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Land Reform and Violence: Evidence from Mexico*

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Abstract

We document the connection between land reform and violent crime in Mexico using the counter-reform (the transformation of *ejido* land into private property) carried out in 1992. Using data at a municipality level, we exploit the fact that municipalities have different exposure to the reform. We report a significant impact of the land reform on the number of murders: In those municipalities with a higher proportion of social land, and therefore more exposure to the land reform, the number of murders decreased more than in those municipalities less exposed to the land reform. Our results suggest that clearly specified and consistently enforced land rights reduce gains from violence, therefore leading to lower levels of violence as measured by the number of murders.

Keywords: Agrarian reform; murders; property rights.
JEL classification: N16; K42.

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1. Introduction

As land continues to be the main source of subsistence in the world, how that land is distributed and owned has the potential to incite or deter different forms of confrontation. Hostility can take place in the form of civil conflict between peasants demanding redistribution and authorities refusing to grant it, a particularly visible form of land-related conflict that has been ubiquitous in the last century (Prosterman and Riedinger, 1987). A sometimes less observable, but arguably more pervasive form of confrontation, however, emerges between individuals or groups over how rights of ownership or utilization are defined, and how effectively they are protected. Alston et al. (1999) have shown, for example, how ill-defined property rights within Brazilian law have contributed to conflict between landowners and squatters. This type of underlying conflict has, of course, the potential to escalate to more serious forms of violence. Bandiera (2003) has convincingly argued, for instance, that the lack of proper enforcement of land rights by the state played a crucial role in the rise of the mafia in 19th century Sicily. But violence not need be channeled only through organized crime, and it is indeed plausible that different land tenure systems lead to extreme forms of violent crime, such as murders. On the one hand, very unequal distribution of land or poorly enforced rights could generate serious, easily intensified tensions. On the other, certain tenure systems could lead to land being less productive or more vulnerable to shocks, and these later effects could trigger acts of violence. Since much of the literature on sources of violence has traditionally had an urban bias (Villareal, 2004), and that on land conflict has focused on its impact on economic variables such as productivity, investment, or resources use (Deininger and Castagnini, 2006), this link between land tenure and violent crime has been somewhat understudied.

Here we document empirically the connection between land tenure and murders

for Mexico, using the counter-reform carried out in 1992. The counter-reform started a certification program providing titles of former *ejidos* (social land) to individuals, arguably defining better property rights over land and making those rights more easily enforceable. Some Mexican thinkers noted that the substantial decline in homicides during the 1990s and early 2000s coincided with agrarian reform, and they hypothesised that there was likely a link (Escalante Gonzalbo, 2009) but never actually tested it empirically. Villareal (2004) tried to look at this quantitatively, examining the correlation between *ejidal* land and murders for a cross-section of a sample of municipalities and indeed found a positive relationship. More recently Garfias and Kronick (2013) have taken a different approach by using a panel of the staged roll-out of the certification program, finding that the connection does not really exist.

Using data at a municipality level, we exploit the fact that municipalities had different exposure to the reform and find a significant impact of it on homicides: in those municipalities with a higher proportion of social land, and thus more exposure to the land reform, the number of murders decreased more than in those less exposed to the reform. Thus, our results suggest that clearly specified and consistently enforced land rights reduce gains from violence, therefore leading to lower levels of violence as measured by the number of murders.

2. Land Reform in Mexico

Of the major land reforms carried out in recent history, the first agrarian reform in Mexico is arguably one of the most transcendental. It involved the entire country, and from 1917 to 1992 redistributed more than 50% of all arable land (about 103 million hectares) from large farms to the "social sector", about 32,000 agrarian communities of nearly 3.5 million families (de Janvry et al., 2011). The details of this reform have been

described extensively in the literature (see for example Sanderson, 1984), so here we simply summarise some of its most relevant features.

The immediate trigger of the reform was the revolution against the *Porfiriato*. The policies promoted by the regime of Porfirio Diaz (1876-1910), in tandem with the legacies of the Spanish occupation in land tenure law, are traditionally deemed responsible for the social and economic turmoil that led to the peasant uprising of 1910. The late *Porfiriato* Mexico was an increasingly open economy. Foreign investment flourished and exports (especially cash crops) grew rapidly. Dependence on those exports also mounted. Previously self-sufficient farmers relied on the external sector for their living and—while population increased—land was consolidated rapidly, leading to the displacement of a rising number of unskilled workers from the villages. Drought and crop failure, coupled with booming food prices and large-scale foreign ventures, fractionalised the labour market and, through increased poverty and inequality, ultimately triggered a crisis at the turn of the century fuelling the 1910 revolution led by Madero, Villa, and Zapata (see Dell, 2012).

The revolutionary government legislated land reform in 1914 and protected it in the 1917 Constitution, where article 27 prescribed the "right of eminent domain" over all land and water within the nation. The State, acting in the public interest, was the agent responsible for returning and redistributing land to villages that could prove they had been deprived of it, and to newly formed centres. The article recognised the establishment of *ejidos*—rural clusters of households modelled as a mix of soviet collectives and pre-colonial indigenous social structures (Deininger and Bresciani, 2002). The *ejido* was conceived of both as the unit of production of rural Mexico and as a means of political representation. Specific legal codes regulated all aspects of production, rights, and obligations of the *ejidatarios*. In particular, *ejidatarios* had to

work on the land directly and continuously, and could not rent it or enter into contracts for sharecropping, sale, or mortgage. They participated in the governance by establishing their heirs and voting through the *comisariado ejidal* on the rules defining access to communal land. Also, they all had an urban estate to reside in and a minimum of 20 hectares for their own direct cultivation. Access to land could be obtained via several channels. Indigenous communities could legally claim it as a right (*restitución*), residents in settlements within a certain radius of available land could request it as a *dotación*, those willing to relocate could acquire land upon creation of new centres (*nuevos centros*), and existing *ejidos* could gain an extension of land to incorporate new members (*ampliación*).

The state intervened in the life of *ejidatarios* in a variety of ways. Firstly, by controlling all public resources flowing to *ejidos*, government banks being the only source of credit at least until the 1970s. All members who received financing were contractors and liable, but credit was assigned to the entity of the *ejido* and owed to enterprises affiliated with the state. Secondly, although internal decision-making took place mainly in the *asamblea ejidal*, the presence of the *Secretaría de la Reforma Agraria* was required for all acts to be valid. Thirdly, all family claims within the *ejido*, conflicts among *ejidos*, and disputes of *ejidos* with private owners or indigenous communities had to be cleared in state administrative tribunals. Lastly, until the mid 1980s, access to public goods and services required *ejidatarios* to be members of the CNC (*Confederación Nacional Campesina*), which was in turn affiliated with the PRI, the governing party (Gordillo de Anda et al., 1994, p. 17). This strong State presence led to new ways of defying the law. *Ejidatarios*, for example, established a vivid secondary market for sale, rent, and tenancy to accommodate the need for liquidity or the necessity to migrate. Legal ambiguities were used to sell and rent while maintaining

the land within the competence of the same *ejido* (Gordillo de Anda et al., 1994, p. 20).

Ejidos tended to differ from one another, as they varied in natural resources, membership composition, and efforts for land appropriation (Gordillo de Anda et al., 1994, p. 13). An *ejido* embraced roughly 95 *ejidatarios*, but could host up to, on average, 80 or 85 *avecindados* (new inhabitants who worked the land but could not acquire it) (Gordillo de Anda et al., 1994, p. 170). *Ejidos* also differed in the amount of internal regulation; a survey by Gordillo de Anda et al. (1994) showed that only about 55% of the *ejidos* possessed internal rules (mostly concerning agriculture), and about 30% had laid down rules in accordance with the *Ley Agraria*. The analysis also highlighted that about 40% of respondents declared having pending legal disputes regarding the boundaries of the territory. In the case of communal land (forests and pasture) these happened mostly with people external to the *ejido*. These conflicts seemed accentuated in the South Pacific region, the indigenous communities (where land could always be donated, as stated above), and in the most ancient *ejidos*. As far as equality of land allocation is concerned, there seems to be a clear geographical pattern: in the Center and North, where *ejidos* are most ancient and there is a *mestizo* majority, *ejidatarios* enjoy a roughly egalitarian distribution "within-*ejido*", while there is high "across-*ejido*" inequality; the opposite is true for the South Pacific and regions with indigenous predominance (Gordillo de Anda et al., 1994, p. 187).

Since 1917, many legal interventions have redefined the right to land, by expanding eligibility, grant size, and type of tenure. The initial trend in the reform was to make concessions to regions where peasants were most powerful (the centre-East, where Zapatistas dominated); also, since small communities (under 50 families) and (initially) haciendas with resident workers were ineligible, the North, Pacific North, and Gulf regions were in large part excluded. It was the Cardenas era (1934-1940) that saw

the most extensive redistribution phase. The 1934 Agrarian Code accelerated the process significantly: it determined an increase in land available for expropriation by imposing a maximum size on exempt single farm plots. Then, in 1940, there was a significant change in the redistribution wave. After the Cardenas presidency ended, leaders started focusing on private farms and stopped new land distributions, thus producing a stalemate period for land reform policies. In the early 1970s, since the government was now focused on empowering the private sector (especially large commercial farms) and helping industrial development, a new modification along these lines was enacted. Under the 1971 Agrarian Reform Law there were new limitations on the possibilities for expropriation on the land of cattle farmers and commercial crop producers. The Lopez Portillo administration (1976-1982) continued this trend, instead of intervening in the *ejido*, encouraging interaction between *ejidos* and with small landowners.

Scholars evaluating the first wave of agricultural reform see in the shortcomings of the *ejido* model of production the main cause for its ultimate failure. Deininger and Bresciani (2002), for example, point out what both the private and the social sectors had to lose from this. A continuing mandate for re-assignment of private land ended up undermining the enforcement of property rights and any possible investment outside the *ejido* sector, while State interference threatened the social sector governance and property rights from within. Property rights were largely incomplete (de Janvry et al., 2011). This was coupled with legal uncertainty around communal land, which led to illegal appropriations and social segregation, and there were a variety of disputes among its members, with the *avecindados* and within the families (Gordillo de Anda et al., 1994, p. 2).

Towards the end of 1991 the crisis in the agricultural sector had become

unmanageable. Rural development relying on the ubiquitous presence of the government had shown its inefficiencies, which stemmed mainly from the cost of subsidies to the agricultural sector. This form of support was channelled both to the *ejidos* and the private sector, but in the former case it served as political tool while in the latter it helped boost production for import substitution. From this backdrop, social movements could converge with the wave of privatization and liberalization of the 1990s. The trade reforms opened the market to international competition by reducing State interference and cutting price subsidies. Liberalization came with high inflation and an overvalued exchange rate, and the high interest rate paralyzed access to credit markets and investment, leaving producers unable to adapt to the new setup. These measures exacerbated disparities in endowments and access to productive assets. A common complaint, for example, is that many elderly living in ancient *ejidos* were unable to exploit the land properly, while young families and communities in the adjacent territories would suffer from land shortage. Urban expansion was staggering, as land transfers within *ejidos* were significantly restricted. Investment in the *ejido* sector was lacking. De Janvry et al. (2011) also report the tendency of powerful leaders to appropriate common property resources and use them as a means of patronage.

The government of Carlos Salinas de Grotari (1988-1994) intervened with a series of long-debated reforms that consisted of modifications of the legal and institutional framework, a package of regional policies, and the implementation of PROCEDE (*Programa de Certificación de Tierras Ejidales y de Titulación de Parcelas Urbanas*), a systematic land regularization for the social sector (Deininger and Bresciani, 2002). Article 27 of the Constitution was re-edited, allowing for the conversion of *ejido* land into private property. This juridical intervention formally allowed for the beginning of the land distribution phase. Land concentration in large estates was still prohibited, and

ejido property could go under three arrangements: *parcelada*, *común* (communal), and *para asentamientos humanos* (for human settlement). The reform dismantled the model of political control and unleashed the productive potential of the *ejido* by finally creating a land market (Gordillo de Anda et al., 1994, p. 25). It was based on three pillars. First, it strengthened the self-governance of the *ejido* and allowed *ejidatarios* to choose the property regime most efficient and suitable to their needs. Secondly, it eliminated rental restrictions, thus significantly limiting the scope for an illegal secondary market responsible for conflicts and uncertainty over the land. Thirdly, it reduced the discretionary influence of the executive over the *ejido* by eliminating the President's power to grant lands.

The reform injected the *ejido* with dynamism and means for self-governance. *Ejidatarios* enjoyed the right to rent, sell, sharecrop, or mortgage their plots within the *ejido*. They were also provided with a mechanism through which they could vote to turn all or part of the *ejido* into full private property (*dominio pleno* or land title), thus allowing for sales to non-*ejidatarios*. The large-scale regularization introduced by the PROCEDE, intended to certify existing rights and issue legal documentation to individual land labourers, enabled regular market transactions to take place (de Janvry et al. 2011). Institutions also changed in the new legal framework. The *Procuradoria Agraria* was created to implement the new legal framework, mediate disputes, and execute the PROCEDE. A tribunal for agrarian matters, the *Tribunal Superior Agrario*, was also established to resolve all claims over land tenure and apply the law in concomitance with local tribunals. Moreover, the *Registro Nacional Agrario* was opened to issue titles and certificates of *ejido* land, and register all social organizations. The *Comisariado Ejidal* progressively lost importance, in favour of the *Asamblea* as the main authority in the *ejido*. Access to credit was also largely expanded, albeit in scope

but not in size, following the first years of the reform. Pronasol and Banrural, two government institutions, were the most common programs, allowing approximately 30% of *ejido* families to obtain financial support for the first time (Gordillo de Anda et al., 1994, p. 119). Long run investment was nonetheless scarce, as most of the liquidity flowed into current expenses, hindering future autonomous development. Informal credit was not largely used, except for insurance purposes.

A series of scholars have used survey-based methods to analyse the impact of the reform and its programs. Deininger and Bresciani, for example, use a 1994-97 survey on PROCEDE. They find that PROCEDE not only produced a positive economic return, but also had a significant effect on equity, conflict resolution, governance, and transparency. Respondents perceived (in good majority) a reduced number of conflicts and an increase in social unity within the *ejido*. The study suggests that PROCEDE has laid the groundwork for a better-functioning rural market, in particular for land rental, as there was no massive land sale following its implementation. The program was less likely to be implemented in large *ejidos* with high inequality of land access, agriculturally marginal areas (i.e., those heavily reliant on natural resources), and periurban regions. Illiteracy and economic backwardness are also obstacles to the progression of the PROCEDE, but there is no evidence of a significant influence of the indigenous component on program participation (Deininger and Bresciani, 2002).

Either because it defined land rights more clearly, made those rights easier to enforce, or generated avenues to improve productivity and overall income, there are reasons to believe the reform had an impact on violence. Timing is one of them. Looking at the long-term evolution of homicides (Figure 1), there was a drastic change in the trend around the year of the counter-reform that reverted only towards the late 2000s, most likely driven by murders of a very different nature than those taking place

before, a fact with which most Mexican specialists agree (e.g., Escalante Gonzalbo, 2011). By providing a clearer institutional framework, the reform also likely gave the government tools to deal with potential sources of conflict. Table 1 provides some evidence in this respect. It reports the correlation between the proportion of social land and an index of governability constructed by the *Observatorio de Desarrollo Regional y Promoción Social*, a Mexican NGO dedicated to understanding governance and development in Mexico. The observed correlation is negative and statistically significant, indicating that more social land is associated with lower governability. The coefficient of interest remains significant when we cluster standard errors at the state level (38 states). The coefficient is smaller but remains significant when controlling for municipality surface, municipality population, and an indicator variable for aborigines' municipalities. It is difficult, however, to infer causality in this type of cross-sectional analysis. The usual way to address potential omitted variable biases is to use panel data and follow a difference-in-differences strategy. However, there is only cross sectional data for the governability index. Fortunately, there is panel information at the municipality level for murders, and therefore we can follow a difference-in-differences strategy in order to try to address the causal relationship between social land and murders. This is developed in the following section.

3. Data, econometric model, and results

We use yearly data (1990-2008) at a municipality level (N = 2,453). We constructed a dummy variable (Land Reform) that takes the value 1 for observations after 1992. The proportion of total land that is socially owned (Percentage of Social Land) was provided by the *Procuraduría Agraria*. Our measure of violence is the total number of homicides (Murders). The dataset (gathered by *Instituto Nacional de*

Estadística y Geografía, INEGI) also includes information on number of accidents (Accidents), suicides (Suicides), and unclassified non-natural deaths (Unclassified), in all cases per 100,000 inhabitants. Summary statistics are reported in Table 2.

We are interested in identifying the causal impact of the land reform in Mexico on Murders. A usual approach to deal with non-experimental data is to estimate a difference-in-differences model. The problem in our application is that the land reform was countrywide and happened in all municipalities at the same time. Different municipalities, however, had different proportions of social land, and therefore they may have had different exposure to the reform (e.g., the reform had no impact on a municipality without any social land). That is, our strategy is to exploit the variability in the proportions of social land previous to the land reform to identify the causal impact of the land reform on the number of murders. Formally, we estimate the following equation:

$$\text{Murders}_{it} = \beta\,(\text{Land Reform}_t \times \text{Percentage of Social Land}_i) + \alpha_i + \mu_t + \varepsilon_{it}$$

where β is the parameter of interest capturing the interaction effect between the land reform (that has time-series variability) and the proportion of social land in the municipality (that has cross-section variability), α_i is a time-invariant municipality effect, μ_t is a time-period effect common to all municipalities, and ε_{it} is the error term.

Column (1) of Table 3 reports our main estimates, indicating a significant impact of the land reform on the number of murders: In those municipalities with a higher proportion of social land, and therefore more exposure to the land reform, the number of murders decreased more than in those municipalities less exposed to the land reform. Indeed, the coefficient is not only statistically significant but also quantitatively

substantial. An increase of one standard deviation in the percentage of social land is associated with a decrease of 2.3 murders per 100,000 inhabitants (the average number of murders per 100,000 inhabitants is 17).

As observed in Figure 1, since 2007 there has been a notable increase in the number of homicides. As mentioned above, this increase in homicides is of a very different nature, since it is mainly related to a sharp increase in drug cartels. Thus, in column (2) of Table 3 we show that results are robust when restricting the sample to the period from 1990 to 2006.

In the difference-in-differences model it is not necessary to control explicitly for time invariant municipality characteristics. This approach, however, does not control for time-varying unobserved heterogeneity. Given that we do not have covariates with variability across municipalities and time, in order to check whether there is spurious correlation between time-varying unobserved heterogeneity and land reform, we run a series of false experiments. Table 4 shows that the land reform is not correlated with the number of suicides or of unclassified non-natural deaths. There is a correlation, however, between the land reform and the number of accidents, but this correlation is weaker than the one reported for murders and not always statistically significant. That is, the false experiments provide additional evidence that the relationship is causal and it is not arising spuriously.

To further address the causal relationship between land reform and homicides, in columns (3) and (4) of Table 3 we include the triple interaction between proportion of social land, the dummy reform, and percentage of rural population. Conditional on the proportion of *ejidal* land, we expect to have a higher impact of the reform in those municipalities with a higher proportion of rural population (since the reform is affecting a larger share of the municipality population). Thus, we expect the coefficient on the

triple interaction to be negative. As observed in columns (3) and (4), this is exactly what we find.

Finally, we explore a mechanism that could be behind our findings, namely that the decrease in conflict (as measured by the number of murders) is due to an increase in farm production. To do so, we explore the impact of the counter reform on three variables available in our database: Sown, Harvest, and Volume. These data are available at the state level (Mexico has 38 states) for the period from 1980 to 2012. As reported in Table 5, in those states with a higher proportion of social land, and therefore more exposure to the land reform, land production (as measured by Sown, Harvest, and Volume) increased more than in those states less exposed to the land reform.

4. Conclusion and discussion

We study the connection between land reform and violent crime in Mexico using the counter-reform carried out in 1992. In a nutshell, the counter-reform involved the transformation of *ejido* land into private property. We find that in those municipalities with a higher proportion of social land prior to 1992, and therefore more exposure to the land reform, the number of murders decreased more than in those municipalities less exposed to the land reform. Given that it is probably unlikely that the reform *itself* may have lowered the level of conflict, the negative relationship between social land and violence points to the actual nature of the reform (the alteration of the land tenure system) as the source of this change.

Our results are important because they provide empirical evidence of a long-run theoretical debate. In theory the effect of land titling is *a priori* ambiguous (Garfias and Kronick, 2013): On one hand, clearly specified and consistently enforced land rights should reduce gains from violence leading, therefore, to lower conflict; on the other

hand, the transition from one land rights regime to another may induce violence. Our results suggest it is the former of these effects that dominates.

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Table 1. Correlation between percentage of social land and governability

	Index of governability	
	(1)	(2)
Percentage of Social Land	-0.046	-0.026
	(0.014)***	(0.010)***
	[0.015]***	[0.015]*
Controls	No	Yes
Observations	2,323	2,323

Notes: Robust standard errors are in parentheses. Standard errors clustered at state level are in brackets (38 states). All models are estimated by OLS. The controls are municipality surface, municipality population, and an indicator variable that takes the value of 1 for municipalities that are mainly aborigine. ***Significant at the 1% level. *Significant at the 10% level.

Table 2. Summary statistics

	Mean	Standard deviation	Unit of observation	Years
Percentage of Social Land	51.55	31.33	Municipality	1990-2008
Murders (per 100,000 inhabitants)	17.18	34.15	Municipality	1990-2008
Accidents (per 100,000 inhabitants)	44.00	45.56	Municipality	1990-2008
Suicides (per 100,000 inhabitants)	3.47	9.45	Municipality	1990-2008
Unclassified (per 100,000 inhabitants)	2.43	8.33	Municipality	1990-2008
Percentage of Rural Population	66.06	34.40	Municipality	1990-2008
Governability index	0.585	0.143	Municipality	2008
Sown (in hectares)	9,526	53,863	State	1980-2012
Harvest (in hectares)	8,548	49,787	State	1980-2012
Volume (in tons)	165,708	3,376,621	State	1980-2012

Sources: See text.

Table 3. Main results

	Murders			
	(1)	(2)	(3)	(4)
Land Reform x	-0.073	-0.065	-0.028	-0.022
Percentage of Social Land	(0.023)***	(0.023)***	(0.024)	(0.019)
	[0.024]***	[0.023]***	[0.020]	[0.020]
Land Reform x			-0.0007	-0.0007
Percentage of Social Land x			(0.0003)**	(0.0003)**
Percentage of Rural Population			[0.0003]**	[0.0003]**
Period	1990-2008	1990-2006	1990-2008	1990-2006
Observations	40,113	35,827	39,159	34,990

Notes: Standard errors clustered at the municipality level are in parentheses. Standard errors clustered at state level are in brackets. All models are estimated by OLS and include municipality and year dummies. ***Significant at the 1% level. **Significant at the 5% level.

Table 4. False experiments

	Accidents	Suicides	Unclassified
	(1)	(2)	(3)
Land Reform x	0.047	0.001	0.001
Percentage of Social Land	(0.021)**	(0.005)	(0.004)
	[0.033]	[0.002]	[0.003]
Period	1990-2008	1990-2008	1990-2008
Observations	40,113	40,113	40,113

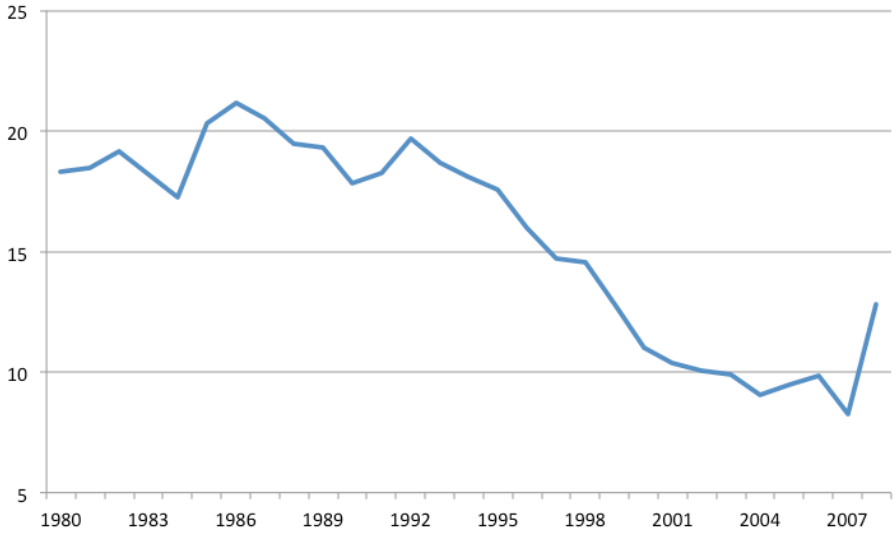
Notes: Standard errors clustered at the municipality level are in parentheses. Standard errors clustered at state level are in brackets. All models are estimated by OLS and include municipality and year dummies. **Significant at the 5% level.

Table 5. Production

	Harvest	Sown	Volume
	(1)	(2)	(3)
Land Reform x	5,569	5,417	101,001
Percentage of Social Land	(2,807)**	(3,020)*	(41,229)**
	[3,737]	[3,703]	[3,737]
Period	1980-2012	1980-2012	1980-2012
Observations	32,782	32,782	32,788

Notes: Robust standard errors are in parentheses. Standard errors clustered at state level are in brackets. All models are estimated by OLS and include dummies for crop, state, and year. **Significant at the 5% level. *Significant at the 10% level.

Figure 1. Murder rates in Mexico



Source: INEGI.