# Are land reforms granting complete property rights politically risky?

## Electoral outcomes of Mexico's certification program[1]

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**Abstract**

What is the impact on voting behavior of strengthening property rights over agricultural land? To answer this question, we use the 14 year nationwide rollout of Mexico's land certification program (Procede) and match affected communities (ejidos) before and after the change in property rights with voting outcomes in corresponding electoral sections across six federal election cycles. We find that, in accordance with the investor class theory, granting complete property rights induced a conservative shift toward the pro-market party equal to 6.8 percent of its average share of votes over the period. This shift was strongest where vested interests created larger expected benefits from market-oriented policies as opposed to public-transfer policies. We also find that beneficiaries failed to reciprocate through votes for the benefactor party. We conclude that, in the Mexican experience, engaging in a land reform that strengthened individual property rights over agricultural land was politically advantageous for the right-wing party.

Keywords: land reform, property rights, voting, Mexico

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## 1. Introduction

It is well recognized in economics that complete property rights are the cornerstone of efficient land use[2] (Demsetz, 1967; Platteau, 2000; Goldstein and Udry, 2008). A large literature on land reform has shown the importance for agricultural growth and rural welfare of property rights that offer security of access to land and incentives to invest in agriculture (Deininger et al., 2004). In spite of this, it is surprising to observe that property rights over agricultural land remain so pervasively incomplete. Land reform programs that ambitiously redistributed land and altered property rights frequently granted incomplete property rights to beneficiaries (Albertus, 2010). And incomplete property rights, once assigned, are rarely subsequently transformed into complete rights (Albertus and Menaldo, 2010). This creates a major puzzle in the field of land reform. Why is land reform so vastly ill-used as a policy instrument in spite of its well recognized potential to generate efficiency and welfare gains (Lipton, 2009)?

The political economy literature addressing this puzzle has identified adverse political fallouts as the main reason why incomplete property rights remain (Warriner, 1969; Montgomery, 1984). Yet, this proposition has not been submitted to rigorous hypothesis testing, and the channels through which this happens have not been empirically validated. Rarely do we have the possibility of identifying a causal relationship between property rights and electoral behavior. This is an opportunity offered by using as a natural experiment the 1992 Mexican land reform that provided certificates of ownership to individuals who previously had access to land but faced a

[2] In the context of international economic development, De Soto (2000) emphasized the role of formal property rights over assets in helping the poor gain access to credit with the limited wealth they control, although Galiani and Schargrodsky (2010) as well as Field and Torero (2006) do not find supporting evidence for this.

variety of property right limitations. In the Mexican case, incomplete property rights granted by the first phase of land reform gave beneficiaries usufruct of a plot for individual use and access rights to lands held in common property. In both cases, land could not be sold, rented, or collateralized, and access could be arbitrarily revoked for individuals. Property rights were incomplete because they did not give beneficiaries full rights to extract, manage, transfer, and alienate as would be expected under full property rights (Ostrom, 1990).

In Mexico, the autocratic government that emerged from the 1910 revolution implemented over the 1914-1992 period a sweeping land reform that assigned land under highly incomplete property rights to 3.5 million rural households over more than half of the country's territory. While successful in its land redistribution objective, this form of property rights increasingly led to agricultural stagnation and extensive rural poverty. In 1992, in the face of imminent economic competition with food imports due to NAFTA, the Constitution was amended to bring land redistribution to an end and initiate a transition to complete property rights for already awarded land. This was implemented under a certification program, Procede (Program for the Certification of Ejido Rights and Titling of Urban Plots), that was rolled out over a 14 year period between 1993 and 2006. The national rollout gives us a credible identification strategy to measure the changes in electoral behavior induced by the change in property rights, provided the timing of certification is uncorrelated with pre-program changes in voting patterns. Crucially, our estimates refer specifically to the effect of strengthening property rights and are not confounded with effects due to changes in access to land.

For the empirical analysis, we use the extensive administrative data from the certification program, matched with electoral outcomes over six successive elections for Federal Congress held every three years before and after the certification process.

Two bodies of theory have been proposed to explain changes in voting behavior derived from shifts in property rights regimes. The first is the investor class or vested interest theory which argues that acquiring ownership of productive assets induces a shift to the right because asset-owning individuals prefer politicians that are more pro-market, championing low taxes on capital and labor income and relying less on state intervention (Richardson, 2010; Nadler, 2000). A logical implication of this theory is that the shift to the right should be greater the larger the value of the asset acquired and the more its use value is determined by market forces as opposed to state interventions (Crano, 1997). Duca and Saving (2008) provide support for this theory by showing that stock ownership induced middle-income Americans to support pro-capital politicians. Earle et al. (1997) argue that privatizations that extensively distributed assets contributed to the election of a conservative prime minister and of a center-right pro-free market party in the Czech Republic. Biais and Perotti (2002) and Jones et al. (1999) note that politicians can underprice assets during privatizations to induce support for their policies. While reviewing this literature, Kaustia and Torstila (2008) note that well identified causal analyses of this regularity are still largely missing. An exception is Di Tella, Galiani, and Schargrodsky (2007), who analyzed a natural experiment in Argentina where some squatters received titles on invaded lands while others did not. They find that those with property rights acquired beliefs supportive of free markets, such as becoming more materialistic, individualistic, meritocratic, and trustful. In this paper, we expand on this

body of work by providing evidence for agricultural landowners instead of financial asset / urban land owners, and by analyzing actual voting behavior instead of beliefs.

The second body of work predicting changes in voting behavior after a property rights reform is known as distributive politics theory. It argues that political parties offer material incentives to individuals who reciprocate with their votes (Dixit and Londregan, 1996). Transfers can be awarded before the election (Stokes 2009) or ex-post, when politicians allocate transfers to reward loyalty (Cox and McCubbins, 1986; Verdier and Snyder, 2002). In both cases, transfers are expected to induce voter reciprocity through electoral support. Recently, Finan and Schechter (2012) have highlighted the role that reciprocity plays in voters' decision making.

When compared to other directed benefits, contract theory argues that voter support is easier to elicit under a recurring short-term private benefit with threat of non-renewal, for example jobs, fertilizer subsidies, or loans. This literature suggests that an irreversible benefit such as a certificate of ownership is less likely to elicit voter response. In support of this difference, a study of voters' responses to benefits from development programs in West Bengal by Bardhan et al. (2008) finds that there was strong response to short-term benefit programs but not to infrastructure benefits nor to more substantial one-time benefits such as receiving a land title.

Our results show that granting certificates of land ownership occurred at considerable political cost for the ruling pro-state party, with beneficiaries swinging to the right in support of the competing pro-market party. Certification induced a shift in favor of the right wing party by 1.5 percentage points, or 6.8% of the average vote share of 21.4% over the whole period. We also show that the shift to the right was stronger in

regions with more valuable land, consistent with the idea that the shift to the right is increasing in the value of the asset. Finally, we find no evidence of beneficiaries reciprocating with votes for the party that awarded the certificate.

Our results are consistent with the political science literature which argues that a carefully crafted political equilibrium that had kept the ruling party in power for over seventy years (Diaz-Cayeros et al., 2003) was based to a significant extent on electoral support from the large peasant population that was dependent on state support to link to the market and delivered votes in reciprocity. The closing down of parastatals and development banks servicing the ejido sector as a consequence of the fiscal adjustment of the late 1980s broke down that dosed support political equilibrium and was followed by the gradual implementation of the complete property rights reform we study.

We draw from the analysis the generic lesson that it is difficult for an incumbent party that is not to the right of the political spectrum to benefit politically from property rights reform. This result has ominous implications for left-leaning governments that may be tempted to engage in property rights reforms in search of efficiency gains but for whom the political consequences may be negative.

We interpret the result as identifying a clear shift to the right as individual property rights were strengthened. However, this should not be interpreted as the only reason why limited property rights may be consciously adopted. An alternative non-political hypothesis contributing to the choice of an incomplete property rights regime is that governments may seek to limit rural-urban migration by tying labor to the land. We explore this hypothesis in another paper (de Janvry et al. 2012), but note that although certification can have a migration response, for our current purposes we only require that

changes in political preferences and migration be uncorrelated. We provide supporting evidence for this in the robustness checks section.

In what follows, we retrace in section 2 the history of land reform in Mexico and describe the certification program. In section 3, we explain how the data were constructed, and analyze the rollout of Procede in section 4. We then present results in section 5. Section 6 verifies that the shift in voting behavior was not due to selection associated with migration and presents tests supporting the validity of the identification strategy. Section 7 concludes.

## 2. Land reform in Mexico

Like most of Latin America, the Mexican land reform initially granted access to land under decidedly incomplete property rights. In a second phase, it transformed incomplete into complete property rights, permitting an analysis of the political response to the regime shift.

*The first land reform (1914)*

Access to land in Mexico was constructed over a turbulent and often violent series of events. Under the colonial regime, land was grabbed from the native indigenous communities by an elite that concentrated the land in large estates. While agriculture was booming at the turn of the XX$^{th}$ century under the Porfiriato regime (Haber et al, 2003), extreme conditions of poverty and inequality fueled the revolution of 1910 that was, symptomatically, led by peasant leaders. The settlement between revolutionary peasants and the other victorious factions was Mexico's first land reform legislated in 1914 and enshrined in the current Constitution enacted in 1917.

This first land reform was to be one of the largest in the world (Lamartine Yates, 1981). Under the reform, the landed elite was gradually expropriated and unclaimed lands covering 52% of the Mexican territory, no less than 103 million hectares, were reallocated to some 32,000 ejido (agrarian) communities composed of 3.5 million families. While the most active period for land redistribution was under President Lazaro Cardenas between 1934 and 1940, expropriations continued through 1992.[3]

Land in ejidos belonged to three categories: individual parcels for farming held in usufruct (right to use), common property lands for grazing and forestry, and household residential plots. Property rights over land parcels were permanently insecure and notably incomplete: the state regulated behavior (prohibiting land transactions, the hiring of labor, and leaving the land idle for two years or more, as well as restricting to only one descendant the inheritance of ejido rights) and mediated access to the market for individual farmers through parastatals[4] (for the purchase of inputs, access to credit, crop insurance, and sale of a marketed surplus).

Ejido members were also tightly controlled politically. They were associated in corporatist organizations (the National Confederation of Peasants) controlled by the ruling party that managed the relation between farmers and the state. The ejido's political bosses were expected to deliver the community's vote as a block in support of the ruling party, the PRI (Institutional Revolutionary Party), with economic support from public institutions coming in reciprocity for political loyalty (Larreguy 2012).

Over time, the 1914 land reform model increasingly showed its economic limitations. Incomplete property rights and the associated constraints on behavior and

[3] See Sanderson (1984) for a historical account of the expropriation and reallocation process.
[4] See Gordillo et al. (1998).

state dependence contributed to stagnant productivity. Magaloni, Weingast, and Diaz-Cayeros (2008) argue that the economic inefficiencies were a conscious cost paid in order to establish a reliable clientelistic relationship between ejidatarios and the state that delivered an important voting bloc in exchange for dosed economic support. With adjustment policies introduced in response to the debt crisis, the late 1980s saw a stark withdrawal of economic support to the ejido sector which eroded this political equilibrium.

As Mexico was negotiating a free trade agreement with the United States and Canada (NAFTA) in the early 1990's, the technocratic elite – then recently ascended to power within PRI ranks – realized that fundamental changes would have to be introduced in the Mexican agricultural sector to improve its competitiveness. According to NAFTA negotiations, import tariffs on all agricultural goods would be completely eliminated within 15 years. As it became imperative for the Mexican agricultural sector to prepare for competition with its trading partners, improving property rights in the ejido sector was seen as essential for this purpose. The technocratic wing of the PRI, a group more concerned with efficiency than political control, used the overwhelming PRI majority in the Mexican congress to amend the constitution in 1992, bringing to an end the flagship land redistribution program and introducing a fundamental change in property rights within the ejido that came to be known as the second land reform.

*The second land reform (1992)*

The overarching objective of the second land reform was to strengthen individual property rights in the ejido sector.[5] Its most important aspects were to: (1) end the 75-year long land redistribution program; (2) establish a national program to provide ejidatarios with certificates of ownership over their land parcels, the Procede program (Program for the Certification of Rights to Ejido Lands); (3) give ejidatarios with certificates the right to rent their plots to willing parties, sell them to other members of the ejido, as well as hire in labor and fallow land; (4) provide a mechanism through which ejidatarios could vote to turn all or part of the ejido certificates into full private property, thereby allowing unrestricted sales to non-ejidatarios and mortgaging of the land; and (5) create a national rural land registry that could track subsequent changes in ownership (de Janvry, Gordillo, and Sadoulet, 1997). Certificates thus gave full freedom for individuals to directly relate to markets as opposed to doing this through control of the ejido assembly and the government (de Janvry, Dutilly, Muñoz-Piña, and Sadoulet, 2000).

Procede was rolled out nationwide over the 1992-2006 period during which it certified 92% of the ejidos. A small program was left in place in 2006 to certify the 2,500 ejidos where this had not been done by the official end of the program, due in particular to armed conflict.

*The certification process*

Procede was organized as a federal government multiagency effort tasked with establishing boundaries for the ejido as a whole and for individual land parcels and with

[5] See De Ita (2006) for a detailed description of the legal changes.

issuing certificates of property rights (World Bank, 2001). A dedicated office was opened in every Mexican state, and worked with human resources from INEGI (Mexican Statistical and Geographical Agency), RAN (National Agrarian Land Registry), PA (Agrarian Attorney's Office), and the SRA (Land Reform Secretariat within the Ministry of Agriculture). Unlike other titling efforts, in which beneficiary demand is paramount (Alston et al., 1996), the Procede certification process was very much a top-down Federal program with limited input from ejidatarios. While ejidos were at first distrustful of the program, interviews with program managers revealed that ejidatarios quickly realized that the certificate facilitated proof of ownership for Federal Government programs, at which point resistance all but disappeared.

The certification procedure[6] formally began when an Information Assembly of the ejido was summoned and in which a simple majority vote was taken to allow the program to measure the ejido and create a contour map with subdivisions. Ejidatarios then cooperated with INEGI to measure individual plots and determine whom they belonged to. INEGI's measurement effort produced a map of the ejido with the names of the beneficiaries of all individually tilled parcels, common land shares, and residential housing plots. Maps were publicly displayed for a month and conflicts resolved through the Agrarian Attorney's Office. With a completed map, a final ejido assembly was summoned to vote on the agreement to partition the land, with a supermajority required for approval. The authorized map was then sent to RAN to issue certificates of ownership to every stakeholder in the community. Certificates were then awarded *simultaneously* for the whole ejido in a political event. The President often participated in handing out the certificates along with local elected officials. In terms of political behavior, and the gains

[6] Appendini (2002) provides a thorough description of the certification process.

to be expected from a pro-market versus a pro-state political party, certificates and titles should thus either be equivalent or certificates should provide a lower bound of the political response from full titles.

**3. Data**

Dates of Procede assemblies in ejidos as well as records of legal conflicts filed during the certification process were obtained from PA. The file contains a comprehensive list for 29,398 ejidos. The core information on land certification is based on Phina (Historical Census of Agrarian Communities) and was obtained from RAN. In March 2010, records were available for 29,221 ejidos. We matched Phina records to the assembly dates file with a success rate of 97%. RAN provided geocoded contour maps of all ejidos certified until 2007. This allowed us to geographically match the ejidos to the 2000 locality-level population census data. Census data provide the GIS reference of the centroid of each locality, and information on age structure, education, housing conditions, employment structure, and access to public services. A census locality was matched to an ejido if its centroid was inside the ejido contour. For ejidos without locality, we assigned the nearest locality not in another ejido. We should note that this geographical matching is not perfect. Whereas an ejido is defined by a land area and a defined population of members, the census information corresponds to a population settlement (or locality). While in most cases the living quarters of ejido members are geographically inside the ejido, it is possible that all or some ejidatarios live in a locality situated outside the ejido perimeter, mixed with non-ejido population. It is also possible that non ejidatario-related population live in localities within the ejido (especially in urban areas, see Gonzalez-Navarro, 2009).

These data sources provide a database for 24,663 ejidos used in the analysis of the program rollout.

Voting data at the polling station level were obtained from the Mexican Federal Electoral Institute (IFE). We use results from Federal Congress elections which are held every three years from 1994 to 2009 in a simple majority election system. Every other election, congressional elections are held jointly with presidential ones. This gives us six electoral cycles beginning in 1994 (year of the presidential election won by Zedillo from PRI), 1997, 2000 (year of the presidential election won by Fox from PAN), 2003, 2006 (year of the presidential election won by Calderon from PAN), and 2009. There are 300 congressional districts subdivided into 65,000 electoral sections.

We focus on legislative elections because they occur every three years instead of every six for presidential ones, providing twice as many observations. Furthermore, compared to presidential or municipal voting, legislative elections are ruled to a larger extent by party preferences rather than by personal attributes of the candidates because information and electoral campaigns are much less salient for congressmen than for presidents.

The Federal Electoral Institute (IFE) provided geo-referenced electoral section maps for the whole country. The section is the most disaggregated electoral unit, and consists of a regular shape containing the homes of around 2,000 registered voters. We only use geographically consistent electoral sections over time for the analysis.

To match ejidos, localities, and electoral sections, we first associate electoral sections with localities that have their centroid inside the electoral section contour. We then discard all electoral sections and associated localities with a large discrepancy

between the number of adults of voting age (18 and above) in the localities and the number of registered voters. This is to avoid poor matches that will attribute large towns to the (small) electoral section lying at the centroid, or reciprocally assigning a single very small locality to an electoral section when the centroid of the main locality is located outside the border of the section. Each locality is then associated to the ejido it lies inside of. Ejido characteristics, notably whether it is certified or not at any particular date, is attributed to the locality.

Because the dependent variable is vote share at the electoral section level, we construct population-weighted average characteristics at the section level from localities inside a given section. Locality weights are given by the population of voting age in each locality. The key independent variable in the analysis is the share of the population in the section that has been certified by Procede in any particular year. It is time varying and ranges between 0 and 1.

Finally, for the rollout analysis, we use electoral results from the 1991 congressional election, which took place before initiation of Procede. The 1991 electoral results are only spatially identified at the municipal level, which consists of many electoral sections.[7]

**4. Technocracy and clientelism in the Procede rollout**

There are three major political parties in Mexico:[8] the PRI, the traditional autocratic party that remained in power for over 70 years winning the presidency for the 1988-1994 and 1994-2000 period; the PRD that split out of the PRI, positioning itself to the left, but

[7] The average municipality has 45,000 people, while electoral sections have around 2,000 voters.
[8] The minor parties control an insignificant share of the vote.

never won the presidency; and the PAN, the pro-market conservative party, that gained control of the presidency for the first time in 2000-2006, and again in 2006-2012. There were 78 million registered voters in 2009.

Descriptive statistics on ejidos are given in Table 1.[9] We group variables into four categories: (1) ejido size and endowment (such as total area, land in agricultural parcels and common property area, and number of members and non-members), (2) locality level economic opportunities (distance to a city, employment structure, education, poverty as measured by the marginality index and number of persons per room), (3) conflicts (legal disputes in the ejido), and (4) baseline politics (shares of municipal votes received by the political parties in the 1991 congressional elections, and incidence of alignment between municipal mayor and state governor, in the last Federal election before the Procede rollout).

While the rollout of the Procede process over the 1993-2006 period progressed simultaneously in all states, it responded within each state to different administrative supply side and demand-driven forces. We can establish which were the main variables associated with the date at which RAN held the first information assembly, initiating the Procede process. Results in Table 2 show that the progressive deployment of Procede reached ejidos in response to the following criteria:

[9] Land reform communities are mostly ejidos, but a small percentage refers to pre-colonial indigenous communities. In this analysis of political responses to certification, we only consider ejidos. Property rights in indigenous communities are granted to the community as a whole, not to individual members, leaving to the community the role of individual land assignment and the flexibility of re-assignment as community membership changes. Political responses to Procede are consequently not comparable to those induced by ejido certification.

(1) Certification difficulty, treating first ejidos of smaller size, with less members (ejidatarios), less presence of landed non-member households (posesionarios), and less conflicts.

(2) Higher demand, as seen by the earlier consideration of ejidos with more of their land in privately cultivated parcels rather than common property, closer to a city, and where the population is more engaged in non-agricultural activities and is more educated. These supply and demand considerations both resulted in a clear bias against the poorest ejidos, as revealed by the higher marginality index of localities treated later.

(3) Political forces. In the early 1990s, Mexico was still largely dominated by PRI. As seen in Table 1, it received 69% of the votes in the 1991 Federal congressional election and had the highest share in 97% of municipalities. There is however variation in the vote share received by PRI, with an inter-quartile range of 20 percentage points, and similarly of 13 and 10 percentage points for PAN and PRD, respectively. At that time 28 of the 31 governors were from PRI, so party alignment between the municipality and governor parties occurred for 87.4% of the ejidos.

Partial correlations between political factors and the rollout of Procede are reported in columns 5 to 7. Surprisingly, the PRI vote share in 1991 is not predictive of the Procede start date, while both higher PAN share and alignment between the parties of the municipality and the state government are associated with earlier start dates. A confounding factor is due to the fact that almost all the municipalities with the highest PAN shares are also where elections were contested (defined as those with a difference between the two parties equal to less than 30% of the votes). Column 6 reports this alternative specification, showing Procede first assemblies to be 2.8 months earlier in

municipalities with contested elections. This association however disappears as soon as we introduce distance to the nearest city or all the other control variables (column 7). The only political variable that remains robust to adding other factors is alignment between the parties of the municipality and the state government. We interpret this as coordination costs delaying program implementation.

While this analysis exhibits the association or influence of both technocratic characteristics and political factors on the rollout, what is key to the identification is that early certification should not be associated with a *differential trend*, not level, in voting pattern. In other words, we can only use the rollout of Procede as a natural experiment to identify the impact of acquiring property rights on changes in political behavior if the timing of certificate issuance to particular ejidos is not correlated with changes in political behavior. To verify this, we proceed in section 7 to different tests of exogeneity of the rollout relative to our variables of interest: changes in party vote shares.

## 5. Impact of certification on voting behavior

### 5.1. Evidence of a shift to the right

We now analyze the prediction of the investor class theory according to which asset ownership induces a conservative shift to the right in voting behavior. The unit of analysis is the electoral section, and the dependent variable is the share of votes obtained by PAN, the rightwing party.

We start with a standard panel analysis, where the PAN share in votes is regressed on the share of the section's population that has been certified by Procede and the average number of years of being certified:

$$PANShare_{st} = \delta\ ShareCertified_{st} + \mu_s + \nu_t + \varepsilon_{st} \quad (1)$$

$$PANShare_{st} = \left(\delta_0 + \delta_1 YearsCertified_{st}\right) ShareCertified_{st} + \mu_s + \nu_t + \varepsilon_{st} \quad (2)$$

for section *s* and election in year *t*. *ShareCertified* is the fraction of the section's population that is in a certified ejido, *YearsCertified* is the (population weighted) average number of years this population has been certified, $\mu_s$ and $\nu_t$ are section and time fixed effects, and $\varepsilon_{st}$ are error terms clustered at the section level. The ejido fixed effect controls for time invariant characteristics mentioned in Table 1 such as distance to city. Time fixed effects control for aggregate time trends in vote share. Under the condition that the participation rate is the same in the ejido and non-ejido population (so that the share of the ejido is the same among voters as it is in the population), and that certification of an ejido does not affect the voting behavior of the other localities in the same section, the parameters $\delta$ identify the effect of certification on the vote of the ejido population.

Results reported in Table 3, columns 1 and 2, show that certification induced a shift in favor of PAN by 1.46 percentage points, or 6.8% of the average PAN share, 21.4%, over the whole period. The impact of certification increases over time, starting at 0.35 percentage points immediately after certification and growing by 0.27 percentage points per year thereafter, reaching a total of 4.4 percentage points 15 years after certification. A non-parametric estimation of the increasing effect of certification over time confirms the linear trend, at least over the 15 year range of our observations.

A more precise measure of this shift is obtained by focusing on the sections which have their first ejido certified around each election. Using a 3 year window on each side of the election date, we estimate a simple regression:

$$PANShare_s = \delta ShareCertified_s + \alpha ShareEjido_s + \varepsilon_s , \quad (3)$$

where $ShareEjido_s$ is the share of the population that belongs to an ejido in section *s*. Too few ejidos were certified between election dates 2006 and 2009 to analyze the discontinuity at the 2006 election. We observe a consistent shift to the right by 1.2 to 2.9 percentage points over an average of 12 to 19 percentage points in the first three elections. However, the impact on the last group of ejidos that gained certification between 2000 and 2003 is small.

Finally, we verify in column 7 that this shift to the right is in fact obtained as soon as the certification process is engaged, by contrasting ejidos that have had their assembly within 6 months of the election in 1994, either before or after the election date. This can only be seen around the 1994 election since the very large majority of ejidos had started the certification process by the next election. In a window of 6 months, the impact of having held the first assembly that introduced the certification program was already a 1.8 percentage points increase in the share of PAN.

**5.2. Heterogeneity of political responses to certification**

In this section we investigate the heterogeneity in voting responses to certification by estimating the following model:

$$PANShare_{st} = \left(\delta_0 + \delta_1 X_s\right) ShareCertified_{st} + \mu_s + \nu_t + \varepsilon_{st} \quad (4)$$

where $X_s$ is a set of structural characteristics of the ejido population in section *s*.

The vested interest theory suggests that the shift to the right in voting behavior depends on the potential gain in profit to be expected from acquiring asset ownership. We characterize this potential benefit by two variables: average land quality and distance

to a city. Land quality in Mexico is frequently measured by corn yield, as corn is the main staple, grown all over the country. The only systematic measure of yield we have is at the municipality level, a higher level of administrative unit than either the locality or the section. We use the average corn yield on rainfed land over the period 2002-2008 as an indicator of land quality.[10] It varies from 0.4 tons/ha (in the lowest decile), to 2.8 tons/ha (in the highest decile), and 8 tons/ha in the best areas. Distance to a city of at least 25,000 inhabitants is calculated from each locality and averaged over the section population.

Results reported in Table 4, columns 2 and 3, show that stronger shifts to the right are associated with proximity to a city and land quality. Ejidos situated 50 kms away from a city have a response half that of ejidos close to a city. A two-fold increase in yield is associated with an almost 50% increase in the shift to the right in voting.

A more accurate specification for Mexican farmers of vested interests in voting is the contrast in their exposure to policies championed by the pro-state PRI and the pro-market PAN. One can expect that the shift to the right would be less important in areas that mostly grow crops such as corn and beans that have traditionally been strongly supported by the state, as they may expect losses in support with the pro-market policies of the right. By contrast, areas growing crops that are left to market forces (such as export fruits and vegetables) have more to gain from complete property rights if they are accompanied by pro-market policies. To analyze this, we use the cropping pattern at the municipal level, and compute the average share of the cropping area dedicated to corn and beans in 2002-2008. That Mexican agriculture is dominated by corn and bean is

[10] Ideally, we would have used pre program yields. However, these data were not collected at the municipality level before 2002. Fortunately, this variable captures mostly land quality and water availability, which are time invariant to a large extent, at least over the time period we analyze.

revealed by these numbers. The mean share of land dedicated to corn and beans is 68%, reaching more than 93% in the 25% most dedicated municipalities. Results reported in column (4) show that an increase in land share cultivated in corn and beans of 20 percentage points is associated with a decline in the shift to the right by almost 11%.

Putting these interactions together in column (5) shows that the coefficients of the distance to city and land share in corn and bean are robust, but not that of corn yield. These associations are thus suggestive of the role of vested interests but one cannot eliminate the possibility that they reflect omitted correlated effects.

### 5.3. Certification is not rewarded by votes

The second land reform was a massive asset transfer program, creating significant wealth and land security benefits for 3.5 million certificate recipients. For the ruling party that initiated the reform, electoral gains could be expected in return, even though, as discussed above (Bardhan et al., 2008), reciprocity is less likely with a one time irreversible transfer such as land certification than with an entitlement to recurrent transfers.

Having established the occurrence of an overall shift to the right associated with certification, a reciprocity-voting behavior could be defined as a modification of the shift to the right. For ejidos granted certification by PAN, reward to the granting party would be additive to the shift to the right, while it would be mitigating for the ejidos granted certification by PRI. This is analyzed with the estimation of equation (5) in which $X$ is the share of the certified population that received its certificate from PRI. Results reported in column 6 of Table 4 show no evidence of reciprocity behavior from voters toward the party that granted them certification.

A caveat in this analysis is that the party granting the certification cannot be distinguished from time, since PRI was in power until 2000, and PAN afterward. Hence one could not separate a trend in the shift to the right from a differential effect associated with the granting party. The absence of evidence on reciprocal voting behavior toward the granting party is conditional on assuming that the shift to the right is constant over time.

## 6. Robustness Checks

### 6.1. Can migration explain the shift in voting patterns?

We now address the concern that the change in vote share associated with the change in property rights could be due to selective migration. In another paper (de Janvry, Emerick, Gonzalez-Navarro, and Sadoulet, 2012), we show that Procede increased outmigration. This generates a decrease in the number of voters. If the decision to migrate (or to abstain from voting) were uncorrelated with voter preferences, this would not affect our results. However, if the decision to migrate were correlated with voter preferences, our results could also be explained by a change in the composition of voters, in which non-PAN voters leave (or abstain) in larger numbers than PAN voters, rather than an actual shift in preferences towards the right.

We address this possibility by directly controlling for the change in the number of voters in the section. If the coefficient we estimated in models (1) and (2) were driven by this effect, then controlling for the change in voters should affect the estimate of $\delta$ in the following specification:

$$PANShare_{st} = \delta\ ShareCertified_{st} + \alpha \Delta voters_{st} + \mu_s + \nu_t + \varepsilon_{st} \qquad (5)$$

where $\Delta voters_{st} = \frac{Voters_{st} - Voters_{s,94}}{Voters_{s,94}}$ or $\Delta voters_{st} = \frac{Voters_{st} - Voters_{st-1}}{Voters_{st-1}}$.

If the effect of certification is to induce a one-time migration and corresponding change in the number of voters, the best control is the first expression. If, on the other hand, certification induces a shift in the migration rate year after year, then the second expression provides a better control for the induced change in the number of voters.

The first two columns in Table 5 confirm the impact of certification on the number of voters.[11] Certification induces a 6% reduction in voters on average (col. 1) or a decrease in their 3 year rate of change by 2.3 percentage points. However, controlling for the change in the number voters has virtually no effect on the estimated certification coefficient (cols. 4 and 5 compared to col. 3). We can thus conclude that the shift to the right associated with certification was not due to selective migration.

### 6.2. Validity of the identification strategy

Our basic estimating equation (1) for the analysis in section 5 was:

$$PANShare_{st} = \delta\ ShareCertified_{st} + \mu_s + \nu_t + \varepsilon_{st},$$

where $PANShare_{st}$ is the share of votes received by PAN in section *s* and election year *t,* and *ShareCertified* is the fraction of the section's population that is in a certified ejido. Hence the key to identification of a causal impact of certification on electoral outcomes is that there is no time varying unobservable that correlates to both the timing of the certification and the change in voting pattern. In what follows, we verify the existence of

[11] We only have the total number of registered voters for years 2003, 2006, and 2009. Similar results are obtained using registered voters for that subsample of years.

pre-program "parallel trends", i.e., that the order or date of the Procede rollout is not correlated with the trends in voting patterns before the program.

We first use the 1991-94 changes in vote share at the municipal level (the lowest level of aggregation available for the 1991 election) as the explanatory variable of Procede start and finish dates. The rollout is best characterized by the information assembly date, but since the impact we are interested in is certification, we run regressions on the dates of both assemblies. We regress these dates on the change in vote share received by PRI and PAN in Table 6, columns 1 and 4. Neither coefficient is statistically significant and both are very small. A one standard deviation increase in the change in PAN share is associated with Procede reaching the ejidos on average less than one month earlier, compared to an average of 48 months. Results are robust to adding the control variables that have been found to be associated with the rollout (columns 2 and 5) and to considering non-linear effects of these changes in party shares (columns 3 and 6).

As a second identification test, we report specifications that are closer to the estimation equation. These are regressions of changes in vote shares for the political parties (PAN and PRI) in a given electoral section *s* as a function of the Procede date and of state and election year fixed effects:

$$\begin{aligned} PRIShare_{st} - PRIShare_{s,t-1} &= \delta ProcedeDate_s + \mu^I_{state} + \nu^I_t + \varepsilon^I_{st} \\ PANShare_{st} - PANShare_{s,t-1} &= \delta ProcedeDate_s + \mu^A_{state} + \nu^A_t + \varepsilon^A_{st} \end{aligned} \tag{6}$$

for $t < ProcedeDate_s$. The section level Procede date, $ProcedeDate_s$, indicates the date of the earliest assembly to take place in the section. We estimated these equations as a SUR system.

Table 7 reports on three windows of pre-program voting results, 1994-97, 1994-2000, and 1994-2003, and correlates the pre-program changes in vote shares on the date of Procede for the subset of ejidos that were reached by the program after the later election date. The rollout date is never significant. In terms of order of magnitude, a 10 month delay in Procede certification would be associated with gains or losses of voting share of 0.02 to 0.18 percent of votes, so the magnitudes are extremely small.

## 7. Conclusions: The political risks of complete land reform

Following the peasant-led revolution of 1910, Mexico engaged in an ambitious land reform that gave access to land to 3.5 million households on more than half of its territory. Property rights granted were highly incomplete, making household behavior strongly dependent on state tutelage. Stagnation and poverty became the norm for the ejido sector, particularly following the debt crisis and introduction of adjustment policies that reduced state support to the ejido starting in the late 1980s. The second land reform initiated in 1992 by the ruling party had the objective of seeking efficiency gains in agriculture by offering peasants complete property rights, thus freeing them from state tutelage as an intermediary to accessing the market.

Using the 14 year rollout of Procede, the land certification program, that we showed to be orthogonal to prior trends in electoral support, we identified the impact that complete property rights—and the associated freedom from state dependency—had on political expression. We found three major results. First, consistent with the investor class and vested interest theory, acquisition of ownership induced a conservative shift in electoral choices, favoring the political party with pro-market (PAN) as opposed to state-

led (PRI) economic policies, thus playing against the interests of the long standing incumbent party. Second, consistent with the theory as well, this shift was more pronounced where expected economic gains from electing a pro-market party were the strongest, not only in terms of value of the assets received but more specifically of the degree of market-dependence of the activities pursued with these assets. Third, consistent with the theory of distributive politics for one-time irreversible asset transfers, certification failed to induce electorate reciprocity, to the demise of the ruling party. These results help explain the well-known puzzle of missing complete land reforms (Warriner, 1969). Through the Mexican case study, we observed how a widely recognized policy instrument in terms of potential efficiency gains—complete land reform—can fail to pass the test of political feasibility. The evidence presented here suggests that it is the privilege of pro-market political parties to gain electorally from implementation of complete property rights reforms, even if land redistribution is a favorite policy platform of pro-state political parties.

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**Table 1. Descriptive statistics for ejidos**

| | Mean | St. Dev. | Median | 25th percentile | 75th percentile |
|---|---|---|---|---|---|
| **Procede** | | | | | |
| Date of first assembly | May-96 | | October-94 | October-93 | November-97 |
| Duration of Procede process (months) | 24.1 | 27.4 | 13.0 | 7.0 | 30 |
| **Ejido size and endowments** | | | | | |
| Total area (ha) | 2,855 | 10,876 | 966 | 387 | 2,491 |
| Parcel area (ha) | 950 | 5,086 | 399 | 109 | 945 |
| Common area (ha) | 1,784 | 8,936 | 105 | 0 | 1,018 |
| Ejidatarios | 92.6 | 134.3 | 56 | 31 | 106 |
| Posesionarios | 20.7 | 87.4 | 0 | 0 | 6 |
| Avecindados | 17.2 | 98.1 | 0 | 0 | 0 |
| Area per member (ha) | 37.8 | 140.4 | 13.6 | 6.7 | 30 |
| Creation date | 1950 | 21 | 1940 | 1935 | 1967 |
| Number of members at creation | 81 | 109 | 49 | 30 | 88 |
| **Locality economic opportunities** | | | | | |
| Distance to city with 25,000 inhabitants (kms) | 34.9 | 29.9 | 26.8 | 13.9 | 46.7 |
| Active population as share of labor force | 0.42 | 0.12 | 0.42 | 0.35 | 0.48 |
| Share of occupied population in agriculture | 0.35 | 0.26 | 0.30 | 0.14 | 0.54 |
| Share of population with superior education | 0.02 | 0.03 | 0.00 | 0.00 | 0.02 |
| Share of population with high school | 0.04 | 0.05 | 0.02 | 0.003 | 0.06 |
| Marginality index[1] | -0.23 | 0.88 | -0.28 | -0.89 | 0.40 |
| Average persons per room | 2.4 | 0.9 | 2.0 | 2.0 | 3.0 |
| **Conflicts** | | | | | |
| Legal disputes | 29.4 | 50.6 | 14.0 | 5.0 | 33.0 |
| **Politics - 1991 federal deputies elections results at municipality level** | | | | | |
| PRI share | 0.690 | 0.134 | 0.698 | 0.595 | 0.782 |
| PAN share | 0.096 | 0.105 | 0.049 | 0.018 | 0.148 |
| PRD share | 0.081 | 0.111 | 0.036 | 0.008 | 0.107 |
| PRI wins | 0.967 | 0.180 | 1.0 | 1.0 | 1.0 |
| Municipal mayor aligned with governor | 0.874 | 0.332 | 1.0 | 1.0 | 1.0 |

[1] The marginality index is an aggregate of a variety of social indicators collected from the census information largely used in Mexico to measure poverty. This index is a normalized Z-score ranging between -3 and 3 standard deviations that correspond to very low and very high marginality respectively.

## Table 2. Technocracy and clientelism in the Procede rollout

| | Mean value of regressor [st.dev.] | Date of the Information Assembly (in months since Jan 1, 1992) Size (1) | Difficulty (2) | Demand/ Opportunity (3) | Poverty (4) | Politics (5) | Politics (6) | All (7) |
|---|---|---|---|---|---|---|---|---|
| **Ejido size and endowment** | | | | | | | | |
| Members | 98.4 | 0.015*** | 0.012** | 0.014*** | 0.017*** | | | 0.014*** |
| | [135.0] | (0.004) | (0.005) | (0.004) | (0.004) | | | (0.005) |
| Total area (100 ha) | 0.29 | 0.009* | 0.008 | 0.001 | 0.002 | | | 0.001 |
| | [1.13] | (0.005) | (0.006) | (0.003) | (0.004) | | | (0.003) |
| Share of agricultural land in parcels | 0.63 | | | -11.750*** | -12.292*** | | | -11.834*** |
| | [0.38] | | | (2.18) | (2.02) | | | (2.19) |
| Ratio posesionarios/members | 0.23 | | 1.13 | 1.606** | 1.734** | | | 1.594* |
| | [0.86] | | (0.75) | (0.78) | (0.79) | | | (0.80) |
| **Conflicts** | | | | | | | | |
| Disputes registered | 29 | | 0.028** | 0.047*** | 0.049*** | | | 0.047*** |
| | [46] | | (0.013) | (0.011) | (0.012) | | | (0.012) |
| **Locality economic opportunities** | | | | | | | | |
| Distance to nearest city (pop > 25,000) in kms | 34.9 | | | 0.043* | 0.038* | | | 0.043* |
| | [29.9] | | | (0.021) | (0.022) | | | (0.023) |
| Share non ag. in occupied population | 0.35 | | | -6.960*** | | | | -6.788*** |
| | [0.26] | | | (2.38) | | | | (2.29) |
| Share of pop. with high school above median | {0,1} | | | -2.143** | | | | -2.118** |
| | | | | (0.87) | | | | (0.88) |
| Locality marginality index | -0.23 | | | | 4.056*** | | | |
| | [0.88] | | | | (0.92) | | | |
| **Politics - 1991 Federal deputies election results at the municipal level** | | | | | | | | |
| PRI share | 0.69 | | | | | 0.35 | | |
| | [0.13] | | | | | (4.69) | | |
| PAN share | 0.10 | | | | | -15.041** | | |
| | [0.11] | | | | | (6.15) | | |
| Contested (Difference PRI-PAN shares ≤ .30) | 0.10 | | | | | | -2.836* | -0.72 |
| | [0.29] | | | | | | (1.39) | (1.31) |
| Alignment with governor's party | 0.87 | | | | | -8.015*** | -8.594*** | -8.674*** |
| | [0.33] | | | | | (0.93) | (1.27) | (1.52) |
| Mean value of dependent variable (months) | 47.3 | | | | | | | |
| | [36.8] | | | | | | | |
| Observations | | 24,663 | 23,495 | 23,428 | 21,903 | 24,346 | 24,346 | 23,177 |
| State FE | | 31 | 31 | 31 | 31 | 31 | 31 | 31 |

Robust standard errors in parentheses, clustered at the state level. * significant at 10%; ** significant at 5%; *** significant at 1%

**Table 3. Certification induces a shift to the right**

Dependent variable: PAN share

| Sample | All sections | | Sections with first ejido titled ± 3 years from election | | | | Sections with first assemby ± 6 months from election |
|---|---|---|---|---|---|---|---|
| | Elections: 1994 - 2009 | | 1994 | 1997 | 2000 | 2003 | 1994 |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| Share of population titled | 0.0146*** | 0.00354* | 0.0124*** | 0.0231*** | 0.0291*** | -0.00242 | |
| | (0.0017) | (0.0019) | (0.0046) | (0.0046) | (0.0070) | (0.0095) | |
| Share of population with first assembly completed | | | | | | | 0.0180*** |
| | | | | | | | (0.0055) |
| Share of population titled* average years titled | | 0.00268*** | | | | | |
| | | (0.0002) | | | | | |
| Share of population in ejidos | | | -0.0542*** | -0.0648*** | -0.106*** | -0.0400*** | -0.0555*** |
| | | | (0.0041) | (0.0059) | (0.0088) | (0.0114) | (0.0073) |
| Fixed effects | Section & year | | None | None | None | None | None |
| Observations | 113,825 | 113,825 | 6,222 | 7,316 | 3,902 | 2,246 | 2,376 |
| Electoral sections | 19,088 | 19,088 | 6,222 | 7,316 | 3,902 | 2,246 | 2,376 |
| Mean PAN Share | 0.214 | 0.214 | 0.119 | 0.158 | 0.194 | 0.198 | 0.112 |

Robust standard errors in parentheses, clustered at the electoral section level in col. 1 and 2. *** p<0.01, ** p<0.05, * p<0.1

**Table 4. Heterogeneity of impact on shift to the right and lack of reciprocity to PRI**

| | PAN share | | | | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Share of population titled | 0.0146*** | 0.0222*** | 0.0156*** | 0.0235*** | 0.0339*** | 0.0145*** |
| | (0.0017) | (0.0025) | (0.0018) | (0.0035) | (0.0042) | (0.0028) |
| Interaction with: | | | | | | |
| Distance to city (10kms) | | -0.00198*** | | | -0.00182*** | |
| | | (0.0005) | | | (0.0005) | |
| Average corn yield (log) | | | 0.00350* | | 0.002 | |
| | | | (0.0018) | | (0.0019) | |
| Share of corn-bean in crop area | | | | -0.0127** | -0.0176*** | |
| | | | | (0.0050) | (0.0052) | |
| Share with title granted by PRI | | | | | | 0.00017 |
| | | | | | | (0.0033) |
| Fixed effects | Section & year | Section & year | Section & year | Section & year | Section & year | Section & year |
| Observations | 113,825 | 113,825 | 111,133 | 111,877 | 111,133 | 113,825 |
| Number of sections | 19,088 | 19,088 | 18,959 | 18,982 | 18,959 | 19,088 |

Robust standard errors in parentheses, clustered at the electoral section level. *** p<0.01, ** p<0.05, * p<0.1

**Table 5. Can migration explain the shift in voting patterns?**

| | Rate of change in the numbers of voters (since 1994) (1) | (since last election) (2) | PAN share (3) | PAN share (4) | PAN share (5) |
|---|---|---|---|---|---|
| Share of population titled | -0.0632*** | -0.0228* | 0.0146*** | 0.0145*** | 0.0153*** |
| | (0.0166) | (0.0133) | (0.0017) | (0.0017) | (0.0022) |
| Change in number of voters (in rate, since 1994) | | | | -0.00194 | |
| | | | | (0.0016) | |
| Change in number of voters (in rate, since last election) | | | | | -0.000321 |
| | | | | | (0.0003) |
| Fixed effects | Section & year | Section & year | Section & year | Section & year | Section & year |
| Observations | 111,865 | 94,749 | 113,825 | 111,853 | 94,748 |
| Electoral sections | 18,685 | 19,087 | 19,088 | 18,685 | 19,087 |
| Mean dependent variable | 0.046 | 0.080 | 0.214 | 0.213 | 0.232 |

Robust standard errors in parentheses, clustered at the electoral section level. *** p<0.01, ** p<0.05, * p<0.1

**Table 6. Test of exogeneity of the Procede rollout 1991-1994**

| | Mean value regressor [st. dev.] | Date of first assembly (1) | (2) | (3) | Date of certification (4) | (5) | (6) |
|---|---|---|---|---|---|---|---|
| Municipal level results for federal deputy elections | | | | | | | |
| Change in PRI share 1991-94 | -0.120 | -0.92 | -0.75 | -1.15 | 2.88 | 1.00 | -2.24 |
| | [0.106] | (6.79) | (7.94) | (8.95) | (9.37) | (11.05) | (11.98) |
| ---- squared | | | | -0.66 | | | -9.62 |
| | | | | (20.65) | | | (25.84) |
| Change in PAN share 1991-94 | 0.066 | -8.17 | -1.06 | 3.88 | -9.09 | -0.23 | 4.55 |
| | [0.073] | (8.03) | (8.98) | (13.27) | (11.87) | (11.21) | (13.30) |
| ---- squared | | | | -29.12 | | | -30.62 |
| | | | | (45.43) | | | (42.64) |
| Constant | | 47.74*** | 60.46*** | 60.41*** | 73.82*** | 84.01*** | 83.96*** |
| | | (0.93) | (5.92) | (5.89) | (1.15) | (6.88) | (6.89) |
| Number of observations | | 24,346 | 21,796 | 21,796 | 24,359 | 21,803 | 21,803 |
| State fixed effects | | 31 | 31 | 31 | 31 | 31 | 31 |
| Controls | | N | Y | Y | N | Y | Y |

Robust standard errors in parentheses, clustered at the state level. *** p<0.01, ** p<0.05, * p<0.1

Date of assemblies is measured in months since January 1992

Controls include all variables from Table 2: members, total area, share of ag. land in parcel, ratio posessionarios, disputes, distance to nearest city, share of non-ag. In occupied, above median high school share, marginaity index, PRI share, PAN share, contested, and aligned.

**Table 7. Test of exogeneity of the Procede rollout prior to certification**

| | Date of first assembly (1) | Date of certification (2) | Elections | Fixed effects | Number of sections in columns (1) / (2) |
|---|---|---|---|---|---|
| Ejidos with first assembly / certification date after July 6, 1997 | | | | | |
| Election to election change in PRI share (%) | -0.0049 | 0.0001 | 1994, 1997 | State | 1,890 / 5,030 |
| mean value of dependent variable: -7.2 | (0.0126) | (0.0067) | | | |
| Election to election change in PAN share (%) | 0.0013 | 0.0022 | 1994, 1997 | State | |
| mean value of dependent variable: +3.6 | (0.0091) | (0.0050) | | | |
| Ejidos with first assembly / certification date after July 2, 2000 | | | | | |
| Election to election change in PRI share (%) | -0.0521* | -0.0115 | 1994, 1997, 2000 | State, year | 603 / 2,298 |
| mean value of dependent variable: -2.9 | (0.0247) | (0.0105) | | | |
| Election to election change in PAN share (%) | -0.0141 | 0.0029 | 1994, 1997, 2000 | State, year | |
| mean value of dependent variable: +3.5 | (0.0177) | (0.0078) | | | |
| Ejidos with first assembly / certification date after July 6, 2003 | | | | | |
| Election to election change in PRI share (%) | -0.0219 | -0.0088 | 1994, 1997, 2000, 2003 | State, year | 320 / 1,138 |
| mean value of dependent variable: -4.4 | (0.0768) | (0.0295) | | | |
| Election to election change in PAN share (%) | -0.0134 | -0.0181 | 1994, 1997, 2000, 2003 | State, year | |
| mean value of dependent variable: +3.6 | (0.0601) | (0.0243) | | | |

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Each pair of number comes from a SUR regression of the changes in shares for the two parties between two consecutive elections on the month of the first assembly (col. 1) or the first certification (col. 2) to take place in the section, with state and time fixed effects, and errors clustered at the electoral section level. Observations are at the electoral section level.