The Ejido System and Economic Growth of the Mexican States

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Abstract: Building on previous work by Chiquiar (2005) we study the impact of the ejido communal property system on economic growth in the Mexican states. The average growth rate of state per capita GDP is negatively related to the share of state land in the communal ejido system during some of the sub-periods examined. The negative relation suggests that the misallocation of resources related to the limited property rights of ejidatarios has been a binding constraint on the growth of the Mexican states at times during the 1970-2012 period. We also examine the conditional convergence or divergence of the Mexican states for 2003-2012 and 2005-2012 and find that definite conclusions cannot be drawn. Whether state GDP per capita converged or diverged depends on whether the estimations start with 2003 or 2005 and, interestingly, on the specific ejido variable included in the model.

Key Words: Economic growth, Mexican states, ejido system, property rights

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I. Introduction

Real per capita GDP in Mexico grew at an annual average rate of 3.25% from 1940 to 1970, 1.42% from 1970 to 2001, and 1.47% from 2003 to 2012. (see Table A in the appendix). More than two thirds of the thirty-one states also had slower annual growth rates in the 1970-2001 and 2003-2012 periods. The remaining states along with Mexico City (Distrito Federal) have grown more rapidly in recent periods. What explains Mexican economic growth and, in particular, the growth slowdown in most states from 1970 to 2012? Numerous authors have attempted to answer these questions.

Esquivel (1999) finds evidence of a slow rate of absolute convergence of per capita gross state product in the Mexican states between 1940 and 1995.[1] When examining the convergence behavior for two subperiods he concludes that almost all movement occurred during 1940-1960 with very little convergence in 1960-1995. Using annual data on state GDP per capita for 1940-2001 Carrion-i-Silvestre and German-Soto (2007) find evidence of stochastic convergence in most states when structural breaks are taken into account.

As an initial step, Chiquiar (2005) looks at absolute (β) convergence in per capita state income in Mexico for 1970-2001 and finds some supportive evidence. Although his estimation over the full sample fails to reveal any indication of β convergence or divergence, conclusions change when he separates the sample into two subperiods. Per capita incomes of the states show convergence during 1970-1985 and divergence for 1985-2001. Since public infrastructure, industrial composition, levels of human capital and other characteristics vary across the states, Chiquiar turns his attention to conditional convergence. Using a general to simple procedure to eliminate insignificant explanatory variables he formulates empirical models for conditional convergence during the two periods. Since the cross-section data set includes only thirty observations for each subperiod he estimates the models using seemingly unrelated regressions (SUR). His results indicate conditional convergence of per capita state income for 1970-1985 and (conditional) divergence for 1985-2001. Chiquiar explores the reasons for divergence in the latter period and concludes that the divergence results are likely due to trade reforms culminating in the North American Free Trade Agreement.[2] Chiquiar concludes that the change in trade policy from import substitution to a more open economy appear to have favored the relatively richer northern

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[1] Esquivel notes that accounting was inconsistent in assigning values to petroleum production during the 1970-1990 period for the states of Campeche and Tabasco. Esquivel and subsequent studies reviewed herein include the Federal District (Mexico City D.F. or Distrito Federal in Spanish) in their estimations although it is not a state. Our use of the term state as applied to Mexico should be understood to include the Federal District of Mexico City.

[2] In November 1985 Mexico announced that it would pursue entry into the General Agreement on Tariffs and Trade and it began to participate in the accord less than a year later in 1986.

states that tended to have better infrastructure and more human capital per person. In particular, the states sharing a border with the United States seem to have benefited most.

Our goal is to examine the effects of a specific form of communal property rights, the ejido system, on per capita economic growth and convergence in Mexico. We start with the same data set as Chiquiar and examine his results when our ejido variable is incorporated into his model. We then extend Chiquiar's data set to examine the effects of the ejido system on Mexico's recent growth experience through 2012. Inclusion of recent data also allows us to revisit the question of conditional convergence or divergence among the states.

Our work is similar to that of Albertus et al. (2013), although our focus is different. Albertus et al. primarily wish to know whether the ejido system is used as a political tool to keep the dominant party, the Partido Revolucionario Institucional or PRI, in power, but they also examine the effects of land redistribution to ejidos on state income growth 1940-1992.[3] They conclude that cumulative land distribution, the variable most closely related to our ejido measure, has a significant, negative effect on state income growth. Conversely, land distribution within the previous five years positively affects economic growth possibly because the redistributed land, previously unused for economically productive activities, was quickly put to use for agricultural production.

Our intial finding using the Chiquiar data set augmented with our ejido measures indicates that the ejido system had a significant negative effect on gdp growth of the Mexican states during 1970-1985 but no significant effect on growth in 1985-2001. During the former period ejido residents had limited property rights; they could not sell or rent the land and use was restricted to agricultural and related activities. Extending the data set alters our initial finding so that the effects of the ejido system are insignificant during the 1970-1985 period. The extended results now indicate a significantly negative effect of the ejido system on state gdp growth during 1985-2001 and, in some specifications, 2005-2012. These results provide some support for conjectures that the ejido system misallocated resources and limited investment due to the absence of full property rights.

II. Ejido System

Much of the land in Mexico is held as communal property in the ejido system formed during the Mexican Revolution. Use of the land is restricted to members of the ejido, termed ejidatarios. The ejidatarios are typically descendants of the original ejidatarios or have married into the

[3] According to Albertus et al. the ejido system is a 'punishment regime'. Ejidatarios are dependent on federal government subsidies and loans. Failure to support the PRI in elections could lead to withdrawal of financial support and substantial welfare losses for the ejidatarios.

families of descendants. Prior to legal changes in 1992 numerous restrictions existed on the use and management of the property within an ejido. Land in the ejido could only be used for agricultural purposes or resource harvesting such as logging and was generally divided into two types: parcels and common land. A parcel was assigned to an individual or family for exclusive use but could not legally be sold or rented. Use of the common land was shared by all members of the ejido. Nor could commonly held land be sold or rented.

Although the Mexican revolution lasted until 1920, some land was distributed to newly formed ejidos before that date. Subsequently land was redistributed to the ejidos on an ongoing basis until 1992. According to the national statistics agency, INEGI (n.d.), more than eleven million hectares of land were distributed to ejidos in the 1915-1934 period. In the following five years the quantity increased to almost nineteen million hectares during the presidency of Lázaro Cárdenas. Grants of additional land to ejidos continued until 1992 reaching a peak of almost twenty-five million hectares in 1965-1970 during the presidency of Gustavo Díaz. Between 1935 and 1988 only one president, Miguel Alemán, redistributed less than five million hectares.[4] Legal changes implemented in 1992 allowed ejidatarios to obtain private titles to their parcels, although the process is more time consuming and costly. After these changes common land could be sold as a complete unit under certain restrictive conditions.

The percentage of each state's area in ejidos varies widely across the states, which allows us to test for the growth effects of the ejido system across states (see Table B of the Appendix). Summary statistics for these shares are shown in Table 1. The range and the standard deviation of the ejido fraction has increased across the analyzed periods.[5] For example, in 1981, the parcel fraction ranges from 0.003 in Baja California Sur to 0.244 in Veracruz; for 2007, the minimum parcel fraction is 0.043 Baja California Sur and the maximum is 0.459 Colima. Data on total land area in ejidos are unavailable for 1981, an issue addressed later in the paper.

INSERT TABLE 1

Schlager and Ostrom (1992) propose four categories of rights associated with property that assist in understanding land use: Access and withdrawal, management, exclusion, and alienation. Before the 1992 legal changes ejidatarios had rights to enter and obtain products of the property, the right of access and withdrawal. The ejidatarios also had management rights since they made collective decisions regarding use of common land and, to some extent, the parcels. By law and collective decisions only ejidatarios generally had access to ejido property, the right of exclusion. However the right to sell or rent the land (or alternatively one's 'membership' in the ejido),

[4] Alemán gave land grants of 4.6 million hectares according to INEGI.
[5] Only data for land area in parcels are available for 1981.

termed the right of alienation by Schlager and Ostrom, was not permitted. After the land reforms of 1992 ejidatarios can obtain this alienation right although the process is difficult.

III. Theoretical Considerations

There are at least two reasons why growth or per capita output might be lower under the ejido system. First, there may be efficiency losses associated with the misallocation of land or labor. i) Land misallocation-The restrictions existing on ejido property may prevent the land from being used in the most productive activities. Prior to 1992 ejido land could not be sold or rented. Indeed it could not be used for other than agriculture or resource harvesting purposes. The fact that nearly 40% of the land area of Mexico City (Distrito Federal in table B of the appendix), the most urbanized part of the country, was in the ejido system in 1991 strongly suggests that at least some ejido land was not used in the most productive manner, at least prior to the legal changes in 1992. After the reforms of 1992, it remains costly and time-consuming for an ejidatario to obtain a private title to a parcel or for the members of the ejido to sell the communally owned property.[6] Suggestive of a significant cost associated with obtaining private titles is that slightly more than 38% of the land area in Mexico City remained in ejidos in 2007, 15 years after reforms allowing private ownership and sales. According to Johnson (2001) prior to the legal changes in 1992 neither parcels nor communal land could be rented nor left idle for more than two years. ii) Labor misallocation-Before 1992 an ejidatario who left the ejido to work in a more productive sector ran the risk of losing his/her ejido rights including loss of the land. An indication that this effect may have been an important constraint on the reallocation of resources comes from Valsecchi (forthcoming) who finds evidence that the loosening of such restrictions in the 1992 reform significantly increased international immigration of ejidatarios. His results suggest that the ejido system restriction was likely a binding constraint on the mobility of ejidatarios within Mexico as well.

Second, the participation of ejidatarios in private credit markets was restricted possibly leading to suboptimal investment. Before 1992 ejido land could not be used as collateral for loans because financial institutions could not take ownership of properties if ejidatarios defaulted on land-collateralized loans. Besley (1996) provides a formal treatment of these effects.

IV. Data

The starting point for the study is the data set developed by Chiquiar. See his work for a complete description of all data apart from the ejido land data. Note that all estimations in Chiquiar and our extensions of his models exclude data for the states of Campeche and Tabasco because of inconsistencies in the treatment of petroleum production in these states during 1970-

[6] Johnson (2001) provides a thorough review of the changes brought about in the 1992 reform.

1990 (see footnote 1). Removal of the two states leaves data for thirty states (including the Federal District).

The data on the fraction of each state's land in the ejido system are drawn from the periodic censes undertaken by INEGI. Chiquiar estimates empirical models to explain average annual growth of state GDP per capita and test for conditional convergence during 1970-1985 and 1985-2001. We include data on ejido land area from the 1981 census in the estimated model for the former period and from the 1991 census in specification for the latter period. Unfortunately, the only ejido data available from the 1981 census are for parcels rather than total land area in the ejido and reflect values estimated by INEGI from a sample of 10% of ejidos. The absence of data for complete ejidos and the dependence on a sample to estimate the number of hectares in parcels is due to the destruction most of the data collected for the 1981 ejido census during the earthquake which struck Mexico City in September 1985. To maintain comparability between the ejido land area measures in the two subperiods we use the fraction of ejido land in parcels in each state during the two subperiods as our measure of extent of the ejido system, even though the fraction in parcels is a less comprehensive measure. The parcel figure is a proxy that to some extent captures the extensiveness of the ejido system in each state. However, it is not a perfect measure. For example in 1991 only 0.3% of the land in Baja California Sur was in ejido parcels but nearly 73% of the state's land area was in the ejido system. The fraction of total ejido land (parcels and common holdings) would be a better measure but these data were among those lost during the earthquake.

V. Methodology and Empirical Results

As a first step we attempt to replicate Chiquiar's results for the 1970-1985 and 1985-2001 subperiods. These estimations yield identical results so any change in the estimated parameters occurring after inclusion of the ejido land variable must be due to the introduction of the additional explanatory variable.

The basic estimated model with the ejido land variable is given by equation (1)

$$\frac{1}{T}(y_i^T - y_i^0) = \alpha + \beta_0 y_i^0 + \sum_{j=1}^{k} \beta_j X_{ij}^0 + \gamma L_i^t + e_i^T \qquad (1)$$

where y_i^0 is the log of per capita GDP in state i for the first year of the period, y_i^T is the log of per capita GDP in state i for the final year of the period so that the left hand side of equation (1) is the average annual log growth rate of per capita GDP in state i over the T periods. L_i^t is the fraction of total state i land in ejido parcels in census year t, the X_{ij} are the state i explanatory variables in the Chiquiar model, and e_i^T is the residual for state i for the period ending in year T. The ejido variable is calculated from the earliest available ejido census within the estimation period. For 1970-1985, the data are from the 1981 census and the 1991 census is the source for the data used

in estimations for the 1985-2001 period. The X_{ji} are different in the two subperiods. A negative sign on the estimated coefficient β_0 indicates (conditional) convergence while a positive sign suggests (conditional) divergence over the period. Since the error terms for state i are likely to be correlated during the two subperiods, we follow Chiquiar and use seemingly unrelated regressions to estimate the model. Results are shown in Table 2. The format of Table 2 follows that of Table 4 in Chiquiar to facilitate comparison.

INSERT TABLE 2

Overall the results accord well with those in Chiquiar. With the exceptions of the estimated coefficients on the crime rate and illiteracy rate variables in the 1985-2001 growth rate equation, all are significantly different from zero at the 5% level or better and similar in magnitude to those reported in Chiquiar.[7] All estimated coefficients have the same sign as reported by Chiquiar.

During the 1970-1985 period the share of land in ejidos had a significant negative effect on per capita gdp growth rates consistent with efficiency losses associated with the communal system. The impact of the ejido system appears to have had an economically significant effect on growth. If the amount of a state's land in ejido parcels increased by ten percentage points the empirical results suggest that average annual growth rate in 1970-1985 would be nearly half a percent lower. Conditional convergence is estimated to occur at a slightly faster rate than uncovered by Chiquiar.

Interestingly, the coefficient on the ejido share variable is not significantly different from zero for the 1985-2001 per capita growth rate. This may be because the 1992 reforms reduced the inefficiency of the ejido system enough so that the system did not exert a significant drag on economic growth. Divergence in state growth becomes somewhat more pronounced with the coefficient on initial log per capita GDP increasing from .055 in Chiquiar to .067 in estimations for 1985-2001 with the ejido variable.

The empirical model includes explanatory variables for agricultural output as a share of GDP and the fraction of the population living in rural areas and the signs and sizes of their estimated coefficients are similar to those reported by Chiquiar. Thus, the significant effect of the ejido variable does not appear attributable to the use of ejido lands for agricultural production nor their predominantly rural location.

The next step is to extend Chiquiar's data set with more recent information. We were able to obtain recent data on all significant explanatory variables in Chiquiar's 1970-1985 and 1985-2001 empirical models except for the fraction of large firms in manufacturing in each state. The base

[7] The crime rate coefficient reported by Chiquiar for the 1985-2001 period has a p value of 0.09.

year for state level gdp changed to 2003 in that year while the Chiquiar data set ends in 2001. In the cross section estimations using SUR there are no particular problems arising from a failure to have a continuous time series for gdp. Consequently rather than estimate gdp in each state for 2002 we develop empirical models for 2003-2012 and 2005-2012 and estimate the growth equations for three periods: 1970-1985, 1985-2001, and 2003-2012 or 2005-2012. Aside from allowing an assessment of the sensitivity of results for the most recent period to different start dates, 2005 is the reporting year for a number of the variables in the model. We consider the 2005 start date in order to use the most recent data available for many of the variables yet reduce the likelihood of feedback from state gdp growth per capita to the right hand side variables. With two exceptions the explanatory variables used in the 2005-2012 estimations are from 2005 and those used for the 2003-2012 estimations are for 2000 or 2003. The exceptions are the crime rate variable available only for 2010 and the ejido land area variable available for 2007.

The 2007 ejido census shows the land area in parcels and the total ejido land area for each state. As with the earlier estimations we compute the fraction of state land in ejido parcels and use this fraction for each of the three periods in estimating the full model. Since the 1981 ejido data are only for parcels and estimated due to the loss of data in the earthquake, the inclusion of more recent data allows the estimation of a restricted model for 1985 to 2001 and 2003 (or 2005) to 2012 using the total ejido share as the explanatory variable.

The extended empirical model consists of an specification of equation (1) for each of three periods. Initially the Chiquiar model augmented with the ejido variables is left intact and a general to simple procedure undertaken to remove jointly insignificant explanatory variables to obtain a parsimonious empirical model for the 2003 to 2012 and the 2005 to 2012 specifications. Subsequently, the full model is also subjected to a general to specific approach to obtain a final specification. The same procedure is followed for the two sub-period restricted model for 1985-2012. The ejido variables and log initial per capita GDP variables always remain in the model even when insignificant. Since most ejidos are in rural areas and all are dedicated to agriculture and related activities, the variables for rural population share and agricultural output as a percent of GDP also remain in the model regardless of their significance to ensure that the ejido variable is not capturing these differences across stats. Since our focus is on the impact of the ejido system and the recent convergence or divergence experience of the states, we report only the coefficients and t-statistics for these variables (see Tables 3 and 4).

INSERT TABLES 3 AND 4

The estimation results from several different model versions are shown in Tables 3 and 4. Model I is the Chiquiar specification with added ejido variables plus a specification for the recent

time period, 2003 or 2005 to 2012 that includes all additional variables. The results from this model are the starting point for a general to specific procedure and included for comparison. As can be discerned from the relatively low adjusted R^2, Model I never provides a good fit for the third period. Model II leaves intact the Chiquiar version with ejido variables and removes jointly insignificant variables from the final period specification. Model III shows the final version for the three period estimations after applying additional Wald tests for joint significance and removing those variables that are insignificant from the three equation system. Due to uncertainties regarding the quality of the ejido data for the 1970 to 1985 period, we also undertake restricted SUR estimations for 1985 to 2001 and 2003 or 2005 to 2012. Restricted Models I to III are as described above, excluding 1970-1985, and contain the ejido parcels variable. Model IV is identical to Model III except that total ejido land as a fraction of the state surface area is substituted for the parcels measure.

The estimation results for the full, three-period model indicate that the ejido share of state land had a negative effect on state economic growth in all periods, but the effect was significant only during the 1985-2001 period regardless of the start date for the third period. Model III is the specification derived from the general to specific approach applied to all three equations, hence best in terms of explanatory power, but the size, sign, and significance of the ejido coefficients vary little across the three versions. The significant negative coefficients on initial GDP per capita confirm previous findings of conditional convergence for 1970-1985. Unlike Chiquiar's results, relatively rich states do not seem to have grown significantly faster during the 1985 to 2001 period; there is little evidence for divergence of per capita GDP. However, there are weak indications of divergence for the 2003 to 2012 period with the p values of about .10 for the positive coefficients on initial GDP per capita. Interestingly, this finding is reversed when the start date for the period is 2005 as can be seen in Table 4.

Estimating restricted Models I-III for periods 1985-2001 and 2003-2012 produce results similar to those for the full sample. When using the ejido parcel share of state land as the explanatory variable, the impact of the ejido system is significantly negative for 1985-2001 and negative but insignificant for 2003-2012. This result is reversed in Model IV which substitutes the total ejido share for the parcel share. Model IV suggests no effects of the ejido system on per capita GDP growth for 1985-2001 and a significant negative effect on growth in the subsequent period. There are no significant coefficients on initial GDP per capita in restricted Models I-III, thus no evidence of convergence or divergence. Since Model IV includes the same variables as Model III except for the measurement of the ejido share it is surprising that substitution of the total ejido share for the parcel share produces evidence of income divergence among the states in

both periods, although the positive coefficient on initial GDP per capita for 1985-2001 has a p value of just .094. Evidence for income divergence is stronger for 2003-2012 as indicated by the p value of .022 for the positive coefficient on initial GDP per capita.

Table 4 shows estimation results in the model when the final period is 2005 to 2012. Conclusions regarding the effects of the ejido system on growth are the same for all periods as those drawn earlier. There is a significant negative effect of ejidos on growth only during 1985-2001 when the parcel measure is used. This effect disappears for 1985-2001 in the restricted model when the total ejido area share is substituted and a significant negative effect is found, instead, for 2005-2012. Changing the start date of the third period has no effect on conclusions regarding the ejido effects on state growth.

The Table 4 results indicate, as before, conditional convergence during 1970-1985. Neither convergence nor divergence appears in 1985-2001 except when the parcel ejido measure is replaced with the total measure resulting in a marginally significant positive coefficient on initial GDP per capita hence weak evidence of divergence for the period. However, conclusions regarding conditional convergence for the 2005 to 2012 period change substantially with the different start date. The initial per capita GDP variable has a negative coefficient in all model specifications for 2005 to 2012 in both the full three period and the restricted two period versions. This negative coefficient, indicating conditional convergence, is significant at the 1% level for the most parsimonious specifications, Models II and III in the three-equation system and Models III and IV in the two-equation system. These different results on convergence in the third period of the model may be related to stagnant GDP growth in Mexico from the first quarter 2000 to the third quarter 2003 or they may just reflect the sensitivity of conditional convergence tests to the date of the initial GDP per capita variable.

VI. Conclusions and Extensions

The initial results suggest that the ejido system in Mexico reduced the growth rates of state per capita GDP during the 1970-1985 period. Although this initial finding is not maintained when the model is extended to include more recent data, the extension does suggest that the ejido system reduced growth during 1985 to 2001. The 1992 agrarian reforms relaxed to some extent the constraints on ejido land use but, apparently, restrictions were not sufficient to reduce the inefficiency of the system given the significant, negative impact on economic growth during the 1985-2001 period. Since land transfers from ejido holdings to private uses remained costly and time-consuming, although no longer illegal, after the reforms, the absence of a negative effect of the ejido system in most estimations for the most recent period, whether starting in 2003 or 2005,

may simply indicate that the impact of the reforms in relaxing or removing growth constraints were not realized until the later period.

The issue of measurement of the ejido variable may also affect the results. For the three-equation system we were forced to use the state share of land in ejido parcels as the explanatory variable since the data on total land in ejidos in each state was destroyed in the Mexico City earthquake. Estimations restricted to the two time periods for which the total ejido land share variable is available suggest that the negative impact of the ejido system is significant for the more recent period and not significant during 1985-2001. If so, the legal reforms have done little to remove the inefficiencies associated with the ejido system, contrary to the conclusion suggested by the absence of a significant coefficient when using the ejido parcel variable to capture the effects of the communal property system.

Overall, the results consistently suggest that the ejido system has restricted growth in the Mexican states during some time periods although the results are sensitive to the measurement of the ejido land share variable. These results are consistent with resource misallocation due to incomplete property rights of the ejidatarios but it is impossible to specify whether the misallocation arises because of land use restrictions, financial constraints, or the reluctance of ejidatarios to migrate. The maintenance of a system fraught with inefficiencies suggests a political rationale as outline in Albertus et al. rather than economic reasons for continuation of the system.

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Table 1-Summary statistics for the fraction of state land in ejido system:1981, 1991, 2007. By land type*

	Fraction 1981	Fraction 1991		Fraction 2007	
	parcel	parcel	total	parcel	total
Mean	0.110	0.194	0.551	0.220	0.569
Maximum	0.244 (Veracruz)	0.404 (Colima)	0.858 (Oaxaca)	0.459 (Colima)	0.919 (Oaxaca)
Minimum	0.003 (Baja California Sur)	0.003 (Baja California Sur)	0.313 (Tamaulipas)	0.043 (Baja California Sur)	0.323 (Nuevo Leon)
Range	0.241	0.401	0.545	0.416	0.596
Standard Deviation	0.073	0.116	0.154	0.123	0.163

* The state having the minimum or maximum fraction is shown in parenthesis.
Source: Derived from data available from the Instituto Nacional de Estadística y Geografía (INEGI)

Table 2 Growth, ejido land area, and conditional convergence in Mexico: 1970-1985 and 1985-2001

	Growth 1970-1985		Growth 1985-2001	
Variable	coefficient	t-stat	coefficient	t-stat
Ejido Land as % of State	-0.0443	-2.929	-0.0222	-.840
Log initial GDP per capita	-0.0092	-5.871	0.0667	2.789
Average Schooling	0.1158	8.822	0.1077	2.844
Schooling*Log initial GDP per capita	-0.0131	-9.101	-0.0129	-3.125
Telephones per 100 persons	0.0075	7.517	0.0031	3.529
Federal Investment % of GDP	0.0591	3.863	--	--
State Expenditure Growth	0.1726	7.296	--	--
Agricultural Output % of GDP	0.0744	5.251	-0.1791	-5.229
Manufacturing % of GDP	--	--	-0.0748	-4.242
% Large Firms	0.9032	6.494	0.4447	2.055
Crime Rate	-0.0003	-4.254	0.0002	1.883
Illiteracy Rate	--	--	-0.0693	-1.676
Rural Population	0.0576	5.008	0.0917	3.000
Log Fertility	--	--	0.0384	2.144
Railroads/State size	--	--	0.1493	2.716
Border Dummy*Schooling	-0.0021	-3.348	0.0025	2.340
% with Electricity	0.0897	5.140	0.0908	2.629
R^2	0.9009		0.8151	
Adjusted R^2	0.8310		0.6169	

Table 3 Growth, ejido land area, and conditional convergence in Mexico, 1970-1985, 1985-2001, 2003-2012

		1970-1985		1985-2001		2003-2012	
Model	Variable	Coef.	t statistic	Coef.	t statistic	Coef.	t statistic
I	GDP	-0.0297	-2.0325	0.0234	1.0978	-0.0166	-0.4358
I	Ejido	-0.0143	-0.5893	-0.0451	-2.6678	-0.0126	-0.8607
Adj. R^2		0.5134		0.5205		-0.0571	
II	GDP	-0.0319	-2.2290	0.0239	1.1183	0.0124	1.6758
II	Ejido	-0.0174	-0.7217	-0.0446	-2.6401	-0.0178	-1.3197
Adj. R^2		0.5146		0.5201		0.1854	
III	GDP	-0.0339	-5.0623	0.0227	1.0952	0.0122	1.6528
III	Ejido	-0.0176	-0.7976	-0.0447	-3.2697	-0.0180	-1.3415
Adj. R^2		0.5574		0.5420		0.1862	
Restricted Model							
I	GDP			0.0280	1.3025	-0.0165	-0.4237
I	Ejido			-0.4237	-2.6300	-0.0162	-1.0785
Adj. R^2				0.5294		-0.0395	
II	GDP			0.0283	1.3166	0.0110	1.4436
II	Ejido			-0.0447	-2.6147	-0.0206	-1.4961
Adj. R^2				0.5295		0.1944	
III	GDP			0.0287	1.3660	0.0110	1.4407
III	Ejido			-0.0436	-3.1580	-0.0206	-1.4982
Adj. R^2				0.5528		0.1943	
IV	GDP			0.0404	1.7124	0.0139	2.3675
IV	Ejido			0.0080	0.8171	-0.0184	-2.2568
Adj. R^2				0.4190		0.2596	

GDP refers to the log initial GDP per capita variable. Ejido is the share of land in each state in ejido parcels in Models I, II, and III and total ejido area in Model IV.
Source: Own calculation.

Model I-Model as specified in Chiquiar augmented by the ejido variable and a 2003-2012 specification that includes all explanatory variables and the ejido variable.

Model II-Model as specified in Chiquiar augmented by the ejido variable and a 2003-2012 specification without jointly insignificant explanatory variables and the ejido variable.

Model III- Model including ejido variables without jointly insignificant explanatory variables.

Model IV-Only in the restricted estimation, the parceled ejido variable is replaced with total ejido land area as share of state total. Otherwise the specification is the same as in Model III.

Table 4 Growth, ejido land area, and conditional convergence in Mexico, 1970-1985, 1985-2001, 2003-2012

		1970-1985		1985-2001		2003-2012	
Model	Variable	Coef.	t statistic	Coef.	t statistic	Coef.	t statistic
I	GDP	-0.0310	-2.0791	0.0222	1.0420	-0.0562	-1.3952
I	Ejido	-0.0226	0.9198	-0.0460	-2.7369	-0.0106	-0.6982
Adj. R^2		0.5241		0.5182		0.3250	
II	GDP	-0.0315	-2.1304	0.0230	1.0859	-0.0425	-4.8289
II	Ejido	-0.0226	-0.9225	-0.0459	-2.7323	-0.0129	-0.9254
Adj. R^2		0.5233		0.5184		0.4494	
III	GDP	-0.0351	-5.0637	0.0214	1.0395	-0.0425	-4.8269
III	Ejido	-0.0224	-0.9989	-0.0466	-3.4267	-0.0134	-0.9571
Adj. R^2		0.5651		0.5405		0.4498	
Restricted Model							
I	GDP			0.0274	1.2782	-0.0550	-1.3566
I	Ejido			-0.0453	-2.6667	-0.0121	-0.7903
Adj. R^2				0.5276		0.3278	
II	GDP			0.0277	1.2940	-0.0486	-1.5216
II	Ejido			-0.0455	-2.6752	-0.0137	-0.9200
Adj. R^2				0.5279		0.4244	
III	GDP			0.0283	1.3551	-0.0429	-4.8425
III	Ejido			-0.0448	-3.2609	-0.0146	-1.0381
Adj. R^2				0.5513		0.4516	
IV	GDP			0.0405	1.7234	-0.0357	-4.2269
IV	Ejido			0.0081	0.8352	-0.0176	-2.2718
Adj. R^2				0.4181		0.5094	

GDP refers to the log initial GDP per capita variable. Ejido is the share of land in each state in ejido parcels in Models I, II, and III and total ejido area in Model IV.
Source: Own calculation.

APPENDIX

Table A-Average annual growth rates of per capita GDP, Mexico and states 1940-2012 and subperiods

	1940 to 1970	1970 to 2001	1940 to 2001	2003 to 2012
National	0.0325	0.0142	0.0232	0.0147
State				
Aguascalientes	0.0232	0.0281	0.0257	0.0237
Baja California	-0.0027	0.0091	0.0033	0.0037
Baja California Sur	0.0447	0.0113	0.0277	0.0180
Campeche	0.0311	0.0347	0.0329	-0.0557
Coahuila	0.0241	0.0167	0.0204	0.0179
Colima	0.0188	0.0176	0.0182	0.0101
Chiapas	0.0403	0.0095	0.0246	0.0019
Chihuahua	0.0275	0.0243	0.0259	0.0141
Distrito Federal	0.0104	0.0233	0.0170	0.0291
Durango	0.0100	0.0200	0.0151	0.0081
Guanajuato	0.0454	0.0130	0.0290	0.0219
Guerrero	0.0477	0.0145	0.0308	0.0149
Hidalgo	0.0350	0.0179	0.0263	0.0127
Jalisco	0.0492	0.0127	0.0307	0.0157
México	0.0595	0.0043	0.0315	0.0152
Michoacán	0.0446	0.0168	0.0305	0.0136
Morelos	0.0329	0.0169	0.0248	0.0132
Nayarit	0.0376	0.0077	0.0224	0.0134
Nuevo León	0.0320	0.0155	0.0236	0.0263
Oaxaca	0.0505	0.0202	0.0351	0.0134
Puebla	0.0469	0.0155	0.0309	0.0222
Querétaro	0.0208	0.0283	0.0246	0.0327
Quintana Roo	0.0086	0.0280	0.0185	0.0126
San Luis Potosí	0.0344	0.0214	0.0278	0.0277
Sinaloa	0.0324	0.0095	0.0208	0.0135
Sonora	0.0343	0.0106	0.0222	0.0231
Tabasco	0.0363	0.0084	0.0221	0.0337
Tamaulipas	0.0198	0.0140	0.0169	0.0091
Tlaxcala	0.0339	0.0208	0.0272	0.0045
Veracruz	0.0292	0.0033	0.0160	0.0249
Yucatan	0.0175	0.0179	0.0177	0.0196
Zacatecas	0.0380	0.0173	0.0274	0.0383

Source: Growth rates for the 1940-2001 period are calculated from data in Carrion-i-Silvestre and German-Soto (2007). The growth rates in the last column are calculated from INEGI data.

Table B-Fraction of state land in ejido system: 1981, 1991, 2007. By land type

State	Fraction 1981	Fraction 1991		Fraction 2007	
	Parcel	Parcel	Total	Parcel	Total
Aguascalientes	0.1588	0.1819	0.4828	0.2327	0.4924
Baja California	0.0511	0.0698	0.8240	0.3498	0.8308
Baja California Sur	0.0030	0.0031	0.7272	0.0432	0.6886
Coahuila	0.0252	0.0206	0.4678	0.1040	0.4295
Colima	0.2125	0.4042	0.5940	0.4593	0.6043
Chiapas	0.1687	0.3112	0.5548	0.3368	0.6059
Chihuahua	0.0301	0.0348	0.4000	0.0499	0.4193
Distrito Federal	0.0218	0.0916	0.3977	0.0681	0.3823
Durango	0.0390	0.0765	0.6817	0.0669	0.6668
Guanajuato	0.1784	0.2355	0.4318	0.2227	0.4338
Guerrero	0.1506	0.2671	0.7179	0.3209	0.7869
Hidalgo	0.1341	0.2463	0.5132	0.2460	0.5124
Jalisco	0.0776	0.2236	0.4003	0.1632	0.4296
México	0.1478	0.3080	0.5156	0.3540	0.6460
Michoacán	0.1243	0.2506	0.4694	0.2514	0.5195
Morelos	0.2318	0.3589	0.7838	0.4202	0.8104
Nayarit	0.2276	0.2532	0.7909	0.2935	0.8039
Nuevo León	0.0178	0.0378	0.3431	0.0869	0.3232
Oaxaca	0.1118	0.2865	0.8582	0.3168	0.9192
Puebla	0.1226	0.2067	0.4404	0.2073	0.4756
Querétaro	0.0894	0.1497	0.5173	0.1617	0.4993
Quintana Roo	0.0425	0.1524	0.6593	0.0601	0.6814
San Luis Potosí	0.0925	0.1648	0.6857	0.1988	0.6878
Sinaloa	0.1539	0.2918	0.6532	0.3128	0.7244
Sonora	0.0206	0.0423	0.3325	0.0656	0.3535
Tamaulipas	0.0666	0.1311	0.3126	0.1788	0.3309
Tlaxcala	0.2150	0.3810	0.4882	0.3827	0.5064
Veracruz	0.2441	0.3577	0.4096	0.3669	0.4193
Yucatan	0.0444	0.1547	0.5684	0.1408	0.5836
Zacatecas	0.0963	0.1233	0.4946	0.1527	0.5056
Campeche	0.0491	0.1310	0.6026	0.1424	0.5508
Tabasco	0.1399	0.3368	0.4534	0.3530	0.4478

Source: Calculated from data developed by INEGI.