On the other hand, the Boston Fruit Company had plantations in the West Indies, a line of steamships, and served the northeastern market in the United States. The merger allowed the companies to diversify the risk, by counterbalancing any disaster in one region, originated from climate or political hazards, with crops from distant plantations (Kepner and Soothill 1935, p. 35, May and Lasso 1958, p. 6)

The banana is a fruit that perishes quickly and easily. To avoid losses, the UFCo coordinated the whole banana production process from the beginning to the end.[3] Through its investments in all production stages, the UFCo became the first vertically integrated fruit multinational (Jones, 2005, p. 51). The UFCo acquired lands in scarce populated humid lowlands where the states had not effectively imposed their authority. The UFCo transformed these lands from tropical forests to plantations and towns that revolved around banana activity. The remoteness of its territory allowed the UFCo to act as an enclave, a "state within a state", dictating policies according to its corporate needs. To increase labor efficiency in an environment threated by tropical diseases, the UFCo provided in its towns healthcare, housing, and sanitation to its workers. The UFCo also invested in infrastructure, such as the railroads necessary to carry the bananas from the plantations to the ports, which were also controlled by the UFCo. Once in the ports, the bananas were shipped to the United States and Europe in the company's vessels, known as the Great White Fleet. Finally, the bananas were distributed to wholesale and retailers through its subsidiaries, the Fruit Dispatch Company in the United States and Elders & Fyffes in Europe.[4] To efficiently coordinate the whole banana production process, the UFCo

[3] See Cutter (1926) or Palmer (1932) for a detailed account of the UFCo banana production stages.

[4] The UFCo was responsible for popularizing bananas and promoting consumption patterns, such as having cornflakes with bananas for breakfast.

installed most-up-date wireless communication systems, such as radio.

In three decades the UFCo became the biggest banana producing and marketing corporation in the world, consolidating a monopoly in the banana market (Ellis 1983, p. 42; Bucheli 2005, p. 49). By 1930, production from the UFCo represented close to 80% of the global banana production. According to the UFCo's Annual Reports to the Shareholders, by 1930, the company landholding reached 13,339.12 km^2 (roughly the size of Connecticut). The company operated in Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, Guatemala, Honduras, Jamaica, Nicaragua, and Panama (May and Lasso, 1958, p. 104). Although its principal crop was bananas, the UFCo also produced sugar, cacao, oil palm, abacá (Manila hemp), and rubber. The UFCo reached its peak in late 1920. After 1930 the hegemony of the UFCo was affected by several challenges (Wiley, 2008, p. 37-38). First, a fungus, known as Panama disease wiped out the output of entire plantations. Then, the Great Depression and Second World War reduced the demand in consumer countries.

After the second half of the twentieth century, the challenges to the UFCo hegemony continued as a result of a different environment in its host countries, in the US, and in the banana industry. In its host countries, the UFCo faced an increased labor union activity and a growing nationalism (Wiley, 2008, p. 69). In the US, the Department of Justice filed a case against UFCo for violating antitrust legislation that forced the company to sell part of its holdings (Bucheli, 2005, p. 61). Finally, in 1956 the banana industry had a major technological transformation when the UFCo's main rival, Standard Fruit Company, introduced a variety of banana that was resistant to the Panama disease(Ellis, 1983, p. 176-178). The technical lead can explain that Standard Fruit Company increased his US market share from 16% in 1955 to 31% in 1966, while the UFCo reduced its participation from 64% to 56% (Arthur et al., 1968, p. 156). More problems followed, as in 1974, Hurricane Fiji destroyed 70% of the company's plantations in Honduras (Mirabile and Derdak, 1990, p. 595). By 1984, Carl Lindner became CEO of the company and made significant divestitures by selling several subsidiaries and focusing mainly on marketing banana, buying the product from local producers.

2.2 Banana Plantations and the United Fruit Company in Costa Rica

The history of banana plantations in Costa Rica gets back to the construction of a railroad to the Caribbean Coast. Since the 1840s coffee rapidly expanded and became virtually the single Costa Rica's exportation product, representing between 1840 and 1890 around 90% of the total value of exports (Hall, 1978, p. 41). However, even though Europe was the main exportation destiny, Costa Rica's only port was on the Pacific Coast. Although the Caribbean Coast provided a more efficient access to Europe, it was completely isolated from the historic core region (the central valley) and without any relevant settlements (Hall, 1978, p. 59-67). Therefore, in 1871 the government contracted the construction of a railroad to the Caribbean Coast to Henry Meiggs, an entrepreneur that have build railways in Chile and Peru. Upon signing the contract, Meiggs delegated the construction to its nephews Henry Meiggs Keith and Minor Cooper Keith.

The limited knowledge of the Caribbean Coast led to underestimating the costs of the construction. In 1874, financial difficulties together with difficult working conditions[5] forced to suspend the construction (Casey, 1976). To conclude the railroad, through the Soto-Keith contract, in 1884 the government gave Minor C. Keith a concession of 3,333 km^2 of undeveloped land (roughly the size of Rhode Island, and equivalent to 6.5% of the national territory), and the lease of the railroad for 99 years (Casey, 1979, p. 26). After completing the construction, Keith experimented with exporting the bananas he had planted along the railroad tracks to feed the workers during the construction (Bucheli, 2005, p. 46). The experiment was successful, and Keith organized the Tropical Trading and Transport Company, which merged in 1899 with the Boston Fruit Company to form the UFCo. In the subsequent years, the banana business increased in volume and importance and by 1905 bananas had reached the same place in Costa Rica's exporting value than coffee.

The banana activity and in particular the UFCo transformed Costa Rican economic structure in a significant way. The banana production gave place to centers of economic activity in the lowlands, far from the regions specializing in coffee farming. Bananas broke down the monoculture based on coffee, and because the UFCo monopolized the market, the

[5]For example, tropical diseases caused that around five thousand men died during the railroad construction.

multinational obtained an enormous influence in Costa Rican economy. By 1950 the UFCo was responsible for 42% of the country's total exportations. The UFCo landholding in the country was equivalent to 1,823 km^2, representing roughly 3.57% of the national territory (demarcated in Figure 1). Moreover, the UFCo employed approximately 6.85% of Costa Rican economically active population. The role that the UFCo had reinforces the choice of Costa Rica as a case study on how a multinational can impact economic development.

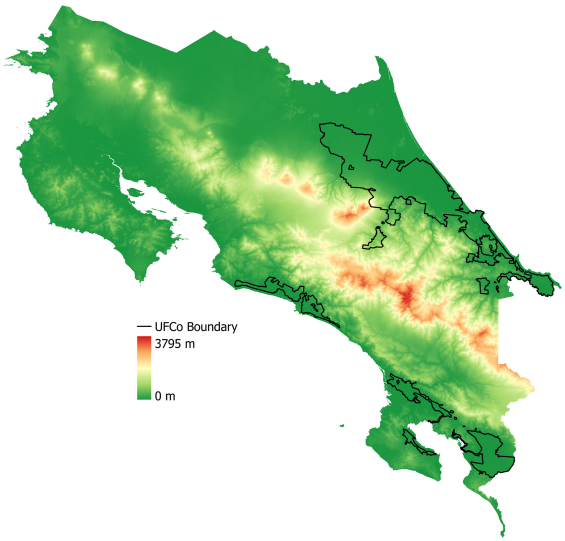


Figure 1: Landscape and UFCo lands

Due to anti-trust laws from the American Government, labor conflicts, soil exhaustion and an increase in production costs the UFCo abandoned banana production in 1984 (Royo, 2009, p. 37). More details are provided in Appendix A.

3 Data

3.1 Outcome Data

We acquired restricted access microdata from 1973, 1984, 2000, and 2011 Costa Rican Censuses collected by the National Institute of Statistics and Census (*Instituto Nacional de Estadística y Censos (INEC)*). As the UFCo stopped operations in 1984, the range covered by these censuses allow us to analyze the outcomes during and after the company's tenure.

The data is recorded at the census block level. The census block is the smallest territorial division of the country, and it has an exclusively statistical purpose: to help census enumeration. The size and delimitation of a census block change across censuses. For 1973, 1984, and 2000 census each census block contains approximately 60 dwellings in urban areas and 40 dwellings in rural areas, and it tends to be constituted by one or two city blocks in urban areas (Bonilla and Rosero, 2008). For the 2011 census, a higher level of spatial disaggregation is possible through the introduction of the Minimal Geostatistical Unit (MGU). The MGUs delimits the space using physical boundaries such as streets, avenues, roads, highways, rivers, or lakes. Therefore, in most cases, the MGU coincides with a city block (Fallas-Paniagua, 2013). The data include each census block centroid's latitude and longitude coordinates. The level of spatial disaggregation provided by the census block data allows us to compare observations within close proximity of each other.

Except for the 1973 census, which includes information on wages, later censuses do not contain income or consumption information. Therefore, to generate variables on economic outcomes, we follow the "Unsatisfied Basic Needs" (UBN) method. The UBN method was introduced by the Economic Commission for Latin America and the Caribbean (ECLAC), to identify households in poverty without relying on income data (Feres and Mancero, 2001). The method requires specifying a set of basic needs and a threshold for attaining those needs (Armendáriz and Larraín B., 2017).

Méndez and Trejos (2004) propose a set of unsatisfied basic needs for Costa Rica using data from the 2000 census, and given the similarity of the questions, it is straightforward to apply their method to the 2011 census (Méndez and Bravo, 2014). To extend the method to the 1973 and 1984 censuses, we restrict the set of unsatisfied basic needs to those whose information is available in all the four censuses considered in our paper. In total, we define four dimensions: housing, sanitation, education, and consumption. Appendix B details the variables from the census that constitute each dimension. A general description of each dimension is:

- Housing: it refers to the quality of the household dwelling's material and household overcrowding.
- Sanitation: it refers to the method for disposal of human excreta that the household uses.

- Education: it refers to school attendance and academic achievement for household members from 7 to 17 years old.

- Consumption: it refers to the relationship between the number of income recipients (employed, pensioners, or rentiers), their years of schooling, and the total number of household members.

We consider a household as poor if it has at least one unsatisfied need. Moreover, we estimate the severity of poverty through the total number of UBN. The total number of UBN is an index that ranges from 0 to 4, where each unsatisfied basic need adds one point to the index.

Furthermore, based on a series of papers that have shown a correlation between nighttime lights and economic activity (Chen and Nordhaus 2011; Henderson et al. 2012; Michalopoulos and Papaioannou 2014; Hodler and Raschky (2014)), we use nighttime lights data. As this literature shows, satellite-recorded data on nighttime lights provide a proxy for income and economic activity. The data on nighttime light is collected by the US Air Force Defense Meteorological Satellite Program's Operational Linescan System (DMSP-OLS) and is processed by the National Oceanic and Atmospheric Agency's (NOAA) National Geophysical Data Center (NGDC). The data covers the years 1992 to 2013 at a spatial resolution of 30 arc-seconds. For each grid cell, an integer between 0 (no light) and 63 represents its light intensity.

3.2 Historical Data

We also use data from 1864, 1892, 1927, 1950, and 1963 Costa Rican Census. Although these censuses do not contain enough spatial detail as to be considered in our regression discontinuity (RD) design, the information allows us to analyze aggregated migration patterns before and during the UFCo apogee.

The documents published by the UFCo provide valuable information to explain the mechanism behind the effect found in our paper. From 1912 to 1931 the Medical Department of the UFCo published an annual report describing the sanitation and health programs carried out by the company as well as the living conditions within the UFCo plantations. Moreover, the company regularly circulated reports to inform the general

public about its contribution to the host countries. These reports contain information about wages, number of employees, production, and investments in areas such as education, housing, and health. We obtained copies of these documents from collections held by Cornell University, University of Kansas, and the Center for Central American Historical Studies (*Centro de Investigaciones Históricas de América Central (CIHAC)*).

Moreover, the 1907 to 1917 Costa Rican Statistic Yearbooks contain information on the number of patients and health expenses carried out by the hospitals in Costa Rica, including the ones ran by the UFCo. The Statistic Yearbooks from 1908 to 1948, and the Export Bulletin 1941-1947 also contain information on product exportations, exportation by coasts, and land use.

3.3 Location of the UFCo

To help organize the production and keep track of land use, the UFCo Engineering Department made maps of the company's properties. The maps contain detailed information about farms, railroads, buildings, and landforms. The National Archives of Costa Rica (*Archivo Nacional de Costa Rica*) has a collection of such maps. While some of the maps have been digitized by the Virtual Map Library of the National University of Costa Rica (*Mapoteca Virtual de la Universidad Nacional de Costa Rica*) gathering all the available maps implied traveling to Costa Rica, taking high-quality pictures of the original maps, and digitalizing them. Based on these maps we obtain data on the location of the plantations. Figure 8 in Appendix C provides an example of a map showing the UFCo landholdings in the Costa Rican Pacific Coast.

3.4 Geographic Data

We obtained the elevation and temperature data from the Global Climate Database created by Hijmans et al. (2005). The spatial resolution is 30 arc-seconds (approximately 1 km^2 at the equator). The elevation above sea level is in meters and was constructed using NASA's Shuttle Radar Topography Mission (SRTM) data. From the elevation information, we calculate the slope data (in degrees). Hijmans et al. also compiled monthly averages of temperature measured by weather stations from 1960 to 1990. We measure temperature in Celsius and take the annual average for our analysis.

4 Estimation Framework

This section explains our identification strategy. First, we outline the specification that will allow us to disentangle the UFCo effect: a regression discontinuity (RD) design. We then provide details on how we implement this RD, choose the boundary where our study is conducted, and the key elements of the setting that allows of to cleanly identify the UFCo effect.

To estimate the causal effect of the UFCo, we use well-defined boundaries based on historical records and compare observations located just inside former UFCo plantations to observations located just outside them. We estimate the following RD specification:

$$y_{igt} = \gamma\, UFCo_{gt} + f(\text{location}_{gt}) + \mathbf{X}_{igt}\beta + \mathbf{X}_{gt}\Gamma + \alpha_t + \varepsilon_{igt}, \tag{1}$$

where y_{igt} is an outcome of individual or household unit i in census block g and year t. $UFCo_{gt}$ is an indicator equal to one if the census block g's centroid was inside a UFCo plantation and equal to zero otherwise. $f(\text{location}_{gt})$ is a RD polynomial, which controls for geographic location of census block g. $\mathbf{X}_{igt}$ is a vector of covariates for individual or household i. $\mathbf{X}_{gt}$ is a vector of geographic characteristics for census block g. α_t is a year effect. The coefficient γ is our main parameter of interest because it captures the effect of being in a zone under the UFCo's control.

The arguments in the RD polynomial are latitude and longitude. Following Gelman and Imbens (2017), and in line with recent work whose estimation framework relies on a geographical regression discontinuity design (e.g., Dell et al. 2015; Lowes and Montero 2016), we use a linear RD polynomial and test for robustness to a variety of specifications.

To analyze the dynamics of the UFCo effect over time, we allow a different coefficient for the UFCo effect in every census, by estimating the following RD specification:

$$\begin{aligned} y_{igt} =& \gamma_{1973}\, UFCo_{g,1973} + \gamma_{1984}\, UFCo_{g,1984} + \gamma_{2000}\, UFCo_{g,2000} + \gamma_{2011}\, UFCo_{g,2011} + \\ & f(\text{location}_{gt}) + \mathbf{X}_{igt}\beta + \mathbf{X}_{gt}\Gamma + \alpha_t + \varepsilon_{igt} \end{aligned} \tag{2}$$

where $UFCo_{g,t}$ is an indicator variable equal to one if at time t individual or household unit i is in census block g whose centroid was inside a UFCo plantation and equal to zero otherwise.

Quasi-Random Land Assignment: One of the assumptions required by a geographical RD is that all relevant factors besides treatment must vary smoothly at the UFCo boundary. This assumption is required to claim that observations located just across the former UFCo plantations are a good counterfactual for those located just across the non-UFCo areas.

In general, the UFCo followed a policy of continuous expansion to new fields to counter soil exhaustion and the appearance of banana diseases (Jones and Morrison, 1952). At the moment of deciding which lands to own and operate, the firm took into consideration geographic characteristics.[6] This land accumulation pattern, coupled with the variety in climate and ecological zones that characterize Costa Rica,[7] explain why geographical features change discretely along many segments of the UFCo boundary. For example, Figure 1 shows that in the Pacific Coast, the UFCo domains coincide with the lowlands, while nearby regions have a higher elevation. As a consequence, the areas out of the UFCo landholdings were mostly inappropriate for tropical fruit production.

However, in the Atlantic Coast, a clarification of the land concessions granted by the government lead to a zone where the land was assigned quasi-randomly. Initially, due to ambiguities in certain capsules of the Soto-Keith contract, the UFCo and the government had some discrepancies on the land concessions. In 1904, a legislative decree modified the Soto-Keith contract, resolving the differences in criterion between the government and the UFCo. As a result, the modification declared some wastelands, that the UFCo considered as part of the original concessions, as state property, establishing a region known as Astúa-Pirie (Soley, 1940, p. 90). The decree specified that the property rights over these lands should be sold only to nationals and restricted its use to agricultural colonization (Viales, 2012).

Because the Atlantic Coast was completely isolated from the more densely populated areas and most of it was unexplored,[8] the Astúa-Pirie Region's limits were drawn using

[6] Casey (1979, p. 46) and Cerdas Albertazzi (1993, p. 122-123) refer to edaphological studies considered by the UFCo when deciding if expand operations to Coto, Esquinas, Palmar, and Sarapiquí area.

[7] Although Costa Rica covers a relatively small continental area of 50,980 km^2, the topographic extremes, combined with changes in slope, wind direction, and orographic precipitation result in a variety of micro-climates, vegetation cover, and soil types within short distances (Alvarado and Cárdenes, 2016)

[8] Keith wrote that when he first arrived "Limón and all the country between it and the cultivated portions of the interior was a dense wilderness. With the exception of the little village of Matina, which contained fifty or sixty inhabitants, not one individual was settled anywhere on the line. In fact, the route had not

salient features of the landscape as a reference. In particular, the boundary was chosen so that it would be easy to enforce for the local authorities. The legislative decree declared that on the south the boundary *"follows the Reventazón River, from La Junta to the Caribbean Sea."*[9] On the east, the boundary adjoins the *"Atlantic Ocean"*. On the northern part of the region, the boundary *"follows an imaginary line drawn from the intersection between Toro Amarillo River with the old railroad up to a point in the coast located five miles northeast from the mouth of Tortuguero River."*[10] Finally, the western boundary *"follows the main railroad, from La Junta to the point where the railroad crosses Toro Amarillo River"*.(ANCR, 1904, p. 44)

This quasi-random design of the boundary is consistent with why the geographic characteristics change continuously across this segment of the UFCo boundary where we focus our attention (see Figure 2). Table 1 shows that elevation, slope, and temperature do not change discretely across this segment of the UFCo boundary. The unit of analysis to examine the geographic characteristics is a 1x1 km grid cell,[11] and we present both robust standard errors, and standard errors that account for spatial correlation (Conley, 1999).[12] Table 1 also shows that consistent with the geography as we move far away from this segment of the boundary the differences in elevation, slope, and temperature become significant. Therefore, exploiting our disaggregated data, and not to contaminate the analysis due to changes in the landscape, our paper restricts attention to census block located at most within 5 km from this segment of the UFCo boundary.

Preexisting social and economic characteristics: Besides the geographical characteristics, in a geographical regression discontinuity design preexisting social and economic characteristics should also change smoothly at the boundary. In our case, the study area was practically uninhabited before the railroad construction and the UFCo arrival. Ac-

even been explored, and the rivers were first named when the engineers crossed them."(Keith, 1886, p. 8).

[9] "La Junta" was the point where the railroad from San José intersected the railroads from Limón and Guápiles.

[10] The "old railroad" was the name given to the railroad to Guápiles because it was the remains of an unsuccessful previous attempt to build a railroad to the central valley.

[11] All results are similar if the MGUs are the unit of analysis.

[12] We compute Conley Standard errors at the cutoff distance of 2 km. However, the results are robust to alternative cutoffs.

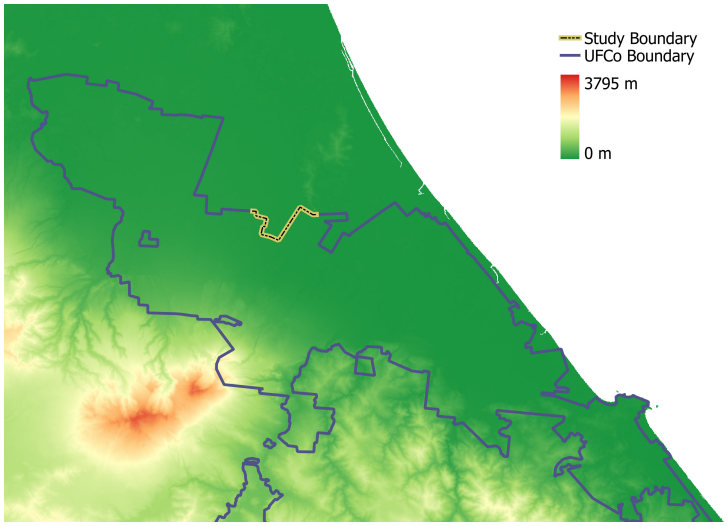


Figure 2: Study boundary.

Table 1: Balance on Geographic Characteristics

	Sample falls within					
	<5 km of UFCo boundary			<10 km of UFCo boundary		
	Inside	Outside	s.e	Inside	Outside	s.e
Elevation	38.552	38.235	(1.330)	50.893	37.759	(2.273)***
			[3.530]			[6.514]**
Slope	0.256	0.312	(0.072)	0.493	0.328	(0.063)***
			[0.140]			[0.154]
Temperature	26.087	26.097	(0.006)	26.028	26.097	(0.011)***
			[0.014]			[0.031]**
Observations	96	85		168	141	

Notes: The unit of observation is 1x1 km grid cells. Robust standard errors for the difference in means between UFCo and non-UFCo observations are in parentheses. Conley standard errors for the difference in means are in brackets.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

cording to the 1864 Population Census, only 545 people lived in the Atlantic Coast, a 0.45% of Costa Rica population at that time (Oficina Central de Estadística, 1868).

Migration: Another assumption for an RD design is that individuals cannot precisely manipulate the assignment variable. On one hand, differential rates of migration at the time of each census are relevant for our long-run analysis. Each census contains information about individuals' place of residence 5 years before the census took place. In the census block located in UFCo areas, 9.35% of individuals migrated from a former non-UFCo canton, while in the non-UFCo areas 11.90% of individuals migrated from a UFCo canton. Table 2 shows that the migration rates are decreasing over time and their difference is not statistically significant. As a robustness check, we examine the influence of migration in the estimates, by running all our regressions excluding migrants, with no change in our conclusions.

Table 2: Migration Rates in UFCo and Non-UFCo Census Blocks (Percentage)

Census	UFCo census block (1)	Non-UFCo census block (2)	p value for difference (3)
1973	16.83	32.74	0.37
1984	14.62	13.48	0.79
2000	7.45	10.25	0.24
2011	6.20	6.73	0.69
All	9.35	11.90	0.30

Notes: The p values in the third column are for the test of the hypothesis that the rates of migration in the UFCo and non-UFCo areas are equal. The p values are clustered at the census block level.

On the other hand, historical migration during UFCo operation is important. Table C.2 in our Appendix summarizes the population dynamic from census data for Limón Province. Between 1883 and 1927 Limón had annual population growth rates higher than the national population growth rates. The increase in population is primarily a consequence

of the railroad construction and the banana activity (Casey, 1979, p. 214). Table C.3 in Appendix shows that the increase was driven by international migration. Initially, the lightly populated Costa Rica combined with the hard working conditions made difficult to recruit labor for rail construction and grow bananas. As a labor source, Minor C. Keith resorted to convicts from New Orleans jails (Bucheli, 2005, p. 46), and he also increased wages. The higher wages attracted mostly immigrants from the economically-depressed sugar plantations in the Antilles(Viales, 1998, p. 44-45). After 1927 both the population growth rate and the foreigner population in Limón decreases due to a decline in the banana activity and restrictions imposed by the government on international immigrants.[13]

Commuting: Another concern for the identifying assumption could be that people who lived outside the UFCo plantations commuted and worked for the company. However, this is unlikely to be the case. Different to other types of agricultural activities that require labor on a temporal basis, the UFCo needed a permanent labor supply of around 150 workers per 800-acre farm. Due to the extension of the plantations and to reduce transportation costs the UFCo created camps within their farms for its workers (Cerdas Albertazzi, 1993, p. 141). The typical farm consisted of 800 acres of land, with about 20 acres devoted to campsite and buildings, and 150 acres to pasture land (Jones and Morrison, 1952, p. 14). Besides houses and administrative buildings, special facilities were also present, such as commissaries, schools, electric plants, sewage systems, and recreational facilities (Wiley, 2008, p. 29). Figure 9 in Appendix C provides an example of a map showing the distribution of a typical banana farm.

Moreover, people in the surrounding areas did not enjoy the services provided by the company. For example, as we describe in detail in Section 5, when examining data on the patients attended at the UFCo's hospitals, very few of them were not on the company's payroll. Given that hospitals were one of the services in which the UFCo was superior to any local provider, this supports our claim that there was no commuting to enjoy the amenities the company provided.

[13]To avoid "Africanization" of the country the Costa Rican government prohibited hiring black immigrants in the Pacific enclave. Moreover, in 1942 the government passed a decree prohibiting the "non-white" migration (Harpelle, 2001, p. 141).

5 Results

Table 3 presents the results of estimating equation 1 using as our dependent variables the probability of having an unsatisfied basic need (in housing, sanitation, education, and consumption), the probability of being poor, and the total number of unsatisfied basic needs. All regressions include geographic controls, demographic controls for the number of household members aged 0-4 (infants), 5-14 (children), and 15 and older (adults), census fixed effects, and a linear polynomial in latitude and longitude. We report Conley standard errors and standard errors clustered at the census block level.

Table 3: Contemporary Household Outcomes: Average UFCo Effect

	Probability of UBN in				Probability	Total number
	Housing	Sanitation	Education	Consumption	of being poor	of UBN
	(1)	(2)	(3)	(4)	(5)	(6)
UFCo	-0.095	-0.016	-0.057	-0.059	-0.124	-0.228
	(0.026)***	(0.017)	(0.022)**	(0.025)**	(0.031)***	(0.057)***
	[0.029]***	[0.015]	[0.019]***	[0.025]**	[0.026]***	[0.051]***
Adjusted R^2	0.102	0.173	0.241	0.015	0.115	0.200
N				8,786		
Clusters				200		
Mean	0.176	0.060	0.235	0.200	0.481	0.670

Notes: UBN= Unsatisfied Basic Need. The unit of observation is the household. Robust standard errors, adjusted for clustering by census block, are in parentheses. Conley standard errors are in brackets. All regressions include geographic controls for slope, elevation, and temperature; demographic controls for the number of adults, children, and infants in the household; census fixed effects, and a linear polynomial in latitude and longitude.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The estimates suggest that the households located in the former UFCo region are in general better off. Column (1) to (4) of Table 3 shows that the households have a lower probability of having an unsatisfied basic need in each of the dimensions. Moreover, the UFCo effect decreases the probability of being considered poor in about 12.4 percentage points (column 5). Finally, the severity of poverty is lower in the former UFCo areas,

where the households have on average 0.228 fewer shortcomings than the households in the non-UFCo region (column 6). Except for sanitation, all the magnitudes are statistically significant at the 1% or 5% level.

Table 4 explores how the UFCo effect changed across time. The company stopped operations in 1984, and we examine census data from 1973, 1984, 2000, and 2011. Therefore, we can disentangle the differentiated effects of the company's presence during its tenure, and also at different points in time after it stopped operating. We first discuss persistence on the probability of having a UBN (columns 1-4). For the housing dimension, the effect is very persistent across years. In 2011, approximately 30 years after the UFCo left, households within UFCo former lands are 9.3 percentage points less likely of having a UBN in housing relative to households outside. The magnitude of the UFCo effect in this dimension is high given the mean probability for the entire region (0.124). For the case of education and consumption, we find that its although it maintains the negative sign on every census, its significance disappears after 2000. Conversely, the effect on water infrastructure rapidly vanishes, and albeit insignificant, reverses in sign in more recent years. Finally, columns (5) and (6) show that the overall probability of being poor and the total number of UBN are also quite persistent over time, being significant during every year of our study.

Besides persistence, the results suggest there has been a convergence in some of the dimensions over the years. We find that for sanitation and consumption the UFCo effect coefficient in 1973 is statistically different from the coefficient in 2011. More generally, the severity of poverty has decreased over time. While a household in 1973 had 0.668 less UBN than a household outside, in 2011 the difference was reduced to 0.126, and the difference is statistically different from zero at 1% level.

Figure 3 summarizes the results. Lighter colors stand for better outcomes. Each dot corresponds to the centroid of a census block, and its size represents the number of observations in the census block. The background in each sub-figure shows predicted values, for a finely spaced grid of longitude-latitude coordinates, from a regression of the outcome variable under consideration on the UFCo dummy and a linear polynomial in latitude and longitude. Panels 3c, 3d, 3e, and 3f presents the probability of having an unsatisfied need in the housing, sanitation, education, and consumption dimension respectively. Panel 3a shows the probability of being classified as a poor household and Panel 3b shows the total

Table 4: Contemporary Household Outcomes: Dynamics Across Years

	Probability of UBN in				Probability	Total number
	Housing	Sanitation	Education	Consumption	of being poor	of UBN
	(1)	(2)	(3)	(4)	(5)	(6)
$UFCo_{1973}$	-0.202	-0.272	-0.069	-0.125	-0.229	-0.668
	(0.064)***	(0.081)***	(0.043)	(0.048)***	(0.070)***	(0.164)***
	[0.066]***	[0.081]***	[0.034]**	[0.045]***	[0.054]***	[0.149]***
$UFCo_{1984}$	-0.056	0.013	-0.086	-0.067	-0.081	-0.196
	(0.048)	(0.028)	(0.028)***	(0.049)*	(0.046)**	(0.093)**
	[0.034]*	[0.013]	[0.027]***	[0.030]**	[0.032]**	[0.063]***
$UFCo_{2000}$	-0.079	0.020	-0.057	-0.132	-0.132	-0.199
	(0.032)**	(0.017)	(0.022)**	(0.036)***	(0.036)***	(0.059)***
	[0.029]***	[0.017]	[0.019]***	[0.024]***	[0.031]***	[0.053]***
$UFCo_{2011}$	-0.093	0.021	-0.039	-0.014	-0.101	-0.126
	(0.030)***	(0.016)	(0.030)	(0.037)	(0.038)***	(0.064)**
	[0.033]***	[0.020]	[0.031]	[0.055]	[0.053]*	[0.095]
Adjusted R^2	0.103	0.199	0.241	0.017	0.116	0.206
N				8,786		
Clusters				200		
$Mean_{1973}$	0.462	0.353	0.393	0.208	0.777	1.416
$Mean_{1984}$	0.209	0.060	0.362	0.201	0.579	0.832
$Mean_{2000}$	0.145	0.031	0.230	0.178	0.452	0.584
$Mean_{2011}$	0.124	0.018	0.156	0.215	0.402	0.512

Notes: UBN= Unsatisfied Basic Need. The unit of observation is the household. Robust standard errors, adjusted for clustering by census block, are in parentheses. Conley standard errors are in brackets. All regressions include geographic controls for slope, elevation, and temperature; demographic controls for the number of adults, children, and infants in the household; census fixed effects, and a linear polynomial in latitude and longitude.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

number of unsatisfied basic needs. The predicted jump across the UFCo boundary is clear in all the sub-figures. Moreover, darker dots tend to overlay darker background areas, and the dark areas coincide with the former non-UFCo regions.

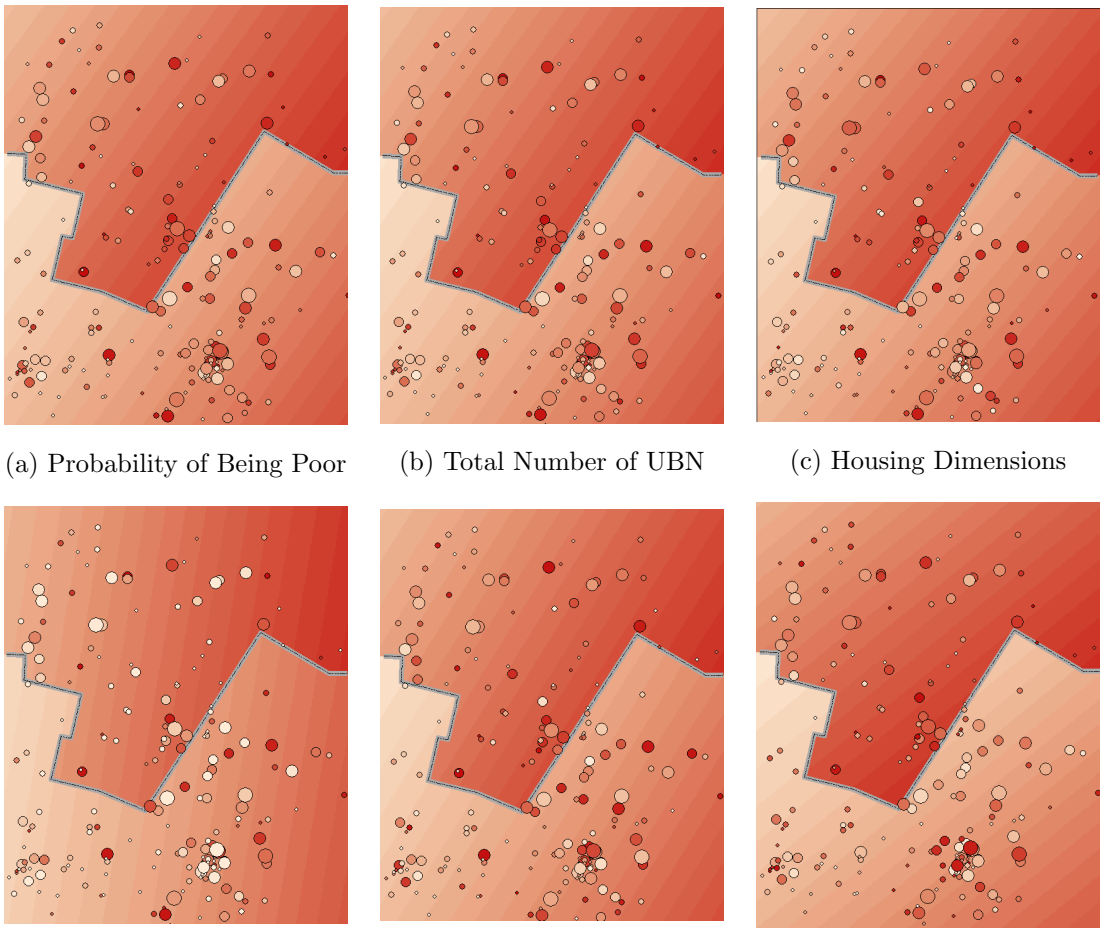
To understand why the UFCo had a positive impact on the economic development of the regions where it operated, we turn on to the analysis of the plausible mechanisms behind our results.

Investments in Sanitation Infrastructure and Healthcare: While Minor C. Keith was constructing the railroad to the Caribbean Coast in Costa Rica, he experienced the loss of around five thousand workers due to the unhealthy and dangerous conditions of the tropical forest (Bucheli, 2005, p. 46). The experience taught Keith the necessity to improve sanitation and hygiene to sustain a large enough workforce in an environment where malaria, hookworm, pneumonia, and tuberculosis were among the common diseases. As a consequence, the UFCo invested in sanitation infrastructure, launched health programs, and provided medical attention to its employees.

The UFCo was responsible for most of the sanitation programs that made possible begin the colonization process in the Atlantic Coast of Costa Rica. While in 1884, more than half of the land in Puerto Limón was a swamp, by 1910 the area hosted the UFCo headquarters, counting with pipes, sewage system, street lighting, macadamized roads, and a dike (Sanou and Quesada, 1998, p. 270-272). Similarly, in the plantations areas, the UFCo drained swamps and invested in sewer and potable water systems (May and Lasso, 1958, p. 22).

In 1905 the UFCo established a Medical Department in Costa Rica to carry out sanitation programs and medical research. By 1942 the company operated three hospitals in the country. The staff included doctors, sanitary inspectors, and nurses from the United States and other Central American countries (Morgan, 1993, p. 20). To cover healthcare for employees and their dependents, the UFCo deducted 2% from their salary. For the employees, the deduction gave access without further charge to medical and surgical treatment, including medicines. For dependents, the coverage provided free medical supervision, but medicines were charged (UFCo, 1916, p. 76-77). Appendix Table C.4 shows that between 1907 and 1917, for people on the company's payroll the UFCo's hospitals spend 71.1 Costa Rican Colones per patient, while the San Juan de Dios hospital, the largest hospital in

Figure 3: Effect of the UFCo's Tenure on Key Contemporary Outcomes



(a) Probability of Being Poor (b) Total Number of UBN (c) Housing Dimensions

(d) Sanitation Dimension (e) Education Dimension (f) Consumption Dimension

Notes: The figure shows a geographic boundary, with UFCo territories being South. **Lighter shades stand for better outcomes.** Circle-size represents the number of households in the census block, while the lighter the circle-color the better the outcome in that census block.

the country at the time, spend 42.4 colones per patient. Although a higher level of spending does not necessarily imply a higher quality of healthcare, the UFCo medical services were among the best in the country (Casey, 1979, p. 114). Each hospital had modern installations and equipment.

In general, the UFCo's healthcare programs were successful in controlling diseases in the plantation regions (Kepner 1936, p. 118; Chomsky 1996, p. 101). In 1929 a farm superintendent wrote that the "sanitary measures have helped to stabilize labor and increase their ability to perform work [...] during recent years with little or no influx of labor we have not experienced the recurrent shortages of labor that used to occur in previous years" (UFCo, 1929, p. 10). For the particular case of malaria, cataloged by the company as "our most important disease, when considered from the standpoints of morbidity and the effects of malaria on labor efficiency" (Deeks, 1928, p. 94), the UFCo carried out an intensive campaign that reduced its prevalence from 29.5 percent in 1926 to 14 percent in 1930 (Salisbury, 1930, p. 34).

Despite the positive impact of the UFCo programs, its benefits were restricted to employees and their immediate families. The general manager of the Medical Department explained that given the size of the UFCo landholdings, it was impossible from a commercial standpoint to sanitate completely all areas and therefore their efforts were "mainly directed to protecting the larger communities and camps were our employees are located" (UFCo, 1921, p. 6). In fact, to increase sanitary benefits, company doctors suggested preventing workers from traveling between plantations and surrounding villages, which were unscreened. Although non-employees could receive medical attention in the UFCo health care network, they had to pay higher fees. According to Appendix Table C.4, the average spending for patients *not* on their payroll was 28.9 colones, lower than the 71.1 colones that on average was spent on people on the company's payroll.

Overall, the company's sanitary and health programs were hard to implement among the workers. Workers had their strong beliefs about the causes and treatment of disease and often preferred their cures (Chomsky, 1996, p. 109). According to the UFCo Medical Department, their workers had to be disciplined because "they are only children who have never grown up mentally, and their helplessness should always stimulate us to give them our best assistance" (López, 1930, p. 167). Consequently, the company's sanitary and health

programs were compulsory for its workers, and there were fines to make them comply. For example, fines were levied against managers who did not report an ill worker; or wages were withheld for workers who did not abide hygienic instructions (Morgan, 1993, p. 23). Even preaches were instructed to preach health along with salvation (Kepner, 1936, p. 113).

Investments on Housing Infrastructure: Because of the remoteness location of the plantations and to reduce transportation costs, the UFCo provided to the majority of the workers with free housing within the company's land. Each of the UFCo's divisions consisted of farms, and each farm had a camp where workers lived, as Figure 9 shows. The houses reflected the rank of their occupants. According to Gerhard Sandner (1962, p. 84), a German geographer who traveled around the country documenting the agricultural colonization process between 1958 and 1959, the social differences in the banana regions were more marked and evident than anywhere else in Costa Rica.

Usually, the houses for plantation laborers were laid out around a soccer field. By 1958 the majority of laborers lived in barracks-type structures built on stilts, made of wood, painted light gray, with corrugated iron roof and no ceiling. Each barrack consisted of two dorms upstairs plus a kitchen downstairs. Single families occupied the majority of barracks, and there were buildings for unmarried workers (May and Lasso, 1958, p. 184-185). Because overcrowding was a problem, and often the barracks did not have access to electricity, running water, and the bathroom was in a separate shared building, a constant demand among laborers was to improve housing conditions (Cerdas Albertazzi, 1993, p. 142). Therefore, in the 1950s the UFCo implemented a program to replace the barracks with dwellings that included electricity, a water tap, and its private bath and toilet. However, despite its problems, even the old-barrack structures exceeded the standards of many surrounding communities (Wiley, 2008, p. 29).

Outside the rectangular area formed by the laborer's barracks were the houses for mid-level employees, such as supervisors or administrative personnel. The houses for mid-level employees were a single family structure surrounded by a small fenced-in yard and usually painted yellow. Finally, the highest-ranking employees lived in larger settlements and main administrative areas. The houses for highest-ranking employees had comparable levels of comfort that those available to a person of similar income status in the United States (May and Lasso, 1958, p. 186-187).

Related to the sanitary programs impulsed by the UFCo, a squad cleaned the grounds, collected trash, systematically sprayed with DDT to control for mosquitos and insects, and scrubbed out public toilets and bathing facilities. Moreover, the water supplied to the taps was safe for drinking. Besides housing, the UFCo provided basic services for its employees within each camp, such as schools, commissaries, dispensaries, and recreational facilities. May and Lasso (1958, p. 209) claim that "the places of worship, recreational facilities, and athletic fields and equipment provided for United's workers are upon a scale matched by few, if any, locally owned agricultural enterprises."

Investments in Human Capital: Although the UFCo was a multinational extracting a natural resource, it was in charge of all the production stages, from plantation to distribution. Besides agricultural workers, the company needed labor with some basic skills to perform administrative tasks, such as supervisors in its farms, or retail-clerks in its commissaries. Furthermore, having employees who understand English was a valuable skill for the UFCo because the company's kept its records in this language, and also it facilitated to communicate with the UFCo higher managers (principally United States citizens), and with immigrant workers (principally Jamaicans) (Castillo-Serrano, 1998, p. 40-46). As a result, among the services that the company provided within the camps was primary education to the children of its employees. The curriculum in the schools included vocational training and before the 1940s, was taught mostly in English. The emphasis on primary education was significant, and child labor became uncommon in the banana regions (Viales, 1998, p. 61). By 1955, the company had constructed 62 primary schools within its landholdings in Costa Rica (May and Lasso, 1958, p. 148).

By the time children completed primary education, they were old enough to work. The UFCo did not provide directly secondary education although offered some incentives. If the parents could afford the first two years of secondary education of their children in the United States, the UFCo paid for the last two years and provided free transportation to and from the United States. Moreover, if the parents organized secondary schools by themselves and paid a private tuition fee for the teachers, the UFCo provided a building and furniture (May and Lasso, 1958, p. 190). However, despite the incentives, secondary and tertiary education was costly and out of reach for most children of its employees.

To assess the impact of the UFCo educational investments on current human capital

accumulation, we estimate equation 1 using educational attainment as the outcome variable. The results are presented in Table 5, restricting the sample to non-migrants. Column (1) shows a positive UFCo effect on human capital accumulation. Consistent with the emphasis on primary education, column (2) shows a positive UFCo effect primary education attainment. On the other hand, in line with the higher costs of more advanced education opportunities, in column (3) the effect of the UFCo presence on secondary education attainment is non-significant.

Table 5: Human Capital Accumulation

	Years of schooling	Primary	Secondary
	(1)	(2)	(3)
UFCo	0.269	0.053	0.003
	(0.130)**	(0.018)***	(0.009)
	[0.143]*	[0.020]**	[0.007]
Adjusted R^2	0.240	0.204	0.042
N		24,587	
Clusters		198	
Mean	4.595	0.462	0.056

Notes: The unit of observation is the individual. The sample is restricted to non-migrants. Robust standard errors, adjusted for clustering by census block, are in parentheses. Conley standard errors are in brackets. All regressions include geographic controls for slope, elevation, and temperature; individual controls for age, age squared, and gender; census fixed effects, and a linear polynomial in latitude and longitude.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Income and Consumption Capacity By 1955, the company employed 1.2% of the total agricultural employees in the country and 5% of the total labor force. The production per worker was on average 5 times higher than the area's average, and 10 times higher

that the country's average(May and Lasso, 1958). As a result of higher productivity, and consistent with theory about multinational companies, it payed higher wages than the reported average wage for a local agricultural employee. In particular, salaries received by agricultural or construction workers in the region were $2.16, compared with a national average of $1.53 (Edelman and Aguiar, 1998). There was persistence in this higher income level, as is reflected in our findings of higher wealth and consumption in former UFCo's lands.

Details on the Counterfactual: An alternative explanation for our results is that the UFCo investments were crowding out public investment from nearby regions, and therefore the positive effect is due to the decrease in government spending that it caused. However, we document that during the company's tenure, public investment per capita on the region outside the boundary was significantly higher than on the average Costa Rican rural area. In particular, we collected original historical records of public spending per municipality from the National Audit Office of Costa Rica. We find that the government invested disproportionately more in rural areas near the company, as compared with rural areas in other regions of the country. For instance, the average expenditure per capita across rural municipalities outside the Province of Limón is 11.7 colones, while the average inside Limón Province is 18.8 colones. Within Limón Province (both the counterfactual and the UFCo lands are entirely inside Limón Province), the municipality with less public spending per capita has an average of 12.5 colones; still, well-above the average expenditure in rural municipalities across the country. Appendix D contains more detailed results. Potentially, this also indicates that our estimates are lower bounds as compared with a case in which the counterfactual region was exposed to a level of government expenditure per capita equal to that on an average rural area.

Placebo Test: As a falsification test, we re-run the analysis using placebo borders, i.e., we draw fake borders at a distance of 2 km both inwards and outwards of the actual UFCo border. If our results are not spurious, we should not find any significant effect in any of these two placebo regressions. Indeed, we do not. Panels A and B of Appendix Table E.8 present the results, showing that the analysis using fake borders deliver insignificant results in every case, both statistically and economically.

Robustness Tests: Although in Tables 3 and 4 we use a linear polynomial in latitude and longitude, our main message is robust to alternative specifications of the RD polynomial. Appendix F documents that a quadratic polynomial leads to similar conclusions. Appendix G shows that estimates are almost identical when we use a linear polynomial in latitude, longitude, and distance to the boundary.

Besides the specification of the RD polynomial, we also analyze how the results change to varying the control variables. Appendix H shows that results are robust to excluding demographic controls, Appendix I to excluding geographic controls, and Appendix J to excluding both demographic and geographic controls.

To exploit the availability of census block level data, we run our main specification restricting the sample to units within one km of the boundary. Appendix K presents the results. In this more precise estimation where we compare households located very close to each other, we find results that are consistent with our findings within 5 km.

To consider if selective migration is generating the differences in living standards between the two regions, we estimate equations 1 and 2 restricting the sample to non-migrants. We classify a household as migrant following two criteria. First, when its head of household reported having lived in a different place of residence five years before the census. Appendix L document that the results are similar to the estimates in Tables 3 and 4. Second, we consider a household as migrant if any member reported having lived in a different place of residence five years before the census. In Appendix M we show that our results remain unchanged. Therefore, current migration is unlikely to generate the differences between the regions.

Our Unsatisfied Basic Needs (UBN) are a modified version of the ones proposed by Méndez and Trejos (2004). Because Méndez and Trejos constructed the index using information from the 2000 and 2011 census, our modification consists of selecting the variables whose information was available in each of the 1973, 1984, 2000, and 2011 censuses. Therefore, as a robustness test, we re-run the estimation restricting the analysis to the 2000 and 2011 census and using the Unsatisfied Basic Needs (UBN) as proposed by Méndez and Trejos. Appendix N shows that our main message is robust to this alternative definition of UBN.

Finally, since the census data does not provide information on income, we use nighttime

lights data as a proxy to confirm our findings through an alternative measure of economic development. Figure 4 presents the satellite image near the study boundary in 1992 and 2012 and suggests higher luminosity in areas inside the former UFCo landholdings. Column (1) in Table 6 confirms this difference in luminosity, by showing that nighttime light intensity is 21% (exp(0.193)-1=0.212) higher in the former UFCo plantations. To give a sense of the economic significance of this estimate, if we assume an elasticity between nighttime light intensity and GDP of 0.3 (consistent with the findings in Henderson et al. 2012 and Hodler and Raschky 2014), the 21% difference in nighttime light intensity implies that the output in the former UFCo plantations is about 6.37% higher. Column (2) shows that luminosity per capita is 18% (exp(0.165)-1=0.18) higher in the former UFCo plantations. Lastly, column (3) shows that the annual growth rate of luminosity per capita is 2.064 percentage points higher in the former UFCo areas. All estimates are significant at least at the 5% significance level.

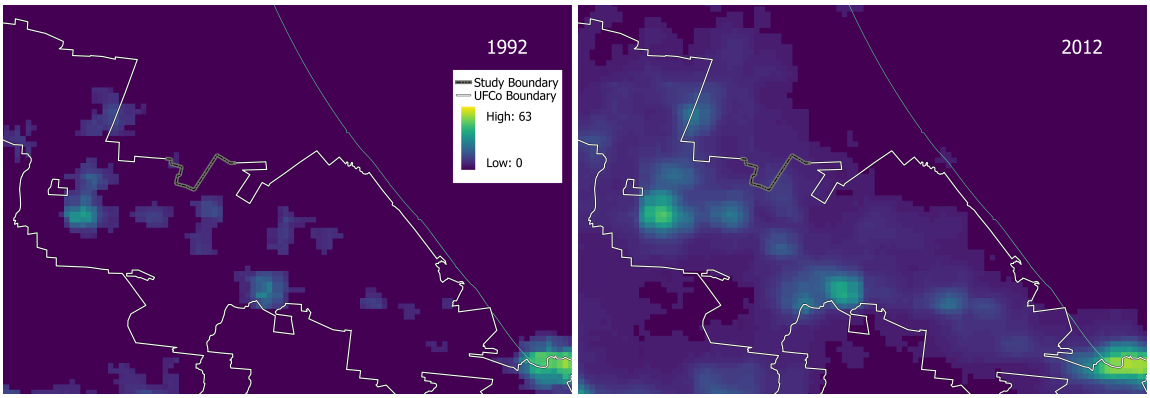


Figure 4: Lights near the study boundary in 1992 and 2012

A total of 9.2% observations in our luminosity data have a value equal to zero. The zero value can be due to a light that is too low for detection by the satellite, or because it corresponds to a sparsely populated area. Appendix O presents the results after we account for the zero observations by adding 0.01 to the luminosity data (or luminosity per capita) before taking the logarithm. Our main message remains unchanged. In general, the nighttime lights results are consistent with the estimates from our main specification by providing evidence that suggests significant higher levels of income and economic activity

Table 6: Luminosity data

	Log Light (1)	Log Per Capita Light (2)	Annual Growth Rate of Per Capita Light (3)
UFCo	0.193	0.165	2.064
	(0.006)***	(0.051)***	(0.781)***
	[0.017]***	[0.065]**	[0.953]**
Adjusted R^2	0.377	0.036	0.282
Observations	5,588	2,061	1,679

Note: The unit of observation is 1x1 km grid cells located within 5 km of UFCo boundary. Robust standard errors are in parentheses. Conley standard errors are in brackets. All regressions include year fixed effects.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

in the former UFCo areas.

Therefore, we find evidence that households in former UFCo regions have higher levels of economic development. We also find that the persistence of the UFCo effect varies across different outcomes of interest, albeit in most cases the convergence is slow. Our descriptive analysis also explains how investments in physical and human capital are plausible mechanisms behind our results.

6 Concluding Remarks

This paper studies the impact of large-scale FDI on economic development. To do so, we consider an agricultural multinational with well-defined boundaries. In particular, we examine the enclave of the United Fruit Company (UFCo) in Costa Rica. We use this setting to analyze the effects of a multinational company's presence on its host country's economic and institutional development, during and beyond its tenure in that country. Our methodology is based on a geographic RD that exploits a quasi-random assignment of land in 1904, leading to a portion of the boundary where all geographic characteristics balance; and the availability of restricted access data geo-referenced at the census block-level.

The company operated from 1889 to 1984. Our census data is available for 1973, 1984, 2000, and 2011. Therefore, we can disentangle the effect of the company during its tenure, and also its short-, medium- and long-run impact after it stopped production. We found a positive, large, and persistent long-run effect on key outcomes in areas where the company operated. Households in the former UFCo areas have a better satisfaction of basic needs (housing, sanitation, education, and consumption capacity). Moreover, these households have a lower probability of being poor and a lower number of unsatisfied basic needs. These findings are validated using nighttime lights data. We also find a higher average number of years of schooling and a higher probability of completing primary education within the former UFCo areas. Our results are robust to different specifications, and a range of distances from the boundary, including values as small as 1 km. This flexibility is novel within the literature and possible because of our novel census data, hard to find even in developed countries.

Moreover, we identify investments in physical and human capital carried out by the UFCo, such as housing and water infrastructure, hospitals, mandatory health programs, and a school curriculum that included vocational training, as relevant mechanisms behind our results. Therefore, we find potential benefits from a major FDI project even in the case of the controversial "Octopus" in Latin America. Our findings of positive and persistent effects from this multinational speak to the debate on the effects from foreign direct investments.

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Appendix A. Historical Details

This section provides more details on the role and decay of the UFCo in Costa Rica, and complements the historical background presented in Section 2.

Figure 5 shows how, in the years that followed the UFCo's foundation in 1889, the banana business in Costa Rica increased in volume and importance. By 1905 bananas had reached the same place in Costa Rica's exporting value than coffee (Costa Rica's main export at the time).

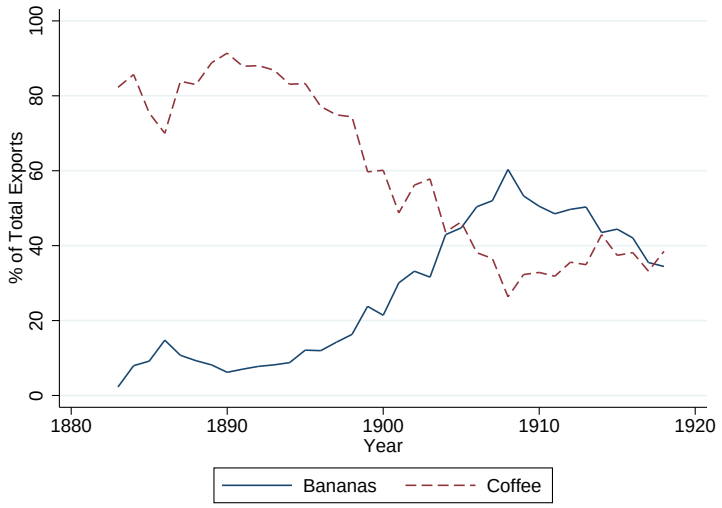

Figure 5: Banana and coffee as percent of total exports 1883-1918

The UFCo operated in the Caribbean Coast until 1938, when the Panama disease forced the company to shift operations to the Pacific Coast. Figure 6 shows how the ports located on the Pacific Coast took a predominant role in the banana exports, while the ports in the Atlantic Coast lost relevance. However, although the enclave structure and the banana production moved to the Pacific Coast, the UFCo kept landholdings in the Caribbean Coast and continued growing alternative products such as cacao and rubber (Viales, 1998). In 1976 the UFCo, now organized under the United Brands name, returned banana production to the Caribbean Coast. By then, new entrants in the banana market prevented the UFCo of having the protagonist role and monopoly power that it had at the beginning of the century (Viales and Montero, 2013). Finally, due to labor conflicts, soil

exhaustion and increase in production costs the UFCo abandoned banana production in the Pacific Coast in 1984 (Royo, 2009, p. 37). The overall production pattern is evident in Figure 7, which documents the total land destined to banana grow.

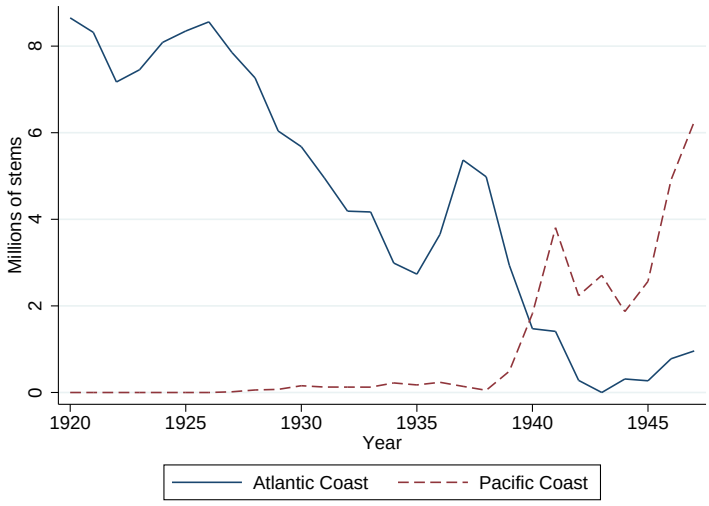

Figure 6: Banana Exports by Coast of Port of Origin 1920-1947

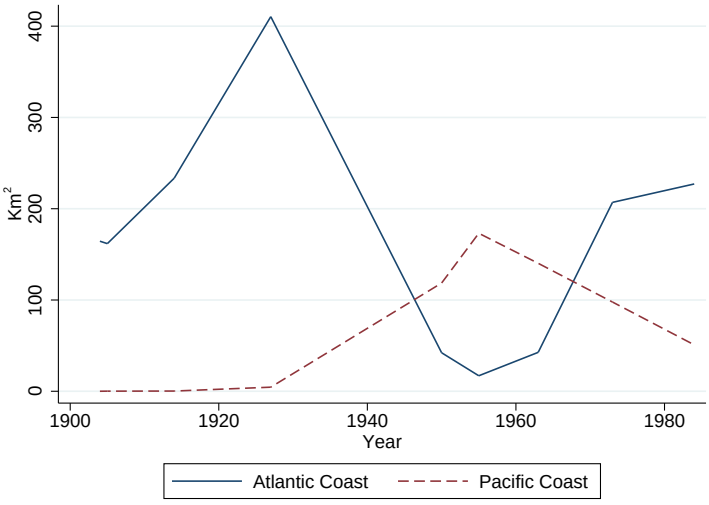

Figure 7: Squared Kilometers of Banana Plantations 1904-1984

Appendix B. Unsatisfied Basic Needs (UBN) Index Construction

To specify the set of basic needs that we consider in the paper and the threshold for attaining those needs, we follow the methodology for Costa Rica proposed by Méndez and Trejos (2004). Méndez and Trejos constructed the index based on information from the 2000 Census. The method can be applied straightforwardly to the 2011 Census, given the similarity of the questions between the 2000 and 2011 censuses (Méndez and Bravo, 2014). To adapt the method to the 1973 and 1984 Censuses, we select the components for which similar variables are available in all four censuses. Moreover, for consumption capacity, we adjusted the minimum average years of schooling for the income recipients according to the average years of schooling of the population from 25 to 65 years old. Table B presents the variables from the census that constitute each basic need.

Appendix N shows that if we use the index proposed by Méndez and Trejos for the census where it can be directly applied (2000 and 2011 Censuses), the main results of the paper are preserved.

Table B.1: Definition and Classification of Basic Needs

Dimension	Component	Variable from Census
Housing	House Quality	Household living in a temporary shelter or slum Household living in a dwelling with waste material in wall, roof or dirt floor Household living in a dwelling with bad conditions in roof, wall, and floor simultaneously
	Overcrowding	Household with more than two persons per room
Sanitation		Urban household where the sanitary service is connected to ditch, trench, river, estuary, cesspit, or latrine, or without sanitary service Rural household where the sanitary service is connected to direct connection to ditch, trench, river, estuary, or without sanitary service
Education	School Attendance	Household with at least one member from 7 to 17 years old not attending school
	School Achievement	Household with at least one member from 7 to 17 years old attending school regularly, but with a school backwardness higher than 2 years

Continued on next page

Table B.1 – continued from previous page

Dimension	Component	Variable from Census
Consumption	Consumption Capacity	Household without regular income recipients (employed, pensioners or rentiers) and whose head is 50 years old or older and with: • 3.59 years of schooling or less for Census 1973. • 5 years of schooling or less for Census 1984. • 6 years of schooling or less for Census 2000. • 6.39 years of schooling or less for Census 2011. Urban household with three or more dependents and one income recipient with less than: • 3.59 years of schooling for Census 1973. • 5 years of schooling for Census 1984. • 6 years of schooling for Census 2000. • 6.39 years of schooling for Census 2011. Urban household with three or more dependents and two income recipients whose on average have less than: • 2.59 years of schooling for Census 1973. • 4 years of schooling for Census 1984. • 5 years of schooling for Census 2000. • 5.39 years of schooling for Census 2011. Urban household with three or more dependents and three or more income recipients whose on average have less than: • 1.59 years of schooling for Census 1973. • 3 years of schooling for Census 1984. • 4 years of schooling for Census 2000. • 4.39 years of schooling for Census 2011.

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Table B.1 – continued from previous page

Dimension	Component	Variable from Census
		Rural household with three or more dependents and one income recipient with less than: • 1.59 years of schooling for Census 1973. • 3 years of schooling for Census 1984. • 4 years of schooling for Census 2000. • 4.39 years of schooling for Census 2011. Rural household with three or more dependents and two income recipients whose on average have less than: • 0.59 years of schooling for Census 1973. • 2 years of schooling for Census 1984. • 3 years of schooling for Census 2000. • 3.39 years of schooling for Census 2011. Rural household with three or more dependents and three or more income recipients whose on average have: • 0 years of schooling for Census 1973. • Less than 1 years of schooling for Census 1984. • Less than 2 years of schooling for Census 2000. • Less than 2.39 years of schooling for Census 2011.

Appendix C. Additional Figures and Tables

Figure 8 provides an example of one of the original maps from the National Archives of Costa Rica that we collected, scanned, and digitized.

Figure 8: One of the Original Maps from the National Archives of Costa Rica.

Figure 9 provides an example of a map showing the distribution of a typical banana farm. Again, we collected, scanned, and geocoded this map from the National Archives of Costa Rica.

Table C.2 shows the dynamics of population growth in Limón province using census data from 1883 to 1963, while Table C.3 shows the role of foreigners in these population dynamics.

Table C.2: Population and Growth Rates

	Census									
	1883		1892		1927		1950		1963	
	Pop.	G.R	Pop.	G.R	Pop.	G.R	Pop.	G.R	Pop.	G.R
Limón Province	1,858	-	7,484	16.74	32,278	4.26	41,360	1.08	68,385	3.94
Rest of Costa Rica	180,215	-	235,721	3.03	439,246	1.79	759,515	2.41	1,267,889	4.02

Source: Authors' calculations based on various historical census.

Notes: Pop= Population. G.R= Annual population growth rate (percentage).

Table C.4 presents a breakdown of the spending per patient in the company's hospitals every year for which we found data. For comparison, we also include spending per patient

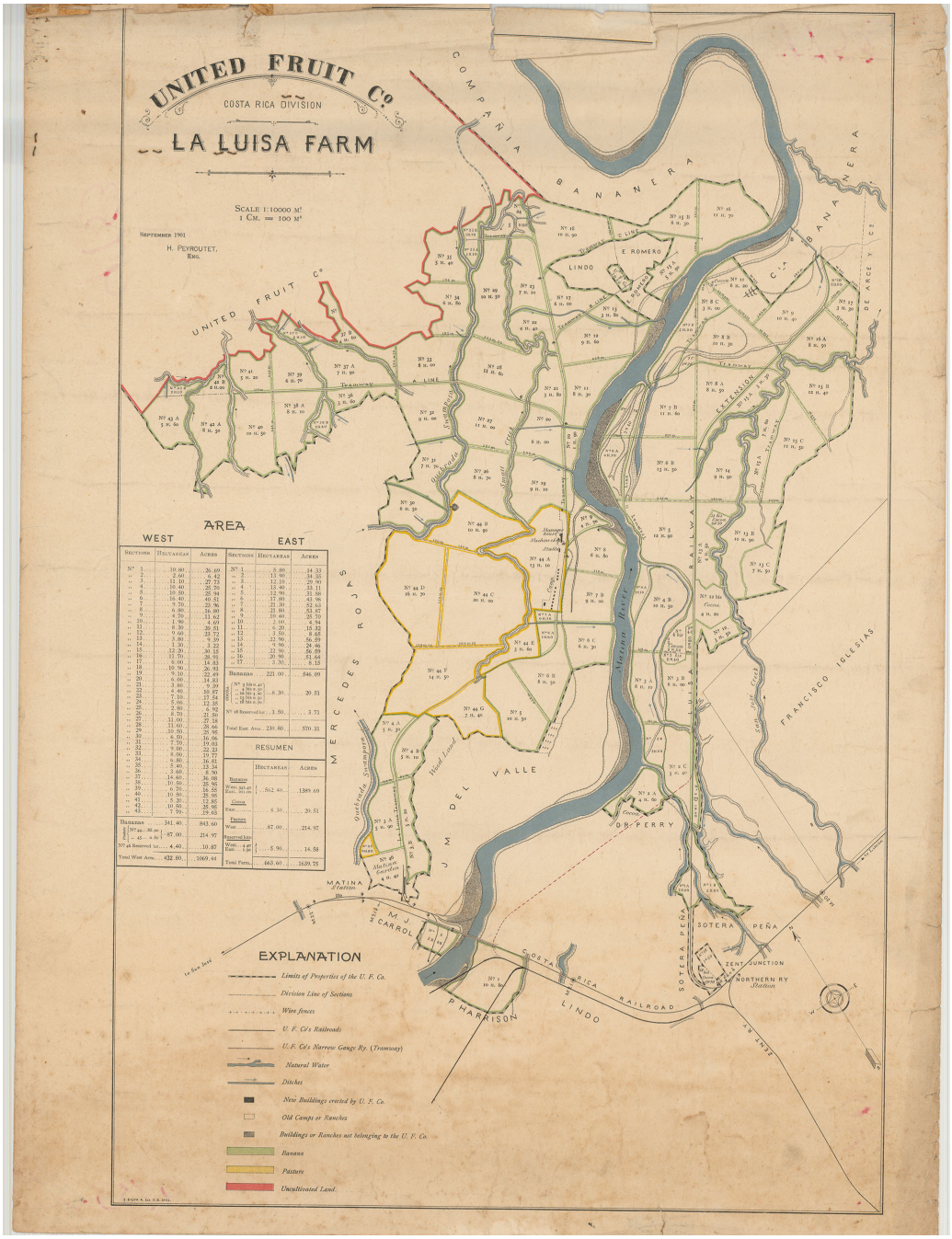

Figure 9: Distribution of La Luisa Farm in the Limón Division (Photo taken by the authors)

Table C.3: Percentage of Foreigners in the Population

	Census				
	1883	1892	1927	1950	1963
Limón Province	68.51	14.04	68.75	26.84	7.53
Rest of Costa Rica	1.80	2.15	4.67	2.96	2.25

Source: Authors' calculations based on various historical census.

in Costa Rica's largest hospital at the time.

Table C.4: Spending per Patient (in Costa Rican Colones)

	1907	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917
UFCo's hospitals (payroll)	50.1	84.2	101.5	44.5	48.3	87.3	69.2	53.2	70.3	83.4	90.4
UFCo's hospitals (not in payroll)	25.2	23.1	30.0	23.9	29.8	31.6	30.4	36.1	31.0	30.1	26.9
San Juan de Dios Hospital	29.6	48.8	48.1	40.4	42.2	37.3	30.5	40.3	42.3	49.3	57.1

Source: Authors' calculations based on original Statistic Yearbooks.

Notes: San Juan de Dios was the largest Costa Rican hospital at the time, located in the capital, San José.

Appendix D. Details on Government Expenditures

In this section, we discuss in more detail why we claim that the government did not discriminate the region near the company in terms of expenditures in public goods. To do so, we collected original records from the National Audit Office of Costa Rica. While these records are not available for every year, they shed light on the overall distribution of expenditures across regions. As we will explain below, we find that the government invested disproportionately more in rural areas near the company, as compared with rural areas in other regions of the country. This implies that our estimates are a lower bound of the potential benefits we might have found if the company would have faced a worse counterfactual region.

Table D.5 shows the total public expenditures per municipality outside the "Great Metropolitan Area (GMA)" in 1960. The UFCo lands were located in Limón Province, and ran across the municipalities of Limón, Pococí and Siquirres (in particular, our boundary runs across the last two). With the exception of the Municipality of Puntarenas (the main city of the province of Puntarenas, where the country's main port (Quepos) was located, the Limón province received a higher expenditure per capita than other regions outside the GMA. For example, the average expenditure per capita across regions outside the GMA outside the Province of Limon is 11.7, while the average inside Limón Province is 18.8.

Further, even comparing Limón with Provinces inside the GMA, public expenditure per capita is higher than in some of these provinces, as documented in Table D.6.

Table D.5: Average Public Expenditures per Municipality outside the "Great Metropolitan Area" in 1959-1960

Province	Municipality	Expenditure	Population	Expenditure per capita
Guanacaste	Liberia	197,411	17,176	11.5
	Nicoya	441,932	47734	9.3
	Santa Cruz	210,902	21478	9.8
	Bagaces	52,351	7141	7.3
	Carrillo	99,385	10634	9.3
	Cañas	136,008	9014	15.1
	Abangares	154,341	12594	12.2
	Tilarán	152500	14652	10.4
Puntarenas	Puntarenas	1,116,077	52031	21.4
	Esparza	139,510	9575	14.6
	Buenos Aires	62,898	8387	7.4
	Montes de Oro	94,428	8378	11.2
	Puerto Cortés	308,931	20104	15.3
	Aguirre	310,656	23057	13.4
	Golfito	137,525	19662	6.9
Limón	Limón	907,745	33795	26.8
	Pococí	195,615	15708	12.5
	Siquirres	190,181	11041	17.2

Source: Authors' calculations based on original records from the National Audit Office.

Table D.6: Average Public Expenditures per Province in 1959-1960

Province	Expenditure	Population	Expenditure per capita
San José	10854041	411308	26.4
Puntarenas	3190018	141194	22.6
Limón	1282342	60544	21.2
Heredia	1,375,746	73857	18.6
Alajuela	4,223,021	223143	18.9
Cartago	2,328,936	148647	15.7
Guanacaste	1444833	140423	10.3

Source: Authors' calculations based on original records from the National Audit Office.

For year 1975, Lizano (1979), in cooperation with the AID, BIRF and the BID, collected data on the total public investment per capita, dividing the country in seven regions. The region corresponding with the UFCo is the Atlantic Region. The capital, San José, lies in the Central Region. The quantities invested (expressed in colones; Costa Rican currency) are shown in Table D.7. Again, despite the Atlantic Region being a very rural area, public investment per capita is much higher than in other rural regions (all regions but the central region are mostly rural, except for the capital of each of the three "non-GAM" provinces).

Table D.7: Public Investment per Capita in each Region in 1975

Province	Investment per capita
Central Region	884.7
Northern Pacific Region	1704.2
Central Pacific Region	1103.5
Southern Pacific Region	486,1
Northern Region	681,2
Atlantic Region	1618,8
All Country	975,6

Appendix E. Placebo Test

Table E.8: Contemporary Household Outcomes: Placebo Test

	Probability of UBN in				Probability	Total number
	Housing	Sanitation	Education	Consumption	of being poor	of UBN
	(1)	(2)	(3)	(4)	(5)	(6)
			Panel A: Placebo at +2km			
UFCo	0.022	-0.009	0.027	-0.010	0.008	0.031
	(0.034)	(0.019)	(0.018)	(0.030)	(0.040)	(0.066)
	[0.039]	[0.017]	[0.021]	[0.020]	[0.031]	[0.067]
Adjusted R^2	0.098	0.173	0.240	0.014	0.111	0.195
			Panel B: Placebo at -2km			
UFCo	-0.030	0.008	-0.006	0.005	-0.008	-0.023
	(0.025)	(0.019)	(0.019)	(0.024)	(0.030)	(0.056)
	[0.031]	[0.019]	[0.019]	[0.027]	[0.029]	[0.054]
Adjusted R^2	0.098	0.173	0.239	0.014	0.111	0.195

Notes: Observations: (A) N =8,786, (B) N=8,786; Clusters=200 for both panels. UBN= Unsatisfied Basic Need. The unit of observation is the household. Robust standard errors, adjusted for clustering by census block, are in parentheses. Conley standard errors are in brackets. All regressions include geographic controls for slope, elevation, and temperature; demographic controls for the number of adults, children, and infants in the household; census fixed effects, and a linear polynomial in latitude and longitude.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix F. Quadratic Latitude-Longitude Polynomial

Table F.9: Contemporary Household Outcomes-Quadratic Latitude-Longitude Polynomial

	Probability of UBN in				Probability	Total number
	Housing	Sanitation	Education	Consumption	of being poor	of UBN
	(1)	(2)	(3)	(4)	(5)	(6)
UFCo	-0.097	-0.013	-0.058	-0.059	-0.122	-0.226
	(0.028)***	(0.019)	(0.022)**	(0.025)**	(0.032)***	(0.060)***
	[0.033]***	[0.015]	[0.012]***	[0.025]**	[0.027]***	[0.055]***
Adjusted R^2	0.102	0.173	0.241	0.015	0.115	0.200
N				8,786		
Clusters				200		
Mean	0.176	0.060	0.235	0.200	0.481	0.670

Notes: UBN= Unsatisfied Basic Need. The unit of observation is the household. Robust standard errors, adjusted for clustering by census block, are in parentheses. Conley standard errors are in brackets. All regressions include geographic controls for slope, elevation, and temperature; demographic controls for the number of adults, children, and infants in the household; census fixed effects, and a quadratic polynomial in latitude and longitude.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table F.10: Contemporary Household Outcomes-Quadratic Latitude-Longitude Polynomial

	Probability of UBN in				Probability	Total number
	Housing	Sanitation	Education	Consumption	of being poor	of UBN
	(1)	(2)	(3)	(4)	(5)	(6)
$UFCo_{1973}$	-0.204	-0.277	-0.064	-0.127	-0.225	-0.672
	(0.068)***	(0.080)***	(0.041)	(0.046)***	(0.070)***	(0.164)***
	[0.071]***	[0.078]***	[0.031]**	[0.050]**	[0.054]***	[0.148]***
$UFCo_{1984}$	-0.059	0.016	-0.087	-0.065	-0.079	-0.194
	(0.050)	(0.027)	(0.028)***	(0.036)*	(0.049)	(0.095)**
	[0.035]*	[0.010]*	[0.022]***	[0.030]**	[0.032]**	[0.060]***
$UFCo_{2000}$	-0.084	0.020	-0.062	-0.085	-0.136	-0.210
	(0.033)**	(0.019)	(0.022)***	(0.027)***	(0.038)***	(0.062)***
	[0.032]***	[0.019]	[0.012]***	[0.024]***	[0.032]***	[0.054]***
$UFCo_{2011}$	-0.095	0.021	-0.039	-0.013	-0.099	-0.126
	(0.031)***	(0.017)	(0.036)	(0.037)	(0.039)**	(0.064)*
	[0.034]***	[0.021]	[0.027]	[0.054]	[0.052]*	[0.093]
Adjusted R^2	0.103	0.199	0.241	0.017	0.116	0.207
N				8,786		
Clusters				200		
$Mean_{1973}$	0.462	0.353	0.393	0.208	0.777	1.416
$Mean_{1984}$	0.209	0.060	0.362	0.201	0.579	0.832
$Mean_{2000}$	0.145	0.031	0.230	0.178	0.452	0.584
$Mean_{2011}$	0.124	0.018	0.156	0.215	0.402	0.512

Notes: UBN= Unsatisfied Basic Need. The unit of observation is the household. Robust standard errors, adjusted for clustering by census block, are in parentheses. Conley standard errors are in brackets. All regressions include geographic controls for slope, elevation, and temperature; demographic controls for the number of adults, children, and infants in the household; census fixed effects, and a quadratic polynomial in latitude and longitude.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix G. Linear polynomial in latitude, longitude and distance to the boundary

Table G.11: Contemporary Household Outcomes-Linear polynomial in latitude, longitude and distance to the boundary

	Probability of UBN in				Probability	Total number
	Housing	Sanitation	Education	Consumption	of being poor	of UBN
	(1)	(2)	(3)	(4)	(5)	(6)
UFCo	-0.095	-0.016	-0.055	-0.060	-0.123	-0.226
	(0.026)***	(0.017)	(0.022)**	(0.025)**	(0.030)***	(0.056)***
	[0.029]***	[0.014]	[0.018]***	[0.026]**	[0.026]***	[0.051]***
Adjusted R^2	0.102	0.173	0.241	0.015	0.115	0.200
N				8,786		
Clusters				200		
Mean	0.176	0.060	0.235	0.200	0.481	0.670

Notes: UBN= Unsatisfied Basic Need. The unit of observation is the household. Robust standard errors, adjusted for clustering by census block, are in parentheses. Conley standard errors are in brackets. All regressions include geographic controls for slope, elevation, and temperature; demographic controls for the number of adults, children, and infants in the household; census fixed effects, and a linear polynomial in latitude, longitude and distance to the UFCo boundary.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table G.12: Contemporary Household Outcomes-Linear polynomial in latitude, longitude and distance to the boundary

	Probability of UBN in				Probability	Total number
	Housing	Sanitation	Education	Consumption	of being poor	of UBN
	(1)	(2)	(3)	(4)	(5)	(6)
$UFCo_{1973}$	-0.200	-0.275	-0.064	-0.127	-0.227	-0.666
	(0.066)***	(0.080)***	(0.041)	(0.048)***	(0.071)***	(0.165)***
	[0.069]***	[0.081]***	[0.034]*	[0.045]***	[0.057]***	[0.153]***
$UFCo_{1984}$	-0.055	0.013	-0.084	-0.068	-0.080	-0.195
	(0.048)	(0.028)	(0.028)***	(0.036)*	(0.049)	(0.093)**
	[0.033]*	[0.014]	[0.026]***	[0.030]**	[0.032]**	[0.063]***
$UFCo_{2000}$	-0.079	0.020	-0.057	-0.082	-0.132	-0.199
	(0.032)**	(0.017)	(0.058)***	(0.026)***	(0.036)***	(0.062)***
	[0.029]***	[0.017]	[0.018]***	[0.024]***	[0.031]***	[0.053]***
$UFCo_{2011}$	-0.093	0.020	-0.038	-0.015	-0.101	-0.125
	(0.030)***	(0.016)	(0.030)	(0.037)	(0.038)**	(0.063)**
	[0.033]***	[0.020]	[0.031]	[0.056]	[0.053]*	[0.095]
Adjusted R^2	0.103	0.199	0.241	0.017	0.116	0.206
N				8,786		
Clusters				200		
$Mean_{1973}$	0.462	0.353	0.393	0.208	0.777	1.416
$Mean_{1984}$	0.209	0.060	0.362	0.201	0.579	0.832
$Mean_{2000}$	0.145	0.031	0.230	0.178	0.452	0.584
$Mean_{2011}$	0.124	0.018	0.156	0.215	0.402	0.512

Notes: UBN= Unsatisfied Basic Need. The unit of observation is the household. Robust standard errors, adjusted for clustering by census block, are in parentheses. Conley standard errors are in brackets. All regressions include geographic controls for slope, elevation, and temperature; demographic controls for the number of adults, children, and infants in the household; census fixed effects, and a linear polynomial in latitude, longitude and distance to the UFCo boundary.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix H. No Demographic Controls

Table H.13: Contemporary Household Outcomes-No Demographic Controls

	Probability of UBN in				Probability	Total number
	Housing	Sanitation	Education	Consumption	of being poor	of UBN
	(1)	(2)	(3)	(4)	(5)	(6)
UFCo	-0.102	-0.014	-0.086	-0.062	-0.142	-0.264
	(0.027)***	(0.017)	(0.025)***	(0.025)**	(0.033)***	(0.063)***
	[0.032]***	[0.014]	[0.014]***	[0.023]***	[0.025]***	[0.055]***
Adjusted R^2	0.071	0.166	0.044	0.003	0.057	0.111
N				8,786		
Clusters				200		
Mean	0.176	0.060	0.235	0.200	0.481	0.670

Notes: UBN= Unsatisfied Basic Need. The unit of observation is the household. Robust standard errors, adjusted for clustering by census block, are in parentheses. Conley standard errors are in brackets. All regressions include geographic controls for slope, elevation, and temperature; census fixed effects, and a linear polynomial in latitude and longitude.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table H.14: Contemporary Household Outcomes-No Demographic Controls

	Probability of UBN in				Probability	Total number
	Housing	Sanitation	Education	Consumption	of being poor	of UBN
	(1)	(2)	(3)	(4)	(5)	(6)
$UFCo_{1973}$	-0.209	-0.269	-0.098	-0.127	-0.247	-0.703
	(0.066)***	(0.081)***	(0.055)*	(0.052)**	(0.073)***	(0.175)***
	[0.067]***	[0.081]***	[0.052]*	[0.049]**	[0.058]***	[0.160]***
$UFCo_{1984}$	-0.056	0.013	-0.089	-0.068	-0.082	-0.200
	(0.051)	(0.027)	(0.034)***	(0.037)*	(0.057)	(0.109)*
	[0.040]	[0.014]	[0.027]***	[0.030]**	[0.035]**	[0.074]***
$UFCo_{2000}$	-0.089	0.023	-0.092	-0.085	-0.155	-0.244
	(0.031)***	(0.018)	(0.027)***	(0.026)***	(0.039)***	(0.062)***
	[0.032]***	[0.017]	[0.017]***	[0.022]***	[0.034]***	[0.059]***
$UFCo_{2011}$	-0.099	0.023	-0.075	-0.017	-0.123	-0.168
	(0.031)***	(0.016)	(0.030)**	(0.037)	(0.039)***	(0.064)***
	[0.035]***	[0.020]	[0.021]***	[0.053]	[0.047]***	[0.083]**
Adjusted R^2	0.072	0.192	0.044	0.005	0.059	0.117
N				8,786		
Clusters				200		
$Mean_{1973}$	0.462	0.353	0.393	0.208	0.777	1.416
$Mean_{1984}$	0.209	0.060	0.362	0.201	0.579	0.832
$Mean_{2000}$	0.145	0.031	0.230	0.178	0.452	0.584
$Mean_{2011}$	0.124	0.018	0.156	0.215	0.402	0.512

Notes: UBN= Unsatisfied Basic Need. The unit of observation is the household. Robust standard errors, adjusted for clustering by census block, are in parentheses. Conley standard errors are in brackets. All regressions include geographic controls for slope, elevation, and temperature; census fixed effects, and a linear polynomial in latitude and longitude.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix I. No Geographic Controls

Table I.15: Contemporary Household Outcomes-No Geographic Control

	Probability of UBN in				Probability	Total number
	Housing	Sanitation	Education	Consumption	of being poor	of UBN
	(1)	(2)	(3)	(4)	(5)	(6)
UFCo	-0.103	-0.021	-0.052	-0.062	-0.131	-0.238
	(0.026)***	(0.017)	(0.023)**	(0.024)**	(0.030)***	(0.057)***
	[0.031]***	[0.017]	[0.018]***	[0.024]***	[0.025]***	[0.052]***
Adjusted R^2	0.101	0.168	0.240	0.015	0.115	0.199
N				8,786		
Clusters				200		
Mean	0.176	0.060	0.235	0.200	0.481	0.670

Notes: UBN= Unsatisfied Basic Need. The unit of observation is the household. Robust standard errors, adjusted for clustering by census block, are in parentheses. Conley standard errors are in brackets. All regressions include demographic controls for the number of adults, children, and infants in the household; census fixed effects, and a linear polynomial in latitude and longitude.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table I.16: Contemporary Household Outcomes-No Geographic Controls

	Probability of UBN in				Probability	Total number
	Housing	Sanitation	Education	Consumption	of being poor	of UBN
	(1)	(2)	(3)	(4)	(5)	(6)
$UFCo_{1973}$	-0.219	-0.288	-0.054	-0.132	-0.247	-0.693
	(0.062)***	(0.079)***	(0.045)	(0.047)***	(0.067)***	(0.158)***
	[0.066]***	[0.078]***	[0.035]	[0.048]***	[0.053]***	[0.146]***
$UFCo_{1984}$	-0.062	0.010	-0.083	-0.088	-0.082	-0.207
	(0.048)	(0.028)	(0.027)***	(0.035)**	(0.046)*	(0.092)**
	[0.035]*	[0.016]	[0.023]***	[0.031]**	[0.033]***	[0.068]***
$UFCo_{2000}$	-0.082	0.018	-0.055	-0.085	-0.136	-0.204
	(0.031)***	(0.018)	(0.023)**	(0.026)***	(0.036)***	(0.059)***
	[0.029]***	[0.017]	[0.018]***	[0.025]***	[0.030]***	[0.051]***
$UFCo_{2011}$	-0.101	0.017	-0.036	-0.020	-0.110	-0.140
	(0.030)***	(0.017)	(0.030)	(0.035)	(0.037)***	(0.062)**
	[0.032]***	[0.020]	[0.031]	[0.050]	[0.049]**	[0.087]
Adjusted R^2	0.103	0.198	0.240	0.017	0.116	0.206
N				8,786		
Clusters				200		
$Mean_{1973}$	0.462	0.353	0.393	0.208	0.777	1.416
$Mean_{1984}$	0.209	0.060	0.362	0.201	0.579	0.832
$Mean_{2000}$	0.145	0.031	0.230	0.178	0.452	0.584
$Mean_{2011}$	0.124	0.018	0.156	0.215	0.402	0.512

Notes: UBN= Unsatisfied Basic Need. The unit of observation is the household. Robust standard errors, adjusted for clustering by census block, are in parentheses. Conley standard errors are in brackets. All regressions include demographic controls for the number of adults, children, and infants in the household; census fixed effects, and a linear polynomial in latitude and longitude.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix J. No Demographic or Geographic Controls

Table J.17: Contemporary Household Outcomes-No Demographic or Geographic Controls

	Probability of UBN in				Probability	Total number
	Housing	Sanitation	Education	Consumption	of being poor	of UBN
	(1)	(2)	(3)	(4)	(5)	(6)
UFCo	-0.108	-0.018	-0.080	-0.064	-0.148	-0.271
	(0.027)***	(0.017)	(0.025)***	(0.025)**	(0.033)***	(0.064)***
	[0.034]***	[0.016]	[0.012]***	[0.023]***	[0.025]***	[0.057]***
Adjusted R^2	0.070	0.161	0.044	0.003	0.057	0.110
N				8,786		
Clusters				200		
Mean	0.176	0.060	0.235	0.200	0.481	0.670

Notes: UBN= Unsatisfied Basic Need. The unit of observation is the household. Robust standard errors, adjusted for clustering by census block, are in parentheses. Conley standard errors are in brackets. All regressions include census fixed effects, and a linear polynomial in latitude and longitude.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table J.18: Contemporary Household Outcomes-No Demographic or Geographic Controls

	Probability of UBN in				Probability	Total number
	Housing	Sanitation	Education	Consumption	of being poor	of UBN
	(1)	(2)	(3)	(4)	(5)	(6)
$UFCo_{1973}$	-0.225	-0.285	-0.080	-0.133	-0.263	-0.722
	(0.064)***	(0.079)***	(0.058)	(0.050)***	(0.071)***	(0.170)***
	[0.068]***	[0.078]***	[0.050]	[0.051]***	[0.059]***	[0.158]***
$UFCo_{1984}$	-0.062	0.010	-0.085	-0.072	-0.089	-0.209
	(0.051)	(0.028)	(0.035)**	(0.036)**	(0.055)	(0.108)*
	[0.042]	[0.017]	[0.026]***	[0.031]**	[0.037]**	[0.079]***
$UFCo_{2000}$	-0.092	0.022	-0.090	-0.088	-0.159	-0.248
	(0.031)***	(0.018)	(0.028)**	(0.026)***	(0.039)***	(0.062)***
	[0.032]***	[0.017]	[0.016]***	[0.023]***	[0.034]***	[0.057]***
$UFCo_{2011}$	-0.106	0.020	-0.071	-0.022	-0.131	-0.179
	(0.031)***	(0.017)	(0.030)**	(0.034)	(0.038)***	(0.062)***
	[0.034]***	[0.020]	[0.021]***	[0.048]	[0.043]***	[0.075]**
Adjusted R^2	0.072	0.191	0.043	0.005	0.058	0.117
N				8,786		
Clusters				200		
$Mean_{1973}$	0.462	0.353	0.393	0.208	0.777	1.416
$Mean_{1984}$	0.209	0.060	0.362	0.201	0.579	0.832
$Mean_{2000}$	0.145	0.031	0.230	0.178	0.452	0.584
$Mean_{2011}$	0.124	0.018	0.156	0.215	0.402	0.512

Notes: UBN= Unsatisfied Basic Need. The unit of observation is the household. Robust standard errors, adjusted for clustering by census block, are in parentheses. Conley standard errors are in brackets. All regressions include census fixed effects, and a linear polynomial in latitude and longitude.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix K. Regression within 1 km

Table K.19: Contemporary Household Outcomes-Restricted 1 km

	Probability of UBN in				Probability	Total number
	Housing	Sanitation	Education	Consumption	of being poor	of UBN
	(1)	(2)	(3)	(4)	(5)	(6)
UFCo	-0.100	-0.014	-0.085	-0.084	-0.149	-0.284
	(0.034)***	(0.030)	(0.030)***	(0.024)***	(0.046)***	(0.074)***
	[0.022]***	[0.010]	[0.018]***	[0.019]***	[0.024]***	[0.027]***
Adjusted R^2	0.144	0.224	0.274	0.031	0.157	0.269
N				1,937		
Clusters				44		
Mean	0.176	0.060	0.235	0.200	0.481	0.670

Notes: UBN= Unsatisfied Basic Need. The unit of observation is the household. The sample is restricted to census block located within 1 km of the UFCo boundary. Robust standard errors, adjusted for clustering by census block, are in parentheses. Conley standard errors are in brackets. All regressions include geographic controls for slope, elevation, and temperature; demographic controls for the number of adults, children, and infants in the household; census fixed effects, and a linear polynomial in latitude and longitude.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table K.20: Contemporary Household Outcomes: Dynamics Across Years-Restricted 1 km

	Probability of UBN in				Probability	Total number
	Housing	Sanitation	Education	Consumption	of being poor	of UBN
	(1)	(2)	(3)	(4)	(5)	(6)
$UFCo_{1973}$	-0.123	-0.226	-0.058	-0.089	-0.132	-0.496
	(0.066)*	(0.059)***	(0.053)	(0.033)***	(0.069)*	(0.103)***
	[0.047]***	[0.061]***	[0.048]	[0.029]***	[0.054]**	[0.084]***
$UFCo_{1984}$	0.027	0.025	-0.092	-0.103	-0.063	-0.142
	(0.082)	(0.038)	(0.061)	(0.042)**	(0.072)	(0.129)
	[0.080]	[0.025]	[0.065]	[0.038]***	[0.054]	[0.109]
$UFCo_{2000}$	-0.103	0.002	-0.085	-0.042	-0.121	-0.229
	(0.044)**	(0.030)	(0.029)***	(0.027)	(0.059)**	(0.089)**
	[0.030]***	[0.025]	[0.017]***	[0.034]	[0.043]***	[0.059]***
$UFCo_{2011}$	-0.104	-0.000	-0.089	-0.117	-0.181	-0.310
	(0.039)**	(0.028)	(0.042)**	(0.032)***	(0.054)***	(0.086)***
	[0.023]***	[0.013]	[0.042]**	[0.020]***	[0.052]***	[0.061]***
Adjusted R^2	0.146	0.238	0.273	0.030	0.157	0.270
N				1,937		
Clusters				44		
$Mean_{1973}$	0.491	0.396	0.455	0.252	0.829	1.595
$Mean_{1984}$	0.265	0.053	0.357	0.186	0.563	0.861
$Mean_{2000}$	0.150	0.037	0.255	0.208	0.497	0.650
$Mean_{2011}$	0.134	0.018	0.164	0.197	0.405	0.513

Notes: UBN= Unsatisfied Basic Need. The unit of observation is the household. Robust standard errors, adjusted for clustering by census block, are in parentheses. Conley standard errors are in brackets. All regressions include geographic controls for slope, elevation, and temperature; demographic controls for the number of adults, children, and infants in the household; census fixed effects, and a linear polynomial in latitude and longitude.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix L. Head of Household reported having lived in different place of residence five years before the census

Table L.21: Head Migrant. Contemporary Household Outcomes

	Probability of UBN in				Probability	Total number
	Housing	Sanitation	Education	Consumption	of being poor	of UBN
	(1)	(2)	(3)	(4)	(5)	(6)
UFCo	-0.107	-0.006	-0.066	-0.062	-0.142	-0.241
	(0.026)***	(0.015)	(0.025)***	(0.025)**	(0.029)***	(0.050)***
	[0.028]***	[0.014]	[0.025]***	[0.031]**	[0.028]***	[0.051]***
Adjusted R^2	0.082	0.157	0.224	0.013	0.104	0.168
N				7,102		
Clusters				198		
Mean	0.163	0.050	0.227	0.201	0.472	0.641

Notes: UBN= Unsatisfied Basic Need. The unit of observation is the household. The sample is restricted to households whose head of household is non-migrant. Robust standard errors, adjusted for clustering by census block, are in parentheses. Conley standard errors are in brackets. All regressions include geographic controls for slope, elevation, and temperature; demographic controls for the number of adults, children, and infants in the household; census fixed effects, and a linear polynomial in latitude and longitude.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table L.22: Head Migrant. Contemporary Household Outcomes

	Probability of UBN in				Probability	Total number
	Housing	Sanitation	Education	Consumption	of being poor	of UBN
	(1)	(2)	(3)	(4)	(5)	(6)
$UFCo_{1973}$	-0.250	-0.315	-0.076	-0.141	-0.308	-0.782
	(0.075)***	(0.102)***	(0.036)**	(0.041)***	(0.086)***	(0.180)***
	[0.087]***	[0.104]***	[0.026]***	[0.048]***	[0.075]***	[0.177]***
$UFCo_{1984}$	-0.087	-0.002	-0.106	-0.094	-0.133	-0.290
	(0.048)*	(0.027)	(0.033)***	(0.041)**	(0.047)***	(0.092)***
	[0.038]**	[0.018]	[0.024]***	[0.038]**	[0.031]***	[0.062]***
$UFCo_{2000}$	-0.089	0.010	-0.060	-0.104	-0.150	-0.242
	(0.030)***	(0.017)	(0.025)**	(0.028)***	(0.035)***	(0.055)***
	[0.028]***	[0.017]	[0.025]**	[0.027]***	[0.030]***	[0.052]***
$UFCo_{2011}$	-0.112	0.018	-0.055	-0.005	-0.118	-0.155
	(0.030)***	(0.015)	(0.033)*	(0.035)	(0.036)***	(0.061)**
	[0.032]***	[0.015]	[0.036]	[0.055]	[0.047]**	[0.082]*
Adjusted R^2	0.084	0.183	0.224	0.017	0.106	0.174
N				7,102		
Clusters				198		
$Mean_{1973}$	0.440	0.360	0.351	0.185	0.770	1.336
$Mean_{1984}$	0.213	0.057	0.379	0.219	0.603	0.868
$Mean_{2000}$	0.141	0.031	0.231	0.176	0.451	0.579
$Mean_{2011}$	0.124	0.018	0.158	0.216	0.404	0.515

Notes: UBN= Unsatisfied Basic Need. The unit of observation is the household. The sample is restricted to households whose head of household is non-migrant. Robust standard errors, adjusted for clustering by census block, are in parentheses. Conley standard errors are in brackets. All regressions include geographic controls for slope, elevation, and temperature; demographic controls for the number of adults, children, and infants in the household; census fixed effects, and a linear polynomial in latitude and longitude.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix M. Any household member reported having lived in different place of residence five years before the census

Table M.23: Any Migrant. Contemporary Household Outcomes

	Probability of UBN in				Probability	Total number
	Housing	Sanitation	Education	Consumption	of being poor	of UBN
	(1)	(2)	(3)	(4)	(5)	(6)
UFCo	-0.104	-0.004	-0.062	-0.055	-0.135	-0.225
	(0.027)***	(0.015)	(0.025)**	(0.025)**	(0.030)***	(0.052)***
	[0.031]***	[0.015]	[0.023]***	[0.028]**	[0.027]***	[0.049]***
Adjusted R^2	0.077	0.145	0.226	0.012	0.102	0.165
N				6,451		
Clusters				198		
Mean	0.158	0.050	0.220	0.205	0.466	0.632

Notes: UBN= Unsatisfied Basic Need. The unit of observation is the household. The sample is restricted to households whose any of its members is non-migrant. Robust standard errors, adjusted for clustering by census block, are in parentheses. Conley standard errors are in brackets. All regressions include geographic controls for slope, elevation, and temperature; demographic controls for the number of adults, children, and infants in the household; census fixed effects, and a linear polynomial in latitude and longitude.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table M.24: Any Migrant. Contemporary Household Outcomes

	Probability of UBN in				Probability	Total number
	Housing	Sanitation	Education	Consumption	of being poor	of UBN
	(1)	(2)	(3)	(4)	(5)	(6)
$UFCo_{1973}$	-0.252	-0.301	-0.070	-0.144	-0.285	-0.767
	(0.067)***	(0.100)***	(0.042)*	(0.035)***	(0.093)***	(0.191)***
	[0.080]***	[0.102]***	[0.031]**	[0.040]***	[0.080]***	[0.183]***
$UFCo_{1984}$	-0.084	-0.000	-0.107	-0.084	-0.131	-0.275
	(0.048)*	(0.029)	(0.033)***	(0.043)*	(0.050)***	(0.094)***
	[0.044]**	[0.019]	[0.026]***	[0.036]**	[0.031]***	[0.062]***
$UFCo_{2000}$	-0.085	0.008	-0.052	-0.098	-0.144	-0.226
	(0.031)***	(0.017)	(0.026)**	(0.030)***	(0.036)***	(0.057)***
	[0.029]***	[0.017]	[0.026]**	[0.028]***	[0.031]***	[0.051]***
$UFCo_{2011}$	-0.110	0.019	-0.053	0.001	-0.113	-0.143
	(0.031)***	(0.016)	(0.033)	(0.035)	(0.037)***	(0.061)**
	[0.036]***	[0.016]	[0.033]	[0.051]	[0.044]**	[0.077]*
Adjusted R^2	0.079	0.168	0.227	0.016	0.102	0.171
N				6,451		
Clusters				198		
$Mean_{1973}$	0.434	0.360	0.342	0.204	0.758	1.339
$Mean_{1984}$	0.212	0.061	0.369	0.232	0.604	0.875
$Mean_{2000}$	0.135	0.033	0.224	0.179	0.446	0.571
$Mean_{2011}$	0.121	0.018	0.154	0.216	0.400	0.509

Notes: UBN= Unsatisfied Basic Need. The unit of observation is the household. The sample is restricted to households whose any of its members is non-migrant. Robust standard errors, adjusted for clustering by census block, are in parentheses. Conley standard errors are in brackets. All regressions include geographic controls for slope, elevation, and temperature; demographic controls for the number of adults, children, and infants in the household; census fixed effects, and a linear polynomial in latitude and longitude.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix N. Méndez & Trejos index

Table N.25: Méndez & Trejos index-Contemporary Household Outcomes

	Probability of UBN in				Probability	Total number
	Housing	Health	Education	Consumption	of being poor	of UBN
	(1)	(2)	(3)	(4)	(5)	(6)
UFCo	-0.088	-0.031	-0.057	-0.020	-0.109	-0.197
	(0.030)***	(0.051)	(0.026)**	(0.019)	(0.043)**	(0.077)**
	[0.033]***	[0.034]	[0.028]**	[0.014]	[0.034]***	[0.069]***
Adjusted R^2	0.020	0.025	0.044	0.025	0.075	0.090
N				6,623		
Clusters				160		
Mean	0.178	0.132	0.180	0.132	0.433	0.622

Notes: UBN= Unsatisfied Basic Need. The unit of observation is the household. Robust standard errors, adjusted for clustering by census block, are in parentheses. Conley standard errors are in brackets. All regressions include geographic controls for slope, elevation, and temperature; demographic controls for the number of adults, children, and infants in the household; census fixed effects, and a linear polynomial in latitude and longitude.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table N.26: Méndez & Trejos index-Contemporary Household Outcomes

		Probability of UBN in			Probability	Total number
	Housing	Health	Education	Consumption	of being poor	of UBN
	(1)	(2)	(3)	(4)	(5)	(6)
$UFCo_{2000}$	-0.081	-0.022	-0.069	-0.038	-0.110	-0.210
	(0.036)**	(0.067)	(0.025)***	(0.022)*	(0.052)**	(0.102)**
	[0.035]**	[0.053]	[0.025]***	[0.016]**	[0.044]**	[0.084]**
$UFCo_{2011}$	-0.094	-0.039	-0.047	-0.005	-0.109	-0.186
	(0.032)***	(0.052)	(0.033)	(0.022)	(0.045)**	(0.074)**
	[0.037]***	[0.035]	[0.035]	[0.020]	[0.039]***	[0.076]**
Adjusted R^2	0.020	0.025	0.146	0.025	0.075	0.090
N				6,623		
Clusters				160		
$Mean_{2000}$	0.164	0.172	0.230	0.178	0.511	0.744
$Mean_{2011}$	0.128	0.101	0.156	0.099	0.365	0.484

Note: UBN= Unsatisfied Basic Need. The unit of observation is the household. Robust standard errors, adjusted for clustering by census block, are in parentheses. Conley standard errors are in brackets. All regressions include geographic controls for slope, elevation, and temperature; demographic controls for the number of adults, children, and infants in the household; census fixed effects, and a linear polynomial in latitude and longitude.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix O. Luminosity Data

Table O.27: Luminosity data

	Log (0.01 + Light)	Log (0.01 + Per Capita Light)
	(1)	(2)
UFCo	0.342	0.215
	(0.035)***	(0.046)***
	[0.072]***	[0.059]***
Adjusted R^2	0.463	0.122
Observations	6,154	2,210

Note: The unit of observation is 1x1 km grid cells located within 5 km of UFCo boundary. Robust standard errors are in parentheses. Conley standard errors are in brackets. All regressions include year fixed effects.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$