

Reverting to Informality: Unregistered Property Transactions and the Erosion of the Titling Reform in Peru

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RAND Labor & Population

WR-1156-1

September 2016

This paper series made possible by the NIA funded RAND Center for the Study of Aging (P30AG012815) and the RAND Labor and Population Unit.

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REVERTING TO INFORMALITY: UNREGISTERED PROPERTY TRANSACTIONS AND THE EROSION OF TITLING REFORM IN PERU

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Abstract

Titling programs have focused mostly on providing initial tenure security and have not properly addressed maintaining the formality of future property transactions. Our data indicates that properties become de-regularized due to unregistered transactions in urban slums, which threatens to undo the success of the titling program in the long run. We exploit a natural experiment provided by the elimination of a streamlined registration system targeted for the poor residents in Peru to identify how costly and burdensome registration policies can increase de-regularization. Our analysis indicated that the elimination of such a system led to a significant reduction in the probability of registering transactions, including those that involved a change in ownership. Overall, our findings stress the necessity of building specific components aimed at maintaining properties formal into the design of urban titling programs.

Keywords: titling programs, registration, property transactions, property rights, natural experiment, Peru

JEL classification codes: P14, O18, R20, R28, K0

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1. Introduction

Worldwide, titling programs are considered to be vital for reducing poverty in developing countries. Governments and multilateral agencies have devoted significant resources to develop these types of programs around the world. Rigorous empirical literature on the positive impacts of tenure security supports these efforts (Di Tella et. al., 2007; Field, 2003, 2005, 2007; Galiani and Schargrotsky, 2004, 2010).¹ However, these programs have focused mostly on granting titles and have not properly addressed maintaining the formality of properties for future property transactions (e.g., sales and inheritances). Currently, there is increasing evidence that titled properties in urban slums become de-regularized due to unregistered transactions (Galiani and Schargrotsky, 2016). De-regularized properties reduce a households' ability to benefit from tenure security in the future. For example, it affects the ability to properly sell the property (and its value) or to use the property as collateral to obtain loans from the banking system. Failing to register a transaction that involves a change in ownership has more serious consequences, such as depriving the new owner of the right to legally claim the property. Potential legal solutions to these problems in the future require long and expensive procedures that become increasingly cumbersome and complex with time. Costs are high enough to adversely impact the poor, who are generally most affected by this situation.

De-regularization is particularly important in countries with civil law legal systems, where registration is fundamental to providing legal status to these types of transactions. In this context, understanding the mechanisms that enhance the registration rate of these transactions is essential to ensure sustainability of the titling programs developed around the globe. In this study, we estimated the impact of changes in the cost and complexity of the registration process on the registration rate of property transactions. We exploit a natural experiment in Peru, where a registration system that targeted poor citizens (named *Registro Predial Urbano* or RPU) was eliminated midway through its staggered implementation due to pressure on the government by a lobby of notaries.

Peru is an emblematic and successful case of titling reform. It was one of the pioneers and maintained one of the largest titling programs targeted to urban areas with more than 2 million property titles granted since 1996. However, our data demonstrates that property owners only registered 7.7% of transactions involving their properties, leading to a de-regularization that threatens the success of the program in the long run. We provide compelling evidence of the relevance of the

¹ Titling has been associated with increased housing investments (Field, 2005; Molina and Soderbom, 2011), increased labor supply (Field, 2007), greater access to credit (Carter and Olinto, 2003; Field and Torero, 2006), increased income and consumption (Galiani and Schargrotsky, 2010), smaller families (Field, 2003), improved child education (Field, 2003; Galiani and Schargrotsky, 2010), improved nutrition and health (Galiani and Schargrotsky, 2004; Vogl, 2007) and an increase in pro-market beliefs (Di Tella et. al., 2007), among other benefits.

cost and complexity of the registration process in the registration rate of property transactions in urban slums. Specifically, we estimated that the elimination of the RPU resulted in a statistically significant 8.1 percentage-point reduction in the probability of registration. When we analyzed the heterogeneous effects of our results, we noted that households in the lowest quartile of income per capita and households with a more educated head of household were most affected. Among the different types of transactions, we determined that the elimination of the RPU had the largest effect on the probability of registering property divisions and early inheritances (from 73% during the existence of the RPU to 11% after its elimination)—precisely the types of transactions that require registration to preserve the legal claim of owners due to a change in ownership.

This study is important for several reasons. First, it documents whether titled properties remain formal, a topic rarely considered in the literature. A notable exception is Galiani and Scharfrodsky (2016), who also document the problem of de-regularization for the case of Buenos Aires, Argentina. Second, to our knowledge, this is the first analysis of the causal effect of how costly and burdensome registration policies can increase de-regularization. Third, the implications of our results are particularly important for policy makers. Our results stress the necessity of building specific components aimed at maintaining properties formal into the design of urban titling programs.

The rest of the paper is organized as follows: In Section 2 of the paper we provide a brief background on the introduction and posterior elimination of the RPU; in Section 3 we describe the data and present descriptive statistics regarding the incidence of property transactions and registration rates; in Section 4 we present the empirical difference-in-difference models and estimation results regarding the effect of the elimination of the RPU on the probability of registration and how the effects vary by household characteristics. We also test for common trends between the treated and control group prior to the reform to validate our empirical strategy; finally, in Section 5 we present the conclusions of the study.

2. Institutional Background and Source of the Natural Experiment

The mass rural-urban migration experienced in Peru since the 1940s explains the formation of numerous slums by migrants in urban areas.² The property registry system in Peru was not prepared for this mass migration phenomenon and was unable to rapidly respond. The first urban real state registry (*Registro Predial Inmueble* or RPI) was established in Peru in 1888 and did not incur any major changes for almost a century. The rise of informal settlements led to the creation of a parallel registry system in 1988 to facilitate the formalization of properties in urban slums. However, the large

² For instance, the population of Lima, the Peruvian capital, grew from 0.6 million in 1940 to 5 million in 1980 and is approximately 9 million today.

boost in reformation of the system began in 1996 with the launch of a national titling program, managed by the Commission for Formalization of Informal Property (COFOPRI). As a component of the reform, a parallel registry for urban slums (the RPU) was created and considerably reduced the cost and complexity of registering transactions involving properties in these settlements (see Table 1). The Peruvian titling reform included, therefore, not only the process of granting titles but also a companion streamlined and low cost system for registering transactions targeted to households that had recently titled. The implementation of the RPU followed the geographic rollout of the titling program.

Both the traditional registry (RPI) and the special registry (RPU) co-existed in unison until mid-2004 when the RPU was discontinued and absorbed by the RPI. This change was a result of pressure on the government by a lobby of notaries who opposed the RPU because of economic interests.³ Consequently, slum dwellers targeted by the RPU suddenly faced identical costs and complexities for registering transactions as all other citizens that used the RPI (see Table 1). We utilized this natural experiment in our analysis to identify the causal effects of a costly and burdensome registration process on the probability of registering property transactions, among poor households.

Table 1: Costs of registering secondary transactions in urban slums

	For properties valued less than US \$17K	For properties valued equal to or greater than US \$17K
Prior to COFOPRI and RPU	\$217	\$217
During COFOPRI and RPU	\$40	\$96
After elimination of RPU	\$140	\$840

Source: Institute for Liberty and Democracy (2007, 2010)

3. Data and Descriptive Results

We used two datasets that were commissioned by COFOPRI. The first dataset consisted of information from a household survey conducted in 2010 in five different regions that were served by the RPU prior to its elimination. Our treated group consists of households from this dataset. The second dataset consisted of information from a household survey conducted to serve as a baseline for

³ The RPU introduced numerous legal and administrative changes that reduced the cumbersome nature of the registration process. Among those changes, the RPU allowed the registration procedure to be legalized by any registered lawyer, instead of the more complicated process of the RPI that required authorization by a notary. The notaries campaigned for the elimination of the RPU and the return to the RPI as the only registration system.

a future impact evaluation of the titling program. This survey was also conducted in 2010 and encompassed 11 regions. Because the implementation of the RPU followed the geographic roll-out of the titling program, numerous districts included in these data were never served by the RPU, and therefore, they serve as controls in our analysis.

Both surveys asked participants if the current property owners had engaged in any of the following activities: construction (including addition of new rooms, construction of additional floors, etc.), partial sale of the property, division of property into two or more independent lots, transfer of property to a relative in an anticipated inheritance, obtaining a mortgage on the property or other activities. Hereinafter, we refer to each of these activities as a *transaction*. Individuals were also asked in what year these transactions occurred and whether they declared or registered them. The surveys contained information regarding the property (such as size in squared-meters, the year it was acquired and whether it was initially acquired by squatting), the household (such as income and number of members) and information regarding the head of household or individual that made property decisions (such as gender, age, education attainment and marital status). All these variables are included in the empirical analysis.

Certain limitations of these datasets are worth noting. First, the transaction information is self-reported data, which may have resulted in measurement errors. However, because most activities go unregistered, these datasets were the only source of information available to study the incidence and the registration rate of property transactions. We restricted our analysis to transactions that occurred in the last 10 years (2000-2010) for two primary reasons: First, to limit the recall period for transactions that might have occurred in the very distant past. Second, because significant efforts for titling reform began in 1996 with the creation of COFOPRI and the RPU and the largest roll-out of the reform took place in the late 1990s. It is unknown precisely the year that the RPU became available for the districts in our treatment group and therefore, we only considered transactions from the years 2000 and later to minimize possible errors of misclassifying a district as treated.

Another limitation arises because, given that we exploit the roll-out of the titling program and the RPU, it was difficult to find treated and control areas that were geographically close. This is indicated in Figure 1, where treated districts are noted in red and control districts are noted in green. The differences may be appreciated by inspecting the sample means of treated and control districts in Table 2. Districts in the treated group were more likely to be located in the coastal region of Peru and possessed higher levels of education, literacy rates and a larger human development index. Concurrently, a larger percentage of households in the treated district acquired their property by squatting as compared to households in the control districts. This reflects the mass migration to the coast that began in the mid-1940s.

Figure 1: Treated and control districts (treated in red, control in green)

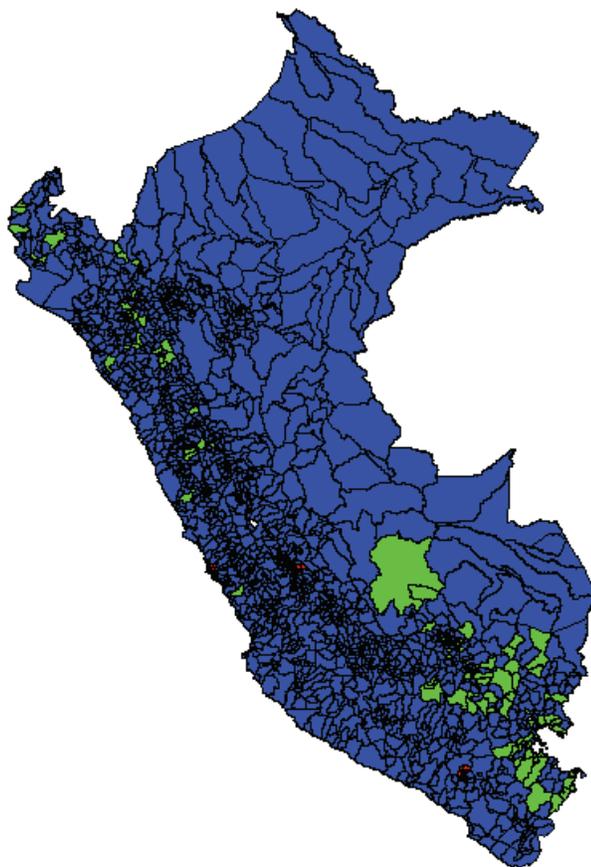


Table 2: Sample means for treated and control districts

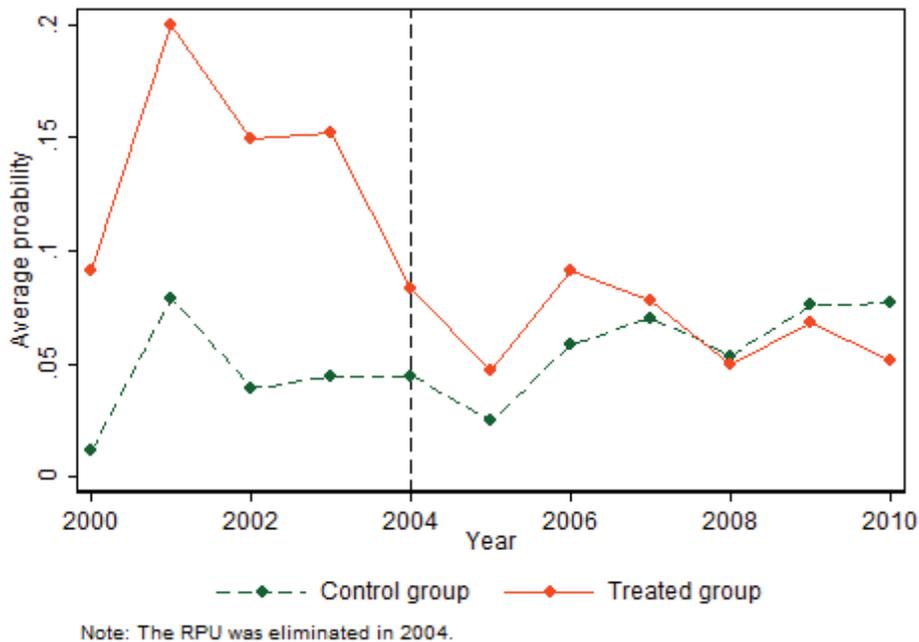
	Control Districts	Treated Districts
<i>Head of household or qualified respondent characteristics</i>		
Age	48.37	50.04
Female	0.19	0.16
Education: Primary or less	0.59	0.34
Education: Secondary or less	0.33	0.5
Education: Postsecondary	0.08	0.16
Civil Status: Married	0.77	0.73

<i>Household characteristics</i>		
Household size	4.25	5.39
Income per capita per day (USD)	1.53	1.75
<i>Property characteristics</i>		
Acquired by squatting	0.07	0.4
Size (squared meters, in hundreds)	3.53	1.43
Time since acquired property (in years)	17.16	22.03
<i>District characteristics</i>		
On the coast (0=no; 1=yes)	0.19	0.81
Index of human development	0.56	0.66
Literacy rate	0.83	0.97
<i>Property transactions in the last 10 years</i>		
All Transactions	0.26	0.28
Construction	0.2	0.2
Partial Sale	0.08	0.1
Mortgage	0.05	0.05
Property division and early inheritance	0.01	0.01
Other type of transactions	0.00	0.02
<i>Source: COFOPRI household surveys; authors' calculations</i>		

Despite these differences between treated and control districts, we are confident in the validity of our results for three reasons. First, most of the observed differences were not important determinants of the probability of registration, with the exception of age and education of the head of household and property size (refer to Table A1 in the Appendix), and our results were robust with the inclusion or exclusion of covariates. Second, we find evidence that the probability of registering property transactions followed similar trends for both treated and control districts, as indicated in Figure 2. Initially, the probability of registration was higher (on average more than double) for the treated districts than for the control districts during the existence of the RPU. After the elimination of the RPU in 2004, the registration rate for the treated districts declined to levels similar to those for the control districts. With the exception of this abrupt decline in 2004 in the treated districts, the registration rates exhibit similar co-movements over time for both the treated and control districts.

Third, we observed similar rates of property transactions in the last 10 years for treated and control districts. Our dataset included information regarding 2,465 households in the treated districts and 1,767 households in the control districts.⁴ Of these households, 28% of treated households and 26% of control households reported a property transaction during the last ten years. This similarity continued when we analyzed the incidence of transactions by type (refer to Table 2).

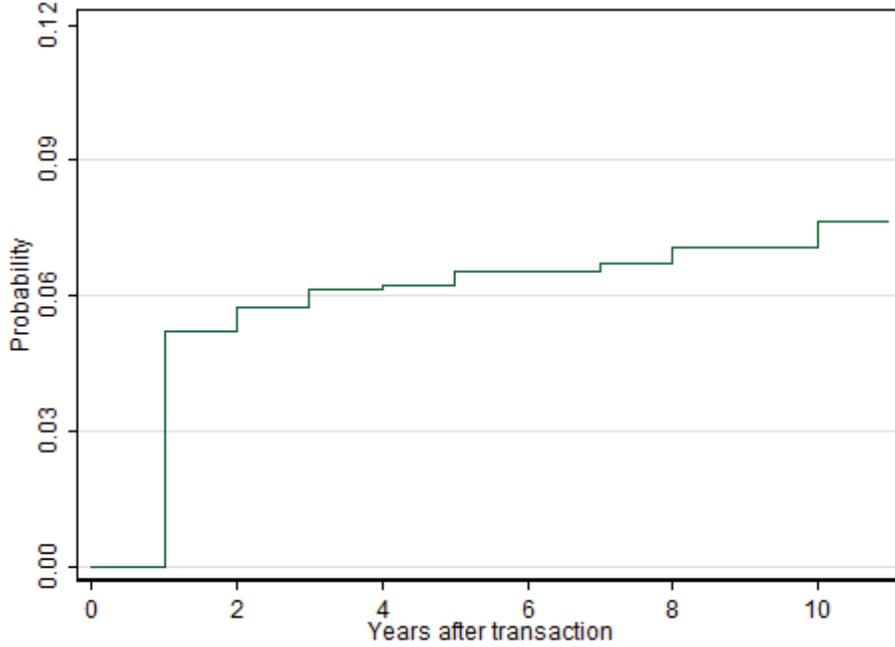
Figure 2: Average Probability of Registration during the First Year (All transaction types)



Before analyzing the impact of the elimination of the RPU on the probability of registering properties transactions, it is important to note that only a small percentage of transactions get registered and they are generally registered within one year of the transaction (or year one). Figure 3 indicates that approximately 7.7% of all transactions in our data were registered within 10 years from the date they occurred and that most of these transactions (5.2%) were registered during the year that they occurred (i.e., in year one). Therefore, in our empirical analysis, we emphasize modeling the probability of registering a transaction during year one.

⁴ We dropped non-poor households with income levels per capita of more than \$4 a day because those households are less likely to benefit from the titling program and the RPU.

Figure 3: Empirical distribution function of registration times (Kaplan-Meier method)



4. Empirical Models and Estimation Results

We began by modeling the probability of registration during year 1 as provided in equation (1) below:

$$R_{ikdy} = \alpha_k + \beta_1 TD_d + \beta_2 After_y + \theta(TD_d * After_y) + \beta_3 X_{id} + \beta_4 y + \epsilon_{iy} \quad (1)$$

Note that i represents the transaction, k represents the transaction type (grouped according to Table 2), d represents the district and y represents the calendar year. The term R_{ikdy} is set to one if transaction i is registered in year 1 and otherwise, set to zero. The term α_k denotes specific intercepts for each type of transaction. The term TD_d equals 1 if the district belonged to the treatment group (i.e., it was served by the RPU) and equals zero otherwise. The term $After_y$ equals 1 if the calendar year was 2004 or later. The term X_{id} denotes the vector of available controls at the household and district level, indicated in Table 2. The $\beta_4 y$ controls for a linear trend in the overall probability of registration. The coefficient of interest is θ , which measures the causal impact of eliminating the RPU on the probability of registering a transaction in the first year.

In addition, we estimated a discrete hazard model specification. We modelled the probability that a transaction was registered after t years conditional on not being registered before, as specified in equation (2):

$$\begin{aligned}
R_{ikt dy} = & \alpha_{kt} + \beta_1 TD_d + \beta_2 After_y + \beta_3 (TD_d * Later_t) + \beta_4 (After_y * Later_t) \\
& + \theta_1 (TD_d * After_y) + \theta_2 (TD_d * After_y * Later_t) \\
& + \beta_3 X_{id} + \beta_4 y + \epsilon_{iy}
\end{aligned} \tag{2}$$

The term α_{kt} denotes fixed effects for the probability of registering a property transaction of type k in year t after its occurrence. The term $Later_t$ equals 1 if more than one year had elapsed since the transaction. Because the probability of registration is largest during the first year after the transaction, we estimated differential causal effects of the elimination of the RPU on the probability of registration during the first year and during subsequent years. The causal effect of the elimination of the RPU on the probability of registering a transaction during the first year is denoted by θ_1 while the causal effect on the probability of registering during each subsequent year (conditional on not being registered during previous years) is represented by $\theta_1 + \theta_2$.

Equations (1) and (2) were estimated using linear probability models and the errors are clustered at the district level.⁵ The estimation results are provided in Table 3. The first column indicates that the elimination of the RPU reduced the probability of registration during the first year by 8.1 percentage points. The second column indicates a similar effect of the elimination of the RPU on the probability of registering during the first year. However, there were no effects on the probability of registering during subsequent years. This result might reflect that households' decisions to register a transaction at a point-in-time later than the first year may depend on factors other than monetary costs and registration procedures. For example, households may register prior transactions to access loans, sell a portion of their properties or comply with sanctions from local supervisory authorities.

⁵ There are 26 districts in the treated group and 93 districts in the control group.

Table 3: Effect of eliminating the RPU on the probability of registration

	Sample Includes:	
	First year after transaction	All years after transaction
	(1)	(2)
Treatment effect for registering in first year	-0.0811**	-0.0785**
	(0.0349)	(0.0356)
Treatment effect for registering in subsequent years		-0.0005
		(0.002)
Number of transactions	1,504	8,685
R-squared	0.069	0.083
<i>Controls:</i>		
Controlling for observed characteristics	Yes	Yes
Dummies for transaction type	Yes	Yes
Time elapsed since transaction	No	Yes

*Notes: Controls included characteristics of the head of household or qualified respondent (age, gender, education level and marriage status), characteristics of the household (size and income per capita per day), characteristics of the property (size, time since acquisition and whether it was acquired by invasion), characteristics of the district (whether it was a coastal district, altitude, human development index and literacy rate) and a time trend. Other controls in column 1 included dummies for each type of property transaction. Other controls in column 2 include dummies for each type of property transaction interacted with dummies for each year that has passed since the date of the transaction. Standard errors are displayed in parentheses and were clustered at the district level. *** denotes statistical significance at the 1% confidence level; ** denotes statistical significance at the 5% confidence level; * denotes statistical confidence at the 10% confidence level.*

4.1 Observed heterogeneity

We estimated differentiated effects by subgroups of the elimination of the RPU on the probability of registering a transaction during the first year, as indicated in Table 4. The estimated model in each case is denoted by equation (3), where DG_i equals 1 if observation i belongs to group g and equals 0 otherwise.

$$R_{ikdy} = \alpha_k + \sum_{g=1}^G \beta_{1g}(TD_d * DG_i) + \sum_{g=1}^G \beta_{2g}(After_y * DG_i) + \sum_{g=1}^G \theta_g(TD_d * After_y * DG_i) + \beta_3 X_{id} + \beta_4 Y + \epsilon_{iy} \quad (3)$$

Table 4 presents the estimated effects θ_g , the model's predicted probability of registration after 2004 for the treated districts and the counterfactual predicted probability of registration had the RPU not been eliminated. We find that the overall probability of registration decreased by 8.1 percentage points from the counterfactual prediction of 14% to the factual prediction of 6%. Because the cost of registration increased approximately 300%, our estimates implied an elasticity of the probability of registration with respect to a monetary cost of approximately 0.19. However, the elimination of the RPU resulted in not only an increase in the cost of registration but also increased levels of complexity. Therefore, we cannot attribute the entire reduction in the registration probability solely to a price effect.

The effects by subgroups are less precisely estimated and thus are only significant in a few cases and are not statistically different among subgroups. Nevertheless, notable patterns emerge from the estimated coefficients. We observed a larger decline in the probability of registrations for households in the lowest quartile of income per capita. However, we also found that the largest effects occurred for the most educated households. We argue that both findings can be reconciled because the elimination of the RPU increased the costs of registering a transaction and also the complexity of the process (e.g. the number of steps required for registration). The increase in costs was likely to be a significant barrier for households with lower earnings. The increase in the burden of the registration process is likely to have affected more educated households, who in the absence of the reform were more prone to registering their property transactions (see Table 4).

Table 4 also indicates that the elimination of the RPU had the largest effect on the probability of registering properties divisions and early inheritances. However, this category also has largest probability of registration. The model predicted that in the absence of the elimination of the RPU, property divisions and early inheritances would have been registered in the first year for 73% of cases. Due to the elimination of the RPU, the probability dropped drastically to 11%, although it continued to be greater than the probability of registering construction activities, partial sales of property and mortgages.

Table 4: Effects on the probability of registering in first year by subgroups

	Predicted probability of registration	Counterfactual predicted probability of registration (if RPU were not eliminated)	Estimated effect
<i>Overall</i>	0.0591*** (0.0131)	0.1402*** (0.0351)	-0.0811** (0.0349)
<i>Effects by income quartile</i>			
Lowest quartile	0.0286 (0.0241)	0.1409* (0.0713)	-0.1123 (0.0747)
Second quartile	0.0514*** (0.0189)	0.1347*** (0.0395)	-0.0833* (0.0441)
Third quartile	0.0730*** (0.0271)	0.1369** (0.0674)	-0.0639 (0.0686)
Highest quartile	0.0769*** (0.0244)	0.1539** (0.0660)	-0.0770 (0.0665)
<i>Effects by education level of head of household or qualified respondent</i>			
Primary or less	0.0561*** (0.0192)	0.0831* (0.0471)	-0.0269 (0.0478)
Secondary or less	0.0521*** (0.0162)	0.1393*** (0.0352)	-0.0872*** (0.0317)
Postsecondary	0.0879*** (0.0262)	0.2926*** (0.0913)	-0.2047** (0.0930)
<i>Effects by type of transaction</i>			
Construction	0.0451** (0.0197)	0.1141*** (0.0404)	-0.069* (0.0378)
Partial Sale	0.0536*** (0.0166)	0.1384** (0.0619)	-0.0848 (0.0638)
Mortgage	0.0119 (0.0113)	0.0958 (0.0687)	-0.0839 (0.0709)
Property division and early inheritance	0.1111 (0.0749)	0.7292*** (0.2290)	-0.6181** (0.2477)
Other type of transactions	0.2564** (0.1010)	0.4786** (0.1862)	-0.2221 (0.2051)

Notes: Controls included characteristics of the head of household or qualified respondent (age, gender, education level and marriage status), characteristics of the household (size and income per capita per day), characteristics of the property (size, time since acquisition and whether it was acquired by invasion),

characteristics of the district (whether it was a coastal district, altitude, human development index and literacy rate) and a time trend. Other controls included dummies for each type of property transaction. Standard errors are displayed in parentheses and were clustered at the district level. *** denotes statistical significance at the 1% confidence level; ** denotes statistical significance at the 5% confidence level; * denotes statistical confidence at the 10% confidence level.

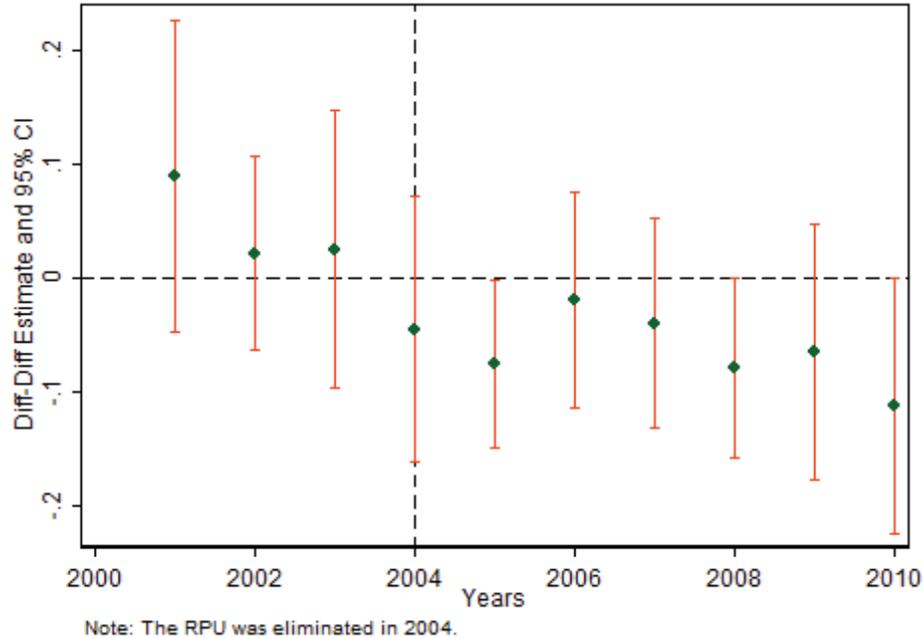
4.2 Assessing common trends

In addition, we assessed whether the estimated effect could be attributed to a declining trend in the probability of registration in the treated districts relative to the control districts. We estimated the following model for the probability of registration during the first year:

$$R_{ikdy} = \alpha_k + \beta_1 TD_d + \beta_{2g}(After_y) + \sum_{y=2001}^{2010} \theta_y (TD_d * DY_{iy}) + \beta_3 X_{id} + \beta_4 y + \epsilon_{iy} \quad (4)$$

where the term DY_{iy} equals one if the calendar year is y and equals zero otherwise. If the treated districts had a declining trend in the probability of registration relative to the control districts, we would expect negative estimates for θ_{2001} , θ_{2002} and θ_{2003} . This result would be problematic because it would be difficult to differentiate pre-existing trends from the effect of the elimination of the RPU. The estimated coefficients θ_y are provided in Figure 4. They are imprecisely estimated and, in most cases, were not statistically significant, with the exception of the years 2005 and 2008. However, it is reassuring that the point estimates prior to 2004 were positive and beginning in 2004 were all negative. This pattern indicates that the probability of registration increased in the treated districts relative to the control districts prior to the elimination of the RPU. In contrast, after the elimination of the RPU, the probability of registration in the treated districts declined relative to the control districts. This pattern of estimates for θ_y lends more credence to the validity of the causal interpretation of our findings.

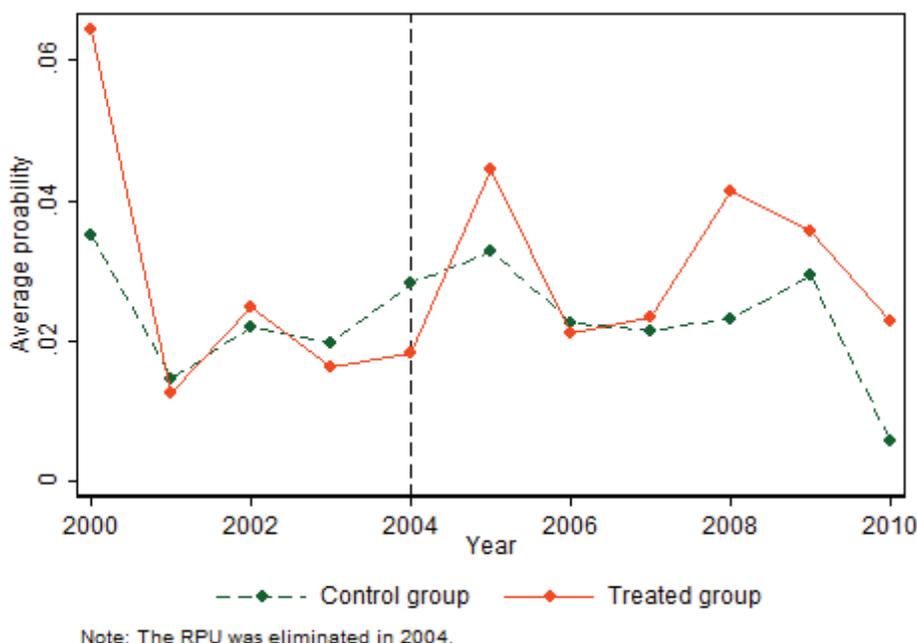
Figure 4: RPU elimination and changes in the registration probability (during the first year after transaction)



4.3 Incidence of property transactions

It is plausible that the elimination of the RPU not only reduced the probability of registering properties transactions but that it also reduced their incidence. For example, higher registration costs (monetary and non-monetary) might have created disincentives for households to perform investments in their properties. To investigate this issue, we analyzed whether households in the treated districts were less likely to perform any type of transaction after the elimination of the RPU (when compared to the control districts). Figure 5 plots the average probability of having a property transaction for the time period of 2000-2010 for households in both the treated and control districts. The figure indicates that households in the treated districts did not systematically have more property transactions than the control districts prior to the elimination of the RPU. In fact, treated and control districts had similar levels and followed identical trends in their probability of having a property transaction. After the elimination of the RPU, the trends remained similar for both the control and treated districts and there was no clear visual evidence of a differential change in levels for the treated districts.

Figure 5: Average probability of transactions (all transaction types)



In addition, we fitted a linear difference-in-difference model similar to equation (1), but used an indicator variable as an outcome to determine whether households had any property transactions (of any type) in year y . We fitted this model at the household level and therefore, it did not include transaction-type specific dummies (refer to Table A2 in the Appendix). The elimination of the RPU had a slightly negative effect (of -0.001) in the yearly probability of having a transaction and was not statistically significant (p-value of 0.893). Therefore, we found no evidence that the elimination of the RPU affected households' decisions to modify their properties or engage in transactions.

5. Discussion and Conclusion

We exploited the natural experiment provided by the sudden elimination of a less expensive and streamlined registration system to identify the causal effects of making the registration of property transactions more burdensome. We noted a significant reduction in the rate of registering different types of transactions, including those that involved a change in ownership.

A lack of registration hinders a households' ability to benefit from tenure security in the future (e.g., use the property as collateral for a loan). Poor households are caught between certain immediate costs of registering a transaction (i.e. fees) and uncertain future benefits. However, households make these decisions with little knowledge regarding the perils of not registering their property transactions and the legal complications and expensive procedures to correct this problem in the future. The policy implications are serious because they may jeopardize the success of titling

efforts. For instance, there may be a high percentage of property owners who are not the legal owners according to public records, which increases tenure insecurity and adversely impacts the effectiveness of the titling program in the long run.

Overall, our results offer the first causal evidence to date regarding the relevance of the registration system for the sustainability of titling programs in developing countries. Currently, policy makers have focused primarily on the process of granting titles. Our results indicate that maintaining a low cost, streamlined registration system is critical to preserve the success of property titling programs.

Acknowledgements

We would like to sincerely thank to Carmen Astorne, Cesar Calvo, Stefan Dercon, Fernando Fernandez, Paul Gertler, Marco Gonzalez-Navarro, Nicholas Magnan, Craig McIntosh, Hari K. Nagarajan, Ernesto Schargrodsky, Mans Soderbom, Graciela Teruel, Maximo Torero, the participants of the Midwest International Economic Development Conference at the University of Minnesota, the Canadian Economic Association Annual Conference at the University of Calgary, the Lincoln Institute of Land Policy Research Seminar, the Latin American and Caribbean Economic Association Annual Conference at the Universidad del Pacifico and the seminars at RAND and the Universidad del Rosario for their helpful comments. In addition, we are particularly indebted to Angel Ayala and Alejandro Bardales of the COFOPRI office for providing the survey data. All remaining errors are ours.

Declaration of interest

The authors have no conflicts of interest to declare

Funding

Dr. Molina gratefully acknowledges funding support by the Lincoln Institute of Land Policy (grant number LUL102914).

References

- Carter, M.R., Olinto, P., 2003. Getting institutions “right” for whom? Credit constraints and the impact of property rights on the quantity and composition of investment. *Am. J. Agricult. Econ.* 85, 173–186.
- Di Tella, R., Galiani, S., Schargrodsky, E., 2007. The formation of beliefs: Evidence from the allocation of land titles to squatters. *Q. J. Econ.* 122, 209–241.
- Field, E., 2003. Fertility responses to land titling: The roles of ownership security and the distribution of household assets. Mimeo.
- Field, E., 2005. Property rights and investment in Urban Slums. *J. Eur. Econ. Assoc.* 3, 279–290.
- Field, E., 2007. Entitled to work: Urban property rights and labor supply in Peru. *Q. J. Econ.* 122, 1561–1602.
- Field, E., Torero, M., 2006. Do property titles increase credit access among the urban poor? Evidence from a Nationwide titling program, Mimeo.
- Galiani, S., Schargrodsky, E., 2004. Effects of land titling on child health. *Econ. Hum. Biol.* 2, 353–372.
- Galiani, S., Schargrodsky, E., 2010. Property rights for the poor: Effects of land titling. *J. Public Econ.* 94, 700–729.
- Galiani, S., Schargrodsky, E., 2016. The Deregularization of Land Titles. NBER Working Paper, No. 22482.
- Institute for Liberty and Democracy, 2007. *The War of the Notaries*, Lima: ILD.
- Institute for Liberty and Democracy, 2010. *Evaluación y Perspectivas de las Políticas Gubernamentales para Consolidar los Derechos de Propiedad en el Perú*, [Presentation], ILD.
- Molina, O., Soderbom, M., 2011. Heterogenous effects of property rights on housing investment in Urban Peru. Preliminary paper, presented as EEA-ESEM, Mimeo.
- Vogl, T.S., 2007. Urban land rights and child nutritional status in Peru, 2004. *Econ. Hum. Biol.* 5, 302–321.

Appendix

Table A1: Effect of eliminating the RPU on the probability of registration – Full Estimation Results

	Sample Includes:	
	First year after transaction	All years after transaction
	(1)	(2)
After	-0.0199 (0.0327)	0.00730 (0.0297)
TD	0.145** (0.0581)	0.0908*** (0.0312)
After*Later		0.00927 (0.0296)
TD*Later		0.0683** (0.0275)
TD*After	-0.0811** (0.0349)	-0.0785** (0.0356)
TD*After*Later		0.0780** (0.0352)
Age	0.00186** (0.000786)	0.000280 (0.000170)
Female	0.0213 (0.0324)	0.00357 (0.00634)
Education: Secondary or less	0.0197 (0.0152)	0.00431 (0.00394)
Education: Postsecondary	0.0622** (0.0270)	0.0119** (0.00558)
Civil Status: Married	0.0216 (0.0258)	0.00624 (0.00516)
Household size	0.00132 (0.00412)	0.000376 (0.000856)
Log(Income per capita per day)	-0.00762 (0.0150)	-0.000922 (0.00297)
Property acquired by squatting	-0.00333 (0.0142)	-0.00124 (0.00332)
Property size (squared meters, in hundreds)	-0.00198*	-0.000539*

	(0.00108)	(0.000279)
Time since acquired property (years)	-0.000189	4.73e-05
	(0.00115)	(0.000289)
District is on the coast (0=no; 1=yes)	-0.0252	-0.0103
	(0.0511)	(0.0113)
Altitude (meters above the sea level)	1.18e-05	3.81e-06
	(1.59e-05)	(3.26e-06)
Index of human development	-0.604	-0.113
	(0.680)	(0.142)
Literacy rate	0.145	0.0377
	(0.303)	(0.0567)
Year	0.00678*	0.00110
	(0.00346)	(0.000690)
Constant	-13.43*	-2.289*
	(6.866)	(1.380)
Number of transactions	1,504	8,685
R-squared	0.069	0.083

*Notes: Other controls in column 1 included dummies for each type of property transaction. Other controls in column 2 included dummies for each type of property transaction that interacted with dummies for each year since the date of the transaction. Standard errors are displayed in parentheses and were clustered at the district level. *** denotes statistical significance at the 1% confidence level; ** denotes statistical significance at the 5% confidence level; * denotes statistical confidence at the 10% confidence level.*

Table A2: Effect of eliminating the RPU on the incidence of property transactions

	Outcome: Probability of any property transactions in the year
After	0.0115*** (0.0034)
TD	0.0107* (0.0058)
TD*After	-0.0005 (0.0037)
Observations	44,781
R-squared	0.004

*Notes: Controls included characteristics of the head of household or qualified respondent (age, gender, education level and marriage status), characteristics of the household (size and income per capita per day), characteristics of the property (size, time since acquisition and whether it was acquired by invasion), characteristics of the district (whether it was a coastal district, altitude, human development index and literacy rate) and a time trend. Standard errors are displayed in parentheses and were clustered at the district level. *** denotes statistical significance at the 1% confidence level; ** denotes statistical significance at the 5% confidence level; * denotes statistical confidence at the 10% confidence level.*