

Housing Affordability:
The Land Use Regulation link to Informal Tenure
in Developing Countries

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Abstract

This paper provides empirical evidence on the causal association between land use regulation and housing affordability in cities from Latin America, where informal residential tenure condition of households is widespread. We collected a nationwide survey of local land use regulation from planning professionals in Argentina's municipalities comprised in the big urban metropolitan areas, and filling the gap of the lack of a source of comparable and systematic knowledge on the topic. A set of land use indicators are then created allowing the analysis of the regulatory environment according to some of the main issues (e.g., existence of land use plans; authorities involved in zoning changes and residential projects approval processes; existence of building restrictions, infrastructure provision, the presence of access to land regulatory elements, and the cost related to project approvals). Then, using data from the National Households Survey and the National Census, we estimate the effect of land regulation on households' formal/informal tenure condition. Between other findings, we document that those municipalities that have incorporated more land planning regulatory measures into their legal and regulatory frameworks also face the cost of larger informal land sectors. We also find negative effects on formality for higher residential approval costs, tighter regulation (in the form of more authorities involved in housing projects approvals), and positive effects on formal tenure housing driven by the existence of inclusionary policies.

Key words: housing affordability, exclusionary land use regulation, land markets, housing informality, land use regulation index, Latin America.

JEL Codes: R14, R52, O54

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Introduction

Given the fact that land regulation is a complex issue with little data available, this study fills a gap in urban policy in Argentina by contributing with applied research that lays the foundation for policy intervention. This research project has the specific aim of assisting in the understanding of land policy and of the specific issues that may be affecting land tenure informality.

The first thing to be remarked about land use policy in Argentina is the great variability among provinces and municipalities, where there is no legal framework guiding urban development and land use emanating from the National State. The existing legislation forms a disperse set of rules —laws, decrees and ordinances— stemming from provincial and municipal governments.

In general, land regulation in Argentina comprises land-planning laws at a provincial level and rules and ordinances at a municipal level. For example, one of the issues in the land regulatory structure is whether municipalities are empowered with independence to establish their local regulations about land. Not all provinces incorporate laws in this direction. The pattern for many provinces is the existence of a group of laws, typically outdated, that tackle only some of the major land issues.

Land use regulations have been studied by the literature of developed countries as a major factor accounting for why housing seems to be inelastic in many cities. The literature also studied the potential effects of regulation, both on house prices and on the amount of building activity (Gyourko et al., 2007). Land use regulation can affect building in a number of ways because not only does it set up minimum consumption levels (i.e., the amount of housing that can be built and other quantitative regulations, setting minimum lot sizes, heights as well as the allocation of open space) but it also affects costs indirectly through expensive or sometimes long lasting permitting procedures which raise the final cost of housing units in the locality. However, where the informal sector is relevant for providing access to land for low income households, the scope of its development might be indirectly regulated by not servicing it with certain public infrastructure investments – such as connections to sewerage, water, and road systems (Henderson and Feler, 2008) or by other fiscal and redistributive instruments that form part of the regulatory framework for land use.

It is interesting to note that there is not much empirical literature that analyzes the key effects of land use regulations in developing countries. However, a stream of research has recently focused on Latin American countries (Lall et al., 2007; Biderman, 2007; Henderson, 2007; Henderson and Feler, 2008) in order to analyze the way in which regulations —which might increase prices in the formal market— could promote more untitled-informal housing development.

Unfortunately, in Argentina, there is relatively little knowledge of the nature of regulatory frameworks for land use so it is not possible to account for their potential effects. Not surprisingly, this means that we do not fully understand the way in which a regulatory environment might constrain the housing supply or affect market prices. This in turn might affect the tenure choice of households, thus driving informality. Even though informal tenure had become prevalent in various agglomerates of Argentina, in general, the regulation only deals with the formal part of the area while no special regulatory instruments are devised for dealing with areas of informality, such as de ZEIST (Zones of Especial Interest) in Brazil.

In order to help remedy these major shortcomings of information about land use regulation in Argentina, we conducted a nationwide survey of local land use regulation covering the municipalities located in the 28 (major) urban agglomerates, covering almost all the urban land universe in Argentina³. As a first outcome of this survey, a set of indicators are built up, summarizing the main issues related with the regulatory environment for residential purposes. An approach similar to the one of Gyourko, Saiz, and Summers (2006), on their measure of the Wharton Residential Land Use Regulation Index in U.S., is followed here. While some of their indicators, as for example, when analyzing the actors and pressures involved in the definition of the regulation, are replicated in this study, several other topics have been added that might provide a more suitable explanation for the analysis of the tenure condition in developing countries, where informal markets are significant. As an example, the process of infrastructure expansion, the presence of redistributive and access to land elements in the regulation, and fiscal policies, are focused on here.⁴

Does our measured regulation have an effect on the actual tenure condition of households in Argentina? The second stage of the research had the objective of exploring the actual relationship between the existing land regulation and the actual patterns of tenure condition. In Argentina, like in most Latin American countries, the tenure condition of households presents various formal (i.e. owner, renter) and informal (i.e. owner of the house but not of the land, occupant, renter in an informal settlement) modes. In this case, as a first approach on the issue, we focused on those factors that determine informal (in opposition to formal) types of tenure. A particular attention was placed on the definition of an informal tenure condition, using alternative criteria in order to define it with different conceptual assumptions. The definitions explored alternatives that took into account a mix of tenure status, physical setting and lack of basic infrastructure and services.

Two empirical approaches were followed in order to explore the relationship between regulation and tenure condition. First, using the Permanent Households Survey (*Encuesta Permanente de Hogares*, EPH) from the National Institute of Statistics and Census (INDEC), a households' tenure choice model was estimated in the cross-section of households. The database allowed assigning each household a set of indicators of the (average)⁵ existing land regulation in the urban agglomerate in which lives, as well as a number of characteristics (e.g., life-cycle, socioeconomic), in order to predict its formal/informal tenure choice. The analysis allows recognizing the effects of certain

³ The definition belongs to the National Institute of Statistics and Census (INDEC) of Argentina. In particular, we follow this classification since the INDEC's households survey (*Encuesta Permanente de Hogares* (EPH)) is the source of the households' tenure choice data that we analyze in the second stage of the Project (see the progress on this stage on the chapter below).

See the Methodological Report for the definition of the agglomerates, as well as the names of the municipalities comprised by them.

⁴ We built up indicators and classified them according to their main topics: (i) Land Use Plan and Regulation Indicator (LPI), (ii) Zoning and Residential Projects Approval Processes Indicator (ZRPI), (iii) Building Restrictions Indicator (BRI), (iv) Infrastructure Provision Indicator (IPI), (v) Access to land Regulation Indicator (ALRI), (vi) Municipality Fiscal Indicator (MFI), and (vii) Projects Approval Costs Indicator (ACI).

⁵ See more details on the methodological section.

characteristics of the regulation into the tenure condition. In addition, for example, age, sex, or the immigrant condition also affects the propensity of having a formal or an informal tenure. In order to check for the robustness of the results on regulation indicators, an alternative source of data was explored. Using the Argentinean Census of 2001, a model of the percentage of population with formal/informal tenure across municipalities' jurisdictions was estimated.

The paper is organized as follows: the following section provides a brief literature review on the relationship between regulation and access to land. Section III describes the methodology of the paper, including the characteristics of our survey, the construction of our regulation thematic indicators, a discussion of the alternative measures of informality and tenure conditions, and the econometric models to be estimated using each of the available databases. Section IV discusses the results, including descriptive statistics of the state of the regulation in Argentina, the patterns of tenure and the econometric results.

Brief Literature Review

Land Use regulation

In this section we refer to the context of the literature on land use regulation, summarizing and drawing some conclusions from existing research while interpreting the evidence currently available. As we have already stressed in the introduction, there is relatively little published research on land market regulation in developing countries. Therefore, the analysis of the effects of land use regulation in those countries is, compared to research on regulation in developed countries, incipient. In this review we want to identify issues that set the basis for our research about the effects on informality.

In the last five years, the economics literature has renewed its interest on the effects of land use regulation, a research mostly led by Glaeser, Gyourko and Saks (2006)⁶, who based their conclusions on earlier research by Malpezzi (1996). Malpezzi showed that higher regulations are correlated with higher median sales prices in communities within the USA⁷. Basically, this literature considers two types of measures for the regulation of land use (Mills and Oates, 1975). First, those measures which establish the quantity of housing that can be built, mostly quantitative regulations, e.g., minimum lot sizes, heights and allocation of open space. Second, measures that require meeting the standards, particularly when it comes to procedures which may be expensive, costly or complex, and whose approval may take a long time. All this raises the final cost of new housing supply in one locality. These factors have also been acknowledged in the development literature for Latin American countries by Turner and Fitcher (1972) and by de Soto (1989), as one of the main sources of urban informality. Standards setting a minimum consumption level might exclude the lowest segment of the market. Moreover, restrictions limiting intensity of land use might affect low-income households, who have a higher demand for high density developments than consumers who are better off (Henderson, 2009 in Lall et al., 2009)

⁶“Urban Growth and Housing Supply,” *Journal of Economic Geography*, 6, 71-89.

⁷While in this case rises in price are due to increased regulation, such increase could be reflecting the value of land scarcity.

The effect that land use regulation has on households from different income groups is not addressed in the literature from developed countries. While most of the literature that is based on US data considers a generic consumer, some evidence about the effects of land use regulation on low-income households comes from Malaysia, thanks to Bertaud and Malpezzi (2001). They suggest that restrictions are more costly for lower income families because the land costs of housing are raised due to a “forced consumption”. This means that, if standards are lowered, the ratio of profitability for the provision of low-income housing is raised, therefore increasing the incentives for developers to supply housing for this segment of the market. They calculate that if restrictions on construction and roads were loosened so that 55 percent of the developable land may be saleable, instead of the actual 40-45 percent,⁸ this would double a developer’s profitability ratio, hence shifting his interest from middle-income groups to low-income housing supply.

There is evidence of the same problem in China (Wu, 2004; Zhu, 2005) and in India (Sivam, 2002), where land and housing restrictions might affect in a disproportionate way the supply for low-income consumers by increasing the costs in the formal markets. In those places, the main effect is to develop an informal housing market rather than to increase the housing prices paid by low-income consumers. As a result, land is elastically supplied at lower costs in the informal sector. Therefore, in most developing countries (Latin America and the Caribbean, as well as Sub-Saharan Africa and China), rapid urbanization has been consistently forcing a significant proportion of the urban population to live in informality. These people are located in different kinds of informal places, such as squatter settlements —due to land invasion— or informal commercial subdivisions. The main characteristics of these settlements are their differing degrees of tenure insecurity as well as the lack of basic infrastructure services, such as water and sanitation.

The argument about land use regulation as a potential cause of informality is associated with what happened in Argentina, in the province of Buenos Aires, when the Decree-Law 8912, regulating urban land use and setting minimum lot sizes, was enacted by the State in 1977. The new requirements for a minimum lot size —an area equivalent to 300 square meters—, forcing developers to finance a complete infrastructure, were more than low-income consumers could afford (World Bank, 2005). As a result, the low-income submarket, that had helped a great part of the low-income population to get access to housing, was practically eliminated. Now developers had incentives to devote their attention to the higher income segments because new land use restrictions left poorer households out of the market (World Bank, 2005; Goytía and Lanfranchi, 2009 in Lall et al., 2009).

Within the empirical literature that evaluates the effects of land use regulation, two methodologies are applied. First, direct calculations, in which the costs of regulation are treated as a residual; that is to say, regulations constitute an increase in prices beyond construction costs and land valuation. Second, empirical exercises that attempt to estimate econometrically the effects of land use regulation on housing prices and the elasticity of supply by specifying models where regulation affects supply elasticity or shifts the supply

⁸In European cities, 65 percent of the land under development is saleable.

curve. What is expected is that more regulated communities should have lower elasticity or smaller supply responses to increases in housing prices.

For the first group of papers, which use hedonic models to assess the costs of building height regulation in Manhattan, Glaeser et al. (2005b) provide empirical evidence of large increases due to scarcity caused by this type of regulation. Another paper, by Glaeser and Gyourko (2003), found large regulation costs in several cities based on hedonic regressions, city by city, to estimate the cost of regulation. The cost is estimated as the difference among the reported house value, the sum of construction (replacement) costs and the shadow valuation of land.

In the second empirical approach the effect of regulation is identified as altering the price elasticity of supply (Glaeser et al., 2006). Most of this literature builds up on Malpezzi (1996) and uses a regulation index—the Wharton Land Use Regulation Index—that is based on different measures of land use restrictions, such as zoning applications approved, or the time it takes to process approvals⁹. However, this literature does not explore in depth the particular effects of regulations or the types of measures that most affect housing supply. In most studies, indices are used or several regulation measures are selected to estimate their particular effects.

It is also important to note that attempts to compare regulation measures or to estimate the most costly ones have been unsuccessful (Henderson, 2009 in Lall et al., 2009). The models applied assessed the effects of direct land use regulation, such as height restrictions, building standards or timing to get permits, all of which might affect production costs and development fixed fees that increase prices without affecting the input costs of housing production.

In this group of studies, the effects of a number of different regulation measures are assessed for communities in the state of California by Quigley and Raphael (2005). Such measures include restrictions on the number of building permits, infrastructure requirements, open space zoning, density and height restrictions and community participation in zoning approvals, among others. The elasticity of supply in the two formulations, both when regulation affects supply elasticity and when considering its effects on shifting the supply curve, are estimated. When the effect of changes in the price of new starts—according to the construction permits issued—is considered, price supply elasticity is found to be lower in more regulated communities. Therefore, an increase in the number of regulations established in the community reduces the number of building permits that are issued.

One of the difficulties of such empirical analysis on the effects of land use regulation is the problem of endogeneity. Most of the empirical literature from the US considers land use regulations as “exogenous”, rather than as endogenous policy decisions that are made in response to local market conditions. This approach is inconsistent with a decentralized institutional framework where local governments establish their own regulations. The literature argues that land use regulation is a policy decision made by each community to

⁹A set of State regulation is also included in his estimations.

try to smooth the effects of rapid population growth. It is said that when a locality faces a positive demand shock, such as rapid migration growth, it may impose tight regulation in the form of increased minimum lot size or a greater number of review processes/permits required for new constructions. In order to support this idea, new research shows that cities that are more regulated in land use are likely to be the ones that are growing rapidly (Gyourko, Saiz, and Summers, 2006).

Mayer and Somerville (2000) attempt to overcome this issue, considering regulation as endogenous by using some community measures, such as presidential voting patterns, as instruments for regulation. They find particular restrictive effects stemming from the number of building permits issued, which are limited by the extended amount of time taken for approvals, cities' referenda on growth proposals, and user's development fees. Since they had quarterly data from cities, they showed that regulation affects supply elasticity in the long run because, in more regulated environments, developers tend to anticipate any increase in demand by having a larger stock of approved lots for development.

Another aspect of regulation, introduced by Pollakowski and Wachter (1990) are externalities, which means that an increase in restrictiveness in one community forces people to migrate to other communities; this supports the idea of interactions between different localities. They create an index of density restrictions to show that housing prices are higher in more regulated communities.

Finally, the emergence of the effects of regulation in the literature for developed countries is supported by more recent analysis on the exclusionary policies of local jurisdictions, such as the one about the Tiebout literature reviewed in Epple and Nechyba (2004), as well as the study on superstar cities in the US, by Gyourko, Mayer and Sinai (2006). In this economic literature, stratification of the population by income within different communities is based on the consumption of local public goods (Epple and Nechyba, 2004 and Hesley, 2004). The result is that richer communities will want to exclude lower income entrants because of fiscal externalities. The rationale that underpins this notion is that lower income residents are a tax burden for existing residents because they consume local public goods and services but pay less than the average amount in local taxes. Land use regulation exclusionary measures can be based on a number of restrictions: restricting the number of new housing units that can be built, thus limiting total population; setting minimum consumption levels that exceed what low-income households can afford; or making housing more expensive through costly permitting procedures, all of which finally raise construction costs for new housing, preventing new migrants from settling in those places because they cannot afford them.

Another main effect of increased migration, which exclusionary regulation intends to avoid, is congestion, which means higher living costs, dissipating the benefits of agglomeration and diminishing the quality of life.¹⁰ In order to avoid that, the literature suggests that (some) cities impose tight land use regulation, hindering further residential housing supply. Gyourko, Mayer and Sinai (2006) show that this argument is consistent with a model of

Some basic characteristic of this superstar cities mentioned in the literature are slower population growth and an increased share of high-income households over time.

high-amenity cities that impose regulations to limit entry and skew the population towards the highest income households, so as to enhance the welfare of the resident populations.

Most of the literature reviewed is based on developed countries, particularly the US, and focuses on the analysis of the direct effects of land use regulation on housing prices. It shows that price variations across cities in the US may reflect different degrees of local regulation (Glaeser et al., 2005; Gyourko et al, 2006). Price increases could just reflect land scarcity in cities where the amount of developable land may be exhausted. The general perception is that this scarcity is caused by regulation that does not allow any increase in density or building height, thus limiting capacity.

Land use regulation and informality

This body of research from developed countries provides some arguments that have to be revised if they are to be applied to developing countries because countries where this literature is based have no informal markets, and institutions are relatively strong (Henderson, 2007). While in developed countries market regulation restricts housing supply and limit population growth, in developing countries formal market restrictions lead to the development of an informal land and housing sector which ignores land-use regulation. A large informal sector develops, which represents 10 to 45 percent of the land and housing market in some of the most important Latin American cities (World Bank, 2005).

Two types of informal land development may be distinguished. One of them is the squatter settlement, *villa miseria*, and *favela or barrio de ranchos*, among other names given in Latin America to settlements originated through invasions— or unauthorized occupations — on public or private land.¹¹ A second mechanism to access land is provided by informal commercial urbanizations, where private plots in the urban peripheries are developed and sold on a market basis, disregarding one or more planning/land use regulations. The illegality in most of these settlements is not conforming to land use regulations or to servicing requirements for land subdivisions. The irregularity of neighborhoods also has to do with the lack of provision of public goods, such as paved streets, public lighting, waste collection, security, among other attributes that usually characterize these types of settlements.¹²

There is not much empirical literature that analyzes the key effects of land use regulations in developing countries. Although there is such literature for developed countries, a stream of research has recently been applied to Latin American ones (Lall et al., 2007; Biderman, 2007; Henderson, 2007; Henderson and Feler, 2008) in order to analyze how regulations,

¹¹Despite the initial invasion of vacant public or private land for the creation of this type of settlement, land purchase is the rule for most of the dwellers (Gilbert and Ward, 1981), and it even includes some type of payment to the organizers, or other agents, who provide coordination and guarantee a certain level of security (Lanjouw and Levy, 2002, 987). The arrival of new residents who may buy or rent can make the settlements become densely populated (Gilbert and Ward, 1981, 98).

¹²The generalized use of these practices and the lack of other valid alternatives to house the poor has made many scholars to claim that it may be better to use terms such as ‘informality’ or ‘irregularity’ (Gilbert, 2002) rather than ‘illegality’ when referring to those settlements because the basic rules that guide ownership are followed, unlike the case of land invasions.

which might increase prices in the formal market, may promote more untitled-informal housing development.

Henderson (2007) and Henderson and Feler (2008) examine some of its implications in the context of Brazil, where informal markets are a major source of housing for low-income migrants. In order to do this, they outline a conceptual framework concerning the political economy of indirect land use regulation in developing countries. Henderson (2007) argues that in developing countries exclusion of low-income migrants by direct regulation may not be possible. The institutional framework — ambiguous rules, lack of enforcement and informal constraints— leaves the operation of this informal segment of the market outside regulatory procedures.¹³ For Henderson, this literature on direct regulation is deficient, and does not cover issues of indirect regulation that arise in many developing countries. This means that, while the informal sector avoids direct land use regulations, the local government may attempt to indirectly regulate the scope of its development by not servicing it with certain public infrastructure investments, such as connections to sewerage, water, and road systems, or by threatening the tenure security of residents (Henderson and Feler, 2008). In this sense, the under provision of infrastructure becomes central to the idea of urban exclusion.

This group of studies focused on Brazil, from 1970 to 2000. The first study, by Henderson and Feler (2008), tracks the evolution of service provision within a constant sample of localities that, in 1970, was conditioned to be 50 percent urbanized, at least. The evidence provided suggests that within a decade, from 1970 to 1980, some localities rapidly expanded their service provision while others remained under-serviced, even in 1991 and 2000. This issue might be considered a strategic element for un-servicing the urban poor.

Another interesting study from Brazil (Henderson, 2009 in Lall et al., 2009) argued that the formal sector housing was made unaffordable for low-income households when the national law from 1979 required a minimum lot size for any housing construction. Furthermore, this gave origin to stricter local minimum size requirements imposed by several localities. A higher demand for housing within urban areas led to informal suburban development. At the same time, localities denied the provision of basic services to stop informal development.¹⁴ While two types of informal settlements developed in Brazil (*favelas and loteamentos*), it is argued that the latter were mainly caused by the effects of the above mentioned law.

The effects of land use zoning and density regulations on formal housing supply and slum formation across Brazilian cities between 1980 and 2000 are examined in Lall et al. (2007). The performance of cities that have lowered land subdivision standards (minimum lot size), below the 125 square meters that are normally required, according to the law, is assessed. In order to do so, they created a model of formal housing supply and slum formation, where population growth was endogenous and decisions of household migration were influenced

¹³In developing countries, if regulation is excessive people have to operate outside the formal market, where such regulation is overlooked. This issue, introduced in the academic literature by Turner (1972), was stressed by de Soto (1989) in his book *The other path*.

¹⁴The main assumption is that during the 80s, exclusionary policies in terms of under provision of servicing were possible even though most localities had democratically elected majors. Dominating elites could legitimately deny services to the informal sector while after the policy reforms of the 90s it was not so easy to implement this kind of strategic behavior.

by inter-city variations in land use regulation. It was interesting to note that the elasticity of formal housing supply in Brazil is very low and can be compared to that of Malaysia, which has a tightly regulated housing market. Regarding formal housing supply, this limits adjustments in response to increases in demand, and therefore promotes informality.

Relaxing land use regulation, zoning, and land use planning are found to improve housing market performance by stimulating a response in the formal sector housing. For example, a reduction in the minimum lot size is found to increase housing supply and cause higher population growth. Therefore, pro-poor minimum lot size regulations increase both migration and the number of formal house residents. Lall et al. (2007) observed that urban zoning regulations increase the growth of the formal housing market and of the city population at the same rate, and therefore no net effect on informality is found. However, a faster growth in population than the formal housing supply response may be one of the reasons for the increase in slum formation.

It is important to notice that land use regulation measures which manage densities, particularly minimum lot size regulations, have important effects in terms of housing supply and slum formation. Contrary to conventional wisdom, lowering minimum lot size regulations does not lead to a decrease in slum formation. If city population growth were exogenous and people did not consider local regulations and residential location decisions at the time of migrating, then lowering minimum lot sizes would allow cities to accommodate more residents into formal housing developments –and would no doubt reduce slum formation. However, regulations are a part of household migration and residential choice decisions, and hence, the exact effect of lowering regulatory standards is not so obvious. Basically, their model suggests that the net effect of land regulations depends on the extent to which new formal housing supply absorbs new demand, both from current informal sectors and from migrants attracted by more flexible regulations.

This means that the cities that lowered minimum lot size regulations not only experienced a higher growth in the formal housing stock but also in the number of migrants. The resulting city population growth exceeded that of the formal housing supply, exacerbating the slum formation problem. Therefore, local measures intended to increase access to land for the poor —such as flexible land subdivisions— enhance welfare if housing with different specifications for different sub-segments of the housing market is also supplied, thus allowing low-income residents to buy those units which they can afford and which meet their preferences.

Lall et al. (2007) found that cities that offer improved access to land compared to others that do not are likely to disproportionately attract (poor) migrants. Informality may grow if this induced population growth is higher than the adjustment of formal housing supply. They argued for the importance of clarifying what are the sources of land and housing supply distortions -that reduce the elasticity of formal housing supply- in future research. Finally, they turned their attention to policies that aim at reducing barriers for the access to land, and which have to be accompanied by instruments that relax preexisting distortions in the land market so as not to exacerbate informal development.

Another empirical study, by Biderman (2008), analyzes the connections among informality, urban land use and building regulations in Brazil, relating the elasticity of demand in the informal and formal sectors of the housing market by using the theoretical framework wherein untitled housing is stimulated by inappropriate regulations that raise the prices in the formal market.

Four measures of urban regulation are examined, and zoning is the one that has the biggest impact on informal settlement development. The notion that formal and informal markets are completely independent is strongly refuted since the findings reinforce the idea of the existence of two sub-markets with different standards, where land use and building regulations have an impact on informality.

Following this argument, it is worth noticing that local regulations currently vary greatly across municipal governments, even in the same region or state. Some local governments have introduced measures that tend to favor access to land and to urban services for the most poor. Therefore, an important issue that should be taken into consideration in our study is the potential effect that those instruments might have in determining formal or informal tenure choice.

Definition of informality in empirical studies

A necessary step to consider the problem of informality in empirical research is how informality should be defined in order to be appropriately measured. So, the question here is: how are households living in the informal sector identified in these studies? Three alternative criteria could be applied to define informal settlers by using data from the national household's survey, which will have different conceptual implications (Biderman, 2008).

First, considering the main concept of informality as illegality, housing may be defined as informal or irregular if it does not comply with legal aspects of regulation, especially formal tenure of the land. While in this option informality is mainly defined by ownership rights, the perception of security alters the definition of this indicator. This measure of informality is under-reported in the national census due to the fact that most households living in informal settlements, and which have paid for the land they occupied, consider themselves homeowners, although no formal title has been granted.

Second, the physical condition of the settlement has to be taken into account, according to the answer provided to the question from the census as to whether households lived in irregular settlements. The answer allows the identification of those settlements that have unpaved roads or no street number. However, the concept of irregularity of the settlement widely differs from that of informality (only 5 percent of households) because many other factors that characterized this last one were not considered.

Third, the definition based on the lack of public services, particularly water connection to the public network or lack of full servicing must be considered. This parameter should be controlled in the case of land tenure/housing when it comes to meeting land use regulations because considering only infrastructure might bias informality to wealthier households.

Methodology

I. i. The Regulation Survey to Municipalities

Our survey of land regulation in Argentina covered a selection of the main issues related with the land regulation for residential purposes¹⁵ and was targeted to those municipalities in the 28 big urban agglomerates in Argentina (a total of 118 municipalities). According to the 2001 Census these agglomerates cover 67 percent of the total population in Argentina. The definition of big urban agglomerates is given by the National Institute of Statistics and

¹⁵ The survey covers some of the main issues related with the land regulation for residential purposes. The selection of issues has been made by the researchers and benefited by the comments of several experts.

Census (INDEC) of Argentina. In particular, in this study we are forced to follow this classification since the INDEC's households survey (*Encuesta Permanente de Hogares* (EPH)) is the (only) source of the household-level tenure choice data.

We distributed the survey across all municipalities. For that purpose, we established a collaboration agreement with *Secretaría de Asuntos Municipales* (Municipal Affairs Secretariat – SAM) at the *Ministerio del Interior de la Nación* Argentina. The Secretariat helped us in generating a contacts' database including the information of the key people in land regulation in each municipality. We contacted the Planning Director in each municipality. Where none existed, we contacted a planning officer, specially designated by the Mayor in each locality to answer the survey.

In order to minimize the non-response, respondents were contacted and followed up by telephone. In order to collect the answers we also built up a web page, which facilitated the task for respondents.

The final response rate we achieved was 75 percent. One main issue of concern is related to the sampling procedure and identification of sample selection bias in the response to our questionnaire.¹⁶ Table A.1 shows that the sample is well represented considering municipalities classified by region or according to their total population. The response rates were above 70 percent for all regions (with the exception of the North-West Argentina (NOA) region where the response was 63 percent) and above 67 percent for all population quantiles. These results suggest to us that our effort in collecting responses was very valuable and that we do not expect any significant selection bias.¹⁷

II. Main Regulatory Issues and the Definition of Land Regulation Indicators

In order to examine land regulation we started by following an approach similar to the one of Gyourko, Saiz, and Summers (2006) on their measure of the Wharton Residential Land Use Regulation Index (WRLURI) for the United States. We replicated some of their indicators, as for example, when analyzing the actors and pressures involved in the definition of the regulation, or on the projects' approval processes. However, this approach, as well as others covered by studies for developed land markets, contains elements that do not fit

¹⁶ As already explained, the survey instrument was sent to the urban planning director of each one of the municipalities that from part of the urban agglomerates across the country. The list was obtained by contacting each major – helped by the Sub-secretary of Municipal Affairs of the Presidency of the Nation; subsequently those authorities were contacted by phone and email, to complete the questionnaire. The decision to answer the survey could not be random if certain types of municipalities had different response rates to our survey.

¹⁷ In order to check for sources of biases in the response rate we did also estimate response models using the available Census data including characteristics of the population (e.g., proportion of population with less than 14 years or more than 65 years, proportion of immigrants), education and socioeconomic status (e.g. using unmet basic needs indicators) and available infrastructure (e.g., sewerage infrastructure, water network, natural gas network, electricity). We did not find any significant correlation between these variables and the response rate.

the reality of land use in a developing country as Argentina.¹⁸ As an example, annual building limits, while particular important to understand the land use development in US markets, lack importance for most municipalities in Argentina. But more importantly, this approach lacks enough elements for the analysis of the dynamics of the tenure condition in informal areas. Our survey adds several topics that might provide an explanation for this central issue. As an example, we focus on the process of infrastructure expansion, on the presence of redistributive and access to land elements in the regulation, and on fiscal policies.

We have built up indicators and classified them according to their main topics:

- i. Land Use Plan and Regulation Indicator (LPI)
- ii. Zoning and Residential Projects Approval Processes Indicator (ZRPI)
- iii. Building Restrictions Indicator (BRI)
- iv. Infrastructure Provision Indicator (IPI)
- v. Access to land Regulation Indicator (ALRI)
- vi. Municipality Fiscal Indicator (MFI)
- vii. Projects Approval Costs Indicator (ACI)

Land Use Plan and Regulation Indicator (LPI)

The aim here is to capture the extent in which a plan for the use of land exists and whether it has been formally established in the legal and regulatory framework. At both the provincial and the municipal level, two indicators (provincial and municipal) reflect the existence of land use plans and whether these has been promulgated as laws or decrees (at the provincial level) or as regulations at the municipality level (e.g. *ordenanzas*, urban planning codes). These indicators take the value of one in the case a plan for the use of land exists and it has already been incorporated in the respective legal or regulatory framework; one-half in the case the plan exists but it hasn't been promulgated, and zero otherwise.

$$\textit{provincial, municipal} = \begin{cases} 1 & \textit{if exists and it has already been incorporated} \\ & \textit{in the respective legal or regulatory framework} \\ \frac{1}{2} & \textit{exists but it hasn't been promulgated} \\ 0 & \textit{otherwise} \end{cases}$$

$$LPI = STD[\textit{provincial} + \textit{municipal}]$$

Zoning and Residential Projects Approval Processes Indicator (ZRPI)

This indicator is aimed to capture the involvement of different governmental authorities, and the community organizations in the approval of residential projects. The indicator considers the approval of projects that require zoning changes and those regular projects that do not require zoning separately.

The *Zoning Change Approval Indicator (ZAI)* was adapted from Gyourko, Saiz, and Summers (2006) and reflects the degree of difficulty of a certain project to obtain a zoning change approval. Our survey asked which authorities are involved in zoning change approvals. The listed organizations are: i) The executive power at the municipal or communal level, ii) The Planning Commission, iii) The Zoning Board or Council, iv) The

¹⁸ See more on this on the Literate Review Section.

Local (Municipal) Council, v) Provincial level governmental officials, and vi) The Environmental Evaluation Committee. The index adds the value of 1 for each organization involved. Finally, the indicator also adds a value of 1 if residential projects requiring changes in current zoning must be presented, debated or approved in local assemblies (public hearings) or meetings with the community, and equals zero otherwise.

$$ZAI = STD(executive + planningcom + zoningcouncil + localcouncil + provgovofficials + envcommittee + Localassembly)$$

The Regular Project Approval Indicator (RPAI) is analogous to the previous indicator. It considers the authorities involved in the approval of projects which do not require changes in zoning. The authorities considered are: i) Planning Commission, ii) Local Council/ local officials, iii) Environmental Revision, iv) Design Revision Office (e.g. cadastre office) and iv) Other authority reported. The index adds one for each authority involved.

$$RPI = STD(planningcomm + loccouncil + envrevision + designrevision + other)$$

The Zoning Change Approval Indicator (ZAI), and the Regular Project Approval Indicator (RPAI) are combined in a single indicator by averaging the value of both indicators. That is, we give equal weight to the two dimensions of the indicator when we build the Zoning and Residential Projects Approval Processes Indicator (ZRPI):

$$ZRPI = (ZAI + RPI)/2$$

Building Restrictions Indicator (BRI)

The following concepts are related with restrictions in the supply of residential buildings, and then summarized in an aggregate indicator. These are: i) Lot size restriction; ii) Maximum Land Use and iii) Maximum Total Building.

First, our survey asked whether there is a minimum residential lot size restriction, and the size of the requirement in case it exists. The indicator will take a higher value for a larger minimum lot size, indicating a higher restriction to the access to land. The indicator considers minimum size lot restrictions in low and high densities areas separately, and adds both dimensions in the aggregate indicator.

Second, the indicator also incorporates the existence of Maximum Land Use and Maximum Total Building Restrictions, and the perception reported by specialists of these as actually being active restrictions for new residential developments in the jurisdiction.

These restrictions are combined in the Building Restrictions Indicator (BRI) as follows:

$$BRI = STD(STD(lotsize_{high} * dlotsize_{high}) + STD(lotsize_{low} * dlotsize_{low}) + STD(landuseopinion * dmaxlanduse) + STD(totbuildopinion * dmaxtotbuild))$$

Where $dlotsize_{high}$ is a dummy variable that takes the value of one if a minimum lot restriction is incorporated in the municipality regulation, $lotsize_{high}$ is the size of the minimum lot size restriction in high density areas. $dlotsize_{low}$ and $lotsize_{low}$ are the analogous variables for low densities areas. $dmaxlanduse$ and $dmaxtotbuild$ are dummy variables taking the value of one if a maximum land use restriction or maximum building restrictions are in place. $landuseopinion$ and $totbuildopinion$ are subjective variables that range from 1 to 5, and take a higher value reflecting the degree in which the respondent believes that these are active restrictions for the supply of residential buildings.

Infrastructure Provision (IPI)

In this indicator we consider how basic infrastructure and public services are provided in sub-urban areas or in areas where these services lack.

We consider two major issues. First, we ask if the municipality has defined an urban perimeter where it guarantees the provision of basic services to new residential developments. We define a sub-indicator that, for those municipalities that have defined a perimeter, adds one for each service that is guaranteed. The “Urban Perimeter Infrastructure Provision (UPIP)” sub-indicator is defined as:

$$UPIP = STD(up_{electricity} + up_{sewerage} + up_{water} + up_{gas} + up_{pavement} + up_{sidewalk} + up_{streetlightingposts})$$

Where up_x is a dummy variable that stands for the provision of service x within the urban perimeter.

The second issue is how infrastructure is financed in those regions that lack complete access to basic services. We consider here if the municipality and the public services related firms finance the service extension to these areas. If neither the municipality nor the respective public service firm provides finance, then the cost is completely born by the developers or new users. Two sub-indicators (IPMUN and IPPUBSERV) are constructed in order to capture the role of the municipality and the public services firms respectively:

$$IPMUN = STD(munfin_{electricity} + munfin_{sewerage} + munfin_{water} + munfin_{gas} + munfin_{pavement} + munfin_{sidewalk} + munfin_{streetlightingposts})$$

$$IPPUBSERV = STD(pubservfirm_{electricity} + pubservfirm_{sewerage} + pubservfirm_{water} + pubservfirm_{gas} + pubservfirm_{pavement} + pubservfirm_{streetlightingposts})$$

Where $munfin_x$ is a dummy variable that stands for the municipality financing the extension of the service x and $pubservfirm_x$ the analogous for the respective public service firm.

Finally the three sub-indicators are added in the Infrastructure Provision Indicator (IPI). A higher value for this indicator is expected to reflect a more active role of the municipality in the provision of infrastructure.

$$IPI = STD(UPIP + IPMUN + IPPUBSERV)$$

Access to land Regulation Indicator (ALRI)

This is a measure of the presence of redistributive and access to land related elements in the regulation of the use of land. The index adds one for each of the following elements incorporated in the regulation: i) Recovery of the added value (appreciation) of land, ii) Obligatory use of the urban land, iii) Regularization of occupied land (e.g., establishing that occupied land, after a certain period of time, and if there is no opposition, might be regularized in favor of the occupant), iv) Building permits reserve for social projects., v) Obligatory donation of land for social projects, vi) Obligatory donation of land for public equipment (e.g., schools, green areas), vii) Possibility for the municipality to acquire land for social purposes, viii) Fiscal Incentives for zones that are desired to be developed.

$$ALRI = STD(AddedValueRecovery + ObligatoryuseUrbanLand + Regularizationoccupiedland + Socialprojectsreserve + LandDonation + LandDonatioPubEquipment + LandMunicipality + FiscalIncentives)$$

Municipality Fiscal Indicator (MFI)

This indicator is aimed to reflect the power of the municipality in obtaining local resources. The following issues are incorporated: i) The total tax collection per capita, which is aimed to reflect the available economic resources for the municipality, ii) In relation to the effectiveness in tax collection, we will analyze the effective tax revenue as a measure of total tax billing. This measure should reflect the efficiency of the municipality in its taxes collecting function. iii) We incorporate two other measures related to the building registry for fiscal purposes. First, we analyze a subjective dummy variable taking the value of one if respondents consider that the building registry or cadastre (i.e., *catastro*) has been recently updated. Second, an objective measure accounts if updating has been made in the last two years. The mentioned aspects are collected in the Municipality Fiscal Indicator (MFI):

$$MFI = STD(taxcollectioncapability) + STD(taxperhhcapita) + STD(dudpdatedregistry) + STD(drecentudpdated)$$

Projects Approval Costs Indicator (ACI)

This indicator is aimed to reflect costs related to residential projects registration procedures. It considers time and monetary costs.

Approval time (AT) is a measure of the average time the revision of a project takes between presentation and approval. This is a subjective indicator, since there are low chances of respondents having a precise estimation of the average delay. We asked separately the average time for single-unit and multiple-units residential building projects. The AT variable is then defined as the average time for the two procedures.

$$AT = \left(\frac{ATsingleunits + ATmultipleunits}{2} \right)$$

The survey also asked the monetary value that is charged for a property registration. In practice, many buyers of land or properties do not have formal land tenure because they avoid the costs related with this registration. We will incorporate this cost as a relevant cost in our comparative analysis. A dummy variable will take the value of one in the case the municipality displays a cost of property above a threshold to be determined in the sample (e.g., the 66th percentile in the sample).

$$ACI = STD(AT) + STD(AMC)$$

IV. Estimating a Tenure Choice Model using a Households Survey Database (2007)

Our first approach to explore the effect of land regulation on formal tenure condition is estimating a tenure choice model with cross-section data from the Permanent Households Survey (*Encuesta Permanente de Hogares*, EPH) of the National Institute of Statistics and Census (INDEC). In this section we provide more details on the data used in this exercise, the alternative definitions employed in order to explore the formality condition, how we incorporated regulation into the estimation, and the details on the econometric approach.

i. Database and Explanatory Variables

Using INDEC's data we have constructed a database covering 28 urban agglomerates and more than 69,700 representative households. This represents information on nearly 250,000 people. The database is a cross-section for the first quarter of 2007. The database is very rich in information regarding socioeconomic and demographic characteristics, as well as the effects of other strategic policy related-variables, such as the nationality and immigration condition of the members of the households (see more below)¹⁹.

ii. Tenure Condition and Informality Definition

As a first approach, we grouped tenure conditions into “formal” and “informal” groups. The groups are translated into a dummy variable that will be the center of the analysis. The formal group comprises formal owners (of the land and the dwelling they occupy) and renters. The informal group comprises owners of the dwelling but not of the land, self-claimed owners because of the payment of property taxes, or other type of occupants (without approval). This approach can be seen as the standard approach found in the literature (see for instance Cruz and Morais (2008). We call this measure Formal Tenure Number 1.

This first definition of formal and informal types of tenure is mostly based on legal ownership rights and aims to capture the lack of well defined property rights, by defining as informal households those who are owners of the house rather than the plot. However, there are reasons to believe that the National Survey data under-reports the measure of owner informality (see Goytia and Lanfranchi, 2009 in Lall et al, 2009). In particular, the literature points to settlements which have been originated by informal commercial subdivisions and where households have already paid for the land they occupy. As a result, many households consider themselves to be homeowners, although no formal title has been granted. In addition, households that fear risk of eviction are more prone to declare ownership of the plot.

¹⁹ In order to be able to compare results, we replicated several of the variables in the study of Cruz and Morais (2008), for the case of urban agglomerates in Brazil.

We employ a second criterion to define informality, focused in the physical conditions at the settlement. In a second variable (formal measure number 2) we exclude from the formal tenure group (and add correspondingly to the informal group) those households that declare to be owner or renters, and are located in what the INDEC survey defines as an informal settlement (i.e.: a slum). The definition of emergency settlements provided by the INDEC Survey considers non-compliance with building codes and related urban regulation. In general, these are substandard areas, encompassing a group of 50 dwelling units or more, occupied land without authorization, privately or publicly owned, laid out in a scattered and dense manner, lacking essential public infrastructure services, also known regionally as *villas miseria, asentamientos or tomas*. These settlements are characterized by the illegality of tenure due to irregularities of the settlement, or great risk on the formal (or the partial) tenure condition in case it exists.

However, this alternative concept might still be an incomplete measure of formality. The reason is that the Housing Surveys might not capture many other places that are not explicitly considered informal settlements, but with similar physical characteristics that may affect the tenure condition. We then consider a third alternative definition of informality (measure 3), which considers informal ownership to include those households located in areas that lack certain basic public services. In particular, we will consider that a dwelling is informal if the source of its water is through a manual pump (i.e., not connected to a water network, or to a suitable substitute of good bacteriological quality), if it has no connection to water inside the house, or if it has no sewer installation (no connection to sewer network, no septic tank or cesspool).

iii. Indicators at the Urban Agglomerate Level

So far, our regulation indicators have been defined for the municipal jurisdiction level.²⁰ Those indicators allow a comparative analysis of the regulation across municipal jurisdictions throughout the country. However, at this stage we also need to know how regulation characterizes the use of land for each urban agglomerate level as a whole (recall that an urban agglomerate might be comprised of more than one municipal jurisdiction), since the objective now is to examine the patterns of household tenure condition in relation to the existing regulation in their location. The reason for not exploring the relationship at the municipal level is essentially practical. The EPH Survey has been built in order to be representative at the urban agglomerate level, and we cannot know in which municipalities the households interviewed are located. Since we only know the urban agglomerate in which each household is located (and its respective weight into the overall agglomerate population) we are forced to generate regulation indicators for the urban agglomerate level.

In order to generate regulation indicators characterizing the urban agglomerate level we need to aggregate the indicators for the municipalities that comprise each one of them. We therefore need appropriate weightings to generate weighted averages of the regulation indicators. Our first criterion in weighting municipalities' indicators is the total population. The resulting formula is the following:

$$RegulationIndicator_{k,j} = \sum_{i=1}^I RegulationIndicator_{k,j,i} * \frac{population_{j,i}}{\sum_{i=1}^I population_{j,i}}$$

²⁰ See more on the definition of indicators in the previous section.

Where k indexes each of the indicators described in this section, j indexes each one of the 28 urban agglomerates, i indexes each municipality, and l is the total number of municipalities in the urban agglomerate j .²¹

A source of concern may arise however, when using the population variable as the weighting variable. The reason is that, if there are interaction effects between municipalities, and then the population is an endogenous variable reflecting the regulation characteristics across municipalities. Using the population variable as a weight of indicators in this case would yield the result of giving less weight to regulation indicators in those municipalities with stricter regulations of access to land, and more weight to the indicators of municipalities with softer regulations.

iv. Econometric Approach

We analyze the relationship between households' tenure condition and the explanatory variables with the estimation of a panel data econometric model. Equation 1 below illustrates an example of an econometric specification to be analyzed.

$$tenure_i = \sum_{k_1} \beta_{k1} * regulationindicator_i^{k_1} + \sum_{k_2} \beta_{k2} * lifecycle_i^{k_2} + \sum_{k_3} \beta_{k3} * wealth_i^{k_3} + \sum_{k_4} \beta_{k4} * socialvulnerability_i^{k_4} + \sum_{k_5} \beta_{k5} * location_i^{k_5} + \varepsilon_i \quad (1)$$

Where i is the sub-index for the household tenure, the dependent variable, is one of the three definitions of the formal-informal tenure dummies explained above. Results for the three models are reported in this paper.

k_1 , k_2 , k_3 , k_4 and k_5 stands for the number of regulation indicators, and the number of life cycle, wealth, social vulnerability, and location-related variables respectively. The definition of variables is given in Table B1. The basic statistics of the variables are reported in Table B.5.

regulationindicator stands for each of the regulation indicators that were defined in the previous section (i.e., LPI, ZRAI, BRI, IPI, ALRI, and ACI) and where averaged for each urban agglomerate. The group of demographic variables include: size of the family, age of the head of household and marital status. The group of income and wealth-related variables include: the household income, head of household level of education, and other income proxies. The social vulnerability-related variables incorporate: gender (of the head of household), the immigrant condition, the economic dependence, status in the job market. Location variables incorporate: urban agglomerate. Notice that in our household-level model of tenure choice it is reasonable to

²¹ The resulting indicators might be interpreted as the “average regulation indicator at the urban agglomerate” (e.g., the average presence of access to land elements in the regulation at the urban agglomerate level) and, as explained above, this simplification is made in order to match “average tenure choice indicators at the urban agglomerate”. It should be emphasized that, in the case there is free mobility of people at the urban agglomerate level, a stricter access-to-land regulation in a certain municipality will probably externalize the tenure choice condition in the surrounding others. An average approach to the regulation at the urban agglomerate level will then be appropriate in the particular case that mobility costs are low enough to encourage within-urban agglomerate migration but high enough to constrain between-agglomerates migration. It also follows from this reasoning that the econometric methodology will have to test for a possible lack of independence between urban agglomerate level observations.

assume strict exogeneity of the regulation indicators, since they are defined in the urban agglomerate dimension, and therefore not affected by individual decisions.

The model is estimated using a Probit regression with weighed data, which includes all demographic, socioeconomic and location controls variables, and the regulation indicators.

V. Estimating the Percentage of Tenure Informality using Municipal-level Census Data (2001)

Methodologically, one of the most problematic issues in the previous tenure choice analysis is the aggregation of regulation indicators into the urban agglomerate level – a limitation forced by the National Survey data-. We exploit a second source of data in order to avoid the problem and compare results. The 2001 National Census counts with tenure information available for each municipality for which we have regulatory information. The data then allows to test the regulation indicators at the municipal level.

The second source of information has its limitations, however. The data is not available at the household level (only aggregate figures are publicly available), and therefore we cannot replicate the exact model. The second, and most important, limitation is because our regulation indicators have been created according to 2009 information, and therefore we might have certain biases due to the temporal mismatch of eight years²².

In this case, we estimate a cross-section model in a database where each observation covers the jurisdiction of a municipality. The aim here will be simply to explore the relationship between regulation indicators and the tenure measures²³. The econometric model to be estimated is defined as follows:

$$pformaltenure_j = \sum_{h_1} \beta_{h_1} * regulationindicator_j^{h_1} + \sum_{h_2} \beta_{h_2} sociodemographic_j^{h_2} + \sum_{h_3} \beta_{h_3} * wealth_j^{h_3} + \sum_{h_4} \beta_{h_4} * location_j^{h_4} + \varepsilon_j \quad (2)$$

Where j is the subindex of the municipality jurisdiction; h_1 , h_2 , h_3 and h_4 stand for the number of regulation indicators and demographic, wealth, and location variables respectively.

The dependent variable, $pformaltenure$, is the percentage of households declaring a formal tenure of the dwelling in which they live. The formal tenure measure used here is similar to the first definition employed in the previous tenure choice model. Formal ownership is defined as those head of households who state they are owners of the house and the land, renters or legal occupants (i.e., with authorization)²⁴.

As in equation (2) $regulationindicator_j$ stands for the regulation indicators defined in the previous section. Also, the following socio-demographic controls —percentages— were incorporated: population below 14 years old, senior population (i.e., above 65), male population; population not born in Argentina and the number of years of education. As regards wealth-related controls, the following indicators were included: i) percentage of

²² Nevertheless, we do not expect significant changes in regulation in this period, since in most jurisdictions the regulation has been reported to be outdated.

²³ Causality will not be possible to identify since regulation is theoretically expected to be determined by the tenure condition of the municipality population.

²⁴ See more details on variable definitions in the Appendix.

population with material resources needs, according to a deprivation index (i.e., *Índice de Privación Material*²⁵); ii) the percentage of population with at least one unmet basic need, according to the unmet basic needs indicator (i.e., *Índice de Necesidades Básicas Insatisfechas*²⁶). It should also be noticed that we do not incorporate an income measure. This is because within the census questionnaire there is not a question about household income. Finally, we incorporated as a control the percentage of population that has immigrated from other localities, provinces or countries in the previous five²⁷ years, and the standard dummies for different regions in Argentina.

The model is estimated using a standard Ordinary Least Squares (OLS) method, and in order to take into account some geographic interactions that might be in place, we proceed to adjust for errors in the regression allowing for possible error correlation within each urban agglomerate.²⁸

VI. Results

III. i. Regulation Survey Preliminary Results

The responses from a nationwide survey of residential land use regulation in nearly a hundred municipalities across Argentina are used in this study to develop a series of indicators to capture the stringency and main features of local regulatory environments at municipal and provincial level. But first, we describe what the average land use regulatory environment looks like. The Survey of land regulation has been divided into several categories, providing information on the general characteristics of land management processes, detailed aspects of land use regulation for residential uses, infrastructure, fiscal issues, land market generalities and legal processes for land access and registration.

The first set of questions elicited information on the levels of government and the main normative instruments, which have an effect on each jurisdiction. In nearly 30 percent of the municipalities there are some higher level of government norms, such as provincial laws or/and plans for land use, that provides basic guidelines for land use at the local level. (e.g. Buenos Aires, Chaco, San Juan) (Tables C.1, C.2 and C.3). As well, several provinces granted total autonomy to municipal bodies for setting all land use regulatory requirements in their jurisdictions, such as Cordoba, Catamarca, Neuquén, La Pampa, San Luis, Salta and Santa Cruz, among others. At an aggregate level, it seems that a considerable proportion of local jurisdictions have municipal plans for land use (70 percent) , while most of them have a set of ordinances to regulate land use (93,5 percent). Some jurisdictions have municipal ordinances as the main -and single- body for land use regulation. As well, 28 percent of the jurisdictions have another set of complementary norms and plans as part of their main

²⁵ The *Índice de Privación Material* is an indicator available in the 2001 Census database which establishes a criterion to measure the lack of material resources among the population. Several observable variables are used with the aim of recognizing population with deprivation of current (i.e., short term) material resources, those with deprivation of patrimonial (i.e., long term) material resources or the ones with deprivation of both (defined as convergent).

²⁶ Since these indicators are highly correlated we decided to use only one of them for alternative specifications.

²⁷ We take this period of time since this is (only) the period which is asked in the immigration question of the Census.

²⁸ Recall the discussion above of the interaction between several municipal jurisdictions within a same agglomerate.

regulatory environment for land use. For example, Rosario has a particular set of comprehensive complementary plans (i.e, preservation of historic areas, metropolitan plans, among others) while others have strategic plans, sometimes not linked to current ordinances for land use.

What is interesting as well is the degree to which regulations are up to date. The question asking for the date of last review of municipal or provincial plans and laws shows a great disparity among replies. Few jurisdictions have recently updated their plans (both municipal or provincial) and many of them have long standing plans and laws regulating land use, dating from a maximum of 47 years, for municipal plans (average of 11.8 years) to 15 years for provincial plans, on average with maximums of 32 years, such as Buenos Aires (table C.3 and C.4) While few municipal ordinances have been recently updated, on average there is 12.1 years since last updated date and 36 years maximum since last adaptation for the oldest ones.

A second set of questions inquired on the general characteristics of the regulatory process, which dealt with who is involved in the process (e.g., states, localities, councils, legislatures, courts, etc.) and who has to approve or reject zoning—or rezoning requests. (Graph C.1) We also asked for other factors which guide the normative framework for the regulatory process in each municipality. The question listed six different entities/groups ranging from a local planning commission to an environmental review board. The more groups with approval rights, the more potential veto points for any given development proposal, which can also be interpreted as reflecting a more stringent, bureaucratic and less laissez faire local regulatory environment. Any project requiring a zoning change is mainly approved by the legislative local council or the Municipal Executive body. Other bodies, such as planning commissions or planning offices, still have a relevant role in many jurisdictions for changes in zoning approvals (35 percent). Involvement of provincial bodies is still significant (30 percent), mainly in municipalities where Provincial laws and plans are in place, like those municipalities in Buenos Aires Province which still have less autonomy in this kind of decisions. Environmental review boards are less involved in granting zoning changes, however in several localities their participation is mandatory (10 percent of the jurisdictions). Several jurisdictions have another set of complementary requirements for granting zoning changes, such as the legislative power of the provincial government, or more specific commissions formed ad hoc within the municipal administration.

At the time to inquire about the way in which institutional mechanisms are currently used for enforcement or consultation, few participation of legislative judicial bodies (in only 3 percent of jurisdictions) is shown, while citizen participation is exercised in 60 percent of the jurisdictions. (Graphs C.2 and C.3) This last issue can be considered as a measure of direct democracy and captures whether there is any kind of community meeting or assembly before which any zoning or rezoning request must be presented and voted up or down. It can also be taken as a measure of more tight restrictions set by the community to avoid zoning changes and densification.

Project approvals which do not require any zoning change are mainly handled by Cadastre commissions, public works and planning offices. Only in less than 30 percent of the jurisdictions other bodies, such as environmental commissions or other public sector officials are involved for granting approval of permissions for new projects. (Graph C.4)

A third set of questions pertained to the rules of local residential land use regulation. These included queries as to whether there are any permits on new constructions, such as FOS

(factor of plot occupation) and FOT (factor of total occupation), as well as information on the presence of minimum lot size requirements, donations or collaborations for affordable housing requirements, open space dedications and requirements to pay for infrastructure.

The wide variety of jurisdictions encompassed in the urban agglomerates show, on average, that 25 percent of zoned land is designated for low density residential use, while 12 percent is allocated for high density and 20 percent for mixed uses. However, several jurisdictions devote up to 80 percent of its zoned area for low density residential use. Industrial uses involved 10 percent of local land –with maximums of up to 50 percent) while rural use is provided for 31 percent of usable land on average. (Table 5)

Some type of density control is exercised in most municipalities. However, it is quite interesting to note that not all jurisdictions have minimum lot size requirements for low density areas (72 percent) ,and 67 percent have this kind of restriction for high density areas. The average sizes for both minimum lot size requirements are 495 and 393 square meters, respectively. However, the variation across jurisdictions is high. Stringency is as low as a 100 square meters minimum plot through 1000 square meters for residential high density use. (Table 6)

Other density requirements are FOS and FOT, which are present in 90 percent and 84 percent of municipalities, respectively. This question tries to capture whether there were any statutory limits on the number of square meters for building permits which are authorized for construction in any given plot. They are considered to be constraining housing supply by 66 percent and 64 percent, as expressed by respondents perceptions, when computing as affirmative responses in our analysis, those replies that together get 4 and 5 points from the 1 to 5 scale. (Table C.6 and Graphs C.5)

The determination of an urban perimeter or boundary within which urbanization can take place, is observed in 48 percent of the municipalities. (Graph C.6) The basic infrastructure and services that the municipality provides within this perimeter varied considerably among jurisdictions. There is great heterogeneity among jurisdictions, street sweeping, cleaning, and lighting, and pavement are essentially provided by most municipalities, while some jurisdictions provide sanitation and water services, as well. (Graph C.7) Another potentially important facet of the local regulatory environment involves requiring developers to pay a share or total costs of any infrastructure (or its improvement) associated with new development. In a third of localities, mainly those of Buenos Aires Province, the developer has to provide basic infrastructure services in order for subdivisions to be approved, at the same time that municipalities are responsible for paved streets and public lighting, as well as sanitation and sidewalks, to a lesser extent. Private companies are in charge of providing electricity, gas and water in many jurisdictions (41 percent, 32.5 percent and 34.5 percent respectively), while sanitation provision has altered between private firms and public sector. (Table C.7)

Another set of questions are mainly related to several factors for land access, some of which can be highly significant for low income housing. Provinces and localities have substantial influence over land systems that conditioned supply , not only land-use planning and enforcement , such as subdivision requirements or indicators of land occupation, but also the real property tax and the public deeds registry, among others.

First, respondents were asked about social housing provision. This question was included considering that social housing, mainly the construction of finished housing units financed completely by the public sector, is still the main policy intervention for housing the very poor. (World Bank, 2006) National and provincial governments are the main providers of

housing to address the needs of the lower income households. Although this strategy is not able to cope with overall housing needs, land availability for public programs still severely limits overall policy intervention. On average 636 and 578 units have been provided in each jurisdiction –with maximums of up to 6.200 and 4.000 units. However, on average, the number of units provided is far less than needed.²⁹ Municipal bodies and NGOs complement the construction of social housing by providing 85 and 50 units on average per jurisdiction, respectively. Informal comments with public sector authorities point out that land availability is the most severe constrain for implementing social housing programs in many localities. The next set of questions address the instruments available in legislation and land use regulation that may be used by local/provincial governments to overcome this situation. (Table C.8)

There is great heterogeneity among municipal jurisdictions on the elements that form part of their regulatory framework. Rural land preservation, public purchase of land for social uses or legal regularization of informal settlements are present in almost 50 percent of the municipalities' regulatory frameworks for land use regulation. However, land reserves for social housing, fiscal instruments for added value capture, and donations for social housing uses are present in 10 percent of the jurisdictions. As well, obligations for selling land for public infrastructure is widespread (87 percent of the jurisdictions) Other instruments, such as fiscal ones that allowed for differential fees to be applied for mobilizing vacant land, are present in 2 percent of the municipalities. (Graph C.8) Fiscal incentives, such as reduced fees for construction projects which are localized in areas where revitalization programs are implemented, are established in 33 percent of the jurisdictions

Cadastre registers are updated in 52.5 percent of the municipalities (standard deviation, 7.76). While 24 percent of the cadastre registers were updated in 2009, more than 50 percent of the updating was done in the last 5 years. However, there are still many jurisdictions where last updating was done before 1980 (5 percent). Some jurisdictions have not had their registers updated since 29 years ago. (Table C.9)

The survey inquires about Municipal revenues (as a way in which the municipal budget might allow for capital investments that will favor the poor) On average, jurisdictions collect 63 percent of payments issued, but efficiency in collecting shows great variation among jurisdictions. (Table C.10 and C.11)

Vacant land is a main issue in Argentina, as well as in many other Latin American cities (Clichevski, 1999). Amounts of vacant and under-utilized land lie within cities, in general, and Greater Buenos Aires, in particular. Many academics have pointed out that accessing this vacant land offers one of the most effective levers at hand for affordable housing development of both the public and private sector. Privately owned parcels can be developed in a straightforward way, through incentive mechanisms to place them in the market. A first step consists of understanding the legal status of vacant lots. Although much of this land is privately-owned, (60 percent of vacant plots, on average in each jurisdiction), another 16.5 percent of plots have complex ownership problems that are difficult to solve, particularly in Greater Buenos Aires. As well, substantial tracts are also owned by a number of government agencies which are estimated to cover up to 21 percent of vacant land available in each jurisdiction (7 percent municipal, 6 percent provincial and 8 percent national) (Table C.13)

²⁹ Further estimations about the ratio of social housing to population with unsatisfied basic needs or living below the poverty line are been included in next report.

Several questions elicit information about technical aspects of regulation and fiscal policy. In particular, we want to inquire about urban growth strategies and whether they are implicit in regulatory or fiscal instruments. It is interesting to show that 45 percent of jurisdictions encourage further urban development through completing existing urbanization, rather than supporting urban extension and sprawl (18 percent). Densification is encouraged as main urban growth strategy in 22 percent of the municipalities, while 12 percent have not defined a particular urban growth strategy. (Graph C.9)

The perceptions about what would be the most severe limitations that hindered access to land point out in the direction towards high land costs (52 percent) high cost of infrastructure (43 percent) and the low income of the population that need to be supported by some kind of public policy (80.5 percent), as evidence of a considerable increase in the house to income ratio that reduces households affordability. Updating of land use regulation is considered important for 27 percent of the respondents, while concentrated land ownership is problematic for 13.5 percent of jurisdictions, on average. (Table C.14)

Finally, other set of questions on technical issues focused on the average time for a residential project from its initial presentation to final approval. It takes 31 days for a single family dwelling (from as low as 2 to 180 days) and 52 days, on average for a multi family project, with a maximum of 240 days, showing a great heterogeneity between jurisdictions. The average cost is \$ 500, with maximums of \$ 1.200. (Tables C.15 and C.16)

IV. ii. Land Regulation Indicators

Tables A2 and A3 provide some insights on what our regulation indicators can tell about land regulatory environments across Argentinean jurisdictions.³⁰

In Table A2 we report the average value of indicators according to the country geographic regions³¹ and to the size (measured by total population) of jurisdictions, Recall that indicators have been standardized to have a mean of zero and standard deviation equal to one. It follows that the sign of an average value in Table A2 will point out whether the jurisdictions involved are above the whole sample average jurisdiction –positive sign- or below the average -negative sign-.Also, an average value above one for a category will point out a group of jurisdictions which average deviate from the mean by more than the average deviation.

There are some regions that display higher values in most indicators than others. For example, the Pampeana region displays the maximum regional average for the LPI, ZRAI and ALRI indicators, and the second maximum for the IPI and ACI. Conversely, Patagonia for example, presents the minimum values for four of the six indicators (LPI, BRI ALRI and ACI). This pattern might not be surprising, since municipalities located in the Pampeana regions are typically more populated than those in Patagonia (or NOA). But still, when considering all regions and indicators, there is no clear pattern of correlation among them. Taking for example the case of the North-East Argentina (NEA) region, Table A2 shows that the region is one where there is less presence of land use regulation plans (-0.09), it is the region where there is least difficulty for obtaining a zoning or a regular project approval (as measured by the ZRP Indicator, -0.31), but is the region with the

³⁰ See the Methodological Section for the definition of the Regulation Indicators.

³¹ The regions are Great Buenos Aires (GBA), North-West Argentina (NOA), North-East Argentina (NEA), Patagonia, Pampeana and Cuyo.

maximum value for the IP Indicator (0.3), suggesting a stronger participation of the municipality in the provision of infrastructure.³²

Table A2 also provides evidence about the pattern of regulation according to the size of the municipalities³³. The LP Indicator increases monotonically with population. This is not surprising since literature from developed countries have already shown that more populated areas are the ones more highly regulated. This is confirmed for the Argentina case, where more populated jurisdictions have higher values of the indicator of land use plans (LPI) as well as higher values for the ZRA Indicator.

Both the indicators for regulation related with building restrictions (BRI) and to access to land (ALRI) also increase with population, although in the case of the BRI the highest value for the indicator is found for the second –from the top- quintile of municipalities with more than 153.000 and less than 288.000 inhabitants (0.41), and in both cases (BRI and ALRI) the minimum value for the indicator is found in the second –from the bottom- quintile of population (-0.38 and -0.15 respectively).

The indicator that results somewhat surprising or seems no to be correlated with population is the IPI (Infrastructure Provision). The IPI shows a higher value in the smallest jurisdictions, which indicates a higher degree of public financing of the new infrastructure. As these are urban agglomerates it may not be surprising to find that some complete urbanized municipalities do not finance infrastructure provision. But still, the relationship found between the IPI and population is still not clear.

Finally, although the maximum approval costs are found in the largest jurisdictions, the figures for the ACI indicator do not suggest a clear relationship between these costs and the population.

Correlations across the Regulation Indicators

Table A.3 reports simple correlations across the indicators. Nearly all of them are positive, although only a few of them are statistically significant.

As was suggested by the previous correlation with population, the LPI, and the ZRAI are positively and significantly correlated. Once again, those jurisdictions that have incorporated local or provincial level land plans or have incorporated them into their regulatory framework tend to need the permission of more authorities for zoning changes or regular projects. The LPI indicator also appears positively correlated with the infrastructure provision indicator (IPI). The association is significant at conventional levels. Plans may establish how basic infrastructure and public services are to be provided in urban and suburban areas, i.e. by defining an urban perimeter where new residential developments are granted basic infrastructure services provision and defining whether the private public

³² The results for the Local Assembly, for example, show that Pampeana and Patagonia have higher values for this sub index, in terms of presence of elements of direct democracy required for changes in current zoning. This indicates that in these jurisdictions, changes in current zoning must be presented and debated or approved in community meetings or local assemblies. This type of requirement is more concentrated in these regions, as well as in cities with more than 288.000 inhabitants. It would be expected to be easier to block projects in order to avoid congestion or increased densification using this instrument.

³³ The categories distinguish municipalities that have less than 24.500 inhabitants, more than 24.500 and less than 51.500, more than 51.500 and less than 153.000, more than 153.000 and less than 288.000 and more than 288.000 inhabitants.

sector firms or the public sector is going to finance its extension to these areas. Notwithstanding this, both mentioned positive correlations are still below 0.5, (0.29 and 0.39), which indicates that still both indicators maintain a degree of independence.

Building restrictions exhibit a positive and significant correlation with infrastructure requirements (IPI), and this correlation is statistically significant at conventional significance levels. This result suggest that municipalities that impose lot size restrictions, as well as tight maximum total building and maximum land usage restrictions, tend to guarantee the provision of public services inside a defined urban perimeter, or alternatively, in those jurisdictions where the municipality has responsibility to finance part of the services, requirements to the developers on the supply of land are also set. Also, those municipalities that guarantee the access to infrastructure within its boundaries may also decide to constraint the generation of new lots in suburban areas (e.g. with minimum size lots) in order to restrict the expansion of infrastructure at a rate higher than what is possible to finance.

Finally, it is interesting to note that the indicator for approvals costs (ACI) is also positively and statistically significant correlated with the IPI. This might be another indicator in the same mentioned direction, that municipalities that regulates the access to infrastructure or take an active role in its provision might delay the time between the application and the approval of standard projects, and therefore increase the costs that are related to residential projects registration procedures.

iii. Households Tenure Condition in Argentina

The National Households Survey allows a description of the tenure condition of the Argentinean population. According to Survey responses, nearly 91 percent of households have a formal type of tenure of the dwelling they occupy (Formal Measure I in Table B2). Formal ownership, which is defined as the legal ownership of the land and the dwelling, accounts for 67 percent of households. Formal renters equal another 16 percent. Another 6 percent of households are legal occupants. The remaining 9 percent of households maintain an "informal" form of tenure. This group comprises owners of the dwelling but not of the land, self-claimed owners which pay property taxes, and other illegal occupants. Table B3 allows checking the degree of variability of formality across urban agglomerates in Argentina. Agglomerates such as Gran Resistencia or Gran Tucumán display the largest percentages of informality with 81 and 84 percent of households under formal tenure conditions. On the other extreme, Rawson-Trelew reaches 98 percent of formality.

As previously mentioned, there is a risk of over-estimating formality measures, since there are reasons to believe that households living in informal settlements which have paid for the land they occupy considered themselves to be homeowners, although no formal title has been granted.

Slums are characterized by the illegality of tenure, or some risk on the formal (or the partial) tenure condition, as well as the lack of basic infrastructure. Then, the definition of informal settlement becomes crucial for our analysis. According to the Survey (Table B2), 2 percent of the households live in these kinds of slums. In some urban agglomerates, as the case of Posadas and Gran Resistencia, the figure climbs to 8 percent and 9 percent respectively³⁴. When incorporating households living in emergency settlements into the

³⁴ These figures are not shown.

informality group, the measure of formality for the whole country displays nearly no changes (90 percent, Formal Measure II, Table B2).

We next test a different definition of an informal settlement, incorporating the access to basic infrastructure. As mentioned above, the lack of water and sewerage basic infrastructure is considered in order to approximate true informality. Table B2 shows that, 5 percent of households in Argentina obtain their water from a manual pump. In addition, nearly 8 percent of households do not have a water connection inside their dwellings. In the case of urban agglomerates such as Posadas and Gran Resistencia, the figure climbs to 14 percent. In other regions, such as Concordia and Formosa, which according to the definition of the Survey do not have households living in emergency settlements, the figure of households without water connection inside their dwelling reaches 10 percent and 15 percent, respectively.³⁵ We also consider the basic sewerage infrastructure. We incorporate in the informal group those households without a sewerage network connection, nor septic tank or cesspool. In Argentina 1 percent of households live in this category.

When we incorporate in the analysis the physical conditions of the settlement, the associated Formal Measure tenure condition decreases to 86 percent (Formal Measure III, Table B2). Concluding, the incorporation of the most basic infrastructure might be useful to check for the true formality percentage, extending the existent measured informality percentage from 9 percent to 14 percent.

V. iv. Tenure Choice Model Econometric Results

Results on Regulation Indicators

The econometric results on the effect of regulation on the tenure condition of households suggest that in those jurisdictions that have incorporated land plans into their regulatory or legal frameworks (as measured by the LPI) it is less likely that households will obtain a formal tenure condition. Higher residential project approval costs (measured in monetary and time terms) seem also to have a negative effect on the probability of obtaining formal tenure. The rest of our regulation indicators are found to display no clear relationship with the formal tenure condition.

Table B.5 displays the results of the econometric model estimation for the regulation indicators. The three columns allow the comparison of results across the three alternative measures of the formal tenure condition.³⁶

In the case of the LPI, a negative and statistically significant relationship with the formal tenure condition holds across the three alternative definitions of the dependent variable. The results suggest that in those jurisdictions where plans for the use of land have been formally established in the legal or regulatory framework, households find it more difficult to access formal tenure, or in other words, a household will have a higher probability of being informal. An increase in 1 point in the indicator reduces the probability by 13 percent.³⁷ The effect increases (to 17 percent) when considering Measure II (incorporating those households located in emergency settlements), but decreases in the case of Measure III (-11 percent) suggesting that LPI provides a poorer explanation of those households without access to basic infrastructure. The negative effect of the LPI in the formal tenure

³⁵ These figures are not reported in tables and are available upon request.

³⁶ See the discussion on these definitions in the Methodological Section above.

³⁷ Recall that indicators have been standardized to have a standard deviation of 1.

condition might suggest that those jurisdictions that have incorporated land planning into their legal or regulatory frameworks have tended to limit the increase of the formal residential sector, in concordance with theories of exclusionary regulation (See for instance Biderman, 2008).^{38 39}

A significant effect of regulation on the tenure condition is also found for the Approval Cost Indicator (ACI), displaying a negative influence on formality. An increase in a value of 1 in the indicator is associated with a decrease in the probability of tenure of 9 percent. The result might therefore reflect that time and costs related to residential projects approval/registration procedures lower the probability of households becoming formal owners/renters. As explained above, the intuition of the result is straightforward, and might be evidence in favor of the supporters of the simplification of approval processes. The result might also reflect the existence of an implicit exclusionary policy in certain agglomerates.

In the case of the Building Restrictions Indicator (BRI), results are less clear. A positive effect on the formal tenure condition appears for Measures I and II, suggesting that in those urban agglomerates with, on average, tighter building restrictions, households have a larger probability of having a formal tenure condition. This result would contradict our a priori hypothesis, since restrictions limiting intensity of land use might affect low-income households, who have a higher demand of high density developments than consumers who are better off. (Henderson, 2009 in Lall et al., 2009) Nonetheless, the effect disappears when incorporating into the informality group those households with the least access to infrastructure (Measure III), and so further analysis is needed in order to draw definitive conclusions in relation to this indicator.

The ZRAI, IPI and ALRI Indicators appear consistently to reflect no statistically significant effect on the tenure choice condition.⁴⁰

Demographic, Socioeconomic and Location controls

As expected, most socioeconomic and wealth related characteristics of households result in statistically significant explanatory variables of their—formal or informal—tenure condition. Significant variables include household size (negative effect), the quantity of children (negative), household income (positive), and the formal employment condition (positive). Other vulnerability conditions such as the sex of the head of household, or the migratory condition exhibit no significant relationship.

Table B.7 reports the estimated marginal effects.⁴¹ Once again, each column represents a specification of the model for each of our formal tenure measures. In relation to socioeconomic variables, for example, the model predicts that education increases the

³⁸ Notice that both provincial plans and municipal regulation have been jointly analyzed in this stage. Further research should evaluate the different levels of regulation separately.

³⁹ As explained in the literature section, many provincial-level plans might have replicated the Buenos Aires Law of 1977, which had the objective of limiting the uncontrolled development of land, and defining the conditions for formality and excluding the lowest segment of the demand.

⁴⁰ In particular the result for the ZRAI was unexpected; since our ex-ante hypothesis was that the ZRAI would proxy the degree of planning (and in line with the exclusionary regulation, might replicate the negative effect of LPI). In the case of the IPI indicator, no clear effect was expected nor in the case of the ALRI. Notice that the existence of access to land elements in the regulation might also be an endogenous factor, taking place when an important percentage of the electorate is under an informal condition. The expected effect was not clear.

⁴¹ Calculated on the average value of the continuous explanatory variables, and representing the discrete increase from 0 to 1 in the case of the dummy variables.

probability of having a formal tenure: 22 percent to 37 percent increase for a household with complete primary, 17 to 26 percent for complete secondary, and 15 to 19 percent for complete university.⁴² The age of the head of household (and its square) resulted in a not significant effect (or an effect close to 0). The household size and the number of children (under five years old) in the house are variables negatively related to the tenure condition. An extra child decreases the probability of formal tenure by 12 percent (calculated at the mean of 0.3 children) and an extra person in the house reduces the probability by 3 percent (at the mean of 3.7 people), which can be explained by the fact that poorer households have relatively more children.

As expected, there is a positive relationship between income measures and the formal tenure condition. The logarithm of the total household income variable is significant and positive, predicting an increase of 16 percent to 33 percent in the formal tenure probability for an increase of a 1 percent in income—at the mean of 1,652 pesos. Another important variable is the formal work condition. The variable is found to have a positive effect—of 10 to 22 percent according to the specification—on the formal tenure condition. Finally the economic dependence variable does not show a significant effect, which might be explained by the fact that several income related variables have already been incorporated as controls. In general no effects are found on the tenure condition for the social vulnerability related variables. No effect is found for head of household employed in domestic service, no clear effect for the sex of the head of household, or for the migrant status of the head of household (considering both domestic and international migrants).

Finally, notice that explanatory power of the model is low. The pseudo R-square measure is 7 percent in Model I and increases to 13 percent in Model III. The incorporation of the population with lack of basic infrastructure in the informal group improves the explanatory power of the model.

VI. v. Percentage of Population with Formal Tenure Model: Econometric Results

The estimation of the model of the percentage of population with a formal tenure using municipal-level data allows the comparison of results with those from the previous tenure choice model. Table B6 reports the results for the estimation of equation (2).⁴³ Columns (1) (2) and (3) report different specifications of the model where some of the socioeconomic variables were alternatively added. The model is jointly significant and has been finally estimated with 62 observations⁴⁴

Regulation Indicators

In general the comparison with the tenure choice model reported three indicators with coincident results (LPI, BRI and IPI), two of them could not be corroborated (ACI and ZRAI), and one indicator presents no concluding results (ALRI).

⁴² Notice that since the three education variables are jointly incorporated in the model, and given the fact that informality affects the segment of the population with the lowest educational level, it is not strange to find a lower coefficient for a higher level of education.

⁴³ See Section III.iv

⁴⁴ From the total of 89 municipalities in our regulation database, several cases are lost due to non response in certain regulation questions.

In the case of the LPI, results are corroborated, displaying a negative and significant (at 5 percent) coefficient. The negative relationship found here between the LPI and the formal tenure percentage corroborates the negative effect that has been previously found for the existence of land plans in the presence of informality. The estimated coefficient suggests that an increase in a value of 1 in the indicator⁴⁵ is related to a decrease in formal tenure of nearly 1 percentage point.

Also consistent with the results of the tenure choice model, the estimated coefficients suggest no relationships between the formal tenure percentage and the Building Restrictions Indicator (BRI), nor the Infrastructure Provision Indicator (IPI). The respective non-significance cannot be rejected at standard significance rates in any of the specifications.

The results for the ACI and ZRAI are not coincidental from what was found in the previous model. In the case of the Approval Costs Indicator (ACI), which in the previous model presented a negative effect on tenure choice, is found to display no significant relationship with the percentage of population with formal tenure.

Zoning and Approval Regulation Indicator (ZRAI), which in the previous model presented no relationship with the tenure choice, shows here a negative relationship with the percentage of formality across municipalities. This indicator, which captures the authorities involved in the approval of zoning and regular projects, was a priori expected to display a negative sign because of its relationship with exclusionary regulation. Notice also that the relationship emerges once the percentage of population with unmet basic needs was controlled for. However, more evidence is needed in order to achieve definitive results in relation to this indicator.

Another indicator which displays the a priori hypothesis here is the Access to Land Regulation Indicator (ALRI), displaying a positive coefficient. The positive coefficient would validate the idea that the inclusion of regulation fostering the access to land has indeed an effect on actual formality. In this case, the estimated coefficient suggests that an increase in 1 point in the ALRI indicator can be related to an increase in the percentage of households with a formal tenure of 0.5 percent. Notice also here that the relationship emerges once the percentage of population with unmet basic needs was controlled for. Nevertheless, our results for the tenure choice model cannot confirm this result and still in this case more evidence is needed in order to arrive to definitive conclusions

Demographic, Socioeconomic and Location Controls

Socioeconomic variables present some interesting results. Recall that because of the correlation among them, two of the variables that capture the lowest income segment of the population (i.e., percentage of population with material resource needs according to a deprivation index and the percentage of population with at least one unmet basic need) were added to the regression in individual specifications. In the case of the proportion of population with at least an unmet basic need, the expected negative coefficient was found, predicting 2.6 percent of decrease of informality for a reduction of 10 points in the percentage of population with unmet basic needs. On average, 14 percent of the population in the municipalities that were analyzed displays at least one unmet basic need, and this percentage reached 34 percent in the poorest municipality. In the case of the percentage of population with material resources needs (according to the *Índice de Privación Material*)

⁴⁵All indicators have been standardized in order to get a standard deviation equal to one, which implies that an increase of 1 point is equivalent to an increase in the average deviation of the indicator.

however, the hypothesis of no relationship cannot be rejected at standard significance levels. An interesting result arises for the average number of years of education variable; since it reports a negative coefficient, but only when incorporating the unmet basic needs variable as control.⁴⁶ Once controlling for the percentage of population with most probability of becoming informal, the education variable might approximate the presence of other exclusionary mechanisms that increase informality in relatively more wealthy—or human capital concentration—municipalities. More precisely, once controlling for the percentage of population with less income, a higher average educational level might capture greater inequality for a given municipality, therefore giving place for exclusionary mechanisms and leaving the lowest income individuals in the informal sector.

Demographic controls presented no relationship with the percentage of formality. No clear relationship with the tenure condition was found for the demographic variables that captured the percentage of youngest and oldest within the population. In addition, no relationship was found for the total population as a control.

The percentage of population that migrated in the five years previous to the census was found to be positively related to the formal tenure condition. In other words, those municipalities that received greater immigration in previous years were those that on average presented a larger percentage of formal tenure. This result is statistically significant, with a confidence level of 1 percent. The result might suggest that population migrates to municipalities where there is easier access to a formal tenure condition.

Finally, the only regional dummy that was found significant in this model is the one corresponding to the NEA region. The result suggests that this region holds a larger degree of tenure informality (nearly 4 percent) that cannot be explained by the other incorporated variables.

VII. Conclusions

This paper has presented a set of empirical findings in relation to the complex topic of the regulation of land for residential use, and its effects on households' access to a formal tenure of residential land. The topic has yet been scarcely accounted in the literature; in particular there is little evidence for developing countries. This study, based on a survey of land regulation across municipalities in Argentina provides a valuable source of comparable and systematic information of land regulation.

Our survey confirmed that regulation of residential land in Argentina is of a quite heterogeneous nature, and only in some provinces have been guided by land plans that have been incorporated in their respective legal frameworks. Also, in general land plans have been found to be quite outdated, with average ages of more than 10 years in the case of provincial-level or municipal-level land plans. There is great heterogeneity not only in the nature of regulation but also in terms of its contents (e.g. the existence of zoning, the authorities involved in approval processes, approval costs). Heterogeneity is also huge in terms of the guarantee of provision of services (e.g. less than half of the jurisdictions guarantee the provision of basic services such as public water supply, street lighting or electricity within their urban perimeters), or the establishment of inclusionary elements in the regulation (e.g. less than 50 percent of the municipalities consider the regularization of lots with illegal occupation and less than 20 percent incorporate measure to recoup value added).

⁴⁶ The same result also appears for the percentage of population with secondary education, not reported in the Table.

Do our regulation measures have an effect on the actual tenure condition of households in Argentina? The regulation data obtained from the survey was synthesized into thematic indicators, and then analyzed in relation to the residential tenure patterns across the country in order to provide insights into this question.

The research provided a first set of insights. The most consistent result across our models and specifications is the negative effect found for the existence land plans, together with the incorporation of these plans in the respective legal or regulatory frameworks, on the formal tenure condition (i.e., the results for the LPI Indicator in the two estimated models). This finding might be consistent with the hypothesis of a “minimum consumption” regulation (as suggested for example by Gyourko et al., 2007), that is translated into a relatively larger informal land market for the lowest segment of the population. Although more results specifically related with the contents of the regulation are needed in order to validate this hypothesis, the present results call attention to this issue.

Other regulation thematic indicators have shown some results in line with our a priori hypothesis, but given the fact that results have not appeared consistently in all our measurements, more research is still needed in order to establish definitive conclusions. This is the case for example of the Zoning and Regular Projects Approval Indicator (ZRAI), which exhibit a negative effect on formality in most estimates (e.g. in the case of the percentage of population with formal tenure model). Since more authorities involved in project and zoning approvals are also expected to be correlated with tighter regulation, a negative effect on formality was expected. Another interesting result was found in the case of the Access to Land Regulation Indicator (ALRI), since as expected, exhibits a positive relationship with tenure formality for those municipalities that report inclusionary policies. Finally, in the case of the Approval Costs Indicator (ACI), a negative effect on the probability of households of becoming formal owners or renters was found for those agglomerates with relatively higher approval costs. Even though these results are promising; more research is needed in relation to these dimensions of regulation.

Other indicators have shown no relationship with the tenure condition across all of our estimations. This is the case of the provision of infrastructure Indicator (IPI), and the building restrictions Indicator (BRI). Recall that while building restrictions explicitly limit the supply of land, the literature has pointed out that the provision of infrastructure might function as well as an indirect restriction of the supply (i.e. by not servicing land with certain public infrastructure investments). At this point our evidence provides low support for these hypotheses.

Finally, it is worth mentioning that the analysis has also brought to light several interesting patterns regarding the relationship of socioeconomic variables with the tenure condition. For example, the paper shows how controlling the tenure choice pattern with the percentage of population with most probability of becoming informal (i.e. the population with basic unmet needs) the average education level of a population appears to be associated with more informality. In this case, the results might also suggest the presence of other exclusionary mechanisms associated with a higher average level of human capital and relatively higher inequality. (See for example: Henderson, 2007, or Henderson and Feller, 2008). Socioeconomic patterns in relation to tenure choice will also be closely examined in a forthcoming paper.

There are several ways to deepen our understanding of this topic. First, the analysis of the contents of regulation is still at a very early stage. For example, to separately analyze the effect of specific components of the regulation, such as zoning or certain building

restrictions will help to better understand the effects of regulation. Another important point to be added to the tenure choice analysis is the existence of vacant land. Forthcoming analysis should measure the extent in which land is available across jurisdictions and analyze how it affects the relative size of formal and informal residential sectors. Also, there is a need to evaluate the existence of measures of regulation enforcement across jurisdictions. Notice that this concept might be a crucial variable omitted from our analysis. The incorporation of variables related with these concepts then becomes a priority in this line of research.

Forthcoming analysis should also be focused in deepening the analysis of the determinants of regulation: exploring the observable patterns of municipalities that are related with regulation, and the changes that have originated regulation such as, for example, changes in immigration patterns, or the effects of rapid population growth. Some initial findings in this paper suggest that regulation reflects observable characteristics such as population, density or other regional characteristics. Research is needed to better understand how regulatory patterns are related to many observable characteristics of municipalities. In particular how municipalities interact between them in the definition of regulation, a topic not sufficiently covered in this paper. Finally, the present analysis should also be complemented with a study of the effect of regulation on land prices, a topic not covered in our paper.

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Appendix A: Regulation Indicators Tables

Table A1: Survey Response Rates by Region and Size of the Municipality*

	Response		Population:		
	Rate %	Sample	Big Agglomerates	Urban	
Region:		No.	%	No.	%
Cuyo	73	11	12.4	15	12.6
GBA	83	29	32.6	35	29.4
NEA	75	12	13.5	16	13.4
NOA	63	12	13.5	19	16
Pampeana	70	16	18	23	19.3
Patagonia	89	8	9	9	7.6
Population (inhabitants):					
less than 24.500	67	16	18	24	20.2
more than 24.500 y less than 51,500	67	16	18	24	20.2
more than 51,500 y less than 153,000	83	19	21.3	23	19.3
more than 153,000 y less than 288,000	80	20	22.5	25	21
more than 288,000	78	18	20.2	23	19.3
Total	75	89	100	119	100

*Size quantiles are calculated on the basis of the 119 municipalities included in the big urban agglomerates definition.

Table A2: Regulation Indicators. Averages by Region, Population, and Density

	LPI	ZRAI	BRI	IPI	ALRI	ACI
Region						
Cuyo	-0.09	0.17	0.09	-0.63	0.23	-0.15
GBA	0.56	0.26	0.21	0.00	-0.03	0.19
NEA	-0.09	-0.31	-0.17	0.30	0.15	-0.04
NOA	-0.34	0.17	-0.02	0.00	0.51	0.04
Pampeana	0.63	0.68	-0.35	0.19	0.91	0.06
Patagonia	-0.42	0.27	-0.36	0.16	-0.13	-0.32
Population (Inhabitants)						
menos de 24,500	-0.35	-0.30	-0.27	0.30	-0.12	-0.06
más de 24,500 y menos de 51,500	-0.04	-0.38	-0.43	0.01	-0.15	-0.17
más de 51,500 y menos de 153,000	-0.38	0.04	0.02	-0.08	-0.09	0.04
más de 153,000 y menos de 288,000	0.23	0.25	0.41	-0.29	0.11	-0.28
más de 288,000	0.50	0.38	0.11	0.14	0.23	0.51

Table A3: Indicators Correlation Matrix: All Municipalities

	LPI	ZRAI	BRI	IPI	ALRI	ACI
LPI	1					
	89					
ZRAI	0.3944	1				
	0.0002					
	85	85				
BRI	0.1442	0.1618	1			
	0.1934	0.1465				
	83	82	83			
IPI	0.2989	0.0946	0.188	1		
	0.0044	0.3893	0.0887			
	89	85	83	89		
ALRI	0.1236	0.1389	0.1308	0.1426	1	
	0.2654	0.2162	0.2477	0.1984		
	83	81	80	83	83	
ACI	0.0059	0.0048	-0.0187	0.2101	-0.0203	1
	0.9624	0.9696	0.8822	0.0903	0.8727	
	66	65	65	66	65	66

Note: p value in italics for null of zero correlation

Appendix B: Tenure Choice Tables

Table B1: Variables and Definitions

Explanatory Variables

Life Cycle and Households Characteristics

Age	Age of the head of household
Head of Household level of Education:	
complete_primary	Equals one if head of household has completed primary school, equals zero otherwise.
complete_secondary	Equals one if head of household has completed secondary school, equals zero otherwise.
complete_university	Equals one if head of household has completed secondary school, equals zero otherwise.
household_size2	Household size
qchild_under5	Number of children under 5 years living in the same house

Wealth and Income Characteristics

income_household_total	Total income per household
income_per_capita	Total household income per capita
ind_econo_dependency	Individual income/total household income
head_income	Head's total income
economic_dependency	Head of household income as percentage of total household income
employer	Equals one if the head is an employer, equals zero otherwise.
employee	Equals one if the head is an employee, equals zero otherwise.
domestic_service	Equals one if the head works in domestic service, equals zero otherwise.
formal_work	Equals one if the head has a formal job, equals zero otherwise.

Basic Needs and Social Vulnerability

Unmet Basic Need Indicators

ubn	Equals one if Unmet Basic Needs (U. B. N.), equals zero otherwise.
ubn_house_density	Equals one if U.B.N. people per room, equals zero otherwise.
ubn_house	Equals one if U.B.N. house, equals zero otherwise.

Table B1: Variables and Definitions (Cont.)

ubn_sanit	Equals one if U.B.N. Sanitary Conditions, equals zero otherwise.
ubn_edu	Equals one if U.B.N. Education, equals zero otherwise.
ubn_survival	Equals one if U.B.N. Survival, equals zero otherwise.
ubn_portion	Portion of U.B.N (one is worse)
sex	Equals one if head of household is male.

dummy_marital	Equals one if head of household is married or lives together with a couple, equals zero if it is single, separated, divorced or widow.
international_migrant	Equals one if the household is an international migrant, equals zero otherwise.
domestic_migrant	Equals one if the household is a domestic migrant, equals zero otherwise.

Locational Variables

more500	Metropolitan area, with more than 500.000 inhabitants
dummy_gba	Dummy for Gran Buenos Aires region
dummy_noa	Dummy for NOA region
dummy_nea	Dummy for NEA region
dummy_cuyo	Dummy for CUYO region
dummy_pampa	Dummy for PAMPA region
dummy_patagonia	Dummy for PATAGONIA region

Table B2: Formal Tenure Definitions and Related Variables*

Variable	Mean	Standard Error	Min	Max
Formal Tenure Definitions				
Formal Measure I	0.909	0.0001	0	1
Formal Measure II	0.903	0.0001	0	1
Formal Measure III	0.857	0.0001	0	1
Owners	0.672	0.0002	0	1
Renters	0.162	0.0001	0	1
Other formal conditions	0.060	0.0001	0	1
Located in Emergency Settlements				
	0.020	0.000	0	1
Water Source				
Network	0.881	0.0001	0	1
Automatic Pump	0.114	0.0001	0	1
Manual Pump	0.005	0.0000	0	1
Water Connection				
Inside dwelling	0.920	0.0001	0	1
Outside dwelling inside land	0.071	0.0001	0	1
Outside land	0.009	0.0000	0	1
Sewerage Connection				
Network	0.637	0.0001	0	1
Septic Cam	0.251	0.0001	0	1
Cesspool	0.103	0.0001	0	1
Pit in the ground	0.009	0.0000	0	1

*EPH sampling weights have been used for calculations.

Table B3: Formal Tenure Condition by Urban Agglomerate. In percentage

	Formal Measure I	Formal Measure II	Formal Measure III
Gran Resistencia	81	80	76
Gran Tucumán - T. Viejo	84	84	78
Posadas	85	84	82
Jujuy - Palpalá	86	86	78
Ushuaia - Río Grande	89	89	89
Partidos del GBA	89	89	81
Gran La Plata	91	91	88
Formosa	91	91	76
Cdro. Rivadavia - R.Tilly	92	92	90
Concordia	92	92	88
Salta	92	92	83
Ciudad de Bs As	92	90	90
Viedma – Carmen de Patagones	92	92	88
Gran Rosario	93	92	90
Gran Santa Fé	93	93	90
Gran Mendoza	93	91	90
Corrientes	93	93	89
Gran Córdoba	93	92	90
Neuquén – Plottier**	93	92	90
Río Gallegos	93	93	92
La Rioja	93	93	87
Gran San Juan	93	93	85
Mar del Plata - Batán	93	93	90
Gran Paraná	94	94	93
Bahía Blanca - Cerri	96	96	95
S.del Estero - La Banda	96	96	85
Río Cuarto	96	96	92
San Nicolás – Villa Constitución	96	95	93
Gran Catamarca	97	97	88
San Luis - El Chorrillo	97	97	93
Santa Rosa - Toay	97	97	96
Rawson – Trelew	98	97	92
Total	91	90	86

Table B4: Explanatory Variables Basic Statistics

	Mean	Mean Std. Error	Min	Max
Lyfe Cycle and Households Characteristics				
age	50.521	0.00	14	99
Head of Household level of Education				
complete_primary	0.871	0.00	0	1
complete_secondary	0.426	0.00	0	1
complete_university	0.145	0.00	0	1
household_size2	3.337	0.00	1	23
qchild_under5	0.254	0.00	0	5
Wealth and Income Characteristics				
income_household_total	1059.902	0.18	0	463100
income_per_capita	428.876	0.08	0	154367
head_income	750.536	0.15	0	460000
economic_dependency	0.560	0.00	0	1
employer	0.054	0.00	0	1
Employee	0.703	0.00	0	1
domestic_service	1.336	0.00	0	2
formal_work	0.665	0.00	0	1
Basic Needs and Social Vulnerability				
Ubn	1.000	0.00	1	1
ubn_house_density	0.086	0.00	0	1
ubn_house	1.000	0.00	0	1
ubn_sanit	0.018	0.00	0	1
ubn_edu	0.004	0.00	0	1
ubn_survival	0.062	0.00	0	1
ubn_portion	0.231	0.00	0	1
sex	0.684	0.00	0	1
dummy_marital	0.622	0.00	0	1
international_migrant	0.082	0.00	0	1
domestic_migrant	0.233	0.00	0	1
Locational Variables				
more500	0.791	0.00	0	1
dummy_gba	0.554	0.00	0	1
dummy_noa	0.081	0.00	0	1
dummy_nea	0.044	0.00	0	1
dummy_cuyo	0.059	0.00	0	1
dummy_pampa	0.237	0.00	0	1
dummy_patagonia	0.025	0.00	0	1

Table B5: Econometric Results. Marginal Effects for the formal/informal Tenure Choice Model*

Dependent variable:	Formal Tenure Measure I	Formal Tenure Measure II	Formal Tenure Measure III
LPI_2	-0.139*** (0.040)	-0.169*** (0.039)	-0.106*** (0.037)
ZRAI_2	-0.051 (0.043)	-0.037 (0.043)	-0.030 (0.040)
BRI_2	0.066** (0.028)	0.078*** (0.028)	0.035 (0.026)
IPI_2	0.032 (0.027)	0.039 (0.027)	-0.009 (0.025)
ALRI_2	0.019 (0.031)	0.022 (0.030)	0.008 (0.028)
ACI_2	-0.090*** (0.028)	-0.089*** (0.027)	-0.074*** (0.025)
Observations	7483	7483	7384
Predicted Probability	0.922	0.919	0.886
Log likelihood first iteration	-2304	-2379	-3023
Log likelihood second iteration	-2150	-2204	-2656
Degrees of Freedom	22	22	22
chi2	308.3	350.1	734.9
Pseudo R2	0.0669	0.0736	0.122

*Only coefficients corresponding to regulation indicators are reported in this table. The remaining control variables, although included in the model, are not reported here.

Note: Robust Standard Error in parenthesis.

Table B6: Econometric Results. Marginal Effects for the Formal Tenure Model*

Dependent Variable: Percentage of Population with formal tenure	(1)	(2)	(3)	(4)	(5)
LPI	-0.946** (0.455)	-1.237** (0.595)	-0.956** (0.449)	-1.258*** (0.423)	-1.258** (0.423)
ZRAI	-0.561* (0.285)	-0.602** (0.284)	-0.592** (0.287)	-0.658 (0.469)	-0.658 (0.469)
BRI	-0.146 (0.290)	-0.115 (0.323)	-0.118 (0.285)	-0.107 (0.333)	-0.107 (0.333)
IPI	0.098 (0.280)	0.015 (0.257)	0.130 (0.312)	0.015 (0.355)	0.015 (0.355)
ALRI	0.511** (0.238)	0.394 (0.259)	0.549** (0.208)	0.394 (0.331)	0.394 (0.331)
ACI	0.480 (0.333)	0.227 (0.283)	0.483 (0.328)	0.190 (0.317)	0.190 (0.317)
propmen14	-0.269 (0.178)	-0.388** (0.147)	-0.248 (0.184)	-0.384* (0.224)	-0.384* (0.224)
propmay65	-0.013 (0.165)	-0.103 (0.167)	-0.017 (0.173)	-0.104 (0.312)	-0.104 (0.312)
anios_educacion_prom	-1.204** (0.570)	-0.126 (0.375)	-1.504*** (0.534)	-0.240 (0.615)	-0.240 (0.615)
pmigrantes	0.296*** (0.091)	0.295*** (0.087)	0.304*** (0.090)	0.299*** (0.095)	0.299*** (0.095)
dregion_NEA	-3.680*** (1.193)	-3.962** (1.434)	-3.786*** (1.185)	-3.961*** (1.030)	-3.961** (1.030)
propatleast1nbi	-0.261** (0.112)		-0.295** (0.108)		
por_ipmh_sinreccorrientes				-0.017 (0.118)	
por_ipmh_solopatrimonial					-0.017 (0.118)
ipmh_convergente		-0.000 (0.000)			
totalpob			0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Constant	111.830*** (9.149)	104.583*** (6.996)	113.711*** (9.153)	105.364*** (12.381)	105.364* (12.381)
Observations	62	62	62	62	62
R-squared	0.723	0.682	0.732	0.682	0.682
Adjusted R-squared	0.656	0.604	0.659	0.595	0.595
F	18.90	12.99	15.03	7.907	7.907

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table B7: Econometric Results. Marginal Effects for the Formal/informal Tenure Choice Model*

	Formal Tenure Measure I (1)	Formal Tenure Measure II (2)	Formal Tenure Measure III (3)
age	-0.015 (0.014)	-0.013 (0.013)	-0.004 (0.012)
age2	0.000** (0.000)	0.000** (0.000)	0.000 (0.000)
complete_primary	0.214*** (0.074)	0.252*** (0.072)	0.368*** (0.065)
complete_secondary	0.168*** (0.052)	0.180*** (0.051)	0.259*** (0.048)
complete_university	0.176** (0.077)	0.188** (0.077)	0.146** (0.074)
household_size2	-0.025* (0.014)	-0.024* (0.014)	-0.046*** (0.012)
qchild_under5	-0.119*** (0.039)	-0.112*** (0.038)	-0.123*** (0.036)
logincome_household	0.159*** (0.035)	0.159*** (0.035)	0.329*** (0.032)
economic_dependency	-0.073 (0.092)	-0.063 (0.091)	0.104 (0.084)
domestic_service	-0.024 (0.092)	-0.018 (0.090)	-0.039 (0.082)
formal_work	0.103* (0.054)	0.140*** (0.054)	0.222*** (0.049)
sex	0.063 (0.071)	0.056 (0.071)	-0.110* (0.066)
dummy_marital	-0.183*** (0.068)	-0.168** (0.067)	-0.023 (0.061)
international_migrant	-0.009 (0.099)	-0.094 (0.095)	-0.110 (0.087)
domestic_migrant	0.071 (0.052)	0.045 (0.052)	0.025 (0.047)
Constant	0.070 (0.387)	-0.112 (0.382)	-1.935*** (0.349)
Observations	7483	7483	7384
Predicted Probability	0.922	0.919	0.886
Log likelihood first iteration	-2304	-2379	-3023
Log likelihood second	-2150	-2204	-2656

iteration			
Degrees of Freedom	22	22	22
chi2	308.3	350.1	734.9
Pseudo R2	0.0669	0.0736	0.122

Note: Regulation Indicators, although included in the model, are not reported in this Table. Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table B8: Econometric Results. Percentage of Formal Tenure Model*

Dependent Variable: Percentage of Population with formal tenure	(1)	(2)	(3)
LPI	-0.946** (0.455)	-1.237** (0.595)	-0.956** (0.449)
ZRAI	-0.561* (0.285)	-0.602** (0.284)	-0.592** (0.287)
BRI	-0.146 (0.290)	-0.115 (0.323)	-0.118 (0.285)
IPI	0.098 (0.280)	0.015 (0.257)	0.130 (0.312)
ALRI	0.511** (0.238)	0.394 (0.259)	0.549** (0.208)
ACI	0.480 (0.333)	0.227 (0.283)	0.483 (0.328)
propmen14	-0.269 (0.178)	-0.388** (0.147)	-0.248 (0.184)
propmay65	-0.013 (0.165)	-0.103 (0.167)	-0.017 (0.173)
anios_educacion_prom	-1.204** (0.570)	-0.126 (0.375)	-1.504*** (0.534)
Pmigrantes	0.296*** (0.091)	0.295*** (0.087)	0.304*** (0.090)
dregion_NEA	-3.680*** (1.193)	-3.962** (1.434)	-3.786*** (1.185)
propatleast1nbi	-0.261** (0.112)		-0.295** (0.108)
ipmh_convergente		-0.000 (0.000)	
Totalpob			0.000 (0.000)
Constant	111.830*** (9.149)	104.583*** (6.996)	113.711*** (9.153)
Observations	62	62	62
R-squared	0.723	0.682	0.732
Adjusted R-squared	0.656	0.604	0.659
F	18.90	12.99	15.03

Table B6: Econometric Results. Percentage of Formal Tenure Model*

Dependent Variable: Percentage of Population with formal tenure	(1)	(2)	(3)	(4)	(5)	(6)
LPI	-0.946** (0.455)	-1.237** (0.595)	-0.956** (0.449)	-1.258*** (0.423)	-1.258*** (0.423)	-1.275*** (0.403)
ZRAI	-0.561* (0.285)	-0.602** (0.284)	-0.592** (0.287)	-0.658 (0.469)	-0.658 (0.469)	-0.626 (0.457)
BRI	-0.146 (0.290)	-0.115 (0.323)	-0.118 (0.285)	-0.107 (0.333)	-0.107 (0.333)	-0.141 (0.327)
IPI	0.098 (0.280)	0.015 (0.257)	0.130 (0.312)	0.015 (0.355)	0.015 (0.355)	0.088 (0.358)
ALRI	0.511** (0.238)	0.394 (0.259)	0.549** (0.208)	0.394 (0.331)	0.394 (0.331)	0.427 (0.332)
ACI	0.480 (0.333)	0.227 (0.283)	0.483 (0.328)	0.190 (0.317)	0.190 (0.317)	0.287 (0.345)
propmen14	-0.269 (0.178)	-0.388** (0.147)	-0.248 (0.184)	-0.384* (0.224)	-0.384* (0.224)	-0.303 (0.247)
propmay65	-0.013 (0.165)	-0.103 (0.167)	-0.017 (0.173)	-0.104 (0.312)	-0.104 (0.312)	-0.015 (0.325)
anios_educacion_prom	-1.204** (0.570)	-0.126 (0.375)	-1.504*** (0.534)	-0.240 (0.615)	-0.240 (0.615)	-0.334 (0.600)
pmigrantes	0.296*** (0.091)	0.295*** (0.087)	0.304*** (0.090)	0.299*** (0.095)	0.299*** (0.095)	0.319*** (0.088)
dregion_NEA	-3.680*** (1.193)	-3.962** (1.434)	-3.786*** (1.185)	-3.961*** (1.030)	-3.961*** (1.030)	-4.089*** (0.964)

propatleast1nbi	-0.261**		-0.295**			
	(0.112)		(0.108)			
por_ipmh_sinreccorrientes				-0.017		
				(0.118)		
por_ipmh_solopatrimonial					-0.017	
					(0.118)	
ipmh_convergente		-0.000				-0.049
		(0.000)				(0.078)
totalpob			0.000	0.000	0.000	0.000
			(0.000)	(0.000)	(0.000)	(0.000)
Constant	111.830***	104.583***	113.711***	105.364***	105.364***	102.989***
	(9.149)	(6.996)	(9.153)	(12.381)	(12.381)	(10.943)
Observations	62	62	62	62	62	62
R-squared	0.723	0.682	0.732	0.682	0.682	0.684
Adjusted R-squared	0.656	0.604	0.659	0.595	0.595	0.599
F	18.90	12.99	15.03	7.907	7.907	7.997

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

