Property with different rights: The long-run effects of Ecuador's agrarian reform

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Job Market Paper

Abstract

I study the long-run impacts of a policy that affected the quality of property rights in a developing country. I focus on a region in Ecuador that experienced land redistribution during the agrarian reforms of the 1960s and 1970s. In this region, one side was granted flexible property rights over crop choice, while the other was restricted to growing rice, the main annual crop, due to food security concerns. I use the 2000 agricultural census to examine the effects of these property rights regimes on crop productivity and credit markets. I use alternative data sets to study the effects on efficient land use and structural transformation. I find that areas that received flexible property rights are more productive in perennial crops. Moreover, this effect comes from outside Ecuadorian traditional crops such as bananas or cocoa, providing evidence that this type of reform fostered diversification. In addition, these zones show more efficient land use, and there is suggestive evidence of rapid structural transformation. In contrast, areas under the crop restriction policy continue to focus on rice production, even without a binding restriction in place, and do not show increased productivity for annual crops in general. These places are more likely to rely on informal credit markets, which I argue has created a novel mechanism influencing farmers' long-term decisions and contributing to a path dependency cycle. Within perennial crops, these areas lack diversification and are heavily specialized in banana production, which was the most common perennial crop before the reform. In an additional comparison, I use a region where the agrarian reform was not fully implemented. This allows me to contrast the outcomes of different types of reforms against a non-reform scenario.

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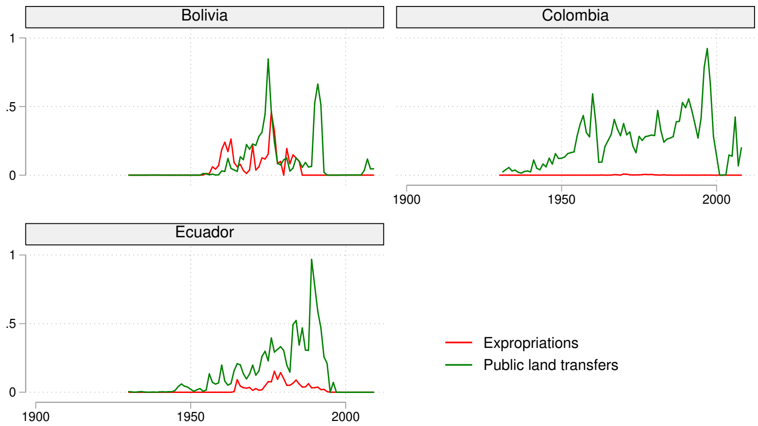
1. Introduction

The quality of property rights has long been recognized as a crucial determinant of economic outcomes, especially for long-term decisions (Demsetz, 1967; Acemoglu et al., 2005; Galiani and Schargrodsky, 2010; Hornbeck, 2010; Libecap and Lueck, 2011). In developing countries, particularly in the rural sector, different property rights regimes coexist due to institutional legacies or sub-optimal implementation of agrarian reforms. Agrarian reforms have been opportunities for policymakers to impose certain practices, such as mandating specific crops to enhance food security, while also aiming to expand the agricultural frontier and provide farmers with flexibility in crop choice. The coexistence of these different property rights regimes raises important questions about their economic consequences. In his contribution, Alchian (1965) reflected on the nature of property rights, suggesting that they consist of a "bundle of rights." He argued that restrictions imposed on property rights may cause more harm to society compared to less restrictive environments.

Agrarian reforms in Latin America have typically involved (among others) two types of projects: expropriations and public land settlement policies/transfers (hereafter PLT) [1] (Albertus, 2015). While the former has been extensively studied, the latter has received little attention, especially with regard to property rights. Expropriations resulted in irregular forms of land tenure among both owners and beneficiary farmers, while PLT was more uniform in this regard. Cumulatively, PLT affected a larger area of land than expropriation in some countries (see Faguet et al. (2020) and Galán (2020) for extensive studies on Colombia). Figure 1 shows the importance of PLT relative to expropriations for a selection of three Latin American countries. Given the ubiquity of both types of land allocation programs, studying agrarian reforms exclusively through the lens of expropriations provides an incomplete assessment of their impacts. In other words, it is crucial to assess the ultimate consequences of each program in relative terms.

[1] In Latin America, it is common to refer to public land distributions as "colonization" processes because one of the goals was to encourage internal migration and expand the agricultural frontier (hence "colonizing" new national/internal lands). For the sake of clarity in writing and proper contextualization, I will not use the term colonization, but *public land transfers.*

Figure 1: Importance of public land transfers in selected Latin American countries



Note: Data is from Albertus (2015). Each series is normalized to be comparable and to be between 0 and 1.

Leading contributions on agrarian reform in Latin America have often concluded that it was unsuccessful across various dimensions, with several challenges-such as the failure to improve rural development-largely unmet (de Janvry, 1981; Kay, 2002). For instance, Kay (2002) compared the Latin American experience to that of East Asia and identified several reasons for Latin America's less successful implementation of agrarian reform: weaker state capacity, the inability to establish an equitable agrarian structure, and the failure to create positive interactions between the agricultural and industrial sectors. While it is evident that Latin America has not significantly improved its agricultural productivity, this does not mean that certain aspects of agrarian reforms failed to generate positive local spillovers. In a recent essay, Kay (2019) reviews contributions to the land reform literature, presenting a skeptical view of land colonization (referred to as PLT in this paper) as an effective method of land redistribution, or even as a valid component of land reform. While a conceptual debate remains, how can the agrarian reforms of the 1960s and 1970s in Latin American countries be effectively assessed without considering the role of PLT, especially in countries where it has played a significant part?

In this paper, I examine the impact of PLT relative to expropriation, the two main land allocation strategies applied during the second half of the 20th Century, on agricultural productivity outcomes. My setting is the coastal region of Ecuador where both strategies were applied in parallel and during the same time frame. The PLT program applied in this setting, allocated state-owned or abandoned land and provided their beneficiaries with flexible property rights over crop choice. Expropriation, on the other hand, tended to be more restrictive. The coastal region of Ecuador experienced a particular restriction: Beneficiaries were expected to grow rice, the main annual crop of the region and one of the most demanded crops for national consumption, given the country's food security concerns at the time. If the Ecuadorian context created a quasi-random allocation of land rights along the dimension of crop choice, what are the implications for agriculture and development in general?

Addressing endogeneity in this setting is challenging because the land allocated to the PLT program could, in principle, be inherently different. In particular, PLT programs aim to expand the agricultural frontier, that is, to convert unoccupied land into productive farms. Unoccupied land may be different from land that already has an owner, leading to potential problems such as land quality selection or omitted variable bias. Land settlement policies aim to be distributive rather than redistributive, i.e., they focus on allocating state-owned land rather than taking land from current owners and broadly redistributing ownership (Albertus, 2015). In Ecuador, public land settlement programs were governed by a separate set of laws from those used in cases of expropriation. However, there were cases where land was abandoned but workers remained in, leading to a potentially redistributive aspect of PLT. Hacienda owners abandoned most of their properties and moved permanently overseas following the collapse of the cocoa boom of the 1920s. In such cases, the Institute of Colonization and Agrarian Reform (IERAC, in Spanish) - the government agency in charge of implementing agrarian reform - had to exercise arbitrary discretion in determining the applicable legislation. I argue that this scenario provides an opportunity to defend an identification strategy based on the geographical proximity of sites. Proximity can serve as a proxy for a quasi-random application of different legal frameworks that influenced the property rights regime within the region under study. Using a geographic regression discontinuity design, I identify the effect of receiving flexible property rights on crop choice via PLT relative to expropriation, where property rights were restrictive in crop choice selection. In experimental terminology, I use the former as my treatment group, while the latter as my comparison group.

Using the 2000 agricultural census of Ecuador, I find that being in a zone that benefited from the PLT program is associated with higher productivity and a preference for growing perennial crops (21% relative to comparison group). Within perennial crops, the effects come from outside traditional crops (78% relative to comparison group) such as cocoa and bananas, indicating diversification. In contrast, areas with inflexible property rights are persistently committed to rice cultivation (28% relative to PLT), in line with the restrictions imposed in the past. On the expropriated lands, the banana yield is 98% higher than in PLT, even when controlling for agro -climatic conditions. Since bananas was the primary perennial crop previous to the agrarian reform, this might further indicate a low willingness to wait in switching to a different perennial crop, and avoidance from diversification. This may have been caused by the uncertain institutional environment created by the expropriations, as they were carried out rapidly and through an executive decree. These results suggest that a specific issue to consider is the effect that these land allocations had on time preferences, investment decisions, and willingness to wait[2]. Finally, I compare the studied regions with one in which the agrarian reform did not fully intervene. To do so, I use a linear regression model that controls for a variety of characteristics. Main conclusions remain.

Following the results, a more diversified set of perennial crops would be expected to result in better land use outcomes, i.e., the selection of crops is more suitable to the potential usage of the land. Specifically, in a more flexible environment, the selection of crops should lead to better perennial crop choices relative to the best potential use of the land. To test this, I use a different and more granular dataset from the Ecuadorian Ministry of Agriculture. I find that PLT areas are associated with better land use within perennial crops, as suggested by the main results. Furthermore, I document that PLT areas experience higher economic growth (measured by night light intensity and satellite-measured agricultural GDP) and a rapid decline in agricultural labor. Overall, my results suggest that areas that received PLT have better economic outcomes relative to areas that experienced the application of the expropriation legislation.

When testing for mechanisms, I document a novel dynamic. While access to credit markets is widely acknowledged as an important factor in increasing property rights security (De Soto, 2000), to the best of my knowledge, there is no comprehensive review of the effect of informal credit markets. Informal credit markets may serve as intermediaries, reinforcing the circumstances of areas that remain predominantly focused on rice production. I find that areas outside of PLT have greater access to informal credit. This might help explain the continued devotion to rice production. Informal credit operates outside the formal market, charges high interest rates, and demands quicker repayment with limited options for debt restructuring. I see this as a novel mechanism that potentially maintains a path-dependent structure, particularly by perpetuating farmers' commitment to short-term crops such as rice. Consequently, this could have implications for efficient crop choice selection and agricultural investment.

[2] See, for example, Bellemare et al. (2020), who finds that in the context of Vietnam, a change in the extension of usufruct rights led to additional investment of a limited dimension.

This paper contributes to the literature by exploring the complexities of contemporary agrarian reform and examining the implications of different institutional environments applied to nearby, similar locations. This research considers a property rights dimension within agrarian reform and examines its relative importance for local long-run development. Works such as Tella et al. (2007) and Galiani and Schargrodsky (2010) analyze cases of formal land titling and find that it is not access to credit that enhances the effect of formal titling on better economic outcomes, but rather investment-related explanations. This research shows that perennial crops, which require a form of investment (future orientation, willingness to wait), are connected with better economic outcomes such as increased economic activity and structural transformation. More closely related to the property rights intervention analyzed in this paper, Libecap and Lueck (2011) and Bellemare et al. (2020) examine "subtle" changes in the property rights dimension of land received by people in the US and Vietnam, respectively. In the former, the type of demarcation and in the latter, a change in usufruct rights lead to significant economic gains. This paper finds that differences in crop choice due to different land allocation laws (PLT vs. expropriation) have significant local economic impacts, specifically on productivity. In addition, I discuss the possibility of an informal credit market channel that could incentivize farmers to remain in the transitory/annual rice crop.

This research further contributes to a growing body of empirical research on the effects of land allocation and its implications for economic development. I add to the contemporaneous literature on the effects of agrarian (and land) reform on agricultural outcomes (see, for example, Montero (2023, 2022); Edwards et al. (2022); Galán (2020); Bühler (2021); Smith (2020); Do and Iyer (2008)), particularly through a variation in property rights (Goldstein and Udry, 2008). In my setting, previous to the agrarian reform, conflict prevailed among workers since property rights were dubious specially among abandoned haciendas(Uggen, 1975). Property titles can reduce conflicts, however the effect is heterogeneous depending on factors such as land inequality(Hidalgo et al., 2010). Property rights can replace conflict with mutually beneficial exchange. However, the inflexibility of those rights over crop choice, while reducing conflict, does not improve economic benefits. At the same time as Latin American agrarian reforms, the Green Revolution may have played an important role in crop choice through its technological innovations (Gollin et al., 2021). However, it is important to consider that some local economies may not have translated these technological improvements into economic development. I argue that while rice productivity increased, it was entangled with low property rights flexibility, hence limiting the optimal allocation of land.

In the Ecuadorian context, it is challenging to engage with studies that argue that agrarian reform schemes benefit authoritarian regimes (Albertus, 2015; Albertus et al., 2016). The military regime that implemented the reform voluntarily transitioned to a democratic government. The newly elected governments served only four-year terms, with no reelection aloud for the executive. This makes it difficult to attribute the negative side effects of the agrarian reform solely to political institutions. Instead, I argue that the institutional framework of the reform played a crucial role. It provided incentives to farmers and private sector actors, such as informal lenders, which in turn influenced agricultural and development outcomes.

Many studies have primarily examined the role of expropriation in agrarian reform, overlooking PLT, which often outperformed expropriated land in terms of land distribution in several Latin American countries (Faguet et al., 2020; Albertus, 2015). Due to minimal political friction (since PLT mostly distributes abandoned or underutilized lands), PLT tended to grant better property rights to its beneficiaries. This paper contributes to the limited empirical research analyzing the effects of PLT, particularly its property rights allocation, and its long-term impact on agricultural and development outcomes. Latin American agrarian reforms are often perceived as failures because they do not significantly increase agricultural productivity at the aggregate level. However, this study reevaluates this claim by taking into account the complexity of contemporary agrarian reform policies. While it's clear that Latin American agrarian reforms have not in general produced positive aggregate effects, certain phases within these reforms have produced positive results at the local level. This research shows that, in the case of Ecuador, a specific aspect of agrarian reform improved agricultural and development outcomes compared to the widespread policy of expropriation. To the best of my knowledge, this is the first quantitative study that compares PLT with expropriation in the context of a Latin American agrarian reform.

The paper is structured as follows: Section 2 presents the institutional and historical context of the setting, Section 3 presents the data and sources to be used, Section 4 explains the empirical strategy to be used, Section 5 presents the results from the main empirical model, Section 6 discusses plausible mechanisms and alternative data sets to test the reasoning and implications of the results, Section 7 concludes.

2. Institutional context

2.1. Pre-agrarian reform

Before the agrarian reform, Ecuador experienced the rise and fall of two crops that significantly influenced the country's agricultural and political development: cocoa and bananas. Traces of cocoa plantations in the Americas come from the pre-colonial period. Ecuador, and specifically its coastal zone, hosted some of the largest cocoa plantations. According to historians , Ecuador experienced two cocoa booms; the first one in the 19th century and the second in the beginning of the 20th century(Chiriboga, 1980; Arosemena, 1991). International trade expanded considerably and Ecuador became one of the most important cocoa exporters in the world. These gains shaped a landed elite that built upon the *hacienda* and established different levels of precarious work. The property rights regime adhered to a *latifundia* system, where land was concentrated in the hands of a few land-owners and the relationships with workers were primarily characterized by serfdom or low-paid labor[3]. Landed elites became rentist (i.e., elites focus was on extract rents rather than improve or developed agricultural practices), since most of them lived overseas, specifically in Europe (Guerrero, 1994).

On the 1920s decade, two phenomena negatively affected cocoa producers: A worldwide decline in cocoa prices and the appearance of a plant pest called "witches' broom". Most hacienda owners opted to leave their estates altogether, as they were already living abroad. As a result, the workers remained uncertain about the ownership of the land, which led to disputes, rebellions, and alternative land uses(Uggen, 1975). These plots were not officially recognized by the state, but they were the result of a de facto agreement between the workers and the former landowners (Espinosa, 2014).

The expansion of rice cultivation had significant effects on the rural landscape in the coastal region of Ecuador. Large areas of land that had been devoted to cocoa were converted into small rice plantations. This shift in land use also had important implications for the local economy. While cocoa had been an export crop that brought foreign currency into the country, rice was mainly grown for local consumption. The uncertainty in land ownership and the increase in rice imports threatened the sector and raised concerns for the central government regarding balance of payments deficits. During the agrarian reform, rice was declared a strategic sector by former President José María Velasco Ibarra.

[3] In recent work, Rivadeneira (2024) highlight the differences of the precarious work experienced by indigenous populations in Ecuador relative to other context. His main focus is the forced labor institution known as "Concertaje".

Ecuador's second commodity boom came from bananas. After the collapse of the cacao haciendas, some landowners decided to take additional risks and switch to banana production. This was especially the case in the center-south of Los Ríos and Guayas, including the province of El Oro. The fruit became relevant after Costa Rica, the first banana exporter in Latin America before the 1950s, experienced a collapse in production. To fill the gap, Ecuadorian banana production increased. In addition, the wave of export-oriented ideas in Latin America was influential during these years. Initially, banana plantations were not concentrated, but rather a general activity among large and small landowners (Larrea, 1987). However, there was no organization among small producers or workers. Larrea (1987) concludes that despite the inequalities generated, areas with banana cultivation had a potentially higher standard of living, particularly due to the influence of the Standard Fruit Company in the Tenguel hacienda in the southern part of the region. Even though life standards can improve due to the investments of a large corporation (Méndez and Van Patten, 2022), its effects are local and concentrated. What happened to farmers and areas that were making decisions and working outside of the large corporation area?

These events set the stage for the implementation of agrarian reform in the provinces of Los Ríos and Guayas. The reform aimed to address land inequality and provide a path for landless peasants to acquire land ownership. Furthermore, it aimed to expand the agricultural frontier by promoting agricultural productivity on unused or abandoned land. The beginning of the reform was marked by the Agrarian Reform Law of 1964, which provided the legal basis for the creation of the National Agrarian Reform Institute (IERAC, in Spanish). The IERAC was responsible for implementing the agrarian reform program, which included public land settlement/land colonization policies(refereed in this paper as public land transfers) and expropriation. The agrarian reform slowed down by the end of the 1960s, primarily due to a change in government. However, after a few years, in 1970, returning President José María Velasco Ibarra declared an intention to intervene intensively in the coastal region of the country[4].

2.2. Agrarian reform and public land transfers

Similar to other Latin American countries that performed agrarian reforms during the second half of the 20th Century, Ecuador experimented with two projects within its agrarian reform: Expropriation and PLT[5]. The former refers to the action of the government to buy land from

[4] The first stage of the agrarian reform, while intervening in some parts of the Coastal region, was more intense on the midlands were indigenous groups were part of old labor intensive institutions called "huasipungo".

[5] The official name of the public land transfers program was "Colonization".

large landowners and reallocate it to farmers, normally to the same people that was working within the land. The latter had the aim of allocating abandoned or non-explored land in order to "expand the agricultural frontier" (Canelos, 1980). PLT played an important role in the Coastal and Amazon region. Expropriation was more common in the midland region of Ecuador, but it was intensified in the southern part of the coastal region from the 1970s.

In the Ecuadorian context, PLT and expropriation were governed by two different set of legislation. In principle, both laws were very similar, requiring beneficiaries to repay the benefit (the land) over a period of 20 to 25 years, with a grace period between 3 to 5 years. Financial conditions were relaxed relative to the private market. This type of process had in mind to prevent any type of patronage. In the Ecuadorian context, it is challenging to engage with studies that argue that agrarian reform schemes benefit authoritarian regimes (Albertus, 2015; Albertus et al., 2016). The military regime that implemented the reform voluntarily transitioned to a democratic government. The newly elected governments served only four-year terms, with no reelection aloud for the executive. This makes it difficult to attribute the negative side effects of the agrarian reform solely to political institutions. Instead, I argue that the institutional framework of the reform played a crucial role. It provided incentives to farmers and private sector actors, such as informal lenders, which in turn influenced agricultural and development outcomes.

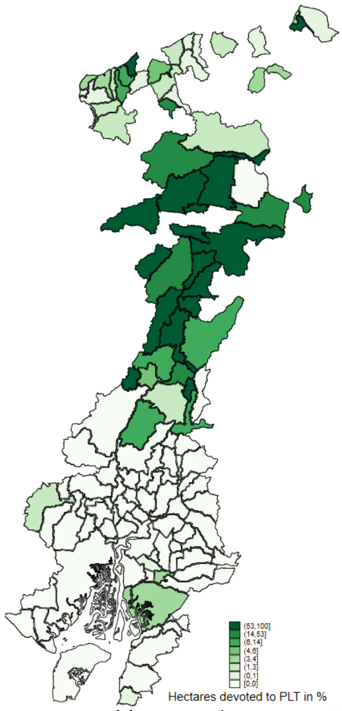
The initial rollout of the PLT program was initially slow [6], but accelerated after the promulgation of the First Law of Agrarian Reform and Colonization of 1964. The PLT program was supported by international organizations such as the World Bank and the Inter-american Development Bank, both of which undertook surveillance of the project. The specialised literature on the agrarian reform in Ecuador, normally concludes that the conditions received by beneficiaries of the PLT were more flexible and generous in terms of land awarded (Barsky, 1984). An important consideration that has not being fully addressed in this literature is that PLT also acted on abandoned land that had complex and organized production beforehand, such as old cocoa haciendas. In fact, Carrasco (1994) acknowledges that the old cocoa haciendas were important in this process. The PLT, in particular, faced several challenges, including the resistance of farmers to change old agricultural practices.

Why this particular region in coastal Ecuador? The provinces of Guayas and Los Ríos witnessed a unique feature of the agrarian reform process. Some areas experimented PLT, while nearby areas in the same province were untouched or affected by expropriations. While expro-

[6] Some first attempts of PLT (land colonization) started in the 1950s with some pilot tests in the Santo Domingo province.

priation was concentrated in the southernmost part of the provinces, PLT did not necessarily affected only vacant land, but rather land that was occupied by previous cocoa hacienda workers as well. Figure 2 shows a map of Guayas, Los Ríos, and the northern provinces of Santo Domingo, Pichincha, and Esmeraldas, which are provinces farther away from the areas where old cocoa haciendas were located, but where PLT was applied. Greener areas represent a stronger intervention by PLT, measured as the ratio of the amount of land devoted to PLT (from IERAC archives) over the overall area of the affected parish.

Figure 2: Variation in PLT



Note: This map represent the region of focus in this paper. Darker green areas represent parishes where PLT was more intense. The source of information is IERAC's statistical reports and parishes match with current administrative borders.

Why Property Rights? The southern region in Figure 2, experienced expropriations governed by legislation similar to PLT. Before the reform, there was no clarity on land ownership, and farmers primarily produced two crops: bananas, as the main perennial crop, and rice as the main annual crop. However, a unique feature was introduced here. Expropriations were carried out under *Decree 1,001*, an executive order issued by President José María Velasco Ibarra. This decree aimed to address food security concerns in the country due to increasing rice imports and declining local production[7]. Specifically, the decree required the beneficiaries of the expropriations in Guayas and Los Ríos to engage in rice production, implicitly imposing a 10-year

[7] It is important to note that Decree 1,001 is also known as the policy aimed at ending precarious labor in the region, as some farmers were paying "representatives" of former landowners for the right to use the land. While that was the political platform, the decree specifically focuses on enhancing rice production.

commitment to this crop.

The expropriation laws, like those of the PLT, tied the beneficiaries to a debt with more flexible terms than market rates. Decree 1,001 leveraged this aspect to ensure that its beneficiaries focused on rice cultivation. It was very specific in directing land use to rice for those who acquired land through expropriation. I interpret this rice cultivation requirement as a restriction on property rights, consistent with Alchian (1965) argument. Alchian suggested that in most societies, property rights are a bundle of rights, and restrictions on them can lead to worse outcomes for society than more flexible scenarios would.

3. Data

The data used in this research come from several sources: National statistics institute of Ecuador for the agricultural censuses and surveys, historical archives for maps and historic data on Agrarian reform in Ecuador. FAO-GAEZ, WorldClim, University of Wisconsin-Madison, the United States National Centers for Environmental Information, IPUMS, and map repositories of the Ministry of Agriculture of Ecuador are the sources for the geographic data. In this section I will briefly describe them and their use in the final data set.

3.1. Historical data

I use historical data in two different formats: Old maps, archival reports from IERAC [8], and physical censuses. The first two were obtained from archives preserved by the Jesuit library "Aurelio Espinosa Polit", the latter are stored in the Ecuadorean National Statistical Agency's (INEC in spanish) library. An example of the original aspect of the sources are found in Figures A1 and A2.

3.2. Geographic data

I use geographic and satellite data to account for different exogeneous characteristics such as: Temperature, precipitation, elevation, agricultural suitability, and potential yields of relevant crops. I obtain this information from several sources: Temperature and precipitation come from WorldClim; elevation and agricultural suitability come from the Center of Climatic Research from the University of Wisconsin-Madison; data of potential yields of relevant crops come from

[8] The specific reports that I got access to are for the years 1960-1970 and 1971, 1974, 1978

the United Nations Food and Agricultural Organization Global Agro-Ecological Zones (FAO-GAEZ) data base[9]. Furthermore, I also use night-light satellite data from the United States National Centers for Environmental Information as a proxy of economic development.

In addition to using international datasets on geographic characteristics, I also use national datasets. The Ministry of Agriculture of Ecuador (MAGAP, in Spanish) publishes large datasets on the agricultural characteristics of the country over several years. Specifically, MAGAP publishes georeferenced data on land use and suitability for specific crops. In the case of land use, the public data measure, at a very granular level, whether the land is being used for its intended purpose, in terms of making the best use of its potential.

3.3. Ecuador's 2000 agricultural census

The analysis that compare areas that received flexible property rights from PLT to the ones that do not, uses data from the 2000 agricultural census. This is the last agricultural census performed in the country. The census was conducted between October 1999 and September 2000 by the Ecuadorean government. It has a total of 110 questions over a wide range of topics including: Characteristics of the land, type of crops, plantation-harvest surface, production, among others. There were 158,486 interviews, which after official data processed by INEC resulted in 154,106 observations[10]. Each observation includes location at the parish level and a plot identifier. The analysis in this paper exploit variation at the plot stage since it is the most disaggregated level to consistently merge different questionnaires of the census.

In this study, I focus on the coastal region, with a specific emphasis on the provinces of Guayas and Los Ríos, Santo Domingo, Manabí, Pichincha, and Esmeraldas[11]. Furthermore, I restrict my sample to self-identified crop (either perennial, annual or both) producers [12]. The total number of observations in this sample is 9,992, from a total of 22,264 (including farmers devoted to cattle)[13].

[9] These are standard sources of geographical data within the economics literature. For details see Galor and Özak (2016); Droller and Fiszbein (2021); Montero (2022)

[10] According to the official methodology manual of the census, approximately 2.3% of the data was dropped due to missing responses.

[11] Additionally, there is another zone referred to as "non-delimited areas," within which the Manga del Cura zone is identified after organizing and aligning the data with current cartography.

[12] The precise criterion here is whether the ID of each plot is listed in the crop questionnaire pertaining to either perennial or annual crops. It's conceivable that plots listed in either questionnaire claim to produce perennial or annual crops but may not have had any production at that particular time.

[13] Given the low likelihood of encountering true zeros, I assign zero values to instances where, during the analysis of a specific agricultural outcome variable, a plot appears in both the perennial and annual crop questionnaires but has a missing value. This assumption ensures consistency in the number of observations across various outcome variables. It's a reasonable presumption, as the absence of production data for one crop, coupled with knowledge that the plot yields another crop, justifies assuming zero production for the former. This make my results to be interpreted on the extensive margin. I provide discussion and alternative and robustness exercises in the appendix.

For the category of perennial/annual crops, I utilize the following crops, categorized as the most relevant by INEC: (perennial)[14] Bananas, cocoa, plantain, sugarcane, and oil palm; (annual)[15] Rice, maize, beans, and potatoes. I define non-traditional perennial crops as perennial crops, excluding bananas and cocoa, which are the principal agricultural commodities of Ecuador.

3.4. Data set construction

The final dataset is a result of merging various data sources in the following manner: I reconstructed the historical IERAC map (Figure A1) and incorporated it as a layer onto current administrative borders in Ecuador. To achieve this, I aligned the 2000 agricultural census data with consistent parish borders, cleaning and hand-coding based on the INEC administrative zones codes[16]. Within the zone under consideration for this study, I successfully matched 125 parishes within the regions under study.

Regarding historical records from the IERAC archives, specifically data on the amount of land dedicated to PLT, I manually collected information from historical reports. Using the name of each parish, I located it with its corresponding INEC administrative zone code[17].

3.4.1. Definition of agricultural-related outcome variables

Descriptive statistics for the main outcomes of the used sample can be found in Table 1. The main agricultural outcomes in this paper are defined as follows:

Land usage in perennial/annual crops: Land devoted to perennial crops divided by total land used in perennial and annual crops.

Aggregate yields (perennial and annual crops): To compute aggregate yields for the primary perennial and annual crops, I adopt the empirical methodology outlined in Aragón et al. (2022). Essentially, I assign weights to each perennial/annual crop based on its 2000 prices according to FAO[18], and then divide this by the corresponding land area dedicated to that specific crop[19]. I

[14] perennial or perennial crops refer to plants that take long periods to reach harvest. Once established, these crops form plantations that typically remain on the land for extended periods.

[15] annual or annual crops refer to plants that have short growing periods and can often be cultivated and harvested multiple times within a single year.

[16] This approach ensures consistency in cases where parishes change provinces or cities, enhancing the usability of the data.

[17] Given that the reports date back to the 1960s and 1970s, some parishes were not yet established. In such cases, historical literature was consulted to determine which provinces were entirely dedicated to PLT, and, whenever possible, it was assumed that a parish was created as a result of the PLT program. Examples of this include Santo Domingo, Esmeraldas, and certain parishes in Quevedo, such as San Carlos. This step allowed for an increase in the number of matched parishes.

[18] I use real prices, specifically producer price index for 2000. This index uses the period 2014-2016 as base.

[19] When using the crop level wave of the data in the census, there are more missing values in land compared to production; certain crops may possess production values but lack corresponding land length values. This observation

calculate yields for self-acknowledged producers of perennial and annual crops and zero otherwise. I subsequently apply a logarithmic transformation.

Yield for specific crops (Rice, cocoa, bananas): When using specific crops I divide the production value of each crop (in metric tons) by land length[20].

Yield non-traditional perennial crops: This variable is computed using a similar approach, with the exception of excluding banana and cocoa, which are deemed traditional crops. I interpret it as a measure of diversification beyond the historically traditional crops[21].

Table 1: Summary statistics main outcome variables

	(1) PLT					(2) no PLT				
	mean	sd	min	max	count	mean	sd	min	max	count
Land usage perm.crops(%)	0.83	0.27	0.00	1.00	3156	0.48	0.45	0.00	1.00	6836
Yield perennial.crops (log)	1.65	1.35	0.00	7.11	3156	0.97	1.51	0.00	8.13	6836
Yield annual.crops (log)	4.02	1.61	0.00	6.81	3156	4.75	1.00	0.00	6.82	6836
Yield Rice	1.09	1.42	0.00	8.57	3156	2.72	1.80	0.00	8.57	6836
Yield cocoa	0.09	0.11	0.00	2.07	3156	0.06	0.12	0.00	4.35	6836
Yield Banana	1.02	4.87	0.00	70.25	3156	1.13	6.55	0.00	80.29	6836
Yield non-traditional peren.(log)	1.36	1.70	0.00	6.79	3156	0.60	1.54	0.00	8.20	6836
Land share devoted to PLT	0.39	0.42	0.00	1.00	3156	0.00	0.01	0.00	0.07	6836
Land share devoted to expr	0.02	0.03	0.00	0.10	3156	0.04	0.06	0.00	0.64	6836
Observations	3156					6836				

Note: Land usage: Land devoted to perennial crops/total land. Yield perennial/annual/non-traditional pern. crops: (log of) Revenue (price*quantity)/land devoted to perennial/annual/non-traditional crops. Yield of a specific crop (rice, banana, cocoa): Quantity produced (in metric tons)/hectares devoted to each crop. Land share devoted to PLT/expropriation: Amount of land (from IERAC records)/total land of available parish (current administrative borders). See main text for more details.

4. Empirical strategy

4.1. Identification strategy

The provinces of Guayas and Los Ríos were partially affected by PLT in its northern zone, while the rest of their areas were either untouched or irregularly affected by expropriation. Most of the unaffected or less-exposed areas were close to the artificial border highlighted in red in Figure 3. To the best of my knowledge, this border is not associated with any past or current administrative boundaries but is a result of IERAC's bureaucratic expectations. The source is a map

has been recognized by Adamopoulos and Restuccia (2014), possibly attributed to plots utilizing the same land for different crops and agricultural censuses providing information of the most relevant crop. To not discard useful information, I utilize the median land length value from complete observations at the crop, plot, and parish levels as a proxy for some missing values. Employing this method, I successfully impute 5% of the missing data for that variable.

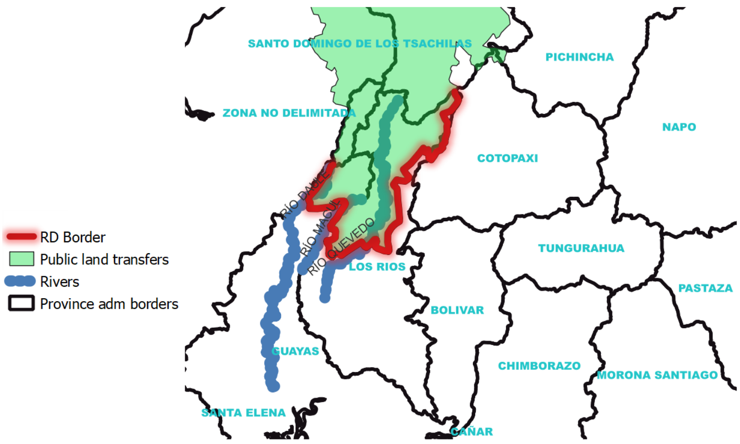
[20] See previous footnote.

[21] Hence, the main perennial crops, excluding bananas and cocoa are: plantain, sugarcane, and oil palm

obtained from the archives of IERAC which I hand digitised using GIS software. As discussed below, there are reasons that follow historical narratives and geographical features to consider this border a good proxy for quasi-random assignment.

Former owners. Along the border -both inside and outside the PLT green area- lay former cocoa haciendas. Some of these haciendas found themselves within the PLT area, a consequence of the cocoa bust the 1920s. Many owners abandoned their plantations, leaving workers with poorly defined lands (limits and rights) until the agrarian reform of the 1960s and 1970s. This abandonment created uncertainty about which legislation applied, whether pertaining to PLT or expropriation. In Los Ríos and Guayas, PLT was somewhat arbitrarily enforced due to unclear land ownership (Carrasco, 1994; Guerrero, 1994). Near the artificial border, both sides accommodated workers, while further north, a land colonization process was underway. Consequently, the region encompassing Quevedo, Mocache, Zapotal, and Balzar -the parishes at the border- experienced the impact of both legislations in areas of similar characteristic.

Figure 3: IERAC historic map: Artificial border PLT intervention area



Note: This map shows a geo ditized version of Figure A1. Green areas denoted the intervened zones by the PLT. The red line is an artificial border created by the historical map. Blue lines represents rivers: Daule, Macul, and Quevedo. Black lines are provincial administrative borders.

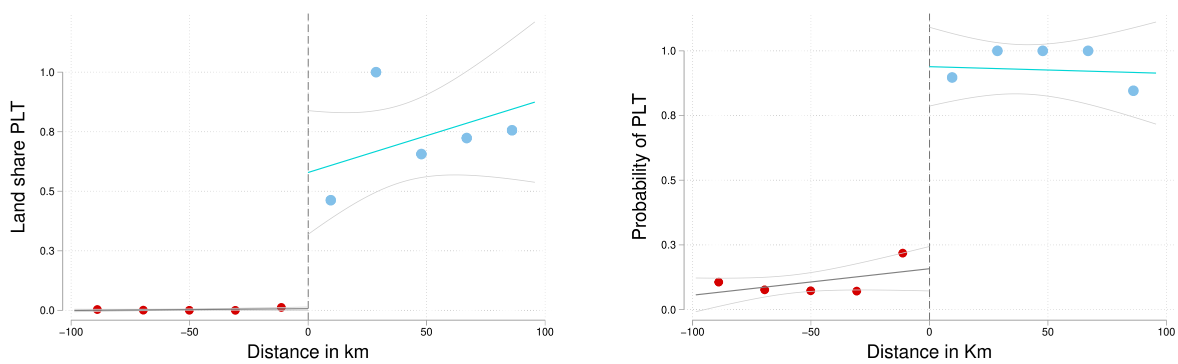
Exogeneous shock experienced by cocoa haciendas that coincides with the artificial border. Historians of the cocoa boom have evidence that suggests that the cocoa boom ended due to exogenous reasons such as changes in international cocoa prices and a cocoa plague known as "witches' broom" (Chiriboga, 1980; Guerrero, 1994). The most important parish in that zone, Quevedo, besides being mostly abandoned after the witches' broom, had its land settlement scheme during the Agrarian reform highly supervised by international organizations and the US (Díaz-Valderrama, 2019; Cuvi, 2015). In fact, the U.S. Department of Agriculture in 1947 wrote a report discussing the case of Pichilingue, a former hacienda in Quevedo during the cocoa boom, which was abandoned because of the witches' broom, in the area where IERAC intervened years later. They confirm that the hacienda was abandoned due to unforeseen reasons, basically the plague in the cocoa plantations [22] (Leonard, 1947).

Figure 4 plots the discontinuity in the application of the PLT program using data from archival registries from IERAC. The archival data is at the parish/district level[23]. The independent variable is the distance to the artificial border from the centroid of every parish, and negative (positive) values indicate parishes in the constrained (flexible) property rights area. As expected, the application of PLT is related to the geographic running variable (distance to the artificial border created by IERAC). I show in the appendix different sets of manipulations tests at the parish and land plot level (Figure A5 and Table A2)[24]. Additionally I show that using the number of workers as a proxy for rural population that there is no apparent sorting at the threshold (Figure A6). Finally, Figure A8 compiles data from IPUMS and reveals that nearly 90% of individuals born in the specified regions relevant to this study (utilizing a sample from 1962-2010) in the crop constrained property rights areas continue to reside in those places.

Figure 4: Fuzzy discontinuity in public land transfers and probability of treatment

(a) Share of PLT relative to parish area

(b) Probability of treatment(public land transfer)



Note: This Figure plots the share of land of a parish devoted to PLT (a) and the probability of being treated from PLT (b). Data from PLT are from historical archives. The running variable is distance in km from a centroid of a parish to the artificial border. Data on PLT transfers is at the parish level and comes from IERAC archives reports from the Library "Aurelio Espinosa Polit".

[22] Figure A4 shows the original map from (Leonard, 1947).

[23] I merge the data from the IERAC archives with current administrative borders, as some parishes, particularly in the PLT area, were established after the agrarian reform. The most notable cases are the parishes in the Santo Domingo province. Since these parishes were created as a result of 'colonization' (PLT), I assume that the new parishes were fully impacted by PLT interventions. This does not affect the impact experimented by parishes at the border since these already existed at the time of the agrarian reform. I follow the same reasoning and follow historical narrative (Barsky, 1984; Larrea, 1987; Canelos, 1980; Redclift, 1976) for parishes in Esmeraldas, Manabí, and Pichincha; together with map A1, to guide my reasoning.

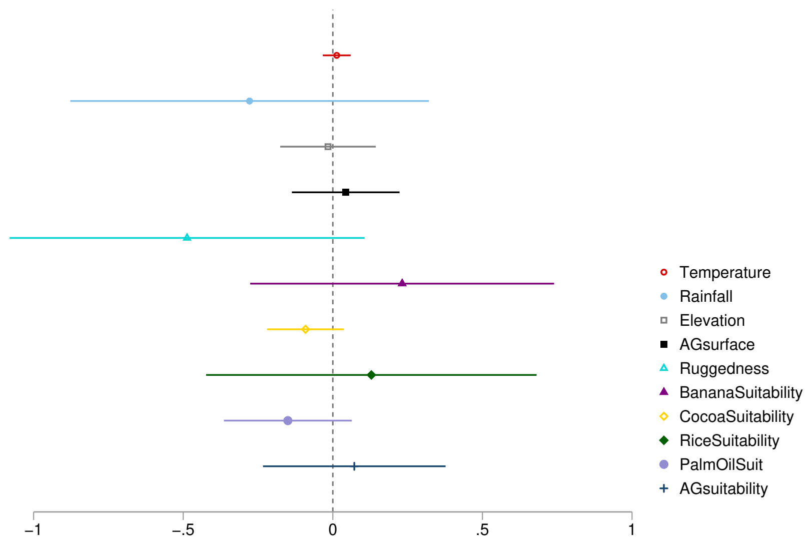
[24] Further, and since I can not apply a manipulation test at the plot/individual level, I apply a donut approach (removing the two closest parishes from the threshold) as robustness of my results.

I enhance this observation by georeferencing the polygons from map A1. The fact that the threshold does not align precisely with administrative borders allows me to calculate the proportion of land impacted by PLT at the parish level. This approach accounts for variations along the border. Figure A16 in the appendix illustrates the discrete jump and the probability, which is not exactly one at the border[25].

4.2. Balance, before-after agrarian reform, and additional considerations

To rule out the possibility of other confounders on the determination of the artificial border, Figure 5 shows different estimates from a regression discontinuity model on different characteristics. From this it is clear that balance holds for the available battery of observable characteristics. Furthermore, I also collected data from the first two agricultural censuses of Ecuador (This censuses were done in 1954 and 1974). An important shortcoming is that the 1954 census is only available at the municipality level. Because of this, I compare Quevedo(the only available region affected by PLT available in the 1954 census) with Ventanas, Publoviejo, Vinces,and Balzar; which are the closest available municipalities in the 1954 census. Figure 6 shows descriptive evidence that the divergence between the share of perennial/annual crops started after the agrarian reform implementation.

Figure 5: Balance on exogenous characteristics

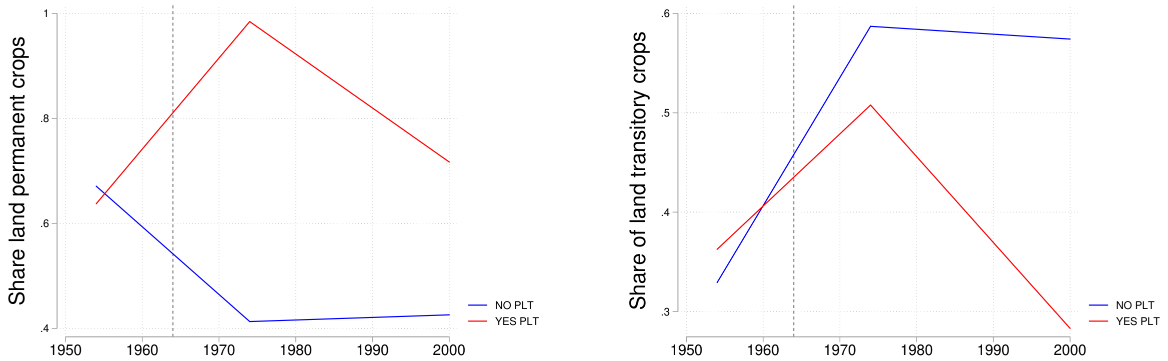


Note: Each dot in this Figure indicates a RD estimate using a linear polynomial and the optimal bandwidths of Calonico et al. (2017) for each of the outcomes presented in the legend. All variables are standardise between 0 to 1.

[25] For robustness, I include this variable in the fuzzy RD analysis as a replacement of the share of land devoted to PLT.

Figure 6: Before-After comparison: perennial and annual crops 1954-2000

(a) perennial crops (b) annual crops



Note: This Figure plots the trajectory in time of the share of perennial and annual crops. The graph is done at the municipal for the number of municipalities available in the agricultural census of 1954. The red line refers to zones beneficiaries of the PLT, while the blue line refers to the areas in the comparison group (affected by expropriations). Available municipalities: Quevedo (only observation available affected by PLT in the 1954 census), Ventanas, Publoviejo, Vinces,and Balzar

It has been stated that the PLT ultimately resulted in larger land parcels for its beneficiaries (Barsky, 1984; CIDA, 1975; Carrasco, 1994). However, in the specific context I am focusing on, there is no statistical significance indicating larger plots within the artificial border by 2000. A hypothesis that arises here is that the land market was more active in the zones that benefited from PLT, leading to the partition of plots and resulting in similar land sizes by 2000. To the best of my knowledge, there is no available information on land markets between the agrarian reform and 2000 in Ecuador. In fact, the "multi-partition" of plots is a phenomenon described in the sociological literature that has studied the Ecuadorian agrarian reform (Jacome et al., 2008). Hence, the ultimate difference and meaningful comparison in this context is the property rights regime, which emerges as a possible explanation.

Bananas and segment fixed effects. The banana boom experienced during the time after the cocoa boom and before the agrarian reform was notable in the region since bananas became the primary export commodity for the country (Larrea, 1987). I use data from the 1954 census to compare the number of banana cultivation areas and production levels (Figure A11)[26]. I do not find significant differences in these dimensions for bananas. I don't find evidence on differences at the border for banana suitability, but the increase in bananas exports might reflect some unobserved underlying characteristic. To take into consideration the role of the banana boom in my research design, I explicitly control for potential yields for bananas as a proxy for plausible banana plantations using the FAO-GAEZ agro-climatic database. Additionally, as is common in

[26] For this I use the same sample of observations as in Figure 6.

spatial RD settings, I also condition my results on border segment fixed effects. Figure 3 shows that three of the most important rivers in the coastal region of Ecuador intersect the artificial border: Daule, Macul, and Quevedo. These rivers roughly align with some segments of the artificial border from north to south. To account for characteristics of segments going from west to east, I include a segment-specific fixed effect based on the location of the rivers. Thus, conditional on these fixed effects, the variation in the border should be as good as random.

4.3. Expropriation

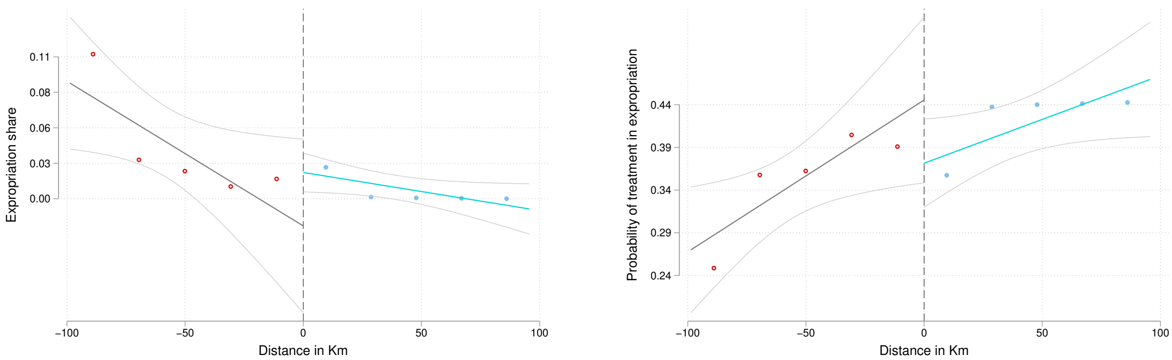
After the PLT program took place, intense expropriation efforts occurred "on the other side" of the IERAC's artificial border (my comparison group). Baquero-mendez (2023) collected data on expropriation episodes during the 1960s and for the years 1971, 1974, and 1978 [27]. In Figure 7, it can be seen the relevant information in the context of the RD design, specifically the likelihood of being affected by it. As demonstrated, there is no significant jump in the probability of experience expropriations. Therefore, around the cutoff, expropriation is independent of the treatment of interest in this paper, which is the PLT.

Figure 7a illustrates the amount of land expropriated relative to the size of the parish. It's evident that on the PLT side, less than 3% of the land was affected by expropriation. On the other side, the highest share of expropriated area reaches 11% due to expropriation leading to land fragmentation and the creation of "minifundias", which are small parcels of land for peasants[28].

Figure 7: Share and probability of expropriation

(a) Land share to expropriation

(b) Probability of expropriation



Note: This Figure plots the probability of being treated from expropriation and share of parish land affected by expropriation.

[27] The reports used are the "mirrors" of the reports I used to construct the PLT data set, but from the expropriation side of the agrarian reform.

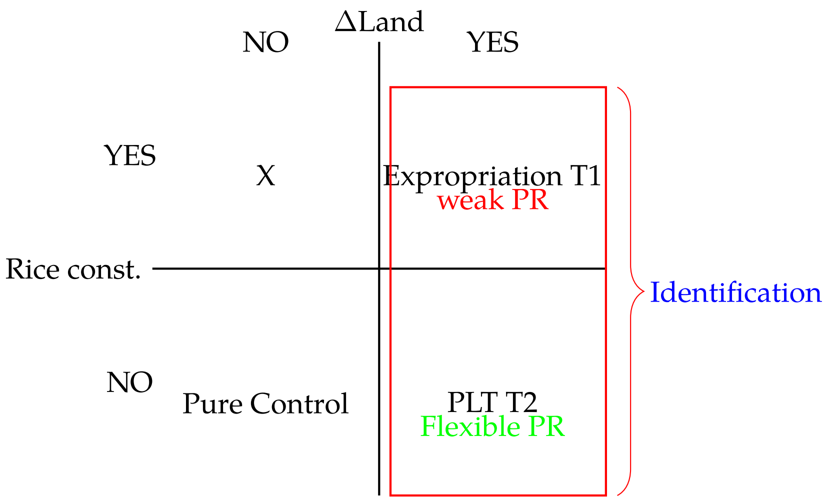
[28] In the case of PLT-affected areas, the average share of intervened land on the treatment side was 80% (refer to Figure 4).

4.4. Final comparison and method

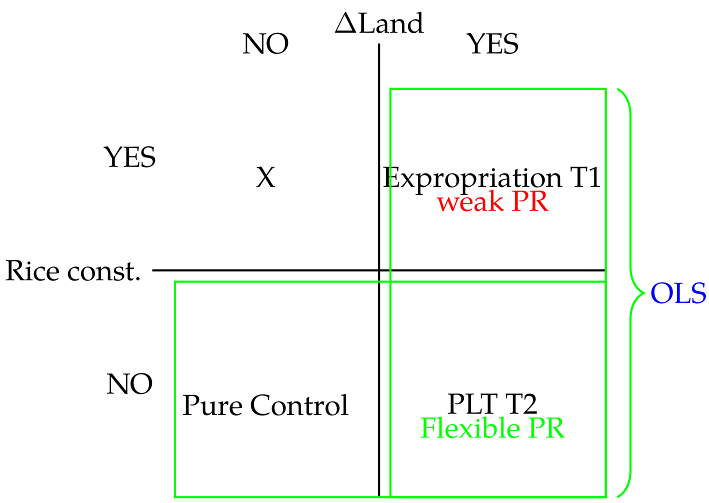
In experimental terms, what I can compare using my identification strategy and geographic RD design is akin to having two treatment arms. Furthermore, given that the province of Manabí is a region untouched by the agrarian reform intervention, I can utilize it as a counterfactual in a controlled OLS analysis, as there is no variation along any border. Despite this limitation, this exercise will aid me in further interpreting my results. A summary of this strategy is depicted in Figure 8.

Figure 8: Comparison explained

(a) Identification strategy RD



(b) OLS strategy



Note: This figure depicts the comparisons made in this paper. Panel a) illustrates my identification strategy for the spatial RD design. In this specification, I compare two 'treatment arms.' To enhance the characterization of my interpretations, I compare PLT and expropriation (the two treatments) with a region unaffected by land reform (counterfactual), as shown in panel b). I employ controlled OLS regression in this case, using the same controls as those used in the balance test.

4.5. Model specification

The estimation framework follows Albertus (2020) and Méndez and Van Patten (2022),

$$y_{i,p,b} = \alpha + \tau C_p + X_p + f(lat, lon)_p + \delta_p + \phi_b + \gamma + \lambda + \epsilon_{i,p,b} \tag{1}$$

where y is the outcome variable in terrain i in parish p along segment b of the artificial boundary. X represents the running variable which in this case is the distance from the centroid of parish p to the artificial border. $f(lat, lon)$ is a polynomial in latitude and longitude. δ_p Represents any control variables, which for my main specification will only include agro-climatic potential yields for bananas as discussed above[29]. ϕ_b indicates the inclusion of border segments fixed effects; these segments fixed effects are determined by the rivers Daule, Macul, and Quevedo. In my main specification I add provincial fixed effects γ [30] and self-reported tenure status (from the 2000 agricultural census) fixed effects λ[31]. ϵ is the error term. Based on the work by Gelman and Imbens (2019) I use as a prefer specification a linear polynomial and, as a robustness, a second degree polynomial in latitude and longitude. Moreover, my main specification estimates the model at the terrain level and cluster standard errors at the parish level. In my robustness tests I include versions using a donut design, conley standard errors, Huber-white standard errors (as noted by Kolesár and Rothe (2018))[32].

My preferred estimation method uses local linear regressions and optimal bandwidth selection. This approach is based on the work of Calonico et al. (2017); Cattaneo et al. (2019a) and has the advantage of using non-parametric techniques to calculate weights around the cutoff.[33] Moreover, I use the robust bias-corrected estimator which has been shown to have important coverage error and work well in clustering situations within RD (Calonico et al., 2014; He and

[29] For robustness tests I also include more controls to test the sensitivity of my results.

[30] These type of fixed effects are suggested in Kelly (2020)

[31] The 2000 census data indicates that approximately 70% of producers reported having individual ownership over their land. There are several categories in the land tenure variable, including: Leasing, cooperative arrangements, mixed ownership (defined as sharing property with a government institution), no title, or other forms of tenancy. It is challenging to interpret these responses, as they are based on self-declarations, and individuals may not necessarily possess any formal documentation (for a related discussion, see Abad and Maurer (2022)). I include these fixed effects in my analysis to compare farmers within each land tenure arrangement since different land tenure arrangements might indicate relevant differences among farmers(Guardado, 2018; Hidalgo et al., 2010). However, when estimating regressions at the parish level, I do not account for this variable, as the data when collapsed at the parish level already considers its information.

[32] Moreover, Kolesár and Rothe (2018) argue that is not prudent in regression discontinuity settings to cluster standard errors when clusters define the running variable. Due to this reason, I also present my results using using conventional heteroskedasticity robust standard errors (HC3) (Cunningham, 2021) in the appendix.

[33] Furthermore, as a robustness and following work by Barreca et al. (2011) I use a "donut" approach in my RD setting by dropping parishes whose centroid is located less than 1km away from the artificial border. This approach is also useful to discard any sorting that may biased the results.

Bartalotti, 2020; Calonico et al., 2021).

Given that the variable I employ in my fuzzy design operates at the parish level, potential inference issues may arise. To address this concern, I provide both my fuzzy RD results and reduced form estimations. While fuzzy RD yields larger estimates, I complement them with the reduced form results to ensure a parsimonious and transparent interpretation of my findings. Furthermore, I place greater reliance on the reduced form model and its results to adopt a conservative stance, interpreting them in relation to a lower bound effect.

4.6. Fuzzy design: First stage

As discussed in the identification section, my strategy relies on a fuzzy regression discontinuity design. Albertus (2020) apply a similar strategy which is described as follows: Define τ as,

$$\tau_{FRD} = \frac{\lim\limits_{\downarrow 0} \mathbb{E}(y_i|X_p = x) - \lim\limits_{\uparrow 0} \mathbb{E}(y_i|X_p = x)}{\lim\limits_{\downarrow 0} \mathbb{E}(C_p|X_p = x) - \lim\limits_{\uparrow 0} \mathbb{E}(C_p|X_p = x)} \tag{2}$$

in simple terms, the parameter τ quantifies the relationship between two distinct factors that impact the outcome of a study. The numerator is the effect of treatment assignment on the outcome (i.e. intention-to-treat). The denominator is the impact of actually receiving that treatment, known as the "take-up effect." In other words, the running variable X becomes an instrument of the actual treatment received C. In this case, C is the share of each parish p affected by the PLT. As discussed in the identification section, Figure 4 shows that there were some affected areas by PLT below the cutoff and some not entirely affected above the cutoff, deviating from IERAC's expectations. This variation creates the opportunity of estimating this model using a fuzzy regression discontinuity design.

5. Results

My results are divided in seven different outcomes: The share of land devoted to perennial crops (labeled as "share"); the (log of) revenue per hectare of all perennial (and annual) crops (labeled as "perennial " and "annual "); the yields (production per hectare) of rice, cocoa, and bananas; and the (log of) revenue per hectare of all perennial crops, except for cocoa and bananas as a measure of diversification (labeled as "Non-traditional") [34]. My main sample is restricted to producers of perennial and annual crops to ensure a consistent number of observations across all outcome variables. I use the entire census sample to further demonstrate the consistency of my results and conclusions. In this section I start with the simplest model, ordinary least squares (OLS), and drag certain conclusions from it. Then, I pass to the geographic RD model, using several specifications in order to discuss the plausible causal effect of the PLT on agricultural outcomes relative to the comparison group (expropriations).

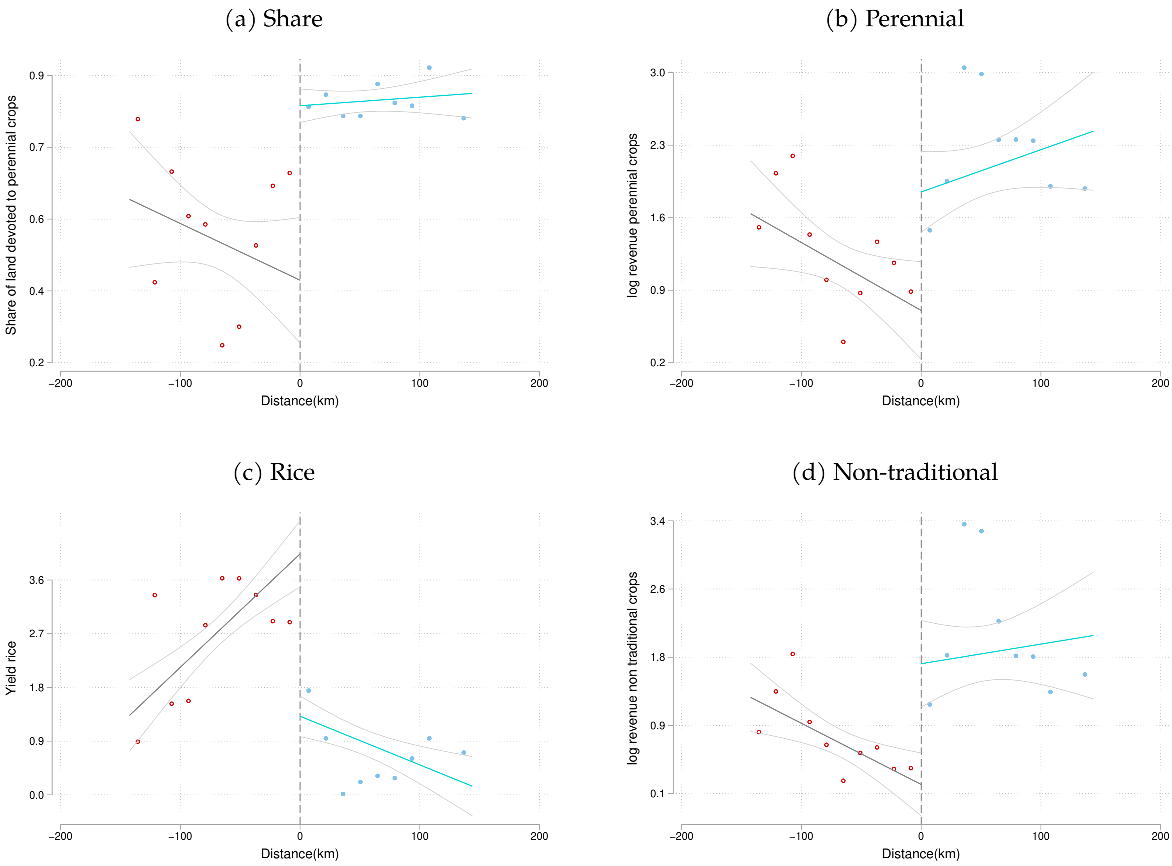
5.1. Raw discontinuities

The main outcomes are shown in Figure 9. Each figure plots a bin scatter and shows the discontinuity relative to the distance of each parish to the artificial border created by IERAC. The sample is constrained to plots that have perennial and annual crops. Panel a) shows the share of land devoted to perennial crops relative to annual, Panel b) shows the (log of) yields for perennial crops(The most important perennial crops are: Bananas, cocoa, plantain, sugar cane, and oil palm. I use international prices (base 2013) from the Food and Agriculture Organization (FAO) as weights)[35], Panel c) shows the yield for rice, and Panel d) shows the (log of) yields for all perennial crops except the traditional ones: bananas and cocoa.

[34] For perennial crops, the agricultural census includes age information, but it has numerous missing values. To address this, I excluded crops older than the initial PLT attempts in the region. Additionally, in some cases, while production is documented for perennial crops, the dedicated land amount is unspecified. In these instances, I used the median value of the land devoted to a specific crop in each parish ,for plots with complete information, to estimate land use and calculate yields.

[35] Figure A7 in the appendix shows that the discontinuity holds for all perennial and annual crops without any weighting

Figure 9: Discontinuities figures



Note: This figure shows the raw discontinuities, i.e., the scatter plots with no controls of the main variables where an effect is found.

5.2. OLS

Table 2 show a simple OLS model in which the independent variable is an indicator on whether an agricultural plot is either on the PLT area or not. This estimates can be interpreted as unconditional means. The seven columns provide the expected signs and magnitudes. Columns 1,2, 5, and 7 present positive coefficients, hence arguing in favor that areas in the PLT zones have on average better performance and more land share devoted for perennial crops. In column 6 the perennial crop banana present a negative non-significant result. From this Table, the increase in productiviy for perennial crops does not seem to come from the traditional ones[36].

For the areas affected by expropriation, columns 3 and 4 find that, on average, intervened zones have less productivity on annual crops, especially, rice. This first set of results present coherence with the historical narrative. Rice is prevalent in the areas with crop constrained property

[36] Table 2 uses the restricted sample specified above (restricted to perennial and annual crop producers to have the same number of observations per outcome). In Table A20 (appendix) I show the unrestricted OLS results using the full sample.

rights following the government incentives and partial control that it executed in the region.

Table 2: Uncontrolled OLS estimates

	(1) Share	(2) Perennial	(3) Annual	(4) Rice	(5) Cocoa	(6) Banana	(7) Non-traditional
PLT	0.342	0.680	-0.727	-1.630	0.029	-0.117	0.764
	(0.041)***	(0.154)***	(0.216)***	(0.198)***	(0.009)***	(0.228)	(0.185)***
Observations	9992	9992	9992	9992	9992	9992	9992
Parishes	125	125	125	125	125	125	125
Mean	0.59	1.18	4.52	2.21	0.07	1.10	0.84
Variation w.r.t mean	57.71	57.59	-16.10	-73.90	39.89	-10.62	91.33

Cluster standard errors at the parish level in parentheses

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

Note: Column (1) refers to land usage. Columns (2)-(7) are measures of productivity (yields) for each aggregate category/crop. Land usage: Land devoted to perennial crops/total land. Yield perennial/annual/non-traditional pern. crops: (log of) Revenue (price*quantity)/land devoted to perennial/annual/non-traditional crops. Yield of a specific crop (rice, banana, cocoa): Quantity produced (in metric tons)/hectares devoted to each crop. Land share devoted to PLT/expropriation: Amount of land (from IERAC records)/total land of available parish (current administrative borders). See main text for more details.

5.3. Regression discontinuity estimates - The effect of public land distributions on agricultural outcomes-

To obtain a causal estimate, I employ my identification strategy to approach the true effect of property rights regimes on agricultural outcomes. I report results for fuzzy and the reduced form version of the geographic RD model. I interpret the coefficients from the fuzzy geographic RD with caution since the variation of the amount of land from the IERAC's archives is at the parish level rather than at the plot level. The reduced form version present more conservative estimates, as is common when using instrumental variables.

In the fuzzy case, the dichotomous variable functions as an instrument for the share of land devoted to PLT relative to the total land of the parish. In presenting results for the fuzzy spatial RD, I include bandwidths calculated using the Calonico et al. (2017) algorithm. For the reduced form case, I use the same bandwidths (35km), which closely align with those suggested by optimal bandwidth calculations. I do this to ensure adequate comparisons. Main results are in Tables 3 and 4 for the fuzzy RD and the reduced form results[37], respectively.

As is common in the empirical literature that employs IV estimation, the estimates from Table 3 tend to be larger than the ones in the reduced form version (Table 4). I choose to present both the reduced form and fuzzy versions of the model to anchor my conclusions within a range. Furthermore, the limitations arising from parish-level information (for measuring distance to

[37] As a robustness exercise I geo code the historical map in Figure A1 to calculate interventions shares by using the polygons of the map instead of the data from IERAC's reports. Results are available in the appendix in Table A21.

the border and land shares devoted to PLT) prompt discussion on the statistical uncertainty of the results, specifically, by discussing its implications in terms of ranges. Because of this the bias-robust estimate is relevant since it can provide credible results even in small number of clusters situations(He and Bartalotti, 2020; Cattaneo et al., 2019b). Taking this into consideration, the effects identified are meaningful (both statistically and in magnitude) and relevant.

Table 3: Geographic fuzzy RD estimates

	(1) Share	(2) Perennial	(3) Annual	(4) Rice	(5) Cocoa	(6) Banana	(7) Else
				Panel A: First stage			
PLT	0.319	0.536	0.552	0.774	0.552	0.319	0.552
	(0.121)**	(0.199)**	(0.192)***	(0.215)***	(0.192)***	(0.120)**	(0.192)***
				Panel B: Fuzzy RD estimates			
Robust	0.291	0.634	0.313	-1.770	0.036	-1.341	0.905
	(0.065)***	(0.370)*	(0.246)	(0.689)**	(0.021)*	(0.585)**	(0.515)*
Observations	3151	3478	3290	2954	3290	3186	3290
BandwidthL	28	29	32	24	34	31	32
BandwidthR	23	34	25	27	24	22	25
Parishes	18	23	20	18	20	19	20
Mean	0.703	1.142	4.880	2.020	0.079	1.364	0.706
Variation w.r.t mean	41.4	55.5	6.4	-87.6	45.0	-98.3	128.1

Cluster standard errors at the parish level in parentheses

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

Note: PLT is an indicator variable that takes the value 1 when a specific parish is in the public land transfer zone according to IERAC's historical map. Robust refers to the robust bias-corrected RD estimate from Calonico et al. (2017). Column (1) refers to land usage. Columns (2)-(7) are measures of productivity (yields) for each aggregate category/crop. Land usage: Land devoted to perennial crops/total land. Yield perennial/annual/non-traditional pern. crops: (log of) Revenue (price*quantity)/land devoted to perennial/annual/non-traditional crops. Yield of a specific crop (rice, banana, cocoa): Quantity produced (in metric tons)/hectares devoted to each crop. See main text for more details.

I find a positive relationship between the PLT intervention and the share of land devoted to perennial crops (column 1), this effect is 13% relative to the comparison group; this effect is larger, 41.4%, when applying the fuzzy RD estimates. When analyzing yields, I find that the areas affected by PLT are between 21-55% higher than the comparison group (column 2). There is no statistical significance when analyzing annual crops (column 3). When disentangling the yield of specific crops, rice has a strong negative relationship with PLT (column 4) of 28-88%. There is no significant result when analyzing cocoa (column 5). For bananas, I find a strong negative relationship with PLT (column 6) of 98-117%, so the effect I find for perennial crops does not come from either cocoa or bananas. Furthermore, the strong and robust coefficient for bananas suggests that those areas that were not affected by expropriations are persistently devoted to only one particular perennial crop. Column 7 calculates the same model, but using the main perennial

Table 4: Reduced form geographic RD estimates

	Share	Perennial	Annual	Rice	Cocoa	Banana	Non-traditional
				Sharp RD case			
Robust	0.095	0.239	0.059	-0.598	-0.002	-1.572	0.590
	(0.030)***	(0.120)**	(0.151)	(0.147)***	(0.015)	(0.319)***	(0.166)***
Observations	3513	3513	3513	3513	3513	3513	3513
Bandwidth	35	35	35	35	35	35	35
Parishes	24	24	24	24	24	24	24
Mean	0.719	1.147	4.818	2.123	0.084	1.339	0.759
Variation w.r.t mean	13.2	20.9	1.2	-28.2	-2.9	-117.4	77.8

Cluster standard errors at the parish level in parentheses

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

Note: Robust refers to the robust bias-corrected RD estimate from Calonico et al. (2017). Column (1) refers to land usage. Columns (2)-(7) are measures of productivity (yields) for each aggregate category/crop. Land usage: Land devoted to perennial crops/total land. Yield perennial/annual/non-traditional pern. crops: (log of) Revenue (price*quantity)/land devoted to perennial/annual/non-traditional crops. Yield of a specific crop (rice, banana, cocoa): Quantity produced (in metric tons)/hectares devoted to each crop. See main text for more details.

crops (oil palm, plantain, and sugar), according to INEC, without the traditional crops of cocoa and bananas. The positive effects of the yields of perennial crops come from diversification rather than specialization in traditional crops, this effect is between 79 and 128%.

5.3.1. Extensive and intensive margins

As discussed above, my main results are computed using a homogeneous sample of observations consisting only of self-reported crop farmers. Farmers engaged in other activities, such as livestock, are excluded from this sample. However, interpreting the results, especially for extensive margins, can be problematic. Therefore, I present results using observations outside the sample of crop producers where it is safe to assume zero crop production[38]. In addition, when considering the intensive margin, I focus on the sample where there are only positive values, i.e. not only self-consider crop producers, but also crop producers who actually produce a particular crop in question.

The results presented in Tables 5 and 6 offer additional confidence in the findings outlined in the previous section, even when considering a larger sample that includes observations beyond crop growers. Furthermore, distinguishing between the intensive and extensive margins can provide deeper insights into the results. I present the results using the optimal bandwidths procedure for each outcome variable. The version using the fuzzy design can be found in the appendix (Tables A18 and A19).

While a detailed analysis of the results is provided in the next subsection, the key takeaway is

[38] Summary statistics for this sample are available in Table A3

the impact of non-traditional perennial crops on both the intensive and extensive margins. Notably, the effect on rice yields arises from the intensive margin rather than the extensive one, suggesting that the increase is due to enhanced productivity among existing rice producers, rather than a shift towards rice cultivation. Additionally, the positive effect on perennial crops is more pronounced on the extensive margin, indicating that farmers are increasingly choosing these types of crops. Although bananas may influence these effects, the main geographic RD model accounts for the agro-climatic suitability for bananas. This reveals that non-traditional perennial crops exhibit greater yield productivity in the areas affected by PLT.

Table 5: Extensive margins

	Share	Perennial	Annual	Rice	Cocoa	Banana	Non traditional
				Sharp RD case			
Robust	0.215	0.309	0.568	0.045	0.001	-1.742	0.552
	(0.076)***	(0.068)***	(0.408)	(0.261)	(0.019)	(0.794)**	(0.048)***
Observations	4578	5319	5952	5569	4620	2766	4707
BandwidthL	25	29	35	38	33	36	28
BandwidthR	29	28	28	29	29	31	40
Parishes	19	22	23	25	23	23	21
Mean	0.897	1.593	5.007	2.942	0.132	22.346	1.598
Variation w.r.t mean	24.0	19.4	11.3	1.5	0.5	-7.8	34.5

Cluster standard errors at the parish level in parentheses

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

Note: Robust refers to the robust bias-corrected RD estimate from Calonico et al. (2017). Column (1) refers to land usage. Columns (2)-(7) are measures of productivity (yields) for each aggregate category/crop. Land usage: Land devoted to perennial crops/total land. Yield perennial/annual/non-traditional pern. crops: (log of) Revenue (price*quantity)/land devoted to perennial/annual/non-traditional crops. Yield of a specific crop (rice, banana, cocoa): Quantity produced (in metric tons)/hectares devoted to each crop. See main text for more details.

Table 6: Intensive margins

	Share	Permanent	Transitory	Rice	Cocoa	Banana	Non traditional
				Sharp RD case			
Robust	0.129	0.093	0.199	-0.444	-0.001	-10.886	0.512
	(0.028)***	(0.137)	(0.055)***	(0.105)***	(0.015)	(5.828)*	(0.265)*
Observations	2211	2151	2712	2210	1743	219	1139
BandwidthL	25	30	22	20	32	36	38
BandwidthR	23	26	25	31	23	36	41
Parishes	15	20	16	19	19	25	27
Mean	0.892	1.571	5.034	2.775	0.128	19.749	1.557
Variation w.r.t mean	14.5	5.9	3.9	-16.0	-1.2	-55.1	32.9

Cluster standard errors at the parish level in parentheses

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

Note: Robust refers to the robust bias-corrected RD estimate from Calonico et al. (2017). Column (1) refers to land usage. Columns (2)-(7) are measures of productivity (yields) for each aggregate category/crop. Land usage: Land devoted to perennial crops/total land. Yield perennial/annual/non-traditional pern. crops: (log of) Revenue (price*quantity)/land devoted to perennial/annual/non-traditional crops. Yield of a specific crop (rice, banana, cocoa): Quantity produced (in metric tons)/hectares devoted to each crop. See main text for more details.

5.3.2. Interpretation and discussion of each result

Land share devoted to perennial crops. Column 1 (of all result Tables) depicts the influence of residing in the PLT area on the proportion of land allocated to perennial crops. Regions that experience higher exposure to PLT, while remaining within the optimal bandwidth, allocate around 8-30% increase in their land for the cultivation of perennial crops depending on the specification. For the extensive and intensive margins exercise this is 24% and 15% respectively.

Aggregate productivity on perennial and annual crops. Columns 2 and 3 show the results of PLT exposure on revenue per hectare for perennial and temporary crops. In the case of the former, the effect is substantial and noteworthy. Residence in an area with higher PLT exposure induces producers to increase their productivity in perennial crops, which is associated with a greater tolerance for delayed harvests. For temporary crops, the impact is almost negligible. This could be due to the profitability of certain crops, which prevents producers from abandoning them completely. For the extensive and intensive margins exercise, perennial crop yields are significant for PLT intervention at the extensive margin (19%). This could mean that farmers in the PLT area choose to engage in these types of crops due to the flexibility that accompanies the intervention. I find a positive result in the intensive margin of annual crops, but its overall effect is negligible (4%).

Specific crops: Rice, cocoa, and bananas. Columns 4-6 revise the yield patterns for specific perennial and temporary crops. The case of rice is particularly relevant as it is the most important annual crop with historical significance in the region analyzed. According to the empirical model, productivity tends to be lower in PLT areas due to the presence of weaker property rights. This scenario pushes these regions into a spiral of rice dependency, resulting in a path-dependent situation centered on rice cultivation. For cocoa, the results lack robustness, while for bananas the results are consistently negative and significant. For the extensive and intensive margins exercise, bananas seem to be relevant in both cases in the comparison region affected by expropriations. The intensive margin analysis, reveals that the number of effective banana producers is low and concentrated (219 observations). The fact that the banana effect is large and robust in every case analyzed leads to the conclusion that areas unaffected by the rice constraint develop an over specialization in a particular crop without further risk diversification. This was likely due to the way expropriations were executed-rapidly and by executive decree-which led to less confidence in diversifying into other types of perennial crops.

Perennial crops except cocoa and bananas (Non-traditional). To assess where the perennial crop productivity gains come from, since bananas are concentrated in the comparison area, I estimate the model using the same outcome variable as in column 2, but removing cocoa and bananas (traditional perennial crops). The results indicate that there is a precise and significant effect of exposure to PLT and revenue per hectare for perennial crops, excluding cocoa and bananas. This effect is between 79-128%. This result suggests that the progress in perennial crops is not only the result of intensification within the traditional perennial crops category, but rather stems from diversification within this category. Moreover, in the appendix (figure A15 and table A15), I delve deeper into the investigation by examining whether this effect is influenced by another important crop, namely oil palm. However, I find no evidence that the presence of another important crop forces farmers to specialize too much in that particular crop. The number of different products also confirms the existence of a discontinuity in crop diversification. For the extensive and intensive margins, it is also clear that this effect is large and positive, I find that the effect is 35% and 33% respectively.

5.4. Robustness

The following robustness tests are found in the appendix: Donut RD-removing the closest parishes from each side of the border-(Table A4), Conley standard errors using different windows[39] (Tables A5,A6,A7,A8,A9,A10), second degree polynomial in latitude and longitude (Table A11), and placebo exercises moving the border, i.e., the PLT "treatment" by 5 and 20 km[40] (Tables A23 and A24).

5.5. Comparing with a region where the agrarian reform did not fully intervene

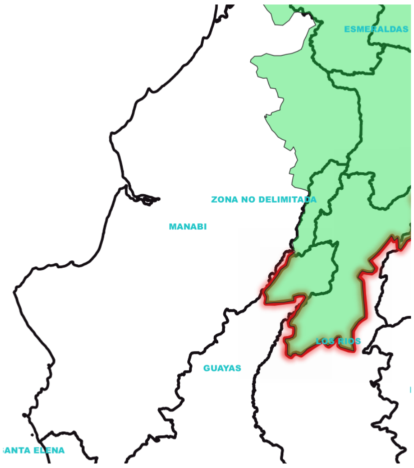
So far, I have investigated the long-term effects of PLT in comparison to a group that received crop constrained property rights in terms of limiting what can be grown as a crop and maintained the pre-existing relationship between landed elites and workers. To further explore the impact of different property rights schemes on long-term agricultural outcomes, a neighboring region, Manabí, which remained largely unaffected by the agrarian reform[41]. Figure 10 shifts the primary map to the west and illustrates the region of Manabí.

[39] For the spatial RD regression using Conley standard errors, I implement the procedure outlined in Colella et al. (2020). This process occurs independently of the algorithm presented by Calonico et al. (2017), resulting in slightly varied estimates while preserving their directional consistency and relative magnitude.

[40] I perform this exercises for the reduced and fuzzy version of the IV. I use the bandwidth of 35 km for all cases.

[41] I use the term "virtually" as there were minimal interventions, but the majority of the province remained untouched by the agrarian reform (Barsky, 1984).

Figure 10: Counterfactual region



Note: This map extended the one in Figure 3 to show the Manabí province.

Since parish centroids are not situated near any border, it is not possible to observe variations close to each other or to a border. As an alternative, I conducted multiple regressions, incorporating controls from the balance section, i.e., I run regressions with the controls from the geographic RD plus the variables shown in the balance section[42]. The independent variable is categorical indicating whether an area is situated in a PLT, expropriation, or "pure" control region. The results are presented in Table 7.

From the findings, it is evident that this counterfactual region performs less favourably than the PLT region in terms of yields for both perennial and annual crops, including the diversification measure (non-traditional). Moreover, rice remains much more prevalent in the area with crop constrained property rights compared to the counterfactual region. The coefficient on land share devoted to perennial crops exhibits a negative sign, which is more pronounced when compared to the crop constrained property rights area[43].

An intriguing aspect of this analysis is the significant importance of cocoa in the Manabí region, as highlighted in column 5. However, the measure of diversification, excluding traditional crops such as cocoa and bananas, is higher in the PLT region. Notably, this diversification measure is also higher in areas with inflexible property rights(expropriation). A plausible interpretation, drawn from both this observation and the main analysis, is that the threat of expropriation may encourage monocropping, with a focus on a single, historically known perennial crop (perceived as the less risky option). The formalization of flexible property rights through PLT

[42] For obvious reasons this does not include the segment fixed effects.

[43] An additional exercise is presented in the appendix AA33, where I geocode the expropriation data and present OLS results comparing areas affected by expropriation and others that were not. In this exercise, I show that the rice and informal credit market effect is due to expropriation.

seems to have stimulated a more complex diversification process. Nevertheless, it is evident that specialization in rice cultivation is a distinctive characteristic of areas with inflexible property rights(expropriation).

Table 7: OLS regressions. Comparing to Manabí region

	(1) Share	(2) Perennial	(3) Annual	(4) Rice	(5) Cocoa	(6) Banana	(7) Non-traditional
PLT	-0.130	0.582	0.457	-0.069	-0.051	-0.642	1.301
	(0.066)**	(0.212)***	(0.228)**	(0.286)	(0.023)**	(0.479)	(0.414)***
Expropriation	-0.400	0.259	0.739	1.115	-0.085	-0.160	0.849
	(0.085)***	(0.238)	(0.243)***	(0.373)***	(0.023)***	(0.556)	(0.427)**
Observations	14250	14250	14250	14250	14250	14250	14250
Parishes	194	194	194	194	194	194	194
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mean	0.63	1.16	4.34	1.72	0.07	0.92	0.81

Cluster standard errors at the parish level in parentheses

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

Note: The table shows the results of an OLS regression with various controls. The independent variable is categorical and classified as follows: 0=no agrarian reform, 1=Area affected by PLT, 2=Area affected by expropriation (crop constrained property rights) legislation. Estimates displayed are relative to the area that did not receive agrarian reform (Manabí). Column (1) refers to land usage. Columns (2)-(7) are measures of productivity (yields) for each aggregate category/crop. Land usage: Land devoted to perennial crops/total land. Yield perennial/annual/non-traditional pern. crops: (log of) Revenue (price*quantity)/land devoted to perennial/annual/non-traditional crops. Yield of a specific crop (rice, banana, cocoa): Quantity produced (in metric tons)/hectares devoted to each crop. See main text for more details.

6. Discussion of mechanism and implications

6.1. Informal credit markets

The research by De Soto (2000) suggests that secure property rights provide people with access to credit markets, establishing a direct correlation between improved property rights and credit accessibility. However, despite being theoretically appealing, this hypothesis has not necessarily found much empirical support.

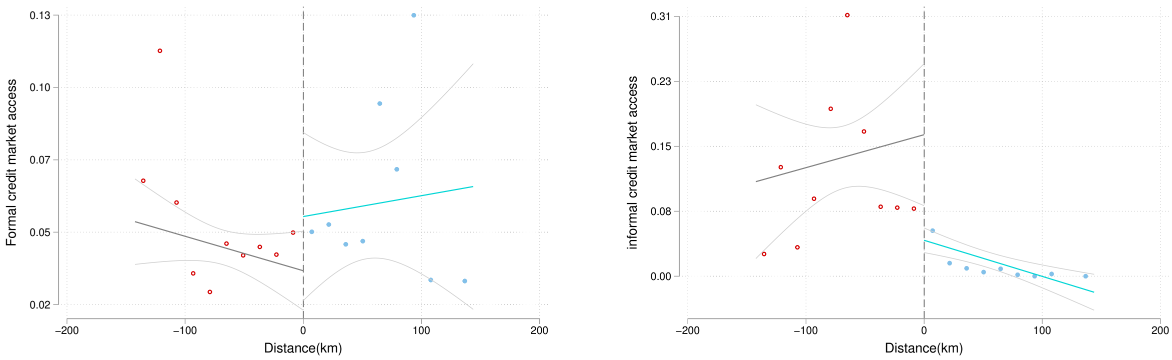
An essential consideration in this paper is the stability of crop constrained property rights as an equilibrium when comparing areas with weak and full property rights. The empirical strategy section discusses various tests that do not support sorting. However, the question arises: why do individuals in areas with crop constrained property rights do not relocate? Fergusson (2013) proposes a political economy argument wherein elites enforce crop constrained property rights, and peasants, fearing the loss of their plots, choose to stay and accept lower wages. In this section, I present another mechanism that may contribute to the stability of crop constrained property rights as an equilibrium.

While the De Soto hypothesis is debated with a focus on formal credit access, rural areas in developing countries may also have access to informal credit markets. Examples include loans provided by individuals at non-market interest rates. This form of informal credit might also bind workers, who, to alleviate liquidity constraints, may seek loans from individuals, thereby becoming tied to the land through the repayment of relatively high debts.

Figure 11 illustrates the share of plots in the 2000 census with access to formal (a) and informal credit (b) [44]. Alongside Table 8 uses the estimation sample to calculate in the RD framework if there is any difference in access to credit[45]. It becomes evident that being in the PLT area significantly reduces the likelihood of access to informal credit. Relative to its mean, PLT decreases access to informal credit by approximately 22% compared to the comparison group.[46].

Figure 11: Credit markets

(a) Formal credit markets (b) Informal credit markets



6.2. Land use

The impact of PLT through property rights should manifest as evidence of improved land utilization. In simpler terms, obtaining enhanced property rights should result in a noticeable improvement in land care within beneficiary areas. To explore this, I leverage data from the Agriculture Ministry of Ecuador, which provides detailed information on land use. The data is comprehensive, derived from a merging process involving multiple administrative sources

[44] The specific questionnaire asks: "Where does your credit come from?" I categorize the banking sector as formal credit and "chulquero" as informal credit. "Chulquero" is a term used in Ecuador referring to an individual who lends money informally and charges high-interest rates.

[45] Not all observations respond affirmative on wheter they access to credit. From the estimation sample, 962 observations responded that they access some form of credit. 507 in the crop constrained property rights area and 455 in the PLT area.

[46] I perform placebo tests for this as well, they are available in Tables A25 and A26

Table 8: Credit market access

	(1) Formal credit market	(2) Informal credit market
Sharp RD results		
Robust	-0.063	-0.071
	(0.045)	(0.023)***
Observations	962	962
Bandwidth	35	35
Parishes	24	24
Mean	0.172	0.319
Variation w.r.t mean	-36.7	-22.2

Cluster standard errors at the parish level in parentheses

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

Note: Robust refers to the robust bias-corrected RD estimate from Calonico et al. (2017). Among the farmers who responded affirmatively to receiving credit, column (1) is an indicator variable that takes the value 1 if the farmer reported that the credit came from private banks or savings cooperatives. Column (2) is an indicator variable that takes the value 1 if the farmer reported that the credit came from a "chulquero" (slang referring to informal credit).

including satellite data[47]. The ministry furnishes a consolidated dataset for the years 2002 and 2021, with variations in granularity and dimensions across the two years.

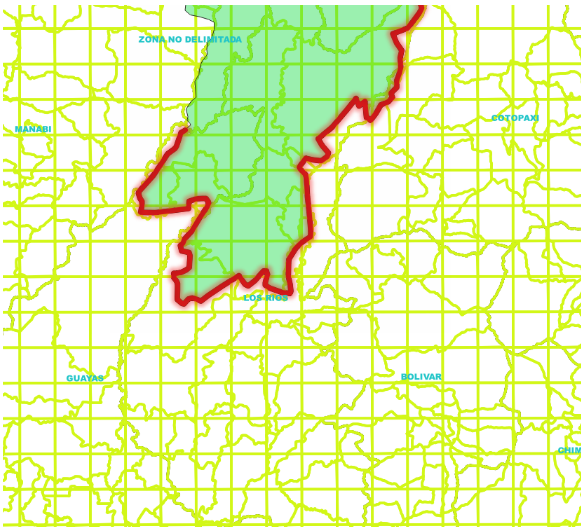
In this research, I have shown that productivity (in terms of yields) comes from crops other than the "traditional" ones. However, banana is an important crop that has maintained its influence, in the hands of fewer producers, in areas where Decree 1,001 was intensively applied. This effect could be due to previous plantations that avoided expropriation and were unlikely to have been affected by the artificial border created by IERAC. Moreover, the counterfactual comparison with the province of Manabí also shows that, in the absence of the reform, farmers seem to have specialized in cocoa, the other traditional crop. Thus, it may be that in the absence of reform, there is some degree of specialization in a particular perennial and "safe" crop.

Is there a cost for land use between specialization vs diversification in permanet crops? I expect that diversification provides a better land use, i.e., that the crop being cultivated is the best fit relative to the potentiality in the land. I use the data from the Ministry of Agriculture to test for this. To fully exploit the granularity of the data, I adopt a strategy of dividing the geographical zone into 10×10 km pixels. This not only allows for a detailed examination but also facilitates the incorporation of pixel fixed effects into the analysis. The outlined strategy is

[47] A complete description can be found in Ministerio de Agricultura y Ganadería (2021).

visualized in Figure 12.

Figure 12: Pixels



Note: This Figure is an illustration of a pixel strategy using the context in this paper.

The land-use index categorizes land into three groups: Good use, underproduction, and overproduction. To streamline this, I collapse the index into an indicator variable, creating two categories: Good use and bad use, where underproduction and overproduction are grouped together as bad use. My primary focus is on perennial cultivations.

The 2021 data provides highly detailed information, disaggregated at the 1:25,000 scale level. Additionally, it includes specifics on whether each observation pertains to perennial or annual crops. In contrast, the 2002 data is less detailed. To classify observations into perennial or annual categories, I merge the data with the 2000 agricultural census at the parish level. I make a simple assumption to determine if an observation belongs to perennial or annual crops: it is the case if the parish has more than its mean amount of land devoted to perennial or annual crops.

In examining the relationship between being in a PLT area and land use, I employ an interaction model and incorporate pixel-level fixed effects. Specifically, I interact two indicator variables: being in a PLT area and having perennial crop cultivations. The results are presented in Table 9. Both datasets indicate that having perennial crops interacted with being in the PLT zone are associated with better land use, preventing cases of overproduction or underproduction. This suggests that these areas take better care of their land, especially when dedicated to perennial crops.

Table 9: Effects of PLT on land use (perennial crops)

Optimal land use index	(1) 2002	(2) 2021
PLT × Permanent	0.233***	0.183***
	[0.064]	[0.045]
Observations	5,468	97,106
Pixel FE	yes	yes
Mean	0.45	0.21
R-squared	0.026	0.103

Cluster standard errors (parish) in brackets
*** p < 0.01, ** p<0.05, * p<0.1

Note: This table presents estimates of an interaction model between areas that received PLT and permanent crops. For the 2002 dataset, I utilize parish-level data from the 2000 agricultural census to classify the type of crop. In the 2021 dataset, specific information is provided regarding whether a plot of land is devoted to permanent or transitory crops. Both regressions include each indicator variable (PLT and permanent) as a control.

6.3. Suggestive evidence on the effect on structural transformation and growth

Structural transformation is a key component of economic growth (Herrendorf et al., 2014). If PLT improved agricultural productivity, this should be reflected in the decline of workers in the agricultural sector over time. I examine this using data from IPUMS (Center, 2020), which provides data from the 1962 Ecuadorian census through 2010[48]. I utilize their harmonized data to ensure comparability across years, benefiting from the standardization of municipalities (cantons) over time. Due to IPUMS sampling limitations, which affect the ability to standardize municipalities, I manually categorize the locations of PLT and expropriations. From this process I was able to match 68 parishes from the main sample from the agricultual census.

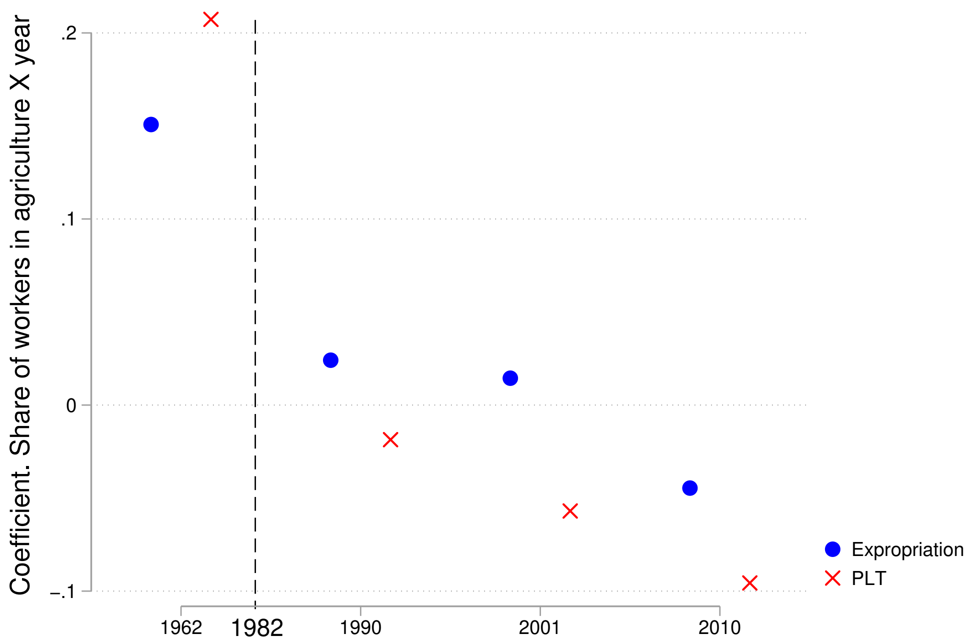
In Figure 13, I plot the estimated coefficients from an event-study regression. Specifically, I regress whether a worker is being classified as part of the agricultural sector on yearly dichotomous variables. Using 1982 as the reference year[49], the results indicate that in 1962, areas later devoted to PLT have a higher point estimate, suggesting that the proportion of agricultural workers in 1962 was larger compared to areas that would later be affected by expropriation. From 1990 onwards, while both groups experience a decline in the share of agricultural workers, the decrease is more pronounced in the PLT areas.

The trajectory reveals a common stylized fact from the structural transformation literature:

[48] IPUMS typically publishes around 10% of the sample.
[49] Although IPUMS includes data for 1974, it does not provide information on job sector for that year.

over time, there is a declining share of workers in agriculture. However, areas benefiting from PLT exhibit a suggestive faster decline. While property rights are recognized as pivotal for structural transformation (Kitamura, 2022), more research is necessary to explore how property rights shape preferences towards growing specific crops, potentially influencing the decisions of future workers. Productivity increases are crucial, as are the implications of productivity gains on crop choices and how farmers might be influenced by various interventions that impact both land size and property rights under specific contexts.

Figure 13: Share of agricultural workers relative to 1982



Note: This Figure plots an event-study type graph using 1982 as reference year (not shown). Crosses refer to areas that received PLT while circles are areas affected by expropriations.

Additionally, I further explore other characteristics associated with structural transformation. Table 10 presents individual estimates for the share of workers in agriculture, manufacturing, households residing in urban areas, and education (measured as the share of the population that completed primary school), including province and year fixed effects. To approximate the main results and account for the IPUMS sample restrictions, I use a bandwidth of 50 km from the IERAC border. Overall, the coefficients display the expected signs: workers in PLT areas are less likely to be in agriculture, more likely to work in manufacturing, and more likely to reside in urban areas. Additionally, people living in PLT areas are more likely to complete primary school. These results suggest that PLT areas are correlated with several dimensions typically associated with structural transformation.

Table 10: OLS regressions. Structural transformation indicators-IPUMS sample within 50 km of parish distance-

	(1) Ag.Share	(2) Manu.Share	(3) Urban.share	(4) Education (Primary school)
PLT	-0.132	0.024	0.181	0.074
	(0.040)***	(0.005)***	(0.066)***	(0.014)***
Observations	50852	50852	43807	60829
Clusters	55	55	46	64
YearXProvinceFE	Yes	Yes	Yes	Yes
Mean	0.44	0.05	0.64	0.57
Variation w.r.t mean	-30.36	47.16	28.23	12.94

Cluster standard errors at the Municipality-IPUMS level in parentheses

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

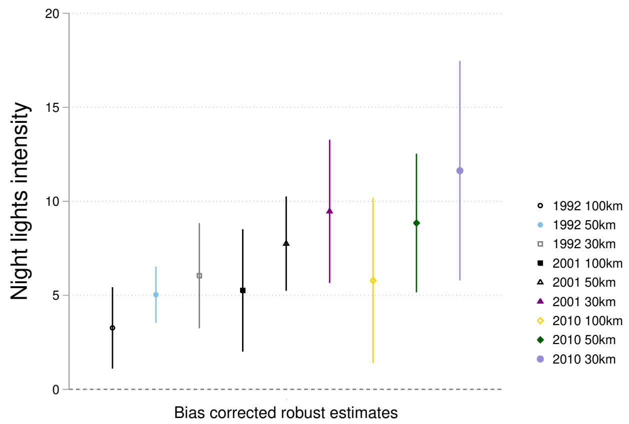
Note: PLT is an indicator variable which takes the value 1 when a specific IPUMS canton is in the public land transfer zone according to IERAC's historical map. Ag.Share: Share of workers in the agricultural sector, Manu.share: Share of workers in the manufacture sector, Urban share: share of the population in urban areas, Education(primary school): Indicator variable on whether or not a person, in the labor force, finished primary school. Sample is constraint to only active workers for each wave from 1962-2010 and within 50 km to the IERAC's border.

Finally, I explore the impact on economic growth using two measures derived from satellite data: night light intensity from NOAA and agricultural GDP from Blankespoor et al. (2022)[50]. This data is constructed using GIS systems and can be mapped to the same sample used in the RD analysis. Figure 14, panel a), presents RD results using night light data at the parish level (for 1992, 2001, and 2010), indicating that areas treated by the PLT exhibit systematically higher economic growth, independent of bandwidth selection. In the same figure, panel b), an alternative measure-agricultural GDP (based on satellite information)-reveals positive and meaningful point estimates, though they are not statistically significant for wider bandwidths. Altogether, these findings suggest that the productivity increases observed in PLT areas, compared to expropriated areas, translated into greater economic growth and a more rapid and meaningful process of structural transformation.

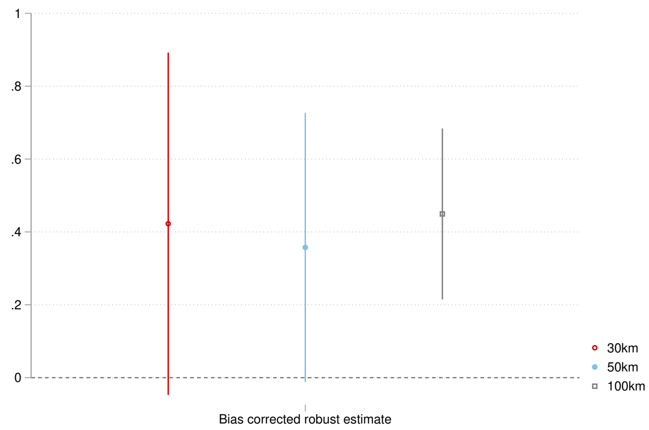
[50] It is important to note that agricultural GDP encompasses various activities beyond crop production, including forestry, fishery, and livestock.

Figure 14: Effect on economic activity

(a) Using night lights



(b) Using Agricultural GDP(Satellite)



Note: Panel a) shows the result of the main specification at the parish level using as an outcome night light data from NOAA. Panel b) does the same but it uses as an outcome agricultural GDP (using satellite data from Blankespoor et al. (2022))

7. Conclusions

In this paper, I explore the complexities of contemporary agrarian reforms by examining the impact of the Ecuadorian reform on a region where different approaches to land allocation were applied. I argue that the two policies-PLT and expropriations-were implemented in a quasi-experimental manner within the area, providing a unique opportunity to study the relative effects of these land allocation strategies. By focusing on geographic proximity, which helps exclude potential confounders, I suggest that the primary difference between the two areas lies in the variation in the flexibility of property rights granted over crop choice.

I find a significant positive impact on agricultural productivity, specifically on perennial crops, in areas mostly affected by PLT which granted flexible property rights over crop choice. The effect come from outside traditional perennial crops such as cocoa or bananas. For a country like Ecuador, promoting diversification in crop production is important. The results of this paper indicate that public land transfers were a policy that directed beneficiary areas towards diversification.

Areas affected by expropriations and constrained to produce rice for 10 years are still devoted to rice production by 2000. Additionally, there is no diversification in perennial crops, which affects efficient land use. Furthermore, I find that these areas are more susceptible to informal credit markets, which might play a complementary role in motivating overspecialization in a short-term crop such as rice.

In general, I also find that areas that benefited from PLT have more economic growth (measured with satellite information proxies) and suggestive evidence points to rapid structural transformation. These findings provide valuable insights for policymakers in designing agrarian reform programs that focus on property rights allocation and sustainable agricultural development. Furthermore, I aim to contribute to the literature on the long-term implications of public land transfer programs and highlight the need for further empirical research on the implications of property rights granted during agrarian reforms on long-term outcomes.

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Appendix

To be organised

Figure A1: IERAC historic map: Original

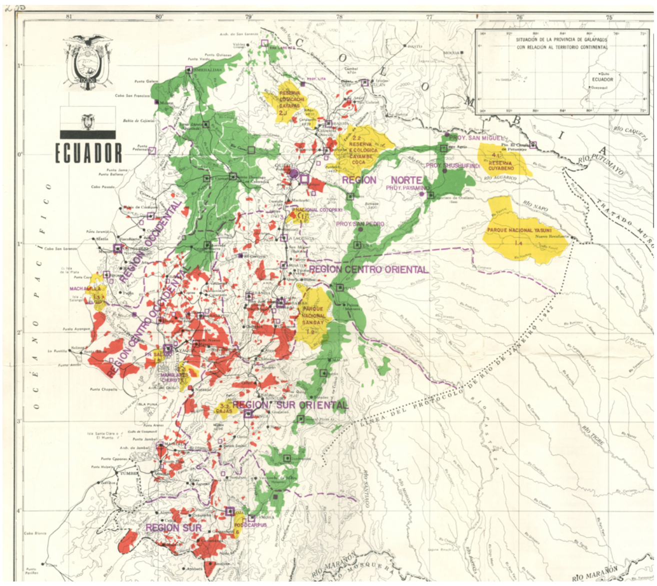
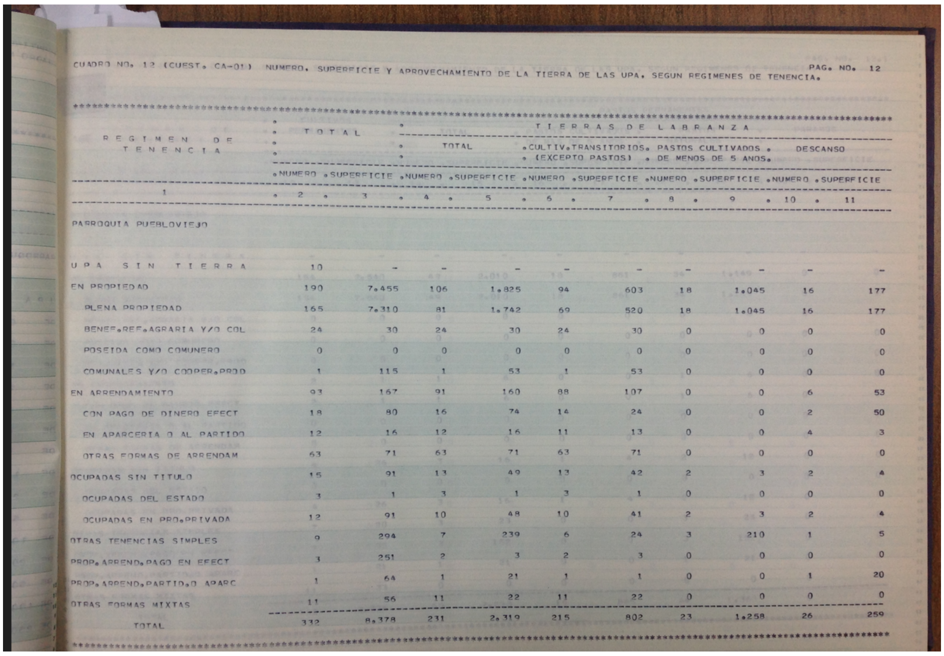


Figure A2: Old agricultural census example



CUADRO NO. 12 (CUEST. CA-01) NUMERO, SUPERFICIE Y APROVECHAMIENTO DE LA TIERRA DE LAS UPA, SEGUN REGIMENES DE TENENCIA. PAG. NO. 12

REGIMEN DE TENENCIA	TOTAL		TIERRAS DE LABRANZA							
			TOTAL		CULTIV. TRANSITORIOS (EXCEPTO PASTOS)		PASTOS CULTIVADOS DE MENOS DE 5 ANOS.		DESCANSO	
	NUMERO	SUPERFICIE	NUMERO	SUPERFICIE	NUMERO	SUPERFICIE	NUMERO	SUPERFICIE	NUMERO	SUPERFICIE
1	2	3	4	5	6	7	8	9	10	11
PARROQUIA PUEBLOVIEJO										
UPA SIN TIERRA	10	-	-	-	-	-	-	-	-	-
EN PROPIEDAD	190	7•455	106	1•825	94	603	18	1•045	16	177
PLENA PROPIEDAD	165	7•310	81	1•742	69	520	18	1•045	16	177
BENEF.REF.AGRARIA Y/O COL	24	30	24	30	24	30	0	0	0	0
POSEIDA COMO COMUNERO	0	0	0	0	0	0	0	0	0	0
COMUNALES Y/O COOPER.PROD	1	115	1	53	1	53	0	0	0	0
EN ARRENDAMIENTO	93	167	91	160	88	107	0	0	6	53
CON PAGO DE DINERO EFECT	18	80	16	74	14	24	0	0	2	50
EN APARCERIA O AL PARTIDO	12	16	12	16	11	13	0	0	4	3
OTRAS FORMAS DE ARRENDAM	63	71	63	71	63	71	0	0	0	0
OCUPADAS SIN TITULO	15	91	13	49	13	42	2	3	2	4
OCUPADAS DEL ESTADO	3	1	3	1	3	1	0	0	0	0
OCUPADAS EN PRO.PRIVADA	12	91	10	48	10	41	2	3	2	4
OTRAS TENENCIAS SIMPLES	9	294	7	239	6	24	3	210	1	5
PROP. ARREND. PAGO EN EFECT	3	251	2	3	2	3	0	0	0	0
PROP. ARREND. PARTID. O APARC	1	64	1	21	1	1	0	0	1	20
OTRAS FORMAS MIXTAS	11	56	11	22	11	22	0	0	0	0
TOTAL	332	8•378	231	2•319	215	802	23	1•258	26	259

Table A1: Comparison of decree 1001 and public land transfers

	Decree 1001	**Public Land Transfers**
Objective/Focus	Expropriate land and end precarious work	Formalize land occupation and promote agricultural frontier expansion
Plot Limits	Unclear (beneficiaries received plots within haciendas)	IERAC defined clear property delimitations
Able to Sell?	No (complex authorization from IERAC after a period)	Yes (fewer restrictions after a certain period)
Type of Crops	Promoted rice cultivation	Not specified (government encouraged agricultural frontier expansion, allowing diversification)

Source: Land Reform and Colonization Laws (1964 and 1973). Decree 1001 (1971).

Figure A3: Raw graphs PLT and Expropriation

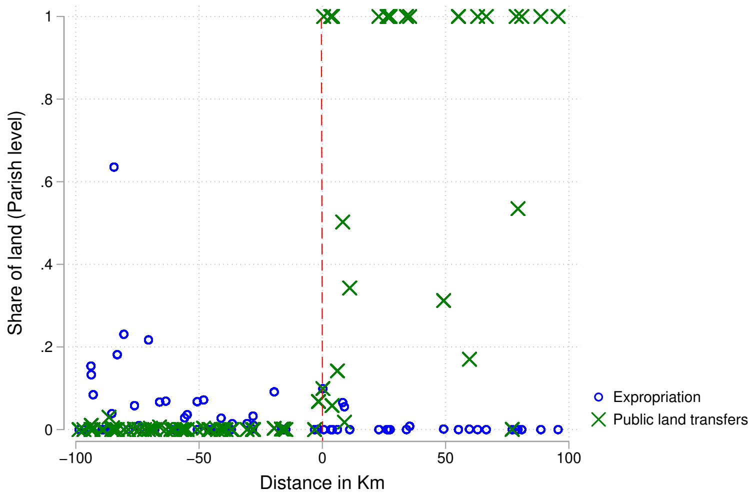
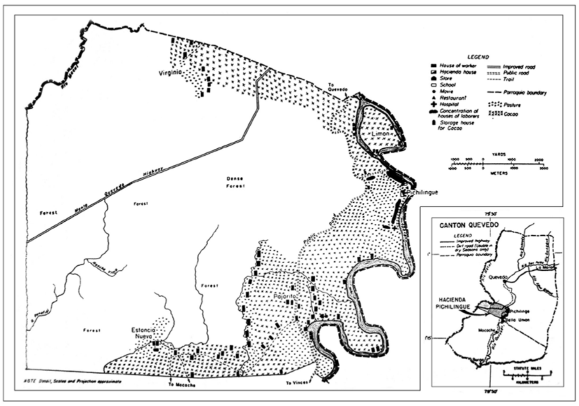


Figure A4: Pichilingue hacienda



Note: This map shows the location of the Pichilingue hacienda that was later transformed into a research center. Its area was affected by the witches' broom plague.

Figure A5: Manipulation test

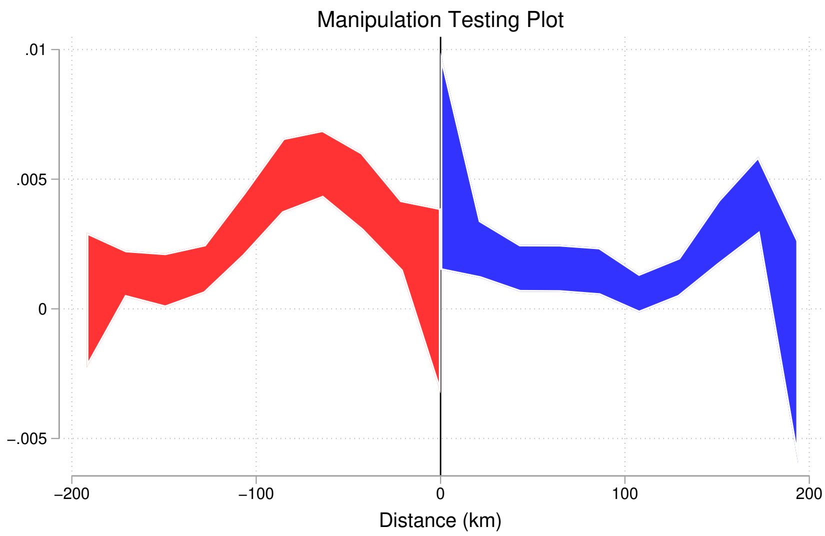
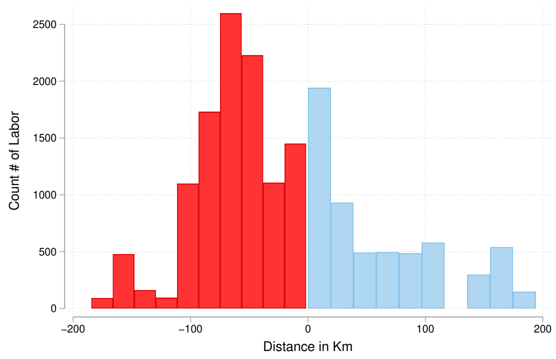


Table A2: Local randomization smallest window - individual data-

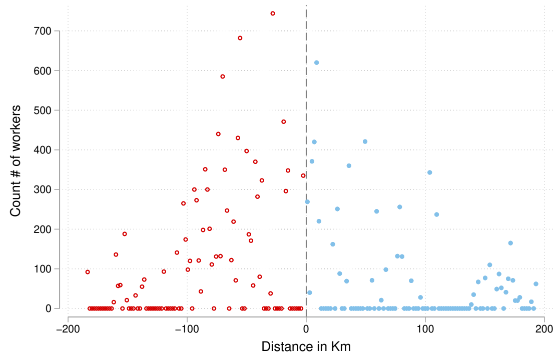
Window	p-value	Obs<c	Obs >= c
-1.576 | 0.221	0.071	249	292

Figure A6: No sorting in workers

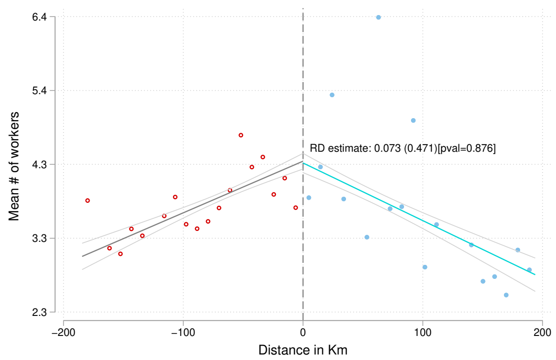
(a) Histogram number of workers



(b) Scatter number of workers



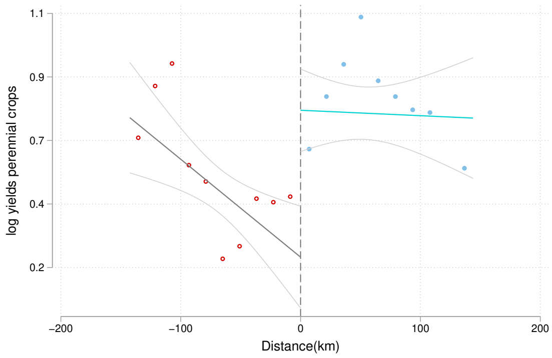
(c) RD no discontinuity in number of workers



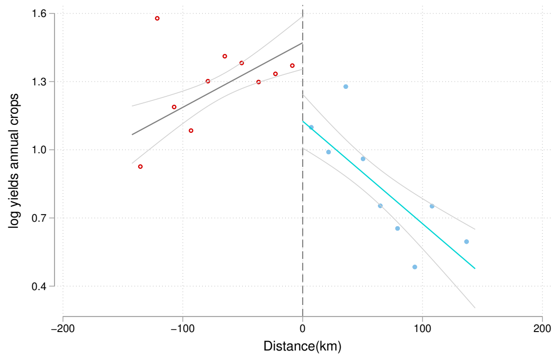
Note:

Figure A7: Discontinuities figures-Yields (Raw-no weights-)

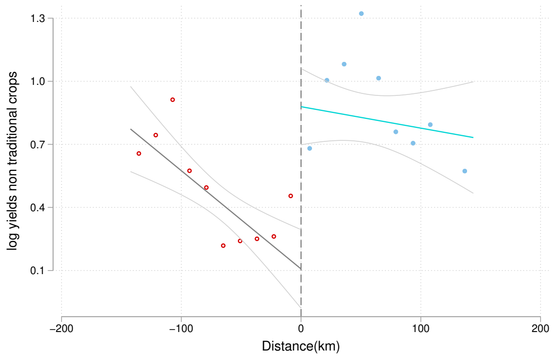
(a) perennial



(b) annual

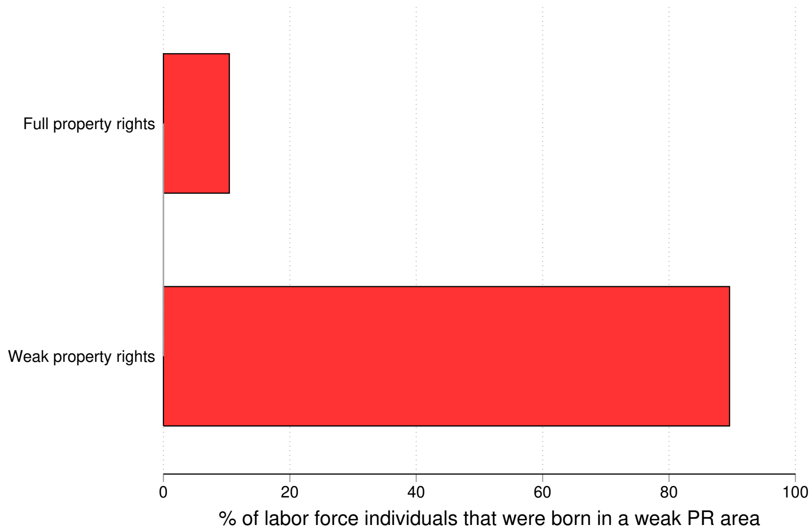


(c) Non-traditional



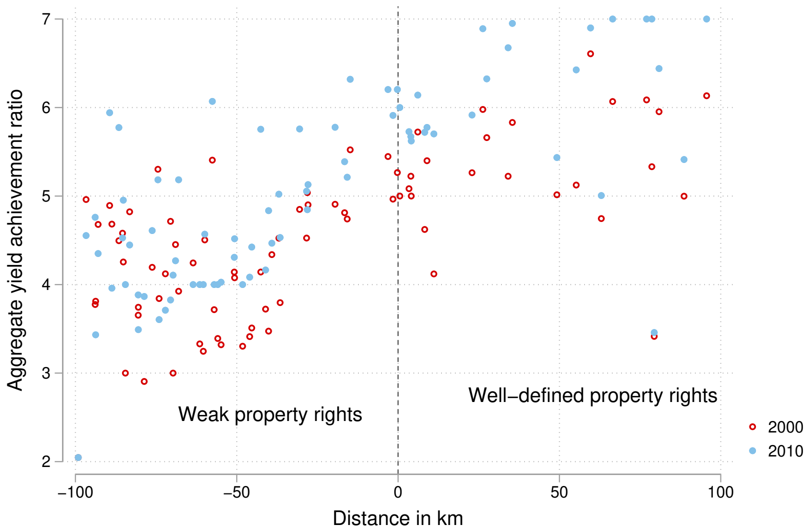
Note:

Figure A8: Internal migration-% of workers that were born in weak PR and continue there



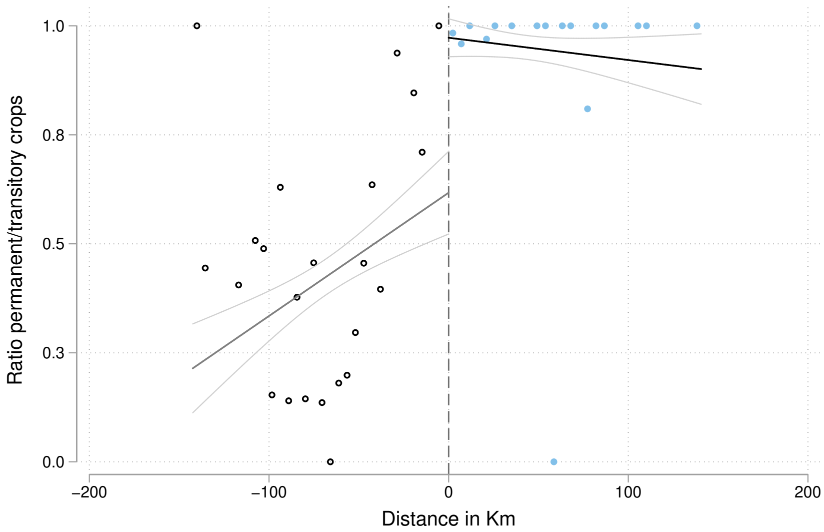
Note: Internal migration with IPUMS and provinces match.

Figure A9: Aggs ratio



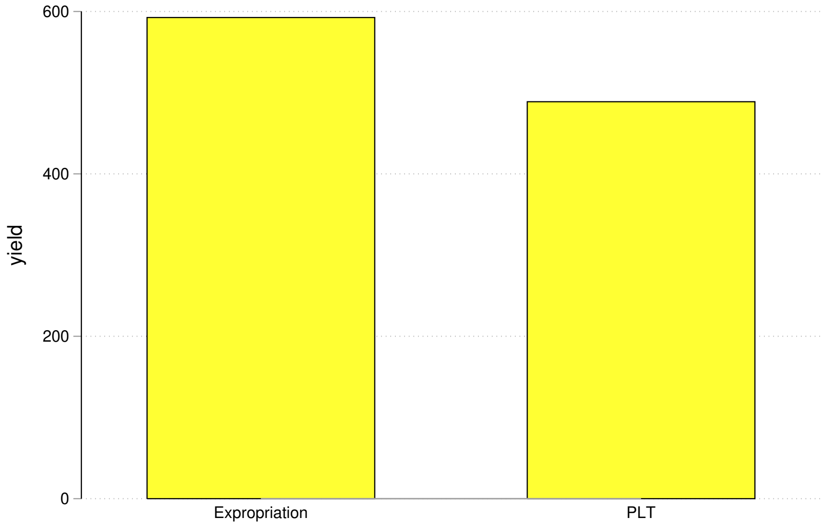
Note: Agg ratio

Figure A10: Ratio perennial and annual crops (1982)



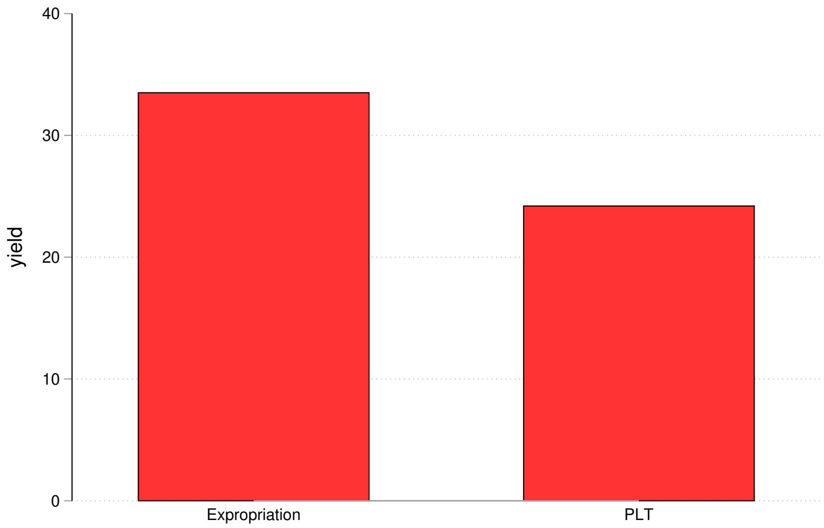
Note: 1982. Source Ministry of Agriculture Ecuador

Figure A11: Banana yields 1954



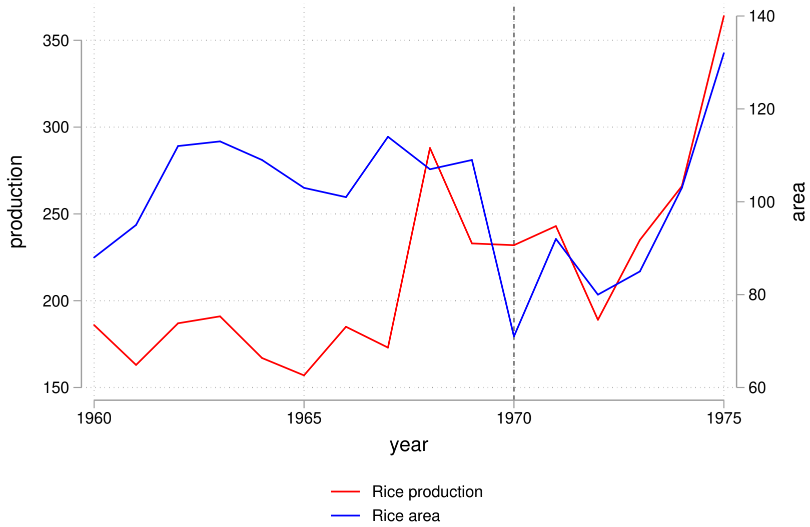
Note: Available municipalities: Quevedo (only observation available affected by PLT in the 1954 census), Ventanas, Publoviejo, Vinces,and Balzar. Yields=production/land devoted to bananas

Figure A12: rice yields 1954



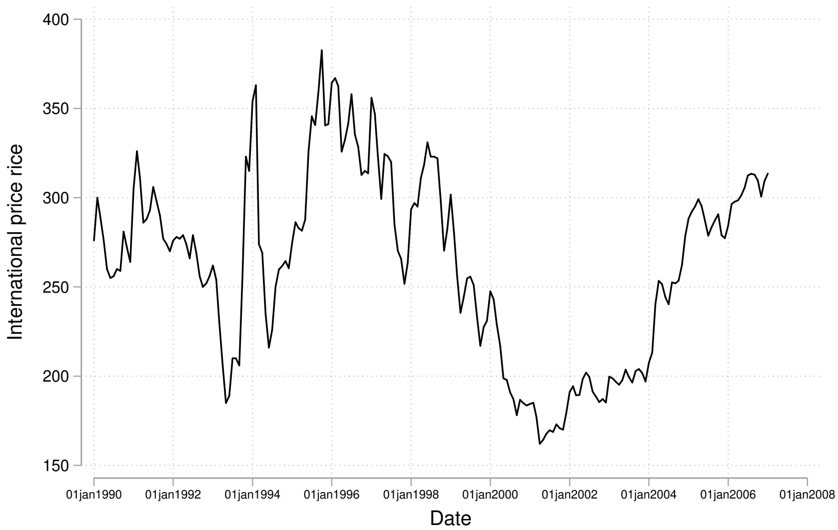
Note: Available municipalities: Quevedo (only observation available affected by PLT in the 1954 census), Ventanas, Publoviejo, Vinces,and Balzar. Yields=production/land devoted to rice

Figure A13: Rice production and area



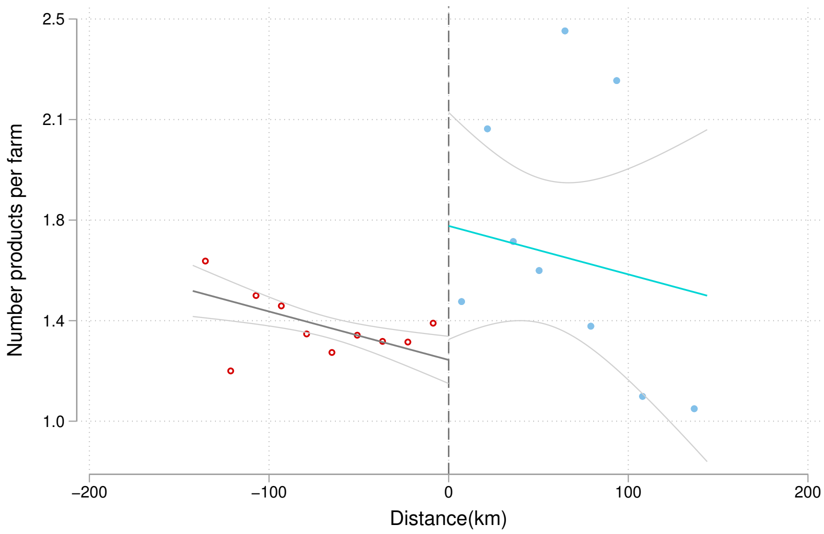
Note: Data from Gollin et al. (2021) (see the paper for sources used to construct a global data set on crops influenced by the green revolution).

Figure A14: International price of rice



Note: International price of rice comes from: International Monetary Fund, Global price of Rice, Thailand [PRICENPQUSDM], retrieved from FRED, Federal Reserve Bank of St. Louis; https://fred.stlouisfed.org/series/PRICENPQUSDM, November 21, 2023.

Figure A15: Diversification



Note: Diver

Table A3: Summary statistics main outcome variables

	(1) PLT					(2) no PLT				
	mean	sd	min	max	count	mean	sd	min	max	count
Land usage perannial(%)	0.33	0.44	0.00	1.00	7934	0.28	0.42	0.00	1.00	11708
Yield perennial (log)	0.66	1.17	0.00	7.11	7901	0.58	1.26	0.00	8.13	11415
Yield annual (log)	1.63	2.22	0.00	6.81	7797	2.31	2.47	0.00	6.82	14063
Yield Rice	0.51	1.11	0.00	8.57	6739	1.43	1.89	0.00	8.57	13020
Yield cocoa	0.04	0.09	0.00	2.07	7064	0.04	0.11	0.00	4.35	10013
Yield Banana	0.58	3.72	0.00	70.25	5522	1.00	6.16	0.00	80.29	7738
Yield non-traditional peren(log)	0.57	1.30	0.00	6.79	7474	0.40	1.29	0.00	8.20	10171
Land share devoted to PLT	0.41	0.41	0.00	1.00	8067	0.00	0.01	0.00	0.07	14197
Land share devoted to expr	0.01	0.02	0.00	0.10	8067	0.04	0.07	0.00	0.64	14197
Observations	8067					14197				

Note: Land usage: Land devoted to perennial crops/total land. Yield perennial/annual/non-traditional crops: (log of) Revenue (price*quantity)/land devoted to perennial/annual/non-traditional crops. Yield of a specific crop (rice, banana, cocoa): Quantity produced (in metric tons)/hectares devoted to each crop. Land share devoted to PLT/expropriation: Amount of land (from IERAC records)/total land of available parish (current administrative borders). See main text for more details.

Table A4: Donut geographic RD estimates

	Share	Perennial	Annual	Rice	Cocoa	Banana	Non-traditional
				Sharp RD case			
Robust	0.145	0.550	-0.103	-0.626	-0.015	-1.038	0.810
	(0.059)**	(0.139)***	(0.109)	(0.226)***	(0.013)	(0.468)**	(0.156)***
Observations	3185	3185	3185	3185	3185	3185	3185
Bandwidth	35	35	35	35	35	35	35
Parishes	22	22	22	22	22	22	22
Mean	0.716	1.178	4.781	2.089	0.085	1.358	0.799
Variation w.r.t mean	20.3	46.7	-2.2	-29.9	-17.2	-76.4	101.4

Cluster standard errors at the parish level in parentheses

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

Table A5: Reduced-form with conley SE (10 km window)

	(1) Share	(2) Perennial	(3) Annual	(4) Rice	(5) Cocoa	(6) Banana	(7) Else
dd	0.130	0.363	-0.085	-0.381	0.003	-1.895	0.674
	(0.048)***	(0.198)*	(0.187)	(0.174)**	(0.013)	(0.557)***	(0.185)***
Observations	3513	3513	3513	3513	3513	3513	3513
Parishes	24	24	24	24	24	24	24
Mean	0.59	1.18	4.52	2.21	0.07	1.10	0.84
Variation w.r.t mean	21.92	30.72	-1.89	-17.25	4.49	-172.79	80.57

Cluster standard errors at the parish level in parentheses

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

Table A6: Reduced-form with conley SE (25 km window)

	(1) Share	(2) Perennial	(3) Annual	(4) Rice	(5) Cocoa	(6) Banana	(7) Else
dd	0.130	0.363	-0.085	-0.381	0.003	-1.895	0.674
	(0.066)**	(0.190)*	(0.106)	(0.106)***	(0.012)	(0.515)***	(0.196)***
Observations	3513	3513	3513	3513	3513	3513	3513
Parishes	24	24	24	24	24	24	24
Mean	0.59	1.18	4.52	2.21	0.07	1.10	0.84
Variation w.r.t mean	21.92	30.72	-1.89	-17.25	4.49	-172.79	80.57

Cluster standard errors at the parish level in parentheses

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

Table A7: Reduced-form donut with conley SE (10 km window)

	(1) Share	(2) Perennial	(3) Annual	(4) Rice	(5) Cocoa	(6) Banana	(7) Else
dd	0.123	0.584	-0.229	-0.371	-0.005	-1.578	0.881
	(0.049)**	(0.215)***	(0.212)	(0.229)$^{+}$	(0.017)	(0.574)***	(0.205)***
Observations	3185	3185	3185	3185	3185	3185	3185
Parishes	22	22	22	22	22	22	22
Mean	0.59	1.18	4.52	2.21	0.07	1.10	0.84
Variation w.r.t mean	20.80	49.42	-5.06	-16.84	-6.87	-143.91	105.35

Cluster standard errors at the parish level in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A8: Reduced-form with conley SE (25 km window)

	(1) Share	(2) Perennial	(3) Annual	(4) Rice	(5) Cocoa	(6) Banana	(7) Else
dd	0.123	0.584	-0.229	-0.371	-0.005	-1.578	0.881
	(0.034)***	(0.147)***	(0.096)**	(0.181)**	(0.015)	(0.469)***	(0.111)***
Observations	3185	3185	3185	3185	3185	3185	3185
Parishes	22	22	22	22	22	22	22
Mean	0.59	1.18	4.52	2.21	0.07	1.10	0.84
Variation w.r.t mean	20.80	49.42	-5.06	-16.84	-6.87	-143.91	105.35

Cluster standard errors at the parish level in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A9: Reduced-form credit outcome with conley SE (10 km window)

	(1) Formal credit market	(2) Informal credit market
dd	-0.047	-0.064
	(0.067)	(0.033)*
Observations	962	962
Parishes	24	24
Mean	0.13	0.39
Variation w.r.t mean	-37.18	-16.36

Cluster standard errors at the parish level in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A10: Reduced-form credit outcome with conley SE (25 km window)

	(1) Formal credit market	(2) Informal credit market
dd	-0.030	-0.076
	(0.111)	(0.037)**
Observations	1356	1356
Parishes	24	24
Mean	0.13	0.39
Variation w.r.t mean	-23.58	-19.55

Cluster standard errors at the parish level in parentheses

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

Table A11: 2nd degree polynomial Reduced-form

	(1) Share	(2) Perennial	(3) Annual	(4) Rice	(5) Cocoa	(6) Banana	(7) Else
			Shard RD case				
Robust	0.042	0.293	-0.131	-0.676	-0.011	-1.653	0.738
	(0.023)*	(0.096)***	(0.066)**	(0.122)***	(0.011)	(0.317)***	(0.096)***
Observations	3513	3513	3513	3513	3513	3513	3513
Bandwidth	35	35	35	35	35	35	35
Parishes	24	24	24	24	24	24	24
Mean	0.698	1.160	3.411	1.567	0.073	2.029	0.821
Variation w.r.t mean	6.0	25.3	-3.8	-43.1	-14.8	-81.5	89.9

Cluster standard errors at the parish level in parentheses

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

Table A12: 2nd degree polynomial

	(1) Share	(2) Perennial	(3) Annual	(4) Rice	(5) Cocoa	(6) Banana	(7) Else
			Panel A: First stage				
dd	0.639	0.639	0.639	0.639	0.639	0.639	0.639
	(0.185)***	(0.185)***	(0.185)***	(0.185)***	(0.185)***	(0.185)***	(0.185)***
			Panel B: Fuzzy RD estimates				
Robust	0.128	0.894	-0.401	-2.052	-0.033	-5.030	2.245
	(0.100)	(0.487)*	(0.369)	(0.857)**	(0.034)	(2.937)*	(1.153)*
Observations	3513	3513	3513	3513	3513	3513	3513
Bandwidth	35	35	35	35	35	35	35
Parishes	24	24	24	24	24	24	24
Mean	0.698	1.160	3.411	1.567	0.073	2.029	0.821
Variation w.r.t mean	18.4	77.0	-11.7	-130.9	-45.0	-247.9	273.5

Cluster standard errors at the parish level in parentheses

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

Table A13: Fuzzy version credit outcome

	(1) Formal credit market	(2) Informal credit market
	Panel A: First stage	
dd	0.593	0.593
	(0.213)**	(0.213)**
	Panel B: Fuzzy RD estimates	
Robust	-0.120	-0.136
	(0.089)	(0.062)**
Observations	962	962
Bandwidth	35	35
Parishes	24	24
Mean	0.172	0.319
Variation w.r.t mean	-69.9	-42.5

Cluster standard errors at the parish level in parentheses

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

Table A14: Different bandwidth

	(1) Share	(2) Perennial	(3) Annual	(4) Rice	(5) Cocoa	(6) Banana	(7) Else
				Panel A: First stage			
dd	0.544	0.544	0.544	0.544	0.544	0.544	0.544
	(0.201)**	(0.201)**	(0.201)**	(0.201)**	(0.201)**	(0.201)**	(0.201)**
				Panel B: Fuzzy RD estimates			
Robust	0.209	0.589	-0.106	-1.328	-0.033	-4.150	1.442
	(0.111)*	(0.391)$^{+}$	(0.462)	(0.430)***	(0.044)	(1.770)**	(0.713)**
Observations	3912	3912	3912	3912	3912	3912	3912
Bandwidth	40	40	40	40	40	40	40
Parishes	28	28	28	28	28	28	28
Mean	0.695	1.277	3.246	1.534	0.073	2.232	0.929
Variation w.r.t mean	30.1	46.2	-3.3	-86.6	-44.8	-186.0	155.1

Cluster standard errors at the parish level in parentheses

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

Table A15: Effect does come from diversification within perennial crops

	(1) Else	(2) Palm	(3) Else no palm	(4) l(N diff.Crops)
	Panel A: First stage			
PLT	0.580	0.638	0.580	0.373
	(0.205)**	(0.210)***	(0.205)**	(0.157)**
	Panel B: Fuzzy RD estimates			
Robust	0.905	0.024	0.881	0.066
	(0.515)*	(0.095)	(0.529)*	(0.036)*
Observations	3290	3352	3290	4057
BandwidthL	32	37	31	45
BandwidthR	25	18	25	24
Parishes	20	20	20	26
Mean	0.783	0.384	0.676	0.232
Variation w.r.t mean	115.6	6.2	130.3	28.4

Cluster standard errors at the parish level in parentheses

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

Table A16: Intensive margin

	(1) Share	(2) Perennial	(3) Annual	(4) Rice	(5) Cocoa	(6) Banana	(7) Else
				Panel A: First stage			
dd	0.646	0.648	0.549	0.468	0.657	0.704	0.732
	(0.187)***	(0.180)***	(0.197)**	(0.180)**	(0.186)***	(0.187)***	(0.138)***
				Panel B: Fuzzy RD estimates			
Robust	0.111	0.050	0.247	-1.184	-0.008	-26.084	1.072
	(0.058)*	(0.192)	(0.132)*	(0.410)***	(0.020)	(12.846)**	(0.467)**
Observations	2912	2132	3208	2210	1834	237	1213
BandwidthL	30	35	32	23	32	38	30
BandwidthR	33	24	25	29	23	37	54
Parishes	22	20	20	19	20	27	25
Mean	0.718	1.110	4.880	2.004	0.079	1.408	0.915
Variation w.r.t mean	15.5	4.5	5.1	-59.1	-9.6	-1853.2	117.2

Cluster standard errors at the parish level in parentheses

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

Table A17: Extensive margin

	(1) Perennial	(2) Annual	(3) Rice	(4) Cocoa	(5) Banana	(6) Else
			Panel A: First stage			
dd	0.436	0.436	0.436	0.436	0.436	0.436
	(0.215)*	(0.215)*	(0.215)*	(0.215)*	(0.215)*	(0.215)*
			Panel B: Fuzzy RD estimates			
Robust	0.206	-0.001	-0.229	0.026	-0.090	0.513
	(0.129)+	(0.042)	(0.139)*	(0.110)	(0.085)	(0.284)*
Observations	3513	3513	3513	3513	3513	3513
Bandwidth	35	35	35	35	35	35
Parishes	24	24	24	24	24	24
Mean	0.668	0.968	0.753	0.574	0.058	0.282
Variation w.r.t mean	30.8	-0.1	-30.4	4.4	-156.6	181.9

Cluster standard errors at the parish level in parentheses

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

Table A18: Extensive margins fuzzy all data

	Share	Perennial	Annual	Rice	Cocoa	Banana	Non traditional
				Fuzzy RD case			
Robust	0.301	0.627	2.230	0.254	-0.001	-7.644	1.690
	(0.147)**	(0.232)***	(1.392)+	(0.488)	(0.039)	(3.470)**	(0.443)***
Observations	5501	5453	4964	4869	4620	3728	5916
BandwidthL	34	32	26	36	33	43	31
BandwidthR	29	34	28	25	29	40	54
Parishes	23	24	19	20	23	31	26
Mean	0.892	1.625	5.007	2.930	0.132	21.507	1.742
Variation w.r.t mean	33.7	38.6	44.5	8.7	-0.6	-35.5	97.0

Cluster standard errors at the parish level in parentheses

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

Table A19: Intensive margins fuzzy all data

	Share	Perennial	Annual	Rice	Cocoa	Banana	Non traditional
				Fuzzy RD case			
Robust	0.111	0.050	0.247	-1.184	-0.008	-26.084	1.072
	(0.058)*	(0.192)	(0.132)*	(0.410)***	(0.020)	(12.846)**	(0.467)**
Observations	2912	2132	3208	2210	1834	237	1213
BandwidthL	30	35	32	23	32	38	30
BandwidthR	33	24	25	29	23	37	54
Parishes	22	20	20	19	20	27	25
Mean	0.892	1.563	5.030	2.775	0.130	21.126	1.742
Variation w.r.t mean	12.4	3.2	4.9	-42.7	-5.8	-123.5	61.5

Cluster standard errors at the parish level in parentheses

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

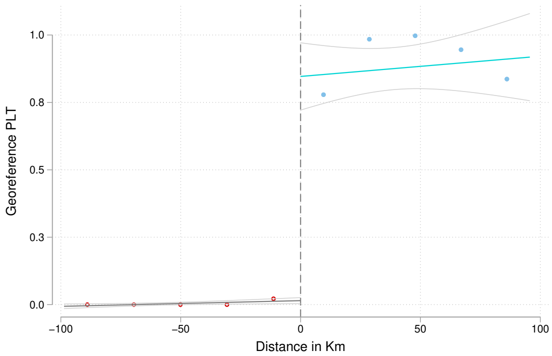
Table A20: OLS all sample

	(1) Share	(2) Perennial	(3) Annual	(4) Rice	(5) Cocoa	(6) Banana	(7) Non-traditional
PLT (=1)	0.413	0.832	-1.795	-1.729	0.041	-0.186	1.035
	(0.047)***	(0.168)***	(0.316)***	(0.206)***	(0.009)***	(0.445)	(0.203)***
Observations	20393	21688	22193	21752	19049	17057	19823
Parishes	125	125	125	125	125	125	125
Mean	0.59	1.18	4.52	2.21	0.07	1.10	0.84
Variation w.r.t mean	69.60	70.46	-39.76	-78.36	56.54	-16.96	123.79

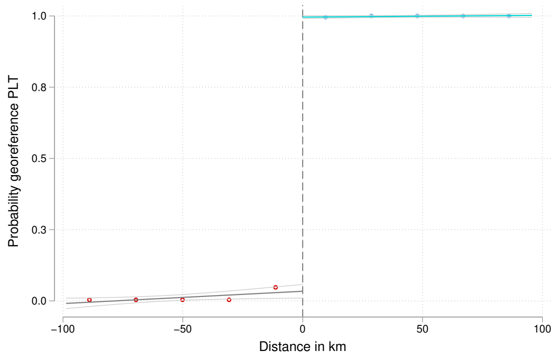
Cluster standard errors at the parish level in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Figure A16: Fuzzy discontinuity in public land transfers and probability of treatment

(a) Georeference PLT data and geographic threshold



(b) Probability Georeference PLT data and geographic threshold



Note: This Figure mimic Figure 4 and exchange the share of PLT taken from IERAC reports by georeferenced information extracted from map A1.

Table A21: Using as an IV geo located data from historical map

	(1) Share	(2) Perennial	(3) Annual	(4) Rice	(5) Cocoa	(6) Banana	(7) Non-traditional
				Panel A: First stage			
dd	0.633	0.633	0.633	0.633	0.633	0.633	0.633
	(0.143)***	(0.143)***	(0.143)***	(0.143)***	(0.143)***	(0.143)***	(0.143)***
				Panel B: Fuzzy RD estimates			
Robust	0.136	0.344	0.082	-0.843	-0.003	-2.233	0.841
	(0.071)*	(0.100)***	(0.212)	(0.143)***	(0.021)	(0.737)***	(0.104)***
Observations	3513	3513	3513	3513	3513	3513	3513
Bandwidth	35	35	35	35	35	35	35
Parishes	24	24	24	24	24	24	24
Mean	0.719	1.147	4.818	2.123	0.084	1.339	0.759
Variation w.r.t mean	18.9	30.0	1.7	-39.7	-3.9	-166.7	110.8

Cluster standard errors at the parish level in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A22: OLS for credit - Including Manabí

	(1) Formal credit market	(2) Informal credit market
1.ddcounter	0.017	-0.034
	(0.128)	(0.056)
2.ddcounter	-0.020	0.247
	(0.123)	(0.075)***
Observations	7214	7214
Parishes	194	194
Controls	Yes	Yes
Mean	0.16	0.36

Cluster standard errors at the parish level in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A23: Placebo moving the border 5km

	(1) Share	(2) Perennial	(3) Annual	(4) Rice	(5) Cocoa	(6) Banana	(7) Else
				Shard RD case			
Robust	0.468	0.202	0.405	0.723	0.045	0.302	-0.506
	(0.394)	(0.910)	(0.431)	(0.951)	(0.046)	(2.423)	(0.632)
Observations	3757	3757	3757	3757	3757	3757	3757
Bandwidth	35	35	35	35	35	35	35
Parishes	24	24	24	24	24	24	24
Mean	0.719	1.147	4.818	2.123	0.084	1.339	0.759
Variation w.r.t mean	65.2	17.6	8.4	34.1	54.1	22.6	-66.7

Cluster standard errors at the parish level in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A24: Placebo moving the border 20km

	(1) Share	(2) Perennial	(3) Annual	(4) Rice	(5) Cocoa	(6) Banana	(7) Else
			Shard RD case				
Robust	-0.177	0.031	-0.198	-0.458	-0.004	1.585	0.222
	(0.124)	(0.429)	(0.280)	(0.594)	(0.036)	(2.047)	(0.361)
Observations	4894	4894	4894	4894	4894	4894	4894
Bandwidth	35	35	35	35	35	35	35
Parishes	24	24	24	24	24	24	24
Mean	0.719	1.147	4.818	2.123	0.084	1.339	0.759
Variation w.r.t mean	-24.6	2.7	-4.1	-21.6	-5.3	118.4	29.3

Cluster standard errors at the parish level in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A25: Placebo moving the border 5km-Credit-

	(1) Formal credit market	(2) Informal credit market
	Sharp RD results	
Robust	-0.012	0.387
	(0.146)	(0.125)***
Observations	1034	1034
Bandwidth	35	35
Parishes	24	24
Mean	0.172	0.319
Variation w.r.t mean	-6.9	121.4

Cluster standard errors at the parish level in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A26: Placebo moving the border 20km-Credit-

	(1) Formal credit market	(2) Informal credit market
	Sharp RD results	
Robust	0.056	-0.219
	(0.093)	(0.156)
Observations	1620	1620
Bandwidth	35	35
Parishes	24	24
Mean	0.172	0.319
Variation w.r.t mean	32.9	-68.7

Cluster standard errors at the parish level in parentheses

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

Table A27: Placebo moving the border 5km-Fuzzy version-

	(1) Share	(2) Perennial	(3) Annual	(4) Rice	(5) Cocoa	(6) Banana	(7) Else
			Panel A: First stage				
dd_placebo1	0.170	0.170	0.170	0.170	0.170	0.170	0.170
	(0.167)	(0.167)	(0.167)	(0.167)	(0.167)	(0.167)	(0.167)
			Panel B: Fuzzy RD estimates				
Robust	1.613	0.803	1.350	2.610	0.158	0.888	-1.621
	(1.293)	(2.397)	(1.524)	(4.787)	(0.137)	(9.297)	(1.923)
Observations	3757	3757	3757	3757	3757	3757	3757
Bandwidth	35	35	35	35	35	35	35
Parishes	24	24	24	24	24	24	24
Mean	0.719	1.147	4.818	2.123	0.084	1.339	0.759
Variation w.r.t mean	224.4	70.0	28.0	122.9	189.4	66.3	-213.6

Cluster standard errors at the parish level in parentheses

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

Table A28: Placebo moving the border 20km-Fuzzy version-

	(1) Share	(2) Perennial	(3) Annual	(4) Rice	(5) Cocoa	(6) Banana	(7) Else
			Panel A: First stage				
dd_placebo2	-0.294	-0.294	-0.294	-0.294	-0.294	-0.294	-0.294
	(0.151)*	(0.151)*	(0.151)*	(0.151)*	(0.151)*	(0.151)*	(0.151)*
			Panel B: Fuzzy RD estimates				
Robust	-0.406	-2.077	2.141	-1.575	-0.212	-22.614	1.641
	(1.130)	(4.650)	(3.156)	(6.191)	(0.363)	(22.389)	(4.350)
Observations	4894	4894	4894	4894	4894	4894	4894
Bandwidth	35	35	35	35	35	35	35
Parishes	24	24	24	24	24	24	24
Mean	0.719	1.147	4.818	2.123	0.084	1.339	0.759
Variation w.r.t mean	-56.5	-181.0	44.4	-74.2	-252.9	-1688.5	216.1

Cluster standard errors at the parish level in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A31: Number of observations per parish

Parish name	**Distance to IERAC border (sorted)**	**Number of observations**
Tenguel	-184.47	126
Posorja	-162.36	27
Balao	-160.50	247
Puna	-157.16	109
General Villamil (Playas)	-156.91	83
Naranjal	-151.66	315
Morro	-151.31	65
Santa Rosa de Flandes	-142.46	53
Jesus Maria	-138.49	74
Juan Gomez Rendon (Progreso)	-135.76	40
San Carlos	-135.47	72
Taura	-119.15	146
El Triunfo	-108.78	212

Continued on the next page

Parish name	**Distance to IERAC border (sorted)**	**Number of observations**
Gral. Pedro J. Montero (Boliche)	-102.67	139
Coronel Marcelino Mariduena (San Carlos)	-102.46	183
Virgen de Fatima	-102.19	20
Guayaquil	-100.64	416
Eloy Alfaro (Duran)	-98.66	143
Gral. Antonio Elizalde (Bucay)	-96.69	151
Roberto Astudillo (Cab. en Cruce de Venecia)	-93.87	155
Yaguachi Viejo (Cone)	-93.73	200
Naranjito	-92.96	379
Sabanilla	-89.39	141
Chobo	-88.70	48
Pedro Carbo	-86.53	236
Milagro	-85.40	246
Isidro Ayora	-85.15	213
Mariscal Sucre (Huaques)	-84.51	62
Crnel. Lorenzo de Garaicoa (Pedregal)	-83.20	354
San Jacinto de Yaguachi	-80.50	282
Narcisa de Jesus	-78.67	136
Simon Bolivar	-76.20	154
Febres Cordero (Las Juntas)	-74.43	390
Los Lojas (Enrique Baquerizo Moreno)	-74.06	180
Samborondon	-72.12	157
Tarifa	-70.52	419

Continued on the next page

Parish name	**Distance to IERAC border (sorted)**	**Number of observations**
Lomas de Sargentillo	-69.73	292
Alfredo Baquerizo Moreno (Jujan)	-68.98	308
Valle de La Virgen	-68.01	107
Daule	-66.01	303
Juan Bautista Aguirre (Los Tintos)	-63.52	135
Limonal	-61.46	143
La Victoria	-60.36	110
Babahoyo	-59.91	109
Montalvo	-57.56	512
Laurel	-57.00	55
El Salitre (Las Ramas)	-55.88	207
Santa Lucia	-54.85	550
Baba	-50.76	273
Pimocha	-50.68	175
Gral. Vernaza (Dos Esteros)	-48.17	205
Junquillal	-45.99	190
La Union	-45.35	78
Colimes	-42.56	437
Caracol	-41.07	57
Palestina	-40.13	275
Isla de Bejucal	-39.11	95
San Juan	-36.94	90
Antonio Sotomayor (Cab. en Playas de Vinces)	-36.55	271
Catarama	-30.52	51
Ricaurte	-28.36	633

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Parish name	Distance to IERAC border (sorted)	Number of observations
Guare	-28.12	181
Puebloviejo	-27.91	123
Balzar	-19.53	598
Vinces	-16.57	355
Ventanas	-15.77	316
Puerto Pechiche	-14.83	128
Quinsaloma	-3.12	213
Zapotal	-1.58	249
Palenque	0.22	292
La Esperanza	0.55	40
El Rosario	3.39	43
Velasco Ibarra (Cab. El Empalme)	3.97	272
San Carlos	4.08	164
Valencia	6.11	646
Quevedo	8.26	226
Mocache	8.96	609
Guayas (Pueblo Nuevo)	11.10	238
San Jacinto de Buena Fe	22.92	246
Luz de America	26.28	167
Manga del Cura	27.04	124
Patricia Pilar	27.49	132
Puerto Limon	34.11	91
Santo Domingo de los Colorados	35.42	508
El Carmen	49.22	536
San Jacinto del Bua	55.21	102
San Miguel de los Bancos	59.66	350

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Parish name	Distance to IERAC border (sorted)	Number of observations
Wilfrido Loor Moreira (Maicito)	62.99	41
La Concordia	66.50	111
Pedro Vicente Maldonado	77.02	185
Puerto Quito	78.65	289
Nanegalito	79.39	35
La Union	80.89	210
Chibunga	88.63	108
Las Golondrinas	95.63	29
Rosa Zarate (Quininde)	103.64	471
Malimpia	109.26	311
Viche	138.17	27
Majua	140.60	48
San Gregorio	143.91	94
Atahualpa (Cab. en Camarones)	150.40	82
Muisne	153.92	137
Chinca	154.06	103
Chontaduro	159.99	57
Tabiazo	161.32	44
La Union	162.63	86
San Mateo	163.53	89
San Francisco	168.34	49
Sua (Cab. en La Bocana)	168.63	31
Atacames	169.09	53
Rocafuerte	169.63	54
Vuelta Larga	171.32	27
Lagarto	171.83	94

Continued on the next page

Parish name	**Distance to IERAC border (sorted)**	**Number of observations**
Camarones (Cab. en San Vicente)	171.89	53
Tonchigue	172.13	49
Tachina	172.20	36
Borbon	173.51	50
Tonsupa	173.63	35
Esmeraldas	174.72	5
Quingue (Olmedo Perdomo Franco)	174.79	29
Rioverde	176.87	24
Galera	179.51	41
Carondelet	189.42	24
Tululbi (Cab. en Ricaurte)	193.49	55
Calderon	193.89	15

Table A29: Placebo runs (reduced form)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	Yield perennial (-5km)	Yield perennial(5km)	Yield annual(-5km)	Yield annual(5km)	Yield cocoa(-5km)	Yield cocoa(5km)	Yield rice(-5km)	Yield rice(5km)	NonT(-5km)	NonT(5km)	Yield banano(-5km)	YieldBanano(5km)	usage(-5km)	usage(5km)
Robust	0.907	0.165	-0.362	-0.370	0.131	-0.004	0.606	-0.423	0.702	0.184	0.695	0.635	0.454	-0.089
	(1.386)	(0.373)	(0.477)	(0.583)	(0.104)	(0.012)	(0.692)	(0.216)*	(0.616)	(0.532)	(2.488)	(0.430)	(0.340)	(0.061)
Observations	3147	3619	3320	3946	3147	3488	3301	3147	3147	4080	3608	3485	3608	3328
Bandwidth	15	30	23	34	15	39	25	32	16	34	25	30	25	33
Parishes	19	29	22	28	17	24	19	23	19	30	21	27	22	26
Mean	1.133	1.133	3.447	3.447	0.072	0.072	1.579	1.579	0.787	0.787	2.034	2.034	0.696	0.696
Variation w.r.t mean	80.0	14.5	-10.5	-10.7	181.8	-5.2	38.4	-26.8	89.2	23.3	34.2	31.2	65.3	-12.8

Notes: bla bla. We denote: * $p < 0.20$, ** $p < 0.05$, *** $p < 0.01$.

Table A30: Placebo runs (Fuzzy RD)

	(1) Yield perennial(-5km)	(2) Yield perennial(5km)	(3) Yield annual(-5km)	(4) Yield annual(5km)	(5) Yield cocoa(-5km)	(6) Yield cocoa(5km)	(7) Yield rice(-5km)	(8) Yield rice(5km)	(9) NonT(-5km)	(10) NonT(5km)	(11) Yield banano(-5km)	(12) YieldBanano(5km)	(13) usage(-5km)	(14) usage(5km)
Robust	403.45361	-0.95884	-739.75621	1.00696	0.47779	0.00694	24.10584	0.68154	55.14777	-1.10218	-215.69670	-1.23447	12.70431	0.17386
	(590.11775)	(2.12524)	(1389.83350)	(3.59180)	(1.70471)	(0.05184)	(26.61510)	(1.01510)	(60.87542)	(3.29558)	(276.16816)	(2.10815)	(26.38922)	(0.23004)
Observations	2992	3854	3147	4725	2992	3854	3453	3608	2992	4437	2992	3608	2992	3643
BandwidthL	16	43	21	55	19	43	25	34	16	51	21	35	15	40
BandwidthR	38	31	41	36	33	36	34	36	35	29	34	34	35	35
Parishes	18	29	21	36	18	31	19	25	18	34	20	23	17	27
Mean	1.133	1.133	3.447	3.447	0.072	0.072	1.579	1.579	0.787	0.787	2.034	2.034	0.696	0.696
Variation w.r.t mean	35603.3	-84.6	-21463.8	29.2	663.3	9.6	1527.0	43.2	7003.4	-140.0	-10604.4	-60.7	1826.3	25.0

Notes: bla bla. We denote: * $p < 0.3$, ** $p < 0.05$, *** $p < 0.01$.

Table A32: Number of observations per parish-restricted sample-

Parish name	Distance to IERAC border (sorted)	Number of observations
Tenguel	-184.4732	13
Posorja	-162.3562	1
Balao	-160.4961	22
Puna	-157.1604	11
General Villamil (Playas)	-156.9122	18
Naranjal	-151.6591	47
Morro	-151.3055	9
Santa Rosa de Flandes	-142.4568	12
Jesus Maria	-138.4864	16
Juan Gomez Rendon (Progreso)	-135.7631	15
San Carlos	-135.4682	28
Taura	-119.145	66
El Triunfo	-108.7762	68
Gral. Pedro J. Montero (Boliche)	-102.671	69
Coronel Marcelino Mariduena (San Carlos)	-102.4561	99
Virgen de Fatima	-102.1858	7
Guayaquil	-100.6373	87
Eloy Alfaro (Duran)	-98.65922	45
Gral. Antonio Elizalde (Bucay)	-96.69392	73
Roberto Astudillo (Cab. en Cruce de Venecia)	-93.86838	59
Yaguachi Viejo (Cone)	-93.72861	128
Naranjito	-92.96298	192

Continued on the next page

Parish name	Distance to IERAC border (sorted)	Number of observations
Sabanilla	-89.3895	86
Chobo	-88.69868	33
Pedro Carbo	-86.52501	142
Milagro	-85.40132	120
Isidro Ayora	-85.15096	78
Mariscal Sucre (Huaques)	-84.51443	18
Crnel. Lorenzo de Garaicoa (Pedregal)	-83.19691	165
San Jacinto de Yaguachi	-80.50276	105
Narcisa de Jesus	-78.67458	78
Simon Bolivar	-76.20212	82
Febres Cordero (Las Juntas)	-74.42698	216
Los Lojas (Enrique Baquerizo Moreno)	-74.06388	27
Samborondon	-72.1179	59
Tarifa	-70.51548	59
Lomas de Sargentillo	-69.73385	163
Alfredo Baquerizo Moreno (Jujan)	-68.98148	209
Valle de La Virgen	-68.01495	49
Daule	-66.01122	100
Juan Bautista Aguirre (Los Tintos)	-63.51685	62
Limonal	-61.46228	79
La Victoria	-60.36295	32
Babahoyo	-59.90731	55
Montalvo	-57.55959	172
Laurel	-56.9951	33

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Parish name	Distance to IERAC border (sorted)	Number of observations
El Salitre (Las Ramas)	-55.88114	124
Santa Lucia	-54.84662	327
Baba	-50.76033	168
Pimocha	-50.67555	131
Gral. Vernaza (Dos Esteros)	-48.17398	158
Junquillal	-45.99139	113
La Union	-45.3502	44
Colimes	-42.5607	298
Caracol	-41.07037	27
Palestina	-40.13063	173
Isla de Bejucal	-39.11358	58
San Juan	-36.93801	45
Antonio Sotomayor (Cab. en Playas de Vinces)	-36.55072	166
Catarama	-30.52181	35
Ricaurte	-28.35747	288
Guare	-28.11565	112
Puebloviejo	-27.90832	61
Balzar	-19.52561	390
Vinces	-16.57451	255
Ventanas	-15.76645	221
Puerto Pechiche	-14.83133	79
Quinsaloma	-3.120633	139
Zapotal	-1.575883	117
Palenque	0.2210712	211
La Esperanza	0.5504975	20
El Rosario	3.392306	35

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Parish name	Distance to IERAC border (sorted)	Number of observations
Velasco Ibarra (Cab. El Empalme)	3.965198	178
San Carlos	4.081524	114
Valencia	6.113094	301
Quevedo	8.257324	114
Mocache	8.962811	405
Guayas (Pueblo Nuevo)	11.1044	111
San Jacinto de Buena Fe	22.92057	104
Luz de America	26.27738	46
Manga del Cura	27.044	114
Patricia Pilar	27.48923	38
Puerto Limon	34.11245	25
Santo Domingo de los Colorados	35.4233	130
El Carmen	49.21864	148
San Jacinto del Bua	55.2111	33
San Miguel de los Bancos	59.65724	144
Wilfrido Loor Moreira (Maicito)	62.99083	13
La Concordia	66.50226	61
Pedro Vicente Maldonado	77.02114	73
Puerto Quito	78.64874	116
Nanegalito	79.38853	4
La Union	80.88995	30
Chibunga	88.63111	38
Las Golondrinas	95.63153	19
Rosa Zarate (Quininde)	103.6406	70
Malimpia	109.2614	79

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Parish name	Distance to IERAC border (sorted)	Number of observations
Viche	138.1715	6
Majua	140.5953	19
San Gregorio	143.9084	13
Atahualpa (Cab. en Camarones)	150.4025	13
Muisne	153.9245	6
Chinca	154.0636	42
Chontaduro	159.9926	23
Tabiazo	161.3236	13
La Union	162.6324	26
San Mateo	163.5267	26
San Francisco	168.3383	8
Sua (Cab. en La Bocana)	168.6279	7
Atacames	169.0913	6
Rocafuerte	169.6285	20
Vuelta Larga	171.315	2
Lagarto	171.8267	12
Camarones (Cab. en San Vicente)	171.8891	23
Tonchigue	172.1263	12
Tachina	172.196	21
Borbon	173.5122	20
Tonsupa	173.6294	10
Esmeraldas	174.7229	1
Quingue (Olmedo Perdomo Franco)	174.7925	9
Rioverde	176.8739	5
Galera	179.5078	4

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Parish name	Distance to IERAC border (sorted)	Number of observations
Carondelet	189.4169	6
Tululbi (Cab. en Ricaurte)	193.4852	20
Calderon	193.8898	9

A. Disentangling effects within expropriations areas

An important concern to address is to test whether the effects I am accounting for are actually coming from expropriation. Since the expropriations were applied quite dispersed (as shown in Figure A1) I can geo code the actual intervention zones and try to compare them to municipalities within the same region, This process leaves me with 69 municipalities which are the ones in the comparison group, of these 63 were intervened and 6 were not. In table AA33 I show the results of a regression which shows that the areas affected by expropriation are indeed those where rice productivity comes from, as well as the share of land devoted to perennial crops. In addition, access to informal credit is higher in these areas. I use the following controls: Latitude and longitude of the municipality, province fixed effects, self-reported tenure status fixed effects, and agro-climatic potential for rice and bananas [51].

Table AA33: OLS regressions. Comparing within expropriation

	(1) Share	(2) Rice	(3) Bananas	(4) Inf.Credit
Experienced expropriation(=1)	-0.113	0.611	-0.102	0.100
	(0.040)***	(0.226)***	(0.246)	(0.053)*
Observations	11708	13020	7738	14197
Parishes	69	69	69	69
Mean	0.28	1.43	1.00	0.15
Variation w.r.t mean	-40.07	42.76	-10.23	64.73

Cluster standard errors at the parish level in parentheses

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

Note: The table shows the results of OLS regressions with different controls. The independent variable takes the value of 1 if an area experienced expropriation. The sample is the region used as the comparison group in the RD models. Share=share of land devoted to perennial crops, Rice-Banana=yield of each crop (quantity/hectare), Inf.Credit=is an indicator variable that takes the value of 1 if the farmer reported that the credit came from a "chulquero" (slang for informal credit).

[51] since I include all municipalities here, I control for the potential of the main crops