Urban Property Rights and Labor Supply in Peru:
Heterogeneity Analysis by Gender and Educational Attainment

Senior Honors Thesis

Juan Sebastián Rozo Vásquez*

Advisor: Dr. Demian Pouzo

Economics Department

University of California, Berkeley

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Abstract

Urban poverty is a pressing issue in Latin America. High urbanization rates across the region translate into slum conformation. These informal settlements introduce a friction in the labor market and thus represent an obstacle for economic growth. Erica Field (2007), employing a difference-in-difference approach, uses the variation on tenure security resulting from a land titling program in Peru between 1996 and 2003 to estimate the impact of the formalization of ownership on the labor market. Her estimates suggest a substantial increase in labor supplied as well as a significant substitution of in-home work for outside employment. This paper replicates Field's results, checks for robustness, and explores the relationship between household labor supply and the formalization of tenure security interacted with gender and educational attainment. This paper concludes that the reported results are robust to the use of neighborhood fixed effects. Furthermore, it suggests that the causal effect of the program is driven by male-headed households and finds no overall bias introduced by the educational attainment of the household's head. Results suggest that there are differences in the way that titling programs affect households in squatter populations.

I. Introduction

Latin America is becoming increasingly urbanized. As Angotti (2013) notes, over 80 percent of its population lives in metropolitan areas, which makes it the most urbanized region in the developing world. This high urbanization trend is concerning because of the rising proportion of urban residents who live in poor, unequal and socially excluded areas. For instance, UN-Habitat, the United Nations programme for human settlements, reports that, in 2001, countries like Bolivia and Peru had an urban slum population that accounted for more than 60 percent of the total urban population (López, 2003). These figures do not represent isolated cases in South America, but instead portray a challenge that has resulted from rapid urbanization rates in the region. In fact, in Argentina, Brazil and Venezuela, informal settlers represented between 30 and 40 percent of the total urban population while in Colombia, Ecuador and Paraguay the figure was around one fourth (López, 2003). Although proportions vary across nations, they are high and consequently, slums have been frequently addressed as issues regarding the economic development of the territory.

Latin America's shift towards urbanization can be connected to economic and socio-political factors. While the before-mentioned 80-percent figure evidences a natural increase in population, it is fundamentally linked to a rural-urban migration, both forced and voluntary, caused by a multitude of internal issues. Angotti (2013) indicates that people who once lived off their land had to relocate to cities after global capital gained control over their main resource, which began to be used to produce commodities in the global marketplace. In addition to this, Field (2007) points out that this process was exacerbated in countries like Peru, one of the countries with highest urban slum population in the region, by ineffective agrarian reforms, and the violence generated by groups that operate outside the law and their consequent forced displacement. As a result of the juxtaposition of these events, among others, some rural residents became marginal inhabitants of

major cities. In this regard, the UN-Habitat estimated that in the period 1970-1990, the poor population in cities increased from 44 million to 115 million while in rural areas it increased from 75 million to 80 million (López Moreno, 2003). Hence, as of 1980, the number of urban poor has been greater than the number of rural poor in Latin America, a shift that has been evident in slum conformation.

People developed informal ownership rights on the perimeters of major metropolitan areas. The high degree of centralization across the region and some urban policies influenced destination choices of rural migrants. Field (2007) indicates than urban migration in Peru, for example, took place after the approval of an implicit housing policy during the 1980's that tolerated squatter settlements on empty and extensive government lands. They could settle on these lands, which were predominantly located on the periphery of major cities, but this occupation had no security of tenure. In this context, urban squatters do not own the land itself, but own socially recognized rights of action. As outlined by the Global Report on Human Settlements (2003), squatters are not protected against involuntary removal from their residences. After initially taking the land, peri-urban residents have a communal right before it is taken by someone else. This constant threat leads them into an unsustainable lifestyle. In order to subsist, they must work outside of their communities due to the lack of opportunities that distinguish peripheral sectors. But, in order to secure housing, they must stay in the land and avoid either displacement by the government, which might take the land back for public use, or exclusion by another unlawful occupant.

For this reason, urban informality has been regarded as an economic development issue. The risk of forced eviction is a burden that impedes households living in irregular settlements from fully engaging in the economy. Because of this, there have been large-scale programs across Latin America that have aimed to allocate property titles to households living in informality. Although

the identification of right owners is not sufficient to break the poverty cycle, it improves the quality of life of squatter populations by providing a shelter, reducing social exclusion and encouraging investment in home-based activities (Global Report on Human Settlements, 2003). In particular, it is the intent of this paper to examine other benefits of land tenure formalization such as the potential labor market effects. Using a titling program in Peru previously studied by Field (2007), this paper measures the impact of addressing urban informality on household workhours, interacted with the gender and level of education of the household head.

The remainder of this paper is organized as follows. Section II offers a survey of literature that documents the reasons why land titling can be a significant tool for poverty reduction. Section III describes the data and section IV explains the estimation methods. Section V interprets the obtained results and section VI provides a conclusion.

II. Literature Review

The relationship between formal land titles and economic development has received significant attention. There are narratives that portray the risk of forced eviction as a perpetuator of poverty in poor urban areas. In this regard, people underutilize resources in order to implement insurance mechanisms. Field (2007) indicates that without the possession of formal land titles, urban squatters have no legal recourse and thus, they rely on family members, including both adults and children, to prevent property disputes. The policing efforts of these household members prevent adults from fully participating in the labor force and increases child labor. According to Field's empirical study on Peru, formalizing property rights in urban squatter communities increases total household labor supply and also reduces child labor in a house with less than four potential workers (2007). Thus, in the absence of formal ownership, households enter a poverty

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cycle in which adults reduce their work hours to ensure informal tenure and child wages are used to smooth over family income shocks.

However, the economic returns to formalizing land tenure are up to debate. In contrast to Field's argument, Galiani and Schargrodsky's study indicates that the lack of formal titles does not deteriorate labor market performance of household members (2010). Instead, based on program data from Argentina, they claim that entitling the poor impacts poverty through three different variables. First, it increases investment in residential infrastructure since returns cannot be seized. Second, it decreases the number of household members either by fewer presence of relatives or a reduction in fertility. Third, it increases educational achievement of their children, which can be linked to greater future earning capacity. Thus, they affirm that without the possession of formal land titles, urban squatters are limited in their ability to invest on physical and human capital, which are conditions that have the potential to contribute to the reduction of intergenerational poverty.

Furthermore, prior research explores the relationship between titling efforts and the ability to obtain financial services. Feder et al. (1988) indicate that the lack of formal ownership impedes the access to credit markets. Yet, Field and Torero (2006) show in Peru that humble landholdings do not necessarily make asset-based lending feasible for the average credit applicant. The authors argue that the Peruvian titling program had a limited reduction in inequality in the financial market for urban squatters. Their findings evidence a slight benefit once their loan has been approved. In this regard, people face lower interest rates (by 9 percentage points) once their loans from the private sector have been granted. But, formal ownership does not have an impact on present sources of income. Although Field and Torero (2006) indicate that untitled households are 9 to 10 percentage points less likely to obtain a home construction loan from a public-funded bank, titling

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does not seem to have a significant impact on the approval rates of other loans provided by the private sector. Therefore, after program implementation, poor urban households still cannot depend on credit to smooth over income shocks.

It is evident that there is no consensus on the specific channel through which land titling influences economic outcomes. Some authors have recognized that the increase in tenure security leads to a greater participation of household members in the labor market. Field (2007) establishes that levels of consumption can be maintained with an increase in adult hours and a reduction in child labor. However, these results appear inconsistent with other narratives that argue that titling carries, exclusively, investment-related benefits. Galiani and Schargrodsky (2010) assert that titles incentivize the urban poor to increase investment in residential infrastructure and in education of their children. In fact, the former argument agrees with Field and Torero's notion that ownership facilitates the approval of public loans that aim to make investments in land (2006). Likewise, there exists a considerable body of literature on the relationship between formal ownership, and credit access and entrepreneurial income. However, according to Field and Torero (2006), formally documented ownership does not seem to improve access to private credit.

Land titling programs across developing countries have been used in several studies to assess the impact of the formalization of property rights on an extensive array of economic variables. The preceding literature focuses on the causal effect on variables like labor, investment on physical capital, formation of human capital and credit access, and assume it to be equal across all the squatter population. This research, however, aims to identify the impact of land titling on labor supply and determine whether its magnitude depends on the gender or education level of the household head. For this study, the data set collected by Field (2007) is analyzed.

III. Data Description

Measuring the average causal effect of land titling is challenging. Due to ethical considerations, the formalization of property rights tends not to be assigned randomly among urban slum dwellers. Because of this, after any program intervention, researchers are left with observational data and the duty of constructing a credible measure of the missing potential outcome. Field (2007), for example, relied on a natural experiment in Peru to estimate the labor market consequences of the regularization of security of tenure.

Between 1995 and 2003, the Peruvian government issued reforms to formalize the property rights of squatters who had invaded public lands in eight cities. According to the 1993 census conducted by the INEI, these human settlements were systematically located in the poorest districts (World Bank, 1998). Because of the spatial concentration of poverty, several project teams entered neighborhoods in different areas of each city and then moved into contiguous neighborhoods until all eligible households in each district had been titled (Field, 2007). Therefore, at any given time, there were neighborhoods where the program had already been implemented while other beneficiaries would still be waiting. However, Field (2007) noticed that teams moved in different directions and at different speeds. Thus, although the timing of neighborhood entry was not randomized, the timing of program implementation was independent of neighborhood characteristics such as socioeconomic status or centrality. Hence, it can be assumed that slums that were selected for earlier program participation were not systematically different from districts that were titled later on.

Peru's titling program provides a basis for causal inference. Out of the universe of all target households, the proportion of slums to which property rights could be simultaneously provided was constrained. Therefore, at any given point in time, there were squatter households in

neighborhoods that had already been reached by the program while there were others in neighborhoods not yet reached. This situation allowed households in late-program areas to provide a credible counterfactual to households in earlier-program areas. In fact, Field (2007) indicates that the treated and untreated groups were similar, at the neighborhood level, across a range of characteristics such as education of household head and household adult literacy rate, among other outcomes of interest. Despite this, neighborhood timing was non-random and thus, assuming that what goes on in the control group is what would have happened to the treatment group in the absence of the program is too strong. For this reason, Field introduces a subcategorization of slum dwellers. Namely, she coins the term nonbeneficiaries to refer to people who already had formal ownership prior to program implementation and beneficiaries to denote squatters. Hence, the appropriate approach is to compare the differences of beneficiaries and nonbeneficiaries in treated neighborhoods to the differences between potential beneficiaries and nonbeneficiaries in the control group. Given this setup, the causal effect is estimated through a difference-in-difference approach.

The empirical analysis presented in this paper makes use of the data set used by Field (2007). From all the residences living informally that were identified by INEI's 1993 census and thus targeted for intervention, a random sample of 2,750 urban residences was drawn. From this sample, 2,592 households (158 were not eligible) were surveyed in March 2000 on information regarding both individual and household characteristics as well as household's experiences after obtaining formal ownership (Field, 2007). It should be noted that since the titling program took place in the period 1995-2003, the 2000 survey provides data on households living in treated and control neighborhoods.

In the survey, Field (2007) collected information regarding household and neighborhood characteristics. The data set contains demographic facts. On one hand, there is information concerning household members directly such as the number of members in different age groups (2-4, 10-69, and over 69), the average age of members, the fraction of adults who are male, the education level of household heads and whether they have experienced a shock in the last year. On the other hand, there is information regarding household's property such as whether it was acquired through invasion or inheritance as well as the walking distance/time to educational centers, bus stop and market. In addition, the set documents characteristics at the neighborhood-level. For example, it indicates whether neighborhoods currently have local educational centers, a bus stop, public phone and a market, and whether this has been the case during the last two years.

From the information collected by this survey, the dynamics of gender and education in the slum population are the most relevant to this paper. Appendix Table I presents descriptive statistics regarding gender in the sample. It suggests that the fraction of households where the head was female is roughly one fourth across squatter and titled dwellings in treated and untreated neighborhoods. Furthermore, Appendix Table II presents the statistics with respect to educational attainment. The data shows that the fraction of households where the head has a level of education beyond elementary school is about three fifths across all four cohorts. Therefore, the similarity in means across units indicates that beneficiaries and nonbeneficiaries seem to, indeed, be similar at the neighborhood level.

IV. Estimation Methods

This paper aims to explore the relationship between household labor supply and the formalization of tenure security interacted with gender and educational attainment using survey

data from Field (2007). In this regard, the identification strategy is split into two stages of interaction terms analysis. Under this structure, the paper aims to identify the impact of the program implementation on labor supply when the household head is either male or female, as well as the causal effect when the household head has completed only elementary school education or more. These stages allow the decomposition of the causal effect into different associations.

To start off, the variation in tenure security is exploited to measure the change in household work hours interacted with gender. This suggests running the following regression:

$$(1)\ labor_{ijk} = \beta_0 + \beta_1(squatter_{ijk}) + \beta_2(program_{jk}) + \beta_3(gender_{ijk}) + \beta_4(program_{jk}$$
$$\cdot\ gender_{ijk}) + \beta_5(squatter_{ijk} \cdot gender_{ijk})$$
$$+ \beta_6(squatter_{ijk} \cdot program_{jk}) + \beta_7(squatter_{ijk} \cdot program_{jk} \cdot gender_{ijk})$$
$$+ \Pi D_{ijk} + \Omega N_{jk} + \varepsilon_{ijk}$$

where $labor_{ijk}$ refers to the total weekly work hours of household i in neighborhood j and city k, $squatter_{ijk}$ is a dummy specifying whether the household belongs to the cohort of beneficiaries in the sample, $program_{jk}$ indicates whether neighborhood j has been reached and $gender_{ijk}$ is a binary variable indicating whether the household head is female. In addition, D_{ijk} and N_{jk} are vectors containing demographic and neighborhood-level controls, respectively. In this setup, the coefficient β_6 is the estimated program effect for men and the sum of coefficients $\beta_6 + \beta_7$ is the expected impact for women in treated neighborhoods.

The included control variables fall under two categories. Variables that describe household members and their properties are grouped together in D_{ijk}. They are incorporated into the regression because it is easy to see that households that have recently experienced a shock, that have more working-age adults, or less members aged 2 to 4, are likely to work more hours during the week. Moreover, variables that describe neighborhoods are included in N_{jk}. Following the

aforementioned argument, dwellers of neighborhoods that have access to public transportation, local educational centers and markets can allocate more of their time to working activities relative to people who have to commute longer distances in order to access those services. Then, it is fair to assume that each of these factors has an impact on household labor supply. Additionally, note that since the program targeted the poorest districts in Peru, household and neighborhood characteristics can also be linked to program implementation. Therefore, including these in the model represent an attempt at isolating the causal effect.

Likewise, the variation is used to determine whether the full enjoyment of property rights has an effect on worked hours that changes when interacted on the level of completed education. To test this, the following regression is run:

$$(2)\ labor_{ijk} = \beta_0 + \beta_1(squatter_{ijk}) + \beta_2(program_{jk}) + \beta_3(educ_{ijk}) + \beta_4(program_{jk}$$

$$\cdot\ educ_{ijk}) + \beta_5(squatter_{ijk} \cdot educ_{ijk})$$

$$+ \beta_6(squatter_{ijk} \cdot program_{jk}) + \beta_7(squatter_{ijk} \cdot program_{jk} \cdot educ_{ijk})$$

$$+ \Pi D_{ijk} + \Omega N_{jk} + \varepsilon_{ijk}$$

where $labor_{ijk}$, $squatter_{ijk}$, $program_{jk}$, D_{ijk} and N_{jk} are defined as above, and $educ_{ijk}$ is a dummy indicating whether the household head has a level of education higher than elementary school or not. The coefficient β_6 can be interpreted as the estimated program effect for squatters with elementary school as highest grade and the sum of coefficients $\beta_6 + \beta_7$ is the expected impact for beneficiaries with higher levels of education in treated neighborhoods.

V. Empirical Results

V.A. Field's Findings

The findings reported by Field (2007) are replicated and presented in Appendix Table III. Although the identification strategy used is not the same as this paper's, Field's results serve as a benchmark that can be used to compare the findings that are obtained later on in this paper. Overall, the titling program leads to a 14% increase in total household labor supply; this increase is also evident when the impact is analyzed by the number of worked hours per member aged 5-69. Moreover, the increase in security of tenure causes a decrease by 11 percentage points of the likelihood of working inside the home, and an increase by 4 percentage points of the probability of working with an outside employer. These coefficient estimates and significance slightly change between regressions with full demographic controls and models with just basic controls.

V.B. Use of Neighborhood Fixed Effects

Field's main results are obtained by regressions that use city fixed effects. Since neighborhood timing was non-random, some variation between cohorts could be introduced by neighborhood-level characteristics. Although the regression estimates of columns (8)-(9) of Appendix Table III had been obtained using neighborhood fixed effects, this paper runs all the models in the table using neighborhood fixed effects and presents the results in Appendix Table IV. In general, coefficient estimates are almost identical. However, since significance associated with certain estimates seems to be slightly greater using neighborhood fixed effects, this paper will run the regressions presented in models (1) and (2) using both fixed effects.

V.C. Effect on Labor Supply Interacted with Gender

This paper aims to extend the understanding of labor supply responses to a variation in security of tenure by running the identification strategy introduced in model (1). For this study, it

is of interest to investigate the gender-based differences in the relationship previously explored by Field (2007). Hence, the survey data, in the context of the large-scale titling program in Peru, was analyzed to identify such relationship. Table I presents estimates of equation (1) and some variations of it. Column (1) presents the model without control vectors, column (2) adds household-level controls, column (3) includes neighborhood-level controls and column (4) has full demographic controls. These four regressions use city fixed effects. Column (5) extends the analysis to neighborhood fixed effects without any controls whereas column (6) includes household-level controls.

TABLE I
Household Labor Supply

	(1) Total Household Hours	(2) Total Household Hours	(3) Total Household Hours	(4) Total Household Hours	(5) Total Household Hours	(6) Total Household Hours
Squatter	-20.85** [5.978]	-8.30+ [4.821]	-21.71** [6.091]	-8.80+ [4.792]	-16.16** [6.125]	-4.94 [5.061]
Squatter x Program	27.24** [9.836]	17.16* [7.669]	27.55** [10.275]	18.59* [7.543]	21.38* [9.869]	17.49* [8.092]
Squatter x Program x Gender	-13.73 [17.064]	-15.12 [12.863]	-15.40 [16.984]	-17.91 [12.990]	-17.28 [18.220]	-18.63 [15.022]
Household-level controls?	No	Yes	No	Yes	No	Yes
Neighborhood-level controls?	No	No	Yes	Yes	No	No
Fixed Effects:	City	City	City	City	Neighborhood	Neighborhood
Observations	2,499	2,489	2,475	2,465	2,499	2,489
R-squared					0.155	0.448
P-value: $\beta_6 + \beta_7$	0.358	0.858	0.417	0.953	0.803	0.933
Mean Program Effect	27.243	17.158	27.555	18.590		
SE	9.836	7.669	10.275	7.543		

The regression estimates in column (4) assess the impact of titling, interacted with gender, on household labor supply using city fixed effects. The results indicate that, in treated neighborhoods, the implied program effect for male-headed households is 18.6 hours. This figure

suggests a 19% increase in total household labor supply as a result of the titling program, which is close to Field's 14%. Moreover, the difference between female- and male-headed households is -17.91 hours, which implies a program effect of 0.69 hours for female-headed households. However, neither β_7 nor $\beta_6 + \beta_7$ are significant. Thus, results fail to distinguish a significant difference between the two cohorts being compared, but they also fail to reject the null hypothesis of no effect for women.

Column (6) evaluates the effect of titling, interacted with gender, on household labor supply using neighborhood fixed effects. The implied program effect for male-headed households in treated areas is 17.5 hours, which is consistent with the estimate given by the regression with city fixed effects. This figure suggests an 18% increase in total household labor supply as a result of the titling program. The difference between female- and male-headed households is -18.63 hours but is insignificant. This result would have implied a program effect of -1.14 hours, which would have suggested that greater security of tenure actually leads to a reduction in total labor supply of female-headed households. However, this result is attributed to chance.

Table II presents the obtained results after running model (1) with three different outcome variables. The saturated versions of the city and neighborhood fixed effects regressions described in columns (4) and (6) of Table I, respectively, were evaluated with other dependent variables. These models aim at evaluating the impacts of the full enjoyment of property rights on the total work hours per working-age member and the choice of work location. The interpretation of the obtained estimates suggests that results are driven by male-headed households.

TABLE II
Other Outcomes

	(1) Hours per Member Aged 5-69	(2) Hours per Member	(3) Residence Used for	(4) Residence Used for	(5) Household Member Commutes	(6) Household Member Commutes

	Aged 5-69	Economic Activity	Economic Activity	More Than 2 Hours	More Than 2 Hours
Squatter	-2.25+ [1.146]	-2.01+ [1.219]	0.02 [0.035]	0.02 [0.034]	-0.02 [0.015]	-0.01 [0.017]
Squatter x Program	4.91* [1.933]	5.74** [1.949]	-0.13* [0.062]	-0.15** [0.054]	0.02 [0.024]	0.00 [0.027]
Squatter x Program x Gender	-5.40 [3.724]	-6.34+ [3.619]	0.19+ [0.101]	0.18+ [0.101]	0.05 [0.042]	0.07 [0.049]
Household-level controls?	Yes	Yes	Yes	Yes	Yes	Yes
Neighborhood-level controls?	Yes	No	Yes	No	Yes	No
Fixed Effects:	City	Neighborhood	City	Neighborhood	City	Neighborhood
Observations	2,465	2,489	2,465	2,489	2,465	2,489
R-squared		0.193		0.176		0.152
P-value: $\beta_6 + \beta_7$	0.882	0.854	0.511	0.747	0.070	0.109
Mean Program Effect	4.915		-0.130		0.024	
SE	1.933		0.062		0.024	

Columns (1)-(2) evaluate the impact of titling on worked hours per working-age member. According to the neighborhood fixed effects regression, the marginal effect is 5.74 hours for male-headed households in neighborhoods already reached by the program. The difference in treatment effect between female- and male-headed households is -6.34 hours and is statistically significant. It should be noted that this figure does not lead to the conclusion that the impact for female-headed households is -0.6 hours because this estimate is not significant. Thus, these results suggest that the greater security of ownership increases the number of worked hours per working-age member in male-headed households while the effect on female-headed households is not increasing.

The regression estimates in columns (3)-(4) assess the effect of titling on home-based economic activities. In this regard, 602 households reported using their residence as a source of economic activity, which is a little over 24% of the sample. The likelihood of working inside the home declines by 13-15 percentage points for the average squatter male-headed household in treated areas. Although the difference in treatment effect between female- and male-headed

households is 0.18-0.19 hours and is statistically significant, it cannot be concluded that the program increases the presence of a home business for female-headed households because β_6 and β_7 are not jointly significant. Therefore, these estimates indicate a substantial reduction in the usage of residences for economic activities for male-headed households and a non-negative effect for female-headed households in treated neighborhoods.

Lastly, columns (5)-(6) estimate the impact of titling on household workers who commute more than two hours to and from work. The fraction of household members seems to be greater for female-headed households than their male-headed counterparts. However, all estimates of interest are statistically insignificant. Hence, it is not possible to break down the increase in work outside of the house reported by Field into female- and male-headed households.

Overall, results are in the direction of male-headed households. On one hand, across the different estimating regressions, the treatment effect for male-headed households matches Field's coefficient estimates and remained significant. Table I suggests large labor supply responses to tenure security in male-headed households. Likewise, table II indicates an increase in hours per working-age member and a decline in in-home work for the aforementioned cohort. On the other hand, the treatment effect seems to be attenuated and not statistically significant for female-headed households. Table I suggests minimal and even negative labor supply responses to tenure security in female-headed households. Furthermore, table II indicates that the titling program implies neither an increase in the number of hours worked per working-age member nor a decline in in-home work for this cohort. Therefore, the results presented by Field seem to be driven by a disproportionately large group in the sample as indicated by Appendix Table I.

V.D. Effect on Labor Supply Interacted with Educational Attainment

Likewise, this paper aims to develop a framework to isolate the impact of greater security of ownership on work hours interacted with educational attainment. In this regard, it is of interest to investigate the education-based differences in the relationship previously explored by Field (2007). It is not unusual to think that household members with higher education levels might be able to work more hours after a reduction in risk of eviction relative to households that have exactly completed only elementary school. Regression (2), and some variations of it, put this intuition into examination and Table III presents the corresponding estimates. Similar to Table I, the first four columns highlight the estimates from regressions that used city fixed effects while the last two used neighborhood fixed effects. In particular, columns (4) and (6) contain the results of model (2) with full controls.

TABLE III
Household Labor Supply

	(1) Total Household Hours	(2) Total Household Hours	(3) Total Household Hours	(4) Total Household Hours	(5) Total Household Hours	(6) Total Household Hours
Squatter	-12.42 [8.969]	-6.76 [6.882]	-12.61 [9.214]	-6.56 [6.868]	-7.93 [8.394]	-2.97 [6.905]
Squatter x Program	25.89+ [13.792]	12.65 [10.607]	24.74+ [14.137]	12.83 [10.495]	17.56 [12.885]	11.59 [10.570]
Squatter x Program x Education	-4.38 [15.887]	0.24 [12.197]	-2.35 [15.823]	1.10 [12.218]	-1.61 [15.599]	1.06 [12.842]
Household-level controls?	No	Yes	No	Yes	No	Yes
Neighborhood-level controls?	No	No	Yes	Yes	No	No
Fixed Effects:	City	City	City	City	Neighborhood	Neighborhood
Observations	2,499	2,489	2,475	2,465	2,499	2,489
R-squared					0.156	0.446
P-value: $\beta_6 + \beta_7$	0.025	0.105	0.024	0.075	0.141	0.157
Mean Program Effect	25.886	12.647	24.743	12.832		
SE	13.792	10.607	14.137	10.495		

The regression estimates in column (4) evaluate the effect of titling, interacted with educational attainment, on household labor supply using city fixed effects. The results suggest that, in treated neighborhoods, the implied program effect for squatter households in which elementary school is the highest educational attainment of the head is 12.8 hours. This indicates that the titling program is associated with a 13% increase in total household labor supply. Additionally, the difference between a household in which the head has completed more education than elementary school and a head that is less-educated is 1.10 hours. The abovementioned result resonates with the intuition that a more educated household head will take advantage of the decline in risk of forced eviction and thus will work more hours. However, although the estimates seem to align with what was expected, all the coefficients on the interaction terms are insignificant and thus, the observed differences are unlikely to be detected if the collected sample were different.

Column (6) evaluates the effect of titling, interacted with educational attainment, on household labor supply using neighborhood fixed effects. The coefficient on the interaction term between squatter and program indicates that a squatter household in which elementary school is the highest educational attainment of the head will on average work 11.6 hours. Moreover, the difference between a household in which the head has only completed elementary school and one in which the head has a higher educational level is 1.06 hours, which is roughly identical to the result obtained in column (4). Nevertheless, these regression coefficients are insignificant as well and, therefore, these differences on the allocations of labor are likely due to chance.

Table IV presents some extensions of the basic estimating equation (2). By changing the dependent variable, it is intended to analyze other potential outcomes that could be impacted differently depending on the household head's education level. Namely, the relationships between titling, and labor supply per working-age members and work location, are analyzed. Each

dependent variable is examined using a city fixed effects and a neighborhood fixed effects regression.

TABLE IV
Other Potential Outcomes

	(1) Hours per Member Aged 5-69	(2) Hours per Member Aged 5-69	(3) Residence Used for Economic Activity	(4) Residence Used for Economic Activity	(5) Household Member Commutes More Than 2 Hours	(6) Household Member Commutes More Than 2 Hours
Squatter	-2.06 [1.547]	-1.63 [1.663]	0.04 [0.037]	0.06 [0.046]	-0.05** [0.016]	-0.05* [0.023]
Squatter x Program	3.93 [2.497]	4.63+ [2.546]	-0.09 [0.067]	-0.14+ [0.071]	0.07* [0.031]	0.06+ [0.035]
Squatter x Program x Education	-0.71 [2.971]	-0.85 [3.093]	0.00 [0.074]	0.05 [0.086]	-0.06 [0.039]	-0.08+ [0.042]
Household-level controls?	Yes	Yes	Yes	Yes	Yes	Yes
Neighborhood-level controls?	Yes	No	Yes	No	Yes	No
Fixed Effects:	City	Neighborhood	City	Neighborhood	City	Neighborhood
Observations	2,465	2,489	2,465	2,489	2,465	2,489
R-squared		0.190		0.175		0.152
P-value: $\beta_6 + \beta_7$	0.108	0.0787	0.163	0.151	0.683	0.671
Mean Program Effect	3.934		-0.090		0.073	
SE	2.497		0.067		0.031	

Columns (1)-(2) examine the relationship between the titling program and the total number of hours worked per working-age member in the average squatter household. According to the neighborhood fixed effects regression, the treatment effect for a household where the head is less educated is 4.63, which is significant. Surprisingly, it also indicates that households where the head has a higher educational attainment work 0.85 hours less than their counterparts, but this result is insignificant. Thus, given this sample, it is not possible to break down the increase in labor supply per working-age member reported by Field into households living with less- and more-educated heads.

Columns (3)-(4) explore the relationship between the titling program and residential economic activity. It turns out that the likelihood of working inside the home declines by 14 percentage points for the average squatter household in which the head has only completed elementary school. Thus, once property rights are secured, some household members living with a less-educated head will decide to substitute some in-home work for a job with an outside employer. Interestingly, it is suggested that such decline is smaller by 5 percentage points for households with higher-educated heads. This could be explained by the fact that a higher investment in human capital, coupled with formal ownership over land, can encourage squatters to engage in residential investment and home-based entrepreneurial projects. However, the regression estimate is insignificant and thus, this difference in the reduction of in-home work between the two cohorts is most likely a feature particular to this sample.

Finally, columns (5)-(6) analyze the relationship between the titling program and work location based on commuting time. The results obtained in this part of the heterogeneity analysis by educational attainment are interesting because both β_6 and β_7 are statistically significant. In the survey, about 5% of the households reported that someone in the residence commuted more than two hours to and from work. The fraction of household members with such commutes increases by 6 percentage points in households in which the head has only completed elementary school. But, the impact on households with higher-educated heads goes in the opposite direction. Although it cannot be concluded that the fraction goes down, it definitely does not increase for them. This implies that the greater security of ownership does not incentivize workers who live with more educated individuals in their households to commute longer distances in order to work outside their communities.

The program effect on labor supply seems to be independent of education across squatter households. Table III suggests large labor supply responses to tenure security. The estimated coefficients are roughly identical to the ones reported by Field (2007), but this approach fails to distinguish a difference in the effect between households with less- and more-educated heads. Table IV presents similar results. Neither the increase in labor supply per working-age member nor the decline in usage of residence as a source of economic activity can be broken down into households living with less- and more-educated heads. However, this table indicates that the formal identification of ownership does cause an increase in the fraction of household members who commute to work in households with less-educated heads whereas the effect is non-increasing for households with more-educated heads. Despite this change in work location, in general, the program seems to not have a differential effect that depends on the educational attainment of urban slum dwellers.

VI. Conclusion

Urban poverty is a pressing issue across Latin American countries. In this region, metropolitan areas host approximately four fifths of the total population and have the highest proportions of people living in poverty relative to rural areas. In Peru, for instance, over three fifths of the total urban population live in informal settlements (López Moreno, 2003). Households living in irregular settlements face constant risks that prevent them from fully engaging in the economy. For this reason, there have been large-scale programs across Latin America that have aimed to allocate property titles to households living in slums.

Researchers have used the resulting variation in tenure security to estimate the causal effect on potential outcomes such as labor, investment on both physical and human capital, and credit

access, among others. Field (2007), for example, claims that a government property titling program in Peru reduced the risk of forced removal or eviction and, as a result, encouraged squatter household members to engage more actively in the labor force. Relying on the data collected by Field, this paper aims to identify the impact of the formalization of tenure security, interacted with both gender and educational attainment, on the allocation of labor.

By introducing gender and educational attainment into the equation, this paper provides a new perspective on the economic returns to the recognition of urban informality. Is the increase in labor supply reported by Field driven by men? Male-headed households work more hours, measured in terms of per working-age member, and reduce the number of hours in which members work at home following the increase in tenure security. In contrast, the average female-headed household does not experience such an increase in labor supply or the reduction in in-home work. Likewise, is the increase driven by households headed by individuals with higher levels of education? To answer this, this paper compared squatter households in which the head had only completed elementary school to households in which the head had attained a higher educational level. In general, the program effect on labor supply does not seem to be driven by education. But, members of households with less educated heads seek more employment opportunities outside the residence.

The empirical analysis suggests that there is a significant increase in labor supply, that Field's results are driven by male-headed households and found a slight bias introduced by education. Beyond any doubt, the high rates of urban informality in Peru, which are also evidenced in other countries across the region, represent a friction in the labor market and are an obstacle to economic growth. For this reason, development policies support nation-wide titling programs as a way to reduce labor-market stickiness. This paper shows that the impact, however, may be

different across beneficiaries. Male-headed households drive the increases in labor supply and the reduction in in-home work whereas households with less-educated heads seem to drive the rise in outside employment. Therefore, the impact of social programs that aim to alleviate poverty can vary between different groups across the targeted population.

Appendix

TABLE I
Household Head Is Female

Population	Observations	Mean	Standard Deviation	Min	Max
No program, titled (enter=0, squatter=0)	1,314	0.2336	0.4233	0	1
No program, squatter (enter=0, squatter=1)	321	0.2399	0.4277	0	1
Program, titled (enter=1, squatter=0)	604	0.2467	0.4314	0	1
Program, squatter (enter=1, squatter=1)	260	0.2385	0.4270	0	1

TABLE II
Household Head's Educational Attainment Greater Than Elementary School

Population	Observations	Mean	Standard Deviation	Min	Max
No program, titled (enter=0, squatter=0)	1,314	0.5837	0.4931	0	1
No program, squatter (enter=0, squatter=1)	321	0.6231	0.4854	0	1
Program, titled (enter=1, squatter=0)	604	0.5911	0.4921	0	1
Program, squatter (enter=1, squatter=1)	260	0.6039	0.4900	0	1

TABLE III
Household Labor Supply with City Fixed Effects

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	Total Household Hours	Total Household Hours	Total Household Hours	Total Household Hours	Total Household Hours	Hours per Member Aged 5-69	Hours per Member Aged 5-69	Total Household Hours	Total Household Hours	Residence Used for Economic Activity	Household Member Commutes More than 2 Hours
Squatter	-7.65+	-8.05+	-34.46+	-6.79	-7.33	-1.53	-1.64	-4.67	-4.70	0.02	-0.03*
	[4.415]	[4.396]	[17.915]	[4.651]	[4.641]	[1.113]	[1.108]	[4.577]	[4.574]	[0.030]	[0.012]
Squatter x Program	13.50*	-7.96	56.50*	12.34	-12.59	3.04	-2.06	13.39+	-10.91	-0.11*	0.04+
	[6.634]	[11.702]	[25.517]	[7.478]	[12.440]	[1.979]	[3.347]	[7.367]	[14.327]	[0.053]	[0.023]
Squatter x Program Periods		10.10*	10.66*		11.78*		2.41*		10.10*		
		[4.274]	[4.179]		[4.602]		[1.135]		[5.111]		
Squatter x Program x Tenure			-0.73								
			[0.559]								
Squatter x Program x Working-age Members			-30.21**								
			[11.335]								
(Squatter x Program x Working-age Members)^2			3.63**								
			[1.243]								
Fixed Effects:	City	City	City	City	City	City	City	Neighborhood	Neighborhood	City	City
Full demographic controls?	Yes	Yes	Yes	No	No	No	No	No	No	No	No
Observations	2,465	2,465	2,465	2,489	2,489	2,489	2,489	2,489	2,489	2,489	2,489
Mean Program Effect	13.495	12.241	4.133	12.337	10.964	3.038	2.757				0.045
SE	6.634	6.772	8.218	7.478	7.529	1.979	2.003				0.023
R-squared										0.028	

TABLE IV
Household Labor Supply with Neighborhood Fixed Effects

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	Total Household Hours	Total Household Hours	Total Household Hours	Total Household Hours	Total Household Hours	Hours per Member Aged 5-69	Hours per Member Aged 5-69	Total Household Hours	Total Household Hours	Residence Used for Economic Activity	Household Member Commutes More than 2 Hours
Squatter	-3.28	-3.32	-28.22	-4.42	-4.42	-1.40	-1.40	-4.42	-4.42	0.02	-0.02+
	[4.843]	[4.842]	[17.719]	[4.847]	[4.848]	[1.186]	[1.186]	[4.572]	[4.570]	[0.030]	[0.013]
Squatter x Program	12.70+	-8.64	53.21*	12.39+	-8.27	4.01*	-0.02	12.39+	-8.27	-0.11*	0.02
	[7.030]	[12.132]	[25.895]	[7.274]	[12.219]	[1.858]	[3.600]	[7.333]	[14.137]	[0.049]	[0.018]
Squatter x Program Periods		8.80*	8.61*		8.53*		1.67		8.53+		
		[4.129]	[4.189]		[4.308]		[1.180]		[4.993]		
Squatter x Program x Tenure			-0.76								
			[0.629]								
Squatter x Program x Working-age Members			-27.80*								
			[11.585]								
(Squatter x Program x Working-age Members)^2			3.31**								
			[1.264]								
Full demographic controls?	No	No	No	No	No	No	No	No	No	No	No
Fixed Effects:	Neighborhood	Neighborhood	Neighborhood	Neighborhood	Neighborhood	Neighborhood	Neighborhood	Neighborhood	Neighborhood	Neighborhood	Neighborhood
Observations	2,489	2,489	2,489	2,489	2,489	2,489	2,489	2,489	2,489	2,489	2,489
Mean Program Effect	12.699	8.971	0.802	12.387	8.797	4.011	3.309				0.024
SE	7.030	7.164	8.950	7.274	7.306	1.858	1.976				0.018
R-squared										0.159	

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