Housing Tenure, Property Rights, and Urban Development in Developing Countries

HOUSING TENURE, PROPERTY RIGHTS, AND URBAN DEVELOPMENT IN DEVELOPING COUNTRIES

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SUMMARY

This dissertation explores how distinctive institutional factors related to property rights determine urban development patterns and housing tenure modalities in a developing economy context. The first part of the dissertation proposes a choice-theoretic model that explains the existence of the antichresis contractual arrangement as a way to temporarily divide property rights. This contractual arrangement is present in most countries that adopted the Napoleonic civil code, among others, and its prevalence in developing countries such as Bolivia or India has not been studied by the main stream economics literature.

The antichresis contract entails a temporal transfer of a property's right of use from a landlord to a tenant in exchange of a large lump-sum payment due at the time the contract is signed. After the contractual period expires, the landlord returns the same lump-sum payment to the tenant and this one returns the property. There are no monthly payments during the contractual period, and the lump-sum returned does not include interest or inflation adjustments.

The model presented in the dissertation explains why the antichresis contract dominates the monthly rent contract in terms of landlord profits for certain types of property in which the gains in expected profits from solving the adverse selection of tenants problem offset the loss of expected profits created by the moral hazard in landlords' investments inherent in division of property right contracts.

The empirical section of the dissertation provides evidence in support of the model. Using data from Bolivia, I find that property types that require less landlord

maintenance investment have higher capitalization rates under antichresis contracts than they would under monthly rent contracts and vice-versa. The theoretical model shows that the antichresis contract has limited capacity for helping the poor as suggested by recent literature. On the contrary, it can be hurtful for the poor in markets were landlords have limited information about tenants' probability of illiquidity or in markets with inefficient court systems or tenant -friendly regulations.

The second part of the dissertation explores the issue of squatter settlements in the developing world. The theoretical model presented in this dissertation explains how the landlord-squatter strategies based on credible threats drive capital investment incentives and ultimately shape urban land development in areas with pervasive squatting. The model predicts that squatter settlements develop with higher structural densities than formal sector development. This prediction explains why property owners of housing that originated in squatter settlements take longer periods of time to upgrade than comparable property owners who built in the formal sector even after they receive titles to their property. The higher original structural density increases the marginal benefit of waiting in the redeveloping decision creating a legacy effect of high density-low quality housing in these types of settlements.

Geo-coded data from Cochabamba confirm that settlements originated in the informal sector present higher structural density than comparable settlements that originated in the formal sector. Furthermore, former informal settlements tend to present lower housing quality than comparable housing that originated in the formal housing sector.

CHAPTER 1

INTRODUCTION

In recent years, the developing world has witnessed an unprecedented acceleration in urbanization rates. This rapid urbanization poses enormous challenges for local and national governments struggling to provide adequate living conditions. In 1990, 653 million people lived in slums in middle and low-income countries; by 2000, that number increased to 857 million (United Nations, 2006). Slum formation in developing countries is mainly a problem of lack of access to affordable and decent housing in the formal housing sector. With no opportunities in the formal housing sector, the poor resort to informal developments in the form of squatter settlements or illegal land sales. This phenomenon poses two fundamental questions with important policy implications: (1) what type of urban development can we expect in the future if urban growth is dictated by informal development? And (2) what are the consequences of this type of development for future neighborhood upgrading and overall poverty alleviation strategies?

As poverty becomes an increasingly urban phenomenon, poverty alleviation policies must deal with the growth of slums. In the past years, however, housing policies in developing countries have dealt almost exclusively with slum upgrading through land title granting programs and ignored the process of new slum formation (Ferguson and Navarrete, 2003). This approach offers few results in terms of urban poverty reduction. Moreover, the failure of these policies has recently sparked a movement that questions

the widely accepted link between property rights and economic development (The Economist, 2006a, 2006b).

With slums growing at current rates it is of utmost importance to study the processes of slum formation. In this sense, an understanding of the mechanisms by which property rights affect urban development is crucial for the design of effective policies that can help the poor access decent housing. But access to housing is not synonymous with access to home ownership. As in most of the industrialized countries, developing countries have dynamic rental housing markets that have been long ignored by governments and international organizations in the formulation of housing policies for the poor (Kumar, 2001). The study of rental markets and innovative tenure modalities that help the poor get access to decent housing is also crucial for the development of comprehensive housing policies.

This dissertation addresses topics of slum formation and rental markets that have been overlooked in the design of low income housing policies in developing countries. The dissertation is divided into two sections. The first looks at how the division of property rights raises inefficiencies that give rise to innovative contractual mechanisms in rental markets where contract enforcement tools are weak and information is scarce. Specifically, the first section studies the "Antichresis" contract, focusing on how this contract functions as a mechanism to access housing in coexistence with the more familiar periodic rent contract in a rental market. The Antichresis, or Anticrético as it is known Bolivia, is a mechanism through which property owners make a legal contract to give the property's rights of use to tenants in exchange for a fixed amount of money payable at the signature of the contract. The Antichresis gives the tenant the right to use

the property in the way specified in the contract for a limited term that usually comprises one required year and one optional year agreed by both parties. At the end of the specified Antichresis period the owner gives back the lump sum of money specified at the beginning of the contract and the tenant returns the property.

Recent literature describing the Antichresis portrays this contractual arrangement as an innovative Bolivian institution that facilitates access to housing by the poor (Payne, 2002, 2002b). The contract, however, did not originate in Bolivian civil law. The Antichresis contract was already in use in early Babylonian law long before being adopted by the Greeks and the Romans. The Antichresis contract was also present in the Napoleonic civil code, which is believed to have had considerable influence on the development of most Latin American civil law. Today, the Antichresis contract is still in use in Bolivia, Korea, and India, among other countries. In some Bolivian cities, about 20% of the non-owner occupied housing is under this modality. Scholarly literature concerning the Antichresis contract is limited to a few descriptive works in the legal literature. The topic has been largely ignored in the mainstream economics literature.

Understanding the economic mechanisms behind the Antichresis contract can help explain the institutional factors that determine the use of such contractual agreements as opposed to other arrangements such as the periodic rent lease. This dissertation provides a theoretical model of the Antichresis contract that explains the economic forces giving rise to this type of property agreement. The model also sheds light on the effect "tenant-friendly policies" may have on landlords' choice of contractual arrangement and how these choices affect housing options for the poorest residents in a rental housing market.

The second section addresses how urban development takes place in the informal sector of a city (squatter settlements and illegal subdivisions). It presents a theoretical model of the process of squatter settlement formation based on the interaction of squatter and landowner credible strategies. The literature is somewhat limited on this topic: Jimenez (1984,1985), and Jimenez and Hoy (1991) constitute some of the early attempts to offer theoretical grounding for urban development under squatting, but offer no empirical support for their hypotheses. Existing empirical work is limited to estimating the "value of a title" using hedonic models based on household surveys. The dissertation begins to fill this gap in the empirical literature. It uses census data from a mid-size Bolivian city to observe the effects of urban squatting and illegal subdivisions on land development by observing an entire city. The nature of the data permits us to observe how informal settlements developed years after they were "legalized" and compare them to new informal settlements as well as formal settlements. Furthermore, the data let us observe if how the settlement's origin (formal or informal) influences the future upgrading after legalization.

The dissertation is organized as follows. Chapter 2 gives a general overview of the history of the Antichresis contract and a general description of the juridical figure as it is used today around the world. Chapter 3 proposes a formal model of the Antichresis contract, looking at landlord and tenant incentives in a two-period context to explain how the Antichresis agreement can coexist with the periodic rent lease in the same markets. The model shows how these two contractual agreements solve different information problems inherent in contractual agreements that involve the division of property rights. Chapter 4 is concerned with how institutional factors commonly believed to affect

Antichresis, such as: inflation, interest rates, taxes, and civil court inefficiency are related to the use of Antichresis. Chapter 5 offers an empirical test of the theoretical model proposed in chapter 3, using market data from Cochabamba. Chapter 6 deals with property rights and their impact on urban development. It starts with a review of the literature that examines squatter settlement formation and how the behavior of squatters affects urban land markets and urban structure. This chapter also lays out a formal model of squatter behavior, introducing a spatial component into Turnbull's (2008) model of squatting and eviction. Chapter 7 deals with upgrading decisions once informal settlers are given formal titles to their property. Chapter 7 draws from widely accepted model of urban economics to explain redevelopment decisions in the context of squatter settlements. The model explains why former squatters tend to hold redevelopment/upgrading decisions for longer periods of time than their counterparts in the formal sector even after they are given titles for their property. Chapter 8 empirically tests the hypotheses proposed in chapters 6 and 7. First, the chapter describes the case of Cochabamba, Bolivia, drawing on the history of both formal and informal settlements in the city as well as census data from 1976, 1992 and 2001. Second, the chapter presents formal hypotheses tests using various econometric specifications that help us examine the differences between formal and informal settlements on key urban development variables such as land prices and structural density.

Chapter 9 integrates how the findings in previous chapters relate to policies that affect housing for the poor. Specifically, it evaluates current policy towards squatter settlements in developing countries in light of our findings. The chapter also provides an assessment of current claims that describe the Antichresis contractual arrangement as a

tool for housing the poor. Finally, chapter 9 offers some concluding thoughts on the importance of research that advances the knowledge of the mechanisms through which property rights affect housing markets and economic development in general.

CHAPTER 2

THE ANTICHRESIS CONTRACT

The word "Antichresis" comes from a combination of the Greek words "Anti" (against) and "Chresis" (use) [1] denoting the action of giving a credit "against" the "use" of a property. The Antichresis is a mechanism through which a property owner gives the rights of use of her property to a tenant in exchange for a fixed amount of money payable at the signature of the contract[2]. The Antichresis agreement gives the tenant the right to use the property in the way specified in the contract for a limited term, typically one required year with the option of an additional year if both parties agree. At the end of the specified period the owner gives back the lump sum of money specified at the beginning of the contract and the tenant returns the property.

Although this legal contract received its current denomination in Greek law, the practice of Antichresis was common in cultures that preceded the golden age of[3] (Silva, 1996). Clay tablets discovered in the ancient city of Nuzi, dated as far as the 15th century (BC), prove that the Antichresis contract was used by the Sumerian and Akkadian Mesopotamian cultures[4]. According to Purves (1945), Nuzi tablets entitled "ṭuppi

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[1] Some authors claim that Chresis stands for "credit" (Farfan, 2002; Payne, 2002b) but this is a faulty translation. Chresis or Chrisi (in modern Greek) means "use"

[2] Property rights are usually defined as the rights to "use," "exclude," and "dispose" a property. In this sense the Antichresis contract gives the tenant the rights to use and exclude for a specified period of time. The rights to dispose stay with the property's original owner. In this sense the Antichresis system is equivalent to the "conveyance" agreement in common law.

[3] I refer to Athens' golden age as the period between 450-530 (BC)

[4] The city of Nuzi is now buried under the northern Iraqi city of Kirkuk, approximately 250 miles north of Baghdad.

titenûtu" describe contracts with the same characteristics of what we know today as the antichretic pledge. In such tablets, "The creditor has usufruct rights over real and chattel pledges. This usufruct right enables the creditor to obtain interest and also provides him with a means of forcing the borrower to repay his debt…the titenûtu transfers possession, but not title" (p.79). Table 2.1 shows a direct translation of an Antichresis agreement found written on a clay tablet in the ancient city of Nuzi.

Table 2.1: Antichresis Agreement Tablet City of Nuzi, 1500 BC

Lines in tablet	Text
1	*Antichresis tablet.*
2-4	*Uqari, his father, has given Taena son of Uqari in Antichresis to Tulpun-naya for six years.*
5-6	*Tulpun-naya has given one homer of barley to Uqari.*
6-10	*When six years have elapsed, Uqari shall repay Tulpun-naya the one homer of barley and take his son.*
10-14	*If Taena absents himself from work for Tulpun-naya for one day, Uqari shall pay Tulpun-naya one mina of copper per day as compensation.*
15-16	*Tulpun-naya shall give barley and clothing rations.*
17-30	*14 witnesses*

Source: Maidman (1979)

Babylonian law, which is considered by many as a main precursor of western law, adopted the Antichresis contract and modified it to their needs by combining it with the mortgage pledge. As Lobingier (1929) explains, in Babylonian law a mortgage pledge could become an antichretic pledge if the loan was not promptly paid.

Little is known about how and to what extent the Greek culture used the Antichresis contract except that it entered Greek Law in the time of Demosthenes[5]

[5] 384 BCE - 322 BCE

(Cohen, 1950). The Antichresis pledge was later introduced into Roman law toward the end of the classical period[6] (Tulane Law Review, 1938). Roman law did not adopt the Antichresis pledge as an autonomous institution. According to Silva (1996) it was considered a modality under the "pignus" and had the particularity that the usufruct obtained from the pledge under Antichresis had to be exactly compensated by the interest on the loan[7].

During the Middle Ages the Antichresis was repudiated under Canon law and it was specifically forbidden by Pope Alexander III in 1163. These were times when receiving interest on loans was condemned, and the Antichresis contract was considered an institution that disguised the practice of usury (Cohen, 1950). Silva (1996) attributes the emergence of contracts that served the same purpose of the Antichresis contract in this period to the ban. One of such contracts was that of the sale with an agreement to resell at the same price.

In modern law, the Antichresis contract reappears in the Napoleonic code to legislate the practice of "droit coutumier" that was popular in southern France at the time the code was being drafted in the early 1800s (Silva, 1996). Spain, Italy, and most of Latin America later adopted most of its contents including the Antichresis contract. In the United States, the Antichresis contract is only used in the State of Louisiana, which

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[6] 500 AD

[7] Civil codes today accept that the usufruct obtained from the antichretic pledge maybe lower than the interest on the loan. In those cases the borrower can also take part of the antichretic loan amount as a part of his payment.

maintains the same features today as it did in the French code and the Louisiana Code of 1808 (Slovenko, 1958)[8].

Today, the Antichresis juridical figure is present in nearly all Latin American and European civil codes but its existence is not limited to these regions. Ambrose and Kim (2003), for example, offer a detailed description of how the Antichresis mechanism is widely used in Korea, and Kumar (2001) accounts for its increasing popularity in India. Even though the spirit of the contractual arrangement remains constant across countries since pre-Babylonian times, some minor differences exist between some of the juridical details governing the.

Table 2.2 shows some of the differences in civil legislation concerning the Antichresis contract across selected countries. Civil law in all these countries recognizes that tenants' payments for the property can be equated to interest on the Antichresis lump sum (and to the principal in selected cases). In all the countries surveyed in table 2.2, tenants are required to pay expenses and taxes on the property during the contractual period. Similarly, in all of these countries, tenants under Antichresis contracts can ask for seizing and sale of the property if the landlord refuses to pay back the Antichresis lump sum at the end of the contractual period. If the property is foreclosed due to landlord's illiquidity at the end of the contractual period, the tenant receives priority over other creditors in most countries (though not in Louisiana)

The use of Antichresis since biblical times raises the question of how or why this contractual arrangement can coexist with the more familiar lease or rental contract.

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[8] Even though the Antichresis contract remains in the Louisiana Civil Code to this day, its use is limited (Tulane Law Review, 1959).

Recently some authors have described its use in Bolivia as an innovative institution that can facilitate access to hosing for the poor in markets that also use common lease contracts (Farfan, 2002; Payne, 2002). However, this or other mainstream literature, present answers to the basic question of what are the economic incentives that would make agents in the marketplace prefer Antichresis as opposed to other contractual agreements. This understanding is crucial to assess the mechanisms through which the use of Antichresis can benefit (or hurt) the poor and how different policies may affect its use and benefits, if there are indeed any benefits for society from using this contractual arrangement. The next chapter explores this question and introduces a theoretical model that explains the use of Antichresis and its coexistence with the monthly rent contract.

Table 2.2:
Institutional Differences in the Antichresis (Civil) Law across Countries

Country	Reference in Civil Code	Fruits of property	Needs to be a public contract	Who pays taxes and expenses?	Tenant rights in case of non-payment	Tenant has first right when property is foreclosed	Tenant can sublease
Spain	Chapter IV Arts.1881-1886	Applied to interest and capital but can convene to equate interest to fruits	No	Tenant, but deducts from property fruits	Can ask for seize and sale of property	Not stated	Not stated
France	Chapter II Arts. 2085-2091	Parts can equate fruits to interests. If not convened tenant has to report fruits to landlord. If interest on loan is not stipulated fruits are taken from capital.	Yes registered in public document	Tenant, if not otherwise stipulated in contract, but deducts from property fruits	Can ask for seize and sale of property	Yes (Tulane law rev 1939 pg 140)	Yes (Tulane law rev 1939 pg134)
Louisiana (USA)	Title XX Arts 3176-3181	Parts can equate fruits to interests. If not convened tenant has to report fruits to landlord.	No	Tenant, but deducts from property fruits	Can ask for seize and sale of property	No art 3181 Tulane Law rev 1939 pg 140	Yes
Argentina	Titulo 16 Arts. 3239-3261	Parts can equate fruits to interests. If not convened tenant has to report fruits to landlord. If interest on loan not stipulated fruits are taken from capital.	No	Tenant, but can deduct from fruits. But if he makes investments on property landlord must pay back the cost of capital, not the added value the property enjoys.	Can ask for seize and sale of property	Yes (Cabanelas)	Yes
Bolivia	Libro V, Arts 1429 - 1435	Fruits are applied first to interest then to principal	Yes registered in public document	Tenant pays taxes and all other utilities. But can deduct such expenses from fruits.	Can ask for seize and sale of property	Yes	No (Opinion of Dr Elba Medinacelli in private communication)

Source: Own elaboration based on countries' civil codes, Tulane Law Review, Medinacelli (2006) in private communication

CHAPTER 3

A MODEL OF THE ANTICHRESIS CONTRACT CHOICE

The Law and Economics literature usually refers to ownership of an asset as a bundle of three basic rights: (1) the right to use the asset, (2) the right to exclude others from using the asset, and (3) the right to dispose of the asset. Because the ability of owners to transfer some of the rights to others for periods of time can create economic gains from specialization (Micelli, 2004), legal systems usually allow these transfers. In the case of a lease or an Antichresis contract, the owner temporarily transfers the rights of use and exclusion of his property to the tenant but retains the right to dispose of the property. This action creates gains for society because it allows landlords to specialize in producing housing services and maintenance and tenants to specialize in other economic activities.

The division of ownership can create gains for society, but it also introduces two sources of incentives for inefficient behavior from both landlord and tenant (Epstein, 1986). First, the adverse selection problem that arises from a landlord's impediment of observing a tenant's of probability of illiquidity. Second, the moral hazard problem that arises from an asymmetry of maintenance incentives in the property after a contract has been signed. In this sense, institutions governing the division of ownership have the potential to serve an important role in society as long as potential inefficiencies are corrected by creating the right incentives in a world with positive transaction costs. This is where the legal framework comes into place. Economic agents will make decisions under a particular institutional framework and this framework may favor the use of some

contractual agreements as opposed to others. The model proposed in this section explains how agents choose between contracts based on the incentives these contracts produce when faced with the typical problems arising from temporal division of property arrangements. We begin by laying out the sequence of events and payoffs in a two period world.

Sequence of Events and Payoffs

Consider a two-period world in which risk neutral tenants and landlords choose between Antichresis and periodic rent contracts. At the beginning of the first period (t_0), tenant and landlord agree on the total amount of money M asked by the landlord in exchange for a temporal use of the property and the type of contract they will sign. If an Antichresis contract is signed, the tenant gives the landlord the Antichresis lump sum A, which is due at the time the contract is signed[9]. If a rental contract is signed, the rental payment R will be due at the end of the first period (t_2). Additionally, during the first period, tenant and landlord decide on the level of inputs x and y to be supplied, respectively. These inputs represent maintenance investments on the property, which may include preventive maintenance, repairs, and periodic cleaning, among other.

During the contractual period, the tenant enjoys housing services T, which are a function of the maintenance investments x and y, and a parameter λ ($\lambda \geq 0$) that captures the marginal effect of landlord maintenance investments on tenants' enjoyment of the

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[9] The Antichresis lump sum A is given by tenants to landlords who will use this sum and obtain a rate of return r that is assumed to be known with certainty for the entire contractual period. At the end of the contractual period landlords must return the lump sum A in order to receive the property back. Thus, for Antichresis contracts the equivalent rental payments will be given by $M=rA$

property. Thus, the tenant's enjoyment of the property is given by equation 1 with $f'>0$, $g'>0$ and $f''<0$, $g''<0$.

$$T(x, y, \lambda) = f(x) + \lambda g(y) \quad (1)$$

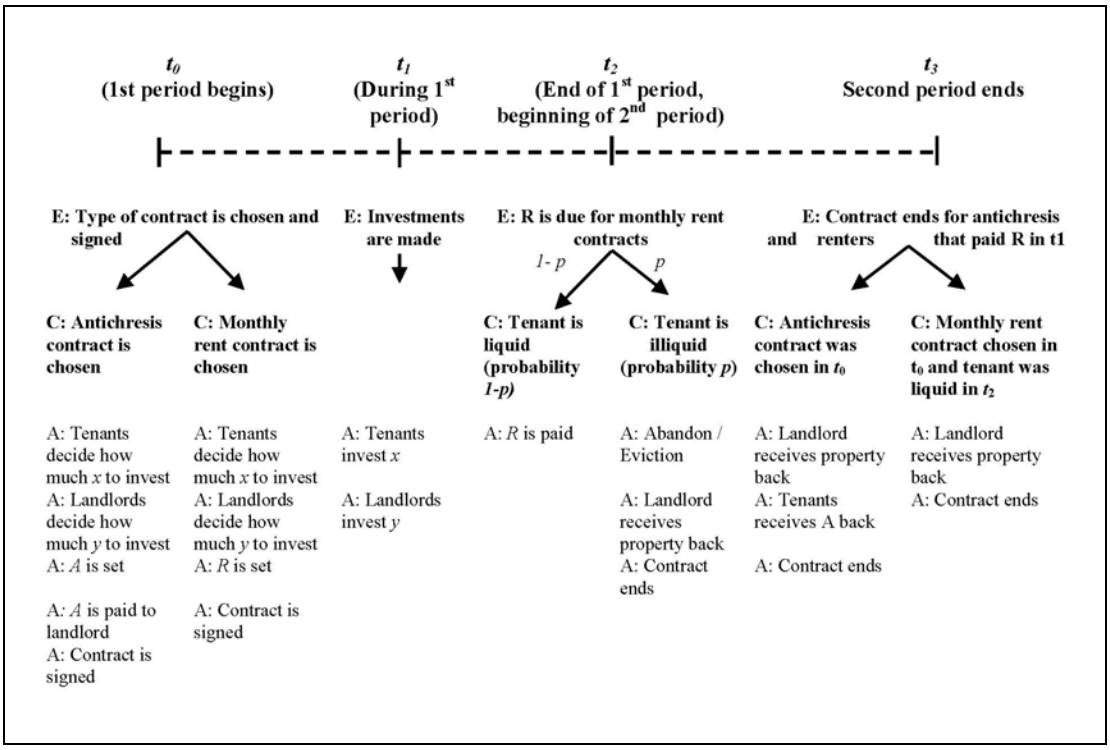
When the second period arrives, rent R is due for tenants who chose the rental contract. However, the tenant faces a probability p of being illiquid at this point of the contractual period. In such event, the tenant can no longer pay rent R so he is forced to abandon the property and move to an alternative place that yields housing services T_0. In case of abandonment, tenants lose any maintenance investment x they made in the property and landlords face the costs of re-renting the property C ($C>0$), which may include opportunity costs of forgone income and eviction procedures.

Finally, at the end of the second period (t_3), the contract term expires for Antichresis contracts and rental contracts with tenants that paid their rents R at t_2. At this point, landlords receive the property back. The property's reversion value L at this point is a function of the maintenance investments x and y made during the first period, and parameter δ ($\delta \geq 0$) that measures the marginal effect of tenant investment x on the property's residual value. Thus the property's reversion value is given by equation 2 where $h'>0$, $k'>0$, $h''<0$, $k''<0$.

$$L(x, y;\delta) = \delta h(x) + k(y) \quad (2)$$

Additionally, the end of the second period (t_3) is the time when tenants who signed an Antichresis contract receive the Antichresis amount A back as they relinquish the property. Figure 3.1 shows the sequence of events in a timeline along with the actions taken by each part given the different states of the world that can occur and the characteristics of the contract. Table 3.1, on the other hand, depicts the payoffs under

each contractual arrangement at the end of the second period when the contractual period ends.



E= Event, C=Condition, A=Action

Figure 3.1
Timeline of Events and Actions in the Contract Choice Decision

Table 3.1: Payoffs at the End of the Second Period

Contract Choice	Tenant is Liquid at t_2	Probability	Landlord payoffs	Tenant payoffs
Antichresis	-	-	$L(x,y)+rA-y$	$T(x,y)-rA-x$
Monthly rent	Yes	1-p	$L(x,y)+R-y$	$T(x,y)-R-x$
	No	p	$L(x,y)-y-C$	T_o-x

The Hidden Information Problem

In this section we describe how R and A are chosen under the rental and Antichresis contracts with a focus on the hidden information problem exclusively. For this reason, this section follows under the assumption that maintenance investment decisions do not change with the nature of the contract. In other words we assume that the optimal level of investment x by the tenant and y by the landlord are not functions of the type of contract chosen. In reality, this is not likely to be the case because of a moral hazard problem and its relation with the different investment incentives each contract produces. We explain how the moral hazard problem arises and expand the explanation of how the equilibrium values x and y change with the contract terms in the next section. For now we look at the values of R and A set by the contract for the same levels of x and y to illustrate how these contracts are affected by the adverse selection problem.

The payoffs depicted in table 3.1 show various important aspects of the different contractual arrangements. In monthly rent contracts, liquid tenants can either pay rent or

abandon the property, but paying dominates abandoning.[10] Using the payoffs in table 3.1 we can obtain the expected social values of Antichresis contracts (ESV_A) and rental contracts (ESV_R) by adding the expected payoffs for tenants and landlords under each contractual arrangement. These are given by equations 3 and 4 respectively:

$$ESV_R = L(x, y) + T(x, y) - p[T(x, y) - T_0] - x - y - pC \quad (3)$$

$$ESV_A = L(x, y) + T(x, y) - x - y \quad (4)$$

In equation 3, the probability that a tenant will have to abandon the property is costly to society. These costs involve tenants having to move to a unit that yields lower utility, not making use of the invested x, and having a vacant unit that results in landlord's costs of re-renting the property to a different tenant. Thus, for a positive p and C and equal levels of x and y under both contracts, $ESV_A > ESV_R$ and society will gain more from Antichresis contracts than from rental contracts.[11]

Now consider the difference between rA and R when the contract is being signed. The landlord requires the expected profit to be at least M to enter the contract, which assuming a competitive market (zero economic profits), is also the maximum she can charge. So, in a world where the parties can only choose between pure rent and pure Antichresis, tenants who chose pure rent will have to pay more than those who chose

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[10] To prove this note that the tenant will only sign a contract if the benefit from it ($T(x,y)$-To) is higher than the costs (R+x). Thus, the participation constraint for the tenant is given by $T(x,y)$-To-x >R. Paying dominates abandoning if $T(x,y) - To > R$ so, by the participation constraint, if liquid, the tenant will always pay instead of abandoning.

[11] For this to be true tenants benefit from occupying the property needs to be larger than landlord's costs C of taking possession of and re-renting the property in case of tenant illiquidity: ($T(x,y)$-To)>C. If this was not the case, there would be no threat of eviction and tenants would never pay R. Thus, this condition needs to hold for landlords to sign contracts.

Antichresis[12]. This means that, holding x and y constant, tenants who choose the Antichresis contract are better off than those who choose rent. But the Antichresis contract is only available to tenants who can pay the lump sum A at the beginning of the contractual period. Therefore, other things being equal, we expect to observe tenant sorting by liquidity in the market. Less liquid tenants will sort into the rental market while the more liquid tenants will sort into the Antichresis market.

Ceteris paribus, tenant sorting according to liquidity will also affect the types of property we observe under these tenancy contracts. Higher quality property will tend to be under Antichresis because more liquid tenants (i.e. higher income) will sort into this contractual arrangement as opposed to rent. This empirical question will be addressed in chapter 5. But first we look at the problem of moral hazard related to investment decisions arising in these types of contractual arrangements.

Maintenance Investment Decisions

> *- Hi, is this the pet shop? Can I buy 20 rats, and 10,000 cockroaches? Oh! and add some spiders to that order please…*
> *- Sure, but may I ask why would you want that?*
> *- Well… it's because my lease contract is over, and my landlord wants the apartment returned "just as he gave it to me"*
>
> Popular Ecuadorian joke (translation from Spanish by the author)

Now we turn to landlords' and tenants' maintenance or improvements investment decisions. This section follows under the assumption that there is no hidden information problem in the rental contract and tenants do not face an illiquidity problem during the contractual period (p=0). The next section relaxes this assumption, but for now, we

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[12] In a world with no illiquid tenants (p=0) renters would have to pay R_1 such that $R_1=rA=M$. However, for $p>0$, pure renters pay $R_2= (R_1+pC)/(1-p)=M$. Thus, $R_2> R_1$, and $R_2> rA$.

concentrate exclusively on the hidden action problem that arises in contracts that involve a temporal division of property rights ignoring the liquidity problem described in the previous section.

To explain how the problem of moral hazard arises in the temporal division of property rights it is important to note that the socially efficient levels of investment on maintenance x and y are those that maximize the asset's net social value V given by

$$V(x, y) = L(x, y) + T(x, y) - x - y \quad (5)$$

This condition is independent of the type of contract chosen by the parties[13]. Thus, the socially optimal levels $x°$ and $y°$ solve the first order conditions:

$$V_x = 1;\ \delta h'(x) + f'(x) = 1 \quad (6)$$

$$V_y = 1;\ k'(y) + \lambda g'(y) = 1 \quad (7)$$

Notice that in the absence of any legal restraints, both tenant and landlord will invest less than the social optimum x and y because they do not maximize the social value function. Tenants will invest in x up to the point where they can maximize their net housing services enjoyment function without taking the property's reversion value (L) into consideration. Thus, in the absence of any legal mechanisms, a tenant's optimal investment $\tilde{x}$ will maximize the net housing services enjoyment function $T(x, y) - x$ rather than the asset's net social value (5). Similarly, landlords will only invest in y up to the point where they can maximize the net property's reversion value by choosing level $\tilde{y}$

[13] Remember that this statement assumes no probability of illiquidity (p=0). In the case of potential illiquidity, the net social value of the asset in a rental contract will be given by $V(x,y)=L(x,y)+(1-p)T(x,y)-x-y-pC$. This yields lower optimal values of x and y than an Antichresis contract. The intuition behind this result is that, given the chance that tenants may not be able to enjoy the property for the entire contractual period due to illiquidity, they adjust the investment levels to account for this possibility. On the other hand, tenants under an Antichresis contract can enjoy their investments with certainty that there will be no eviction. This certainty leads them to invest higher levels of x and y than in the case of a rental contract..

that optimizes the net reversion value of the property $L(x, y) - y$ instead of the asset's net social value (5).

Under this formulation, the inefficiency arising from the moral hazard problem is a function of δ and λ. Consider a property where landlord's investments have no effect on tenants enjoyment of the property ($\lambda = 0$) so that $T_y=0$. In such case, the marginal effect of an extra unit of landlord's investment y on the asset's social value V is equal to the marginal effect of an extra unit of y on the property's reversion value L. That is, $V_y=L_y$ so the landlords optimal level of investment $\tilde{y}$ that satisfies $L_y=1$ is the social optimal level of investment ($y°=\tilde{y}$). However, when landlord investment affects tenant enjoyment of the property ($\lambda>0$) so that $T_y>0$, then the value of landlord investment $y°$ that satisfies $T_y+ L_y=1$ is greater than investment level $\tilde{y}$ that satisfies $L_y=1$[14]. The same logic applies to tenant investment x. When this investment has an impact on the property's reversion value (i.e. $\delta>0$), in the absence of legal restrains, tenants will invest a socially inefficient amount $\tilde{x}$ (where $\tilde{x} < x°$). However, for property with $\delta=0$, $\tilde{x}$ becomes the socially efficient tenant investment level ($\tilde{x} = x°$).

The rental contract gives the tenant the power to withhold rental payments if the landlord fails to maintain the property. In this sense, the contract gives the tenant a credible enforcement mechanism for the landlord to invest in y in higher levels than she would in the absence of such mechanism. On the other hand, if the tenant does not invest in maintenance x that would affect the residual value of the property the landlord could

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[14] This comes from the fact that functions L and T are concave in y and therefore the sum of them V is also concave in y. Since V lies above T when $L\neq0$ (i.e. $\lambda>0$), then $V_y > L_y$ at any given $y_o>0$. *So if* $y°$ satisfies $Vy=1$ and $\tilde{y}$ satisfies $L_y=1$,then it has to be the case that $y°>\tilde{y}$ wherever $T_y>0$

sue the tenant for waste[15]. But the enforcement mechanism, in this case reduced to the law of waste, will be credible only to the extent of the costs of taking the tenant to court are sufficiently low. In other words, if the tenant knows how expensive it is for the landlord to take him to court, the threat of a lawsuit will only be credible if the landlord's losses in residual value of the asset are greater than the costs of suing the tenant. In this sense, the law of waste need not guarantee efficient tenant investment in maintenance.

The Antichresis contract introduces different enforcement mechanisms. The lump sum payment at the beginning of the contract serves as an enforcement mechanism for the tenant to invest in maintenance x that will affect the asset's residual value[16]. Failure to maintain the property could result in the landlord discounting the maintenance costs from the Antichresis lump sum. On the other hand, the Antichresis payment at the outset means that the tenant loses a mechanism to entice landlord maintenance investment while the tenant occupies the property. The tenant could sue the landlord under minimum habitability provisions but then she would face court costs that are likely to be quite high. The landlord knows the court cost so threats of a lawsuit by the tenant may not be credible. For this reason, under an Antichresis contract, equilibrium landlord investments for tenant enjoyment of the property y will generally be lower than the efficient level.

In conclusion, the division of property rights creates problems of moral hazard with investment decisions. The Antichresis contract solves the problem of moral hazard with tenant maintenance investments but it does not solve the problem of moral hazard related to landlord maintenance investments. On the other hand, pure monthly rent

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[15] Equivalently, both parties can use security bonding (i.e. security deposits) at the contract outset
[16] At the least it ensures that the tenant is not judgment-proof in the event of litigation.

contracts solve the problem of moral hazard in landlord investments but do not solve the problem of moral hazard in tenant maintenance investments. Each contract solves a different moral hazard problem; as a result, the investment incentives exposed above suggest that we should expect some type of self-selection by type of contract depending on property characteristics. Other things being equal, property where tenant's input has a large effect on the residual value of the property (property with high δ) will tend to be under Antichresis, and property where the landlord's input is important for the tenants' enjoyment of the property (property with high λ) will tend to be under monthly rent. A high λ corresponds to properties in which there are activities that the tenant cannot do himself like fixing elevators or maintaining common yards or pools in an apartment building that enhance the tenant's enjoyment or use of the property. Thus, the model would predict that, ceteris paribus, property such as office and apartment buildings or rooms in a condominium would tend to be under monthly rent. In the case of other types of property like detached houses, for example, most investments that affect the tenant's value of the property may not come from landlords' investments in maintaining common areas or facilities. These properties have low λ. Thus, for these properties, the rental contract will tend to be less attractive than Antichresis.

On the landlords' side, there are properties that require more tenant input than others to maintain residual value after the contractual period has expired (i.e. correspond to a high δ). For these properties, the Antichresis contract might be more attractive than monthly rent. However, most rental contracts today include a mechanism to insure that tenants invest efficient levels of x. This mechanism consists of a security deposit payable

at the beginning of the contractual period. Thus, other things being equal, in rental contracts where a security deposit that ensures an efficient tenant investment x

Equilibrium *R* and *A* with Endogenous *x* and *y*

So far the discussion of the equilibrium R and A that result from a choice of contract assumed fixed levels of maintenance investment x and y. This assumption is not realistic simply because, as explained in the previous section, both landlord and tenant will invest in x and y responding to the incentives created within the contract. In this section we begin by describing the equilibrium R, A, x, and y in the two contract modalities separately and then we compare them in terms of efficiency.

The Monthly Rent Contract

Before choosing a contract, landlord and tenant weight their options based on their expected profits under each arrangement. Using the payoffs in figure 3.1 we obtain the expected profit for a tenant under a pure monthly rent contract:

$$\pi_{t,R} = (1\text{-}p)[T(x, y) - R] + pT_0 - x \qquad (8)$$

Under the standard assumption that there is a perfectly elastic supply of potential tenants allows us to derive the maximum rent a tenant is willing to pay in equilibrium[17]

$$R = \{T(x, y) - p[T(x, y) - T_0] - x\} / (1\text{-}p) \qquad (9)$$

The landlord's expected profit from a pure monthly rent contract is the sum of the net residual value plus the expected rental income.

$$\pi_{l,R} = L(x, y) - y + (1\text{-}p)R - pC \qquad (10)$$

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[17] This gives the familiar bid price equilibrium condition. The assumption follows Eswaran and Kotwol (1985) and Micelli, et al (2001). With a perfectly elastic supply of potential tenants, in equilibrium, landlords are able to extract tenant profits to the reservation utility level profit (in this case assumed to be zero).

Substituting the equilibrium rent (9) into (10) we obtain the landlord's expected profit under a pure monthly rent contract.

$$\pi_{l,R} = L(x, y) + T(x, y) - p[T(x, y) - T_0] - x - y - pC \quad (11)$$

Expression (10) shows that a landlord receives the expected social value of the contract (given also in equation (3)); this follows from the assumption of perfectly elastic supply of potential tenants. Thus, the landlord's return serves us to evaluate the welfare properties of each contract.

Now consider the efficiency of the pure monthly rent contract in terms of investments x and y. The efficient levels of maintenance investment in a rental contract are those that maximize the expected social value of the contract given by (10) and yield optimal amounts of investment $\hat{x}$ and $\hat{y}$. For simplicity assume that tenants pay the optimal amount of $\hat{x}$ upfront in the form of a security deposit S so that the amount of tenant investment is equal and efficient in both contractual arrangements (i.e. $\hat{x}$ that maximizes (3) is paid upfront in both contracts). Recall that at the moment the contract is signed the landlord sets the rent R that brings the tenant to his reservation utility. At this point the landlord can commit to pay the optimal level of $\hat{y}$ which would yield a rent that maximizes the social value and therefore the landlord's return. However, the relevant question at this point is whether this is incentive compatible. After the contract is signed the landlord maximizes (10) taking R as given. This results in the landlord investing y^* where $y^* \leq \hat{y}$ as $\lambda \geq 0$. The tenant knows this at the onset so he will never agree to pay unless $\lambda=0$. As a result, in the absence of any mechanism that can bring the landlord to

credibly commit to invest $\hat{y}$ for $\lambda \geq 0$, she will only invest y^*, making the arrangement inefficient[18]. However, as explained in the previous section, in a pure monthly rent contract, the tenant is allowed to withhold rental payments if the landlord is not honoring the contractual agreement. As a result, the tenant has an enforcement mechanism that allows the landlord to credibly commit to invest $\hat{y}$ maximizing the social value of the rental contract.

The Antichresis Contract

In an Antichresis contract, the lump sum payment A is made upfront when the contract is signed. This removes any probability of illiquidity on the tenant's side during the contractual period. Thus the tenant's expected profit under an Antichresis contract is given by:

$$\pi_{t,A} = T(x, y) - rA - x \tag{12}$$

Assuming a perfectly elastic supply of potential tenants, the maximum amount rA tenants will be willing to pay under an Antichresis contract is.

$$rA = T(x, y) - x \tag{13}$$

The landlord's expected profit from a pure Antichresis contract is the sum of the net residual value plus the Antichresis lump sum's income.

$$\pi_{l,A} = L(x, y) - \mathrm{y} + rA \tag{14}$$

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[18] When the landlord maximizes 10 taking R as given, the optimal level of investment (y^*) satisfies the first order condition: $L_y - 1 = 0$. However, if the tenant can force the landlord to credibly commit to invest higher levels of y with a threat of withholding rent, the landlord will be forced to maximize 11 which would yield an optimal investment $\hat{y}$ that satisfies the first order condition $L_y + (1-p)T_y - 1 = 0$, Thus, $\hat{y} > y^*$ for $p<1$ and $\lambda \geq 0$

Substituting the equilibrium rent (13) into (14) we obtain the landlord's return under an Antichresis agreement, this is equal to the social value of the contract.

$$\pi_{l,A} = L(x, y) + T(x, y) - x - y \qquad (15)$$

As with the rental contract above, assume that tenants pay S upfront in the form of a security deposit, which is deducted from rA in the form of a lower A at the time the contract is signed[19]. In the Antichresis contract the landlord can promise to invest the optimal amount $\tilde{y}$ at the time the contract is signed[20]. As with the rental contract, however, once the contract is signed and the Antichresis lump sum is received, the landlord maximizes (14) as opposed to (15) taking rA as given and invests y^*. In the monthly rent contract the tenant could bring the landlord to honor the promise of investing $\hat{y}$ by threatening to withhold rent. In the case of Antichresis the tenant loses that capacity and can not entice the landlord to invest the efficient level $\tilde{y}$. In Antichresis the landlord cannot credibly commit to invest any more than y^*, making the contract inefficient when $y^* \leq \tilde{y}$ as $\lambda \geq 0$.

Comparing Antichresis and Periodic Rent Contracts

This section compares the Antichresis and monthly rent contracts in terms of landlord profits for different property types. The previous section established that in the absence of a landlord maintenance investment a moral hazard problem (i.e. property with

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[19] In the Antichresis contract this assumption is irrelevant because the landlord can always make the tenant to credibly commit to invest x^* since he holds a large lump sum A that serves as a security deposit.

[20] Note that the optimal social amounts of investments in an Antichresis contract come from maximizing 15 with respect to x and y. This yields optimal social amounts $\tilde{x}$ and $\tilde{y}$. On the other hand the optimal social investments for a rental contract are obtained from maximizing 11 with respect to x and y. This yields optimal social values $\hat{x}$ and$\hat{y}$. where $\tilde{y} > \hat{y}$ and $\tilde{x} > \hat{x}$ As explained in a previous footnote, this is due to the probability of the tenant being forced to abandon the property and not being able to enjoy investments x and y.

λ=0), the Antichresis contract yields higher expected profits than the monthly rent contract. This result is depicted in Figure 3.2, which shows the maximum landlord profit under each contractual arrangement as a function of λ. When λ=0 the Antichresis contract yields higher profits due to the inherent risk of tenant illiquidity in monthly rent contracts. As the level of λ increases for a property, profits under both contractual arrangements increase[21]. Looking at the relative slopes, however, as tenant's enjoyment of the property increase with landlord's investment, profits under the monthly rent contact increase at a faster rate than profits under an Antichresis agreement. This result implies that, there will be a λ_o>0 such that $\pi_{l,R} = \pi_{l,A}$. Therefore, for properties where $\lambda < \lambda_o$ the Antichresis will dominate the rental contract and the opposite will take place for properties where $\lambda > \lambda_o$.

The rental contract dominates the Antichresis contract in terms of maintenance investment efficiency because it does a better job at fixing the moral hazard problem. But the monthly rent contract does not solve the adverse selection problem as effectively as the Antichresis contract. The probability of tenants' illiquidity in a monthly rent contract makes the expected landlord return lower than the Antichresis contract for some types of property where the marginal effect of tenant's investment on tenants enjoyment of the property is low (low λ). The shaded region in figure 3.5.1 shows the region where the

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[21] This result can be obtained by differentiating the maximized landlord profit functions under each contractual arrangement with respect to λ and applying the envelope theorem. For the monthly rent contract differentiating (11) with respect to λ and applying the envelope theorem yields $\frac{d\pi^*_{l,A}}{d\lambda} = (1-p)g(\hat{y})$, which is positive for p<1. Similarly, differentiating the maximized landlord profit function under Antichresis (15) with respect to λ and applying the envelope theorem we obtain a positive slope of $\frac{d\pi^*_{l,R}}{d\lambda} = g(\tilde{y})$

Antichresis contract dominates the monthly rent contract. This region corresponds to properties with low λ and tenants with positive probability of illiquidity ($0<p<1$). For properties that exceed some threshold value λ_o the expected profits under a monthly rent contract exceed the profits under an Antichresis contract. In this region the monthly rent contract dominates the Antichresis contract because the landlord can credibly commit to invest higher levels of *y* and obtain higher profits. An important aspect to note in figure 3.5.1 is that higher probabilities of tenant's illiquidity *p* or higher costs of eviction/re-renting the property *C* shift the landlords' equilibrium expected profits curve downward[22]. This downward shift increases the shaded area in figure 3.5.1 and moves the threshold value λo to the right making the Antichresis contract more attractive than the monthly rent contract over a wider range of property types.

[22] Differentiating the landlords' equilibrium profit function under a monthly contract with respect to p using the envelope theorem can also show this. In the case of higher eviction costs the effect is more evident. Increasing C shifts the intercept downward increasing the shaded area and therefore increasing the range of property types where Antichresis dominates the rental contract.

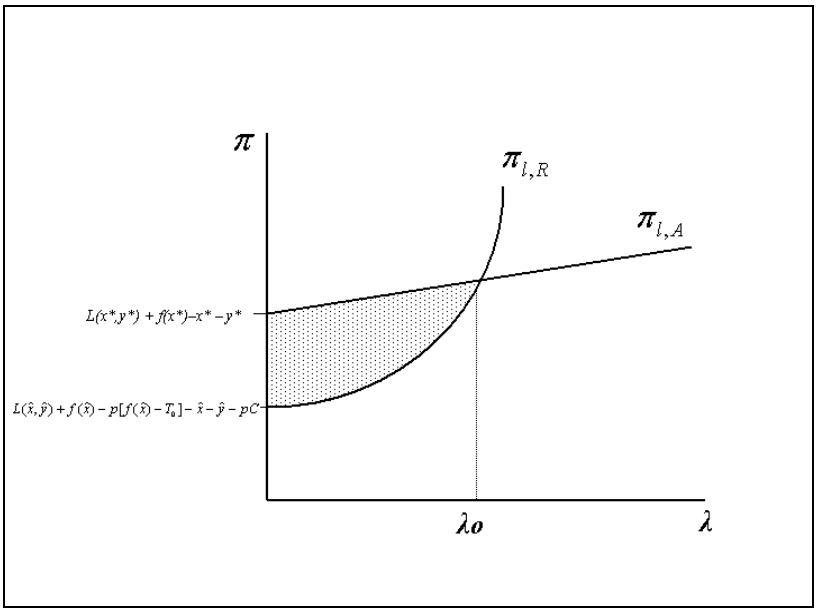

Figure 3.2:
Landlord Profits under Antichresis and Monthly Rent Contracts as a Function of λ

Proof

Differentiating the maximum profit function slope with respect to λ for an Antichresis contract we obtain:

$$\frac{d\left(\frac{d(\pi^*_{l,A})}{d\lambda}\right)}{d\lambda} = g'(y^*)\frac{\partial y^*}{\partial \lambda} = 0$$

Recall that, by assumption, $g'(y^*)>0$. Therefore, this result comes strictly from the moral hazard problem which determines that the landlord can only commit to pay y^* regardless of the property characteristics or level of λ. Once the contract is signed, the landlord takes rA as a given. Thus, comparative static analysis on (14) yields $\frac{\partial y^*}{\partial \lambda} = 0$ because once the contract is signed the optimal condition for the landlord does not include tenants utility. As a result, for properties with high or low λ, the landlord can only credibly

commit to pay y^* in the absence of an enforcement mechanism. The tenant knows this at the onset so she will never agree to pay a higher rA (i.e. higher profits for the landlord). On the other hand differentiating the profit function's slope with respect to λ for a monthly contract (11) we obtain:

$$\frac{d\left(\frac{d(\pi^*_{l,R})}{d\lambda}\right)}{d\lambda} = (1-p)g'(\hat{y})\frac{\partial \hat{y}}{\partial \lambda} > 0$$

In monthly rent contracts, tenants can entice landlords to paying optimal levels of y by threatening to withhold rental payments, this enforcement mechanism drives landlords to maximize (11) after the contract has been signed and allows them to credibly commit to pay optimal levels of y. This in turn lets tenants pay higher levels of R for properties that require more landlords input (higher λ). Totally differentiating (11) and using comparative static analysis in the usual manner yields $\frac{\partial \hat{y}}{\partial \lambda} > 0$. Thus, the slope of the profit function for monthly rent contracts is increasing in λ.

Because profits for monthly rental contracts are increasing at a faster rate than profits under Antichresis contracts with respect to λ, there will be a $\lambda_o > 0$ such that $\pi_{l,R} = \pi_{l,A}$. Thus, for properties where $\lambda < \lambda_o$ the Antichresis will dominate the rental contract and the opposite will take place for properties where $\lambda > \lambda_o$.

Mixed Contracts

Up to this point we assumed that parties could only choose either rental or Antichresis contracts with no possibility of mixed contracts. Under mixed contracts, part of the payment could take the form of an Antichresis lump sum A to be returned to the tenant at the end of the contractual period and the other portion could be a monthly rent

R. Thus, under mixed contracts the contractual amount would be given by $rA+R$ and the incentives produced by the contract will depend on the payment mix.

Consider first a contract where the Antichresis lump sum is set higher than the agreed rent ($A \geq R$). In such case, the incentives will be the same as in a pure Antichresis contract. If the tenant was illiquid when *R* is due, the landlord could simply deduct *R* from *A* without having to evict the tenant. In the same manner if the tenant threatened to withhold *R* to motivate higher levels of landlord maintenance investments these threats would not be credible since the landlord can simply deduct the withheld payments from *A*. Thus, mixed contracts where $A \geq R$ will create the same incentives a pure Antichresis contracts.

Now consider a mixed contract where the Antichresis lump sum was set lower than the rental payments ($R>A$).[23] In this scenario tenants can credible threaten to withhold *R* and enforce landlord investments in *y*. So mixed contracts where $R>A$ serve as pure rental contracts in terms of solving the moral hazard problem[24]. However contracts where $R>A+C$ do not solve the hidden information problem because tenant illiquidity can still cause tenant abandonment/eviction and loss to society.

Conclusions

The division of ownership can create gains for society, but it also introduces incentives for inefficient behavior from both landlord and tenant (Epstein, 1986). The Antichresis contract solves the adverse selection problem caused by landlords' inability

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[23] Note that landlords will never agree to contracts where the rental payments are lower than the eviction costs $R<C$. If they did, tenants will never pay rent even if they were liquid. In the case of a mixed contract the condition for a landlord to get into mixed contract will be $R-A>C$ or $R>A+C$.

[24] Note that this contract is equivalent to a monthly rent contract with a security deposit of A.

to observe tenants' probability of illiquidity. By imposing a large lump sum payment at the beginning of the contractual period, the Antichresis contract assures that tenants will not abandon the property and will not impose the social costs of having an unoccupied unit. Although not formally included in the model, we expect the large lump sum to ensure that only the more affluent tenants will sort into this type of arrangement.

The Antichresis contract's major shortcoming is that it cannot solve the moral hazard problem of landlords' maintenance investment. The initial payment of the Antichresis lump sum removes the essential landlord credible commitment mechanism. The social cost stemming from this unresolved moral hazard problem of Antichresis contracts, however, is not the same for all types of property. The actual impact hinges critically on the technology governing the delivery of services from real estate assets. Properties where the supply of landlord inputs does not have a large effect on tenant value will not lose much from being in an Antichresis contract when compared to the monthly rent contract. The model presented in this chapter therefore suggests that different types of property will self-select into the alternative lease regimes, Antichresis and rent, and the sorting will reflect the underlying real estate services technology. This represents one possibly important empirical implication of the theory.

Although the model presented in this chapter does not fully develop the adverse selection issues, it nonetheless illustrates that property types for which the losses arising from the moral hazard problem outweigh the expected losses from the adverse selection problem will be more likely to be under monthly rent. On the other hand, property types for which the expected losses arising from the adverse selection problem outweigh the losses from the moral hazard problem will tend to fall under Antichresis. This notion

underlies the empirical analysis of property sorting across contract forms in chapter 5.; but first we describe the use of Antichresis and monthly rent contracts in Bolivia and explain how some institutional factors may affect the demand for such contracts.

CHAPTER 4

THE ANTICHRESIS CONTRACT IN BOLIVIA

This chapter provides a description of the use of Antichresis in Bolivia. We begin by showing the relative importance of the contract in housing tenure in urban Bolivia. We then turn to a description of two institutional factors that are most commonly believed to influence the demand for Antichresis contracts: Inflation and interest rates. We briefly explore the channels through which these macroeconomic factors could affect the use of Antichresis and then test our hypotheses using aggregate data from Bolivian cities. This chapter also considers the taxes and fees applied on Antichresis contracts with special emphasis on the incentives these might create for tenants to choose between contract modalities in the Bolivian case. Finally we examine the costs associated with eviction cases arising from a breach of monthly rental contracts in Bolivia by looking at case processing times in the civil court system.

Use of Antichresis in Bolivia

Although the Antichresis contract is present in several European countries and most Latin American countries, Bolivia is one of the few Latin American countries where the contract is widely used for residential housing[25]. A shown in Table 4.1, housing under Antichresis tenure increased in Bolivia's 10 largest cities between 1992 and 2001. Although Bolivian civil law prohibits the use of mixed contracts, they are still in use in

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[25] For a complete work on housing tenure statistics in Latin America see Rivera (2005)

most cities but are relatively small in number. Table 4.1 also shows that rental contracts represent the largest proportion of non-owner occupied housing.

Table 4.1:
Housing Tenure in Bolivia's 10 Largest Cities

CITY	CENSUS YEAR	% ANTICHRESIS	% RENT	% OWN	% MIXED	% GIVEN FOR SERVICES	% GIVEN BY FRIENDS	% OTHER
Santa Cruz	1992	**6.77**	24.24	52.04	0.25	5.5	10.06	1.14
	2001	**9.41**	27.02	48.11	0.58	3.77	9.45	1.66
Cochabamba	1992	**9.09**	27.65	45.82	0.17	4.31	12.07	0.91
	2001	**10.29**	26.87	50.6	0.4	2.58	8.02	1.24
El Alto	1992	**1.99**	27.83	54.59	0.29	2.93	10.93	1.45
	2001	**2.82**	22.59	60.81	0.5	1.78	9.76	1.75
La Paz	1992	**7.77**	27.81	44.72	0.28	3.44	15.12	0.87
	2001	**12.09**	23.45	49.71	0.45	2.36	10.36	1.58
Sucre	1992	**7.87**	31.25	45.62	0.15	3.41	11.15	0.55
	2001	**9.91**	28.59	50.01	0.38	2.22	7.77	1.13
Tarija	1992	**2.9**	29.17	52.26	0.18	4.13	10.53	0.82
	2001	**5.74**	29.88	52.35	0.36	2.93	7.24	1.5
Potosi	1992	**4.94**	31.02	43.47	0.08	4.57	15.51	0.41
	2001	**6.77**	28.89	51.37	0.37	2.28	9.06	1.25
Trinidad	1992	**1.76**	26.6	50.32	0.21	6.9	11.52	2.69
	2001	**3.73**	24.03	53.34	0.66	4.82	11.21	2.21
Oruro	1992	**7.44**	29.37	44.76	0.1	3.62	13.97	0.73
	2001	**8.79**	23.6	53.67	0.34	1.83	9.71	2.06

Source: Indicadores Sociodemográficos por Ciudades Capitales, Censos 1992, 2001; INE Bolivia, 2004

Bolivians commonly believe that the Antichresis system is popular because of Bolivia's traumatic experiences with high inflation and because of high lending interest rates that force landlords to finance their projects using Antichresis contracts. In the same line, some authors suggest that in addition to interest rates and inflation, taxes and registration costs constitute an incentive for landlords and tenants to prefer Antichresis to monthly rent contracts or the opposite (Farfan, 2002; 2004; Durand-Lasserve, 2006). The rest of this chapter explores the validity of these claims. First we analyze with the

relationship between Antichresis use and the inflation rate and interest rates. We then turn to a detailed description of the Bolivian tax system and its application to Antichresis and monthly rent contracts. Finally we explore Bolivian Civil Courts' efficiency to provide a better understanding of the costs involved in contract enforcing in the country. The final section offers the conclusions.

Antichresis Use and Inflation Rate

Unexpected and steady changes in the inflation rate can produce an arbitrary redistribution of wealth among individuals. When the inflation rate differs from the expected inflation rate, the interest rate a creditor was expecting when the contract was signed (ex-ante) differs from the realized interest rate (ex-post) when the payment is due. Higher than expected inflation makes the ex-post real interest rate lower than the ex-ante real interest rate and this produces a transfer of wealth from creditors to debtors.

This principle suggests that in economies with volatile inflation rates, long-term contracts that involve fixed amounts of money (not inflation indexed) are riskier and therefore less common. This would certainly be the case for an Antichresis contract where landlords receiving an Antichresis lump sum in local currency at the signing of the contract would have to give back the same amount of money without taking the inflation rate into consideration at the end of the contract. If the inflation rate in an Antichresis period was higher than expected, the landlord would return a lower Antichresis amount in real terms at the end of the contractual period. As a result, demand for Antichresis contracts on the tenants' side would tend to decrease in periods of high inflation rate volatility.

The Bolivian case, however, does not show a strong relationship between current inflation, past inflation or inflation rate volatility and the percentage of homes under Antichresis tenure. As table 4.2 shows, the percentage of homes under Antichresis tenure in Bolivia's three largest cities increased slightly between 1976 and 1992, despite the large increases in the inflation rate (current and past). This positive relation is not consistent with the hypothesis proposed above[26]. On the other hand, as inflation rates decrease between 1992 and 2001, the percentage of homes under Antichresis increases. This negative relation is consistent with the hypothesis proposed above but not with the observed relation in the previous period rates.

Table 4.2:
Antichresis Use and Inflation

Census Year	% Homes under Antichresis	Current year Inflation	Past year Inflation	Inflation Std. Deviation (previous 5 years)
1976	7.55	4.49	7.98	23.66
1992	7.70	12.06	21.44	3.13
2001	10.55	1.60	4.60	4.01

Source: Censos de Poblacion y Vivienda 1976, 1992, 2001; INE, Bolivia
Source: (CPI Inflation) World Development Indicators CD ROM

[26] This increase of the use of Antichresis in the 1976-1992 period is even more puzzling considering that Bolivia suffered one of the worst hyperinflations in the history of the world during that period (in 1985). The hyperinflation coupled by a rent control policy and a ban on foreign currency indexation in contracts between 1982 and 1985 created a set of perverse incentives that virtually made the rental and Antichresis markets disappear. These set of policies were reversed in 1986 when the hyperinflation was controlled, rent and price controls were abolished and the use of foreign currency in any type of contract or transaction was unrestricted (see Morales and Sachs, 1990; Ugarteche, 1986; and Torrico 1999). Given the traumatic experiences with inflation during this period, the fact that there was an actual increase in the use of Antichresis shows that the use of the contract is not sensitive to changes in the inflation rate.

The relationship between the percentage of homes under Antichresis and inflation rate volatility is also weak. As volatility dramatically decreased from 1976 to 1992, the percentage of homes under Antichresis increases slightly as expected by the reasoning above. However, the opposite occurred between 1992 and 2001 when the inflation rate volatility increased and the percent of homes under Antichresis increased as well by 2.85 percentage points contradicting the argument above.

The weak relationship between inflation rates and volatility and the use of the Antichresis contract might be explained by the fact that most Antichresis contracts are made in US Dollars. If Antichresis contracts are signed specifying payments in a relatively stable foreign currency, agents can avoid the uncertainty produced by unexpected inflation and devaluation of the local currency. This would make the Antichresis contract very attractive, but the use of contracts in foreign currency is not exclusive to Antichresis. Most monthly rent contracts are also signed specifying the rental payments in US dollars[27] . Therefore the choice of Antichresis contracts over rental contracts is likely driven by factors other than inflation.

Antichresis Use and Interest Rates

Real interest rates are also believed to have an impact on the use of the Antichresis contract as opposed to the monthly rent contract and vice versa. This assertion assumes that landlords and tenants have different returns for investments. Otherwise, other things being equal, the Antichresis contract would only exist if both

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[27] In the sample of 300 Antichresis contracts and 300 monthly rent contracts used in the empirical section of the dissertation, 100% of the Antichresis and 90% of the monthly rent news paper adds were on listed on $US dollars

landlord and tenant are indifferent between the two contractual arrangements. To see this, assume that both landlord's and tenant's best investment option for the Antichresis amount was the same banking savings real interest rate r_s. Everything else being equal, the tenant would take the property under Antichresis instead of monthly rent only if the opportunity cost of the Antichresis amount A is lower than what she would have to pay in monthly rents R ($r_sA \leq R$). On the other hand the landlord would only choose Antichresis over monthly rent if the gains from the use of the Antichresis amount were higher than what she would receive in monthly rental payments ($r_sA \geq R$). As a result, the only way Antichresis would exist is if $r_sA = R$ so that both landlord and tenant are indifferent.

Now consider the case where the landlord has a better investment option than the tenant for the Antichresis amount A and the tenant faces the same participation constraint ($r_s A \leq R$). In this new case, the landlord could borrow A from the banking system and face the lending interest rate (r_l) (with $r_l > r_s$) or could finance the investment by putting his property under an Antichresis contract and get A from the tenant. The participation constraints for landlord and tenant become $r_lA \geq R$ and $r_s A \leq R$ respectively. Under this new set up, the Antichresis contract is beneficial for the landlord even if $r_s A < R$ as long as the monthly rent payments are lower than the cost of borrowing A from the bank at the prevailing landing rate r_l ($r_lA \geq R$). This reasoning suggests that, with other things being equal, large differences between r_l and r_s and different rates of return for landlords and tenants may explain the use of the Antichresis contract. Thus, we should observe that an increase in the interest rate spread (difference between the lending and savings interest rates) would increase the use of Antichresis contracts. However, this hypothesis does not hold in the Bolivian case.

Table 4.3 shows the percentage of homes under Antichresis in Bolivia's largest cities and the country's interest rate spread for the latest census years. The observed relation between the use of Antichresis and the interest rate in spread is exactly the opposite of the prediction stated above. As the interest rate spread decreases by 12 percentage points, the percentage of homes under Antichresis actually increases by 2.85 percentage points.

Table 4.3:
Use of the Antichresis Contract and Interest Rate Spread

Census Year	% Homes under Antichresis	Interest rate Spread
1976	7.55	..
1992	7.7	22.29
2001	10.55	10.24

Source: Bolivian population and housing Census 1976, 1992, 2001, and International Financial Indicators (IMF)

The Bolivian case shows that even though inflation and changes in the interest rate spread might have an impact on the use of the Antichresis contract, they certainly do not provide a complete explanation; the data shows that none of these variables has a strong relationship that would logically explain the use or prevalence of the Antichresis contract in Bolivia. As a result, we argue that any model that tries to explain the origins and use of the Antichresis contract needs to move beyond these variables and the simple explanations provided above. Before testing the model proposed in the previous chapter with Bolivian data it is useful to explore two other institutional factors that may affect the decision to choose Antichresis over monthly rent in the Bolivian context: taxes and court efficiency.

Taxes and Registration Costs

Property Taxes

In Bolivia, the property tax is administered at the municipal level and is one of the main revenue sources for municipal governments. The property's current owner pays the property tax once a year[28]. Landlords will pass the property tax to tenants in the Antichresis payments *rA* if the property is in Antichresis, in *R* if the property is under monthly rent, or a combination of the two if the contract is a mix of Antichresis and monthly rent. Under Bolivian Civil Law the tenant under an Antichresis contract is obligated to pay for property taxes, but the Antichresis contract can include a provision giving the landlord the responsibility to pay the property tax if both parties agree to it when signing the contract (Civil Code Art 1434). Such provision will not make the Antichresis more or less attractive than monthly rent because the tenant will end up paying the property tax either as a part of what the owner will charge in *rA* if there is a provision, or from his pocket if there is no provision[29]. Thus, property taxes will not influence landlords' or tenants' decision to choose Antichresis over monthly rent or vice versa. The next section explores registration costs and other taxes that are thought by some authors (Farfan, 2002) to affect the contract choice decision.

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[28] For taxing purposes, owner is the person whose name appears on the property's title.

[29] In a full Antichresis contract, the owner will set the amount she wants to receive from the contract $M = m + t = rA$ where m is the revenue net of property taxes and t are the property taxes. The equality will hold so that the tenant always pays the tax: $M = m + t = rA$ (if there is no provision) or $M = m = rA\text{-}t$ (if there is a provision)

Registration Costs

Bolivian law requires the Antichresis contract to be a public document (Civil Code Art 1430) registered in the Office of Real Estate Registry (Derechos Reales). The registry serves two main purposes: (1) It insures that the property involved in the Antichresis contract has a clean title registered to the person signing the Antichresis contract as owner, and (2) It ensures that the property has no legal claims to it such as mortgages or other legal claims.

In case of a dispute courts can only intervene and give the tenant the first claim on the Antichresis amount A if the if the contract was made public (i.e. signed in front of a public notary) and registered in the real estate registry office. If the Antichresis agreement lacks either of these two requirements, tenants have to go through ordinary debt collection legal procedures, which take considerably longer and are subject to disputes of payments with other claimants. The real estate registry office charges 0.4% of the Antichresis amount plus a fixed fee of $6 for administrative processing.

The registration of an Antichresis contract becomes insurance for the tenant because it ensures that the property is free of other legal claims and that the contract can be held in a court of law. However, it is common in Bolivia to find situations in which tenants do not register the Antichresis contract in the real estate registry office or sign a public contract. In most of these cases tenants usually lose their Antichresis amount and are evicted from the property when foreclosed by a bank that had a previous mortgage claim on it (La Razon, 2002; Farfan, 2002).

Registration is not required for monthly rent contracts. According to Bolivian law, verbal agreements of monthly rent deals are considered contracts. Thus, other things

being equal, registration costs may be a factor deterring agents from using the Antichresis contracts as Farfan (2002) states. However other factors have to be taken into consideration when looking at how registration costs affect the choice between contracts. One of these factors is the value added tax.

The Value Added Tax on Antichresis and Monthly Rent Contracts

Economic structural reforms enacted in Bolivia to combat the rampant hyperinflation in 1985 included a comprehensive tax reform that replaced the old tax system with a Value Added Tax system in 1986[30]. Since then, Bolivia uses the Value Added Tax (IVA in Spanish) system to collect revenues for the central government. The IVA is a tax on gains and not on the costs of a product. For example, if product X is sold at $100 but it costs $90 to produce, the tax will be applied on the $10 gain. In Bolivia, the IVA rate is 13%, so the tax in this case would be $1.3

Firms or individuals who are involved in commercial and or leasing activities are required to pay the IVA tax of 13% on gains every month. Complementing the IVA tax, salaried individuals are required to pay the RC-IVA (complementary regime value added tax in English) that acts like a tax on earnings and is applied to an individual's taxable income minus the expenses the individual made in the current or previous tax periods. For every transaction, an individual receives a receipt. At the end of the tax period she has to pay 13% of her taxable salary (which is the salary minus 2 minimum salaries). However, the individual can use the receipts to discount her taxable base. If her receipts

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[30] The tax reform (Law 843) was signed by President Victor Paz Estensoro in May 1986 and was later amended in 1994 under President Gonzalo Sanches de Lozada. The major 1994 amendment raised the tax rate from 10% to 13%.

are equal to the taxable base her RC-IVA taxes would be 0, if her receipts add up to more than her taxable salary she will have a credit equal to the exceeding amount for the next taxing period. If her receipts add up to less than her taxable salary she will be taxed on that difference. To explain the impact of the IVA and RC-IVA taxes on these contracts it is necessary to divide the tax burden for landlords and tenants under both contractual agreements. We start with the monthly rent contract.

The Rent Contract

Each month, the landlord is obligated to pay IVA (13%) on rent revenues (R) but can discount the taxable revenues with receipts of all the expenditures made on the property (y). Thus, the yearly IVA tax for the landlord amount to $IVA_t = 0.13(R\text{-}y)$. Note that if the expenditures on the property are equal to the revenues ($R=y$) the IVA tax will be 0.

If there is a breach of contract and a legal dispute arises in the contractual relation, courts require proof of IVA tax payments in order to establish a monthly rent contractual relationship. As a result landlords need to have paid their taxes before they can start an eviction procedure. This requirement serves as an incentive for landlords to comply with tax regulations. However, tax authorities estimate that less than 20% of monthly rent contracts pay IVA taxes (Torrico, 1999).

The landlord is also required to pay the RC-IVA every three months. This tax is applied to 87% of the rent revenue minus 2 minimum salaries per month (about $125). However, with the RC-IVA the landlord can deduct his taxable base using expenditure receipts of any expense not included in his IVA declaration. It is important to note that

for monthly rent contracts of $143 per month or less, the taxable base for the RC-IVA is 0 even if the taxpayer does not present any expenditure receipts[31].

Finally, the landlord has to pay the transaction tax (IT, in Spanish), which is equal to 3% of the rents he receives before IVA and RC-IVA taxes. As with the IVA tax, authorities estimate 20% compliance for this tax (Torrico, 1999). Tenants are not required to pay any taxes related to their monthly rent contract. Tenants are only required to pay RC-IVA on their earnings and they can use the monthly rent expenditures to deduct their taxable base as explained above.

The Antichresis Contract

When an Antichresis contract is signed, both owner and tenant have to register the contract in the tax offices and obtain the "Contributors Unique Registration" number (RUC in Spanish). Once the contract is signed, both parties are subject to the RC-IVA taxes on a supposed yearly income equivalent to 10% of A. As with other RC-IVA taxes, the taxable base is calculated by subtracting 2 minimum salaries from the monthly income and then subtracting expenditures made previous to the tax payment date not claimed in other taxes or taxing periods.

For example, if an Antichresis contract is done for $17,000, the taxable supposed income for the year is $ 1700, which is equivalent to a monthly (supposed) income of $ 142. After subtracting 2 minimum salaries ($125) the taxable base becomes $ 17. If the taxpayer presents receipts of expenditures amounting to $17 the tax will be 0. But if the taxpayer does not present any receipts the monthly tax will be $ 2.21 (13% of $17). For

[31] This is because 87% of a monthly rent of 142.6 contract is equivalent to 2 minimum salaries: $125, which is the automatic deduction for the taxable base in the RC-IVA.

Antichresis contracts of $15,000 or less, the taxable base for the RC-IVA is 0 even if the taxpayer does not present any expenditure receipts[32].

Taxes and Contract Choice

Table 4.4.4 presents a summary of the total yearly tax burden for both parts under each contractual arrangement. For simplicity, table 4.4 assumes that neither landlords nor tenants present any receipts to obtain RC-IVA credits or IVA credits in case of the rental contract so that they are fully taxed.

Table 4.4:
Yearly Taxes and Registration Costs for Antichresis and Monthly Rent Contracts

Tax / Registration cost	Monthly Rent Contract *R*= Yearly rent	Antichresis Contract *A*= Antichresis lump sum
Registration costs	0	.04% of *A*
IVA	13 % of *R*	0
IT	3 % of *R*	0
RC-IVA (landlord)	13% of (.87**R* -125*12)	13% of (0.1*A -125*12)
RC-IVA (tenant)	0	13% of (0.1*A -125*12)

Source: Own elaboration using the Bolivian tax code, 2005

Using the formulas in table 4.4 for different amounts of *R* and *A*, we can observe the total tax burden on both contracts. Figure 4.1 depicts these tax burdens using yearly rents for monthly rent contacts and an equivalent Antichresis lump sum *A* assuming a return of 10% (*r*=.10). The figure shows that monthly rent contracts where the specified yearly rent is below $7,000 have a higher tax burden than Antichresis contracts with equivalent yearly rents (*rA*). This indicates that, for contracts with yearly payments below

[32] This follows from the fact that the supposed monthly income for a $15,000 contract is equivalent to 2 minimum salaries: $125, which is the automatic deduction for the taxable base in the RC-IVA

$7000, we might observe that market rents R for monthly rent contracts may be higher than the Antichresis rents *rA* for identical properties to account for the differences in the tax burden. Other things being equal this would tend to drive tenants from rental contracts to Antichresis contracts. But taxes alone do not seem to explain contract choice.

Empirical data from the city of Cochabamba show that 93% of monthly-rent contracts are signed for amounts were the tax burden is higher than it would be for equivalent Antichresis contracts[33]. We explore this result further in chapter 5 using market data. But now, we turn to another institutional factor that may influence the choice of contracts.

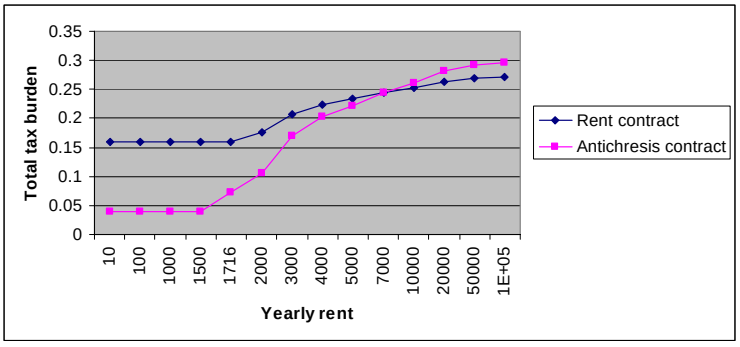

Figure 4.1:
Tax Burden for Antichresis and Monthly Rent Contracts

[33] The sample contained 300 Antichresis and 300 monthly rental ads posted in the "Los Tiempos" news paper in 2005. The results showed that 60% of the Antichresis ads had specified Antichresis lump sums below $15,000 US and 95% had lump sums below $30000 US. Among the monthly rental units, 48% were offered below $1500 US and 93% below $7000 US annually.

Court Efficiency

The effectiveness of institutions in a country can be critical to the development process because they establish the environment in which individuals make decisions and therefore determine how an economy performs (North 1990, 1992). Under this logic and using the institutionalist and transaction costs approaches, several authors demonstrate that efficient judicial systems can improve economic performance as they determine the enforceability of property rights (Sherwood, 1994). In the context of contracts that regulate the division of property rights such as a monthly rent or Antichresis contracts, the judicial system efficiency may play an important role on influencing the type of contract tenants and landlords prefer.

In this section we explore some efficiency indicators in the 10 courts that cover civil law cases in the district of Cochabamba, Bolivia, with specific attention to cases that involved tenant eviction under Antichresis and monthly rent contracts. The purpose of this section is to shed some light on the incentives created by the transaction costs related to enforcement of contracts and how this may relate to the choice of Antichresis over monthly rent contracts and vice versa.

Civil Courts' Efficiency

The city of Cochabamba has 10 courts in charge of cases that involve civil law. Table 4.5.1 shows a summary of cases served by these courts in the November 2004- November 2005 period. As the second column in table 4.5 shows, the number of eviction cases in each court for the November 2004- November 2005. The third and forth columns show the total number of cases introduced between November 2004 and November 2005 and the number of cases introduced previous to November 2004 with no resolution

respectively. The last 2 columns show the number of cases that obtained a resolution and the percentage these represent from the total amount of cases for the period.

Table 4.5:
Civil Court Case Attendance in Cochabamba Between 2004 and 2005

Civil court	Eviction cases	Cases Introduced in Period	Pending cases from previous periods	Total number of cases in period	Cases closed in period	% of cases resolved
1	4	912	1551	2463	1637	66.46
2	4	1260	877	2137	648	30.32
3	5	955	1506	2461	711	28.89
4	5	1303	1108	2411	1346	55.83
5	9	1279	1063	2342	824	35.18
6	0	1358	1288	2646	743	28.08
7	7	1140	886	2026	940	46.4
8	3	1266	1007	2273	803	35.33
9	13	1065	379	1444	506	35.04
10	9	1058	703	1761	414	23.51
Total	59	11596	10368	21964	8572	39.03

Source: Authors elaboration based on data obtained from *Poder Judicial de Bolivia Juzgados de Instruccion en lo Civil Cochabamba*

Table 4.5 clearly shows that eviction cases do not represent a large percentage of the total number of cases in the civil courts in Cochabamba. It also shows that, on the aggregate, the numbers of civil cases solved in a year exceed the capacity of the courts to solve them in less than a year (column 6 < column 3). This deficit creates a backlog of cases that cause the courts to completely process only about 39% of the total number of cases pending in a given year.

Eviction Cases

In order to have a better understanding of the court costs associated with eviction cases, a sample of cases was obtained from each civil court in the Cochabamba district. The sample was collected between October 16th and October 25th 2006 by 3 law students working at the Consultorio Juridico office in San Simon University under the

direction of Dr. Elba Medinaceli. The students collected basic information about 35 eviction cases from 9 of the 10 civil courts in Cochabamba.

The sample revealed some important findings concerning eviction cases: There were no evictions involving Antichresis contracts among the 35 sampled cases. All of the eviction cases in the sample involved a breach of a monthly contract due to lack of payment for more than three consecutive months[34]. The sample included 22 closed cases (63%) and 13 others (37%) that were still pending a final rule at the time the sample was collected. The monthly rent amount for property involved in an eviction case ranged from $12.50 to $600 with an average of $231. The eviction cases involved a wide range of property types. Residential property, including houses, apartments, and rooms, comprised 37 % of the sample. Commercial property accounts for the remaining 63% (table 4.5.2).

[34] In the Procedural Civil Code this means causal code 623 for residential property and causal code 632 for commercial property

Table 4.6:
Sample of Eviction Cases from Cochabamba's Civil Courts

Variable	Mean	SD	Min	Max
All Cases				
Monthly Rent $ US.	231.5	150.79	12.5	600
Processing time (days)	312.34	191.98	12	793
Residential property	37%	-	-	-
Closed Cases				
Monthly Rent $ US.	267.27	153.6	50	600
Processing time (days)	345.82	145.23	43	544
Residential property	41%	-	-	-
Case took more than 1 year	55%	-	-	-
Sentence was appealed	50%	-	-	-
Police force was used for eviction	32%	-	-	-
Cases still open				
Monthly Rent $ US.	170.96	129.69	12.5	500
Processing time (days)	255.69	248.96	12	793
Residential property	31%	-	-	-
Case took more than 1 year	31%	-	-	-
Sentence was appealed	na	-	-	-
Police force was used for eviction	na	-	-	-

Source: Authors' compilation

The processing time for eviction cases was the most important variable in this part of the investigation. The time was measured in days from the time the case was introduced to the court until a final sentence was pronounced including appeals. For all of the closed cases the average processing time was 345 days. Closed cases with no appeal took an average of 298 days, while cases where the sentence was appealed took an average of 394 days to be resolved. In the sub sample of closed cases, 50% had an appeal and 55% lasted for more than a year. The sub sample of open cases the processing times were counted from the day the case was received by the court to the day the observation as sampled. These cases had a lower average processing time (256 days) because it included cases just introduced in the court system. However, these cases also had a higher range of processing times with 15% of them lasting more than 620 days. Finally, the

relationship between processing time and monthly rent amount was not statistically significant either by itself or when controlling for type of property and whether the first sentence was appealed[35].

The information collected from the courts shed compelling evidence of the high costs landlords face when trying to evict an illiquid tenant. Under Bolivian law, the landlord can start an eviction process in the courts for lack of tenant payments after three consecutive months of non-payment. Adding these 90 days to 345 days that an average eviction sentence will take to be completed (394 if there is an appeal) there is a good chance for a landlord facing more than 1 year in lost income if the tenant becomes illiquid. These processing times do not seem to be affected by the type of property (commercial or residential) or the property's quality (measured in monthly rent). It is important to note that if the landlord can take legal action to recover the lost earnings but this would entail even higher costs. Even with a favorable court decision in a bad debt case, tenant's illiquidity lowers the chances of recovering lost earnings. In most cases, evicted tenants facing a bad debt case will end up in jail for the bad debts before paying because Bolivia does not have bankruptcy protection laws.

This section has shown that the adverse selection problem included in the theoretical model of the Antichresis contract is indeed genuine in the Bolivian case. Landlords face high eviction costs in terms of forgone earnings due to court inefficiency. Not surprisingly, many cases do not even make it to the courts. According to legal

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[35] The Pearson correlation coefficient between processing time and monthly rent was –0.091 (p value =0.684). The standardized regression coefficients in a regression of processing times on monthly rent, property type, and whether the sentenced was appealed were -.047 (p value =0.83), .03 (p value= 0.89), and 0.33 (p value= 0.16) respectively.

experts, a large number of cases do not make it into the courts because landlords cannot prove a legitimate contractual relationship (i.e. they did not have their taxes up to date). This situation is very common due to the low tax compliance in this economic activity (Medinaceli, 2006). The inability to use the court system and low court efficiency has driven landlords facing this problem to recur to their own coercion methods to evict illiquid tenants, including changing door locks and violent evictions where tenants' personal property is thrown on the streets or simply stolen. It is also common for landlords to pay tenants their cost of eviction (forgone income and out of pocket expenses) upfront in order to make them vacate the property (Medinaceli, 2006).

Conclusions

This chapter explored four institutional factors thought to have an influence on the choice of the Antichresis contract. The Bolivian case shows that inflation and real interest rates do not have a direct impact on the use of Antichresis as many Bolivians believe. On the other hand, taxes and registration costs make a difference in the market value we might observe for similar properties under different contractual arrangements. This may alter tenants' incentives by driving them towards Antichresis contracts. But data from the city of Cochabamba shows that most rental contracts are signed with amounts where the tax burden for rental contracts is higher than the tax burden for Antichresis contracts. This means that there are other factors in play that may determine contract choice.

Court efficiency may also be related with contract choice because it determines the costs of contract enforceability. If the costs of enforcing a contractual agreement are high, agents will choose the type of contract that can best benefit them without having to use the courts. The Bolivian case shows the existence of backlogs in civil court cases in

general and that eviction cases take about a year to be resolved. In the context of Antichresis versus monthly rent contract choice, the incentives created by court inefficiency are twofold: If tenants cannot use the courts to enforce minimum conditions of habitability regulations they will prefer monthly rental contracts so that they can enforce landlord investment by withholding rents. On the other hand, if it is costly for landlords to evict tenants they will prefer Antichresis contracts for a wider range of property types, as the model proposed in this dissertation predicts. The next chapter tests these predictions using market data for the city of Cochabamba.

CHAPTER 5

DATA AND EMPIRICAL TESTS

The theoretical model proposed in a previous section of this dissertation predicts that landlords will offer their properties in the market under the contractual arrangement that yields the highest expected profit. Specifically, the model predicts that these expected profits are a function on the type of property (in terms of landlord and tenant investment requirements) and the type of tenant that is likely to demand the property (in terms of probability of illiquidity). In this section we use market data for property offered under Antichresis and monthly rent contracts to explore the sorting mechanism of property and tenants into different contracts based on observable and unobservable property characteristics.

Empirical Methodology

The strategy in this section is to estimate the differences in rental prices under different contractual arrangements using a hedonic price framework. We use this method to answer 5 questions: (1) Are there differences in the price generating functions of rental property between Antichresis and monthly rent contracts? (2) Are there differences in market prices between Antichresis and monthly rent contracts for comparable properties? (3) Is there a selection mechanism based on property and tenant characteristics that drives landlord decisions to choose between contracts? (4) What is the magnitude of the selection effect in terms of landlord profits? (5) Does the selection effect vary with the type of property in terms of landlord investment impact on tenant's enjoyment of the unit λ ?

Econometric Specification

In hedonic price models the equilibrium price of a good is expressed as a function of a good's attributes (Rosen, 1974). Housing hedonic models usually model the rental price of a housing unit as a function of some physical characteristics in vector **X** (x_1, x_2, x_3,..) using a popular semi-logarithmic specification.

$$\text{Ln}(M) = \mathbf{X}\beta + \tau \qquad (1)$$

where M is the rental price for a housing unit, and τ is a randomly distributed disturbance term uncorrelated with X. The same framework could be extended to test for differences between rental and Antichresis prices by estimating two separate regressions.

$$\text{Ln}(R) = \mathbf{X}\beta_1 + v_i \qquad (2)$$

$$\text{Ln}(rA) = \mathbf{X}\beta_2 + \upsilon_j \qquad (3)$$

Where R is the yearly rent charged for property under a rental contract, r is a market rate of return for capital, and A is the Antichresis lump sum charged for property under the Antichresis regime. If property was selected randomly into rental and Antichresis regimes, we could obtain consistent estimates of β_1 and β_2 by estimating (2) and (3) using OLS.

The theoretical model presented in the previous section, however, predicts that certain properties will be more valuable under Antichresis than they would be under monthly rent and vice versa. This suggests that landlords will offer the property under the contractual arrangement that yields the highest expected return, not randomly. This is a typical problem of sample selection where consistent estimation of parameters will require estimating the expected value of a property under a particular regime given that the property is observed in that regime. Estimates of (2) and (3) using OLS will produce

biased estimates because of unobservable characteristics in v and υ related to property characteristics **X**.

In the presence of selection, consistent estimation of the parameters in the hedonic equations requires the estimation of parameters β_i conditional on the property being observed under contractual arrangement i. The observed landlord's decision on the preferred contractual arrangement will be based on an expected profit value I^* function of the expected contract gains under Antichresis relative to rent[36]. Thus, consistent estimates of β_i require the estimation of the system of equations below:

(4) $$I^* = \delta(\ln(rA) - \ln(R)) + Z\gamma + u$$

(5) $$\ln(rA) = \mathbf{X}\beta_1 + \varepsilon_1$$

(6) $$\ln(R) = \mathbf{X}\beta_2 + \varepsilon_2$$

The system represents a switching regression model with endogenous switching (see Maddala, 1983), also known as a Tobit type 5 model (Amemiya, 1985) where properties will be observed under Antichresis if $I^*>0$ and under monthly rent when $I^*\leq 0$. I^* is treated as an unobserved latent variable represented by an observed indicator I that takes the value 1 if $I^*>0$ and 0 when $I^*<0$

Using Heckman's 2-step method for the parametric estimation of the system above requires the assumption that the errors follow a joint normal distribution with:

$$\begin{bmatrix} u \\ \varepsilon_1 \\ \varepsilon_2 \end{bmatrix} \sim N\left[\begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}\begin{bmatrix} 1 & \sigma_{u\varepsilon_1} & \sigma_{u\varepsilon_2} \\ \sigma_{u\varepsilon_1} & \sigma^2_{\varepsilon_2} & \sigma_{\varepsilon_1\varepsilon_2} \\ \sigma_{u\varepsilon_2} & \sigma_{\varepsilon_1\varepsilon_2} & \sigma^2_{\varepsilon_3} \end{bmatrix}\right] \tag{7}$$

[36] This discussion follows Lee's (1978) discussion of workers decisions to enter unions.

Assumption (7) above permits consistent estimation of bi using equations 8 and 9:

$$E(\ln(rA) \mid I = 1, X) = X\beta_1 - \sigma_{u\varepsilon 1}\frac{\phi(Z\gamma)}{\Phi(Z\gamma)} \tag{8}$$

$$E(\ln(R) \mid I = 0, X) = X\beta_2 + \sigma_{u\varepsilon 2}\frac{\phi(Z\gamma)}{(1-\Phi(Z\gamma))} \tag{9}$$

Where $\sigma_{u\varepsilon 1}$ and $\sigma_{u\varepsilon 2}$ are estimates of the covariance between u and ε_1 and ε_1 respectively, and $\frac{\phi(Z\gamma)}{\Phi(Z\gamma)}$ is the inverse mills ratio (see Maddala, 1983). The model can also be estimated using Full Information Maximum Likelihood (FIML), which, instead of yielding estimates of $\sigma_{u\varepsilon 1}$ and $\sigma_{u\varepsilon 2}$, estimates $\rho_1\sigma_u\sigma_{\varepsilon 1}$ in (8) and $\rho_2\sigma_u\sigma_{\varepsilon 2}$ in (9) directly; where ρ_1 and ρ_2 are estimates of the correlation coefficients between u and ε_1 and ε_1 respectively[37]. Statistically significant coefficients of ρ_1 and/or ρ_2 would suggest that landlords are selecting into the contract that would yield them the highest expected returns given the property characteristics.

Market Data

The data was extracted from newspaper ads in the most important newspaper in Cochabamba. The ads were obtained in electronic format from the "Clasificados" unit of the paper and corresponded to the November 2005- May 2006 period. Ads that did not contain property characteristics, location, or price were dropped from the sampling frame.

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[37] Breen (1996) shows that the estimates of rho sigma obtained by the maximum likelihood method are equivalent to the covariance estimates of the Heckman model: $\rho_1\sigma_u\sigma_{\varepsilon 1} = \frac{\sigma_{u\varepsilon 1}}{\sigma_u\sigma_{\varepsilon 1}}\sigma_{\varepsilon 1} = \sigma_{u\varepsilon 1}$

The final sample of 300 Antichresis, 300 rent, and 300 sale ads was obtained randomly by an independent party and transferred to a spreadsheet for analysis[38]. The majority of the ads did not contain specific addresses of housing units but they had sufficient information to place the units in one of 14 municipal districts of the city of Cochabamba or in a neighboring municipality. Neighborhood level variables were obtained using census information from the year 2001 and aggregating it to the municipal district level. Not all the variables could be obtained for units located in neighboring municipalities so these observations were dropped from the sample.

Table 5.1 presents a summary of all the variables used in the hedonic models. The dependent variable in the Antichresis and monthly rent hedonic models is after-tax yearly rental prices. All prices in table 6 are expressed in US dollars. In the Antichresis and sale samples all the ads had prices listed in US dollars. In the monthly rent sample, 20 % of the ads were listed in local currency. These prices were converted to US Dollars using the average exchange rate for the November 2005- May 2006 period. The rental price for property under Antichresis was calculated using a 10% return rate on the advertised Antichresis amount[39]. The dependent variable in the for-sale property hedonic model is the advertised price.

The neighborhood characteristics included in the hedonic models were distance from the CBD, measured in Kilometers from the heart of the CBD (Plaza 14 de Septiembre) to each district's centroid, an indicator of neighborhood's median income,

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[38] The services of a sociologist student from San Simon University were contracted to extract the ads randomly from the sampling frame and transfer them to a spreadsheet.

[39] This rate of return is based on the average real interest rates in the 2003-2005 period using data from the World Bank Development Indicators.

and a set of binary indicators reflecting whether the neighborhood is in the northern, central, or southern part of the city in order to capture rental price differences attributed to geographic orientation in the city[40]. All of the hedonic models included the number of suites (bedrooms with bathrooms), total number of rooms and a set of binary indicators reflecting the type of property being advertised. We identified 5 types of properties: apartments, chalets, houses, commercial, and single rooms. Each of these property types is described below and shown in table 5.1.

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[40] We used information of the 2001 census at the block level to construct an income scale using factor analysis. The variables included in the analysis were: percent of households in the block that own a TV set, percent of households in the block that own a car, percent of households in the block that own a refrigerator in the kitchen, and percent of households in the block that own a telephone line. These 4 variables produced a highly reliable index of city block income. The median income variable at the neighborhood level shown in table 5.1.2 represents the median value of the constructed block income variable.
For details on the construction of this variable please refer to the appendix section.

Table 5.1:
Market Data Descriptive Statistics

	Monthly Rent ads		Antichresis ads		For-Sale ads	
Property type	n	Percent	n	Percent	n	Percent
Apartment	80	28.17	120	43.32	68	27.2
Chalet	3	1.06	10	3.61	26	10.4
Commercial (store, office)	47	16.55	10	3.61	15	6
House	76	26.76	113	40.79	140	56
Room	78	27.46	24	8.66	1	0.4
Geographic Orientation	n	Percent	n	Percent	n	Percent
North	209	73.43	221	79.86	197	78.8
Central	71	24.82	50	17.99	34	13.6
South	5	1.75	6	2.16	19	7.6
Property Characteristics	Mean	Std.	Mean	Std.	Mean	Std.
Number of Suites	0.192	0.661	0.152	0.407	0.428	0.81
Total Number of rooms	2.243	1.416	2.818	1.027	3.531	1.65
Market Prices	Mean	Std.	Mean	Std.	Mean	Std.
Yearly rent (R) for rental contracts	$2,344	3,070	-	-	-	-
Yearly rent for rental contracts after tax*	$1,849	2,260	-	-	-	-
Antichresis amount (A)	-	-	$13,486	10,035	-	-
Yearly rent (rA) for Antichresis contracts	-	-	$1,349	1,004	-	-
Yearly rent for Antichresis contracts after tax*	-	-	$1,345	995	-	-
Sale price					$62,841	41,572
District variables	Mean	Std.	Mean	Std.	Mean	Std.
Distance from the CBD (Km)	2.338	1.72	2.64	1.638	3.041	1.724
Median income	0.913	0.542	0.888	0.561	0.761	0.68
Proportion of population employed in commerce	0.207	0.019	0.208	0.02	0.213	0.028
Proportion of population younger than 15	0.269	0.045	0.276	0.046	0.289	0.051
Proportion of children born in hospital	0.871	0.035	0.87	0.038	0.857	0.058
Number of valid observations	**284**		**277**		**250**	

* Taxes are estimated for the landlord using the highest taxable rate

Apartments

This type of property is generally located in buildings. We consider apartments to be the property type with the highest λ. In apartment buildings landlord presence is relatively more important because these settings generally need maintenance investments that are out of tenants' normal possibilities such as elevator repairs, or the cleaning and fixing of common building areas. Apartments have the highest relative frequency in both rental property samples, but have the second highest relative frequency in the sales sample.

Houses

This type of property had the second highest relative frequency in both rental property samples but the highest in the sales sample. We consider that tenants in houses generally need lower levels of landlord involvement to enjoy the property than tenants in apartment buildings. Even though the city of Cochabamba has recently been experiencing a growth in housing in gated communities, the majority of houses in the market are still in non-gated communities and generally in higher density areas than chalets.

Chalets

The concept of chalets was introduced in Cochabamba in the mid 1940's when architects begun applying the ideas of Ebenezer Howard and his garden city model. The term chalet in other parts of the world is used for rural housing; in fact, Webster's dictionary defines a chalet as "A wooden dwelling with a sloping roof and widely overhanging eaves, common in Switzerland and other Alpine regions." However, according to Solares (2006), in the city of Cochabamba the term chalet is commonly used for detached up-scale housing units. We consider chalets to have lower need for

landlords' maintenance investment than apartments and houses because of their detached nature.

Commercial

This classification involves any non-housing property including offices, stores, and storage. We consider commercial property to have relatively lower needs of landlord maintenance investment than apartments, houses, and chalets for the tenant to conduct her business in this type of property.

Rooms

This type of property refers to portions of other property that are offered in the rental market. Homeowners that decide to put spare rooms in their own houses in the market for extra income usually offer them under rent or Antichresis to college students. In terms of our model, this type of housing is of special interest because it creates a situation where landlord and tenant live in the same property. In this setting, tenants' need to commit landlords to make maintenance investment disappears because landlords will invest in the property for their own utility[41]. For this reason, we consider single rooms to have the lowest levels of λ from all types of property.

Estimation

Identification of the switching regression model requires that the selection equation (4) to include a set of instruments that have an effect on the landlord decision to offer the property under a particular contractual regime but not on property value. For this purpose, we include the proportion of individuals employed in the commerce sector

[41] This is similar to the effect of owner tenancy in commercial buildings (Glascock, Sirmans, Turnbull, 1993)

of the economy and the proportion of children born in a hospital in the district where the property is located. These variables are used as proxy indicators of liquidity risk of potential renters. Bolivian data shows that 80% of commerce employment is in the informal economy[42]. Furthermore, mothers not covered by insurance commonly offered in formal sector jobs tend to avoid hospital deliveries and have their children by other means such as contracting nurse practitioners or friends. We consider that landlords who cannot observe tenants status of employment (formal or informal) will tend to prefer Antichresis contracts in places where they think they are more likely to get a tenant that works in the informal sector. We do not expect this indicator to be related with how much a landlord can charge for the property once we control for property characteristics, neighborhood income, and distance from the CBD.

In order to test instrument validity we introduced the instruments in a yearly rent regression for a pooled sample of Antichresis and monthly rent property. An F test on the instruments confirmed, at the $\alpha = .05$ level of significance, that the instruments in the selection equation as a group do not enter the yearly rent regression after controlling for other property characteristics[43].

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[42] This number was obtained using data from the 2002 MECOVI survey conducted by the Inter-American Development Bank and the Bolivian institute of statistics (INE).

[43] The F statistic was: $F(3, 547) = 2.17$; yielding a P-value = 0.09. We also used the Sargan test of exclusionary restrictions in each hedonic equation. The P-values under the null that the instruments are uncorrelated to the residuals in the monthly rent and Antichresis regressions were 0.06 and 0.18 respectively.

Results

The models were estimated using OLS and a switching regression framework using FIML. Table 5.2 shows the results of the hedonic price functions estimated by OLS. The first 2 columns show the hedonic price equations for properties under Antichresis and rent contracts respectively. The third column shows a hedonic price function of property for sale. The OLS parameter estimates showed differences in some coefficients across the different samples. Mainly, single rooms earn less than apartments under monthly rent contracts than they do under Antichresis holding other variables constant. In addition, the number of suites and rooms seem to have a larger effect on price under Antichresis than under monthly rent contracts holding other variables fixed.

Table 5.2:
Hedonic Price Functions Estimated by OLS

	Antichresis	Monthly Rent	Sale
	log(*rA*) after tax[a]	log(*R*) after tax[b]	log(*Sale price)*
Distance from the CBD (Km)	-0.106	-0.062	-0.136
	[0.080]	[0.059]	[0.094]
North[c]	-0.143	0.409	0.669
	[0.248]	[0.248]*	[0.179]***
Center[c]	-0.488	0.182	0.223
	[0.212]**	[0.180]	[0.318]
House[d]	0.376	0.264	0.311
	[0.076]***	[0.081]***	[0.090]***
Chalet[d]	0.7	0.713	0.711
	[0.154]***	[0.130]***	[0.113]***
Commercial (office, store) [d]	-0.283	-0.273	-0.261
	[0.172]	[0.100]***	[0.139]*
Single Room[d]	-0.683	-1.067	-0.542
	[0.139]***	[0.077]***	[0.111]***
# of Suites	0.34	0.129	0.103
	[0.070]***	[0.095]	[0.057]*
Total # of Rooms	0.25	0.166	0.092
	[0.046]***	[0.038]***	[0.033]***
Median income(scale)	0.261	0.053	-0.072
	[0.162]	[0.151]	[0.191]
Constant	6.309	6.75	10.169
	[0.303]***	[0.207]***	[0.424]***
Observations	277	284	250
R-squared	0.58	0.69	0.41

Robust standard errors in brackets
* Significant at 10%; ** Significant at 5%; *** Significant at 1%
a. *rA* was calculated using a 10% rate of return
b. R was calculated subtracting all applicable taxes
c. Reference group is the southern part of the city
d. Reference group for property type dummies = Apartment

Table 5.3 presents the parameter estimates of the switching regression model estimated by FIML. The selection equation estimates are consistent with some of the

model predictions proposed in the previous section. Mainly, holding other variables constant, more expensive property such as chalets is more likely to be under Antichresis than apartments. Surprisingly, though, apartments are more likely to be under Antichresis than commercial property and single rooms. Larger property (greater total number of rooms) is also more likely to be under Antichresis than under monthly rent. Property in neighborhoods with a larger proportion of workers in the commerce sector is more likely to be under Antichresis. Finally, the percentage of children delivered in hospitals increase the likelihood of properties being under Antichresis. However this increase has a lower rate in neighborhoods with high proportion of workers in the commerce sector, as the negative sign on the interaction term between the two instruments reflects.

A comparison between tables 5.2 and 5.3 reveals several important discrepancies between the OLS and the switching regression estimates: The difference in prices in the south of the city compared to other part of the city disappears once we control for self-selection. The estimated difference between apartments and chalets in the monthly rent equation and apartments and commercial property tends to disappear as well once we control for the selection effect. The difference between apartments and single rooms is not significant in the Antichresis equation once we control for the selection effect but it is still significant in the monthly rent regime. The number of suites has a similar effect on price in both regimes after controlling for selection but the number of extra rooms becomes non-significant in the Antichresis equation once we introduce the selection effect.

Table 5.3 also shows estimates of the correlations between the selection equation errors u and the hedonic equations' errors ε_1 and ε_2 denoted as ρ_1 and ρ_2 respectively.

Statistically significant estimates of these parameters denote the presence of a selection mechanism. The negative sign in ρ_1 implies a negative covariance between the error terms in the selection equation (i.e. property under Antichresis) and the Antichresis hedonic equation or $\sigma_{u\varepsilon 1}<0$. Conversely, $\rho_2 >0$ implies $\sigma_{u\varepsilon 2}>0$. This, in turn, implies that $(\sigma_{u\varepsilon 2} - \sigma_{u\varepsilon 1})>0$ and provides evidence that properties are being selected into the regime where they can earn the highest yearly gross income[44].

[44] For a detailed explanation on how to interpret the selection effects based on the size and magnitude of these covariances see Maddala (1983) pg 258, 262.

Table 5.3:
FIML Estimation of Hedonic Equations Corrected for Self-Selection

	Selection Eq	Marginal effects[a]	Hedonic Eq (1)	Hedonic Eq (2)
	Antichresis =1	Antichresis=1	log(*rA*) after tax	log(*R*) after tax
Distance from the CBD (Km)	0.389	0.241	-0.113	-0.062
	[0.219]*		[0.084]	[0.070]
North[b]	-0.833	-0.175	0.073	0.44
	[0.941]		[0.317]	[0.306]
Center[b]	0.816	0.389	-0.278	0.203
	[0.958]		[0.297]	[0.268]
House[c]	-0.075	0.0004	0.391	0.27
	[0.141]		[0.083]***	[0.092]***
Chalet[c]	0.803	0.309	0.455	0.888
	[0.416]*		[0.230]**	[0.304]***
Commercial (office, store) [c]	-1.179	-0.382	0.138	-0.509
	[0.234]***		[0.198]	[0.124]***
Single Room[c]	-0.964	-0.346	-0.327	-1.273
	[0.176]***		[0.148]**	[0.102]***
# of Suites	-0.453	-0.077	0.478	0.057
	[0.119]***		[0.094]***	[0.056]
# of Rooms	0.067	0.032	0.225	0.178
	[0.059]		[0.042]***	[0.031]***
Median income (constructed scale)	-0.985	-0.217	0.219	0.038
	[0.661]		[0.170]	[0.146]
% of workers in the commerce sector	203.243	0.959	6.516	7.087
	[103.912]*		[0.362]***	[0.321]***
% hosp born children*% commerce sector emp.	-250.812	-0.837		
	[127.285]**			
% of children born in hospital	79.616	0.863		
	[40.279]**			
$\sigma\varepsilon$			0.642	0.569
			[0.052]***	[0.044]***
ρ			-0.797	0.691
			[0.083]***	[0.109]***
Constant	-65.76		6.516	7.087
	[33.557]*		[0.362]***	[0.321]***
Observations	561		561	561

* Significant at 10%; ** Significant at 5%; *** Significant at 1%

a. Measures the change from 0 to 1 for property type and geographic location dummies. For continuous variables, it measures the change from 1/2 std. dev. below the mean to 1/2 std. dev. above the mean

b. Reference group for geographical orientation dummies = South

c. Reference group for property type dummies = Apartment

Following Lee (1978) we estimate the average percent increment of the yearly income from a property being in monthly rent compared to one in Antichresis. Tables 5.4 and 5.5 show the average predicted yearly income using OLS and the selection corrected FIML estimates respectively. Each table shows the predicted average incomes for different types of property under the two contractual regimes for both samples. For each sample in both tables the first two rows show the average yearly gross income after taxes under monthly rent and Antichresis respectively. The third and fourth rows for each sample in both tables represent the ratio of the property's gross operating income to its estimated sale price under monthly rent and Antichresis respectively. This ratio is known as the gross capitalization (cap) rate. The fifth row for each sample in both tables represents the percentage gain in gross income after taxes that the average property could make by switching from Antichresis to monthly rent. For example, the fifth row in table 5.5 shows that the average apartment in the Antichresis sample would increase its after tax gross earnings by 88% by switching from Antichresis to monthly rent. This difference represents an increase of 2.10 percentage points in its gross cap rate.

Table 5.4:
Predicted Income Under Antichresis and Monthly Rent Contracts by Property Type Using OLS Estimates

Antichresis Sample	ROOMS	COMMERCIAL	CHALET	HOUSE	APARTMENT	TOTAL
Predicted R	$493	$1,080	$4,590	$2,509	$1,768	$2,037
Predicted A	$337	$502	$3,005	$1,567	$937	$1,201
Predicted R/S	2.36%	3.90%	4.99%	4.43%	4.34%	4.21%
Predicted A/S	1.61%	1.79%	3.12%	2.69%	2.25%	2.39%
Difference in gross income	46.24%	114.96%	52.75%	60.18%	88.78%	69.66%
Difference in cap rates	0.75%	2.11%	1.87%	1.74%	2.10%	1.83%
Monthly Rent Sample	**ROOMS**	**COMMERCIAL**	**CHALET**	**HOUSE**	**APARTMENT**	**TOTAL**
Predicted R	$473	$1,026	$4,898	$2,920	$1,720	$1,617
Predicted A	$312	$469	$3,946	$2,407	$915	$1,107
Predicted R/S	2.31%	3.84%	4.98%	4.59%	4.25%	3.75%
Predicted A/S	1.50%	1.74%	3.65%	3.36%	2.20%	2.26%
Difference in gross income	51.93%	118.92%	24.13%	21.32%	87.88%	46.14%
Difference in cap rates	0.82%	2.10%	1.32%	1.24%	2.05%	1.49%

Table 5.5:
Predicted Cap Rates Under Antichresis and Monthly Rent Contracts by Property Type Correcting for Self-Selectivity*

Antichresis Sample	ROOMS	COMMERCIAL	CHALET	HOUSE	APARTMENT	TOTAL
Predicted R	$580	$1,226	$7,461	$3,685	$2,564	$2,978
Predicted A	$663	$1,062	$3,816	$2,151	$1,288	$1,669
Predicted R/S	2.78%	4.43%	8.18%	6.50%	6.31%	6.08%
Predicted A/S	3.16%	3.80%	3.91%	3.69%	3.08%	3.39%
Difference in gross income	-12.40%	15.42%	95.51%	71.30%	99.01%	78.40%
Difference in cap rates	-0.38%	0.63%	4.28%	2.82%	3.22%	2.69%
Monthly Rent Sample	**ROOMS**	**COMMERCIAL**	**CHALET**	**HOUSE**	**APARTMENT**	**TOTAL**
Predicted R	$556	$1,163	$7,679	$4,185	$2,470	$2,242
Predicted A	$619	$995	$5,958	$3,792	$1,285	$1,774
Predicted R/S	2.71%	4.35%	8.00%	6.62%	6.12%	5.04%
Predicted A/S	2.97%	3.69%	5.32%	5.13%	3.09%	3.73%
Difference in gross income	-10.21%	16.87%	28.88%	10.36%	92.26%	26.35%
Difference in cap rates	-0.26%	0.65%	2.68%	1.49%	3.03%	1.32%

* Selection term not included in the predictions

Comparing tables 5.4 and 5.5 we can observe that OLS estimates tend to bias the earnings under Antichresis for most types of property downwards. The bias is especially large for commercial property and single rooms, which tend to have low λ. Once we control for this bias, we observe in table 5.5 that the average property under Antichresis would increase its gross earnings by about 80% if it switched to monthly rent. This represents an increase of 2.8 percentage points in its gross cap rate. Conversely, the average property currently under monthly rent would gain about 26% if it switched from Antichresis to monthly rent. This represents an increase of 1.3 percentage points in its gross cap rate. This difference may be explained by the risk premium in each market. Larger and more expensive property tends to be in the Antichresis market. Because of its

price this is also more risky property in terms of tenant's illiquidity. This higher risk is translated into a higher risk premium under monthly rent, which adds to the cap rate. This is the reason why property seems to earn more under monthly for all property types with the exception of rooms.

According to our theoretical model, once we control for the selection mechanism, we should observe that a property's yearly gross income under different contractual arrangements should vary by type. In other words, property with high λ should earn more under monthly rent than property with low λ. In our sample we expected that controlling for other characteristics, apartments, houses, chalets, commercial property, and single rooms should earn more under monthly rent than under Antichresis in that order judging by the size of λ in each of those property types.

The sixth rows for each sample in table 5.5 show that the theoretical predictions are consistent with what we observe for most types of properties. Mainly: After controlling for self selection, the property type with the highest λ (apartments) has the greatest increase in monthly rent earnings from switching from Antichresis to monthly rent in both samples. On the other extreme, property with the lowest λ (single rooms) is the type of property that loses the most by switching from Antichresis to monthly rent in both samples. In the same line, chalets and houses tend to benefit more from monthly rent contracts than commercial property, which tends to have lower requirements of landlord input (lower λ). Interestingly, chalets appear to benefit more than houses from monthly rent contracts in both samples. We expected the opposite considering that we suspect that chalets would need lower requirements of landlord input than houses, in part because of the greater effect of landlord on the property's residual value.

Finally, following Maddala (1983) and Cameron and Trivedi (2005) we computed the average gross benefit of choosing Antichresis (AGB_A) for each property *i* currently observed under Antichresis using the expressions:

$$AGB_A = E(rA_i \mid I = 1) - E(R_i \mid I = 1) \tag{10}$$

$$= X_i(\beta_1 - \beta_2) + (\rho_2\sigma_2 - \rho_1\sigma_1)(\tfrac{\phi(Z_i\gamma)}{\Phi(Z_i\gamma)}) \tag{11}$$

Table 5.6 presents the average AGB_A for each type of property[45]. The first and second columns present the first and second terms of expression (11) respectively. The selection effects are all positive; this means that, given the observable property characteristics in the model, properties are self-selecting into the regime that gives them the highest yearly gross earnings. The third column shows that the AGB_A are positive for commercial property and single rooms and negative for apartments, chalets, and houses. These results are consistent with the model predictions.

Table 5.6:
Average Gross Benefits of participation in the Antichresis Regime by Property Type

Property type	Average X($\beta 1 - \beta 2$)	Selection Effect	Average AGB
APARTMENT	-0.739	0.554	-0.185
HOUSE	-0.592	0.580	-0.012
CHALET	-0.834	0.388	-0.446
COMMERCIAL	-0.163	1.336	1.173
ROOMS	0.122	1.167	1.289
Total	-0.587	0.640	0.053

[45] The analysis presented in previous pages looks at averages of samples. This analysis uses property-by-property calculations and isolates the contract selection effect.

Conclusions

This chapter used market data on properties from the city of Cochabamba, Bolivia, to test the theoretical Antichresis contract model. The data was obtained from newspaper ads reflecting property characteristics, prices asked, and type of contractual arrangement. The econometric specification found a strong presence of self-selection of properties into Antichresis and monthly rent. The results indicate differences in the price generating functions between contractual arrangements once we control for selection effects. Furthermore, property under monthly rent tends to earn more (higher cap rates) than comparable property under Antichresis after controlling for self-selectivity. This difference is likely due to the risk premium inherent in monthly rent contracts.

The most important finding came from analyzing the selection mechanism that makes one regime more attractive than the other. Our results confirmed that the incentives pulling landlords towards the Antichresis regime are higher for property where landlord's investment impact on tenant's enjoyment of the property is lower (lower λ). This was the case for rooms and commercial property. On the other hand, for properties where landlord's investment impact on tenant's enjoyment of the property is high (higher λ), the incentives pulling landlords towards Antichresis were lower. This was the case with apartments, chalets and houses.

CHAPTER 6

SQUATTER SETTLEMENTS AND URBAN DEVELOPMENT

In previous chapters we explored how the division of property rights creates incentives that may resolve or create economic inefficiencies. The theoretical lease model presented in chapter 3 suggests that the periodic monthly rent and the Antichresis contracts arise to solve different problems associated with information asymmetries and moral hazard. We explore the importance of understanding the economic forces behind these contracts in the analysis of housing policy for the poor in greater depth in chapter 9 where we evaluate current claims that present the Antichresis contract as an innovative tool for low income housing provision. In this and following chapters, we explore how a different dimension of property rights can shape urban development and affect the quality of low income housing in developing countries. Specifically, we explore how a large informal housing sector, resulting from land invasions or illegal land sales, affects urban form and housing quality.

Informal transactions and squatting give rise to differing implied quality of land title and levels of ownership risk for occupants. Differences in title quality, especially when land is not formally conveyed, can have profound effects on economic development in general (Alchian and Demsetz, 1973; Alston, et al., 1996; Besley, 1995; Bohn and Deacon, 2000; De Soto, 2000) and urban development in particular (Miceli, et al., 2003; Turnbull, 2008). The underlying question addressed in the next three chapters is whether observed land use patterns are consistent with the predicted implications of ownership risk. This chapter briefly examines the current literature on property rights and

urban development and builds on Turnbull's (2008) model of squatting and eviction to make predictions about the spatial distribution and density patterns of informal settlements within a city. Chapter 7 considers the extent to which the initial legal status of the squatter settlement creates legacy effects on the type and quantity of subsequent investments in upgrading property after the settlement has been legalized and brought into the formal sector. Although the literature on informal property markets is large and varied, there has been to date no formal tests of the predicted ties between the initial legality of an urban settlement and the subsequent land use and property value. As a result, the nature of the squatting-urban development nexus remains an open question. In order to begin filling this gap in the literature, chapter 8 tests the squatting-land use relationships implied by theory, using block level data for Cochabamba, Bolivia. Cochabamba embraces a variety of informal settlements—from both land invasions and illegal consensual sales—as well as a range of current legal status, and therefore offers a particularly useful case for empirical study.

Squatting and Urban Development

The property rights-urban land development nexus has been the focus of growing attention in the field of urban economics in recent years. Part of this literature concentrates on the dynamic effects of insecure property rights arising from public sources like land use regulations and takings by governments, or private sources like squatters and adverse possession[46]. Turnbull (2005) argues that ownership risks arising from private sources (like squatters) tend to hasten the pace of land development at the

[46] See Turnbull (2005) for an overview of this literature.

city level more than ownership risks arising from government taking or regulation because they affect all land in an urban area rather than the narrower range of plots that are typically the target of government policy. Ownership risk arising from private sources also affects developers' choices of structural density. Whether ownership risk causes higher or lower structural density depends on the relative growth in the demands for alternative land uses over time; greater ownership risk will increase (decrease) the optimal development structural density when the demand for structural density of the plots with ownership risk is decreasing (increasing) over time. One implication is that, other things equal, locales with disorganized or corrupt titling systems and/or where squatting is pervasive will have less undeveloped land remaining in the urban interior than comparable cities with secure property rights. When applied to ownership risk from private sources, these models are useful for comparisons across different urban areas but they may not be as useful for empirical studies of land development patterns within a single urban area.[47] In any case, at the moment there are no empirical tests of models explaining the effects of squatter settlements on urban development.[48]

Jimenez (1985) offers a second type of model to explain the behavior of entire squatter communities invading government owned lands. In his model, the squatter community decides on the number of squatters to settle as a community. Additional members in the squatting community increase government's costs of land clearing and

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[47] This is because the risk to ownership that arises from private sources is spread equally across a particular urban area. The opposite is true when looking at ownership risk arising from public regulations such as zoning where the regulation targets specific parts of the urban area.

[48] Miceli, et al. (2002) focus on the effects of private source ownership risk from encroachment, conveyance errors, and fraud on property values in Chicago. As such, it does not address the level of ownership risk commonly associated with squatting or other forms of illegal settlement.

therefore decrease the probability of eviction. At the same time, however, additional members in the squatting community increase the cost of providing public services and property upgrading once the community is settled. Jimenez (1985) concludes that greater government efforts to reduce squatter settlements will actually result in more populated squatter communities.

A third type of model that appears in the urban economics literature concerning urban development and squatter settlements views the squatting process as an interaction between the individual squatter or squatter community and the private land owner in a dynamic context of a two-period environment (Jimenez and Hoy, 1991; Turnbull, 2007). The landowner holds undeveloped land in the first period that has an expected future value once it is developed for the formal sector in the second period. The greater the future expected value of the land, the more resources the owner will expend to secure eviction when he is ready to develop it. The squatters, however, invade the land in the first period while taking into account that the landowner may evict them in the second period. The squatters' investments in housing capital therefore reflect their anticipation of the likelihood of future eviction by the landowner.

In the Jimenez and Hoy (1991) model, squatters respond to the eviction plans announced by the landowner in the first period, regardless of whether the announced strategy represents a credible threat by the landowner. In this setting, the landowner's inability to legally collect rent from squatters prompts more frequent eviction than is efficient. Because squatters' housing demands are negatively related to the perceived probability of eviction, the inefficiently frequent eviction by the landowner leads to lower than efficient levels of investment in housing by squatters.

Turnbull (2008), on the other hand, assumes that squatters will believe the landowner's eviction threat only if it is credible, that is, if the owner's benefits from evicting the squatters in the second period exceed the costs. By excluding the possibility of non-credible threats by the landowner in the first period of the model, Turnbull (2008) finds a different result than Jimenez and Hoy (1991) concerning the squatter's housing investment strategy. In Turnbull's model, squatters have an incentive to over-invest in housing capital, making it more costly for the landowner to implement the eviction strategy. This leads to greater than efficient structural densities in squatter settlements.

Jimenez (1985) and Turnbull (2008) both predict that the density of a squatter settlement is positively related to the vigor of the landowner's eviction strategy, whether the owner is a private party or government. These predictions, however, have not been tested empirically. The empirical question of whether squatter settlements present greater structural densities than comparable non-squatter settlements also remains unsettled. We come back to these questions in chapter 8. The next section presents the Turnbull (2007) model of squatter-landlord behavior and extends it by adding a spatial component in the demand for land in the formal sector.

Squatting, Eviction, and Density

The Squatting Model

The Turnbull (2008) two-period model assumes a representative squatter who makes the decision on how much capital, h, to invest on a single plot of land owned by the landlord. The landlord then decides whether to develop the land for formal sector use in taking into consideration the capital investment made by the squatter in the first period. Her decision takes into account the value of the developed land in the formal property

market, V, where V reflects the state of the formal property market, indexed by s such that $V_s>0$. The index s is distributed over [0,1] with a cumulative density F.

Before developing the land for the formal land market, the landowner must first evict the squatter and clear his capital investment h from land at cost $C(h)$. The model assumes that additional capital per unit land h while holding land fixed increases landlords' clearing costs $C_h>0$. The intuition behind this assumption is straight forward; removing a two story house from a plot of land, for example, is expected to require more resources than removing a single story house from the same plot of land. The landowner will develop the land in the formal land market only if the present value of the net rent in the realized state s, $V(s)$ is greater than or equal to the cost of clearing the land $C(h)$: $V(s)\geq C(h)$ (with $V_s>0$ and $C_h>0$). In this manner, the land owner evicts the squatters and develops the land for formal sector use whenever the realized state of demand, s, in the formal land market is greater than the critical value θ satisfying

$$V(\theta)= C(h) \tag{1}$$

Thus, the landowner's eviction strategy is summarized by θ implicitly defined by (1). Solving implicitly,

$$\theta =\varphi(h) \tag{2}$$

with $\varphi' > 0$.

The representative squatter knows the landowner's eviction policy at the outset and includes it in his decision as a probability of eviction given by the function

$$\pi(\theta) = \int_{\theta}^{1} dF(s) \tag{3}$$

Given the landowner's credible strategy, the squatter maximizes her utility, which is a function of housing capital h and non-housing consuming goods *x*. subject to an income constraint

$$I = px + rh \tag{4}$$

where *I* is monetary income, and r and p represent the prices of capital and non-housing goods respectively. If the squatter is evicted he enjoys a utility $u(x,0)$ and if the squatter is not evicted he enjoys utility $u(x,h)$. Thus, the squatter's best response to the landowner's eviction policy is to maximize the expected utility function

$$Eu = [1 - \pi(\theta)]\, u(x,h) + \pi(\theta)\, u(x,0) \tag{5}$$

subject to (4). Doing so, the squatter's optimal strategy conditional on the landowner's behavior can be expressed as the implicit solution to the appropriate necessary conditions as

$$h = \psi(\theta, I, p, r) \tag{6}$$

where it can be shown that income normality or neutrality ($\psi_I \geq 0$) implies $\psi_\theta > 0$. Thus, under this set up, equations (2) and (6) can be used to show that the squatter's optimal level of housing capital and the landowner's critical demand state are strategic complements. Therefore, the private market equilibrium is given by the Nash solution $\{\theta^*, h^*\}$ satisfying (2), (6) and the usual stability conditions.

The Intra-Urban Spatial Component

Squatter settlements are mostly an urban phenomenon; yet, most models that explain squatting behavior and urban development omit a spatial element. The model described above is easily modified to introduce a spatial component to better understand the manner in which squatter settlements shape urban areas.

Bid rent functions decrease with distance from the city center in the standard neoclassical mono-centric urban land market (Mills, 1972; Muth, 1969). Land located near the central business district (CBD) garners higher rents in the formal sector than land located at the periphery where the price of urban land is driven equal to the price of agricultural land. For simplicity, figure 6.1 depicts a two zone circular urban area with center k_0, the single point representation of the CBD, and radius k_2. The first zone perfectly circumscribes the urban center with radius k1 (with $k_2 > k_1$) and the second zone comprises the residential area between k_1 and k_2. The distance k from the CBD to any point in the city were zone 1 ends and zone 2 begins is k_1 and the distance between the CBD and the city limit is k_2.

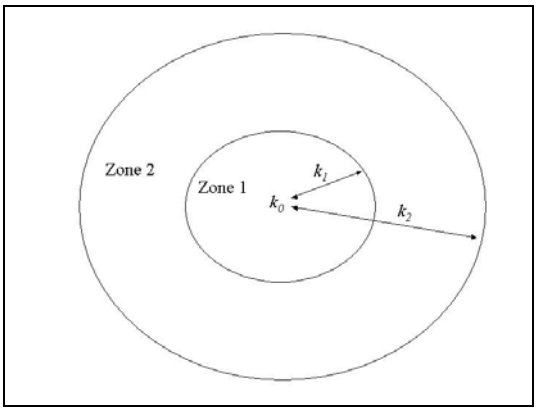

Figure 6.1:
Two-Zone City

Assuming that residents working in the city's formal sector commute to the CBD, location equilibrium requires that land rent, hence land value, decreases with distance k from the CBD, approaching the agricultural land rent at the city limit. Competition for land near the CBD will increase the demand for developed property in all states in the formal land market at a faster rate than it will for property far from the CBD. Thus,

distance k will enter the land owner's net return function increasing the demand for developed property as a shift parameter that varies with distance from the CBD, $V(s, \beta(k))$ where $V_\beta>0$ and $\beta_k<0$ $V_k=V_\beta\beta_k<0$. The equilibrium critical value θ^* satisfying (2) and (6) is now a function of distance k.

Totally differentiating (2) and (6) and solving for the comparative static predictions in the usual manner yields

$$\frac{\partial\theta^*}{\partial k} = -\frac{V_\beta\beta_k}{V_\theta(1-\phi_h\psi_\theta)} > 0$$

showing that the equilibrium critical value θ^* increases with distance from the CBD. This result is intuitively appealing. Greater distance from the CBD decreases the demand for developed land in the formal sector and therefore diminishes the range of second period demand states that make clearing land of squatters worthwhile to the landowner. The resultant increase in the critical value θ^* with greater distance reduces the range of states in which land will be formally developed, so squatting will be more likely to persist closer to the city fringe than near the CBD.

Illegal Subdivisions

Squatting is one option open to urban area residents. Another common strategy found in Latin America is that of urbanizing land despite prohibition by municipal land development regulations (Abramo, 2003). This practice of illegal land subdivision is commonly referred to as illegal "loteos" in Latin America, where land owners of agricultural land (usually with the help of professional "loteadores") divide their land and sell it as developable land to individuals or communities who then construct their own dwellings on these plots.

Turnbull (2008) also presents a model of an informal land market, interpreted here as the market for illegal subdivisions. The key difference between the informal market and the squatting situation is that the landowner can collect rent, *R*, from the informal settlers occupying the land in question in the former while no rent is collected in the latter. This is an informal transaction, that is, the transaction is not recognized under law. Therefore, the landlord remains free to clear the land in the second period and develop it for the formal sector if the gains from doing so exceed the costs, in forgone informal rent plus the clearing cost. Preserving the notation, the landowner's decision rule to develop in the formal sector is now given by:

$$V(\theta) - C(h) \geq R \tag{7}$$

which yields a new optimal strategy function for the landowner

$$\theta = \tilde{\varphi}(h) \tag{8}$$

The informal settler's expected utility function remains the same as in the squatter's case (4), but now the expected utility function is maximized subject to budget constraint (9) that includes the payment R in the first period:

$$I = px + rh + R \tag{9}$$

The necessary conditions for the informal settler's problem lead to a new housing demand function

$$h = \tilde{\psi}(p, r, I, R) \tag{10}$$

The Nash equilibrium for the informal land market $\{\tilde{h}, \tilde{\theta}, \tilde{R}\}$ can be compared with the equilibrium $\{\theta^*, h^*\}$ for the squatter case. In general, the rent *R* entering the landowner's function in the illegal subdivision case increases the owner's opportunity cost of developing the land for the formal sector. In other words, it reduces the range of

demand states for which it would be profitable to clear the land and develop it for the formal sector. On the settler's side, the extra payment R reduces his equilibrium utility level and therefore the demand for housing capital, h. As a result, in general, equilibrium eviction rates are lower in the illegal subdivision case ($\tilde{\theta} > \theta^*$) as is the equilibrium housing demand ($\tilde{h} < h^*$)[49].

Comparing Squatting and Illegal Subdivision Outcomes

The model does not make any explicit predictions about rent gradients in informal settlements beyond what location equilibrium predicts. It does, however, offer insights about density gradients. The previous result is straightforward: illegal subdivision generally leads to a lower density than does squatting. But more can be said. Because formal sector land rents tend to decline with distance from the CBD, structural density in the formal sector similarly declines with distance from the CBD. But what do we observe in an informal market comprising both squatters and illegal subdivisions? Informal market participants make decisions under the same economic incentives as their formal sector counterparts. Thus, sites near employment centers or amenities will tend to be more highly valued than locations not so fortunately situated. So, it is not surprising that we will observe negative rent and density gradients in informal settlements as well.

This yields a pattern of urban land use according to legal status of the original settlement. Refer to the linear city in Figure 6.2. The density curves for the informal sector (squatters and illegal subdivisions) lie above the corresponding formal sector density curve for equivalent distances from the CBD, as depicted for the outlying

[49] There may also be cases in which the informal subdivision market will have higher eviction rates or higher housing capital but never both at the same time (Turnbull ,2007).

locations in the figure (recall that informal land development is more likely in the outlying locations than closer to the CBD).

The model presented in this chapter suggests that informal development tends to use higher-than-efficient levels of capital per unit of land. This is because the amount of capital squatters invest on the land is directly related to their strategy to avoid eviction. The more capital they invest the less likely that they will face eviction. Squatters tend to have less income than city residents who have access to formal sector housing. As a result, in order to achieve high capital per unit of land, squatters tend to choose smaller plots of land than their counterparts in the formal sector in conjunction with several other squatters when occupying plots of land[50]. This creates informal settlements with greater number of homes and population per unit of land (i.e. higher density) than comparable formal settlements. Further, the density gradients for the informal sector tend to be steeper than in the formal market. This is because, even though proximity to the CBD increases structural density in both sectors, it also increases the probability of eviction in the informal sector and therefore increases the capital/land ratio faster in the informal sector than in the formal one as we move closer to the CBD. In Figure 6.2, formal sector development takes place in the zone nearest the CBD to k_a, informal subdivisions occupy the city from k_a to k_b and squatters occupy the city from k_b to the city limit k_c.

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[50] This effect is partially due to the normality of housing and the fact that formal sector consumers enjoy greater real income than do informally employed squatters.

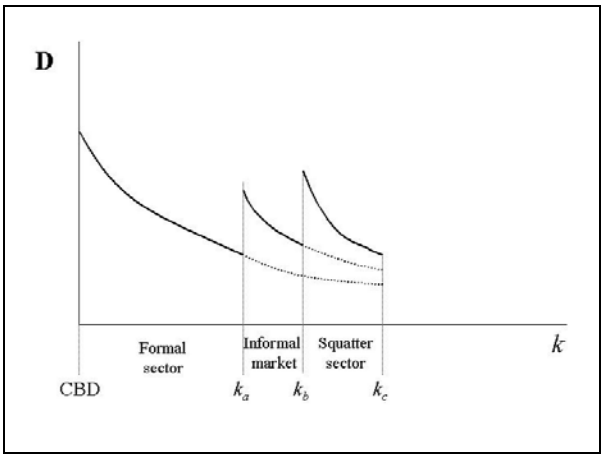

Figure 6.2:
Density Function of a Linear City with Informal Settlements

Implications for Community Squatting

The model above focuses on a representative squatter and an individual landowner. However, cases in which organized communities obtain land through both illegal land transactions and squatting are common and amply documented in the informal settlement literature. The Jimenez (1985) model describes the behavior of a squatter community invading public lands. Recall that the community's problem in this model is to determine the optimal number of squatters. Additional squatters lower the probability of eviction as they increase the costs of land clearing the landowner faces (there is a community level decision on the settlement's structural density). But additional members in the community also increase the costs of future public service provision and property upgrading once the community is settled. The formal model used above does not include the infrastructure and community service complications arising from community squatting, but it arrives at the same implication regarding density.

CHAPTER 7

LEGAL STATUS AND URBAN REDEVELOPMENT

In the last decade several countries have gone through great efforts to legalize squatter settlements and illegal subdivisions by providing property titles to squatters. These programs are being evaluated on several fronts. Specifically, the links between property titles and property values, health, child labor, access to credit, among others, have been the subject of several studies (Jimenez, 1984; Lanjouw and Levy, 2002; Do and Iyer, 2002; Besley, 1995; Carter and Olinto, 2000; Field, 2003; Galiani and Shargrodsky, 2004). This section explores the relationship between land title regularization of informal settlements and property redevelopment. Our interest lies with the property redevelopment/upgrading decision squatters and owners of property located in illegal subdivisions face once they receive legal recognition in the form of a property title.

We begin the analysis by recognizing that redevelopment/upgrading decisions involve expectations about the property's most profitable use in the future. Since urban growth and economic development are inherently dynamic processes, agents will maximize land profits by choosing the time and type of development they put in their property, basing their decisions on expectations of the city's future growth. Different plots of land will have different development options depending on their location in the urban area. For this reason, we explore informal settlement upgrading after title regularization using a partial equilibrium model of land development based on a standard spatial dynamic framework developed in a series of papers by Fujita (1982), Wheaton

(1982), and Turnbull (1988). While the original formulation treats location explicitly, we focus on individual plots of land and can therefore suppress location notation without loss of generality.

Consider a residential land user facing the decision to redevelop her property after a land title regularization program has granted her property rights that are recognized by law[51]. Following the established notation, the property has a structural density of h_0 at the time the property is regularized and formal title issued to the squatter. If the property owner wants to redevelop the land she must clear the land at cost C, which is an increasing function of the current structural density h_0. Building the new structure requires costs D, which is a function of the new structural density put in place h_n with $D' > 0$ and $D'' > 0$. The present value of land profit is

$$V(h_n, T, h_0) = \int_0^T R(h_0, t)e^{-rt}dt + \int_T^\infty R(h_n, t)e^{-rt}dt - [D(h_n) + C(h_0)]e^{-rT} \qquad (11)$$

where T is the time period during the which the property is redeveloped, $R(h_0, t)$ is the property rent during time period t with the structural density as it is at the time of regularization, $R(h_n, t)$ represents the property rent during time period t if a new construction with structural density h_n replaces the original h_0, and r is a discount rate.

Maximizing (11) with respect to h_n yields the structural density condition

$$\int_T^\infty R_{h_n}(h_n, t)e^{r(T-t)}dt = D'(h_n) \qquad (12)$$

In the same manner, maximizing (11) with respect to T yields the timing condition

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[51] Following mainstream law and economics literature we define property rights as a bundle of rights given to an individual over a defined property that include the right to use the property, exclude others from using the property and dispose of the property.

$$r[D(h_n) + C(h_0)] + R(h_0, t) = R(h_n, t) \qquad (13)$$

The structural density condition requires that the stream of extra revenues resulting from the redevelopment equals the extra cost of redevelopment in present value terms. The timing condition requires that the marginal benefit of waiting for redevelopment (equal to the savings of not incurring on the costs of demolition and new development plus the gains from the property under the current construction) equals the marginal cost of waiting (given by the forgone income from the property with the new construction in place). Conditions (12) and (13) yield the optimal time T^* for redeveloping the property at a new structural density h_n^* replacing the current structure h_0.

Totally differentiating the system (12) and (13) and solving in the usual manner shows that the optimal waiting time T^* unambiguously increases as initial levels of density h_0 increase:

$$\frac{\partial T^*}{\partial h_0} > 0$$

This result is intuitively appealing. Timing, in a redevelopment decision, is fundamentally a choice of how long to wait before redeveloping the property in order to make it more marketable. If the property is not redeveloped the owner earns rents produced by the original structure and she saves the (annualized) costs of redevelopment, which entail demolition costs and new development capital improvements. On the other hand, by waiting to redevelop the owner forgoes the income she would receive from the property when upgraded to h_n. The optimal development time T^* occurs when the marginal benefit of waiting is equal to the marginal cost of waiting. So what does this result mean for a legalized squatter settlement? In the previous chapter we established

that informal settlements tend to have higher structural densities than settlements originated in the formal sector as part of their survival strategy. When a plot of land has already been developed (by squatters in this case), redevelopment involves demolition costs, which increase the benefit of waiting. Greater initial structural density (in squatter settlements) translates into higher demolition costs, which in turn increase the benefit of holding off on property improvements a little longer. This means that property owners in former (legalized) squatter settlements will tend to hold off their redevelopment decision for longer periods of time than owners of property originated in the formal sector. The slower redevelopment will in turn have an effect on the quality of housing in squatter settlements.

Now we turn to the optimal density question: what is the optimal density of redevelopment (h_n) in former squatter settlements? The effect of initial development density h_0 on the planed future density h_n* depends on how the demand for density changes over time for the particular plot of land. Each location in the urban area will have competing demands for alternative uses over time. When the demand for alternative uses for a plot of land are changing over time in a way that the future best and highest use has a greater structural density than the current highest and best use, the demanded density is said to be rising over time (Wheaton 1982; Turnbull, 1988). In this case, greater initial density h_0 increases the optimal future density h_n*.

$$\frac{\partial h_n^*}{\partial h_0} > 0 \qquad \text{if } R_{ht} > 0$$

On the other hand, when the demand for alternative uses for a plot of land are changing over time in a way that the best future use has a lower structural density than current use,

the demanded density is said to be decreasing over time. In this case, the initial development density h_0 decreases the optimal future density h_n*. Thus,

$$\frac{\partial h_n^*}{\partial h_0} < 0 \qquad \text{if } R_{ht} < 0$$

These results suggest that settlements with higher initial levels of structural density tend to redevelop/upgrade later and at higher (lower) densities than comparable settlements that stared with lower structural densities in regions of the urban area where the demanded density is rising (decreasing) over time. Turnbull (1988) shows that the demanded density can be rising anywhere throughout a growing mono-centric urban area with homogeneous amenities, but it can be falling over time only at the urban periphery.

As we explained in the model of squatter behavior, informal settlements will tend to take place in the outskirts of the city. As the city grows, however, several of these settlements end up as interior areas of the city by the time they receive formal titles, areas where demanded density is rising over time. This suggests that informal settlements will eventually redevelop with even greater densities than comparable legally developed settlements. As a result, we expect to observe lower quality of housing (i.e. later redevelopment/upgrading) and greater density in settlements that originated informally when compared with similar settlements that originated legally. We test this prediction empirically in the next chapter using the case of Cochabamba, a medium sized Bolivian city.

CHAPTER 8

DATA AND EMPIRICAL METHODOLOGY

Brief History of Urban Cochabamba

Cochabamba was founded in 1574 as a center of food production and shipment that for the booming colonial mining industry in the western part of what is known today as Bolivia. Situated at 8,360 feet (2,550 meters) above sea level on the fertile lands of the low valley region of the state of Cochabamba, the city became the largest distribution center for the grain and chicha[52] that was produced in its hinterland (Solares and Rodriguez-Ostria, 1990). Up to the 1900's, the city experienced slow growth (see map 8.1.1) as its economy remained virtually unchanged (Ledo and Escobar, 1988). Even after Bolivia's independence from Spanish colonialism in 1825, neither its production nor its production methods changed significantly (Solares and Bustamante, 1986). By 1900, the city's population grew to become the second largest city in Bolivia, with 21,886 habitants living in an urban area of around 230 Hectares (see tables 8.1.1 and 8.1.2)

The period between 1900 and 1950 represents the first significant population growth episode caused by a wave of peasants leaving the countryside and migrating to Cochabamba in search of a better life. Solares and Rodriguez-Ostria (1990) attribute this first wave of rural-urban migration in Cochabamba to a large number of discharged soldiers in the Chaco war that Bolivia lost in 1935 to Paraguay. Many of the soldiers

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[52] A popular alcoholic beverage made of fermented maize

were farmers who used to work under the "pongueaje" system[53]. They decided to establish residence in the city to avoid returning to the conditions of their farm life. The migrants were not welcomed to the city as the established middle class reacted with fear to the wave of new indigenous migrants and the city was not prepared to accommodate the new comers. The result was the first housing crisis in the city (Goldstein, 2004). Physically, the city began its expansion in this period, incorporating neighborhoods to the north and south (see figure 8.1). The introduction of the automobile and the construction of the airport in the south of the city also contributed to this spatial expansion. But it was the population explosion that put the most pressure on land located at the city limits. As the indigenous migrants began urbanizing the southern part of the city, the need for a comprehensive growth plan became evident and the fearful ruling elite did not wait long to embark on the task.

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[53] System of indentured servitude, equivalent to bonded labor in the US

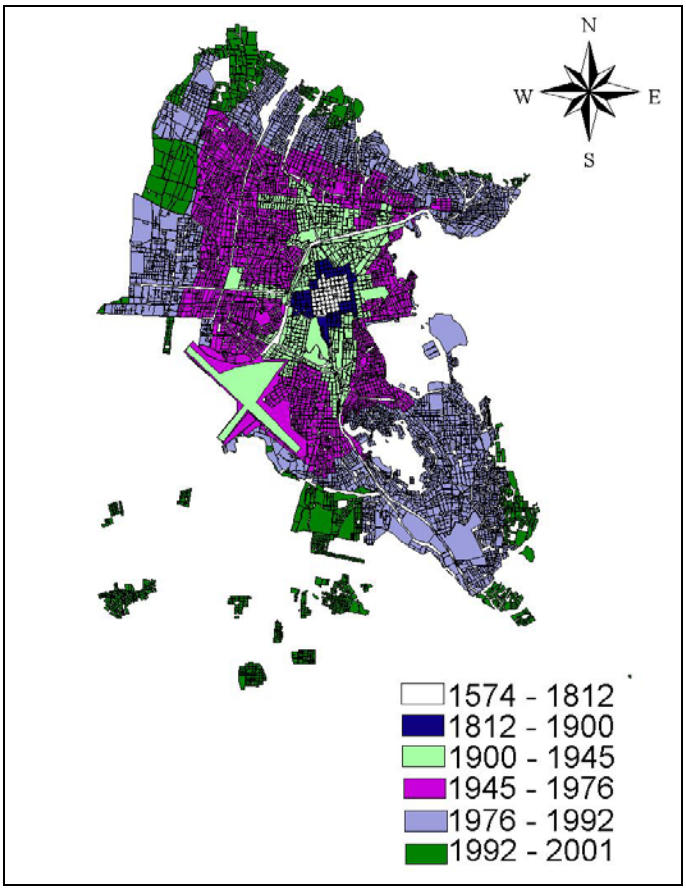

Figure 8.1:
Cochabamba's Urban Growth 1812-2001

The First Law of Urbanization and Squatters Settlements

In the early 1940s Cochabamba was experiencing unprecedented rapid growth that was perceived as chaotic and dangerous to the city by the ruling elite (Solares and Rodriguez-Ostria, 1990). One of the main preoccupations was the growth created by loteadores[54] . These individuals would subdivide rural land with no services or transportation connection to the city, advertise it as future modern urbanization, and sell to migrants coming to the city. As Solares and Rodriguez-Ostria (1990) describe, press

[54] Illegal land broker/speculator

editorials often referred to loteadores as “enemies of Cochabamba” but public repudiation could not stop their lucrative practice. It was not until 1946 that the first “General Law of Urbanization” was enacted to define legal urbanizations as those that complied with municipal guidelines and had public services. The General Law of Urbanization was later complemented with the 1950 comprehensive plan that regulated the city’s future growth (Solares and Rodriguez-Ostria 1990). The plan was later updated in 1961 and 1985. One of the main characteristics of the comprehensive plan was based on the “garden city” concept taken from the writings of Ebenezer Howard (1902). This concept advocated the creation of greenbelts surrounding decentralized urban satellites. The plan’s concept brought special attention to green areas that surrounding the city by serving as natural boundaries to the urban space and separating the city from other neighboring urban centers: “Sacaba” situated on the east, “Quillacollo” on the west; and a third urban center to be created later in what is now the “Valle Hermoso” neighborhood in Cochabmaba (Goldstein, 2004).

The comprehensive plan came at a time when drastic transformations were taking place in Bolivia. In 1952, a popular uprising guided by the Nationalist Revolutionary Movement (MNR in Spanish) party toppled the military government and instituted profound social and economic changes in the country. These changes included an agrarian reform that redistributed agrarian land in the western and central part of the country to peasant workers. By this time, Bolivia’s main cities were still experiencing a housing crisis created by rural-urban immigration. When city dwellers who lived as

renters observed their rents rising they began to organize in "sindicatos de inquilinos"[55] and push for an urban reform (Solares, 1999).

The MNR's government response to the housing problem was to enact the Urban Reform Law in 1956. This law involved the expropriation of undeveloped land parcels greater than 1 hectare in urban centers to distribute it to the "sindicatos de inquilinos" that denounced the existence of such plots. It is hard to quantify the effect of such reform in Cochabamba since the city did not have a cadastre at the time, but some authors estimate that no more than 5 hectares[56] were affected by the reform (Rivera, 2005). Solares (1999) claims that this reform was not effective as it tended to favor government-supporting groups only and it was not enough to solve the housing crisis of the time. In 1960, under these conditions, the "sindicato unico pro vivienda" San Miguel began the first successful land invasion at the southeastern part of the city on the San Miguel hill (see figure 8.2). The San Miguel hill was a part of a green belt proposed in the municipality's comprehensive plan and part of a reforestation project. The worst encounters between the squatter settlers and municipal police took place in 1961. The squatters were organized and armed with dynamite. At the end, the "sindicato" prevailed and by 1962 the squatter settlement occupied the entire Cerro Verde and San Miguel hills. After a series of legal battles, these settlements were later regularized and property titles were given to the squatters in the late 1970's (Solares, 1999).

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[55] Renter unions

[56] At this time, the city had an area of about 1300 hectares. As a result, less than 0.3% of the city's area was affected by the urban reform law.

After 12 years in government, the MNR party fell to the military regime led by Rene Barrientos, later replaced by a series of military dictatorships that governed Bolivia until 1982. According to Solares (1999), these military regimes did not significantly change the existing housing policy. However, two aspects influenced urban growth during these regimes in the 1950s and early 1960's: (1) Most of the renter's unions were abolished or lost power as they were considered a threat to military regimes; and (2) squatter evictions became more effective because they had complete military support. An example of these changes in government response to squatters was the violent eviction that took place in the eastern part of the city in 1979[57]. Despite these conditions, during this period, there was one successful land invasion in barrio El Solterito. There was also the beginning of one of the largest squatter settlements in the city: barrio Alto Cochabamba in the southern part of the city (see figure 8.2).

During 1950-1976 the city approximately doubled its population and its urbanized area. This period also marked a turning point in the city's history as it had its first forms of illegal growth- mostly in the form of land invasions. In this period illegal settlements accounted for about 10% of the urban area growth (see table 8.1). The rapid population growth and the lack of available legal urban space were the precursors of an explosion of illegal settlements in years to come.

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[57] In this incident 400 families were evicted at nighttime and relocated after a long and painful struggle to what is known today as *Barrio 24 de Enero* (Neighborhood January 24th) (Richmond, 1997).

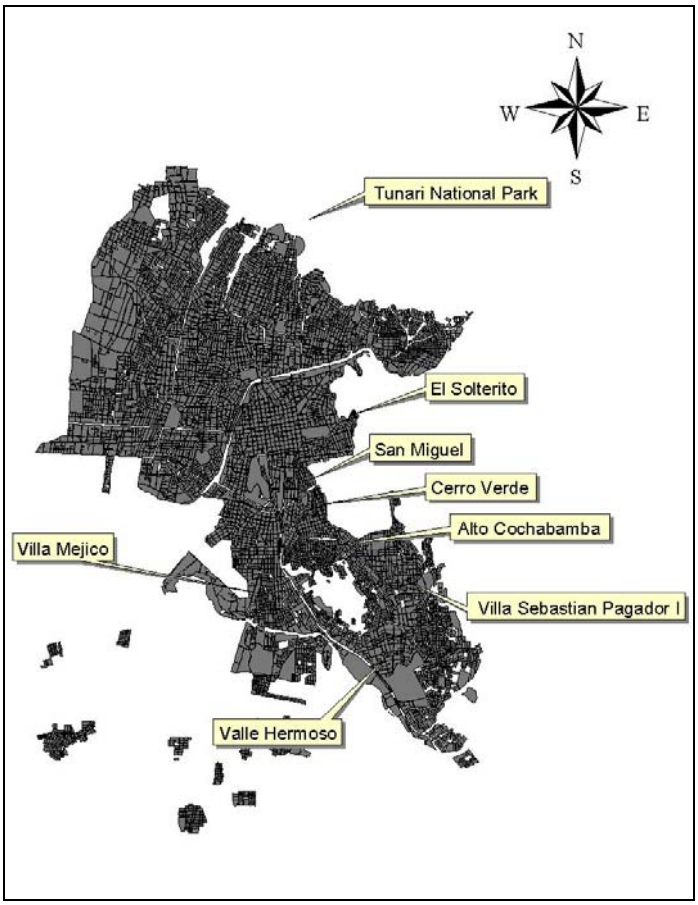

Figure 8.2:
Selected Illegal Settlements in Cochabamba

The Illegal City

In the period between 1976 and 1992, the city had an annual population growth rate of 4.55 % and the urban area grew by about 2800 hectares. Various factors motivated this rapid growth. Among the most important was the drop in international prices of mineral exports that created a financial crisis at the national level which prompted the closing of state mines in the western part of the country. This event, coupled with a severe drought in the western region, encouraged thousand of indigenous land workers and miners to look for better opportunities in Cochabamba and Santa Cruz.

In Cochabamba, the new migrants found a booming illegal land sale market that could accommodate them in the southern part of the city. Some migrant communities took advantage of a government plan (Plan socio Urbano) to obtain land and regularize it even if the acquisition was not completely legal- for example, the case of "Villa Mejico" (1978); or it was recognized by the municipal comprehensive plan- for example, the case of "Villa Sebastian Pagador I" (1977) in the southeast (see map 8.1.2).
Other communities were acquired directly from loteadores through illegal land sales.

Municipal authorities failed to control this type of development because they lacked the political and economic resources required for massive evictions (Solares and Bustamante, 1986). By the late 1970's the municipal authorities realized that the comprehensive plan was obsolete and tried to update it in 1985. At this point, the municipality declared most of the growth taking place in the southeastern part of the city as illegal and took action denying public service provision and freezing all attempts from settlers to legalize these plots (Goldstein, 2004). This strategy, however, did not discourage loteadores from subdividing and selling more land in this and other regions of Cochabamba. It was not until 1993 that the municipality opened the opportunity for these settlements to be regularized. During 1976-1992, the city's urbanized area grew by 2,778 hectares. Only 70% of those were legal (see Table 8. 2.).

Table 8.1:
Population Growth in Cochabamba 1900-2001

Time period	1900-1950	1950-1976	1976-1992	1992-2001
Population at the beginning of period	21,886	80,795	203,447	414,307
Population at the end of period	80,795	203,447	414,307	517,024
Years	50	26	16	9
Annual Population growth rate	2.65	3.62	4.55	2.49

Source: Ledo (1988) and Bolivian Census 1992, 2001

Facing the Problem of Illegal Settlements

After several years of virtually ignoring illegal land subdivisions in the southern part of the city, the municipal government began applying a policy of inclusion to these settlements (Goldstein, 2004). This policy shift in policy was caused in large part by a second wave of structural reforms at the national level began in 1985. These reforms included the widespread privatization of public enterprises and an aggressive plan of administrative and fiscal decentralization that gave more importance and power to state and municipal governments. Of special interest to urban development were the Law of Popular Participation (LPP)[58], the Law of Administrative Decentralization (LAD)[59], and the Law of Municipalities (LM)[60]. The LPP authorized the creation of a new stratum of an elected political leadership below the municipal level. Under the LPP, urban and rural neighborhood organizations could be constituted as "Organizaciones Territoriales de Base) (OTB) (basic territorial organizations) and were able to obtain public funds directly from the central government for development projects that concerned their jurisdictions.

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[58] The law of popular participation, also known as "Ley 1551 de participacion popular" was enacted by congress in April 20th 1994.
[59] Ley de decentralizacion administrativa 1654, enacted by congress July 28, 1995
[60] Ley de Municipalidedes 2028, enacted by congress in October 28, 1999

By the late 1990's there were around 343 OTBs in the city of Cochabamba; most of them in areas with a large proportion of illegal settlements (Cochabamba-Municipality (2005)). The LPP also defined municipal and state boundaries. Thus, under the new boundary delimitation, Cochabamba's municipal government incorporated its 9th and 13th district. The former district was mostly rural at the time, but today is the district with the highest level of illegal subdivisions. The former was a national park situated in the northern part of the city. As a national protected area, the park became under the state government control. However, because of its location it was part of the municipal government's jurisdiction. Municipal and state governments engage in disputes over territorial management of the park to this day.

The LAD came to strengthen the LPP by giving state governments more autonomy in the use of funds and financing mechanisms. But it was the LM that gave municipalities the power to administer their own revenue systems and increased their police power and resources for planning and evictions.

The political and administrative structural reforms taking place during the 1990's at the national level gave municipalities more funds and authority to face their urbanization problems. It also gave them more incentives to incorporate illegal settlements into the city -especially into the city's revenue system. Under the LPP organized neighborhoods could obtain resources directly from the central government to upgrade and build services on their own. Under the LM, the municipality could now take some of the political credit for the upgrades as well as access to additional sources of revenue from legalizing and taxing these settlements. Along these lines, the municipal government of Manfred Reyes villa (1993-2002) created decentralized offices or sub-

municipalities, also known as zonal workshops. The main objective was to regularize illegal settlements and to control the urbanization process in protected areas better, following the updated plan of 1981 (Goldstein, 2004).

In the 1992-2001 period, most of the illegal settlements in the southeastern part of the city were regularized through the issuing of titles for individual land plots. This massive legalization effort was accompanied by an upgrade of the entire cadastre system and brought neighborhoods to comply with some urbanization rules. In some cases, the municipality had to adapt the rules to the established development characteristics. As a consequence, for example, it decreased the minimum allowed plot size from 250 to 180 square meters (Cochabamba-Municipality (2005)).). In the period between 1992 and 2001, Cochabamba's population grew at a much slower rate than it did in the previous 50 years. But the lower population growth rate did not stop the boom in illegal subdivision markets taking place in district 9 corresponding to the southern part of the city. During this period, the city added about 1,000 Hectares of urbanized land. 70 % of this urban expansion was in the form of illegal subdivisions.

Table 8.2:
Urbanized Area Growth 1812 –2001

Time period	1574-1812	1812-1900	1900-1945	1945-1976	1976-1992	1992-2001	Total
Growth in # of city blocks	74	92	588	2171	2655	1001	6581
Growth in Urbanized Area (Hectares)	77	110	1,110	2,049	2,778	957	7,081
Growth in # of legal city blocks	74	92	588	1892	1527	149	4322
Growth in Legal Urbanized Area (Ha)	77	110	1,110	1,870	1,956	285	5,408
% Legal Growth (Area)	100	100	100	91	70	30	76
% Legal Growth (city blocks)	100	100	100	87	58	15	66

Source: National Institute of statistics INE Cartographic data 1976, 1992, 2001 and Solares (1990)

Illegal Subdivisions of the XXI Century

The 2001 population census showed that the southern part of the city had the highest growth rate by means of illegal subdivisions. The census revealed that the city is still attracting rural migrants who settle this area through illegal purchases of land. During 1992-2001 the population in this area quadrupled and the number of illegal settlements grew at a yearly rate of approximately 20% (Montano, 2007). Facing this phenomenon, the municipality started a new regularization plan supported by the law of Regularizacion de Fundos Urbanos signed by president Carlos D. Mesa in 2002. The law creates programs of Shared Responsibility Agreement (ARCO in Spanish) that requires municipalities and central government to regularize illegal settlements that originated before 1998.

To date, the rate of urbanization through illegal land subdivisions far exceeds the rate of regularization (Solares, 2006). Overall, in the past 10 years, government response towards illegal subdivisions ranges from quick evictions to full regularizations with no consistent pattern. In many cases, the municipal government ignores new settlements as

illegal land brokers have devised more effective ways to evade municipal regulations (Montano, 2007). Violent land disputes among settlers are common in certain areas of the city's southern districts because plots are sold several times to different owners or to different communities (Cochabamba-Municipality (2005)).). These disputes have turned more violent with rising expectations of regularization. Nonetheless, land prices increased dramatically in anticipation of regularization (Farfan, 2004).

A Typology of Settlements Based on Legality of Origin

The theoretical model proposed in this dissertation predicts that the legal origin of a settlement is directly related to its structural density because it determines the optimal strategy settlers will follow in order to avoid eviction based on landowners' credible threats. For the purpose of this dissertation we identified 5 types of settlements according to their legal origin in the city of Cochabamba: (1) Legal settlements, (2) Squatter settlements, (3) Government supported settlements, (4) Illegal land subdivisions, and (5) Illegal subdivisions in protected areas. All these types of settlements are presented in figure 8.3.

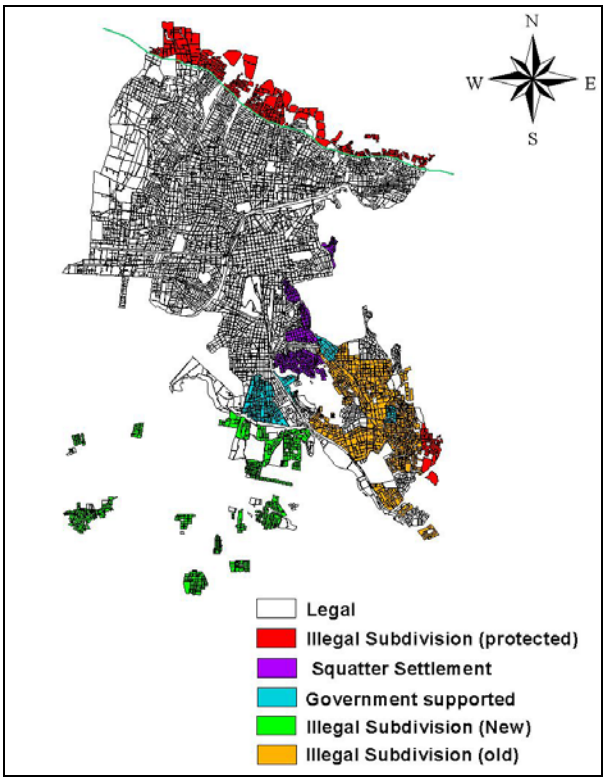

Figure 8.3:
Settlements by Legal Origin

Legal Settlements

By definition, legal settlements are those that comply with the laws of urbanism and the laws of property. Legal settlements are typically developed on purchased land. Every purchase needs to be recorded in the real estate office and the sale needs to be notarized as a public document. In addition, before a legal settlement is developed, the municipality has to approve that the development follows all the regulations established in the city's master plan and that all the fees and taxes are paid in full. Successful completion of all of these requirements typically result in the issuance of a "property title" which is the only legal document that gives the "owner" the legal right to use, transfer, and dispose of the property in the eyes Bolivian law. Although, the laws and

regulations have changed over time, all development that did not break existing laws at the time is considered a legal settlement. This type of settlement, by definition, did not follow any strategy to avoid eviction at the time of origin.

Squatter Settlements

This type of settlement refers to those neighborhoods that originated from an individual or a community invading land owned by other public or private parties. The laws of property were broken because no sale of land was completed before the occupation and no registry of property transfer was made in the real estate office. Moreover, in addition to violation of property laws, all squatter settlements broke the norms of urbanism by taking place in land reserved for uses other than residential and without any consideration of building codes. The first squatter settlements were formed in the early 1960's and two other settlements followed in the 1970's. Although the first squatter settlement faced the hardest opposition from government and battled evictions more than the other two, all of them faced legal battles and high probability of eviction from the time of initial settlement until they were fully regularized and titled. Our theoretical model predicts that this type of settlement will exhibit higher densities than comparable legal settlements and comparable illegal subdivisions.

Government Supported Settlements

Until the MNR government came to power in 1952, housing policy for the poor had been reduced to rent controls that had little or no effect on solving the housing crisis

in the city of Cochabamba[61]. It was in the late 1950's that the national government decided to actively participate in the planning and construction of housing for the poor by creating several offices and plans that were to work with municipal government. In 1956, one of the first interventions was the construction of the neighborhood Barrio Minero as part of the "Consejo Nacional de Vivienda" (CONAVI) in the southeastern part of the city followed by other major interventions under the "Plan Socio-Urbano" such as "Sebastian Pagador I", "Villa Mejico," and "Las Ulalas".

This type of development was originated by organized communities that received support from the central government to acquire land in vacant plots, and then acquired municipal support in the planning stage. Nonetheless, in most cases these communities settled in the areas before the land transfers were completed or even initiated -as in the case of "Villa Mejico" (Torrico, 1999). In other cases, the municipality had not even approved their settlement - as in the case of "Villa Sebastian Pagador" (Goldstein, 2004). In most of these cases the communities took the land, and developed it in order to pressure the municipality to approve the plans and legalize ownership of the settlements. Thus, this type of development responded to a strategy similar to that of the squatters but with a lower probability of eviction since they knew that there was an a priori intention from the municipal government to help them settle, even if it was not on the places or in the circumstances these developments took place. Thus, we expect this type of

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[61] This rent controls were first enacted in 1937 by President German Busch and then again in 1945 by President Gualberto Villarroel. However, none of them had a significant effect on reducing rents or solving the housing crisis (Solares, 1999)

development to have greater structural densities than comparable legal settlements but less structural density than squatter settlements.

Illegal Land Subdivisions

This type of development refers to those settlements that originated under direct violation of the laws of urbanism. Usually, these settlements originated in rural lands owned by agrarian communities that benefited from the agrarian reform of 1952. As these lands were subdivided among community members' families over the years following the agrarian reform, they became inefficient for agricultural use. These owners then sold their plots to illegal land brokers or loteadores, who subdivided them and sold them as urban land. Property laws were not completely violated because there was an exchange of rents and some documents signed (as public documents in some cases) but rarely recorded in the real estate office (Zapotocka de Ballon, 2007). This is by far the most common type of illegal settlement in Cochabamba and it is as common today as it was in the early 1970's (Montano, 2007). The strategy in this type of development is to build with enough density to avoid evictions; but since this type of settlers pay for the land, landowners' credible threats of eviction require less structural density than squatter settlements. Thus, we expect these types of settlements to have less structural density than comparable squatter settlements but have higher structural density than comparable legally developed land.

Illegal Land Subdivisions in Protected Areas

This final type of development shares the same characteristics as the illegal subdivision development described above with the difference that its location is in national parks (forest areas). At the time these forest areas were declared national parks

they were owned by private parties. National park regulations did not expropriate the lands but restricted their use for forestry or specific types of agriculture. National park regulations were respected until the late 1980's but changes in the law created an opportunity for illegal land brokers to subdivide these lands and sell them as urban.

As explained above, national parks control was given to state governments under the LAP, however, the Law of Municipalities gave municipal governments control of all the area situated in urban municipal districts including parks. This incongruence in law gave room for disputes over national park jurisdiction. Many illegal land brokers took advantage of the situation and used this opportunity to develop land on in the northern part of the city (Solares, 2006). Because municipal and state governments could not agree on jurisdictional issues no evictions or enforceable controls were imposed. Furthermore, because this land was not developable under the national park law, owners did not have the incentive to claim it back. In recent years the municipality initiated an effort to regularize the legal situation of some developments situated in the northern part of the city, but because of their national park status, they require changes in national law which have proved difficult to obtain. Our model would predict this development to have lower structural density than comparable squatter settlements or illegal subdivisions but more density than comparable legal settlements.

Data and Empirical Models

To test our hypotheses, we use city blocks as our unit of analysis. The data is drawn from the 1992 and 2001 censuses collected by the Bolivian National Institute of Statistics (INE in Spanish) for the entire city. Land prices were obtained from the municipality's cadastre system, which was updated in 2002. In order to classify the

settlements by legal origin, we used municipality maps reflecting the city's master plans in 1945, 1961, 1977, and 1998. We also relied on the expert advice of urban historian Humberto Solares when classifying city blocks according to their legal origin[62]. Table 8.3 presents the variables used in the empirical analysis.

Population Density Models

We use several common rent and density gradient specifications to test the relationship between a settlement's legal origin and its characteristics in the year 2001. Our simplest model uses a basic negative exponential function where density follows an exponential function (Clark, 1951; Mills, 1972; Muth, 1969),

$$D = D_0 e^{-\gamma k + \beta x}$$

where D is a measure of density, D_0 is the density at the CBD, k is a measure of distance from the CBD, and γ denotes the density gradient holding other variables fixed. We also include a vector **X** of variables thought to influence population density, such as distance to a major transportation artery, block income, provision of public services, direction from the CBD (in octants), time period of consolidation, and a set of dummy variables indicating legal origin type[63]. Table 8.2.1 presents descriptive statistics for all the variables used in the analysis.

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[62] Professor Solares of San Simon University is one of the most recognized urban historians in Cochabamba, with several books and influential professional reports on the city's urban history.

[63] We used information in the 2001 census to construct an income scale at the block level applying factor analysis. The variables included in the analysis were: percent of households in the block that own a TV set, percent of households in the block that own a car, percent of households in the block that own a refrigerator in the kitchen, and percent of households in the block that own a telephone line. These 4 variables produced a highly reliable index of city block income (Cronbach Alpha = .88) that explained 75 % of the combined variance of the variables used. For details on the construction of this variable please refer to the appendix section.

Following Frankena (1978) we also consider an alternative functional form using a third degree polynomial specification:

$$D = D_0 e^{(\gamma_1 k + \gamma_2 k^2 + \gamma_3 k^3 + \beta x)}$$

Finally, a third variant follows Kau and Lee (1976), allowing for different functional forms in the gradient estimation using a Box-Cox transformation of the form:

$$\frac{D(k)^{\lambda} - 1}{\lambda} = \gamma_0 + \gamma_1 k + \beta x$$

We use two indicators to measure development density: total population per hectare and total number of homes per hectare, exploiting the principle that structural density and population density are vertical translations of each other in standard urban economics literature.

Land Price Models

We also estimate land price gradients, using analogues to the density gradient models described above. Land prices are measured in 2002 US dollars per hectare. Our interest in the land price gradient is driven by the rent relationship implied by the underling density gradient and the degree to which the legal status of the settlement confers secure title to land occupiers.

Housing Quality Models

The variables indicating settlement housing quality are measured as a proportion of homes in a city block that fall into a high, medium and low quality (Q) classification. We used the Bolivian INE index to define housing structure quality by evaluating each

home's construction materials in walls, roofs and floors[64]. Because these variables represent proportions, we used fractional Logit specifications as suggested by Papke and Wooldrige (1996)[65] . Thus, the housing quality models are estimated using

$$Q = G(\beta x) + u$$

where $G(\cdot)$ is a logistic function and vector x includes distance from the CBD, distance to a major transportation artery, block income (scale), % of homes in the block connected to the sewer system, direction from the CBD (in octants), time period of consolidation, % of homes occupied by owner, and legal origin type.

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[64] The appendix contains the details on how this variable is constructed.
[65] We also estimated these models using two-limit linear Tobit specifications. The results were virtually the same as those obtained from the fractional Logit marginal effects evaluated at sample mean values.

Table 8.3:
Descriptive Statistics

Block's Legal Origin	**City Blocks N**	**Percent**	**Cum.**
Illegal Subdivision (protected area)	334	5.06	5.06
Squatter Settlement	304	4.61	9.67
Public Supported Subdivision	221	3.35	13.01
Illegal Subdivision (Still Illegal)	581	8.8	21.81
Illegal Subdivision (Now legal)	818	12.39	34.21
Legal	4,343	65.79	100
Consolidation Time Period	**City Blocks N**	**Percent**	**Cum.**
1574-1812	74	1.12	1.12
1812-1900	91	1.38	2.5
1900-1945	584	8.85	11.35
1945-1976	2,171	32.89	44.24
1976-1992	2,656	40.24	84.47
1992-2001	1,025	15.53	100
Octant (Origin =CBD)	**City Blocks N**	**Percent**	**Cum.**
1. N-NE	611	9.26	9.26
2. NE-E	533	8.07	17.33
3. E-SE	228	3.45	20.78
4. SE-S	1,987	30.1	50.89
5. S-SW	802	12.15	63.04
6. SW-W	431	6.53	69.57
7. W-NW	727	11.01	80.58
8. NW-N	1,282	19.42	100
Block characteristics	**City Blocks N**	**Mean[a]**	**Std. Dev[a].**
Population Density (Pop/Ha)	5896	115.4	80.59
Homes Density (Homes/Ha)	5949	27.27	19.68
Land Price ($US/Sq m)	6601	79.37	74.54
Distance from the CBD (Km)	6601	4.47	2.23
Distance to a major Road (m)	6601	855.56	1266.08
% Homes connected to sewer system	5880	52.65	45.14
% Homes occupied by owner	5880	54.31	21.6
% Homes under Antichresis tenure	5880	8.81	10.5
% Homes under monthly rent tenure	5880	23.59	17.56
Income (Factor)	5787	0	2.03
% of High Quality homes	5880	40.65	32.22
% of Medium Quality homes	5880	56.87	31.19
% of Low Quality homes	5880	2.5	8.4

a. Calculated using the number of city blocks observed for each variable

Empirical Results

Tables 8.4 and 8.5 show the density gradient estimates using both population density and structural density, respectively, for the various specifications. Given the high correlation between population destiny and structural density implied by standard land use theory the similarity between the results using these indicators is not surprising[66]. In both tables, column 1 shows the simple negative exponential specification and column 2 allows for differences in gradients across legal origin types. Column 3 shows the cubic function estimates and columns 4 and 5 present the Box- Cox transformation estimates in both tables. In the simple negative exponential specification (column 1 in both tables), all of the coefficients on legal origin binary indicators using formal development as the reference group are positive and statistically significant. This shows that development in the informal sector occurs at higher density than development in the formal sector as the theoretical model presented in chapter 6 suggests.

City blocks that originated as squatter settlements through violent invasions of land tend to have 57% more housing units per hectare than comparable formal development. Further, city blocks that originated as squatter settlements tend have higher population and structural densities than blocks that originated as informal land sales (which tend to have 33% more housing units per hectare than formal development) and government supported subdivisions (which tend to have 31% more housing units per hectare than formal development). Interestingly, the highest density was observed for

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[66] In our sample the Pearson correlation coefficient between the population per hectare and number of houses per hectare was 0.94.

recent illegal subdivisions, which tend to have 62% more homes per hectare than comparable settlements originated in the formal sector.

The empirical models show that there are differences in density gradients within different types of informal development as evidenced by the statistically significant coefficients on the interaction terms between the legal origin indicators and distance from CBD in models 2 and 5 of tables 8.4 and 8.5 figure 8.4 depicts these differences in density gradients across legal status using the Box-Cox estimates from model 5 in table 8.4. Squatter settlements, illegal subdivisions on protected land and recent illegal subdivisions have steeper density gradients than formal sector development while government supported subdivisions and the first illegal subdivisions in the city have flatter density gradients than formal sector development. These comparisons are calculated for locations between k_1 and k_2 where informal development is likely to take place[67]. In this section of the city, the rank of structural density from most dense to least dense is given by squatter settlements followed by recent illegal subdivisions, government supported subdivisions, illegal subdivisions on protected land, old illegal subdivisions and formal sector development.

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[67] In Cochabamba $k_1$and k_2 occur at about 3 Km and 10 Km from the CBD respectively.

Table 8.4:
Population Density Models

Model	1	2	3	4	5
Dependent variable	Log(pop/Ha)	Log(pop/Ha)	Log(pop/Ha)	$(Pop/Ha)^{\lambda}$	$(Pop/Ha)^{\lambda}$
Box-Cox transformation estimate λ	-	-	-	0.5092	0.5223
Distance to CBD (Km)	-0.08	-0.0895	-0.3031	-0.7926	-0.9562
	[0.0138]***	[0.0165]***	[0.0643]***	[0.1008]***	[0.1282]***
$(\text{Distance to CBD (Km)})^2$			0.0597		
			[0.0138]***		
$(\text{Distance to CBD (Km)})^3$			-0.0041		
			[0.0009]***		
Distance to a major Road (m)	0.0001	0.0001	0.0001	0.0007	0.0009
	[0.0000]***	[0.0000]***	[0.0000]***	[0.0001]***	[0.0002]***
% Homes connected to sewer system	0.0067	0.0067	0.0071	0.0623	0.0656
	[0.0005]***	[0.0005]***	[0.0005]***	[0.0038]***	[0.0042]***
% Homes occupied by owner	0.0008	0.0009	0.0007	0.0026	0.0054
	[0.0009]	[0.0009]	[0.0009]	[0.0060]	[0.0064]
Neighborhood Income (factor)	-0.0347	-0.035	-0.0316	-0.5862	-0.6139
	[0.0130]***	[0.0131]***	[0.0131]**	[0.0894]***	[0.0946]***
Illegal Subdivision (Protected Area)	0.1501	1.3519	0.0981	1.5681	10.7532
	[0.0828]*	[0.3483]***	[0.0852]	[0.6052]***	[2.1518]***
Squatter (Invasion)	0.5698	0.6731	0.6182	6.7052	16.4291
	[0.0550]***	[0.1755]***	[0.0555]***	[0.5407]***	[2.2341]***
Government supported subdivision	0.3353	-1.4128	0.2918	2.8237	-13.6172
	[0.0573]***	[0.2835]***	[0.0584]***	[0.5182]***	[2.7523]***
Illegal Subdivision (New: Still Illegal)	0.6246	0.5713	0.5702	3.3686	4.7916
	[0.0837]***	[0.2751]**	[0.0869]***	[0.6108]***	[2.2611]**
Illegal Subdivision (Old: Now legal)	0.3064	-0.0952	0.2756	1.2592	-3.4945
	[0.0529]***	[0.1566]	[0.0543]***	[0.3966]***	[1.3032]***
Illegal Subdivision (protected area) *CBD dist		-0.0002			-0.0016
		[0.0001]***			[0.0004]***
Squatter (Invasion) *CBD dist		0			-0.0032
		[0.0001]			[0.0007]***
Government supported subdivision*CBD dist		0.0004			0.0035
		[0.0001]***			[0.0005]***
Illegal Subdivision (New: still Illegal) *CBD dist		0			-0.0002
		[0.0000]			[0.0003]
Illegal Subdivision (Old: Now legal) *CBD dist		0.0001			0.0007
		[0.0000]**			[0.0002]***
Constant	3.6498	3.6061	3.6922	11.0886	11.0667
	[0.1062]***	[0.1085]***	[0.1106]***	[1.0104]***	[1.0868]***
Observations	5787	5787	5787	5787	5787
R-squared	0.24	0.25	0.24	0.32	0.33

Robust standard errors in brackets

* Significant at 10%; ** Significant at 5%; *** Significant at 1%

(1) For brevity coefficients on direction (octants) and time of consolidation variables are not shown in this table.

Table 8.5:
Structural Density Models

Model	1	2	3	4	5
Dependent variable	Log(pop/Ha)	Log(pop/Ha)	Log(pop/Ha)	$(Pop/Ha)^{\lambda}$	$(Pop/Ha)^{\lambda}$
Box-Cox transformation estimate λ	-	-	-	0.5092	0.5223
Distance to CBD (Km)	-0.08***	-0.0895***	-0.3031***	-0.7926***	-0.9562***
	[0.0138]	[0.0165]	[0.0643]	[0.1008]***	[0.1282]
$(\text{Distance to CBD (Km)})^2$			0.0597***		
			[0.0138]		
$(\text{Distance to CBD (Km)})^3$			-0.0041***		
			[0.0009]		
Distance to a major Road (m)	0.0001***	0.0001***	0.0001***	0.0007***	0.0009***
	[0.0000]	[0.0000]	[0.0000]	[0.0001]***	[0.0002]
% Homes connected to sewer system	0.0067***	0.0067***	0.0071***	0.0623***	0.0656***
	[0.0005]	[0.0005]	[0.0005]	[0.0038]***	[0.0042]
% Homes occupied by owner	0.0008	0.0009	0.0007	0.0026	0.0054
	[0.0009]	[0.0009]	[0.0009]	[0.0060]	[0.0064]
Neighborhood Income (factor)	-0.0347***	-0.035***	-0.0316**	-0.5862***	-0.6139***
	[0.0130]	[0.0131]	[0.0131]	[0.0894]***	[0.0946]
Illegal Subdivision (Protected Area)	0.1501*	1.3519***	0.0981	1.5681***	10.7532***
	[0.0828]	[0.3483]	[0.0852]	[0.6052]***	[2.1518]
Squatter (invasion)	0.5698***	0.6731***	0.6182***	6.7052***	16.4291***
	[0.0550]	[0.1755]	[0.0555]	[0.5407]***	[2.2341]
Government Supported Subdivision	0.3353***	-1.4128***	0.2918***	2.8237***	-13.6172***
	[0.0573]	[0.2835]	[0.0584]	[0.5182]***	[2.7523]
Illegal Subdivision (still illegal)	0.6246***	0.5713**	0.5702***	3.3686***	4.7916**
	[0.0837]	[0.2751]	[0.0869]	[0.6108]***	[2.2611]
Illegal Subdivision (now legal)	0.3064***	-0.0952	0.2756***	1.2592***	-3.4945***
	[0.0529]	[0.1566]	[0.0543]	[0.3966]***	[1.3032]
Illegal Subdivision (protected area) *CBD dist		-0.0002***			-0.0016***
		[0.0001]			[0.0004]
Squatter (invasion) *CBD dist		4.7e-05			-0.0032***
		[0.0001]			[0.0007]
Government Supported Subdivision*CBD dist		0.0004***			0.0035***
		[0.0001]			[0.0005]
Illegal Subdivision (still illegal) *CBD dist		5.7e-06			-0.0002
		[0.0000]			[0.0003]
Illegal Subdivision (now legal) *CBD dist		0.0001**			0.0007***
		[0.0000]			[0.0002]
Constant	3.6498***	3.6061***	3.6922***	11.0886***	11.0667***
	[0.1062]	[0.1085]	[0.1106]	[1.0104]	[1.0868]
Observations	5787	5787	5787	5787	5787
R-squared	0.24	0.25	0.24	0.32	0.33

Robust standard errors in brackets
* Significant at 10%; ** Significant at 5%; *** Significant at 1%
For brevity coefficients on direction (octants) and time of consolidation variables are not reported in this table.

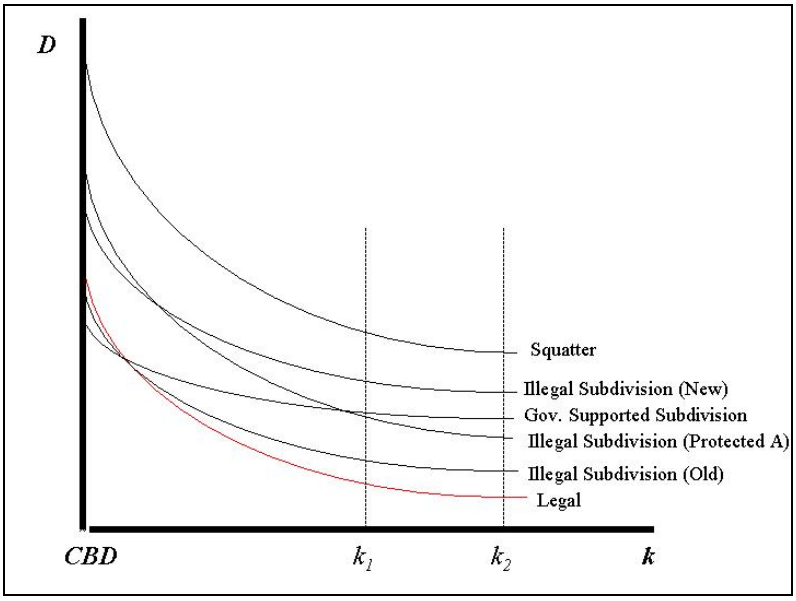

Figure 8.4:
Estimated Density Gradients by Settlement Type (Box-Cox Results)

The price gradient estimates shown in table 8.6 reveal that city blocks that originated as squatter settlements tend to have lower rents and steeper rent gradients than comparable city blocks that originated in the formal sector. Given that squatter settlements were regularized and formally titled in the 1980s, this result suggests that former squatter settlements have a legacy effect of sub-optimal land use at present time. City blocks in recent illegal subdivisions and illegal subdivisions on protected land also present lower and steeper price gradients than comparable city blocks that originated in the formal sector. Since these types of settlements are not yet regularized, these lower rents may be capturing an eviction threat risk premium. Interestingly, old informal subdivisions that were regularized during the 1990s have a flatter price gradient than that of formal subdivisions. Consequently, old informal subdivisions have higher rents than comparable formal development as distance from the CBD increases. This difference

may be capturing the land regulation effects in development that originated in the formal sector. This result can be observed in figure 8.5 where the price gradient estimates from the Box -Cox model in column 5 are depicted graphically. In the region of the urban area between k_1 and k_2, old illegal subdivisions tend to have the highest land rents followed by legal development and government supported subdivisions, which have similar rent gradients. Below legal development land rents lay illegal subdivisions on protected land, followed by recent illegal subdivisions and squatters, in that order.

Perhaps one of the most interesting findings is that, for settlements originated in the informal sector, structural density does not necessarily follow land prices in the way standard urban economics theory predicts. In standard urban economic theory land prices are positively related to structural density. Thus, sectors of the urban where the land is relatively cheap tend to have lower structural densities than other sectors where land rents are greater. Squatter settlements, which, ceteris paribus, have lower land rent than any other type of development, also tend to exhibit the highest density. This reflects the importance of a settlement's legal origin. The legal origin determines the settlement's pattern of occupation, which in turn determines its development settlement's trajectory over time. This legacy effect can be also observed in housing quality, as suggested by the redevelopment model presented in chapter 7.

Table 8.6:
Land Rent Models

Model	1	2	3	4	5
Dependent variable	Log($ /sqm)	Log($ /sqm)	Log($ /sqm)	($ /sqm)$^{\lambda}$	($ /sqm)$^{\lambda}$
Box-Cox transformation estimate λ				-2.146	-2.192
Distance to CBD (Km)	-0.1272***	-0.1828***	-1.0963***	-9.49E-06***	-1.32e-06***
	[0.0060]	[0.0087]	[0.0283]	[4.12e-07]	[4.97e-07]
(Distance to CBD (Km))^2			0.1634***		
			[0.0050]		
(Distance to CBD (Km))^3			-0.0078***		
			[0.0003]		
Distance to a major Road (m)	0.0001***	0.0001***	0***	9.42e-09***	4.24e-09***
	[0.0000]	[0.0000]	[0.0000]	[4.10e-10]	[5.36e-10]
% Homes connected to sewer system	0.0011***	0.0004**	0.0006***	2.11e-07***	1.16e-07***
	[0.0002]	[0.0002]	[0.0002]	[1.26e-08]	[1.14e-08]
% Homes occupied by owner	0.0008***	0.0005**	0.0006***	5.03e-09	-1.32e-08
	[0.0002]	[0.0002]	[0.0002]	[1.56e-08]	[1.26e-08]
Illegal Subdivision (Protected Area)	-0.1416***	-1.2594***	-0.0709**	-0.00001***	-0.000094***
	[0.0331]	[0.0691]	[0.0299]	[2.39e-06]	[4.19e-06]
Squatter (invasion)	-0.3298***	-0.4301***	-0.2834***	-0.000036***	2.89e-06***
	[0.0195]	[0.0744]	[0.0193]	[1.82e-06]	[3.97e-06]
Government Supported Subdivision	0.0251	-0.5607***	0.1812***	0.000002	-0.000048***
	[0.0161]	[0.0492]	[0.0114]	[1.70e-06]	[6.75e-06]
Illegal Subdivision (still Illegal)	-0.0421**	-0.5602***	-0.0167	-0.000016***	-0.00007***
	[0.0185]	[0.0695]	[0.0161]	[1.52e-06]	[4.46e-06]
Illegal Subdivision (now legal)	0.1585***	-0.7824	0.0793***	0.000014***	-0.00007***
	[0.0150]	[0.0469]	[0.0088]	[1.41e-06]	[4.30e-06]
Illegal Subdivision (protected area) *CBD dist		0.0002***			1.58e-08***
		[1.4e-05]			[8.85e-10]
Squatter (invasion) *CBD dist		1.7e-05			-1.24e-***
		[2.1e-05]			[1.09e-09]
Government Supported Subdivision*CBD dist		0.0001***			1.12e-08***
		[9.76e-06]			[1.29e-09]
Illegal Subdivision (still illegal) *CBD dist		0.0001***			9.84e-09***
		[1.1e-05]			[7.21e-10]
Illegal Subdivision (now legal) *CBD dist		0.0002***			1.34e-08 ***
		[8.82e-06]			[7.08e-10]
Constant	5.9271***	6.0288***	6.3713***	0.465997***	0.4563***
	[0.0348]	[0.0360]	[0.0353]	[2.80e-06]	[2.32e-06]
Observations	5880	5880	5880	5880	5880
R-squared	0.69	0.71	0.78	0.72	0.76

Robust standard errors in brackets

* Significant at 10%; ** Significant at 5%; *** Significant at 1%

For brevity coefficients on direction (octants) and time of consolidation variables are not reported in this table.

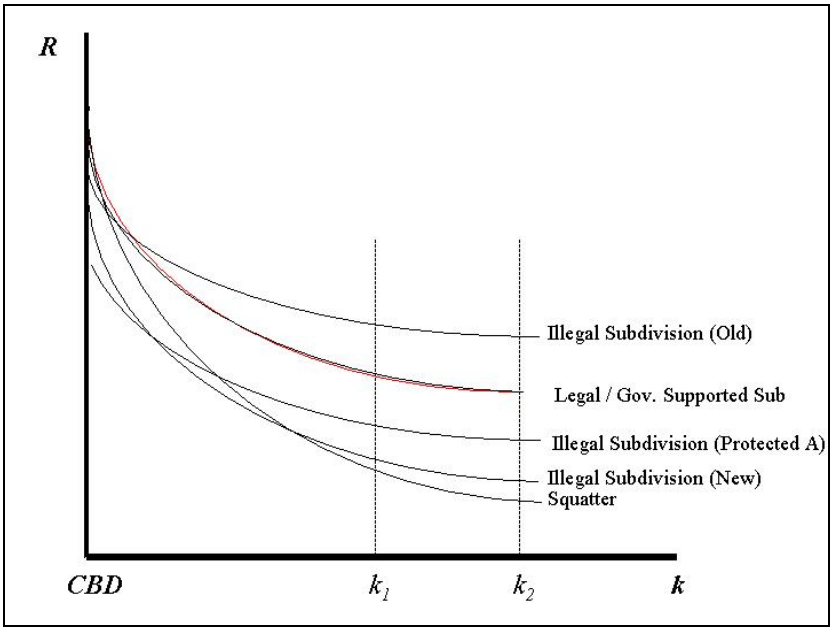

Figure 8.5:
Estimated Price Gradients by Settlement Type (Box-Cox Results)

Table 8.7 shows the neighborhood housing quality estimates for the fractional Logit model. Columns 1, 2, and 3, predict the percentage of houses in a city block that can be classified as high, medium and low quality respectively. The main variables of interest are the neighborhood's legal origin and the interaction terms between the legal origin and neighborhood income. The coefficient on the income variable in the three models reflects the effect of rising income on the type of housing quality for city blocks that originated in the formal sector holding other characteristics fixed.

The estimates show that, holding other block characteristics constant, rising income increases the percentage of high quality housing and decreases the percentage of medium and low quality housing in blocks that originated in the formal sector. The coefficients on the legal origin binary indicators represent the difference in the percentage of homes falling in a quality category between blocks developed in the formal sector and

blocks developed under each particular informal modality holding other variables constant and holding income constant. Thus, comparing city blocks with similar characteristics, blocks that originated as squatter settlements tend to have fewer high quality houses than blocks that originated in the formal sector. Further, blocks that originated as squatter settlements tend to have higher rates of medium and low quality housing than blocks that originated in the formal sector.

The coefficients on the income-legal origin interaction terms show the differences in the effect of income on city block housing quality between blocks that originated in the formal sector and those that originated in the informal sector. The negative signs for the income-legal origin interaction term coefficients in table 8.7, columns 1 suggest that income tends to increase the percentage of high quality housing in blocks that originated in the formal sector at a higher rate than it does in city blocks that originated in the informal sector. The positive signs of the interaction term coefficients in column 2 indicate that income leads to a more modest increase in the percentage of medium quality housing in blocks that originated in the formal sector than in city blocks that originated in the informal sector. For easier interpretation, we present marginal effects for the legal origin indicator variables and their interaction terms in table 8.8. Holding other characteristics constant at sample mean levels, the proportion of high quality housing in former squatter settlements tends to be about 20 percentage points lower than the proportion of high quality homes in formally originated settlements.

Table 8.7:
Housing Quality Models - Fractional Logit Specification

Model	1	2	3
Dependent variable	Proportion of High Q homes	Proportion of Medium Q homes	Proportion of Low Q homes
Distance from the CBD (Km)	-0.0434	0.0555	-0.116
	[.021]**	[.0202]***	[.0516]**
% Homes connected to sewer system	0.004	-0.003	-0.009
	[0.001]***	[0.001]***	[0.001]***
Distance to a major road (Km)	-0.1075	0.118	-0.14
	[0.0327]***	[0.03]***	[0.0651]**
% homes under Antichresis	0	0.002	-0.016
	[0.002]	[0.002]	[0.005]***
% homes under rent	-0.004	0.007	-0.015
	[0.001]***	[0.001]***	[0.002]***
Income (factor)	0.471	-0.417	-0.534
	[0.018]***	[0.018]***	[0.050]***
Illegal Subdivision (protected area)	-0.08	0.105	0.014
	[0.120]	[0.117]	[0.334]
Squatter (Invasion)	-1.047	1.05	0.672
	[0.145]***	[0.135]***	[0.236]***
Government supported subdivision	-0.371	0.376	0.47
	[0.099]***	[0.095]***	[0.203]**
Illegal Subdivision (New: Still Illegal)	-0.141	0.249	0.411
	[0.145]	[0.141]*	[0.257]
Illegal Subdivision (Old: Now legal)	-0.47	0.727	-1.429
	[0.095]***	[0.095]***	[0.318]***
Illegal Subdivision (protected area) * Income	-0.004	0.08	0.027
	[0.074]	[0.064]	[0.148]
Squatter * Income	-0.301	0.404	0.221
	[0.109]***	[0.090]***	[0.131]*
Government supported subdivision * Income	-0.3	0.294	0.291
	[0.145]**	[0.129]**	[0.136]**
Illegal Subdivision (still Illegal) * Income	0.013	0.238	-0.045
	[0.071]	[0.067]***	[0.110]
Illegal Subdivision (Now legal) * Income	-0.209	0.373	-0.469
	[0.050]***	[0.053]***	[0.140]***
Constant	0.804	-1.123	-3.703
	[0.151]***	[0.146]***	[0.680]***
Observations	5794	5794	5794

Robust standard errors in brackets

* Significant at 10%; ** Significant at 5%; *** Significant at 1%

(a) Coefficients are Logit estimates

(b) For brevity coefficients on direction (octants) and time of consolidation variables are not shown.

The interaction effect between squatter settlement and the income scale shows that an increase of one unit in the income scale raises the proportion of high quality homes in former squatter settlements at a 5 percentage points lower rate than it does for formally originated blocks.

Table 8.8:
Fractional Logit Estimates (Marginal Effects)

Model	1	2	3
Dependent variable	Proportion of High Q homes	Proportion of Medium Q homes	Proportion of Low Q homes
Legal Origin Binary Indicators **			
Illegal Subdivision (protected area)	-0.019	0.025	0
Squatter	-0.207	0.219	0.012
Government supp subdivision	-0.084	0.088	0.007
Illegal Subdivision (still Illegal)	-0.033	0.06	0.006
Illegal Subdivision (Now legal)	-0.105	0.164	-0.01
Legal Origin-Income Interaction terms ***			
Illegal Subdivision (protected area) * Income	-0.001	0.019	0
Squatter * Income	-0.045	0.066	0.005
Government supp subdivision * Income	-0.063	0.065	0.006
Illegal Subdivision (still Illegal) * Income	0.003	0.055	-0.001
Illegal Subdivision (Now legal) * Income	-0.043	0.074	-0.002

*Each of the coefficients is evaluated at mean levels and holding other binary variables at 0

** Measures effect of a discrete change from 0 to 1

*** Measures marginal effect dy/dx

The interaction terms provide evidence of a lock-in effect taking place in informal sector development. Even when informal settlements are regularized or "legalized", their upgrading occurs more slowly and at lower rates than in comparable settlements that originated in the formal sector. Furthermore, a simple comparison between the interaction term coefficients in table 8.8 as well as the settlements structural density gradients in figure 8.4 indicates that the magnitude of this lock-in effect seems to be proportional to

the settlement structural density. These relationships are what is expected in light of the theoretical models presented in chapters 6 and 7.

Conclusions

Illegal settlements constitute a large portion of urban development in many developing countries. Moreover, a large percentage of urban growth in many regions of the world takes place in the form of illegal settlements of one type or another, the bulk of which are identified as slums. It is becoming increasingly important to understand the effects of this type of growth on overall urban development. The empirical literature dealing with these questions has been hampered by the limited availability of relevant data.

Chapters 6 and 7 laid out two models dealing with the initial squatter settlement and subsequent redevelopment effects of illegal settlements, paying special attention to the spatial land use implications of illegal settlements. This chapter provided a new empirical look at the slum formation process. In this chapter we tested the theoretical predictions using data from Cochabamba, Bolivia, a city with long experience with a wide variety of informal urban settlements.

The theory suggests that illegal settlers tend to invest in greater structural density than is efficient, their behavior reflecting the best response to landowners' credible threats of later eviction. The empirical results are consistent with the theoretical predictions; neighborhoods that originated as squatter settlements exhibit greater density than comparable illegal subdivisions. Further, illegal settlements of all forms exhibit greater density than comparable legal settlements. The land rent analysis reveals that squatter settlements are not the best and highest use for the land; land rents tend to be

significantly lower than rents in comparable legal settlements. In the case of illegal subdivisions, land rents tend to mimic those of the legal market more closely, as expected.

In terms of redevelopment after the settlements is formally titled or regularized, the theory predicts that the original status of an illegal settlement has significant legacy effects on future neighborhood upgrading. Greater initial density of development tends to delay redevelopment and upgrading; hence, it tends to reduce future housing quality in the neighborhood. Our empirical estimates confirm these predictions; neighborhoods that originated as illegal settlements generally have lower housing quality than comparable legal settlements even after legalization. In addition, income tends to have a lower marginal effect on housing quality in illegal settlements than it does in comparable legal settlements. These results help to explain the pervasiveness of low housing quality and the low rates of neighborhood upgrading in former squatter settlements even long after regularization.

This chapter presented one of the first empirical studies of how property rights, property title quality, and related institutions affect urban land use in developing countries. The need to understand the future consequences of current slum formation is growing as this mode of development itself grows. This is essential for effective housing and land use policy in an era in which poverty is becoming an increasingly urban phenomenon. Applying the arguments of De Soto (2000) and others, we need to understand the channels through which property rights institutions affect urban development before establishing the micro foundations for broader economic development questions. This section of the dissertation represents a step in that direction.

CHAPTER 9

HOUSING POLICY IN DEVELOPING COUNTRIES

This chapter presents a succinct evaluation of low-income housing policy in developing countries in light of our findings. This discussion is divided into two sections, each analyzing a specific policy field of low-income housing. The first section deals with policies related to informal settlements. We begin this section with a brief history of policies used to deal with informal settlements in the past 50 years. We then turn to the effects of current policies on low income housing conditions and comment on new policy directions governments take to better address the problems associated with informal settlements. The second section of this chapter concentrates on rental housing policies and their effect on the quality and availability of housing for the poor. We then evaluate current claims that portray the Antichresis system as a tool for low-income housing. The final section concludes.

Brief History of Informal Settlement Policy in Developing Countries

In the past 50 years, governments in developing countries have applied different combinations of policies to deal with the rapidly growing presence of slums in urban areas. These policies have not been uniform over time and place and range from violent evictions to benign neglect. These policies have not been homogeneous within urban areas either. It is common practice in many cities around the developing world to observe forceful evictions in some slum areas of a city and relative tolerance in other slum areas of the same city (UN HABITAT, 2003).

The phenomenon of squatter settlements and the informal economy began to draw attention from academics and government officials in the 1940's. At the time, and through the 1950's, mainstream development economists attributed the growth of the informal sector to the existence of a large labor force surplus that had to create employment and housing for itself in order to survive (Wilson, 1998). Thus, at this point, the informal economy and squatter settlements were conceived as byproducts of underdevelopment that would disappear as soon as poor countries entered an industrialized stage (Moser, 1994). The policy of choice towards informal settlements during these years was to simply ignore squatter settlements with the idea that they would disappear. This policy later became know as benign neglect (UN HABITAT, 2003). After decades of ignoring informal settlements, governments realized that this type of development was guiding most of the urban growth. This realization brought a radical shift in the policy towards squatter settlements and introduced the practice of large scale forceful evictions during the 1960s and 1970s. In many Latin American countries this policy tool was used by military regimes, which were characterized by highly centralized government power. Forceful evictions, however, proved to be ineffective and costly in political and economic terms. As a consequence, they became less popular in Latin America during the 1980's as country governments became more democratic. This was not the case for several African nations where violent forceful evictions are still the policy of choice (UN HABITAT, 2003).

During the 1980's it became clear that informal settlements were not going to disappear any time soon, and that governments did not have the resources or the capacity to stop informal growth. The policy options then were less clear: governments could not

completely permit informal settlements but they could not control it either. As a result, governments adopted a policy of partial neglect. In Latin America, the policy of partial neglect came at a time when American and British scholars began writing about the benefits of "spontaneous self-help" housing as tool for fighting poverty by documenting the Peruvian experience (Mangin, 1967; Turner, 1982). Turner (1982), in an influential writing, suggested that government participation in housing policy for the poor should be limited to land provision assistance, small cash transfers at specific stages of the settlement's development, and technical support in settlement planning. In several cases governments used these suggestions to justify policies of partial neglect in the name of housing policy for the poor (Solares, 1999). Furthermore, governments would use partial neglect policies towards informal settlements and keep the probability of eviction latent in order to position the informal settlers in a clientilistic relation. These governments then would ask for political support in exchange for tenure security (Coppedge, 1993).

By the late 1980's, amidst a wave of economic reforms taking place in the United States and England to downsize government and celebrate private entrepreneurship, Hernando de Soto (1989) changed the perception developing lending organizations had regarding the informal economy and informal housing. De Soto's argument is that government's inefficient bureaucracy and outdated regulations were the main causes of informality (De Soto, 1989). Using the city of Lima as a case study, he persuasively argues that poor settlers faced with large legal and bureaucratic costs of obtaining land through legal means have no other alternative than to invade plots of land and engage in self-help housing construction. De Soto's policy prescription is simple: provide property titles to all illegal settlers and let them unleash the power of their capital (as collateral) to

upgrade their property and create businesses (De Soto, 2000). De Soto's ideas became, as Woodruff (2001) describes, a "smash hit" in the media and in the developing policy community. Soon after, during the 1990's, institutions like the World Bank began financing large-scale titling programs around the world. The results of such programs are currently being evaluated.

Today's Housing Policy

Today, informal settlement policy is generally characterized by a combination of relative tolerance and eviction followed by a regularization (land titling) program for settlements that survive eviction (Solares, 1999; Smolka, 2003). Some studies find that issuing property titles to informal owners has a positive impact on beneficiaries' well-being. Studies in Peru and Argentina show that owners of informal settlements that received property titles tend to have relatively higher housing quality and child education investment (Galiani and Schargrodsky, 2006), better child health (Galiani and Schargrodsky, 2004), and supply more labor than informal settlers with no formal property title (Field, 2003). Interestingly, however, none of the mentioned studies find a positive and significant relation between formal title provision and increased access to bank loans. Calderon (2003) finds that less than a quarter of households receiving formal titles use bank loans to upgrade their houses in Peru. Similarly, Galiani and Schargrodsky (2006) find that only 4% of owners who receive titles obtain mortgage loans in a former squatter settlement in Argentina. Surprisingly both of these studies report that the modest housing upgrades done by beneficiaries of titling programs were made with their own resources as opposed to loans that could have financed greater housing upgrading.

These and other studies are now being portrayed as evidence of a missing link between formal titles and access to financial markets (The Economist, 2006), and therefore a big weakness in the philosophy of large scale De Soto-style titling programs.

The theoretical model presented in chapter 7 of this dissertation presents a tentative answer to why beneficiaries of titling programs tend to withhold significant investments in property upgrading longer than their counterparts in formal settlements. Our model showed that the greater the initial density of development in a settlement, the longer the optimal time for redevelopment/upgrading tends to be. Thus, our model predicts that squatter settlements that go through a title regularization program will not make serious upgrading or redevelopment investments at the same rate property originated in the formal sector does largely because they originate with greater density. We found this pattern in Cochabamba, Bolivia in the empirical analysis presented in chapter 8. As a result, the model presents a compelling argument as to why former squatters do not use bank loans to upgrade their properties like owners of formally originated property.

Our findings raise serious concerns about the practice of relative tolerance towards informal development. Keeping a threat of eviction latent with the possibility of granting a title to those settlements that avoid eviction in the future creates incentives that have perverse future consequences for a settlement. As explained by the theoretical model in chapter 6, the threat of eviction induces squatters to over-invest in housing capital in order to reduce the credible eviction threat and increase the chance of receiving formal title in the future. This strategy creates a legacy effect that leads owners to postpone large investments in housing upgrading for longer periods of time. As a result,

the incentives created by current policies drive future squatters to build high density and low quality housing and curtails the incentive to upgrade their property after they receive titles for this properties. In a sense, a policy that seems benevolent and pro-poor has perverse effects in the long run for poverty alleviation strategies. Our work does not question titling programs per se, but raises questions about the costs of a policy that combines relative tolerance towards squatter settlements with the expectation of a title in terms of future quality of housing for the poor.

Informal settlements represent one of the only long-term strategies for low-income populations to own a house in developing countries. Throughout the last 50 years, governments experimented with several policy tools to deal with informal settlements with no clear results in terms of living conditions for the poor. Both benign neglect and forceful evictions proved to be costly and ineffective, and the current policy, of relative tolerance combined with a possibility of title, has perverse effects on future upgrading incentives. There is no silver-bullet in low-income housing policy, but chapters 6 though 8 of this dissertation show the important negative legacy effects of informal settlements on urban development in terms of living conditions. These findings call for a shift in policy concerning informal settlements from "dealing with informal settlements" to a "helping the poor obtain housing in the formal sector" paradigm. This shift, in turn, calls for innovative tools to acquire and develop land that can later be accessed by the poor. This dissertation does not present policy prescriptions for dealing with existing or potential informal settlements. Our findings, however, highlight some of the costs associated with the current policy in terms of legacy effects that undermine future upgrading possibilities. It also offers one of the first empirical studies of how informal

development strategies shape urban form in developing countries. This represents an important contribution for the understanding of the mechanisms through which property rights affect economic development.

Rental Housing for the Poor

Urban dwellers in developing countries use a variety of tenure mechanisms to access housing. This wide variety in tenure type modalities that shape housing markets are influenced by several aspects such as the types of landlords, tenants, legal status of properties and existing legal and social frameworks (Payne, 1997). Owner-occupied housing represents one type out of many housing tenure modalities observed in housing markets, yet it has become the gold standard of low-income housing policy for most governments and international development organizations. As Kumar (2001) states, "National housing policies show little sign of deviating from their primary objective – conferring ownership rights" (p. 1). This myopic view of housing policy creates a one-dimensional approach that obviates diverse and dynamic needs and priorities of different landlords and tenants in a housing market. In other words, it ignores that the poor can (and do) also gain from having access to rental markets. Recognizing the neglect toward polices that facilitate housing alternatives for the poor, some authors recently began to explore how innovative methods, other than ownership, can be fostered by governments and international aid organizations (Payne, 1997). One of the tenure modalities gaining recognition is that of the Antichresis contract (Payne, 2002b; Farfan, 2002). Even though the Antichresis contract has been in use since biblical times in different countries, its study by mainstream economics as a tool for housing is fairly recent. This dissertation proposes a model of the Antichresis contract that explains its coexistence with the

commonly used periodic-rent lease and allows us to analyze its potential for helping the poor.

The Antichresis Contract as a Tool for the Poor

We began our analysis of the Antichresis contract by recognizing that the division of property rights produces to two potential inefficiencies arising from information asymmetries between landlord and tenant: The problem of adverse selection of tenants, and the problem of moral hazard in landlord maintenance investments. The first is an information problem in which the landlord cannot observe the probability that the tenant will become illiquid and therefore unable to comply with the contractual obligation of timely rental payments. In the event of tenant illiquidity, the landlord faces costs in the form of forgone income and eviction costs. Therefore, because landlords require a minimum expected return for the housing services they provide to a tenant, other things being equal, the probability of encountering an illiquid tenant increases the rental payment for a property. This aspect is crucial in the analysis of rental markets in developing countries where the probability of encountering a potentially illiquid tenant is high because of the inherent poverty and the lack of information systems (e.g. credit reports) available to landlords. Furthermore, the costs faced by landlords in the event of tenant illiquidity tend to be greater in developing countries because of inefficient court systems and "tenant-friendly" regulations that make evictions very costly.

The Antichresis contract requires the tenant to pay a large lump sum upfront and the landlord returns on that lump sum amount represent the payments for the property. The tenant is not required to make any more payments and therefore the probability of him becoming illiquid during the contract term is irrelevant to the landlord. In this sense,

the Antichresis mechanism solves the problem of adverse selection. As a result, holding everything else constant, the implicit rental payments are expected to be lower under Antichresis than they would be under a periodic rent agreement. This characteristic makes the contract appealing as a tool for housing the poor. On the other hand, the Antichresis mechanism may be unattainable for the poorest populations which usually do not have access to the large up-front lump sums required to enter an Antichresis agreement.

Tenants that have access to a large lump sum to enter an Antichresis agreement tend to be those that will have a lower probability of illiquidity during the contractual arrangement in the first place, so every else being equal, we would expect to observe a sorting of liquid (richer) tenants into Antichresis and probable illiquid (poorer) tenants into periodic rent agreements. This reasoning suggests that the Antichresis agreement can be an effective mechanism to lower rental payments (by solving the adverse selection problem) for those who can afford to access the system. Tenants who cannot access the Antichresis mechanism will only have the option of periodic rent contracts at higher yearly rents than their counterparts under Antichresis agreements.

Following the discussion above, it is tempting to picture a market where individuals with higher income levels sort into Antichresis agreements and individuals with lower income levels sort into periodic rent agreements. As explained in chapter 3, however, the Antichresis does not solve the moral hazard problem of landlord maintenance investment as effectively as the periodic rent agreement does. Therefore, properties where the supply of landlord inputs has a large effect on tenant value will gain more from being in a periodic rent contract than in an Antichresis contract. As a result,

we should expect to observe higher income individuals still choosing monthly rent contracts when living in a property type that requires greater levels of landlord maintenance investment. This is because property types for which the losses arising from the moral hazard problem outweigh the expected losses from the adverse selection problem will tend to be under monthly rent and vice versa. This point is important from a policy perspective because government actions that increase the costs of the adverse selection problem will tend to increase the range of property types for which the Antichresis contract dominates the monthly rent contract. Increases in court inefficiency and/or in the costs of tenant evictions, for example, will make it more profitably for landlords to offer their properties under Antichresis as opposed to monthly rents for a greater variety of property types[68]. Thus, such policies will tend to decrease the range of property types available for individuals who cannot access an Antichresis contract. As a result, laws that are usually thought to be "tenant friendly" by increasing the bureaucratic process of tenant eviction due to illiquidity tend to have the perverse consequence of restricting the choices for poor individuals seeking to enter the housing rental market in markets where the Antichresis option is available for landlords.

Policies that make tenant eviction more costly will tend to drive landlords toward Antichresis agreements, but the same can be argued for policies than make the monthly rent agreement less profitable such as rent controls or taxes. The rationale behind rent controls is that they will keep rental prices at affordable levels for the poor and thereby

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[68] These policies will tend to increase parameter *C* of the model presented in chapter 3 which produces a shift downwards in the landlord profit curve for a monthly rent agreement in figure 3.5.1

increase their access to housing services[69]. However, in markets where landlords have the option of using unregulated Antichresis agreements, rent controls will tend to make the Antichresis agreement more attractive to landlords for a greater range of property types - thus restricting access to housing by economically disadvantaged groups. This was the case in Korea during the 1990's, where strict rent controls drove landlords to use the Chonsei lease, a Korean version of the Antichresis contract (Ambrose and Kim, 2003).

Differences in tax rates between Antichresis and monthly rent contracts may also drive landlords to prefer one contractual arrangement to another. Some authors argue that high tax rates and registration costs pose a major obstacle for landlords and tenants to enter Antichresis agreements and therefore represent a threat to the Antichresis system in the Bolivian case (Farfan, 2002; 2004). Our data paints a different picture. A sample of market data from the city of Cochabamba reveals that the majority (95%) of Antichresis agreements are taxed at a lower rate than monthly rent contracts. We found that 60% of the Antichresis contracts had tax rates running 12 percentage points lower than the tax rates for equivalent units under monthly rent contracts. Our results show that everything else being equal, landlords would actually prefer Antichresis contracts to rental contracts based on tax rates. Furthermore, the data shows that properties with lower rents (i.e. those more accessible to poorer tenants) tend to have a lower tax rates for tenants under Antichresis than they would under monthly rent. Thus, we found no evidence that tax rates pose a threat to the Antichresis system or tend to exclude the poor from Antichresis agreements in the Bolivian case.

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[69] This policy is also commonly referred in the literature as a "first generation" rent control (Buckley, 2005).

Helping the Antichresis Help the Poor

Previous sections of this dissertation argue that the Antichresis contract can be a very effective tool for landlords and tenants, but its nature does not serve the most disadvantaged populations. Poorer tenants that cannot raise a relatively large cash lump sum do not have access to Antichresis agreements. Moreover, this chapter argues that policies that make evictions costly or otherwise make the monthly rent contract less profitable, tend to drive landlords of a wider range of property types towards Antichresis agreements further restricting the range of housing options for the poorest sectors. So how can the Antichresis contract be used to help the poor?

Consider subsidized loans for Antichresis targeted to the poorest prospective tenants. Under this policy, beneficiaries would access loans at a subsidized rate to be used for entering an Antichresis agreement for housing purposes. Every month, beneficiaries could make payments on the principal and interest until the loan is completely paid. After then loan is paid, beneficiaries would own the Antichresis lump sum and could use it for entering other Antichresis contracts or any other productive activity. In this sense the subsidized loan would have two main benefits; (1) it would help the beneficiary enter an Antichresis agreement for housing, and (2) it would help the beneficiary to save. One additional benefit of this policy is that it would not distort landlord profits and therefore will not drive landlords from one contract to another. The main drawback of this policy, however, rests with tenant illiquidity. In this case, the government assumes the risk of default and is left with no instruments to force tenants to honor their debt (because government cannot evict tenants without hurting the landlord). Thus, this policy not only shifts the problem of adverse selection of tenants to government, but it also introduces a

different moral hazard problem. The combination of these problems will likely make the policy extremely costly.

In conclusion, the Antichresis contract is an important contractual agreement for society but its use as an innovative tool for helping the poor as claimed by various authors seems to be limited at best. On the contrary, the Antichresis mechanism may serve to restrict options for the poor in markets where periodic rent agreements are heavily regulated or function under laws that make tenant eviction costly.

Conclusions

This section of the dissertation evaluated policies for low income housing in developing countries in the light of our findings in previous chapters. The chapter presents no policy prescriptions but it highlights the costs of current policies that deal with squatter settlements in terms of legacy effects that hinder informal settlements' upgrading possibilities. The second section studies how commonly used policies such as rent controls, or regulations that make tenant eviction costly tend to restrict options for the poorest tenants. Finally, this chapter presented an analysis that dispels claims that portray the Antichresis system as a tool for helping the poor using the theoretical framework developed in chapter 3 and empirical data from chapter 4.

The link between property rights and economic development has been a focus of interest since the early years of economic science. Even though very few mainstream economists would question that secure property rights are a precondition for economic development, the mechanisms through which property rights guide incentives and how these can lead to economic development is still contested territory. This dissertation explores some of the issues faced by developing countries in the low-income housing

policy field. It concentrated on the issue of informal development and the Antichresis tenure modality taking property rights as a foundation for the theoretical analysis. The squatter model shows how unsecured property rights drive informal settlers into a certain strategy that takes into account landowners' best responses. Landowners, in turn, base their decisions on how profitable it is for them to exercise their property rights and reclaim a property after squatters occupy it. The Antichresis analysis, on the other hand, focuses on another dimension of property rights by exploring the economic incentives that arise when property rights are divided. Results from both models show that when regulatory environments threaten property rights, policies intended to help the poor gain access to decent housing can have perverse consequences. In this sense, this dissertation highlights the importance of considering institutional aspects that govern property rights in a market in order to design effective housing polices for the poor. Furthermore, this study stresses the dire need for more theoretical and empirical studies that help discover the mechanisms through which institutions such as property rights can help the poor obtain access to a better future. This dissertation represents a step towards that goal.

APPENDIX A

CONSTRUCTION OF THE HOUSING QUALITY VARIABLES

For the purpose of this dissertation, housing quality refers exclusively to construction materials employed in the housing structure. Construction materials were classified into low, medium or high quality using the Bolivian National Institute of Statistics (INE) as shown in table A-1.

Table A1:
Classification of Housing Construction Quality by Main Materials Used in Walls, Roof and Floors

Quality	Wall Materials	Roof Materials	Floor Materials
High	Bricks, Cement, Concrete	Tiles (cement, clay fiber-cement)	Treated wood Carpets Tile, ceramic
Medium	Rock Adobe (covered)	Zinc plates	Brick Cement
Low	Adobe (not covered) Cane, Palma Other	Palma, Cane, Dirt Other	Dirt Other

The next step was to construct a set of housing quality variables that reflected the percentage of houses in a city block that fell in the high, medium, or low classification according to the construction materials employed in the housing structure. Houses that had high quality materials in at least 2 parts of their structure were classified as high quality houses. In the same line, houses that had low quality materials in at least 1 part of

their structure were classified as low quality houses. Finally, all houses that did not fall into the high or low quality categories were classified as medium quality houses.

APPENDIX B

CONSTRUCTION OF THE INCOME FACTOR

Bolivia's last population census (2001) did not ask respondents to provide their level of income. However, the survey included a series of questions concerning home appliances, household equipment, and household education choices, among others. A group of these indicators was used to construct an income index at the census block level using exploratory and confirmatory factor analysis.

The variables used to construct the index using a principal component extraction method of factor analysis were:

A) % of households in the block that own a TV set.

B) % of households in the block that own a car.

C) % of households in the block that own a refrigerator.

D) % of households in the block that own a telephone line.

The correlation matrix for these variables is presented below in table B.1

Table B.1
Correlation Matrix of Variables Used to Construct the Block Income Index

	Tvpnt	Carpnt	Refripnt	Phonepnt
Tvpnt	1.00			
Carpnt	0.45	1.00		
Refripnt	0.69	0.67	1.00	
Phonepnt	0.59	0.73	0.84	1.00

A principal component analysis used on the 4 variables produced a set factors of which the first one explained about 75% of the variance in the 4 variables combined (Eigen value = 2.98). The second factor explained only 14 % of the variance in the 4 variables combined (Eigen value =.58). Using the Kaiser-Guttman rule we confidently conclude that these 4 variables produce only 1 principal component (i.e. block income) with a decent degree of reliability[70]. The estimated Eigen-values for each component are depicted in table B.2. Finally, the block income variable was constructed using the estimated Eigen-vectors (factor loadings) presented in table B.3.

Table B.2:
Estimated Eigen-Values Using Principal Component Extraction Method

Component	Eigen value	Difference	Proportion	Cumulative
Component 1	2.98	2.40	0.74	0.74
Component 2	0.58	0.29	0.15	0.89
Component 3	0.29	0.14	0.07	0.96
Component 4	0.15	.	0.04	1.00

Table B.3:
Factor Loadings Used to Estimate the Block Income Variable

Variable	Component 1
Tvpnt	0.45
Carpnt	0.47
Refripnt	0.54
Phonepnt	0.53

[70] The Cronbach alpha coefficient for these 4 variables was .88. We also applied Confirmatory Factor Analysis to test the one-factor model. The results give ample support for the one-factor model: Model χ^2= 12.96 (df =1); Root Mean Square Error of Approximation (RMSEA)=0.04; 90% confidence interval for the RMSEA = (0.024; 0.066); Comparative Fit Index (CFI) = 0.99

REFERENCES

Abramo, P. (2003). A Cidade Da Informalidade : O Desafio Das Cidades Latino-Americanas. Rio de Janeiro, Lincoln Institute, Livraria Sette Letras, FAPERJ.

Alchian, A. and H. Demsetz (1973). "The Property Rights Paradigm." Journal of Economic History 33(1): 16-27.

Alston, L., G. Libecap, and R. Scneider (1996). "The Determinants and Impact of Property Rights: Land Title on the Brazilian Frontier." Journal of Law, Economics, and Organization 12(1): 25-61.

Ambrose, B. W. and S. Kim (2003). "Modeling the Korean Chonsei Lease Contract." Real Estate Economics 31(1): 53-74.

Amemiya, T. (1985). Advanced Econometrics. Cambridge, Mass., Harvard University Press.

Besley, T. (1995). "Property Rights and Investments Incentives: Theory and Evidence from Ghana." Journal of Political Economy 103: 903-937.

Bohn, H. and R. J. Deacon (2000). "Ownership Risk, Investment, and the Use of Natural Resources." American Economic Review 90: 526-549.

Breen, R. (1996). Regression Models; Censored, Sample-Selected, or Truncated Data. London, Thousand Oaks.

Buckley, R. M. and J. Kalarickal (2005). "Housing Policy in Developing Countries: Conjectures and Refutations" World Bank Res Obs 20(2): 233-257.

Calderon, C. J. (2003). Formalizacion de la Propiedad, Cultura Registral y Credito en el Peru. A Cidade Da Informalidade : O Desafio Das Cidades Latino-Americanas. P. Abramo. Rio de Janeiro, Lincoln Institute, Livraria Sette Letras, FAPERJ.

Cameron, A. C. and P. K. Trivedi (2005). Microeconometrics: Methods and Applications. Cambridge, New York, Cambridge University Press.

Carter, M. and P. Olinto (2000). "Getting Institutions 'Right' for Whom: Credit Constraints and the Impact of Property Rights on the Quantity and Composition of Investment." Agricultural and Applied Economics Papers, Staff Paper Series 433.

Clark, C. (1951). "Urban Population Densities." Journal of the Royal Statistical Society 114: 490-496.

Cochabamba-Municipality (2005). Plan de Ordenamiento Territorial del Municipio Cercado de Cochabamba - Diagnóstico. Cochabamba, Honorable Municipalidad de Cochabamba - Unidad de Planificacion.

Cohen, B. (1950). Antichresis in Jewish and Roman Law. New York, Jewish Theological Seminary of America.

Coppedge, M. (1993). "Parties and Society in Mexico and Venezuela: Why Competition Matters." Comparative Politics 25(3): 253-274.

Do, Q.-T. and L. Iyer (2002). "Land Rights and Economic Development: Evidence from Viet Nam." World Bank - POLICY RESEARCH WORKING PAPER 3120.

Durand-Laserve, A. (2006). Informal Settlements and the Millennium Development Goals: Global Policy Debates on Property Ownership and Security of Tenure. Global Urban Development. 2.

The Economist, (2006a). The Mystery of Capital Deepens. The Economist. August 26, 2006.

The Economist, (2006b). Of Property and Poverty; Development. The Economist. August 26, 2006.

Epstein, R. (1986). "Past and Future: The Temporal Dimension in the Law of Property." Washington University Law Quarterly 64: 667-722.

Eswaran, M. and A. Kotwol (1985). "A Theory of Contractual Structure in Agriculture." American Economic Review 75: 162-177.

Farfan, F. (2002). Bolivia's Land Tenure Experience. Land, Rights and Innovation: Improving Tenure Security for the Urban Poor. G. Payne. London, ITDG: 181-192.

Farfan, F. (2004). "Formal and Customary Housing Tenure Initiatives in Bolivia." Habitat International 28(2): 221-230.

Ferguson, B. and J. Navarrete (2003). "A Financial Framework for Reducing Slums: Lessons from Experience in Latin America." Environment & Urbanization 15(2): 201-216.

Field, E. (2003). "Entitled to Work: Urban Property Rights and Labor Supply in Peru." Princeton, United States: Princeton University. Mimeographed document.

Frankena, M. (1978). "A Bias in Estimating Urban Population Density Functions." Journal of Urban Economics 5: 35-45.

Friedman, J., E. Jiménez, and S. K. Mayo (1988). "The Demand For Tenure Security in Developing Countries." Journal of Development Economics 29: 185-198.

Fujita, M. (1982). "Spatial Patterns of Residential Development." Journal of Urban Economics 12: 22-52.

Galiani, S. and E. Schargrodsky (2004). "Effects of Land Titling on Child Health." Inter-American Development Bank Research Network Working Paper #R-491.

Galiani, S. and E. Schargrodsky (2006). "Property Rights for the Poor: Effects of Land Titling." Working Paper - Universidad Torcuato di Tella, centro de investigación en finanzas 05-2005.

Glascock, J. L., C. F. Sirmans, and G.K Turnbull (1993). "Owner Tenancy as Credible Commitment under Uncertainty." Journal of the American Real Estate and Urban Economics Association 21(1): 69-82.

Goldstein, D. M. (2004). The Spectacular City: Violence and Performance in Urban Bolivia. Durham, Duke University Press.

Howard, E. (1902). Garden Cities of Tomorrow. London,, S. Sonnenschein & co., ltd.

Jimenez, E. (1984). "Tenure Security and Urban Squatting." The Review of Economics and Statistics 66(4): 556-567.

Jimenez, E. (1985). "Urban Squatting and Community Organization in Developing Countries." Journal of Public Economics 27: 69-92.

Jimenez, E. and M. Hoy (1991). "Squatter's Rights and Urban Development." Economica 58(229): 79-92.

Kau, J. B. and C. F. Lee (1976). "The Functional Form in Estimating the Density Gradient: An Empirical Investigation." Journal of the American Statistical Association 71: 326-327.

Kumar, S. (2001). Social Relationships Rental Houisng & the Poor in India. London, U.K., London School of Economics & Political Science.

Lanjouw, J. O. and P. I. Levy (2002). "Untitled: A Study of Formal and Informal Property Rights in Urban Ecuador." The Economic Journal 112(October): 986-1019.

La-Razon (2002). Se Disparan las Denuncias por Estafas en Anticreticos. La Razon. La Paz, Bolivia: Oct 24th.

Ledo G, C. and S. Escobar De Pabon (1988). Urbanizacion, Migraciones y Empleo en la Ciudad de Cochabamba. La Paz, Centro de Estudios para el Desarrollo Laboral y Agrario (CEDLA) Centro de Investigacion y Desarrollo Regional (CIDRE).

Lee, L. F. (1978). "Unionism and Wage Rates: A Simultaneous Equations Model with Qualitative and Litited Dependent Variables." International Economic Review 19(2): 415-433.

Lobingier, C. S. (1929). "The Cradle of Western Law: A Survey of Ultimate Juridical Sources." United States Law Review 63: 572-580.

Louisiana and West Publishing Company (1952). Chapter 3: Of Antichresis. Civil code; under arrangement of the official Louisiana civil code. St. Paul,, West Pub. Co. 13: 279-291.

Maddala, G. S. (1983). Limited-Dependent Variables in Econometrics. Cambridge, Cambridge University Press.

Maidman, M. P. (1979). A Nuzi private Archive: Morphological Considerations. Malibu, Undena Publications: 8 p.

Mangin, W. (1967). "Latin American Squatter Settlements: a Problem and a Solution." Latin American Research Reviews 2: 65-98.

Medinaceli, E. (2006). Antichresis and Monthly Rent Contracts. I. Navarro. Cochabamba, San Simon University.

Medinacelli, E. (2006). Los Contratos de Anticresis y Alquiler en Bolivia. I. Navarro. Cochabamba, Bolivia, (Personal Communication).

Miceli, T. J. (2004). The Economic Approach to Law. Stanford, California, Stanford University Press.

Miceli, T. J., H. Munneke, C.F. Sirmans, and G.K. Turnbull (2002). "Title Systems and Land Value." Journal of Law and Economics 45(565-582).

Miceli, T. J., C. F. Sirmans, and J. Kieya (2001). "The Demand for Land Title Registration: Theory with Evidence from Kenya." American Law and Economics Review 3: 275-287.

Miceli, T. J., C. F. Sirmans, and G.K Turnbull (2001). "The Property Contract Boundary: An Economic Analyis of Leases." American Law and Economics Review 3(1): 165-185.

Miceli, T. J., C. F. Sirmans, and G.K. Turnbull (2003). "Land Ownership Risk and Urban Development." Journal of Regional Science 43: 73-54.

Mills, E. S. (1972). Urban Economics. Glenview, IL, Scott Foresman and Company.

Montano B., C. (2007). Estudio Exploratorio del Distrito 9: Localizacion de Asentamientos y Organizacion Social del Espacio. Interpelaciones Periurbanas: Analisis Juridico y Sociopolitico de los Asentamientos Humanos Irregulares. J. Zapotocka de Ballon. Cochabamba, Instituto de Investigaciones Juirdicas y Politicas - Universidad de San Simon.

Morales, J. A. and J. D. Sachs (1990). Bolivia's Economic Crisis. Developing Country Debt and Economic Performance, Volume 2: Country Studies--Argentina, Bolivia, Brazil, Mexico. J. D. Sachs. Chicago, University of Chicago Press.

Moser, C. O. (1994). The Informal Sector Debate, Part 1: 1970-1983. Contrapunto : the informal sector debate in Latin America. C. A. Rakowski. Albany, State University of New York Press: 11-29.

Muth, R. (1969). Cities and Housing. Chicago, University of Chicago Press.

Nathan, M. J. (1970). "The "In Rem" Mortgage." Tulane Law Review 44: 497-515.

North, D. (1990). Institutions, Institutional Change, and Economic Performance. Cambridge, Cambridge University Press.

North, D. (1992). "Transaction Costs, Institutions, and Economic Performance." Occasional Papers, International Center for Economic Growth 30.

Papke, L. E. and J. M. Wooldridge (1996). "Econometric Methods for Fractional Response Variables with an Application to 401(K) Plan Participation Rates." Journal of Applied Econometrics 11(6): 619-632.

Payne, G. (1997). Urban Land Tenure and Property Rights in Developing Countries: a Review. London, Intermediate Technology Publications.

Payne, G. (2002). Land, Rights and Innovation: Improving Tenure Security for the Urban Poor. London, ITDG.

Payne, G. (2002b). Secure Tenure for the Urban Poor. Cities Alliance, Cities Without Slums, Washington DC.

Purves, P. M. (1945). "Commentary on Nuzi Real Property in the Light of Recent Studies." Journal of Near Eastern Studies 4(2): 68-86.

Rivera, A. (2005). La Propiedad de la Vivienda Urbana en Bolivia y América. CENTRO DE ESTUDIOS DE LA REALIDAD ECONOMICA Y SOCIAL; Cochabamba, Bolivia.

Rosen, S. (1974). "Hedonic Prices and Implicit Markets: Product Differentiation in Pure Competition." Journal of Political Economy 82: 34-55.

Sherwood, R. M., G. Shepherd, et al. (1994). "Judicial Systems and Economic Performance." The Quarterly Review of Economics and Finance 34(Supplement 1): 101-116.

Silva, A. V. (1996). Anticresis. Enciclopedia Juridica OMEBA. Buenos Aires. TOMO I: 700-706.

Slovenko, R. (1958). "Of Pledge." Tulane Law Review 33: 60-132.

Smolka, M. O. (2003). Regularizacao da Ocupacao do Solo Urbano: A Solucao que e parte do Problema, O Problema que e Parte da Solucao. A Cidade Da Informalidade : O Desafio Das Cidades Latino-Americanas. P. Abramo. Rio de Janeiro, Lincoln Institute, Livraria Sette Letras, FAPERJ.

Solares, H. (1999). Vivienda y Estado: Politicas Habitacionales y Produccion del Habitat Popular en America Latina. Cochabamba, Bolivia, Editorial Serrano.

Solares, H. (2006). La Vivienda en Bolivia. I. Navarro. Cochabamba, (Personal Comunication).

Solares, H. and F. Bustamante, Eds. (1986). Crisis Urbana y Barrios Populares: El Caso de Alalay, Ticiti, y Valle Hermoso. Cochabamba, Editorial Universitaria.

Solares, H. and Rodriguez-Ostria (1990). Historia, Espacio, y Sociedad: Cochabamba 1550-1950: Formación, Crisis y Desarrollo de su Proceso Urbano. Cochabamba, Centro de Investigacion y Desarrollo Regional (CIDRE).

Soto, H. d. (2000). The Mystery of Capital : Why Capitalism Triumphs in the West and Fails Everywhere Else. New York, Basic Books.

Soto, H. d. and Instituto Libertad y Democracia (Lima Perú) (1989). The Other Path : The Invisible Revolution in the Third World. New York, Harper & Row.

Torrico G., M. E. (1999). Inquilinato en la Ciudad de Cochabamba: La Vivienda en Arriendo. Sociologia. Cochabamba, Universidad Mayor de San Simon.

Tulane-Law-Review, E. C. (1938). "Antichresis: An Ancient Security Device Revived." Tulane Law Review 13: 131-143.

Turnbull, G. K. (1988). "Residential Development in an Open City." Regional Science and Urban Economics 18: 307-320.

Turnbull, G. K. (1995). Urban Consumer Theory. Washington, D.C.
Lanham, MD, The Urban Institute Press; Distributed by University Press of America.

Turnbull, G. K. (2005). "The Investment Incentive Effects of Land Use Regulations." The Journal of Real State Finance and Economics 31(4): 357-396.

Turnbull, G. K. (2008). "Squatting, Eviction, and Development." Regional Science and Urban Economics 38 (1): 1-15

Turner, J. F. C. (1982). Issues in self -help and self -managed housing, Chapter 4. Self help housing: a critique. P. M. Ward. London, Mansell: 99-113.

Ugarteche, O. (1986). El estado deudor: Economia politica de la deuda, Peru y Bolivia, 1968-1984. Lima, Peru, Instituto de Estudios Peruanos.

United-Nations (2006). The Millennium Development Goals Report 2006. New York, United Nations.

UN-HABITAT (2003). The Challenge of Slums: Global Report on Human Settlements. London, Earthscan.

Urquidi Zambrana, J. (1967). La Urbanización de la Ciudad de Cochabamba: Síntesis del Estudio. Antecedentes, vol. 1. Cochabamba, Editorial Universitaria.

Urquidi Zambrana, J. (1986). La Urbanización de la Ciudad de Cochabamba y el Desarrollo Regional y Urbano: Examen Crítico, vol. 2. Cochabamba, Colegio de Arquitectos de Bolivia, Filial Cochabamba.

Westbrook, R. and G. M. Beckman (2003). A history of ancient Near Eastern law. Leiden ; Boston, Brill.

Wheaton, W. C. (1982). "Urban Spatial Development with Durable but Replaceable Capital." Journal of Urban Economics 3: 3-36.

Wigmore, J. H. (1898). "The Pledge-Idea: A Study In Comparative Legal Ideas III." Harvard Law Review 11: 18-39.

Wilson, T. D. (1998). "Introduction." Latin American Perspectives 25(2): 3-17.

Woodruff, C. (2001). "Review of De Soto's The Mistery of Capital." Journal of Economic Literature 39: 1215-23.

Wooldridge, J. M. (2002). Econometric analysis of cross section and panel data. Cambridge, Mass., MIT Press.

Zapotocka de Ballon, J. (2007). Funcion Social de la Propiedad Urbana y Asentamientos Irregulares. Interpelaciones Periurbanas: Analisis Juridico y Sociopolitico de los Asentamientos Humanos Irregulares. J. Zapotocka de Ballon. Cochabamba, Instituto de Investigaciones Juirdicas y Politicas - Universidad de San Simon.