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Can land inequality and land reforms affect agricultural credit access? Evidence from Mexico state-level data, 1940-1960

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A B S T R A C T

High land inequality can lead to lower access to credit in rural populations, as they lack a collateral. In the case of Mexico, the concentration of land and a shortage of agricultural credit caused the rural population to seem less creditworthy; the Mexican agrarian reform was designed to resolve this inequality and lack of resources. Using the Mexican's original agricultural censuses, a new dataset on land inequality and the flow of agricultural credit is provided for each Mexican state. With this unique data set, this article analyses if the agrarian reform was successful in its early years, by helping to reduce land inequality, and if access to credit was improved by reducing land inequality. The results show that, although harmful, land inequality did not affect credit access. Access to credit probably depended on political factors instead.

¿Pueden la desigualdad de tierra y las reformas agrarias afectar al acceso al crédito agrario? Evidencia a nivel estatal de México, 1940-1960

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R E S U M E N

La elevada desigualdad de la tierra puede provocar un menor acceso al crédito en las poblaciones rurales, ya que carecen de una garantía. En el caso de México, la concentración de la tierra y la escasez de crédito agrícola hicieron que la población rural pareciera menos solvente; la reforma agraria mexicana se diseñó para resolver esta desigualdad y falta de recursos. Utilizando los censos agrícolas originales de México, se proporciona un nuevo conjunto de datos sobre la desigualdad de la tierra y el flujo del crédito agrícola para cada estado mexicano. Con este conjunto único de datos, este artículo analiza si la reforma agraria tuvo éxito en sus primeros años, al contribuir a reducir la desigualdad de la tierra, y si el acceso al crédito mejoró al reducirse la desigualdad de la tierra. Los resultados muestran que, aunque perjudicial, la desigualdad de la tierra no afectó al acceso al crédito. En cambio, el acceso al crédito dependió probablemente de factores políticos.

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1. Introduction

Access to credit is essential for any economic sector. Several authors argue that land inequality negatively affects agricultural credit access (Deininger and Squire, 1998; Griffin, Khan and Ickowitz, 2002; Rajan and Ramcharan, 2011). On the one hand, they hypothesise that land inequality causes a large part of the agrarian population not to have collateral to offer when they ask for a loan, which makes them seem less creditworthy for the banking sector. On the other hand, they defend that land inequality is associated with a powerful landed elite that, apart from owning the majority of land, exerts social and political influence to bias credit to its benefit to maintain its economic position and to have guaranteed cheap labour. Owning or not owning land is vitally important, especially in an agrarian country, since land is an advantageous asset as collateral because it cannot be eliminated or devalued (Field and Torero, 2006).

This paper examines these issues by analysing the Mexican case. Mexico has been an agrarian country for most of its history, with a landed elite of colonial origin and alleged high levels of land inequality. This situation was attempted to be solved in the early 20th century with a revolution and one of the most significant agrarian reforms in history, the Mexican agrarian reform.[1] This reform aimed at reducing land inequality, limit the power of the landed class, and improve access to agricultural credit by granting land to landless tenants who could use it as collateral to obtain loans.

To corroborate if it is true that land inequality can affect access to agricultural credit and if Mexico's agrarian reform reduced land inequality and favoured access to this credit, I analyse the possible impact of land inequality on agricultural credit using an extensive collection of original data on land distribution and agrarian credit at the state level in Mexico for the period 1930-1970. One of the contributions of this paper is to offer a new, original and unique database state with information on state-level agricultural credit and land inequality that I have obtained from the original censuses of the country. Thanks to this original data, I can examine the progress of the agrarian reform and the evolution of credit in each Mexican state in the first fifty years of the revolution.

The second contribution of this paper is to provide evidence of how both landed and political elites use land inequality as a tool to stay in power. It is misleading to think that only landed elites are responsible for and benefit from unequal land distribution. Unlike other research, this paper shows how they promoted, maintained, and used land inequality to protect their interests.

My estimates indicate that land reform hardly reduced land inequality in the first fifty years, nor did it improve access to agricultural credit. Meanwhile, unlike other authors, I do not find econometric evidence that land inequality negatively affects access to agricultural credit.

[1] The Mexican agrarian reform was developed as one of the main objectives of the Mexican revolution. This reform was legislated and included in the new Constitution of Mexico in 1917 and is known for being the first to be developed on the American continent and for being one of the longest and most ambitious (Thiesenhusen,1995; De Janvry, Gonzalez-Navarro and Sadoulet, 2014).

To the best of my knowledge, no one has studied how land inequality can affect access to agricultural credit in the case of Mexico, least of all analysing the possible effect by state. Nor has it been studied if land reform helped reduce land inequality in the first fifty years after the revolution and reform began.

The paper will be organised as follows: Section 1 reviews the literature on how land inequality affects credit access. Section 2 offers an explanation of how agricultural credit and land inequality evolved in Mexico; it is also analysed if land reform reduced land inequality and if this land inequality had any impact on credit access. Section 3 presents the new data on land Gini indices, large holding ratio, and agricultural credit flow estimates for the 32 states of Mexico. Section 4 discusses the methodological approach to measuring land inequality and agrarian credit. Section 5 shows and analyse the econometric results. Section 6 deals with conclusions.

2. Related literature

The development literature has spent years analysing the possible relationship between land inequality and access to credit. A clear example is Binswanger and Deininger (1997), who already highlighted how land inequality is associated with a powerful landed elite who can use their influence to easily bias credit provision and the economic environment in their favour. Besides, they showed how imperfect credit and insurance markets limit the ability of the poor to acquire land and capital. Later, in more analytical work, Deininger and Squire (1998) emphasise the importance of owning assets, such as land, to explain the individual's productive capacity and the ability to invest and access credit, especially in agrarian economies where land is the most important asset. They argue how individuals will only have access to credit if they have assets they can use as collateral, stressing that higher land distribution inequality would imply that for any level of per capita income there would be a higher number of people with restricted access to credit. In a detailed global study about land inequality and land reforms, Griffin, Khan and Ickowitz (2002) examine how large landowners have access to commercial banks and other financial institutions while small farmers are denied access to commercial banks because they are illiterate, lack land to use as collateral, or have unsecured land titles which make them seem less solvent. This situation causes small farmers to seek credit in informal markets or from the landowner himself, and to end up being a victim of usury. They argue, however, that small farmers and tenants have proven to be more compliant in arrears and have lower default rates than landowners. However, the banking system gives large landowners preferential treatment by owning large tracts of land as collateral and by their political influence. Calomiris and Ramirez (2004) analyse the entry barriers to the banking market in several countries and show how in areas where large landowners predominate, access to financing is limited, particularly in times of recession because the landowners have incentives to monopolise access to savings and deposits.

In a more quantitative line of work, Erickson and Vollrath (2004) study how land inequality can affect financial markets. To do this, they examine the possible impact of land inequality on liquid assets, deposits, and bank credit in various countries worldwide. Their results show that there is scant macroeconomic evidence linking land inequality with the financial system; land inequality did not significantly affect financial development in any given country. However, Galor, Moav, and Vollrath (2009) study the effect of land inequality on human capital formation and argue the idea that in areas with high land inequality, large landowners may have interests in preventing rural unskilled workers from having access to credit, which unskilled workers could use for their training and would cause migration and loss of cheap labour in the field. Rajan and Ramcharan (2011) analyse whether land inequality can be related to the level of bank development; with this objective, they carry out a state-level analysis of the U.S at the beginning of the 20th century and find empirical evidence that states with the highest level of land inequality tend to have fewer banks per capita. The presence of banks is significantly lower in states where landed elites had the power to exert influence locally and had incentives to suppress the proper functioning of financial markets. They also found evidence that states with the highest land inequality levels had higher interest rates and lower loan-to-value ratios, showing that in states with higher land inequality, access to credit markets was more restricted.

More descriptively, Albertus *et al.* (2016), in a study on why economic policies applied in underdeveloped countries end up undermining economic growth, highlight that lack of access to credit and high land inequality are essential elements that undermine economic growth. They emphasise that the agrarian reform in India could be successful by reducing land inequality and by increasing the amount of land that could be used as collateral to access credit. The farmers were able to improve their sharecropping contracts and their productivity.[2]

3. Linking land inequality and agricultural credit

According to the literature, high land concentration may have negatively affected access to agricultural credit due to a lack of collateral and due to landed elites, which can skew credit in their favour thanks to their extensive land holdings and their influence. The case of Mexico fits in with the hypothesis raised by the literature.

Land inequality and the shortage of credit and banks oriented to agriculture have been a characteristic in Mexico since colonial times. The first banks established in the country were dedicated to commerce, business and industry; due to the lack of security they saw in agriculture. In fact, until 1901, most banks dealt preferentially with commerce and industry. Only after 1901 banks began to offer financing to agriculture, such as the Agricultural Mortgage Bank of Mexico (1901) or National Bank of Agricultural Credit (1926).[3]

Only landowners and large farmers could have access to credit thanks to the extensive possession of the land they used as collateral and their social status that gave them certain respectability and reliability to request credit. The rest of the rural population did not usually own their land, could not offer collateral, and did not have access to financing. Generally, they were forced to go to the grocer, or if they were tenants to the landlord himself (stripe shops)[4] to obtain credit in cash or kind at high interests, generating such debt that they were trapped by usury or lost their few possessions.

This situation resulted from a high land inequality that caused a small landed class to concentrate most of the land on their hands, while most tenants or small farmers did not own the land they worked for.[5] Moreover, if they had any titles, they were confusing titles such as those granted by confiscations, those granted to indigenous people in the form of ejidos, or even those received by the Royal Mercedes granted by the kings of Spain during colonisation. In this situation, banks were reluctant to lend money to tenants or small farmers, who seemed lacking in confidence to obtain credit, either because of the lack of collateral or because of doubts about the validity of their land titles.

This inequality and bias in access to agricultural credit were further accentuated during the Porfirio Díaz regime (1876-1911). During these years, large landowners were encouraged and allowed to delimit (deslindar) vacant land,[6] allowing landowners to keep part of these demarcated lands to sell or to increase their wealth further. Under these circumstances, poverty and extreme land inequality increased, and in 1910, a revolution led by agrarian leaders broke out.[7] As a consequence of this socio-political revolution, although originally agrarian, the Porfirio Díaz regime was overthrown, and one of the most significant and ambitious agrarian reforms in the world was developed, the Mexican agrarian reform, which was included in the New Mexican Constitution of 1917 (De Janvry, Gonzalez-Navarro and Sadoulet, 2014).

Apart from reducing land inequality, one of the objectives of this agrarian reform was to improve growth and productivity in the countryside. To achieve this goal, improving access to agricultural credit was essential. With this purpose, the landed elite was gradually expropriated, and the expropriated land was distributed among the landless peasants.[8] The Mexican agrarian reform, one of the largest in the world, was also one of the longest, continuing with expropriations until 1992.

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[2] See Besley and Burgess (2000) for a more depth analysis of India's land reform case.

[3] For a complete chronology of Mexican banks and their relationship with agriculture, see Reyes Osorio and Reyes Rives (2018).

[4] The "stripe shops" were stores established next to haciendas whose owner was the landowner himself. Workers bought food, clothing, etc., in these stores because these stores were the only stores that accepted the currency and the promissory note with what workers were paid. Due to low wages, workers had to buy on credit with a high interest creating an "unpayable" debt that, if they could not pay in life, their descendants inherited, causing peonage or debt bondage (Thiesenhusen,1995, pp. 30-31). These were called "stripe stores" because most farm workers or tenants were illiterate and signed with a stripe instead of their name.

[5] In 1910, upon Porfiriato Díaz's exit, fewer than 11.000 landowners controlled 57% of the national territory, and 834 of these landowners held 1.3 million square kilometres. Meanwhile, about 15 million peasants were landless (Thiesenhusen, 1995, p. 30).

[6] In 1883, the Law of Colonization and Demarcation of Vacant Lands allowed to mark land and its limits. Through this law, different individuals and institutions were authorised and supported to delimit vacant or national lands in the Republic to later sell them to Mexican or foreign investors.

[7] An agrarian movement ended with the political proclamation of the "Plan de Ayala", which demanded to improve the conditions of land ownership in the countryside, returning lands to peasants taken from them by landowners and chieftains (Thiesenhusen, 1995).

[8] At least 103 million hectares were reallocated to 32,000 ejidos (agrarian communities); most of these ejidos were formed of some 3.5 million families and covered 52% of the Mexican territory. The most active period of redistribution was from 1934-1940 (De Janvry, Gonzalez-Navarro and Sadoulet, 2014). See Sanderson (1984) for further statistics and details on land expropriation and subsequent reassignment.

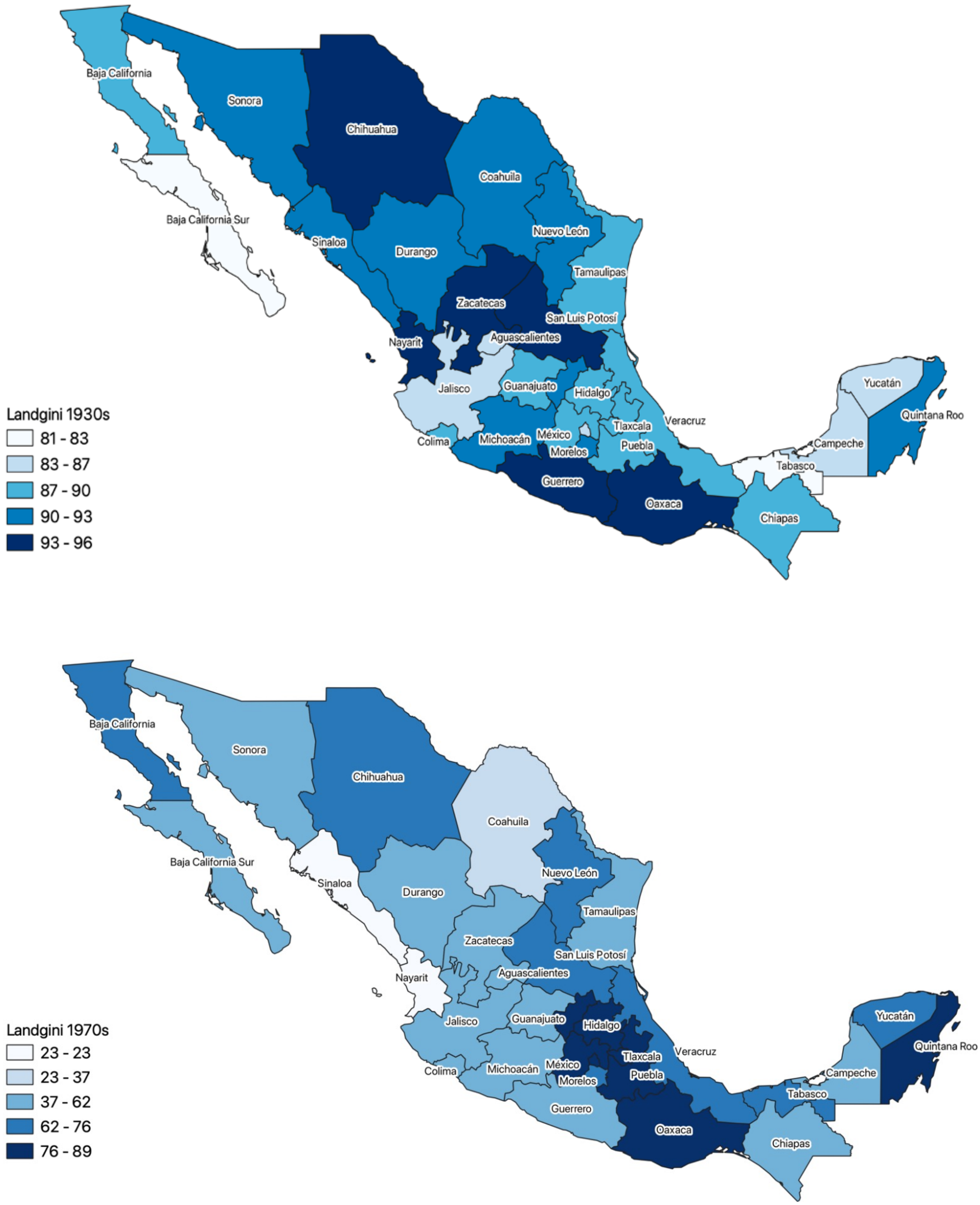

Figure 1. Land concentration (Gini index) by state in the 1930s and 1970s

Note: For simplicity, landgini is expressed in per cent, 0 (equality) and 100 (inequality).

Source: Author's elaboration from Mexico agricultural censuses, 1930-1970.

To begin to visualise more clearly how land was distributed during the agrarian reform in these years, we can start by considering at the levels of land inequality. Figure 1 shows the level of land inequality by state for the 1930s and 1970s. The data has been obtained from the original Mexican agricultural censuses, and land inequality is analysed using a land Gini index.[9] The first question we can ask ourselves is: Up to which point is the progress of the land reform captured? The agrarian reform was legislated in 1914 and included in the new Constitution of 1917.[10] However, the first agricultural census where information is collected on agriculture in general, and the distribution of land, in particular, is the First Agricultural and Livestock Census of 1930. Given the high levels of inequality that we can see from Figure 1, it is more than evident that there were no significant changes in the land distribution between 1917 and 1930, or at least, land inequality barely decreased. How can this conclusion be reached without better data on land distribution pre-reform? If we focus on the levels of land inequality in the 1930s, we can see that land inequality is exceptionally high, and most states are at levels close to 100 per cent. Land redistributions that took place before the 1930s had to be moderate. Otherwise, inequality levels would not be as high in the 1930s.

Despite the application of the agrarian reform, with few exceptions, land inequality did not drastically decrease at the national or state level during most of the studied period. This trend can be seen especially in the southern states, which historically were dominated by haciendas, strong landed classes, and where even slave labour was employed, such as the states of Oaxaca or Puebla.[11]

The main explanation for this situation is that the agrarian reform, although well-intentioned in its beginnings, ended up being an instrument of political control for the new elite of the Institutional Revolutionary Party (PRI); this new elite designed the reform to be an eternal and continuous distribution of land (Prosterman and Riedinger, 1987). Through land redistribution, votes were obtained, peasant revolts were quelled, and the PRI remained in power.[12]The most damaging fact was that the land expropriated was not efficiently redistributed to the landless peasants, because they did not obtain full rights to the property they received; they could not sell it, rent it, or use it as collateral to obtain credit.

The PRI took advantage of this situation to offer public credit to the new owners as long as they politically supported them. If they did not conform with this, they risked not receiving land or public credit. Given that they had no access to private credit due to a lack of rights over their property or a lack of collateral by the high land inequality, this situation made them dependent on the new regime (Albertus *et al.*, 2016). This fact made land redistribution useless because land without access to credit was a disappointment. Actually, until 1992, greater security of tenure was not provided to privately owned land, nor were ejidatarios given certificates granting them the right to rent, sell, or mortgage their land (De Janvry, Gonzalez-Navarro and Sadoulet, 2012). In this period, most of the credit received by holdings (farms and ejidos) came from national credit institutions. Private or individual credit institutions did not provide the same level of financing as the government (see Appendix B, Figures B1; B2 and B3).

Figure 2 presents agricultural credit per capita by states for the 1940s and 1960s. If we analyse this figure, we can appreciate the agricultural credit in the rural population. It is distinguished how the northern states, historically with equal land distribution, showed higher levels of credit per capita. While the southern states, characterised by higher land inequality, recorded a lower level of credit per capita. In any case, forgetting the state differences, what can be distinguished is a decrease in credit per capita caused by the increase in the rural population and the maintenance or reduction of credit dedicated to agriculture.

[9] This index, which will be explained in greater detail in the data section, classifies land inequality between 0 and 1, where higher values show higher land inequality and lower values show lower land inequality.

[10] Thiesenhusen (1995, pp. 29-51).

[11] Historically, the northern Mexican states had an equal land distribution, sometimes with a specific smallholder structure. Meanwhile, the southern states always experienced higher levels of inequality and were dominated by large latifundia (Galor, Moav and Vollrath, 2009).

[12] During the 1920-30s and 1960-70s, the PRI increased land distribution to calm rural protests and restore order in the countryside (Albertus *et al.*, 2016). We can see, in Figure 1, how the 1960-70s is when landgini decreased quite a bit in some states.

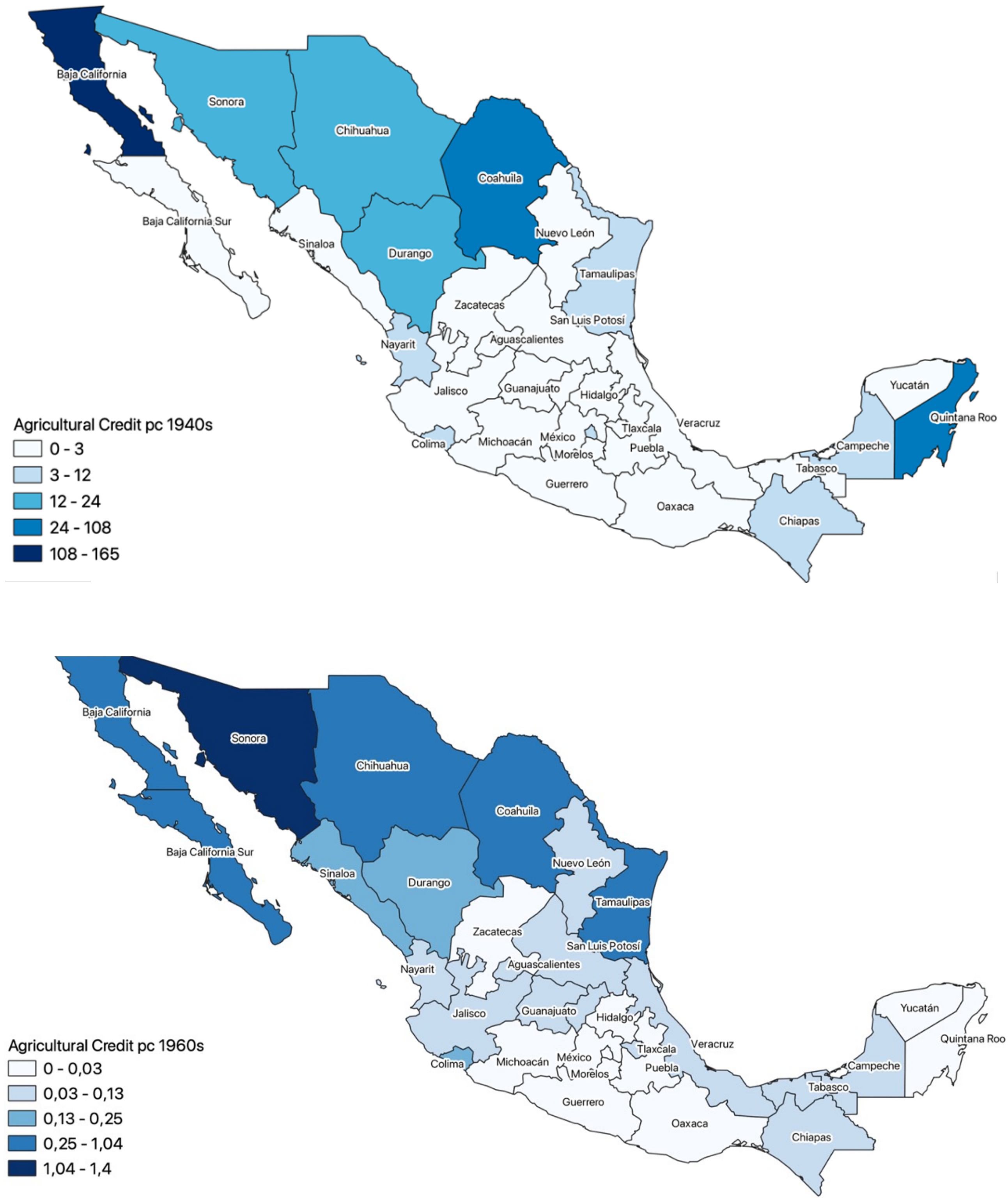

Figure 2. Agricultural Credit per capita by state in the 1940s and 1960s

Note: Credit in thousands of pesos.

Source: Author's elaboration from Mexico agricultural censuses, 1940-1960.

The land tenure system in Mexico did not grant security to banks to give credit to agriculture, either before or after the agrarian reform. Under the old regime, the land distribution was polarised between a large number of small farms and a few large holdings, where most of the country's land was concentrated and owned by the landed elite (Appendix B, Figure B4 presents the polarised land distribution in Mexico). The Mexican landowners did have access to agricultural credit for owning large farms that they could use as collateral and for their social influence. At the same time, small farmers or tenants were not worthy of credit due to a lack of collateral for lack of property. This situation was attempted to be resolved with the agrarian reform, which initially was going to redistribute land. However, the new political elite of the PRI redistributed less than promised and high land inequality was kept high, as can be seen in Figure 1.

According to the literature, this high land inequality before and after the revolution and the reform had negatively affected access to agricultural credit due to a lack of collateral. The case of Mexico is an excellent example to analyse this hypothesis; since both the old landowner elite and the new political elite of the PRI acted as exploitative landowners, promoting and perpetuating land inequality in the country.

4. New Data

How to measure latifundia tradition or land inequality in a country? Most studies use land distribution as an indicator to determine if the land was unevenly distributed, that is, if there was land inequality since high land inequality tends to be linked to strong landed elites (Rajan and Ramcharan, 2011).

Data on land distribution and rural credit is scarce, both published and unpublished, particularly at the state level. For that reason, I exploit a little-used source: the original agrarian censuses of Mexico. These censuses allow me to construct a new and original compilation of data on land distribution and agricultural credit for Mexico in the 20th century. To obtain this, extensive archiving and compilation work has been carried out. The Mexican censuses were conducted every decade and provided information on the number and size of all "predios" (holdings), including holdings exploited, non-exploited, and ejidos. They are within a particular hectare category or bin, ranging from 1-5 hectares up to 40.000 hectares.

There are several options to measure land distribution.[13] The Gini coefficient applied to the land distribution (landgini) is chosen in this case, which measures land distribution between 0 (equality) and 1 (inequality); Appendix C, Eq. (1) shows the specific calculation of this index.

The reasons for choosing this index are simple: first, it is widely used in the literature to analyse land distribution.[14] Second, this index captures the land owned by all owners, individuals, or governments; it measures all registered land and includes the size and number of all holdings. Third, it has a straightforward interpretation (Summerhill, 2010). Finally, it is an indicator without measurement units, which facilitates comparison between states and regions, making it suitable for this study's comparative purpose.

However, it is necessary to mention that this index measures landowner inequality, does not distinguish between tenants and owners, and does not capture landless individuals[15] (Frankema, 2008; Funari P.P.P, 2017). Nevertheless, these characteristics should not prejudice this analysis: a high landgini shows that in a state, a minority of owners own most of the land, while the rest, the vast majority of owners, own a small part of the land. Furthermore, it is in these states where large owners could have easier access to credit than minor owners. Table 1 shows land inequality level measured by the landgini from the 1930s to the 1970s.

Nonetheless, due to the possible limitations that the Gini index may have as the only measure to analyse land inequality and the latifundia tradition, another complementary variable is calculated to help analyse land distribution. This measure is the Large Holding ratio, which indicates the percentage of large holdings, that is latifundia, in a given state for each year (Appendix C, Eq. (2) shows how this is calculated). Although there are no clear minimum or maximum dimensions for large holdings, according to the agrarian structure of Mexico in these years, it is possible to begin to consider as large holdings those with an area greater than 100 hectares[16] (see Appendix B, Figure B4). This Large Holding ratio is similar to other measures used in the literature with similar purposes, such as Cinnirella and Hornung (2016) or Ricci and Zanibelli (2021). Table 2 shows the land inequality level measured by the large holding ratio from the 1930s to the 1970s.

[13] Family farm index (Vanhanen, 1997), agricultural population per holding (Erickson and Vollrath, 2004), the fraction of farm labourers over the total agricultural population (Beltrán Tapia and Martinez-Galarraga, 2018), labour-dependent agriculture (Albertus, 2017), percentage of agricultural labourers as a proportion of the active agricultural population (Beltrán Tapia *et al*., 2021).

[14] E.g., Erickson and Vollrath (2004); Acemoglu *et al*., (2007); Nunn (2008); Ziblatt (2008); Frankema (2008); Ramcharan (2010); Vollrath (2013); Funari P.P.P (2017); Albertus, Brambor and Ceneviva (2018).

[15] For methodological reasons, this index does not include the population that does not own land (see Appendix C, Eq. (1)). The indicator measures the total area surveyed to determine how the land is distributed among the population that owns it, but it does not analyse the rural population itself. Probably, the estimates would increase slightly if the landless population could be added to the calculation. For example, if a state already shows high levels of inequality between landowners, adding a landless population would increase the pressure on the unequal distribution of land.

[16] Colistete and Lamounier (2014), in Brazil, classify large farms as those between 242 and 1.210 hectares, and latifundia those holdings larger than 1.210 hectares. They also mention that a holding of 400 hectares would be latifundia in Colombia.

Table 1.
Mexico's Landgini by states, region, and country for the 1930s-1970s

State	1930s	1940s	1950s	1960s	1970s
Aguascalientes	86.9	88.7	86.6	86.4	60.1
Baja California Norte	90.9	90.1	88.5	84.6	71.9
Baja California Sur	81.2	82.5	84.4	76.5	60.5
Campeche	86.8	93.7	90.3	84.5	61
Chiapas	88.3	89.9	89.2	85.6	61.4
Chihuahua	94.3	96.2	92.8	91.05	68
Coahuila	92.2	95.5	92.2	89.8	37.9
Colima	90.07	88.07	82.7	79.3	54.5
Distrito Federal	86.1	77.3	88	84.05	85.4
Durango	92.9	95.3	93.1	91.2	52.5
Guanajuato	89.03	87.2	86.5	84.8	62.1
Guerrero	94.9	98.1	97.2	96.5	56.9
Hidalgo	89.7	85.07	91.6	88.8	85.08
Jalisco	87.5	87.04	87.7	86.04	59.6
Mexico	90.01	90.5	93.5	90.5	87.01
Michoacan	92.2	92.1	92.9	91.06	60.9
Morelos	93.8	85.9	95.9	94.08	76.4
Nayarit	94.9	97.7	93.2	91.1	23.04
Nuevo Leon	91.6	93.2	91.9	90.2	66.2
Oaxaca	96.3	96.09	96.7	96.2	89.1
Puebla	89.7	88.4	91.3	89.7	86.3
Queretaro	93.3	90.1	93.5	91.7	84.4
Quintana Roo	93.9	91.5	87.7	94.3	79.3
San Luis de Potosi	95.8	96.3	96.4	93.2	66.2
Sinaloa	93.3	93.8	90.7	89.6	23.6
Sonora	92	93.4	89.7	87.4	56.7
Tabasco	83.01	85.7	87.2	85.4	71.4
Tamaulipas	89.3	89.8	89.3	85.9	57.1
Tlaxcala	90.05	85.1	91.9	86.7	88.2
Veracruz	88.7	91.3	89.8	86.4	74.07
Yucatan	87.9	91.7	92.4	89.4	66.7
Zacatecas	94.5	92.5	91.3	90.2	57.3
North Zone	94.7	95.8	94.2	92.03	57.8
Gulf Area	92.1	94.6	94.3	93.2	70.4
North Pacific	92.9	93.8	90.8	88.6	47.14
South Pacific	95.4	96.8	96.7	95.9	65.4
Centre Block	91.3	92.3	93.9	92.4	75.9
Country Level (Mexico)	95.3	96.8	96.3	95.3	77.3

Source: Author's elaboration from Mexico agricultural censuses,1930-1970.

Table 2.
Large Holding Ratio by states, region, and country for the 1930s-1970s

State	1930s	1940s	1950s	1960s	1970s
Aguascalientes	21.3	4.1	16.5	18.8	18.3
Baja California Norte	28.2	14.4	18.7	17.6	21.8
Baja California Sur	55.5	38.8	41.5	48.7	46.3
Campeche	44.4	32.8	33.1	44.3	34.5
Chiapas	21.5	15.2	16.2	20.6	19.8
Chihuahua	25.5	16.09	23.7	24.7	28.4
Coahuila	36.06	24.3	29.1	35.1	35.4
Colima	26.7	22.4	33.1	38.2	27.09
Distrito Federal	1.8	0.06	0.17	0.42	0.68
Durango	24.8	17.3	20.5	27.08	20.5
Guanajuato	13.3	8.2	10.3	9.3	8.7
Guerrero	9.7	3.2	6.3	6.7	6.09
Hidalgo	4.1	1.04	1.5	1.8	2.3
Jalisco	11.8	6.6	9.7	12.03	16.1
Mexico	3.2	0.6	1	1.12	1.7
Michoacan	7.8	3.3	5.3	8.1	7.7
Morelos	7.1	0.4	2.3	2.1	2.9
Nayarit	14.1	7.05	20.1	28.06	20.4
Nuevo Leon	21.9	11.8	13.4	17.9	19.3
Oaxaca	2.5	0.8	1.12	1.44	2.18
Puebla	2.7	0.6	0.8	1.06	1.9
Queretaro	9.9	5.3	6.4	6.7	7.3
Quintana Roo	17.2	16.1	18.8	19.8	49
San Luis de Potosi	11.3	4.6	6.7	15.05	13.7
Sinaloa	9.7	9	14.5	23.5	15.7
Sonora	24.2	18.4	28.1	33.9	35.5
Tabasco	10.3	6.6	8.8	10	9.8
Tamaulipas	33.9	26.9	21.1	27.5	25.9
Tlaxcala	2.5	0.6	1.2	1.2	1.18
Veracruz	9.8	5.8	7.3	8.8	10.7
Yucatan	25.3	12.2	17	22	22.2
Zacatecas	12.06	8.5	10.4	13.5	12.5
North Zone	20.5	12.5	15.1	21.3	22.2
Gulf Area	11.8	7.04	8.9	10.5	25.2
North Pacific	19.07	15.08	22.4	29.6	28
South Pacific	7.3	3.9	4.45	5.6	13.8
Centre Block	6.1	1.9	2.8	3.3	6.2
Country Level (Mexico)	10	4.5	6.06	8.06	9.59

Source: Author's elaboration from Mexico agricultural censuses,1930-1970.

Analysing the results of the large holding ratio and comparing them with the landgini estimates, we can better appreciate the actual land distribution in Mexico in these fifty years and its evolution. The landgini and the large holding ratio did not decrease significantly until the 1970s. On the other hand, one of the most relevant findings is the low percentage of large holdings found in states with high landgini. It is the case of states such as Oaxaca or Puebla, where the high land inequality together with the low percentage of large holdings makes us see that a few large holdings seem to concentrate most of the land—showing a possible agrarian structure formed by a few large holdings concentrating a large part of the land, versus many small holdings with little land concentration (Figure B4, Appendix B shows this agrarian structure at the national level).

Concerning agricultural credit, data is relatively scarce, especially in these years. Nevertheless, the agricultural censuses of Mexico for the 1940s and 1960s offer useful information on agrarian credit for all holdings larger or equal than 5 hectares, expressed in thousands of pesos. Sometimes, they even show the origin of agrarian credit, which can come from national, private, or particular institutions for each state (Appendix B, Figures B1; B2, and B3 show credit by state according to its origin).

Following examples in the literature, I analyse agricultural credit about the rural population to measure the relationship between the agrarian credit and the number of rural inhabitants in each Mexican state (Rajan and Ramcharan, 2011).[17]

5. Methodology

The central hypothesis presented here is that land inequality had a negative effect on agrarian credit access in Mexico. Such land inequality caused a great lack of collateral to access financing, and furthermore, this latifundia system used to be linked to strong landed elites who tended to skew the financial markets in their favour.

To corroborate this hypothesis, the landgini index, the large holding ratio, and the rural credit per capita are calculated for each "i" state in Mexico in the 1940s and 1960s. These data are then used to estimate the following econometric panel data (strongly balanced) model for a total of 62 observations[18] referring to the 1940s and 1960s:

$$(1)\quad lCreditpc_{i,t} = \beta_0 + \beta_1 landgini_{i,t} / Ratiolargeholding_{i,t} + \beta_2 lruralilliteracy_{i,t} + \beta_3 lurban_{i,t} + \beta_4 lGDPpc_{i,t} + \beta_5 livestock_{i,t} + \beta_6 ILP_{i,t} + \beta_7 ldistance_{i,t} + \beta_8 landlocked_i + \beta_9 geocontrols_i + u_{i,t}$$

The logarithm of agrarian credit per capita is used as the dependent variable (Table A.1, Appendix A presents details and summary statistics of each variable). This represents the relationship between the level of credit for a given Mexican state and its rural population. As mentioned above, a version of this relationship between credit and population has already been used in the literature by Rajan and Ramcharan (2011). The key independent variable is landgini, which refers to state-level land inequality. The large holding ratio is also calculated in a complementary way since according to the literature, large holdings would tend to have easier access to credit by offering greater collateral and profitability to banks.

As control variables, indicators used in the study of land inequality and financial markets are also included; these have also been estimated from original censuses. For reasons of possible discrimination, rural illiteracy and the fraction of producers who speak indigenous languages (ILP) are included. The idea is that having low educational skills or exhibiting other cultural or racial traits might make more difficult obtaining credit (id., 2011). The model also includes a logarithm of the percentage of the population residing in urban areas to control for the possible effect that urbanisation and industrialisation may have on agricultural credit. Agriculture will be less critical in more urban and industrialised states, and there will be a lower demand for agricultural credit.

The logarithm of gross domestic product per capita is added as a control for overall development (Erikson and Vollrath, 2004). The fraction of surface dedicated to livestock (Livestock) is also included because, in general, livestock farms tended to have the possibility of using livestock as collateral to obtain credit more easily, or simply in case of short-run credit needs cattle could be sold to obtain the necessary resources. Besides, landowners with cattle tended to have more preferential political treatment,[19] something that can influence access to credit. Other elements that can influence credit access are considered, such as the distance of each state to the capital city, and a dummy that records whether a state has access to the sea or not. Distance to big cities and access to the sea give us information about the economic size and relevance of a given state. Lastly, several geographic controls such as area, latitude and longitude for each Mexican state are also included to account for regional and climatic diversity (Mariella, 2022).

To test the hypothesis that land inequality may harm credit access, and following the recent literature, models with ordinary least squares (OLS), fixed and random effects (FE and RE) are estimated (Albertus *et al.*, 2016). The latter models account for unobserved heterogeneity and time-invariant factors. The Hausman test will be applied to determine the most appropriate estimation. Additionally, due to common institutions and serial correlation within states, standard errors are clustered at the country-state level (Arroyo-Abad, 2016).

6. Econometric results

Table 3 reports the results of estimating equation 1: Column 1 presents the specification with ordinary least squares, and columns 2 and 3 show the specification with fixed and random effects, respectively. Columns 4, 5, and 6 represent the same specifications but with standard errors clustered at the country-state level. The rest of the columns show the same model specifications just mentioned, but using the large holding ratio as the key independent variable.

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[17] Rajan and Ramcharan analysed the relationship between land inequality and credit access in the United States at the beginning of the 20th century. In the absence of data on agricultural credit, measured banks per capita state by state to analyse the presence of credit and the population's access to it.

[18] It should be noted that there should be 64 observations. However, when the logarithm of the distance to the capital is calculated, two observations are lost when we are located in the capital and the distance is 0.

[19] In 1937, large cattle and stock ranches with over 500 head of cattle and 300 head of smaller livestock were exempted from expropriation for a period of up to 25 years, Albertus *et al.* (2016).

The estimations via OLS, FE and RE presented in columns 1, 2 and 3 show that landgini has a negative effect on agrarian credit per capita but only in the estimation via random effects, its effect has statistical significance. The coefficients of the other variables included in the models also provide interesting insights. Rural illiteracy is significantly positively related to agricultural credit in all estimates; rural illiteracy is by far the most significant variable. It can seem counterintuitive, but there is a logical reason behind this: the high illiteracy of most credit applicants.[20] The level of illiteracy in Mexico in these years was very high. In 1940, it registered an adult literacy rate of only 46%. While countries like the United States registered rates of 97.1%, Latin American countries like Argentina offered adult literacy rates of 86.4% in 1945.[21] The rural Mexican world was no exception, and it also suffered from high illiteracy.

On the other hand, the percentage of the urban population has a positive effect but lacks of statistical significance in models 1 and 3 via OLS and RE. However, its effect and significance change in the estimation via FE. GDPpc shows a positive effect on all estimations but without statistical significance. The fraction of surface dedicated to livestock has a negative and statistical significance effect on OLS and RE. The producers who speak indigenous languages (ILP), show a negative effect in all estimates but without statistical significance.

To find out which estimate is the most appropriate the Hausman test is applied. This test indicates that the estimation via fixed effects (model 2) is the most appropriate in this case. The findings obtained via fixed effects are in line with results in the literature (Erickson and Vollrath, 2004). Land inequality has a negative effect on access to agrarian credit but it does not show statistical significance. Only the urban population has a negative effect and statistical significance. It shows that the more urbanised and industrialised a state was, the less agrarian credit was demanded. On the other hand, the percentage of the rural illiteracy population has a positive and significant effect, possibly as mentioned above, because most credit applicants were considered illiterate.

When standard errors are clustered at the country-state level (models 4, 5, y 6), the landgini maintains its negative effect but loses its absolute statistical significance. If we look at the estimation via FE (model 5), rural illiteracy and the urban population maintain their effect and significance. While GDPpc in model 5 shows statistical significance for the first time, higher GDPpc positively impacts agricultural credit per capita; similar results can be found in the literature (Rajan and Ramcharan, 2011).

About the estimates made with the variable large holding ratio, we can see that its coefficient is positive in all models; larger holdings would attract more credit. However, it does not show statistical relevance. Following the previous methodology, the Hausman test is applied, and again it indicates that the most appropriate estimate is FE (model 8). In these estimates, we see the ratio without statistical relevance; only illiteracy and urban population maintain the same effect and significance. GDPpc again shows statistical significance in FE (model 11) when the standard errors are clustered at the country-state level.

Nevertheless, despite these striking results, we must consider the possibility of facing a possible endogeneity problem. A system where credit is granted using land as collateral could increase land inequality. For example, if small farmers cannot pay their debts, they would have to sell their land or offer it as payment. Large landowners could take advantage of this situation, acquire these lands and even serve as credit suppliers. Small landowners would lose their land, large landowners would increase their holdings, and land inequality would rise.

To address this potential problem, I adopt the same instrumenting strategy used by Rajan and Ramcharan (2011). These authors, in a very similar study on the effect of land inequality on credit in the United States in the 20th century, face similar concerns of endogeneity and decide to use average rainfall as an instrument for land concentration.[22] They argue, like other authors,[23] that climatic characteristics have influenced the type of farms and crops grown. Areas with higher average rainfall specialised in profitable crops with plantation-style agriculture, such as sugar cane. In contrast, more arid regions chose less profitable crops and were more suitable for these climatic conditions, such as cereals or grain, grown on small-medium-sized farms.

Average rainfall affects land concentration by affecting farms size, but this does not obviously affect credit demand or supply. A higher level of rain could improve the productivity of farms, and they could have easier credit access. But, due to this increased productivity, they could obtain the necessary resources independently without resorting to any bank. Or conversely, farms located in areas with seasonally high rainfall levels could suffer floods, causing damage to crops and being less creditworthy. Therefore, it is possible to say that there is no clear direct effect of average rainfall on access to credit. However, it is necessary to mention that no natural instrument can completely satisfy the exclusion criterion (id.).

Table 4 reports the results of estimating equation 1 using average rainfall as an instrument. Model 1 does not confirm that, in this case, average rainfall is significantly related to land inequality, measured by landgini. On the other hand, we can see that the F test collapses below the standard threshold value of 10. Therefore, given that average rainfall is not a valid instrument in this case, the negative and statistically significant coefficient of landgini in model 2 cannot be trusted.

In models 3 and 4, we can see how average rainfall is significantly related to land inequality, measured by the large holding ratio. The effect is negative effect given that, as seen in Table 2, the northern areas of the country show a higher percentage of the ratio, and these areas tend to be the most arid. The F test, in this case, shows that the model is not weakly identified. The coefficient exhibits a similar size as that estimated with the fixed-effects strategy, and likewise without statistical relevance.

After analysing all models, it is not possible to say that there is evidence of an apparent effect of land inequality, either through the landgini or the large holding ratio, on access to agricultural credit, at least in the case of Mexico for the 1940s and 1960s.

[20] Hussain and Thapa (2016), analysing the fungibility of agricultural credit for smallholders in Pakistan, found the same results. Illiteracy positively and significantly affects credit applications in areas where most of the population is illiterate.

[21] See the World Development Indicators Database (World Bank) and World Illiteracy at Mid-Century (UNESCO).

[22] The authors defend that it is a plausible and exogenous instrument. In a previous study, Ramcharan (2010) already used average rainfall as an instrument for land concentration.

[23] Sokoloff and Engerman (2000).

Table 3.
Land Inequality on Agricultural Credit Per Capita, the 1940s-1960s

Dependent Variable: Agrarian Credit per capita

	Model 1 (OLS)	Model 2 (FE)	Model 3 (RE)	Model 4 (OLS)	Model 5 (FE)	Model 6 (RE)	Model 7 (OLS)	Model 8 (FE)	Model 9 (RE)	Model 10 (OLS)	Model 11 (FE)	Model 12 (RE)
$Landgini_{i,t}$	-0.11 (0.06)	-0.04 (0.12)	-0.11* (0.06)	-0.11 (0.07)	-0.04 (0.13)	-0.11 (0.07)						
Ratio $LargeHolding_{i,t}$							0.04 (0.03)	0.02 (0.07)	0.04 (0.03)	0.04 (0.03)	0.02 (0.05)	0.04 (0.03)
$lruralilliteracy_{i,t}$	3.88*** (0.82)	2.16* (1.10)	3.88*** (0.82)	3.88*** (0.71)	2.16** (0.88)	3.88*** (0.71)	3.84*** (0.83)	2.16* (1.13)	3.84*** (0.83)	3.84*** (0.71)	2.16** (0.86)	3.84*** (0.71)
$lUrban_{i,t}$	1.67 (1.03)	-6.46** (2.38)	1.67 (1.03)	1.67* (0.95)	-6.46*** (2.21)	1.67* (0.95)	1.48 (1.06)	-6.72*** (2.29)	1.48 (1.06)	1.48 (0.88)	-6.72*** (2.37)	1.48* (0.88)
$lGDPpc_{i,t}$	0.49 (0.72)	1.76 (1.09)	0.49 (0.72)	0.49 (0.80)	1.76* (0.94)	0.49 (0.80)	0.48 (0.73)	1.82 (1.08)	0.48 (0.73)	0.48 (0.82)	1.82* (1.01)	0.48 (0.82)
$Livestock_{i,t}$	-0.03* (0.01)	-0.04 (0.03)	-0.03* (0.01)	-0.03** (0.01)	-0.04 (0.03)	-0.03** (0.01)	-0.03 (0.01)	-0.03 (0.03)	-0.03* (0.01)	-0.03** (0.01)	-0.03 (0.02)	-0.03** (0.01)
$ILP_{i,t}$	-0.07 (0.04)	-0.10 (0.08)	-0.07 (0.04)	-0.07 (0.05)	-0.10 (0.15)	-0.07 (0.05)	-0.07 (0.04)	-0.10 (0.08)	-0.07 (0.04)	-0.07 (0.06)	-0.10 (0.15)	-0.07 (0.06)
$Landlocked_{i}$	0.45 (0.70)		0.45 (0.70)	0.45 (0.73)		0.45 (0.73)	0.53 (0.70)		0.53 (0.70)	0.53 (0.66)		0.53 (0.66)
$lDistance_{i,t}$	0.65 (0.46)		0.65 (0.46)	0.65 (0.43)		0.65 (0.43)	0.30 (0.53)		0.30 (0.53)	0.30 (0.42)		0.30 (0.42)
$LandArea_{i}$	7.19e-06 (7.40e-06)		7.19e-06 (7.40e-06)	7.19e-06 (6.41e-06)		7.19e-06 (6.41e-06)	2.40e-06 (6.84e-06)		2.40e-06 (6.84e-06)	2.40e-06 (5.01e-06)		2.40e-06 (5.01e-06)
$Latitude_{i}$	0.50** (0.19)		0.50** (0.19)	0.50** (0.20)		0.50** (0.20)	0.54** (0.20)		0.54*** (0.20)	0.54*** (0.18)		0.54*** (0.18)
$Longitude_{i}$	0.10 (0.08)		0.10 (0.08)	0.10 (0.09)		0.10 (0.09)	0.09 (0.08)		0.09 (0.08)	0.09 (0.09)		0.09 (0.09)
Standard errors clustered	NO	NO	NO	YES	YES	YES	NO	NO	NO	YES	YES	YES
Observations	62	62	62	62	62	62	62	62	62	62	62	62
R^2 (within/between)	0.58	0.80/0.28	0.70/0.47	0.58	0.80/0.28	0.70/0.47	0.58	0.80/0.24	0.69/0.46	0.58	0.80/0.24	0.69/0.46
Prob > F	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	
Prob > Chi2			0.0000			0.0000			0.0000			0.0000

Note: All regressions include a constant. Robust standard errors in parentheses, ***p<0.01, **p< 0.05, *p<0.1.
Source: Author's elaboration.

Table 4.
Land Inequality on Agricultural Credit Per Capita, the 1940s-1960s. IV Estimates

	Model 1 First-Stage	**Model 2 IV**	**Model 3 First-Stage**	**Model 4 IV**
	Dependent Variable	***Dependent Variable***	***Dependent Variable***	***Dependent Variable***
	Landgini	**Agrarian Credit per capita**	**Ratio LargeHolding**	**Agrarian Credit per capita**
$AverageRainfall_{i,t}$	-0.0002 (0.0018)		-0.012*** (0.003)	
$Landgini_{i,t}$		-0.24** (0.11)		
Ratio $LargeHolding_{i,t}$				0.01 (0.07)
$lruralilliteracy_{i,t}$	1.64 (1.29)	4.10*** (0.90)	-4.14 (2.99)	3.73*** (0.76)
$lUrban_{i,t}$	-0.88 (2.37)	1.56* (0.88)	-0.07 (4.57)	1.69 (1.14)
$lGDPpc_{i,t}$	0.10 (1.23)	0.51 (0.71)	1.74 (2.65)	0.48 (0.69)
$Livestock_{i,t}$	-0.08** (0.03)	-0.04*** (0.01)	0.18** (0.06)	-0.02 (0.02)
$ILP_{i,t}$	0.06 (0.06)	-0.07 (0.05)	-0.32* (0.18)	-0.08 (0.05)
$Landlocked_{i}$	-0.96 (1.20)	0.31 (0.59)	4.36 (2.78)	0.56 (0.52)
$lDistance_{i,t}$	-0.02 (0.84)	0.65 (0.43)	8.00*** (1.72)	0.58 (0.60)
$LandArea_{i}$	0.00004*** (0.00001)	0.00001* (6.58e-0.6)	3.96e-0.6 (0.00002)	2.25e-0.6 (5.25e-0.6)
$Latitude_{i}$	0.13 (0.40)	0.52*** (0.16)	-1.76** (0.77)	0.50*** (0.17)
$Longitude_{i}$	0.07 (0.15)	0.10 (0.07)	0.45 (0.42)	0.09 (0.07)
Observations	62	62	62	62
R^2	0.39	0.55	0.76	0.57
Prob >F	0.0009		0.0000	
Prob > Chi2		0.0000		0.0000
F test	0.012		15.87	

Note: All regressions include a constant. Robust standard errors in parentheses, ***p<0.01, **p< 0.05, *p<0.1.
Source: Author's elaboration.

7. Conclusion

This empirical paper tests the hypothesis that land inequality hurts access to credit. In the case of Mexico, this hypothesis cannot be accepted, even if the tenants or small farmers had difficulty obtaining credit; it was not due to the lack of land to offer as collateral. The flow of credit to the countryside was not conditioned based on owning land. The main reasons for the provision of agricultural credit were political. If applicants were landless peasants but were faithful to the PRI, they would have easier access to credit than others who did not support this political party.

On the other hand, the agrarian reform did not help reduce land inequality considerably until the 1970s, as demonstrated by the new data presented above. In addition, it has been possible to observe how the old landowning elite that perpetuated land inequality for their interests was replaced by another elite, in this case political, which also seems to have used land inequality for similar purposes.

Future research should focus on access to informal credit. Nothing about this is commented on because all the information used in this study comes from official sources. Informal credit is more difficult for the government to audit, hence the lack of data on this credit, which may shed light on this and other hypotheses.

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