Property Rights Reforms and Local Economic Development: Evidence from Mexico *

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February 16, 2018

This paper is preliminary. Please do not cite.

Abstract

A recent literature explores the effects of rural land titling programs on labor reallocation. Yet, we have little evidence on the second-order effects titling programs can have on the non-agricultural sector for both local areas and surrounding cities. This paper fills that gap by using the rollout of the Mexican land title program Procede together with restricted-access data on non-agricultural firms. We employ a panel fixed effects research design to control for the non-random rollout of the program. Our preliminary results suggest that outmigration, as opposed to increased local labor supply or income effects, from rural areas is the likely dominating force with total wages and the number of large firms decreasing. The results of the land reform are heterogeneous areas favorable to agriculture have differentially more firms, driven primarily by small-scale manufacturing, but lower wages. Further iterations of this paper will include analysis on cities and agricultural production.

Keywords: Land reform, economic development, tenure rights

*We thank 2017 IEA conference participants for their helpful thoughts and comments on this project.

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1 Introduction

Many theories of economic development emphasize the value of strong individual land rights (De Soto, 2000; North, 2005). In these theoretical frameworks, land tenure rights improve individuals' welfare through three main channels. First, individual tenure rights increase individuals' incentives to work and invest in the land (Besley, 1995; Anielski et al., 2002). Second, they allow landowners to collateralize their land with the purpose of accessing credit markets. Third, they enable landowners to optimize their allocation of time and skills by buying and selling land.

Based on these theoretical arguments, most research to date has focused on establishing the effect of improved property rights on agricultural output and productivity. On the other hand, a recent literature has provided evidence that property rights over land can have important effects on labor reallocation towards non-agricultural uses (De Janvry et al., 2015). This new stylized fact motivates this papers exploration of how improving land rights in rural areas affects non-agricultural economic development both in rural villages and in nearby urban areas.

Within a village that experiences improved property rights over agricultural land, farmers who are hitherto willing to sell or rent their land may decide to switch to non-agricultural local ventures, possibly attracting outside investment and new non-agricultural opportunities. Local demand for goods and services may also expand due to higher incomes in the agricultural sector. A countervailing force to these effects comes from reduced total population due to outmigration from the village. This can lead to depressed levels of non-agricultural economic activity.

An extensive literature on rural-urban migration establishes that migrants gravitate towards proximate and large cities given that migration behaves very much according to a gravity equation. We use this fact to explore effects on cities of improved agricultural property rights in their rural hinterland. An influx of labor from rural areas into cities is expected to induce expanded economic activity, although which sectors expand as a result of agricultural land experiencing property rights transformations is an open question.

In this paper, we quantify the impact of enhanced private property rights on agricultural and non-agricultural output in Mexico over the period of 1993-2007. Mexican land property rights evolved in two main phases. From 1914-1992, Mexico reallocated roughly 52% of its land from large private landowners to 3.5 million beneficiary households in the form of shared, community-based land holdings. These communal tracts of land known as ejidos were comprised of a mix of common property and individually-allocated plots where individual property rights were maintained through a use-it-or-lose-it system. From 1993-2006, Mexico underwent a second and unprecedented land tenure reform program called Procede. Under this program, the government issued individual land certificates to almost all of the community-owned land in the ejidos, freeing people from the use-it-or-lose-it policy and also granting them the right to sell their land.

To identify the causal effect of land titling in the context of a non-random program rollout, we use a difference-in-differences approach with a village- (or city-) level panel fixed effects estimation to control for time-invariant characteristics like distance to major cities and baseline levels of poverty. In the case of cities, we assign rural land using a partition of rural areas throughout the country using Voronoi (Thiessen) polygons. As a robustness check, we also use circles centered on urban centers and use variation in the share of land within the circle that obtains title.

This identification strategy relies on the assumption of parallel trends between treated and untreated localities. In this case, the non-random rollout means that the localities treated early were on average different before the program began from localities treated later, indicating that they could be trending differently than localities treated later. However, we find that indicators of treatment in the pre-period are small and insignificant, suggesting that any violation of parallel trends is unlikely to be a serious threat to our research design.

We use three new sources of data at the production unit level to explore the questions outlined above. First, we obtained access to farm-level confidential microdata describing farm production in 1993 and 2007. This provides us with measures of agricultural development due to improved property rights. Second, the Censos Economicos conducted every 5 years provides a full description of all non-agricultural activity in localities with over 2,500 inhabitants. Third, we are the first to use the rural sample of the Censos Economicos, which provides representative information for localities with less than 2,500 inhabitants for the same survey rounds.

We aggregate the microdata to the locality level to obtain measures of local economic development which are then linked to the 26,481 ejidos with GIS boundaries using the spatial matching procedure outlined in De Janvry et al. (2015). We complement these administrative data with FAO Global Agro-Ecological Zones (GAEZ) data on agricultural suitability across the country, to explore heterogenous effects by high and low agricultural productivity regions.

In this first draft of the paper, we present preliminary results for the rural sample. We are currently analyzing the cities dataset as well as the agricultural production dataset. For the rural sample of localities, we find that titling led to reduced non-agricultural economic output. The number of firms sized five persons and above falls by about 10%, while the sum of wages firms pay in a village also falls significantly. These effects are heterogenous by high vs low agricultural output regions. Both types of regions experience a reduction in firms sized 5 and greater, although in high agricultural productivity regions there is an expansion in the number of small firms (size from 1 to 4 persons). This suggests the depressive effect of population loss in rural villages is the dominating factor in determining the impact of land titles on villages.

In terms of effects of titling on average firm characteristics, we find no effects on measures such as firm size and value added, except for value added among small firms. This last effect is coming from high agricultural productivity regions.

Overall, our preliminary results point to a slight reduction in non-agricultural economic activity after the agricultural land in a village becomes titled. We expect an opposite effect of rural land titles on economic activity in cities.

2 Background and Mechanisms

2.1 Property Rights Reforms in Mexico

Following the revolution of 1910 that originated in rural areas of Mexico, the country embarked on an extensive land reform with the purpose of pacifying the countryside and avoiding a recurrence of violence. Over the period of 1917 to 1992, the first mexican land reform created 32,000 *ejidos*, semi-autonomous rural communities, that ultimately covered 52% of the Mexican land and included 3.5 million households corresponding to more than half of the rural population. Property rights under this first reform were highly incomplete. Beneficiaries had access to a plot of agricultural land in usufruct and to extensive forest and pasture resources under a common property rights regime. Property rights over the land plot were restrictive: ejidatarios had no right to sell or lease, had the obligation of working the land with family labor but no hired labor, were not allowed to leave the land idle for more than two years, could only transfer the land to one heir, and could be dismissed by a state-level commission if rules were not respected. Ejido affairs were managed by an assembly with heavy government tutelage. Access to inputs, credit, insurance, and the market were obtained through the assembly. The fact that land rights were linked to land use led to a large over-allocation of labor to agriculture, basically family labor to deter land expropriation. Political control was effective, with votes gathered by party bosses and the ruling party effectively remaining in power for the 75 years of the reform, but the cost was enormous in terms of foregone economic growth in agriculture and local industry, and extensive rural poverty (Albertus et al., 2016). As a consequence, the transformation of rural areas toward economic diversification with the emergence of a local rural non-farm economy, and the structural transformation of Mexico with a declining share of the labor force in agriculture were severely postponed.

To remedy this situation in the context of the upcoming NAFTA reforms and OECD membership, Mexico initiated a second land reform over the period 1993-2006. Under this reform, the Procede program (Programa de Certificación de Derechos Ejidales y Titulación de Solares) carried out a certification of land plots to current users, delinking land rights from land use. Certificates were registered as property in the National Cadaster and allowed owners to freely decide on using the land or leaving it fallow, hiring labor, and renting the land to other community members, permitting them in particular to eventually reduce labor allocation to agriculture, engage in economic activities in the rural non-farm economy, and potentially migrate domestically or to the United States.

We used the rollout of Procede as an identification strategy to measure the causal effect of land titling on labor retention in agriculture, and the movement of labor out of rural localities affected by the reform (De Janvry et al., 2015), it successfully titled some 26,000 ejidos covering about half of the Mexican land, only leaving pending cases with difficult to resolve boundary conflicts or areas with civil insecurity. Agricultural plots were assigned certificates of ownership while land in common property resources was attributed as corporate shares to certified ejidatarios, creating incentives for management similar to private ownership.

Migration could be analyzed using data from Progresa (the national conditional cash transfer program), the population censuses, and the ejido censuses.

Results of this analysis showed a large migration effect due to the change in property rights. With certification of the land, there was a 30% increase in the probability that an ejido household had a migrant member. There was a 4% population decline in the Procede-treated localities. There was also heterogeneity in out-migration across localities, with more out migration in: (1) localities with previously more conflicted property rights and hence the need for more defensive labor in residence, (2) localities with better off-farm wage opportunities, and (3) localities with lower land quality and smaller holdings, and hence offering less opportunities for increased incomes in agriculture.

There were also important changes in the pattern of land use mirroring labor reallocation. We find that total land cultivated did not change, and that the departure of labor was compensated by land consolidation in larger farms supported by mechanization. We also find a difference between more and less favorable regions for agriculture. There was an increase in cultivated land area in the more favorable regions, and land abandonment in unfavorable areas. Any impact on the rural non-farm economy should thus be contrasted between regions favorable and unfavorable to agriculture, with expectedly larger effects in the higher yield areas.

Finally, we find evidence that the property rights reforms contributed to an increase in the consumption of nonfood items. Specifically, nonfood consumption increased by 17% for households in ejidos that had been certified for at least six months at the time of the survey. The ejido reforms thus have the potential of generating effective demand for nonfood items, the less tradable of which can be produced by enterprises located in the rural non-farm economy and in secondary cities.

2.2 Hypotheses

An important question for this paper is whether the release of labor and the income effects induced by the property rights reform led to increased investment and employment in the rural non-farm economy where the reformed ejidos are located. This would be seen in more local enterprises in manufacturing and services and potentially more employment in these enterprises. This rural non-farm effect can originate in the labor market, where increased labor supply as released by agriculture and potentially lower wages can create incentives for local non-farm investments and the movement of firms toward these areas (Foster and Rosenzweig, 2004). It can also originate in effective demand effects where higher incomes for the remaining populations, especially in the better endowed areas for agriculture, can create demand for non-tradable goods in an ADLI/S (Agriculture demand-led industrialization/services) effect as proposed by Adelman (1984).

Development of the rural non-farm economy is the driving force of a "rural transformation" (IFAD, 2016). In this transformation, rural households sources of income are increasingly diversified to include returns from employment and entrepreneurship in non-farm activities mainly related to agriculture (through forward and backward linkages) or driven by local effective demand (through final demand linkages originating in gains in agricultural incomes). These activities can be home-based in family farms and more typically located in secondary towns. They are important not only in contributing to poverty reduction in rural areas but also in helping secure the competitiveness of the family farm. Typical successful smallholder farming is thus importantly anchored in income opportunities in the rural non-farm economy. Using the Mexican property rights reforms and the associated release of labor and gains in rural incomes is thus a unique natural experiment that can be used to analyze the rise of a rural non-farm economy and the associated rural transformation.

3 Data

To measure the effect of the land tenancy reforms on non-agricultural economic development, we obtained data on non-agricultural establishments across Mexico linked to the staggered rollout of the Procede program. We further include measures of agricultural suitability to understand how outcomes diverge across locations with differential fixed factors, namely agricultural suitability.

Our study of the effects of tenancy on local and non-local economic activity motivates our usage of the Mexican Economic Census, administered by Mexico's National Statistical Institute (INEGI). This census is a complete enumeration of non-agricultural establishments with a fixed location, hence, not including street vendors. The census, collected every 5-years, completely enumerates all urban localities, those categorized by population greater than $2,500$ individuals. In contrast, rural localities are sampled at the level of the locality, but once sampled, all firms that met the basic requirements are included. Our data spans 1994-2008, an almost complete coverage of the time during the land transformation we examine. Due to institutional constraints, the 1993 data from rural areas is absent, leaving our data covering the period of 1998-2014. Thus, we are identified off ejidos that received Procede after 1998. This includes approximately half of all ejidos, as shown in Figure 2. For both samples, at the level of the establishment, the data includes number of workers, production, revenue, value-added, and total capital. As our treatment operates at the level of the locality, the lowest level of governance, we aggregate firm outcomes to the locality level in all regressions either as the sum of firm outputs or as average firm characteristics.

We map data on the rollout of Procede to our firm outcomes following the procedure in De Janvry et al. (2015). GIS maps of 26,481 ejidos created during the Procede certification over the period 1993-2006 by INEGI and managed by Registro Agrario Nacional (RAN) serve as our main source of information on the rollout. Figure 1 shows the grand extent of the land certification program and the rollout over time. Since the vast majority of data collected by Mexico corresponds to localities rather than ejido units, we match ejidos to localities based on whether the centroid of the locality falls within the ejido boundary. Using this technique, it's possible for multiple localities to correspond to a single ejido, but it's rare. In the end, 17,328 localities are matched to the ejido maps and serve as our focus of study in rural areas.

To measure variation in the response to the land certification as a function of land quality, we use the local area's agricultural suitability for maize, one of the most common crops in Mexico, taken from the Global Agro-Ecological Zones (GAEZ) project administered by the Food and Agriculture Organization (FAO). The data, provided as a raster of cell sizes 0.5 degrees by 0.5 degrees (approximately 56km by 56km at the equator), calculates agricultural suitability for 154 separate crop types using climatic, soil quality, and land slope measures. We use one crop, maize, as our baseline measure of agricultural suitability, although it's highly correlated to agricultural suitability for other crops that are common in Mexico, such as beans. The high degree of correlation between the measures can be seen in Figure 3. Although this measure exhibits a high-degree of spatial correlation, an example municipality, seen in Figure 4, shows how variability enters even within relatively small regions. As crop suitability differs based on various conditions and inputs, we chose suitability related to intermediate-level inputs for rain-fed land for the period of 1961-1990. Thus, this data provides a baseline measure of agricultural suitability and is not time-varying in our sample. We operationalize the crop suitability measure as a binary variable of high/low agricultural suitability based on whether the cell is above or below the median suitability in Mexico.

4 Identification and Empirical Strategy

The long duration and relatively spatially uncorrelated architecture of the rollout of the Procede program is attractive to study, but the nature of the rollout provides some challenges. In particular, the rollout of the program was non-random– small, conflict-free, less marginalized ejidos nearest to large cities were most likely to receive the program first. A simple cross-sectional regression of the effect of the Procede certification would be biased by the level-differences across these locations. Following De Janvry et al. (2015), our solution is a panel-fixed effects research design, controlling for time-invariant characteristics of these location, which clearly includes such factors as natural fundamentals, distance to city, and other general characteristics of the local areas. Our regression specification takes the form

$$y_{ist} = \alpha + \beta(\text{Procede})_{it} + \mu_i + \gamma_{st} + \varepsilon_{ist} \tag{1}$$

where i is locality, s is state, and t is the time our outcomes are measured. Our outcomes, y_{ist}, include various firm and locality characteristics, such as value-added or number of firms. Procede is a binary variable taking a 1 after the ejido has been certified, otherwise it's 0. μ_i is a locality fixed effect, controlling for time-invariant characteristics of the localities. γ_{st} is a state by time fixed effect, controlling for aggregate time trends that vary across states. This controls flexibly for variations in both our treatment and the nature of the economic evolution across state and time in Mexico during our study period. ε_{ist} is a stochastic error term we cluster at the locality-level, the level of the treatment. β, our coefficient of interest, measures the impact of the Procede program on the firm outcomes we study.

We augment our base specification, Equation 1, to allow for heterogeneity in the agricultural suitability of the land, labeled High yield GAEZ, through a simple interaction with our regressor of interest. This time-invariant characteristic is a likely source of heterogeneous response to the land certification. High agricultural areas may have increased demand effects from greater productivity in the agricultural sector, whereas communities with poor quality land may no longer function the same way, as many leave to find more productive uses for their labor. We operationalize this heterogeneity as a dummy, where 1 refers to the localities with above median land quality.

As is familiar, our exclusion restriction is that of "parallel trends." We assume that, after controlling for state-level time varying shocks, those who received the Procede certification would have been on the same time-path as those units that did not receive the certification at this time. As shown in De Janvry et al. (2015), with a similar research design, the timing of the Procede certification was orthogonal to changes in pre-certification migration patterns, a likely first-order approximation to some of the economic conditions under study in this paper. Further justification of the parallel trends assumption will be included in subsequent versions of this paper.

5 Results

5.1 Impact of Titles on Firms in Rural Areas

De Janvry et al. (2015) shows that overall village population decreases after titling, and that the effect is stronger in lower land quality regions. A reduction in village population would thus suggest a concomitant reduction in non-agricultural activity. However, increased profitability among remaining farmers could counteract this force by increasing demand for local non-agricultural products.

Using this as a framing for our results, we begin with the average treatment effect of the Procede certification and then to turn to how these results vary across one important source of heterogeneity, the agricultural land suitability of the ejido. Our first set of results look at aggregate firm characteristics and the number of firms to see on average how the localities have been affected. We then look at average firm characteristics to understand firm-level responses.

In Table 1, we see that average effect of the Procede certification on locality-level aggregate firm measures and the number of firms. From columns (1) and (3), we see that total production and total value-added have not decreased after the Procede certification, a likely outcome if Procede simply caused a large outmigration to dominate other local non-agricultural economic firms following suit. We do find a large reduction in total wages paid out, a decrease of 18% as a results of the Procede certification, suggesting some decrease in non agricultural economic benefits. While there are no impacts on the number of firms overall and number of firms with 4 or fewer employees, there is a .1 percentage point or 10% reduction in the number of large firm, those with 5 or more employees. The reduction is driven primarily by a reduction in large service-sector firms. As large firms typically have higher wages, it may be tempting to see the majority of the wage bill decrease coming from the reduction in large firms, but it's unlikely to be the full story, as these large firms make up a small relative share of the number of firms in the local economy.

A nuanced story of the heterogeneous impacts of the Procede certification can be seen in Table 2. In Columns (1) and (3) we see a pattern of differential impacts, but if anything, there are appears to be higher value-added in high agricultural suitability areas as compared to low suitability areas, albeit imprecisely estimated. The number of firms overall, and number of firms with 4 or fewer employees is larger in the high agricultural areas as compared to the low agricultural areas, with the latter variable also being positive as compared to the null effect of high yield areas having no impact overall. In low yield areas, we find a reduction in the number of large firms, those with 5 of more employees. The preceeding results make the results on total wage bill all the more surprising. All of the reduction in wages are coming from high agricultural suitability areas, surprisingly as they have more firms. One explanation could be both labor supply and demand curves both shifting inwards. A more plausible story is that there has been a shift towards relatively smaller firms that don't pay explicit wages. The increase in number of small firms in the high agricultural suitability is driven by an increase in small manufacturing firms, marking a relative diversification of industries in rural areas.

In Table 3 and Table 4, we analyze the direct and the heterogeneous impacts of the Procede certification on average non-agricultural firm characteristics, instead of the aggregated measures previously seen. On average, we don't find meaningful impacts on firm size overall, nor split into firms below size 5 and those size 5 and above. We can see that the Procede program increases average firm value-added for small firms, but decreases for larger firms. These effects are most pronounced in high agricultural suitability areas, that likely experienced the largest productivity increases in the agricultural sector as well. Thus, there may be some downsizing overall for the largest firms, but small firms are now more profitable in the high agricultural areas. The compositional effect of increased activity in the manufacturing sector may explain some of the increase in average firm value-add as these sectors typically produce more local value-added. Overall, firm characteristics look generally unchanged as a result of the land titling program.

5.2 Impact of Titles on Firms in Urban Areas

TBA

5.3 Impacts on Agricultural Production

TBA

6 Conclusion

TBA

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7 Figures

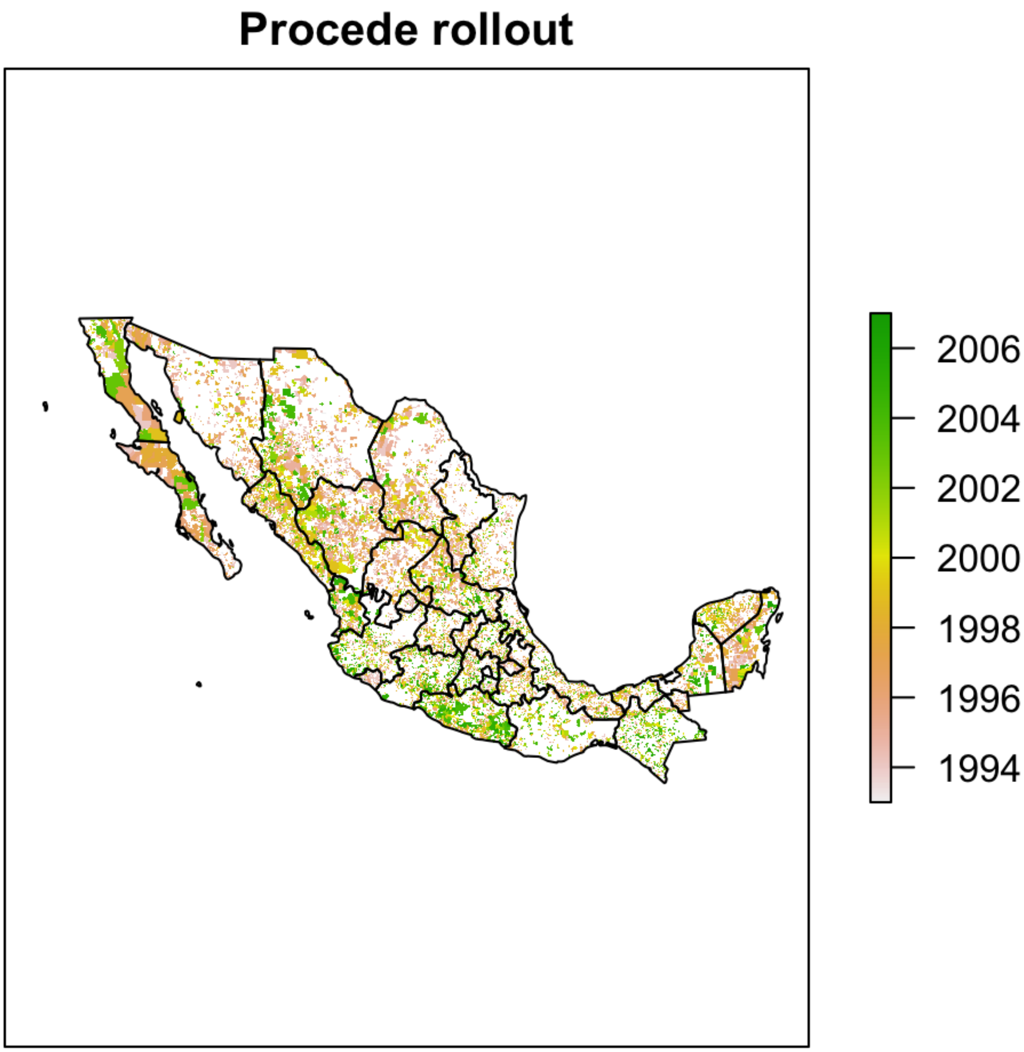

Figure 1: Map of rollout

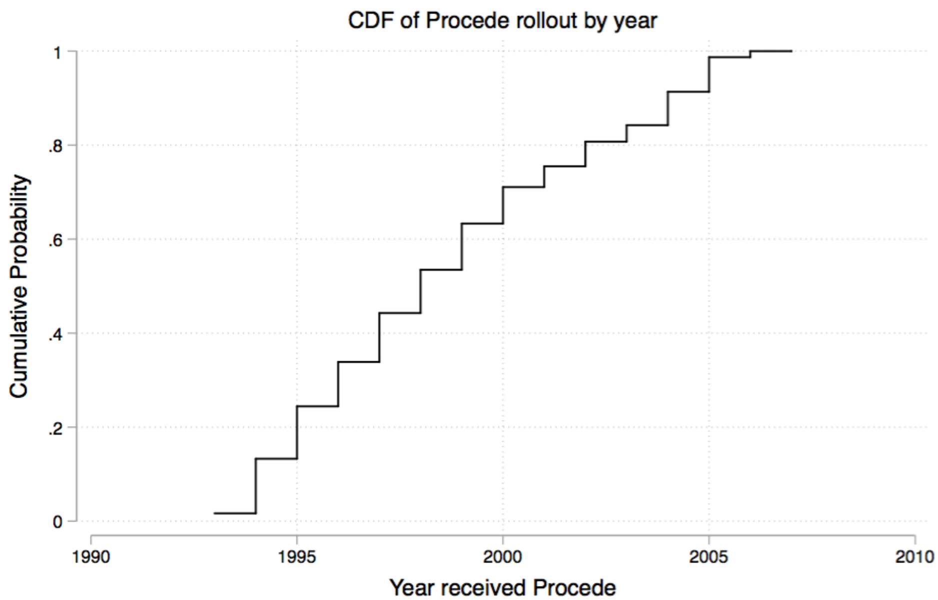

Figure 2: CDF of rollout over time

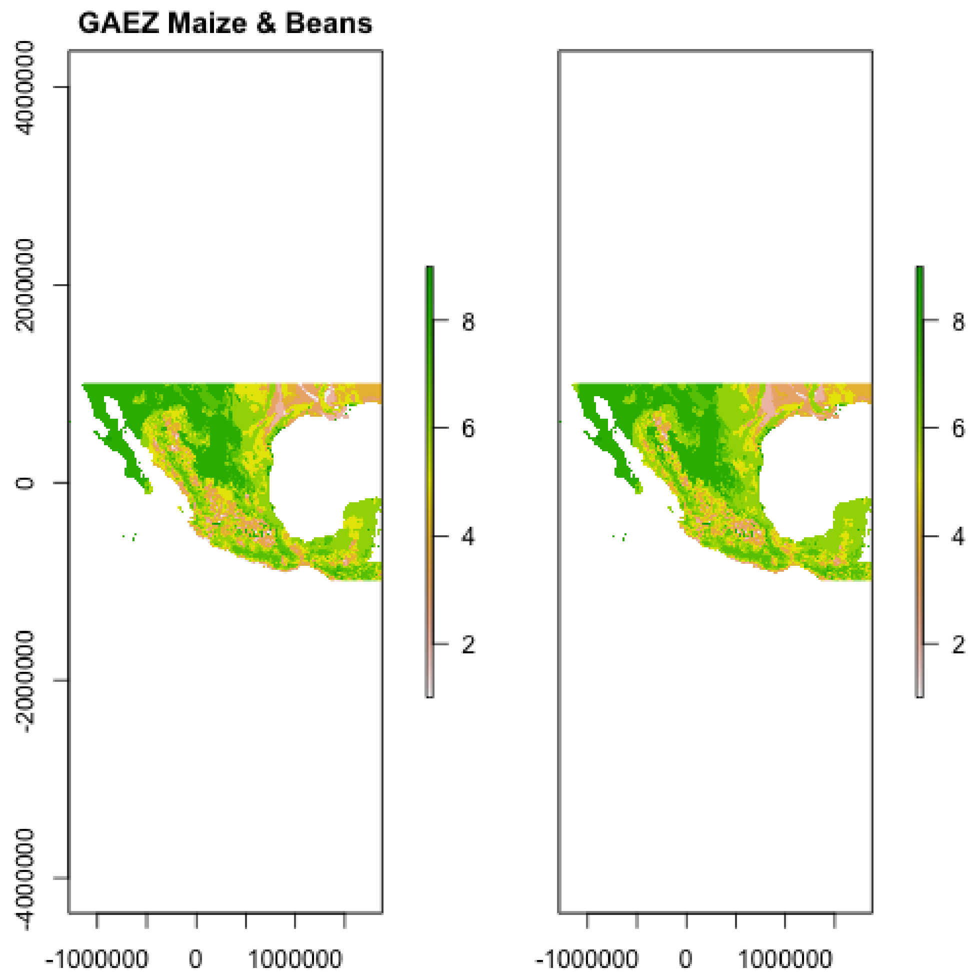

Figure 3: Map of GAEZ agricultural suitability for maize and beans

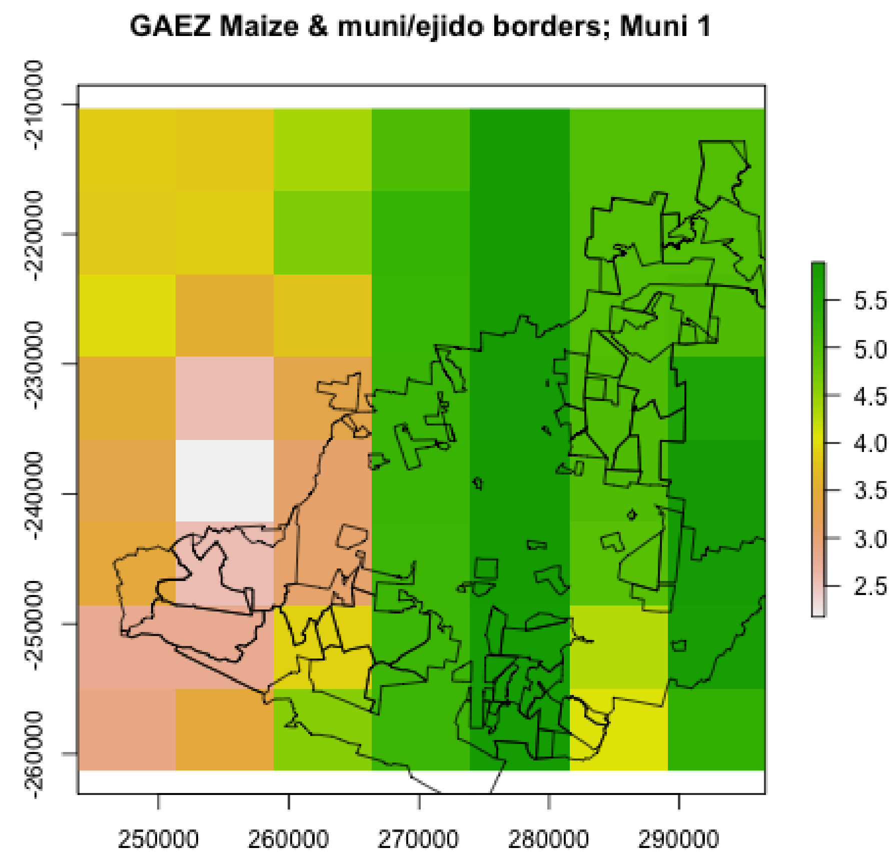

Figure 4: Map of GAEZ agricultural suitability for maize showing a single municipality with ejido boundaries

8 Tables

Table 1: Effect of Procede on overall locality firm measures

	ln(Production) (1)	ln(Wages) (2)	ln(Value Added) (3)	Num Firms (4)	Num Firms | Size $\leq$ 4 (5)	Num Firms | Size > 4 (6)
Treat	-.024	-.18***	-.017	.15	.25	-.1**
	(.042)	(.066)	(.072)	(.29)	(.28)	(.044)
Locality FE	Yes	Yes	Yes	Yes	Yes	Yes
State-year FE	Yes	Yes	Yes	Yes	Yes	Yes
Aggregation	Loc. total	Loc. total	Loc. total	Loc. total	Loc. total	Loc. total
Adj R-squared	.71	.56	.51	.82	.83	.57
Mean DV	5.5	3.6	4.6	13	12	.99
Localities	11123	11123	11123	11123	11123	11123
Obs	26197	26197	26197	26197	26197	26197

Standard errors in parentheses
* $p < .10$, ** $p < .05$, *** $p < .01$

Table 2: Heterogeneous effects of Procede on overall locality firm measures

	ln(Production) (1)	ln(Wages) (2)	ln(Value Added) (3)	Num Firms (4)	Num Firms | Size $\leq$ 4 (5)	Num Firms | Size > 4 (6)
Treat	-.021	.072	-.078	-.53	-.4	-.12**
	(.057)	(.085)	(.1)	(.37)	(.35)	(.056)
Treat * High yield GAEZ	.0098	-.4***	.17	1.3**	1.2**	.046
	(.077)	(.12)	(.14)	(.6)	(.24)	(.079)
Locality FE	Yes	Yes	Yes	Yes	Yes	Yes
State-year FE	Yes	Yes	Yes	Yes	Yes	Yes
Aggregation	Loc. total	Loc. total	Loc. total	Loc. total	Loc. total	Loc. total
Combined effect (p-val)	.85	.00038	.35	.12	.075	.23
Adj R-squared	.73	.57	.52	.83	.83	.58
Mean DV	5.5	3.6	4.6	13	12	.99
Localities	10015	10015	10015	10015	10015	10015
Obs	23743	23743	23743	23743	23743	23743

Standard errors in parentheses
* $p < .10$, ** $p < .05$, *** $p < .01$

Table 3: Effect of Procede on average firm measures

	Firm size	ln(Value Added)	Firm size | Size ≤ 4	ln(Value Added | Size ≤ 4)	Firm size | Size > 4	ln(Value Added | Size > 4)
	(1)	(2)	(3)	(4)	(5)	(6)
Treat	-.047	-.022	-.014	.097**	.048	-.1
	(.25)	(.048)	(.016)	(.045)	(.35)	(.073)
Locality FE	Yes	Yes	Yes	Yes	Yes	Yes
State-year FE	Yes	Yes	Yes	Yes	Yes	Yes
Aggregation	Loc. Avg	Loc. Avg	Loc. Avg	Loc. Avg	Loc. Avg	Loc. Avg
Adj R-squared	.22	.5	.2	.44	.27	.37
Mean DV	2.9	3	1.6	2.8	4.5	.95
Localities	11123	11123	11123	11123	11123	11123
Obs	26197	26197	26197	26197	26197	26197

Standard errors in parentheses
* $p < .10$, ** $p < .05$, *** $p < .01$

Table 4: Heterogeneous effects of Procede on average firm measures

	Firm size	ln(Value Added)	Firm size | Size ≤ 4	ln(Value Added | Size ≤ 4)	Firm size | Size > 4	ln(Value Added | Size > 4)
	(1)	(2)	(3)	(4)	(5)	(6)
Treat	.15	-.089	-.016	-.017	.23	-.07
	(.19)	(.065)	(.022)	(.053)	(.35)	(.097)
Treat * High yield GAEZ	-.2	.17*	.0039	.17**	-.19	-.018
	(.18)	(.086)	(.029)	(.082)	(.45)	(.13)
Locality FE	Yes	Yes	Yes	Yes	Yes	Yes
State-year FE	Yes	Yes	Yes	Yes	Yes	Yes
Aggregation	Loc. Avg	Loc. Avg	Loc. Avg	Loc. Avg	Loc. Avg	Loc. Avg
Combined effect (p-val)	.67	.22	.57	.0092	.91	.38
Adj R-squared	.44	.5	.19	.47	.4	.36
Mean DV	2.9	3	1.6	2.8	4.5	.95
Localities	10015	10015	10015	10015	10015	10015
Obs	23743	23743	23743	23743	23743	23743

Standard errors in parentheses
* $p < .10$, ** $p < .05$, *** $p < .01$