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REGIONAL DEVELOPMENT

Land Regularization in Tijuana, Mexico

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January 2008

UNIVERSITY OF CALIFORNIA

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Abstract

Land titling programs are increasingly encouraged by international organizations as an essential component of urban policy in developing countries. The clear definition of property rights is argued to be a *sine qua non* of economic development. However, most academic research on land titles has focused on the impacts of land titles and there is a dearth of analysis of the demand for land titling and the structure of land titling programs. A better understanding of land titling programs is essential for the policy to succeed in improving the lives of people living in informally developed neighborhoods.

This paper presents a model of demand for land regularization in Tijuana, Baja California, Mexico. The model adapts previous work on land registration in agricultural areas to regularization in urban areas, incorporating insights on the different sources of value for urban land and titles in urban areas, as well as the characteristics of the regularization process in Mexico. An empirical test of the determinants of success in land titling is conducted using administrative and spatial data from 140 irregularly developed neighborhoods where regularization agencies are active. The prediction of previous models—that there should be more land titling for land that is valuable—does not hold. The results demonstrate inefficiency in the land titling system of Tijuana, inefficiency that is possibly explained by governmental opportunism.

Land Regularization in Tijuana, Mexico

Paavo Monkkonen

I. Introduction

While the importance of property rights to land for urban development has been recognized for most of the 20th century, the work of Peruvian economist Hernando De Soto (2000) galvanized the international development community into placing a high priority on land titling programs for urban policy in developing countries. Thus, understanding the dynamics of land regularization and titling programs and the demand for land titles should be increasingly important. Mexico provides an exemplary case study, as a significant proportion of its urban areas were developed irregularly and it has a long-standing regularization and titling program. The present paper explores land regularization programs in the city of Tijuana, Baja California, Mexico.

In order to understand the empirical evidence on the success of land titling programs and the theoretical models of demand for land titles, it is necessary to focus on the transaction between the government agency and the resident. Using the lens of transaction-cost economics to analyze land titling is beneficial because of its emphasis on the opportunism of actors in the governance of contracts, contractual incompleteness and flawed, second-best organization. Additionally, the four levels of social analysis outlined by Williamson (2000) provide a useful framework for the analysis of this transaction. Separating the formal rules governing the transaction from the actual workings of the "play of the game" reveals insight about contracting problems. For example, in the case of land regularization in Tijuana, potential for governmental opportunism is created by the variability in the fees charged and the minimal monitoring of agencies by politicians.

To date, no model of demand for land regularization in urban areas has been developed. Thus, in this paper, models of demand for land *registration* of agricultural land in Brazil and Kenya, developed by Alston, Libecap and Mueller (1999) and Miceli, Sirmans and Kieyah (2001), respectively, are adapted to the demand for land *regularization* of urban land in Tijuana, Baja California, Mexico.[1] The two central predictions of existing models—that the value of land titles increases with the value of

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[1] Regularization differs from registration in that is requires more technical work, such as taking land surveys and creating parcel maps.

the land, and that the characteristics of residents are important—will be determinants of the extent of land registration observed.

While the basic drivers of the demand for regularization are similar to those for land registration, the regularization process is more complicated and fees are generally levied on the lot holders. Additionally, there are important differences in the sources of value for agricultural and urban land. These differences lead to distinct predictions for the model developed in this paper as compared to previous efforts. The main contribution of the model is its consideration of programmatic features of regularization, which is important because cost recovery is generally emphasized in urban upgrading programs and results in significant impacts on demand. Moreover, in the case of Tijuana, variability in regularization fees creates opportunity for governmental opportunism. In Mexico, lots in irregularly developed neighborhoods are regularized through a contract between residents and a government agency. Residents must agree to pay a fee for regularization proceedings, and these fees fund the agency operations. Agency discretion over its funding source gives incentive and opportunity to extract rents.

A test of a basic prediction of the model, using data from Tijuana, produces results that contradict the basic theoretical predictions of previous models and suggest the possibility of rent-seeking behavior on the part of government agencies. There is a negative relationship between the amount of land regularization in a neighborhood and indicators of the value of the land in that neighborhood, controlling for a variety of other factors. However, the result does not fully test the model because of a lack of data and thus has some potential for bias. Nevertheless, it is a provocative indicator of inefficiency in the regularization system and perhaps opportunism on the part of government agencies.

The paper is organized as follows. The following section reviews the literature on the demand for land titles. Section three presents an overview of the land regularization process in Mexico and the land regularization institutions in Tijuana. Section four reviews previous theory and presents a model of the demand for land regularization for Tijuana. Section five provides evidence on the success of land regularization agencies and conducts a partial test of the model with data from 140 irregularly developed neighborhoods in Tijuana. The paper concludes with a summary and directions for further research.

II. Research on the Value and Demand for Land Titles and Land Titling Programs

In the international development community, property rights to land have been an important topic for research during the past several decades. Early academic work in this area focused on estimating the value premium associated with legal title for plots of land. Studies in Indonesia and Jakarta found high coefficients on a dummy variable for land title in hedonic models of land value (Friedman et al., 1988; Dowall, 1991). Recently, however, a more nuanced understanding has emerged of the effects of different forms of property rights claims on the value of land. For example, research in Ecuador demonstrated that informal property claims also have a significant value premium (Lanjouw and Levy, 2002). In the case of Ho Chi Minh city, where a full-scale formal property market has yet to emerge after decades of government control, a combination of informal claims and legal title actually has a higher premium than legal title alone (Kim, 2004).

In addition to the value premium associated with land titles, recent academic work has examined the impacts of holding a land title on the various benefits ascribed to the formalization of property rights. In a natural experiment of squatters in Buenos Aires, Galiani and Schargrodsky (2007) found that land titles led to several hypothesized effects, such as increased investments in housing, reduced household size, and improved education of children. They did not find that titles led to increased credit access or labor income, as did an analysis of the effects of the COFOPRI land titling program in Peru, where Field (2003) found that titling increased labor hours, especially work away from the home. The discrepancies in this research suggest that the benefits of land titles depend on context; for example, access to credit will not increase if banks do not accept houses as collateral for loans or if people will not access formal credit sources.

While the understanding of the benefits of titles deepens, research on titling programs is still relatively new. The renowned COFOPRI program in Peru assigned titles without charging lot holders; however, in most countries, this will not be the nature of policy. Cost recovery mandates will mean that some of the cost of the technical and administrative work of titling, as well as some compensation for the original landowner in the case of squatting, will be passed on to the recipients of titles. In addition, in the case of illegal squatting rather than illegal subdivisions, some compensation for the original landowner might be charged to the residents before they are given titles, as occurs in Mexico.

Thus, an increasingly important component of research on titling and regularization programs is a more complete understanding of the demand for land titles. Recently, scholars have begun to focus their attention on this question; however, the two existing models focus on frontier and agricultural land exclusively. Alston, Libecap and Mueller (1999) develop and test a framework for analyzing property rights on the Brazilian Amazon frontier, and Miceli, Sirmans and Kieyah (2001) develop and test a model of the probability of the registration of agricultural land in Kenya. These models will be reviewed more completely in section four.

Existing literature has not made a distinction between land titling programs in agricultural areas and urban areas. This is surprising given that land titles should be more important in urban areas than in agricultural areas. Competition for land is greater in urban areas, and market transactions that depend on the transferability and security of titles—sales, loans, rentals and inheritance—are more common. Fixed capital investment in urban areas is much larger than in rural areas. Investment in land as a savings mechanism is also common, which makes security from squatting more important. Additionally, the determinants of land values in urban areas are different. In the model of Alston, Libecap and Mueller (1999), the determining factor in land value was potential agricultural productivity derived from natural characteristics, like the amount of rainfall; in urban areas, however, the three principal determinants of land value are its location relative to job centers and amenities, access to services, and the characteristics of the neighborhood and neighbors.

III. Land Regularization in Mexico

Mexico has one of the most extensive and longest running land regularization programs in the developing world. Massive rural-to-urban migration after the Mexican revolution led to problems of squatting in Mexico City as early as the 1920s. Land regularization programs began at the federal level in the 1950s to regularize squatter settlements on state land. A second regularization program was created for settlements on *ejido* land in the 1970s. *Ejido* land is a communal land tenure system established under Article 27 of the Mexican constitution of 1917. Under this system, residents of the *ejidos* have agrarian rights to their land in perpetuity, but the land cannot be sold, rented or mortgaged. The growth

of Mexican cities onto proximate *ejidos* has meant that they are frequently converted to urban use illegally, which prompted a reform of Article 27.[2]

As in many countries, land regularization in Mexico is often a politically driven process. Squatting is tolerated as a form of gathering support of the urban poor. In the case of Mexico, through a clientilistic system of favors for votes, the Partido Revolucionario Institucional (PRI) was able to continually "win" elections and govern for the large part of the 20th century. One favor that was traded for votes was access to urban land and services. Subsequently, regularization and titling programs were instituted in these neighborhoods for continuing political support.

Apart from the political nature of the land regularization programs, two further characteristics of land regularization in Mexico deserve mention. While in many countries land regularization is important to residents of informal settlements because it is a prerequisite for municipal services, this is not true in the case of Mexico (Azuela and Duhau, 1998). Because urban services are not dependent upon land regularization, the demand for regularization is significantly affected; moreover, once services are installed, they provide implicit tenure security from government eviction. Secondly, slum clearance has never been a widely applied policy in Mexico. Thus, demand for land regularization and titling will be limited to the desire to use the land in market transactions.

Land Regularization in Tijuana, Baja California, Mexico.

Over one-half of the urbanized land in the city of Tijuana was developed irregularly. There are over 160,000 lots currently registered with land regularization agencies and only 270,000 households in the city (INEGI, 2000). Only about 60 percent of these lots have been contracted for regularization; of those that have been contracted, only about 60 percent have successfully completed titling procedures.[3] There are three types of land developed irregularly in Tijuana. First, land that was originally owned by the federal, state or municipal government is often developed irregularly, either squatted or converted to urban use as part of a program for low-income housing. State-owned land that is slated to be developed for public housing must go through a regularization process. Secondly, *ejido* land that was urbanized must be expropriated and regularized.

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[2]   In 1992, Article 27 was amended and *ejido* lands were allowed to be expropriated from communal use and developed as private property; however, this development modality has not been extensively utilized (Jones and Ward, 1998).

[3]   The data on irregular settlements used in this section and the rest of the paper are taken from research conducted for *Legalizando la Ciudad* (Alegría and Ordoñez, 2005).

Finally, land owned privately is often developed irregularly, sometimes with and sometimes without consent from the landowner.

The two principal models of irregular housing development in Mexico and other parts of Latin America are the invasion of land by squatters and the illegal subdivision and sale of lots by the landowner. Land invasions can be on a large scale, organized groups of squatters who settle a particular area in a coordinated fashion, or on a lot-by-lot basis. In general, large-scale squatting, known in Mexico as *invasión pirata*, occurs very infrequently these days. The form of squatting that continues to occur regularly is the latter kind, known as *invasión hormiga,* and tends to occur in areas where residential development is not permitted by law due to steep slopes or other environmental conditions. The second mode of irregular development, and the most common, is the illegal subdivision and sale of land without regard for planning regulations or registry of transaction. Settlements developed in this manner are not necessarily for people with low-incomes, and are often indistinguishable from areas developed following the legal requirements for residential development.

Agency Organization. There are currently six active land regularization agencies in Tijuana with mostly separate spheres of operation. They were created over the past fifty years by different levels of government. Program administrators argue that several agencies are needed to deal with the problem of irregular land development because of the legal status of neighborhoods built on state, private or *ejido* land. However, it seems likely that intergovernmental politics have played a role in the creation of the agencies. Baja California often cites its distance from the central government in Mexico City as a reason it is ignored. Some say the central government's neglect has led to relatively high political independence in the city and state along with several innovations in local governance (Ward and Rodríguez, 2000; Perló, 1999). Baja California was the first Mexican state to elect a non-PRI governor, Ernesto Ruffo, in 1989. Several mayors of Tijuana have also been from the opposition party. Thus, the creation of the locally-controlled regularization agencies, Fiduzet and PAR, was likely politically motivated and local political administrations probably have had an involvement with federal efforts in land regularization.

The first regularization agency in Tijuana, which is currently known as CORETTE (Comisión de la Regularización de la Tenencia de Tierra del Estado), was created by the federal government in 1957 to regularize land in squatter settlements. Subsequently, separate agencies were created for regularization of *ejido* land and land owned by different levels of government. Recently, the municipal government created another

regularization agency, PAR (Programa de Acciones de Regularización), which will attempt to deal with illegal subdivisions through an amnesty program for landowners who have already sold their lands without following proper procedures.[4] Descriptive information on the six agencies is given in Table 1.

TABLE 1.
Descriptive Information on Regularization Agencies in Tijuana

Agency	Year Created	Type of Land	Number of Lots	Level of Government	Original Purpose	Full Name
CORETTE	1957	Private, State and Municipal	58,000	Federal	Main organization for regularization of invaded state land. Has taken over responsibility from other agencies in many neighborhoods.	Comisión de la Regularización de la Tenencia de la Tierra del Estado
CORETT	1978	*Ejido* and Federal	26,000	Federal	Regularization of illegal settlements on *ejido* land.	Comisión de la Regularización de la Tenencia de la Tierra
INETT	1975	State	35,000	State	Took over responsibilities from a federal agency that was created to develop low-income housing.	Inmobiliaria Estatal Tijuana-Tecate
Produtsa	1983	Federal and State	13,000	State	Created by federal decree to satisfy demand for land for low-income housing.	Promotora del Desarrollo Urbano de Tijuana, S.A.
Fiduzet	1992	*Ejido*	8,000	Municipal	Began as a state-level agency to regularize neighborhoods on *ejido* land and was later transferred to the municipal government.	Fideicomiso para el Desarrollo Urbano de la Zona Este de Tijuana
PAR	2002	*Ejido* and Private	24,000	Municipal	Recent municipal effort to relax planning regulations by giving amnesty to landowners who have illegally subdivided their land.	Programa de Acciones de Regularización

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[4]   Because PAR was formed in 2002—the year that research for *Legalizando la Ciudad* was conducted—data was not yet available on its domain. It is therefore not included in the remainder of the analysis.

Regularization process. The regularization process works in a similar way for the six agencies and has four basic steps. First, an agreement is signed with the original landowner to expropriate the land and transfer it to the regularization agency. Second, surveys are conducted, parcel maps are drawn, and planning approval is obtained. Third, contracts for titling are written between the lot holders and the regularization agency. Finally, the individual titles are paid for. The first step differs depending on the original owner of the land, but once the land passes to a regularization agency, the remainder of the process is the same.

In order to initiate regularization proceedings, public land has to be unincorporated from government ownership and transferred to the regularization agency. Similarly, *ejido* land must be expropriated from agrarian use and transferred to CORETT. In the case of privately owned land that was settled against the will of the owner, the owner can give the land to the agency, which will then include the land costs in the fees for regularization charged to the residents. After taking a commission (about 30 percent of the land value), the agency will pay the landowner fees recovered. In the case of private land that was sold without permits, the owner simply gives it to the agency. Once the land is transferred to the agency, they conduct the standard administrative procedures for the planning of subdivisions, surveying the land for parcel maps and a zoning plan, and recording the land in the property registry.

The final two steps of the regularization process are transactions between the regularization agency and the residents of the irregular lots. First, the agency negotiates a contract with the lot holders for regularization, under which they agree to pay fees for regularization proceedings. Fees vary depending on the technical costs of regularization for a given area and whether the land was squatted. Payments are generally made in installments over a period of two to five years, and upon full payment, the lot holders receive their titles. There is no foreclosure on lots for which payments are not made, thus the incentive to pay stems completely from the benefits of obtaining a title.

IV. Theory

Two studies serve as precedent for the model in this paper. Alston, Libecap and Mueller (1996) developed a simple model of demand for land titling in the Brazilian Amazon frontier. Their model is based on the relationship between the value of a land title and the value of land. While the empirical test performed in section five is similar to the Alston, Libecap and Mueller model, the theory developed in the context of land regularization in Tijuana is based on the work by Miceli, Sirmans and

Kieyah (2001). Their research is on the demand for land *registration* in rural Kenya. Though the context is significantly different from land regularization in urban Tijuana, the model requires only slight modification.

Alston, Libecap and Mueller (1996) conceptualized the value of agricultural land as determined by the production possibilities of the land, which increase with proximity to a market. A title adds value to land by enabling investment and exchange to expand production possibilities. This added value declines as one moves away from a market center, as reduced competition implies less need of state protection. At some distance from a market, titled land will be of equal value to untitled land. In an empirical test of their model, Alston, Libecap and Mueller demonstrate the above as well as predictions that the cost of accessing a title increases at greater distances from the administrative center. In addition, they test hypotheses that the human and physical capital of claimants to land will affect the cost of accessing land titles. Claimants with more education and wealth, for example, have an easier time acquiring land titles.

Miceli, Sirmans and Kieyah (2001) formalize the relationship between the cost of accessing land registration and the probability of registering land by modeling the probability of land registration, p, as a function of the cost of retaining a title, t. They assume the function $p(t)$ has a positive but diminishing marginal benefit of the input, thus $p' > 0$ and $p'' < 0$. Furthermore, $p(0) \leq 0$ and $p(t) < 1$ for a finite t.

Miceli, Sirmans and Kieyah write the expected net present value of land with the equation,

$$EV = pV - c(e,\delta)t \qquad (1)$$

Where V is the dollar value of land and the costs of titling are a function of education, e, and distance from the administrative center, δ. Landowners are expected to maximize the expected value of their land. In the Miceli, Sirmans and Kieyah model, the optimal title system for the landowner is the pair (p, t) that maximizes utility, subject to the constraint given by $p(t)$. Utility increases to the northwest along the indifference curves of the landowner, which are straight lines with slope $dp / dt = c / V > 0$. This is shown graphically in Figure 1.[5]

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[5]   A continuum of *(p,t)* pairs are assumed to exist and the optimum occurs at the tangency of an indifference curve and the function *p(t)*.

FIGURE 1.
Miceli, Sirmans, and Kieyah Model of the Probability of Land Registration
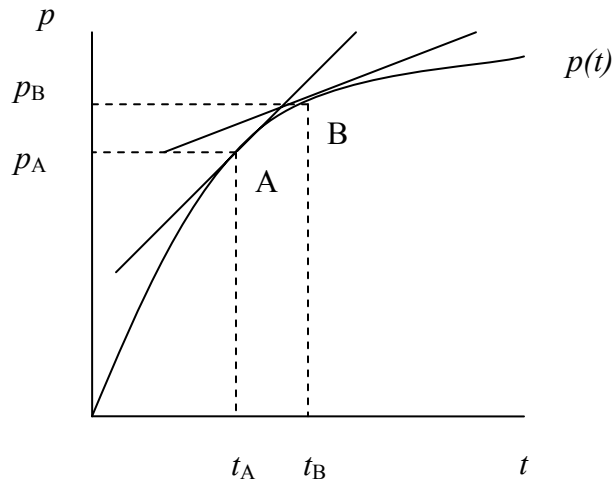
Varying the parameters V, e and δ gives comparative static results. As V increases, the indifference curve becomes flatter, and the optimum will shift from point A to B. Thus, owners of more valuable land demand more protection even though this increases the cost of access. Assuming that $c_e < 0$ means that increases in education will lower the cost of accessing land registration, also flattening the indifference curve from point A to B. They also posit that areas closer to market and administrative centers will have lower costs of accessing the system, thus $c_\delta > 0$. This implies that as distance increases, demand for land registration decreases, causing the owners' indifference curve to steepen and the optimum to shift from point B to A.

I use a model similar to Miceli, Sirmans and Kieyah; however, it differs in two important ways. First, land regularization is different from land registration. It adds a layer of complexity and potential for opportunism on the part of the government. Because regularization involves technical work for which fees are charged, and because the fees charged to residents vary considerably, there is significant opportunity for corruption. Evidence of corruption in land regularization programs in Mexico has been documented in other sources (Varley, 1996). Secondly, while education will continue to be an important component of system access costs for residents of irregular settlements, income will also matter considerably as it will determine the ability to pay for proceedings. Therefore, using the same probability function, $p(t)$, I write the expected net present value of land with the equation,

$$EV = pV - c(e, Y, a, R(V), V{*}P)t \qquad (2)$$

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In the majority of the cases, the costs of obtaining a title are the effort of negotiating a contract and an administrative fee, which in the model are represented by the education, c_e, and income, c_Y, of the lot holder. I assume that $c_e < 0$ and $c_Y < 0$, which means that increases in education or income will flatten the indifference curves of lot holders and shift the optimum from point A to B on Figure 1.

However, in this model, the pair (p, t) chosen reflects an agreement between residents and regularization agencies on a payment contract. The cost of regularization then will also depend on government administrative costs, $a,$ for which $c_a > 0$. As costs of regularization increase, indifference curves will steepen, shifting optimum from point B to A. Additionally, government rent-seeking behavior will increase costs of regularization as $c_R > 0$. I propose that rent-seeking, R, is positively correlated to the value of land, V. Because the value of a land title increases as the value of land increases, opportunity for rent-seeking by government officials will increase with the value of land.

While some predictions of the above model are clear, the introduction of land value into the cost function creates ambiguity in the predicted effects of land value on the probability of titling. It is clear that increases in resident income and education will increase the probability of titling and that it will decrease with the technical difficulty of titling. An increase in land value will increase the probability of titling if the benefits dominate the potential for governmental opportunism and the appraised value of land, but whether this is the case is not clear from the model.

Finally, the costs will be greater for private land that was squatted. Squatters must pay an appraised value of the land in addition to the administrative fee. This extra charge is represented by c_{V*P}, in addition to the administrative fee. This cost only applies in certain cases, thus it is multiplied by P, which is a dummy variable that equals 1 if the land was squatted private land.

V. Empirical Analysis

At this time, existing data are insufficient to perform a complete test of the above model; however, a partial test is possible. Unfortunately, data describing residents of irregular neighborhoods are not readily available because boundaries of census tracts do not correspond sufficiently with the boundaries of irregular neighborhoods. Nevertheless, the amount of land regularization activity in a neighborhood as a function of indicators of land value and the technical difficulty of titling, controlling for agency characteristics, is estimated. This corresponds to the simple model of the value of land titles proposed by Alston, Libecap and

Mueller (1999). They theorized that the value of a title will increase with the value of the land. However, in the case of Tijuana, a test of this theory provides an interesting and counterintuitive result.

Before performing the test, one should note that the different agencies exhibit wide variation in performance. Recall that the regularization process has two final steps: contracts are negotiated between an agency and residents on a lot-by-lot basis, and the residents pay fees in exchange for titling. As Table 2 shows, some agencies, like Produtsa, have contracted for titling with all or almost all the lots in their jurisdiction, while others, notably CORETTE, have contracted with fewer than half the lots on average. The number of lots that have actually been paid off may be quite a bit less than the number contracted for titling—in the case of INETT, only 35 percent.

TABLE 2.
Contracting and Titling Rates by Agency

Agency	Mean Percent Contracted	Standard Deviation	Mean Percent Titled	Standard Deviation
CORETTE	45	.37	75	.25
CORETT	79	.16	66	.47
INETT	92	.12	35	.25
Produtsa	100	0	89	.09
Fiduzet	97	.04	86	.07

CORETTE and INETT have had the least success contracting and receiving payment, respectively. It is likely that these differences arise from the functions and institutional structure of the different agencies. For example, it makes sense that INETT and Produtsa have a high rate of contracting because they develop low-income housing through programs of sites with services, and contracting occurs before residents inhabit the piece of land. On the other hand, regularization agencies working in areas where residents bought illegally subdivided land will have a harder time contracting because they must negotiate payment for the land as well as an administrative fee. People who purchased their land in an informal market will resist paying again for it. In addition, the agency's institutional organization—i.e., their contracts with employees, institutional priorities, and mandates from politicians—also influences its performance rates significantly.

Therefore, in order to test the previously elaborated theory, controlling for agency fixed effects will be important. Unfortunately, we do not have data on the exact administrative fee or appraised land value charged for regularization. The available data show that it varies greatly. There are two components, a regularization fee and a titling fee, both of which depend on a variety of factors and differ between organizations, neighborhoods and lots.

Data on 140 irregularly developed neighborhoods was obtained from the five regularization agencies. In addition to the total number of lots, the number contracted for titling, the number paid in full, the average lot size and whether the land was originally owned by the government, digital maps of the locations of the settlements were obtained. Using digital mapping software (ArcMap and ArcView), the distance from the city center was calculated along with the percent of land in a settlement that has a slope of greater than 35 degrees. This is the legal maximum slope for development in Tijuana. Table 3 presents summary statistics for the sample.

TABLE 3.
Summary Statistics of Regularization Contracting in 140 Neighborhoods

Variable	Mean	St. Dev.	Minimum	Maximum
Percent contracted	.52	.41	0	1
Log distance from city center	8.72	.61	6.84	9.91
Average lot size	442.5	718	76	5449
State land (dummy)	.39	.49	0	1
Percent slope > 35°	.19	.19	0	.76
Year regularization began	1987	8.39	1957	1999

The above variables were used to regress the percent of lots contracted for regularization on a set of independent variables. Indicators of land value and the technical difficulty of regularization, and controls for the original owner of the land, the year regularization began, and agency fixed effects were included. The indicators of land value included are the natural log of distance from the city center and the average lot size. Generally, half the variation in land value is explained by the distance from the city center and the relationship is a negative exponential. Thus, the expected relationship between the distance from city center and the percent of lots contracted is positive; more valuable land should see more contracting for regularization. Second, a dummy variable for whether the

land was originally owned by the government is included with the hypothesis that it will be cheaper to regularize government land, as private parties will not demand compensation. However, land owned by the government will give more degrees of freedom to agencies negotiating a contract, thus the relationship is not so clear. In addition to the proxies for land value, a measure of the percent steeply sloped areas in a neighborhood serves as a proxy for administrative difficulty in regularization. It is expected that neighborhoods with lots of steeply sloped areas will be more difficult to regularize. Finally, controls for agency fixed effects are included.

Results. Table 4 presents the results of OLS and tobit models. Tobit models are estimated because the dependent variable is a percent constrained between values of 0 and 1. Tobit estimation corrects for bias and inefficiency generated when using OLS on a constrained dependent variable. While several independent variables perform as predicted, the coefficients on indicators of land value have the opposite sign than the simple model would predict. Neighborhoods closer to the city center with smaller lots have a smaller percentage of lots contracted for titling. These two variables are statistically significant to the .05 level in both OLS and tobit models. This seems to indicate that government opportunism dominates the incentives to contract for titling more valuable land.

Also of note is that the dummy variable for neighborhoods that were developed on government land has a negative coefficient, indicating that these have a lower percentage of lots contracted for titling. This is also a counterintuitive result because, in these neighborhoods, residents will generally have to pay less for their titles. Again, this suggests government opportunism, as it is in these neighborhoods where agencies have more flexibility in charging for regularization procedures.

The remaining variables have the predicted effects. Neighborhoods with a large proportion of steeply sloped area have less contracting, reflecting the increased administrative and technical difficulty in regularizing land in areas where development is illegal. The year regularization proceedings were initiated, included mainly as a control, attains significance in the tobit model, indicating that more recently developed neighborhoods have a slightly smaller percentage of lots contracted for regularization. Finally, the dummy variables for regularization agencies indicate that, *ceteris paribus,* CORETTE has a significantly lower success rate in contracting for regularization.

TABLE 4.
Regression Results of Determinants of Percent Contracted

Variable	OLS Model		Tobit Model	
	Coefficient	T stat	Coefficient	T stat
Log distance from city center	.121**	1.97	.174**	2.29
Average lot size	-.0001**	-2.61	-.0001**	-2.78
State land (dummy)	-.135*	-1.80	-.127	-1.41
Percent slope > 35°	-.264*	-1.74	.329*	-1.79
Year regularization began	-.005	-1.38	-.008*	-1.64
CORETT (dummy)	.367**	2.57	.328*	1.92
Fiduzet (dummy)	.316	1.59	.353*	1.40
INETT (dummy)	.356**	3.66	.501**	3.97
Produtsa (dummy)	.261**	2.62	.207*	1.73
Adjusted R²	.39		Pseudo R²	.31
N	140		N	140
F stat	10.78		Log likelihood	-79.2

* indicates significance at the .1 level
** indicates significance at the .05 level

Two caveats must be considered in interpreting the above results. There is a potential for omitted variable bias in the models due to the lack of data on residents of irregular areas, and there is a potential for ecological fallacy due to the aggregate nature of the data used. It could be the case that the residents of the more valuable land are low-income and lack education, which may be the dominant predictors of the extent of regularization. However, this is not likely to be the case because, in Tijuana, like much of Latin America, lower-income groups live on less valuable land, further from city centers. The better-educated and higher-income residents are more likely to live on greater-valued land closer to the city center, which will actually increase the counterintuitive nature of the results of the regression equations. The potential for ecological fallacy, which is the threat that aggregating data at the neighborhood level obscures relationships at the lot or household level, in the estimated regressions is not large due to the relatively homogenous nature of

neighborhoods in Tijuana. However, this can only be overcome by using household-level data.

A regression of the percentage of titles that have been paid for on the same independent variables as the above regression was also conducted. However, there is no statistical significance for the explanatory variables, other than the agency dummy variables. Resident characteristics are likely the principal determinants in whether the title is paid for or not, though, again, it is surprising that the lots in more valuable areas are not paid off at a higher rate.

VI. Conclusion

Understanding the nature of demand for land regularization and titling in urban areas is increasingly important. Sustained interest in land titling as an intervention in developing countries around the world stems from the essential role that clearly-defined property rights play in the functioning of market transactions. While research has demonstrated that there is demand for titled land, the details of how regularization and titling programs function has not received sufficient attention. Analysis through the lens of New Institutional Economics reveals the importance of the governance of the transaction between government agency and squatter or resident of an illegally developed neighborhood.

Until now, analysis of the drivers and characteristics of demand for land regularization has focused on agricultural land. The nature of demand for land regularization and titling in urban areas is different from agricultural areas due to the different sources of land value and the increased importance of market transactions in urban areas.

Mexico is an ideal case for the study of regularization programs. The system has existed for several decades and has characteristics that will be problematic in most program designs—namely, the political nature of land titling efforts and the potential for governmental opportunism in charging title recipients. A model of demand for land titling procedures in this context will differ from previously elaborated models not only because of the characteristics of the Mexican titling system, but also because of the nature of land value in urban areas. A partial test of the model elaborated in the paper gives unexpected results; there is less land titling in neighborhoods that are on more valuable land. This indicates an inefficient system, possibly generated by governmental opportunism. Though there is a potential for omitted variable bias, it is not likely, based on evidence of the spatial distribution of income groups in Tijuana.

To truly unpack the dimensions of demand for land titles, household-level data on the residents of informal neighborhoods is needed.

A multilevel model could be constructed that included neighborhood-level data along with characteristics of households. This model would disaggregate the effects of the various determinants of the variation in titling between different neighborhoods. Testing such a model should be a high priority for government agencies interested in pursuing land titling programs as it could inform the reform of regularization proceedings. Additionally, analysis of the governance of the regularization agencies themselves and their relationship to politicians should be an important component of future research.

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