Property Rights, Land Conflicts and Tenancy in Brazil

Lee Alston
University of Colorado
National Bureau of Economic Research

Bernardo Mueller
University of Brasília[♦]

February 2010

Abstract

Tenancy has been a mechanism for labor for career advancement in agriculture yet in Brazil and Latin America, tenancy rates are low compared to the U.S. and the OECD countries. We test for the importance of insecure property rights in Brazil on the reluctance of landowners to rent because of a fear of expropriation arising from land reform. Since 1964, the Land Statute in Brazil, has target rental lands for redistribution. Expropriation of farms resulting from land conflict is currently at the heart of land reform policies in Brazil. Land conflicts are a means for landless peasants to bring attention to land reform agencies for the need of redistribution. Land conflicts may also signal to landowners that their land is at risk for expropriation. Utilizing data across all counties in Brazil we found that land conflicts reduce the likelihood of tenancy. This result implies: a reduction in agricultural efficiency; a reduction in the well-being of potential renters, now landless peasants; and an expansion of the agricultural frontier through deforestation. Because of endogeneity between land rentals and land conflict we instrument land conflict with Catholic priests.

1. Introduction

Compared to the rest of the world, farmers in Brazil rely relatively little on tenant contracts.[1] In agriculture, career mobility is associated with moving up the agricultural ladder from working for wages to renting to owning [Alston and Ferrie 2005]. Alone, this fact may not

♦ The authors acknowledge the support of the National Science Foundation Grant 0528146. Mario Miranda and Adam Canton provided able research assistance organizing the data set. We received useful comments from Wolfgang Keller, A. Mushfiq Mobarak, Charles Mueller, Décio Zylbersztajn, Peter Houtzager and participants at the following conferences: IV Research Workshop on Organizations and Institutions in São Paulo 2009, and the International Society for New Institutional Economics 2009 Berkeley.

[1] The use of land rentals is relatively low across all of Latin America. de Janvry, Macours and Sadoulet (2002) present tables showing the importance of land rentals across the world and for certain countries in Latin America. Data exhibited in Hayami and Otsuka (1983: 9) show that in 1970 Latin America only had 11.8% of farmland in tenancy while North America had 63.4%, Europe 41.0%, Africa 32.2% and Asia 16%. It is noteworthy that for the world as a whole tenancy has fallen considerably since 1930: 1930 – 43.3%, 1950 – 41.6%, 1970 – 22.2%, 1990 – 18.8% and 2000 – 22.6% (Federico, 2006).

present a puzzle but coupled with the large number of landless peasants and large amounts of unused land the question is: why don't landowners with unused or under-utilized land negotiate land rental contracts with the landless.[2] In Brazil this avenue for advancement has been hurt by a reluctance of owners to rent in areas experiencing land conflict. The lack of rentals is an important issue because Brazil is geographically a large country, roughly the size of the continental U.S. and has an expanding agricultural frontier, some of which is cutting into the Amazon. If the lack of land rentals is pervasive across Brazil and also signals inefficiency in production, the total magnitude is likely to be large when summed across the country. Some scholars have attributed the lack of rentals to a fear by landlords that renters will become *de facto* owners because of existing legislation making it extremely costly to evict tenants, if they are in default with their rental payments [Buanin et al. (2008); Conning and Robinson (2007) ,de Janvry, Macours and Sadoulet (2002); de Janvry and Sadoulet (1989); Deininger (2003) and Macours (2002).] A similar fear of rentals may arise from land reform projects [de Janvry, Macours and Sadoulet (2002), Rezende (2006)]. For example, in Brazil, land should be put to productive use or it may be subject to compensated expropriation [Alston, Libecap and Mueller (1999)]. Renting land could be deemed unproductive use by land reform agencies and as a result owners would be fearful of renting [Buanin et al. (2008), Brandão et al. (2001); Deininger and Chamorro (2003); Jamarillo (2001); World Bank (1994: 199-200)]. An additional explanation for the lack of rentals rests on the labor and capital intensity of different crops. Some land may not be worth the opportunity cost of capital, and the return to applying labor via a rental contract may be close to zero. As such landowners may opt to leave land vacant as a potential store of value or in some cases collateral for credit to be used elsewhere. Alternatively, if farmers are fearful that land may be invaded and expropriated if left idle, they might opt to rent to demonstrate use and possession, particularly if the landlord has reason to trust the renter. To the extent that land conflict and land reform policies affect land rentals and encourage expansion of the agricultural frontier into the Amazon, deforestation will result. By estimating the impact of land conflict on land rentals we can better judge the deficiencies in

[2] The MST (Landless Peasant Movement) estimates that there are 4 million landless peasants in Brazil. However, this estimate includes all who are 'demanding land' and is broader than those with actual aptitude for agriculture and the intention to stay on the land.

current land reform policies and this can be a guide for better policies in the future. Better land reform policies can be trebly important: 1) Lives can be saved and poor people's lot improved if tenancy is a step on the agricultural ladder; 2) land reform policies can improve the productivity of agriculture in Brazil; and 3) land reform policies can slow the rate of deforestation in the Amazon, which holds the largest stock of forest in the world.

We test for the impact of land conflict on land rentals by using *municipio* (county) level data from the Brazilian censuses along with data on land conflicts from the Pastoral Land Commission (CPT). In Section 2 we give a brief overview of the theoretical literature on tenancy contracts. In Section 3 we discuss the specific hypotheses to be tested for the Brazilian case. In Section 4 we describe the data and in Section 5 we present the results and discussion. We offer concluding remarks in Section 6.

2. Theoretical Hypotheses about Tenancy

The theoretical literature on tenancy is voluminous. We assume that the standard explanations for the efficiency of sharecropping and tenancy – share and fixed-rent - are now public knowledge. By standard explanations we mean risk and transaction costs.[3] In short, depending on the endowments of landlords and workers as well as their preferences towards risk, there exist conditions such that the optimal operator status can be either, owner-operator (with only household or with hired wage workers); sharecropper; share tenant; or fixed-rent tenant.[4]

In the U.S. in the 19th and early 20th centuries there was a life-cycle to contract choice which agricultural economists referred to as the agricultural ladder. The 'ladder' referred to the movement with age from the statuses of wage worker to tenant to owner [Alston and Ferrie (2005); Alston and Kauffman (1997) and (1998)]. Climbing the rungs on the ladder meant acquiring human and physical capital as well as improving socio-economic status. Most

[3] By transaction costs we mean the information, monitoring and enforcement costs associated with contracting. They include issues of moral hazard and adverse selection. We stick to the Coase and Williamson pedigree in referring to the costs as transaction costs. We also follow in the footsteps of the agricultural economists analyzing tenancy in the early part of the 20th century. For a review of the some of the earlier work of agricultural economists see Alston and Higgs (1982).

[4] de Janvry, Macours and Sadoulet (2002) provide a very helpful table of the 'contextual conditions' under which each land tenure status is observed.

transaction cost explanations for contract choice rest on the costs of information, negotiation, supervision and enforcement. The plethora of explanations based on transaction costs (or market failures) arose because many economists initially took to heart the Marshallian inefficiency argument and then had difficulty explaining why various forms of tenancy and sharecropping have been so ubiquitous over time and space (Marshall, 1890). Now economists are turning the issue on its head: why are there some regions of the world that rely too little on tenancy and sharecropping, given the existence of transaction costs? Consistent figures are difficult to find but both North America and Europe stand out in the high percentage of land and farm establishments rented. For example, de Janvry, Macours and Sadoulet (2002; pp. 24-25) present data showing that farmers in the U.S. leased 45% of agricultural land in 1988 and in Europe the figures for 1995 range from a low of 12% for Ireland to above 60% for Belgium, France and Germany. Figure 1 shows the evolution of tenancy in Brazil from 1920 to 1995. The total number of farm establishments that were rented fell nearly half from 1970 (20%) to 1995 (11%), while the corresponding area fell from a high of 10% in 1940 to a low of 2.5% in 1995.

[Figure 1 here]

Most explanations for the lack of rentals rest on the insecurity of property rights. Insecure property rights may reduce the prevalence of rentals because of difficulties in conflict resolution. If it is difficult to evict tenants who do not meet the rental terms, landlords may respond by using wage labor or by only renting to those they trust such as relatives and friends.[5] In some countries tenants receive the right to purchase the land that they rent and not surprisingly landlords may be reluctant to rent.[6] Some governments prohibit land rentals on land redistributed through land reform projects, either *de facto* (because there are frequently delays in assigning formal titles) or *de jure* because of a fear of absentee beneficiaries.[7]

Conning and Robinson (2007) analyze the effect of property rights insecurity on agricultural organization by linking a model of contract choice to a political economy model of potential property rights reform. In the contract choice model the key feature is the existence

[5] Macours (2002) found that in the Dominican Republic landlords were more likely to rent to those in their same social network.

[6] This was the case in the Pampas in Argentina under Peron (Gallo, 2003); and in the Dominican Republic following legislation passed in 1972 (de Janvrey, Macours and Sadoulet, 2002).

[7] Brazil is probably not atypical in the long delays associated with assigning formal titles. In Mexico, until recently, the government forbade the renting of *ejidos.*

of an essential non-traded factor (skill) that is required for production in addition to land and labor. Because this factor cannot be traded, the efficient organization of agriculture requires farm sizes that are proportional to the distribution of this factor, with land being leased from those who do not have enough of the essential factor to those with an excess relative to their own holding of land. This first-best situation will hold if property rights are secure. But if the agents have reasons to fear that future events might bring a change in the security of property rights, such as a land-to-the-tiller reform, then the agents might optimally chose to forgo the potential gains of entering into tenancy contracts so as to avoid the losses that will be borne if the threat does in fact materialize. The approach thus includes two market imperfections - a non-traded factor and insecure property rights– with both reform and the extent of tenancy being endogenously determined. The most important testable hypothesis that emerges from the model is that anything that increases the threat to property rights will lower the incidence of land rentals. We will test this hypothesis with county level data for Brazil in Section 4.

A similar approach that integrates the choice of agricultural organization to the political economy of reform is presented by de Janvry and Sadoulet (1989) to analyze what they call 'the lost game of Latin American land reform.' The equilibrium they see prevailing in most of Latin America is one where the threat of reform in the 1960s induced large and medium sized farms to modernize and increase their productivity so as to preempt any form of expropriation, which in turn increased their economic and political power thus hindering any future attempts at reform even though these could potentially lead to large net social gains. Although the authors refer to distributive land reform, the argument fits perfectly the history of tenancy in Brazil where legislation put into place in the early 1960s was explicitly hostile to tenancy and sharecropping contracts thus inducing landowners to expel masses of tenants from their lands in the following decades (further details in section 3).

In addition to the fear by landlords of expropriation (de facto or de jure) there may be factors on the demand side limiting rentals. It may be that many 'would be' renters lack either the physical capital or human capital necessary to profitably rent land. We are less persuaded by the physical capital constraints because presumably rental markets for physical capital should arise, though we recognize that there are transaction costs associated with abuse in renting capital that may preclude the emergence of active rental markets. On the human

capital side many potential renters may lack the skills necessary to successfully rent. This may be particularly important where the region is shifting to new crops, e.g. niche crops like flowers or even a switch from tree crops like coffee to annual crops like soybeans.

3. Hypotheses about Tenancy in Brazil

3.1 – Introduction

In this paper we utilize a dataset that includes all counties in Brazil and contains variables that measure both the agro-climatic/geographic determinants of contract choice, as well as the political economy determinants. We will estimate a system where the dependent variable of each equation is the percent of total farm area that is held under each of the four categories included in the Brazilian Agricultural Census: fixed rent, sharecropper, owner and occupant (no formal title).[8] In order to measure the extent to which contract choice is determined by the natural and physical endowment of each county, we will use as independent variables the percent of total farm land that is placed under cotton, rice, coffee, cane, beans, manioc, corn and soy beans. Each crop has its own physical attributes and agro-climatic requirements which determine where they can be grown and the best farm size, given relative prices. At the same time each crop's attributes along with attributes of the landowner imply that a given type of contract would be best for dealing with the problems inherent in its production. Coffee, for example, is a perennial crop, by nature labor intensive, has few economies of scale and consequently tends to be produced more productively by smaller owner-run farms than by fixed rent contracts.[9] Other variables that control for the impact of endowments, capturing elements of geography, transport costs and climate, are the distance to

[8] In the Brazilian Agricultural Census fixed rent are those properties that belong to a third party but are worked by a producer who pays a previously set fixed quantity in cash or its equivalent in products. Sharecroppers work properties that belong to a third party in exchange of a previously set proportion of the production. Occupants are those on land that belongs to some third party (may be public land) with no payment in exchange, which might be the case of squatting or of consensual cession of the use of the land. Owned land belongs to the producer on the land.

[9] Potentially long term leases could deal with the perennial nature of coffee but perennial leases may be more problematic with respect to the land statute and constitution's emphasis on beneficial use, issues that we discuss shortly.

state capital, transport costs to São Paulo, existence of train stations and latitude and longitude.[10]

The major objective of the empirical test is to ascertain whether the choice of agricultural organization in terms of contract choice is essentially determined by endowments, that is agro-climatic and geographic factors, or whether political economy factors also have an effect, distorting the choice of contract by limiting the extent of tenancy despite its superiority in terms of efficiency, given the crop mix in the county. To this end we use data collected by the Pastoral Land Commission of the Catholic Church (CPT) to measure the extent of land-related violence in each county from 1985 to 1995. In those places that experienced violence and conflict, land owners and claimants expect a greater probability of intervention from the government, generally in the form of expropriation and redistribution of land to landless peasants through the creation of settlement projects (Alston, Libecap and Mueller, 1999a, 1999b, 2000, 2008). The struggle for land in Brazil since the mid 1980s has essentially revolved around the strategy by organized groups of landless peasants, such as the MST, of selectively invading properties that are legally vulnerable to expropriation (low productivity and/or large area) so as to attract the government and force it to expropriate in their favor. The impact of conflicts affects not only the decision of whether to plant or not, but also whether to engage in tenancy contracts. One of the main reasons for this is that the Land Statute of 1964, which still underpins all of the land related legislation, imposes very rigid limits for tenancy contracts and explicitly states that farms in rental arrangements may be preferable candidates for redistribution.[11] The origins of this bias in the legislation may be a reaction to the historically very unequal distribution of wealth and power in the Brazilian countryside. Nevertheless, as noted in World Bank (1994: 199):

> … the perverse effect is to reduce access to exactly those people the regulations were designed to protect. In addition, the Land Statute contains other provisions that relate the incidence of renting and sharecropping to the possibility of expropriation of farms, that is, the law provides that "expropriation... will be applied to: … areas with high incidence of renters, sharecroppers and squatters." The threat of expropriation may have been much more effective in constraining the rental market and sharecropping

[10] Other factors such as soil type, temperatures, rain, sunshine etc are partially captured by state dummies.
[11] For a very good discussion of the hostility towards tenancy arrangements in Brazilian legislation see Rezende (2006, section 8). See also Romeiro and Reydon (1994).

arrangements than the provisions that regulate such arrangements. This seemed to be particularly true when claims for land reform were increasing.

Another strong legal impediment to tenancy in Brazil is the 1963 Rural Worker Statute that extended the set of legal labor benefits already held by urban workers to those in agriculture (Rezende and Kreter, 2007).[12] The Statute set regional minimum wages, established the 13th salary, holidays, payment for overtime, 48-hour workweek and limited the employers' acceptable justifications for firing. It is argued by several authors that even though this regulation was not well enforced, it was far from innocuous and the imposition of these encumbrances led landowners to dispense hordes of rural workers, both tenants and wage workers and to switch towards using temporary workers [Saint, 1980; Ribeiro and Stolf, 1975; Nichols, 1971, IPARDES 1978; Carvalho, 1991].

Given this nature of land and labor policy in Brazil, our expectation is that the variable that measures conflict will be negatively related to both the percentage of area in fixed rent and sharecropping and positively related to the area in owner-farmed properties, even after controlling for endowments. Although labor legislation and those parts of the land legislation that directly refer to tenancy impose impediments to this type of contracting, land reform legislation may provide incentives in the other direction. As noted above, land reform today in Brazil starts with invasion of unproductive properties by organized landless peasant groups with the government providing land reactively. In this scenario it may make sense for a landowner who wants to hold land but not yet put it to use, to lease the land as a means to make it productive and thus immune to expropriation.[13] Our results will thus allow us to test which effect of conflicts predominates in Brazil or if they cancel each other out. If the coefficient is found to be positive and statistically significant for fixed rent and sharecropping, then we can conclude confidently that land reform provides incentives for landowners to enter into more rental arrangements than they would in the absence of conflicts, and the low levels of tenancy

[12] To the present day Brazil possesses very progressive labor laws conceding a wide set of benefits and privileges to rural and urban workers. Labor justice in Brazil almost always decides in favor of the employee, which at least reduces uncertainty. However these benefits make for more rigid labor markets and may increase unemployment.

[13] During much of the 1970s and 1980s the lack of a more highly developed financial system meant that land ownership was a widely used instrument to hedge against inflation. This resulted in large areas of unproductive latifunidia despite the possibility for the owners to gain twice by renting the land out to productive use while still fulfilling its financial objective. Rezende (2006) argues that this outcome is a consequence of the hostility of the agrarian legislation towards tenancy arrangements.

in Brazil would be even lower without conflicts. This result would be in line with that found in Ghana by Besley (1995), in Uganda by Place and Otsuka (2002), in Paraguay by Carter and Olinto (2003), in Africa by Pinckney and Kimuyu (1994) and for Brazil by Vertova (2006). Finally, if we find the coefficient of conflicts in the fixed rent and sharecropping equations to be negative, this will be strong evidence of a perverse effect of land legislation on the choice of agricultural contract leading to inefficiencies of the type predicted in the models by Conning and Robinson (2007) and de Janvry and Sadoulet (1989).[14] It is possible, or course, that different impacts prevail in different regions, for different types of producers and in different periods of time. We will test for these possible variations where data allows.Before turning to the results, it is necessary to address the problem of simultaneity between contract choice and conflicts.

3.2 – Instruments for the First-stage Estimation of Conflict

Our major objective is to determine the relative impacts of conflicts and endowments on contract choice. However, there is a potential endogeniety of conflicts that would render OLS estimates inconsistent, given that land invasions and other forms of violence may be more probable in areas where there is a greater incidence of tenancy arrangements and farms without formal title. This endogeneity is in fact confirmed by a Hausman-Wu test which will be presented in the results section. Therefore we need to find appropriate instruments for conflict in order to estimate a first-stage equation that will allow us to control for the potential simultaneity. These instruments must be correlated with conflicts but should have no direct effect on contract choice.

The dependent variable of the second-stage regression is contract choice in 1996 (the last agricultural census available with county level data). Because we want to determine the impact of conflict on contract choice, the conflict data aggregates all land-related conflicts in each county from 1985 to 1995.[15] Thus an instrument which is correlated with conflict should

[14] Pande and Udry (2006) provide a very detailed review of the literature on the effect of property rights on economic outcomes in agriculture in developing countries. In Table 5 they summarize numerous studies for many different countries. The results in the literature vary considerably leading the authors to conclude that "… land titling and registration typically increase agricultural productivity and farm investment. However, the extent of increase depends upon the details of the titling program and the pre-existing land tenure system."

[15] Note that this gives some element of dynamics to our estimation despite it being a cross-section.

be situated in the 1980s. An examination of the nature of rural conflicts in Brazil indicates the crucial role of organized rural movements. The literature on these movements in the late 1970s and early 1980s identifies a key role played by the Catholic Church, suggesting that a possible instrument for conflicts could be the magnitude of the presence of the church in a given county. The politics behind the struggle for land in this period was not so much, as one may expect, a contest between poor rural communities against the military state, but rather a campaign by the military-technocratic elite against regional oligarchies and local elites that resisted the modernization of the countryside seen by the government as essential for the development of the country (Houtzager, 2001). The government sought to empower the rural communities by encouraging rural unions that would, under its tutelage, organize the poor and give the state a stronger presence in rural areas:

> The military-technocratic elite extended the developmental state into the countryside in an effort to modernize the agrarian sector and, in doing so, sought to replace an oligarchic pattern of authority based on traditional and clientelist forms of social control, and in which agricultural wage laborers and small farmers in various forms of land tenure were effectively excluded from existing labor legislation, social security, and national law generally. (Houtzager, 2001:16)

In a parallel but separate effort the Catholic Church, which was transforming into the "most progressive Church in Latin America" (Bruneau, 1985: 271), having made in the late 1970s a 'preferential option for the poor', became instrumental in organizing groups of landless peasants to demand their rights (Mainwaring and Wilde, 1989). As noted by Houtzager (2001: 23-24):

> The church was an ideal institutional host. It is a transnational institution with firm roots in rural communities. It is able, on the one hand, to garner critical resources, information, and political support from national and international sources and, on the other, it is a local actor represented by the Bishop, the parish priest and local pastoral agents. Progressive clergy and lay activists in Brazil were able to mobilize rural social groups (primarily small farmer and peasant groups) and local resources through the church's impressive associational web, its own elaborate organizational structure, and a popular religious identity. The church's myriad pastoral programs, the CPT and other church entities, linked community leaders and activists to each other and to the national movements of the left emerging in the transition. …The religious content of its organizing initiatives resonated with the prevailing belief system in rural communities and allayed the fears of community members of being labeled communists and agitators by local authorities and the military. Religion conferred a degree of legitimacy and provided protection from repression by local elite groups and the national state. This

> depth of the church's involvement in organizing rural social groups and its direct, self-conscious, sponsorship of these groups' involvement in a national movement, distinguishes the church as institutional host from the church as a simple ally.

This key role of the Church in organizing rural communities is highlighted by one of the founders and still currently the main leader of the Landless Peasant Movement (MST) João Pedro Stédile in Menezes Neto (2007):

> The CPT (Pastoral Land Commission) was the practical application of the Theology of Liberation, which was an important contribution to the landless peasants' struggle from the ideological point of view. The priests, pastoral agents and pastors discussed with the peasants the need for them to organize themselves. The Church stopped doing messianic work and saying to the peasant: 'Wait and you will go to heaven.' Now they started saying 'You have to get organized and fight to solve your problems here on earth'.

This instrumental role of the Catholic Church in enabling the rural organizations that would change the nature of the struggle for land after 1985 is also recognized by several other authors, such as Adriance (1991, 1994, 1995), Hewitt (1990) and Krischke (1991), Mainwaring (1986), Maybury-Lewis,(1994). Therefore a variable that measures the strength of the church's presence in a given county during the 1975-1985 period would be expected to correlate with the existence of conflicts over land. We thus use the number of priests per hectare in a county in 1985 as a proxy of the church's presence.[16]

In order for priests to be an appropriate instrument for conflict in our contract choice regression it is necessary to show that there is no direct impact of priests on contract choice. Because our argument depends on the validity of the instruments we present several arguments to justify the orthogonality of priests to contract choice. First of all it is necessary to make it clear that the instrument's validity depends on there being no direct link between priests and choice of land contracts, that is fixed rent,

[16] The sources and description of the data used will be provided in the next section. A better variable for our purposes than the number of priests per hectare would be the number of Church Base Communities (*Comunidades Eclesiais de Base*), small, faith-inspired lay circles which exist in the tens of thousands in cities and countryside, that help educate and organize the poor, making them more aware of their rights. These groups have been greatly studied by sociologists for their role in the transition to democracy. There is some controversy on the size and nature of their impact. Interestingly the Marxist literature has downplayed their role as they do not like the idea of social change coming through religious-inspired channels (Hewitt, 1990: 140). Unfortunately there is no systematic data of these groups, not least because of their often informal nature.

sharecropping, occupied and land used by the owner. A connection between priests and conflicts does not invalidate the instrument. On the contrary it is precisely the channel through which priests affect contract choice. What cannot happen for our argument to stand is that the church systematically allocates priests based on criteria where the proportion of farms in each contract category is a significant component. Note also that our contract choice variable refers to land and not labor. If the Church allocates priest according to areas where there are tensions regarding labor relations, that does not invalidate our instrument. Both our contract choice variable and our conflict variable refer exclusively to land-related issues and not labor related issues. The Pastoral Land Commission data does have information on labor-related conflicts, but we do not incorporate those in our conflict variable. Similarly, farms under any of the contract choice categories (fixed rent, sharecrop, occupied and owner) can have wage laborers and problems between workers and those that hired them. If the Church does in fact take into account the presence of rural strife when allocating priests, it is much more probable that they will target areas where there is land conflict and labor unrest rather than land contract type. In fact there are several other issue areas that compete for the Church's interest. Besides the Pastoral Land Commission the Church has more than 25 other Pastoral Commissions, with themes such as children, imprisoned, health, migrants, elderly, sobriety, family, Aids, etc. Several of them existed in the early 1980s. Also during this period the Catholic Church started losing believers to rapidly growing evangelical groups. The allocation of priests is potentially affected by all these interests of the church, further reducing the probability that land tenure is a major determinant.

Furthermore, although the total number of priests increased by 16% in Brazil from 1985 to 1995, the correlation across *municipios* in those two years is 97% suggesting that the allocation of priests remained very stable in the 10 years prior to our contract choice variable. Contributory factors for this inertia are the reluctance of priests to move to smaller cities in the interior, and the restraining effect of infrastructure, such as churches and priest's quarters on changes in priest allocation. During the same period the correlation of the tenancy variables was much lower, 0.41

for sharecropping and 0.72 for fixed rent, suggesting a much greater variability over time of these variables than that of priests. Finally, in order to ascertain that priests is an appropriate instrument we will show that the same results hold if instead of the number of priests per rural population in 1985 we use the data for 1975, that is 20 years before the land contract variable.

In order to better capture the catalyzing effect of priests over rural organization we will interact our priest variable with another variable that measures the 'frontierness' of the county. The idea is that frontier areas are more contentious, with less well-defined property rights than areas that are already well established (Garcia-Jimeno and Robinson, 2009). Similarly, in these areas the priests will suffer less monitoring from hierarchical superiors that tend to be less progressive and will thus have greater liberty to pursue more radical interventions in line with Liberation Theology. This strategy will allow us to identify how the effect of priests on conflicts varies depending on the socio-political nature of the county in question.

In order to measure the 'frontierness' of a given county we take advantage of the fact that over time the number of *municipios* in Brazil has greatly increased through the subdivision of counties into two or more autonomous entities. This movement has lead to an increase from 643 counties in 1872 to 5,507 in 2000. The evolution of the number of counties shown in Figure 2 suggests that the creation of new counties accompanies the expansion of the economic, demographic and agricultural frontiers (Reis, Pimentel and Alvarenga, 2009). As the frontier expands there is a natural tendency for political-administrative decentralization by creating new counties out of localities within the original *municipio*. Our index of 'frontierness' explores this correlation to create a measure of which *municipios* have undergone a greater process of frontier expansion. The subdivisions that take place over time have always made comparisons of county-level data over time very difficult. Luckily there has recently been an effort to create minimum comparable areas (MCA) that aggregate the data in such a way that makes comparison possible (IBGE, 1984; Reis, Pimentel and Alvarenga, 2009). Figure 3 shows the MCAs for 1920-2000. The current subdivision of *municipios* in

light grey lines shows how some MCAs are composed of a large number of current counties. In our empirical tests we use the minimum comparable areas for 1970-2000 which aggregate the 5,507 counties of 2000 into 3659 comparable areas. The index of 'frontierness' is created by counting the number of *municipios* of 2000 that are in each of these MCAs. The great majority of MCAs (2894 out of 3659) did not undergo any modification from 1970 to 2000, indicating a consolidated frontier process. The remaining 765 MACs underwent varying number of subdivisions, with the distribution varying from 482 MCAs that subdivided twice to one that subdivided 52 times. This variable will be used in the conflict equation both to access its own impact on conflict as well as interacted with the priest data. An alternative to try to capture the same effect is the distance from the state capital, which will also be used, however the frontier index is superior as the furthest places are not always where the frontier has expanded the most.

[Figure 2 here]

[Figure 3 here]

Another instrument that will be used to account for the possible endogeneity of conflicts in the contract choice equation is the percent of seats in each county assembly that were won by the MDB (Brazilian Democratic Movement) in the 1982 election and by the PT (Worker's Party) in 1996. Each of these parties was the main opposition party in each of these years. The logic is similar to that of using the number of priests. In counties where the opposition had a greater influence there would be greater ease for progressive ideas and organization to thrive, leading to higher chances of invasions and land-related conflicts (Houtzager 2001, 25-26; Ondetti, 2008: 52-53). Here again, for the instrument to be appropriate it is necessary to argue that political parties do not have a direct effect on the choice of land contract. As was the case for the Church`s interests, it is much more probable that political parties were concerned with more salient issues such as jobs, redistribution, public services, etc., or even land and labor conflicts than with type of agricultural contracts. In any case we present the results with and without the use of opposition parties as instruments.

4. Data

Our estimation procedure, presented in the next section, involves a first-stage regression to obtain predicted level of conflicts per hectare in each county, and then a second stage where contract choice is the dependent variable. This involves four general groups of variables which we describe briefly here leaving the details to Appendix 1. As noted above the observations are at the level of minimum comparable areas for the period 1970-2000, which comprises a total of 3659 observations. Some of the variables were available for downloading from IPEADATA (www.ipeadata.gov.br) in the MCA format, but other variables, such as the conflict and priest data, and even some of the agricultural census variables had to be painstakingly aggregated to fit the MCA format.[17]

The first group of variables is from the Agricultural Census (IBGE). This includes the contract choice variables (% of total farm land), crop mix (% of total farm land), land use variables (natural forest, planted forest, permanent crops, temporary crops, pasture, etc, all in % of total farm land), average size of farms (hectares), tractors per hectare. We use agricultural data for both 1995 and 1985, sometimes to calculate growth rates.

We acquired conflict data from the Pastoral Land Commission (CPT) of the Catholic Church. The CPT released data on conflicts in yearly reports since 1985. The data cover threats, murders, murder attempts and occupation, by *municipio*. We used this data to create a simple additive index. In this index we gave a weight of ten to occupations because these are central to land conflicts and involve large numbers of people. A non-weighted index yielded essentially the same results.[18] In creating the index the total number of violence-related incidents is divided by the number of farms in the *muncipio*.

The third set of variables measures the presence of the Catholic Church in each county. This data is from Catholic Hierarchy (http://www.catholic-hierarchy.org/) which provides not only the number of Catholics and of priests per diocese but even the names of all the bishops, sometimes as far back as the 16th century. In order to make the diocese level data compatible with the county and MCA data we used the Catholic Census of Brazil compiled by CERIS (1997). The priest data we used is for 1985 as the conflict data is for 1985 to 1995 and the priests'

[17] We thank Mario Miranda and Adam Canton for research assistance preparing the data.
[18] The index is merely additive instead of being created by principal components because most observations had no conflicts, and these methods do not work well when the series have many zeros.

organizing effort precedes the conflicts. The number of priests is divided by rural population to account for the different diocese sizes.

The final group of variables captures assorted effects. There are variables that control for geographic and climatic variations such as distance of the county to the state capital, transportation cost to São Paulo, number of train stations and latitude and longitude coordinates. Other variables control for economic and political effects such as county GDP and the number of assemblymen in the opposition party in 1982. Descriptive statistics are shown in Table 1.

[Table 1 here]

5. Estimation and Results

5.1 – First-stage: Determinants of Rural Conflict

Table 2 presents the results of the first-stage regression where we estimate the determinants of rural conflict per 1000 farms using as instruments priests, frontier and the strength of the opposition party. The first column uses priest data from 1985 and the second data from 1975 to make any direct effect of priests on the second stage dependant variable even less likely. The estimation procedure used is Tobit because there are 2,930 observations censored at zero, that is, without any conflicts from 1985 to 1995. We interact priests with the frontier index, thus the estimated impact of priests on rural conflict has to be interpreted taking into account the coefficients of all three variables, priests, frontier and the interaction term. This impact is more easily perceived in Figure 4 that plots the estimated coefficient of priests for every value of the frontier index in our sample (1 to 52).[19] The interpretation is that for *municipios* where the frontier index equals 1, that is, those that have been consolidated since 1970, the estimated coefficient for priests is negative but not significant. For *municipios* with a frontier index greater than or equal to 2 the impact of priests on conflict is positive, significant and growing as the index increases. An additional priest per 1000 rural population in a county with a frontier index of 10 leads to 0.31 additional conflicts per 1000 farms. At a frontier index

[19] The coefficient of the interaction term in Table 2 is the value that holds when the frontier index is zero, a value which makes no sense as the index starts at 1. Similarly the reported standard deviation for the estimate of this coefficient ignores some covariance terms which should be taken into account. The correct interpretation of the interaction term taking these issues into account is given in the graph of Figure 4.

of 20 this value jumps to 0.71 conflicts. These results imply that priests serve as catalysts for land related conflict by organizing social movements, as recognized in the literature cited in the previous section. Our result qualifies this perception by showing that it is stronger in areas that are currently undergoing a more intense frontier process. Besides these impacts through priests, the frontier index also has a positive and significant direct on conflicts, with a unit increase in the index leading to an additional 0.02 conflicts per 1000 farms. A McDonald and Moffit (1980) decomposition of the marginal effects of the independent variables on the number of conflicts shows that 18% of these effects work through *muncipios* that already have conflicts (above the limit) and 81% through those that do not. This implies that policies that seek to reduce the determinants of rural conflicts should not focus exclusively in areas that have already experienced violence, as the potential for conflict is often latent even in areas that have been apparently peaceful in the past.

In addition to the influence of priests and the frontier we also use as an instrument for conflict the strength of the opposition party in the county assembly (MDB in 1982 and PT in 1996). Both of these variables are found to have a positive and significant impact on conflicts. In order to compare the effect of priests with that of opposition parties we calculated the effect of a one standard deviation increase in each of these variables. The impact found for the strength of the opposition party in 1982 is 0.11 additional conflicts per 1000 farms and that for 1996 is 0.07 additional conflicts. In order to compare the impacts of priests and politicians we have to consider that the effect of priests varies with the level of the frontier index of the *municipio*. When the index is set at 2, a one standard deviation increase in priests leads to a decrease of 0.15 conflicts. When the index is set at 3 the impact is an increase of 1.26 conflicts per 1000 farms. Thus priests have a greater impact on rural conflict than politicians only in the more frontier *municipios*.

[Table 2 here]

[Figure 4 here]

Of the three geographic variables, distance to state capital is positive and significant, while latitude and longitude are statistically equal to zero. Latitude and longitude capture the effect of temperature and other climatic factors, so this result suggests that these factors are

not important determinants of conflicts. However the state dummies also partially capture the same factors. We found some variables that control for the level of agricultural activity in the county to be negative and statistically significant. These variables are the number of tractors per hectare and the proportion of rural to urban population. The amount of cattle per hectare was also negative but not significant. These results show that conflicts are less likely, *ceteris paribus*, where there is more economic activity. On the other hand greater population growth from 1985 to 1995 – which includes migration – has a positive and significant effect on conflicts as does population density. Similarly those *municipios* that experienced greater rates of GDP growth from 1985 to 1995 registered less violence.[20] These results are not trivial as one may have expected that conflicts would occur with greater probability in regions that are not yet fully put to use. But the data are very clear in showing that conflicts are more likely in regions where there are rents to be captured, a notion which is in line with several models of the evolution of property rights, such as Demsetz (1967) and Alston, Harris and Mueller (2009).

Finally there are the crop mix variables and the land use variables, all in % of total area for the year of 1995. Of the land uses, forests, pasture and unused land all reduce conflict. Permanent crops on the other hand have a positive effect. Temporary crops are the excluded category. This fits the previous results as pasture and forests are low intensity land uses in Brazil, as is, by definition, unused land, whereas temporary and permanent crops are more often associated with higher levels of activity. The results also show that rice, coffee, beans and manioc are less likely, *ceteris paribus*, to lead to conflict. Once again this fits the notion that conflict occurs where agriculture is more active, as these crops (except for coffee) are more often associated with subsistence farming. Soybeans on the other hand are found to be positively associated with conflict. In addition state dummies are statistically significant for several states, indicating that there are many idiosyncratic factors not captured in our other variables.

5.2 – Second Stage: Determinants of Contract Choice

[20] We used GDP growth rather than levels to reduce the possibility of endogeneity of GDP. Removing GDP from the equation has practically no effect on the other results.

The objective of the second-stage regression is to test for the determinants of contract choice. The dependent variables are the percent of total farm land that is cultivated under fixed rent, sharecropping, by the owner or cultivated without formal title. We will thus estimate a system of four equations through seemingly unrelated regression. The advantage of this method is that we can restrict the coefficients of every variable in the four equations to add up to one. This is desirable because the dependent variables are measured in percent of total farm land so that if a change in an independent variable causes one of the dependent variables to rise, this must be compensated with a decline in one or more of the other three dependent variables. Furthermore, because the conflict variable that enters each equation is endogenously estimated in the first stage, the method will actually be three-stage least squares, which besides applying instrumental variable estimation to each equation also controls for contemporaneous correlation in the errors. That instrumental variables are necessary is confirmed by a Hausman-Wu test in each of the four equations (see last line in table 3). The exogeneity of conflicts is strongly rejected (1%) for the sharecropping, fixed rent and owner cultivated equations, though it is not rejected for the equation that measures occupied land. We present the the non-instrumented, though not consistent results in Table A1 in the appendix.

The purpose of the estimation is to ascertain the relative impacts of endowments and political/institutional factors on the form of agrarian organization. The endowments of a given county are captured by the crop mix that is found to prevail in 1995, the idea being that given relative pries, the choice of crops is overwhelmingly determined by agro-climatic and geographic factors, i.e. you can't grow coffee too far south because of the frosts. Latitude and longitude coordinates are also used to control for these factors in addition to the crop mix variables and the land use variables. In addition we control for other factors through variables that measure distance to the state capital, transportation costs, the growth from 1985 to 1995 of the *municipio's* GDP, tractors, cattle, population growth, urbanization and population density.

The political/institutional determinants of contract choice are captured by the conflict variable that was estimated in the previous section. The conflict variable includes any incidence

of land related violence that was registered from 1985 to 1995 by the CPT (Pastoral Land Commission). The assumption is that the existence of such events in a county reflects a perception by economic agents of property rights insecurity that, given the biases in Brazilian land legislation and enforcement discussed in section 3, may affect their choice of contract. Our interest is not only to determine whether these issues actually affect contract choice, but also the direction of the impact. In Section 3 we showed that there are theoretical models and empirical evidence in the literature going both ways, that is, greater property right insecurity leading to both less and more tenancy arrangements. Our results are shown in Table 3.[21]

[Table 3 here]

The results show that the crop mix that prevails in a given county affects the form of agrarian organization. Almost all the estimated coefficients for the eight crops are statistically significant in each of the four equations. The results show that the use of fixed rent is more probable where cotton, soybeans, rice and sugar cane is planted, and less probable where coffee and corn are planted, with beans and manioc having no statistically significant effect. These results are compatible with generally held perceptions of the nature of these crops, for example Almeida and Buainain (2001: 4-5) state that in Brazil fixed rent contracts are particularly intense in rice growing areas. The magnitudes of the impacts of the crop variable will be discussed below in comparison to the impact of conflicts. First we will analyze the impact of the other variables. Latitude and longitude are both statistically significant in all four equations except sharecropping, thus increasing the confidence that we are controlling for geographic and climatic factors so that any effect captured by the conflict variable will be *ceteris paribus*. Similarly counties that are more distant from the state capital were found to use less fixed rent contracts and more sharecropping. Transport costs to São Paulo increased the area in occupations and reduced the sharecropped area. The availability of train stations increased the area in fixed rent contracts.

The positive effect of GDP growth from 1985 to 1995 on occupied areas and the negative effect on owner-run areas is an indication that less-developed areas tended to grow

[21] Table 3 shows the results using data on priests for 1985. The results with data on priests for 1975 will be discussed below.

more during this period. An increase in the number of tractors per hectare had the effect of making *municipios* more sharecrop and occupant intensive to the detriment of owner-run areas. Increases in cattle reduced fixed rent and increased owned area, while population density had the opposite effect. The greater the proportion of rural to urban population the greater the occupied area. Fixed rent areas increased where the population grew more from 1985 to 1995.

The main variable of interest in this regression is conflicts per farm. The results show that increases in conflicts lead to lower use of fixed rent and sharecropping, with a corresponding increase in owner run farms. All three coefficients are statistically significant at the 1% level, while no impact was found on occupied area. This result provides strong evidence that property rights insecurity is detrimental to the adoption of tenancy arrangements and may have important efficiency effects as recognized by the large literature on the economics of agricultural organization. The evidence in our test thus corroborates for Brazil the hypotheses in Conning and Robinson (2007) and de Janvry and Sadoulet (1989) concerning the perverse effects of politics and conflict. In order to gauge the magnitude of these effects and compare them with the effect of endowments, Figure 5 shows how a one-standard deviation increase in each of the crop variables and the conflict variable affect each of the dependent variables. These results show that the negative effect of conflicts on tenancy arrangements is large, decreasing fixed rent contracts from over 4% to less that 3% and sharecropping by half, from almost 2.5% to approximately 1.25%. Correspondingly, a one-standard deviation increase in conflicts increases the average level of owner-run farms from about 83.5% of the total farm area to 86%. The crops that have the greatest impact are shown by this exercise to be sugar cane, rice and soybeans, increasing both forms of tenancy and reducing owned area. When we use the 1975 priest data in the first regression as a further measure to assure an appropriate instrument, the results remain basically the same.

[Figure 5 here]

5.3 – Testing the appropriateness of the instruments

For the results just presented to be valid it is necessary that the instruments used have certain properties. The first is that they have a clear effect on conflict. The second is that the only reason for the relationship between contract choice and priests is the first stage. One way to test for the first property, that is, whether the instruments are weak, is through an F-statistic on the joint significance of the instruments in the first-stage regression (Stock, Wright and Yogo, 2002). If the F-statistic is greater than a given threshold value then the instruments can be considered as not being weak. The threshold value at 5% for the case of 5 instruments is 9.20 (Stock, Wright and Yogo, 2002: Table 1 pg. 522). Table 4 column 2 shows the F-statistic for several different specifications of the first-stage, allowing for different combinations of the instruments to show the robustness of the results. In the first row we use all instruments; priests (1985), the interaction of priests with frontier, and opposition party strength in 1982 and 1996. These are the results shown in Tables 2 and 3. In the second line we replicate the previous specification but use instead priest data from 1975. In the third line opposition parties are dropped and in the fourth line the interaction term is dropped. In all cases the null hypotheses of weak instruments is clearly rejected.

In order to test the second property of the instrument, that is, the exclusion restriction, a Sargan–Hansen statistic to test for overidentifying restrictions would be recommended. However this is not possible in our case because although we do have several instruments in the first stage, the second stage is actually estimated using the fitted value from the first stage as a single instrument rather than plugging in the separate fitted values. This procedure is necessary because the first stage is nonlinear (Wooldridge, 2002: 542; Angrist and Pischke, 2009). Applying 2SLS reasoning directly with a non-linear first-stage is not guaranteed to produce first-stage residuals that are uncorrelated with fitted values and covariates. In any case we show in Table 4 that our main result is robust to different specifications of the instruments. Columns 3 to 6 show the estimated coefficient of conflicts in each of the four contract choice equations. The table shows that conflicts have a negative impact on tenancy even if priest data from 1975 is used and if opposition parties are not included. Only when the interaction of priests with frontier is dropped do the results start to breakdown, although even then the negative impact of conflict on fixed rent remains.

[Table 4 here]

5.4 – Testing the robustness of the negative relationship between conflict and tenancy

The strong negative relationship found between insecure property rights and tenancy arrangements contradicts studies that predict insecure property rights will lead to incentives for more investment as a means to signal occupancy and use and thus preempt invasion and expropriation (Besley 1995, Carter and Olinto 2003, Place and Otsuka 2002, Pinckney and Kimuyu 1994 and Vertova 2006). One might interject, however, that our estimation of the full sample of Brazilian counties only provides an overall average, and that the effect of property rights on agrarian organization might vary in different regions or for different subsamples. Similarly it may be the case that the effect we estimated is valid only for the specific time period of our data, that is conflict from 1985 to 1995 affecting contract choice in 1995, and the relationship might have been different before and after this specific window. In this subsection we test the robustness of our findings to consider its validity more generally.

The first check is to look at the data for contract choice and violence graphically, which allows us to include data from other census years and thus get a more dynamic picture. In Figure 6 we plot the % of total farms under fixed rent and sharecropping for the census years from 1970 to 1995, separating the counties into subsamples that experience some violence from 1985 to 1995 and those that had none.[22] The graph shows that since 1975 those areas with conflicts had about half of the area in tenancy arrangements of those that did not. Furthermore it shows that overtime the use of tenancy arrangements is slowly falling in both areas with and without conflicts. Also, the impact of violence has decreased slightly from 1985 to 1995 for sharecropping but not discernibly so for fixed rent, a result we shall return to below. These results are for the country as whole. When the data are analyzed for specific regions separately, we find that there is significant regional variation. Figures 7 and 8 show the data for the southern and the north (Amazon) regions. In the south there is no apparent impact of conflicts throughout the entire period and about twice the use of tenancy arrangements than

[22] This uses data from the agricultural censuses of 1970, 1975, 1980, 1985 and 1995. Note that although data for contract choice, agricultural production and priests exists for each of these years, the conflict data is only available for the period after 1985. This is what impedes the estimation of a panel across these years.

the country average. In the north there was significant use of fixed rent contracts up until 1985 with a high impact of violence. Probably as a consequence of the widespread violence in the region by 1995 the use of tenancy arrangements had become almost negligible.[23]

[Figure 6, 7 and 8 here]

Given this regional variation we ran a regression allowing for a separate coefficient for conflict for each state by interacting conflict with each of the state dummies. In this regression the dependent variable is the sum of the area in fixed rent and in sharecropping. Of the 27 states 20 had a negative and statistically significant impact of conflict on tenancy. In six states conflict was found to have no effect, and in one single state the relationship was positive and significant. This state was the Federal District, but this is somewhat of an outlier given that it is a one-*municipio* state, while all other states have hundreds of counties.[24]

Another possibility is that there are some counties that have certain characteristics that make for a positive relationship between conflicts and tenancy, but that are not grouped regionally, being instead dispersed throughout the country. In order to test for this possibility we implemented a bootstrapping exercise that repeatedly sampled from our data set of 3659 *municipios* sub-samples of size 500 and ran an instrumental variable regression on the % of total area in fixed rent, registering the coefficient and standard deviation of conflict.[25] The total number of repetitions was 10,000 to allow for a great number of combinations of *municipios* in the subsample. The idea is to see if some combinations of counties are randomly drawn that have a positive relationship of conflicts and fixed rent area. If so we can gauge how frequently this happens and what are the characteristics of those samples. The distribution of the estimated coefficient for conflict is shown in Figure 9. Of the ten thousand regressions 1,380 had coefficients that were statistically significant at least at 10% and are included in the distribution. The mean of the distribution is -0.009 which contrasts with the coefficient for the whole sample of -0.0025. Of all the coefficients that were significant, only 110 (8.7%) were positive, while 1270 (91.3%) were negative. Repeating the same exercise with samples of 1,000

[23] Graphs for the other three regions are omitted in the interest of space.
[24] These regression results are available upon demand from the authors.
[25] We used only fixed rent because it was too demanding computationally to run the full 3SLS system 10,000 times and fixed rent is the more prevalent of the tenancy arrangements.

yields 3,346 significant coefficients out of which 2.2% were positive and 97.8% negative (see Figure 10). With N=2,000 there are 6,726 significant coefficients and only 0.1% are positive. As N increases there is thus a convergence of the estimated coefficient to the full sample value of -0.0025 and fewer occurrences of positive coefficients.

[Figure 9 here]

[Figure 10 here]

This provides strong evidence that the negative relationship between conflicts and tenancy arrangements is general across counties. Even with the smaller sample size of 500 we incur a Type-I error of only 1.1% when we reject the hypothesis that conflicts are positively related to fixed rent tenancy.[26] This indicates that those subsamples found where conflicts increases tenancy are probably flukes rather than samples with special characteristics. In any case we examined 20 of those 110 positive samples to see if any systematic characteristics could be found. This was done by performing difference in means tests for all variables in our data set comparing these N=500 subsamples which exhibited the positive coefficients with the overall sample where N=3659. Although each of the samples had a few variables that proved to be statistically different from the full data set, there was no evidence of characteristics systematically related to all or most of the samples. The estimated impact of distance to the state capital, for example, was statistically different in 6 of the 20 samples, but in 3 of those it was larger and in the other 3 smaller. The evidence is thus overwhelming for a negative impact of conflict on tenancy in Brazil in 1995.

6 – Which Tenancy Contracts are Forgone Due to Property Rights Insecurity?

With census data aggregated at the *municipio* level we cannot directly examine which types of contracts are most affected by the property rights insecurity in the form of land conflicts. Figure 11, constructed using that data, shows the distribution of fixed rent and sharecropped farms both in terms of area and number of properties. These distributions show that sharecropping tends to take place on smaller farms, but this does not provide any information on the channels through which conflicts affect contract choice. We can, however,

[26] This value comes from 110 positive and significant relationships out of 10,000 regressions.

get at this issue indirectly by using our data to test the determinants of average farm size. This can be done by using the results from our contract choice regression (Table 3) to calculate how a change in violence affects average farm size through its effect on contract choice. In order to do this we assume that all the variables in the contract choice regression, as well as the instruments in the conflict regression, affect average farm size indirectly through the choice of contract type. Thus in Table 5 we regress average farm size on the contract variables and add state dummies to capture other fixed local effects. Because the four contract type variables add up to 1 we cannot have them all simultaneously in the regression and must leave one out. This excluded variable will be the one against which the estimated coefficients for the other three variables will be interpreted. Each estimated coefficient measures the amount by which average farm size changes given a change in that coefficient keeping the other two fixed. If we exclude the variable '% owned', for example, the estimated coefficient for '% fixed rent' gives us a measure of how average farm size is affected by an increase in the % area under fixed rent and corresponding decrease in % area of owned properties, keeping 'sharecrop' and 'occupied' fixed. In Table 4 we show four estimations each excluding one of the four contract variables. We will focus only on the first column of Table 4 that excludes owned properties because our main interest is to understand how violence affects the choice between renting and farming directly oneself.

[Figure 11 here]

[Table 5 here]

The results show that a decrease in the area under fixed rent leads to a decrease in average area, and that a decrease in sharecropped area leads to an increase in average area, both statistically significant at 1%. This implies that when conflicts reduce both types of contracts, as we showed above, the impact on average farm size is different through fixed rent and sharecropping. Because a drop in fixed rent reduces average farm size, it must be that the fixed rent contracts that are being forgone on the margin involve farms larger than the average size. Thus an increase in violence that reduces fixed rent contracts is on average impeding larger properties (compared to the average in the *municipio*) from contracting. With sharecropping the effect is the opposite. When violence decreases sharecropping the average farm size increases, which implies that the sharecropping must occur predominantly in

properties below the *municipio* average. The coefficient for occupied is not statistically different from zero so no changes to average farm size take place when occupied area changes. These results show that the losses in efficiency due to insecure property rights that we identified involve the forgoing of fixed-rent contracts on larger size farms and the forgoing of sharecropping contracts on smaller size farms.

In order to measure the magnitude of these effects we use the contract choice equations in Table 3 to estimate how much a change in violence from zero to the average level of violence in those *muncipios* that had any violence (that is, 4.4 conflicts) affect the size of fixed rent and sharecropped farms. The effect of this change in violence on average farm size through its impact on fixed rent is a decrease from 163.8 to 156.6 hectares, that is a drop of 4.4%. The effect through sharecropping is an increase in average farm size from 167.5 to 180.8 hectares, a 7.9% increase. Both the increase in average size that results from the decrease of sharecropping as well as the decrease that results from lower fixed rent are inefficient as they preclude gains to trade that would be realized were it not for the insecurity of property rights caused by conflict. Furthermore, the 13.3 hectare increase due to less sharecropping is greater than the 7.2 hectare fall due to less fixed rent, so that in net average farm size increases, which in a country with such high land ownership concentration as Brazil, is considered in itself an undesirable outcome.

7 – Concluding Remarks

In Brazil, land reform, by affecting the security of property rights via increasing land conflicts, has a perverse impact on land rentals resulting in an inefficiency or inability to realize the gains from agricultural contracting. In a large commodity based country like Brazil the losses are undoubtedly high. Even if there are other reasons not related to land conflict for why some farmers may want to hold large and unproductive properties, such as to hedge against inflation (very relevant for the time period of our data) or for political power, it would still be advantageous to the prospective tenant and sharecroppers, as well as to society, for the landowner to rent the land and profit twice (Rezende, 2006; Sayad, 1982). The very low levels of tenancy in Brazil and much of Latin America are thus a puzzle. The difficulty of solving this paradox lays not so much in being able to point to causes of the scarcity of rental contracts. In

this paper we have provided very robust evidence that insecure property rights are an important deterrent to tenancy arrangements. The greater puzzle, as noted by Conning and Robinson (2007: 421) is why economic agents are not able to contract around these inefficiencies.

The extent of the losses from forgoing rental contracts in Brazil has in the recent past led to several attempts at getting around the impediments of tenancy by creating special regional programs where all the necessary conditions would be provided by policymakers and other organizations for rental transactions to take place. Buainain et al. (2008) survey some of these attempts and conclude that "however well considered the initiatives are, they have not achieved their goals … county administrations do not manage to use either the incentives or the coercive instruments required to induce landowners and landless farmers to negotiate under equal conditions leading to mutually profitable contracts." It is the understanding of this greater inability to credibly commit to not expropriating rented farms and thereby the inablility to realize the gains from contracting that is the real puzzle to be explained. Put another way: given that both landowners and tenants would benefit from more secure property rights, what are the impediments to a more sensible land reform policy? We conjecture that the answer rests on the politics of land reform, a debate that entails the entire electorate and not simply the parties to the contract. Given Brazil has the highest land inequality in Latin America, with a highly urbanized and enfranchised citizenry, voters favor a land reform policy based on redistribution which has the unintended consequence of increasing land conflicts and reducing the career mobility prospects of many landless rural peasants.

References

Adriance, Madeleine C. 1991. “Agents of Change: The Roles of Priests, Sisters, and Lay Workers in the Grassroots Catholic Church in Brazil,” *Journal for the Scientific Study of Religion*, 30(3): 292-305.

Adriance, Madeleine C. 1994. “Base Communities and Rural Mobilization in Northern Brazil,” *Sociology of Religion*, 55:2, 163-178.

Adriance, Madeleine C. 1995. “The Brazilian Catholic Church and the Struggle for Land in the Amazon,” *Journal for the Scientific Study of Religion*. 34(3): 377-382.

Allen, Douglas and Dean Lueck. 1992. “Contract choice in modern agriculture: cash rent versus cropshare.” *Journal of Law and Economics*, 35 (2), 397-426.

Almeida, Patricia J. and Antonio M. Buainain. 2001. “Arrendamento de Terras: uma Contribuição ao Neoinstitucionalismo Econômico,” In: III International Conference on AgriChain/Networks Economics and Managemente, 2001, Ribeirão Preto/SP – USP, - 24 a 26 de outubro de 2001, p. 10-30.

Alston, Lee J., Samar K. Datta and Jeffrey B. Nugent. 1984. "Tenancy Choice in a Competitive Framework with Transactions Costs," *Journal of Political Economy*, 92 (December): 1121-1133.

Alston, Lee J. and Joseph P. Ferrie. 1999. *Paternalism and the American Welfare State: Economics, Politics, and Institutions in the U.S. South, 1865-1965*. New York: Cambridge University Press 1999).

Alston, Lee J. and Joseph P. Ferrie. 2005. *Time on the Ladder: Career Mobility in Agriculture,* 1890-1938. *The Journal of Economic History*, Cambridge University Press, vol. 65(04): 1058-1081, December.

Alston Lee J. and Robert Higgs. 1982. "Contractual Mix in Southern Agriculture since the Civil War: Facts, Hypotheses and Tests," *Journal of Economic History*, XLII (June): 327-353.

Alston, Lee J. and Kyle Kauffman. 1998. “Up, Down and Off the Agricultural Ladder: New Evidence and Implications of Agricultural Mobility for Blacks in the Postbellum South,” *Agricultural History* 72,: 263-279.

Alston, Lee J. and Kyle Kauffman. 1997. “Agricultural Chutes and Ladders: New Estimates of Sharecroppers and Welfare Implication for the Southern Agricultural Labor Market, 1900-1960," *Journal of Economic History* (June): 464-475.

Alston, Lee J., Edwyna Harris and Bernardo Mueller. 2009. “*De Facto* and *De Jure* Property Rights: Land Settlement and Land Conflict on the Australian, Brazilian and U.S. Frontiers” NBER Working Paper No. 15264, September.

Alston, Lee J., Gary D. Libecap, and Bernardo Mueller. 1999a, A model of rural conflict: violence and land reform policy in Brazil. *Environment and Development Economics*, Cambridge:UK, 4:135-160.

Alston, Lee J., Gary D. Libecap, and Bernardo Mueller. 1999b. *Titles, conflict and land use: the development of property rights and land reform on the Brazilian Amazon frontier*, Ann Arbor, The University of Michigan Press.

Alston, Lee J., Gary D. Libecap, and Bernardo Mueller. 2000, Property rights to land and land reform: legal inconsistencies and the sources of violent conflict in the Brazilian Amazon. *Journal of Environmental Economics and Management*, 39:162-188.

Alston, Lee J., Gary D. Libecap, and Bernardo Mueller. 2010. How Interest Groups can Influence Political Outcomes Indirectly through Information Manipulation: The Landless Peasants Movement in Brazil. Working Paper.

Angrist, Josua D. and Jorn-Steffen Pischke. 2009. *Mostly Harmless Econometrics: An Empiricist's Companion*. Princeton University Press.

Bailey, Martin J., "Approximate Optimality of Aboriginal Property Rights," Journal of Law and Economics, 1992, XXXV(1), 183-198.

Bardhan, Pranab and Dilip Mookherjee. 2008. Determinants of redistributive politics: an empirical analysis of land reform in West Bengal. Working paper, Department of Economics, University of California, Berkeley, September.

Besley, T., 1995. "Property Rights and Investment Incentives: Theory and Evidence from Ghana." *Journal of Political Economy*, 103 (5): 903-937.

Binswanger, Hans P., Klaus Deininger and G Feder. 1995. Power, distortions, revolt and reform in agricultural land relations. In *Handbook of Development Economics, Volume III*, ed. Jere Behrman and T.N. Srinivasan, Amsterdam: Elsevier Science: 2659-2772.

Brandão, Antônio S., Guilherme S. Bastos Filho, Alexandre P. Brandão. 2001. "Land Markets and Rural Poverty Alleviation," Chapter 4 in World Bank, *Rural Poverty Alleviation in Brazil: Towards an Integrated Strategy- Vol. 1: Policy Summary*, World Bank, Report No. 21790-BR

Bruneau, Thomas. 1985. "Church and Politics in Brazil: the Genesis of Change," *Journal of Latin American Studies*, n. 17: 271-293.

Buainain, Antônio M., Patrícia J. Almeida, Fernando de Lima and José Maria de Silveira. 2008. "Land Rental Markets and Land Access in Brazil," *Basis Brief: Assets and Market Access*, CRSP, July, http://www.basis.wisc.edu.

Carvalho, Marcia S. 1991. A Pequena Produção de Café no Paraná, São Paulo, University of São Paulo, Ph.D Thesis, Dept. of Geography.

Carter Michael R. and Pedro Olinto. 2003. "Getting Institutions 'Right' for Whom? Credit Constraints and the Impact of Property Rights on the Quantity and Composition of Investment," *American Journal of Agricultural Economics*, Vol. 85, pp. 173-186, 2003

CERIS – Centro de Estudos Religiosos e Investigações Sociais. 1997. *Anuário Católico do Brasil*, Rio de Janeiro, Vol. 10: 1-973.

Cheung, Steven N.S. 1969. *The Theory of Share Tenancy*. University of Chicago Press, Chicago.

Conning, Jonathan H. and James A. Robinson. 2007. Property Rights and the Political Organization of Agriculture. *Journal of Development Economics* 82: 416-447.

de Janvry, Alain and Elisabeth Sadoulet. 1989. "A Study in Resistance to Institutional Change: The Lost Game of Latin American Land Reform," *World Development,* Vol. 17, No. 9: 1397-1407.

de Janvry, Alain, Karen Macours, and Elisabeth Sadoulet. 2002. "Access to Land in the Rural Development Agenda," Sustainable Development Department, Inter-American Development Bank, Washington D.C.

Deininger, Klaus and José S. Chamorro. 2004. "Investment and Income Effects of Land Regularization: The Case of Nicaragua." Agricultural Economics 30 (2): 101-16.

Deininger, Klaus and Gershon Feder. 2000. Land Institutions and Land Markets. In *Handbook of Agricultural Economics,* ed. Jere Behrman and T.N. Srinivasan, Amsterdam: Elsevier Science: 2659-2772.

Demsetz, Harold. 1967. "Towards a Theory of Property Rights", *The American Economic Review*. Volume 57, Issue 2 May, 1967, 347-359.

Federico, Giovanni. 2006. "The 'Real' Puzzle of Sharecropping: Why is it Disappearing?" *Continuity and Change*, 21(2): 261-285.

Gallo, Andres. 2003. "Rural Rent Legislation in Argentina: Congress and Renters, 1912-1943," Working Paper.

Garcia-Jimeno, Camilo and Robinson, James A. 2009. "The Myth of the Frontier," NBER Working Paper Series, March, Vol. w14774, pp. -, 2009. Available at SSRN: http://ssrn.com/abstract=1352954 .

Hayami, Yujiro and Keijiro Otsuka. 1993. *The Economics of Contract Choice: an Agrarian Perspective*. Oxford: Oxford University Press.

Hewitt, Warren E. 1990. "Religion and Consolidation of Democracy in Brazil: The Role of the Comunidades Eclesiais de Base (CEBs)," *Sociological Analysis*, 50:2, 139-152.

Houtzager, Peter P. 2001. "Collective Action and Political Authority: Rural Workers, Church, and State in Brazil," Theory and Society, Vol. 30, No. 1, Feb: 1-45.

IBGE. 1984. *Áreas Mínimas de Comparação a Nível Municipal : 1980-1970-1960*. Rio de Janeiro, IBGE.

IBGE. 2007. "Séries Estatísticas & Séries Históricas," Rio de Janeiro, IBGE, Censo Agropecuário 1920 to 1995/96: http://www.ibge.gov.br/series_estatisticas/subtema.php?idsubtema=100 .

IPARDES. 1978. "O Trabalhador Volante no Estado do Paraná," Vol I, Curitiba.

Jamarillio, C.F. 2001. "El Mercado Rural de Tierras em America Latina: Hacia uma Nova Estatrategia," Washington, Inter-American Development Bank, Technical Report No. EVN-124.

Krischke, Paulo, J. 1991. "Church Base Communities and Democratic Change in Brazilian Society," Comparative Political Studies, Vol. 24, No. 2: 186-210.

Macours, Karen, Alain de Janvry, and Elisabeth Sadoulet, 2007. "Insecurity of Property Rights and Matching in the Tenancy Market", submitted to The Economic Journal, revised October 2007.

Mainwaring, Scott. 1986. The Catholic Church and Politics in Brazil, 1916-1985, Stanford: Stanford University Press.

Mainwaring, Scott and Alexander Wilde. 1989. *The Progressive Church in Latin America*. Notre Dame: University of Notre Dame, Press/Kellogg Institute.

Mançano, Bernardo F. and João P. Stédile. 1999. Brava Gente: A Trajetória do MST e a Luta pela Terra no Brasil, São Paulo, Editora Fundação Perseu Abramo.

Marshall, Alfred. 1890. Principles of Economics. Edited by C.W. Guillebaud, Macmillan Company London (1961).

Maybury-Lewis, Biorn. 1994. *The Politics of the Possible: The Brazilian Rural Worker´s Trade Union Movement, 1964-1985*, Philadelphia, Temple University Press.

McDonald, John F. and Robert A. Moffit. 1980. "The Uses of Tobit Analysis," *The Review of Economics and Statistics*, Vol. 62, No. 2, May: 318-321.

Menezes Neto, Antonio J. 2007. "A Igreja Católica e os Movimentos Sociais do Campo: a Teologia da Libertação e o Movimento dos Trabalhadores Sem Terra," *Cadernos do CRH* (UFBA), v. 20, p. 331-342.

Murrell, Peter. 1983. "The Economics of Sharing: a Transactional Cost Analysis of Contractual Choice in Farming," *The Bell Journal of Economics*, 14 (1), 283-293.

Nichols, William H. 1971. "A Frontiera Agrícola na História Recente do Brasil: O Estado do Paraná, 1920-65," *Revista Paranaense de Desenvolvimento*. Curitiba, set-out., 26:19-53.

Ondetti, Gabriel A. 2008. *Land, Protest and Politics: the Landless Movement and the Struggle for Agrarian Reform in Brazil*, Pennsylvania State University Press.

Pande, Rohini and Christopher Udry. 2006. "Institutions and Development: A View from Below," with Chris Udry in Proceedings of the 9th World Congress of the Econometric Society, edited by R.Blundell, W.Newey and T.Persson, Cambridge University Press.

Pinckney, Thomas C. and Peter K. Kimuyu. 1994. "Land Tenure Reform in East Africa: Good, Bad or Unimportant?" *Journal of African Economies*, Vol. 3, No. 1: 1-28.

Place, Frank and Keijiro Otsuka. 2002. "Land Tenure Systems and Their Impacts on Agricultural Investmetns and Productivity in Uganda," *Journal of Development Studies*, 38 (6):105-124.

Reis, Eustáquio, Márcia Pimentel and Ana I. Alvarenga. 2009. "Áreas mínimas comparáveis para os períodos intercensitários de 1872 a 2000," Rio de Janeiro, IPEA-DIMAC.

Rezende, Gervasio C. 2006. "Políticas Trabalhista, Fundiária e de Crédito Agrícola no Brasil: Uma Avaliação Crítica," *Revista de Economia e Sociologia Rural*, Vol. 44, No. 1: 47-78.

Rezende, Gervasio C., Ana C. Kreter. 2007. "Agricultural Labor Legislation and Poverty in Brazil: A Transaction Costs Approach" *Revista de Economia Agrícola*, v. 54: 121-137.

Romeiro, Ademar and Bastiaan P. Reydon (coords.) 1994. *O Mercado de Terras*. Brasília: IPEA, 1994, Estudos de Política Agrícola (Documentos de Trabalho, 13).

Ribeiro, M.C.M and M.I. Stolf. 1975. "A Moradia do Trabalhador na Fazenda de Café Paulista," in E. Carone (ed.) *O Café: Anais do II Congresso de História de São Paulo*. São Paulo: 135-156.

Saint, William S. 1980. "Mão-de-Obra Volante na Agricultura Brasileira: Uma Revisão da Bibliografia," *Pesquisa e Planejamento Econômico*, IPEA, Vol. 10, Agosto, No. 2:503-526.

Sayad, J. 1982. "Especulação com Terras Rurais: Efeitos sobre a Produção Agrícola e o Novo ITR," *Pesquisa e Planejamento Econômico*, v. 12, n. 1, p. 87-108, abr.

Stiglitz, Joseph E. 1974. "Incentives and Risk Sharing in Sharecropping," *Review of Economic Studies*, 41 (2), 219-255.

Stock, James H., Jonathan H. Wright and Motohiro Yogo. 2002. "A Survey of Weak Instruments and Weak Identification in Generalized Method of Moments," *Journal of Business & Economic Statistics*, October, Vol. 20. No. 4: 518-529.

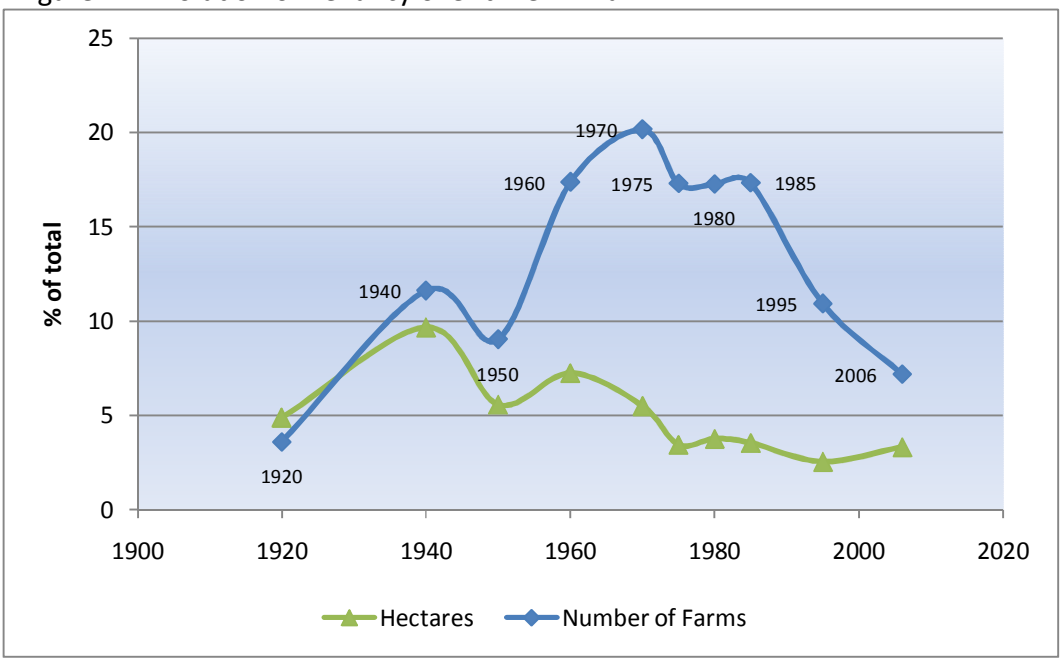
Valdés, Alberto and Johan A. Mistiaen. 2001. *Rural Poverty Alleviation in Brazil: An Integrated Strategy, Vol. 1: Policy Summary*, Washington, World Bank.

Vertova, Pietro. 2006. "Property Rights on Unused Asset and Investment Incentives: Evidence from Brazil," Tilburg University, Center for Economic Research, Discussion Paper 48.

Wooldridge, Jeffrey M. 2002. *Econometric Analysis of Cross Section and Panel Data*, MIT Press.

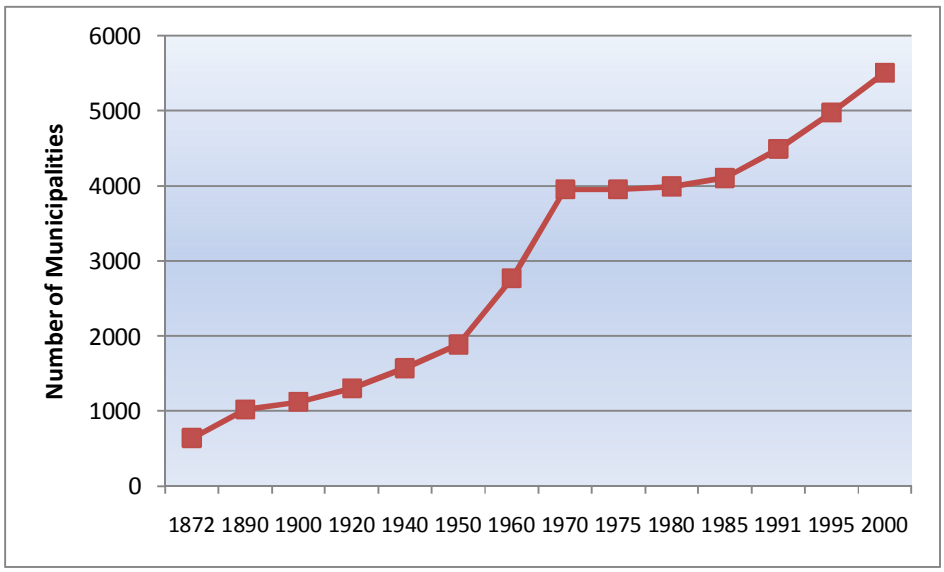
World Bank. 1994. "Brazil: The Management of Agriculture, Rural Development and Natural Resources, Vol. 2 Background Papers" Natural Resource Management and Rural Poverty Division, Country Department, Latin America and the Caribbean Region, July 31.

Figure 1 – Evolution of Tenancy over time in Brazil



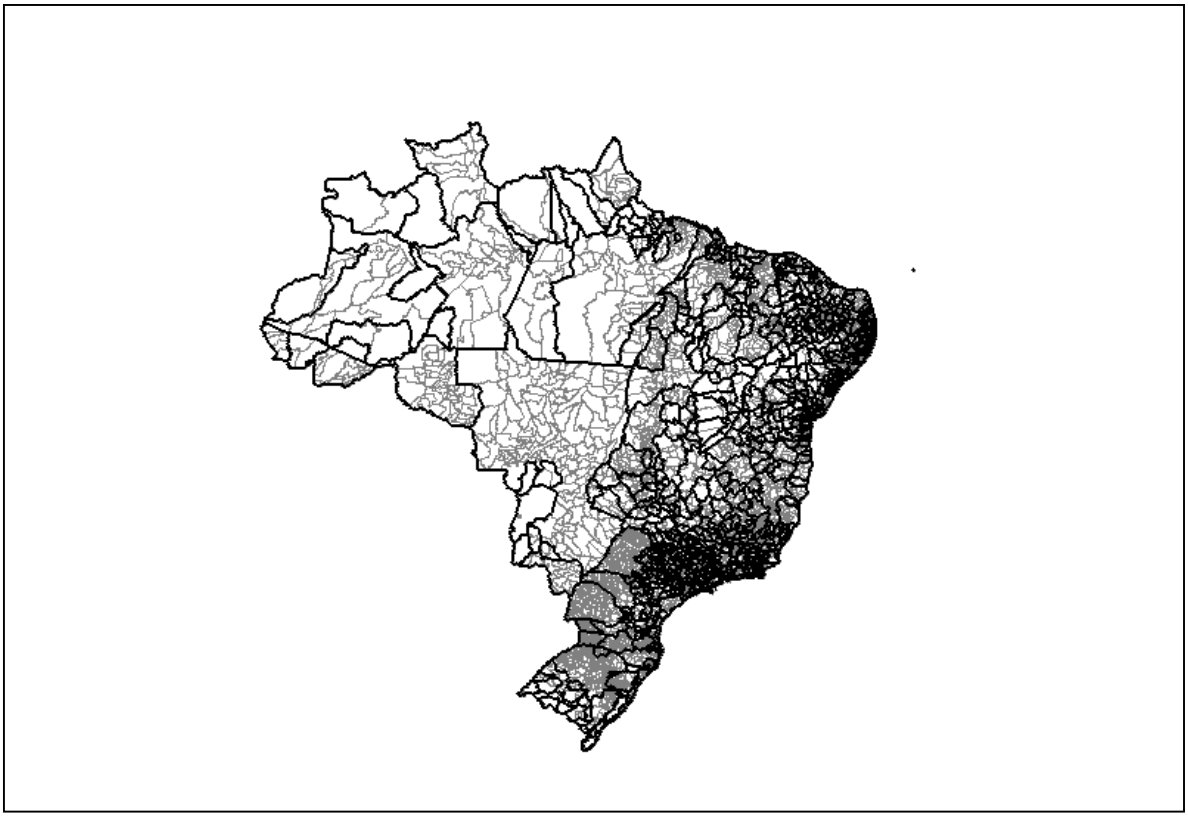
Source: IBGE (2007). Data for 2006 from the 2006 Agricultural Census and may not be perfectly comparable.

Figure 2 – The Evolution of the Frontier - Number of Counties, 1872 - 2000.



Source: Reis, Pimentel and Alvarenga (2009: 3).

Figure 3 – Minimum Comparable Areas 1920-2000 (dark lines), *Municipios* in 2000 (grey lines)



Source: Reis, Pimentel and Alvarenga (2009: 14).

Table 1 – Descriptive Statistics

Variable	N	Mean	Stand. Dev.	Min	Max
Conflicts per 1000 farms	3640	0.7885	5.921	0	283.582
Priests per rural population 1985	3631	16.66	42.232	0.072	831.683
Frontier	3659	1.505	2.262	1	53
Political opposition 1982 (% seats – MDB)	3659	0.340	0.243	0	1
Political opposition 1996 (% seats – PT)	3652	0.025	0.057	0	0.615
Population density 1995	3640	240.62	13,572.77	0.0087	818,792.3
GDP growth 1985-1995 (log)	3639	-0.165	0.677	-4.806	4.062
Tractors per hectare1995	3588	0.004	0.007	0	0.129
Average size of farms (hec.)	3640	93.720	174.619	0.104	4296.837
Cattle per hectare1995	3640	0.556	1.227	0	63.462
Latitude	3659	-16.491	7.644	-33.519	3.843
Longitude	3659	44.881	5.833	32.411	72.67
Rural/Urban Population (1995)	3621	1.071	1.631	0.0004	63.661
Population growth 1985-1995	3659	0.111	0.209	-0.400	3.490
Natural Forest (% total farm area) 1995	3640	0.154	0.136	0	0.900
Natural Pasture (% total farm area) 1995	3640	0.250	0.184	0	0.911
Permanent crops (% total farm area) 1995	3640	0.053	0.093	0	1
Usable but not used (% total farm area) 1995	3640	0.048	0.069	0	0.601
Unsuable area (% total farm area) 1995	3640	0.048	0.034	0	0.846
% of land in Fixed Rent contracts, 1995	3640	0.049	0.073	0	0.781
% of land in Sharecropping contracts, 1995	3640	0.021	0.041	0	0.714
% of land farmed by owner, 1995	3640	0.892	0.104	0	1.00
% of land occupied, 1995	3640	0.038	0.063	0	1.00
Cotton, % 1995	3640	0.003	0.012	0	0.315
Rice, % 1995	3640	0.008	0.026	0	0.709
Coffee, % 1995	3640	0.012	0.038	0	0.429
Cane, % 1995	3640	0.039	0.142	0	1.00
Beans, % 1995	3640	0.024	0.047	0	0.715
Manioc, % 1995	3640	0.009	0.027	0	0.580
Corn, % 1995	3640	0.048	0.067	0	0.851
Soya, % 1995	3640	0.021	0.136	0	0.901
Distance to state capital (km)	3659	240.467	158.039	0	1365.742
Transport cost to São Paulo (index)	3658	1475.81	1114.83	10	10,511.92
Train stations	3659	0.485	1.696	0	63

Table 2 – Determinants of Rural Conflict – First Stage Equation

Dep. Var.: Violence 1985-1996	**Priests 1985**	**Priests 1975**
Priests per rural population	-0.709***	-0.617***
	(-10.59)	(-10.29)
Frontier	0.150***	0.161***
	(3.09)	(3.34)
Priest X Frontier	0.329***	0.263***
	(8.08)	(7.77)
Political opposition 1982 (% seats	4.71**	4.95***
in state assembly – MDB	(2.44)	(2.57)
Political opposition 1996 (% seats	12.30*	13.50*
in state assembly – PT	(1.77)	(1.95)
Population density 1995	0.013***	0.012***
	(5.48)	(5.11)
Agricultural GDP growth 1985-	2.839***	2.849***
1995.	(4.81)	(4.84)
Distance to state capital	0.006**	0.007***
	(2.29)	(2.60)
Transport cost to São Paulo	0.0007	0.0007
	(0.72)	(0.71)
Number of train stations	0.203	0.281
	(1.05)	(1.44)
Latitude	0.317	0.386
	(1.31)	(1.59)
Longitude	-0.406	-0.444
	(-1.45)	(-1.59)
Cattle per hectare1995	-0.561	-0.619
	(-0.55)	(-0.58)
Tractors per hectare1995	-1452.65***	-1533.59***
	(-9.88)	(-10.21)
Rural/Urban Population (1995)	-0.976**	-0.981**
	(-2.54)	(-2.55)
Population growth 1985-1995	11.850***	11.951***
	(7.09)	(7.22)
Constant	29.034	32.340*
	(1.52)	(1.69)
Number of observations	Total: 3556	Total: 3556
	Censored at 0: 2930	Censored at 0: 2930
	Uncensored: 625	Uncensored: 625
Crop variables (8 crops)	Yes	Yes
Land Use Dummies (5 categories)	Yes	Yes
State Dummies (27 states)	Yes	Yes
Pseudo R^2	0.1644	0.1629
$\chi^2(55)$	1269.66	1256.13
Prob>χ^2	0.0000	0.0000

Tobit Estimation. t-stats in parentheses. Statistical significance: 1% ***. 5% **, 10% *. Weighted by the number of county subdivision from 1970-2000.

Figure 4 – Interaction of Priests and Frontier: Effect of Priests on Conflicts.

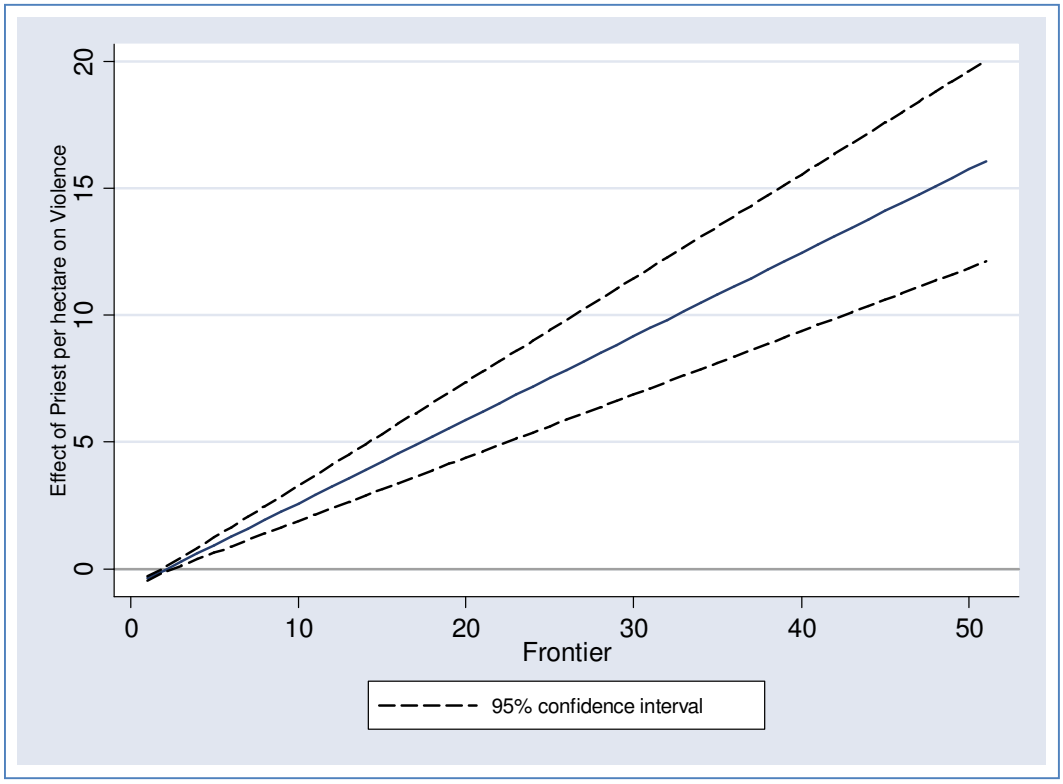


Table 3 – Determinants of Contract Choice

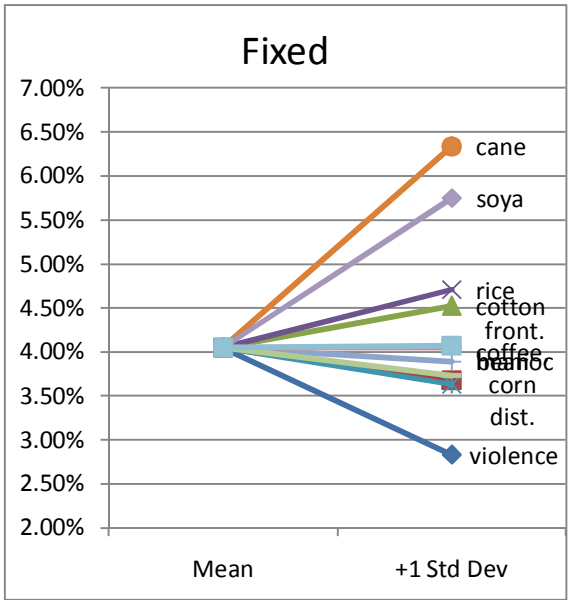
	Fixed Rent (%)	Sharecropper (%)	Owner (%)	Occupant (%)
Conflict per 1000 farms	-0.002***	-0.002***	0.004***	0.0001
	(-3.02)	(-4.86)	(3.57)	(1.17)
Frontier	-0.0003*	0.0001	0.0005**	0.002*
	(-1.85)	(0.99)	(2.12)	(1.75)
GDP growth 1985-1995	0.002	0.001	-0.007***	0.004***
	(0.94)	(1.22)	(-2.78)	(2.71)
Latitude	-0.001***	0.0002	0.005***	-0.002***
	(-4.00)	(0.45)	(4.38)	(-3.08)
Longitude	0.001	0.0003	-0.005***	0.003***
	(1.26)	(0.59)	(-4.13)	(5.11)
Distance to state capital	-0.00002***	0.00001**	0.00002	0.00001
	(-2.71)	(2.74)	(1.62)	(1.63)
Transport cost to São Paulo	0.0000008	-0.000004**	-0.00005	0.00001***
	(0.28)	(-2.07)	(-1.24)	(3.36)
Number of train stations	0.002**	-0.0005	-0.001	-0.00006
	(2.81)	(-1.28)	(-1.31)	(-0.13)
Population density 1995	0.00002***	0.000002	-0.00002***	0.00003
	(2.53)	(0.61)	(-2.37)	(0.58)
Rural/Urban Population 1995	-0.0008	-0.0002	-0.001	0.002***
	(-1.33)	(-0.54)	(-1.21)	(4.04)
Population growth 1985-1996	0.014***	0.004	-0.010	-0.008*
	(2.62)	(1.08)	(-1.26)	(-1.78)
Tractor per hectare growth 1985-1995	-0.135	0.461***	-0.828***	0.503***
	(-0.71)	(3.77)	(-3.02)	(3.13)
Cattle per hectare1995	-0.007***	-0.001	0.009***	-0.001
	(-3.59)	(-1.03)	(3.51)	(-0.97)
Cotton, % of total farm area	0.387***	0.206***	-0.705***	0.113*
	(4.81)	(3.98)	(-6.08)	(1.66)
Rice, % of total farm area	0.250***	0.242***	-0.514***	0.022
	(4.81)	(10.26)	(-9.72)	(0.70)
Coffee, % of total farm area	-0.110***	0.031	0.073	0.005
	(-3.47)	(1.54)	(1.61)	(0.20)
Cane, % of total farm area	0.161***	0.058***	-0.209***	-0.010
	(19.38)	(10.81)	(-17.42)	(-1.44)
Beans, % of total farm area	-0.033	0.115***	-0.201***	0.119***
	(-1.22)	(6.60)	(-5.12)	(5.17)
Manioc, % of total farm area	0.0001	0.081***	-0.688***	0.607***
	(0.00)	(3.00)	(-11.36)	(17.12)
Corn, % of total farm area	-0.048**	0.027**	0.013	0.008
	(-2.36)	(2.06)	(0.46)	(0.44)
Soy Beans, % total farm area	0.197***	0.026***	-0.207***	-0.016
	(-14.51)	(3.02)	(-10.57)	(-1.44)
Forest, % total farm area	-0.071***	-0.013**	0.036**	0.048***
	(-6.99)	(-2.06)	(2.46)	(5.66)
Permanent crops, % total farm area	-0.042***	0.013	0.046**	-0.016
	(-3.19)	(1.55)	(2.37)	(-1.45)
Pasture, % total farm area	-0.021***	-0.008*	0.005	0.024***
	(-2.70)	(-1.67)	(0.46)	(3.68)
Usable but not used, % total farm area	-0.051**	-0.027**	-0.009	0.081***
	(-2.28)	(-2.14)	(-0.31)	(4.86)
Unusable, % total farm area	-0.047	0.050**	-0.128**	0.125***
	(-1.33)	(2.22)	(-2.54)	(4.23)
Constant	-0.034	0.010	1.153***	-0.129***
	(-0.59)	(0.27)	(14.11)	(-2.70)
Number of observations	Total: 3556	Total: 3556	Total: 3556	Total: 3556
State dummies (27 states)	Yes	Yes	Yes	Yes
Pseudo R^2	0.42	0.20	0.39	0.38
$\chi^2(16)$	2826.27	1273.49	2484.34	2242.88
Prob>χ^2	0.0000	0.0000	0.0000	0.0000
Hausman-Wu Test	F(1, 3503)=15.51	F(1, 3503)=36.24	F(1, 3503)=0.20	F(1, 3503)=37.77
H_0: Conflicts are exogenous.	p-value= 0.0001	p-value=0.0000	p-value=0.6514	p-value=0.0000

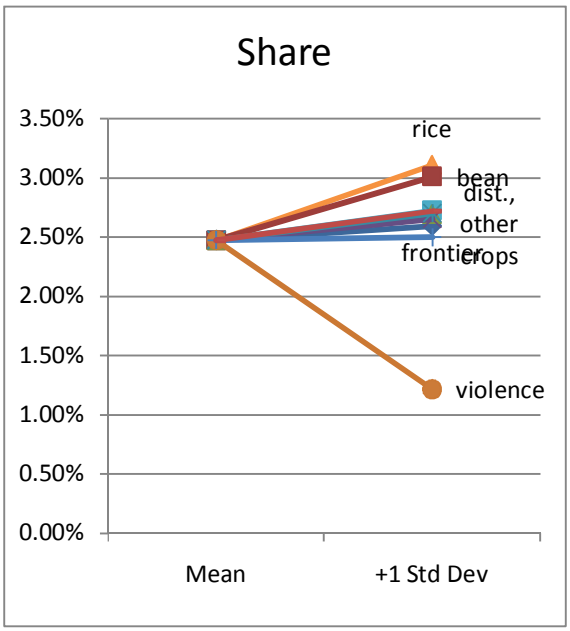
Estimated by 3-Stage Least Squares using predicted conflict as the single excluded instrument (Wooldridge, 2002: 542). t-stats in parentheses. Statistical signif.: 1% ***. 5% **, 10% *. The coefficients for all four equations are constrained to add up to 0 for every variable.

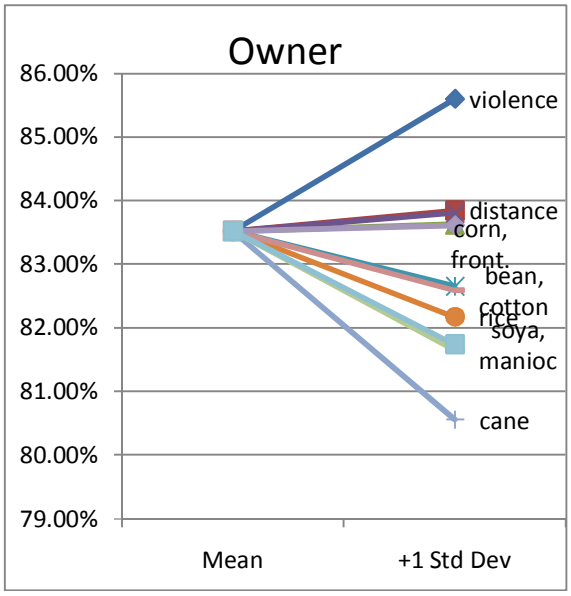
Table 4 – Analysis of Instruments

Instruments	F-test first stage	Sharecrop (impact of conflict)	Fixed-Rent (impact of conflict)	Occupied (impact of conflict)	Owned (impact of conflict)
Priests 1985, interaction, opposition parties	F(5, 3501)= 32.18	-0.002*** (-3.02)	-0.002*** (-4.86)	-0.0001 (1.17)	0.004*** (3.57)
Priests 1975, interaction, opposition parties	F(5, 3500)= 31.58	-0.002*** (-3.41)	-0.003*** (-3.52)	-0.0002 (0.29)	0.004*** (3.75)
Priests 1985, interaction, no opposition parties	F(3, 3510)= 51.94	-0.003*** (-3.74)	-0.002*** (-5.19)	0.0008 (1.41)	-0.004*** (4.09)
Priests 1985, no interaction, no opp. parties	F(1,3502)= 62.50	-0.0008 (-1.34)	-0.002*** (-4.20)	0.002*** (2.74)	0.001 (1.16)

Figure 5 - Marginal Effects of Crop Mix and Conflicts on Contract Choice (+ 1 std. dev.)







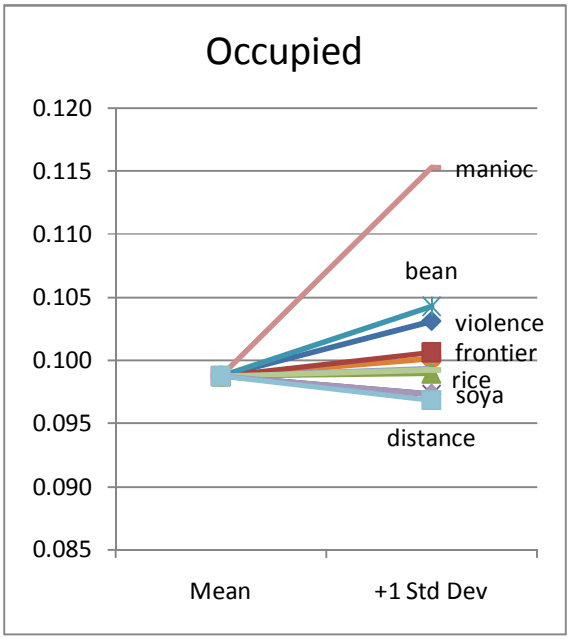
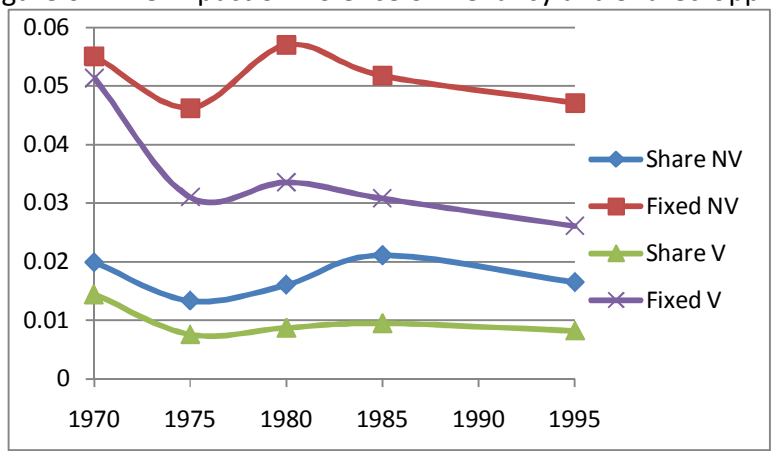
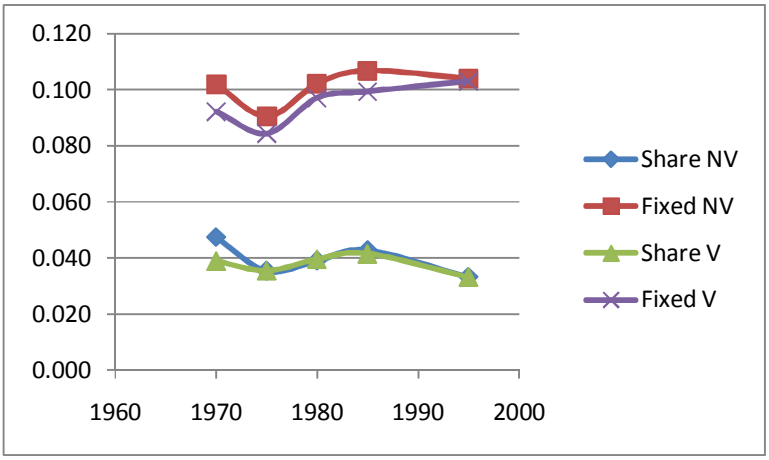


Figure 6 – The impact of Violence on Tenancy and Sharecropping - Brazil



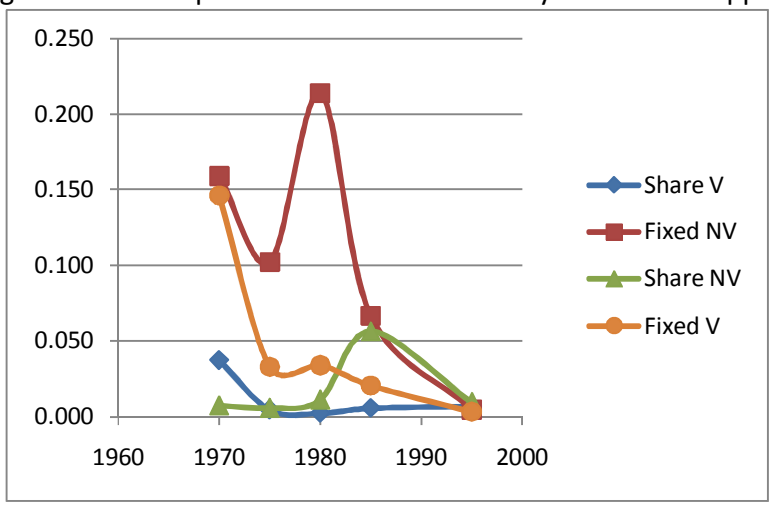
Percent of fixed rent and sharecropping in municipios with (V) and without (NV) violence.

Figure 7 – The impact of Violence on Tenancy and Sharecropping - South



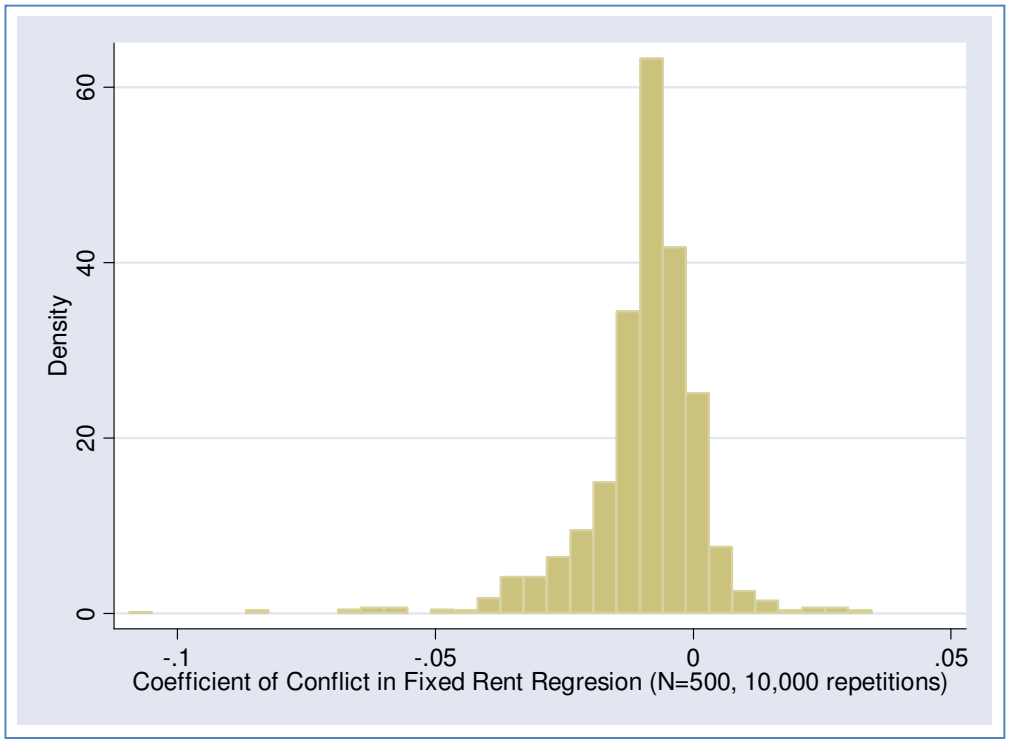
Percent of fixed rent and sharecropping in municipios with (V) and without (NV) violence.

Figure 8 – The impact of Violence on Tenancy and Sharecropping - North



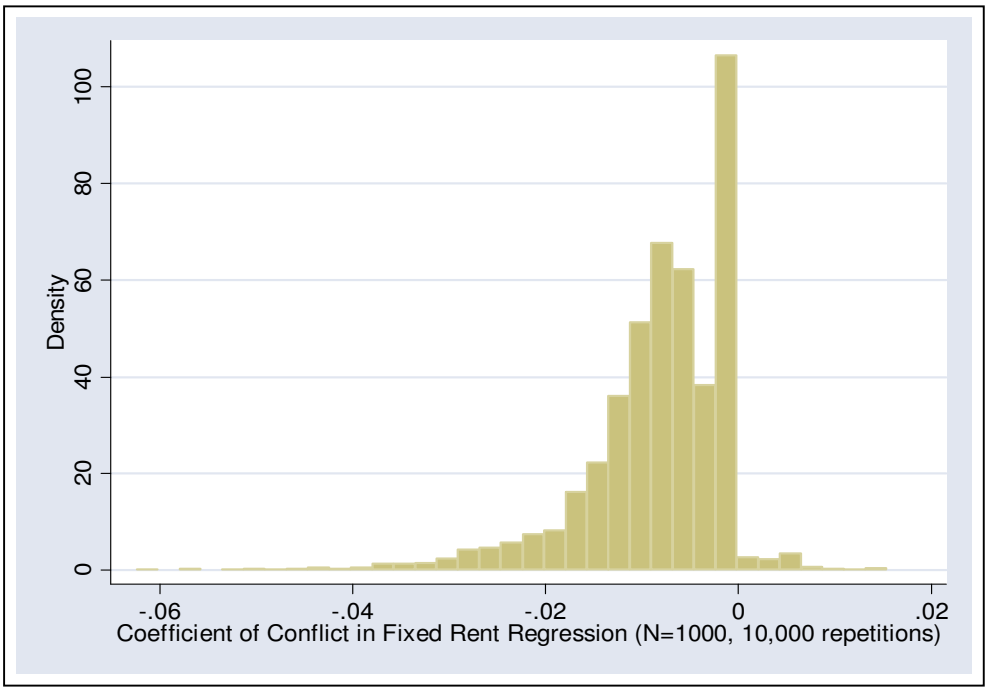
Percent of fixed rent and sharecropping in municipios with (V) and without (NV) violence.

Figure 9 – Distribution of Bootstrapped Coefficient of Conflict on Contract Choice, N=500



Sub-sample size = 500, Number of subsamples = 10,000. Only 1380 statistically significant (10%) coefficients were included in the histogram, of which 110 (8.66%) were positive and 1270 (91.34%) were negative.

Figure 10 - Distribution of Bootstrapped Coefficient of Conflict on Contract Choice, N=1000



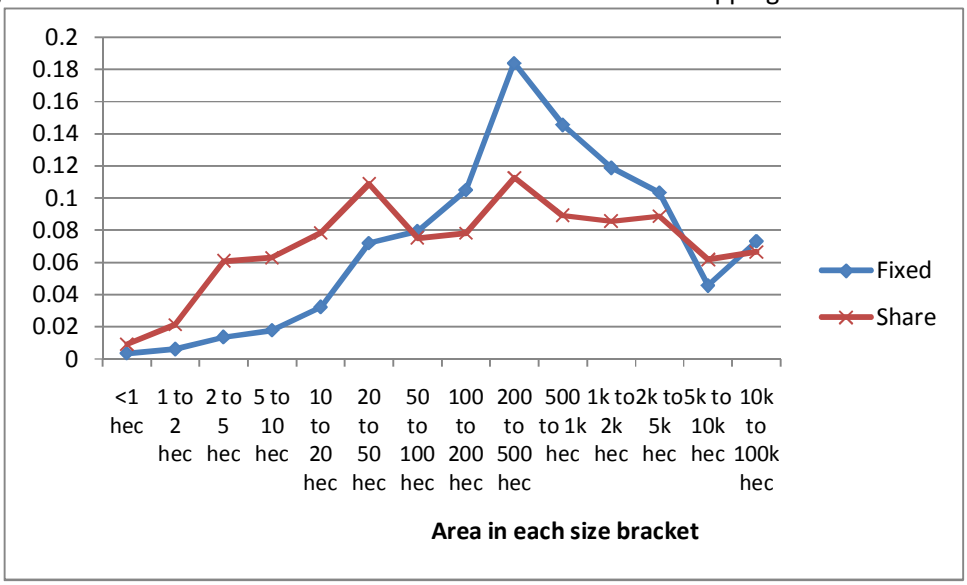
Sub-sample size = 1000, Number of subsamples = 10,000. Only 3347 statistically significant (10%) coefficients were included in the histogram, of which 75 (2.2%) were positive and 3271 (97.8%) were negative.

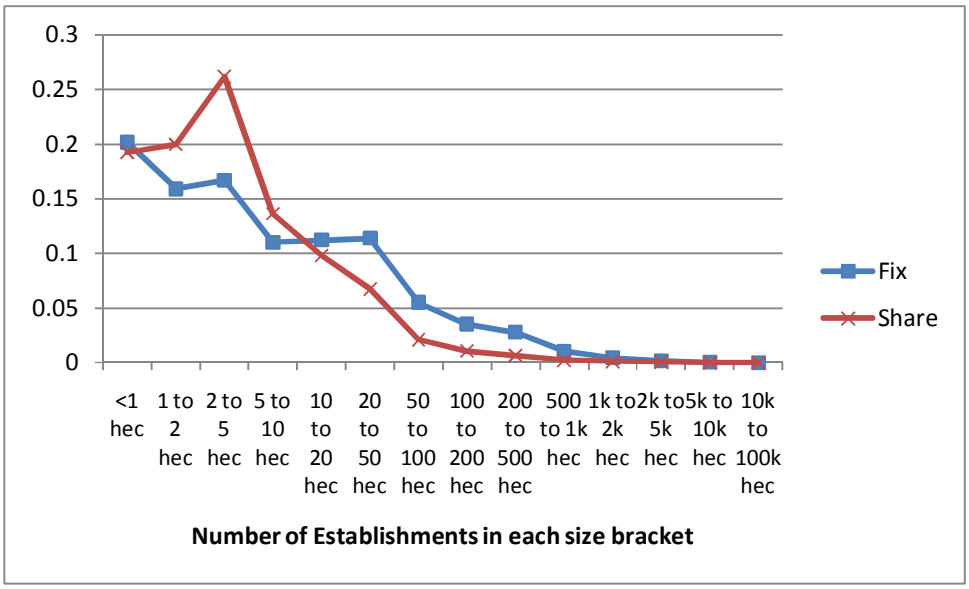
Table 5 – Impact of Contract Choice on Average Farm Size

	Excluded category: Owner	**Excluded category: Sharecrop**	**Excluded category: Fixed Rent**	**Excluded category: Occupant**
Fixed Rent (% of total farmland)	-1579.2***	2072.0***		766.5***
	(-6.20)	(5.99)		(5.39)
Sharecrop (% of total farmland)	561.2***		-2141.1***	-1404.1***
	(5.04)		(-6.42)	(-4.16)
Occupant (% of total farmland)	-219.7	1295.8***	-785.4***	
	(-1.53)	(3.72)	(-5.55)	
Owner (% of total farmland)		1514.2***	-561.1***	195.5
		(5.85)	(-5.14)	(1.39)
Constant	189.3***	-1325.5***	751.4***	-11.0
	(4.04)	(-4.83)	(6.93)	(-0.09)
Number of observations	Total: 3556	Total: 3556	Total: 3556	Total: 3556
State dummies (27 states)	Yes	Yes	Yes	Yes
R^2	0.392	0.388	0.395	0.388
R^2 - adjusted	0.387	0.383	0.390	0.383
F(,29,3526)	96.87	96.03	97.39	96.24
Prob>F	0.0000	0.0000	0.0000	0.0000

Instrumental Variables Estimator. Instruments are all the right-hand side variables in Table 3. t-stats in parentheses.
Statistical significance: 1% ***. 5% **, 10% *.

Figure 11 – Distribution of Farm Area in Fixed Rent and Sharecropping.





Appendix 1 – Data

Total number of observations = 3659. This the AMC7097 grouping created by IPEA/IBGE which makes data comparable from 1970 to 2000 by adding, or in some cases averaging, the data of *municipios* that sub-divided from 1970 to 1997. There are 27 states. The data for most of the variables are available for two set of years, 1985 and 1995/96. Agricultural data and Priest data can be added for 1980 and 1975, but Conflict data only goes back to 1985. Not all variables are used in the estimation but we list all variables available.

Agricultural data (source = IBGE Agricultural Census)

1) Area in farms (1985 and 1996), hectares.
2) Number of establishments (1985 and 1996).
3) Total municipio area (fixed)
4) Farm area in natural forest (1985 and 1996), hectares.
5) Farm area in planted forest (1985 and 1996), hectares.
6) Farm area in permanent crops (1985 and 1996), hectares.
7) Farm area in temporary crops (1985 and 1996), hectares.
8) Farm area in natural pasture (1985 and 1996), hectares.
9) Farm area in planted pasture (1985 and 1996), hectares.
10) Farm area left fallow (1985 and 1996), hectares.
11) Farm area productive but not used (1985 and 1996), hectares.
12) Farm area unsuitable for productive use (1985 and 1996), hectares.
13) Total area in farms run by owner (1985 and 1996), hectares.
14) Total number of owner run farms (1985 and 1996).
15) Total area in rented farms (1985 and 1996), hectares.
16) Total number of rented farms (1985 and 1996).
17) Total area in sharecropped farms (1985 and 1996), hectares.
18) Total number of sharecropped farms (1985 and 1996).
19) Total area in squatted farms (1985 and 1996), hectares.
20) Total number of squatted farms (1985 and 1996).
21) Number of heads of cattle (1985 and 1996).
22) Number of tractors (1985 and 1996).
23) Investments realized in the year R$ (thou) of 2000(mil) (Deflated) (1985 and 1996).
24) Revenues received in the year R$ (thou) of 2000(mil) (Deflated) (1985 and 1996).
25) Expenditures in the year R$ (thou) of 2000(mil) (Deflated) (1985 and 1996).
26) Area irrigated (1985 and 1996) hectares.
27) Total number of tractors in the municipio (1985 and 1996).
28) People working in farms (1985 and 1996).
29) Area in cotton (1985 and 1996) hectares.
30) Area in rice (1985 and 1996) hectares.
31) Area in coffee (1985 and 1996) hectares.
32) Area in sugar cane (1985 and 1996) hectares.
33) Area in beans (1985 and 1996) hectares.
34) Area in manioc (1985 and 1996) hectares.
35) Area in corn (1985 and 1996) hectares.
36) Area in soy beans (1985 and 1996) hectares.

Conflict data

37) Number of murders, yearly data (1985 to 1995). (Pastoral Land Commission)
38) Number of threats of murder, yearly data (1985 to 1995). (Pastoral Land Commission)
39) Number of murder attempts, yearly data (1985 to 1995). (Pastoral Land Commission)
40) Number of occupations/invasions, yearly data (1988 to 1995). (Pastoral Land Commission)
41) Area expropriated for land reform, yearly data (1979 to 1996). (INCRA/Ipeadata)
42) Capacity for settling families in settlement projects, yearly data (1979 to 1996), unit=families. (INCRA/Ipeadata)
43) Number of expropriations, yearly data (1979 to 1996). (Pastoral Land Commission) (INCRA/Ipeadata)

Priest data (source Catholic Hierarchy – The hierarchy of the Catholic Church http://www.catholic-hierarchy.org/)

44) Number of Catholics, data for 1975, 1985, 1995 (proximate years in some cases).
45) Total population (data from Catholic Hierarchy, not IBGE), for 1975, 1985, 1995 (proximate years in some cases).
46) Number of priests in Diocese, data for 1975, 1985, 1995 (proximate years in some cases).
47) Number of Catholics per preist, for 1975, 1985, 1995 (proximate years in some cases).

Other data

48) Area of entire municipio, square kilometers (oddly this varies from 1985 to 1996) (IBGE/Ipeadata).
49) Distance from the municipio head to the federal capital, kilometers, fixed for 1985 and 1996.
50) Distance to the state capital kilometers, fixed for 1985 and 1996.
51) Transport cost to São Paulo (index) – Nucleo de Estudos e Modelos Espaciais Sistêmicos, http://www.nemesis.org.br/ .
52) Number of train stations in the município - Nucleo de Estudos e Modelos Espaciais Sistêmicos, http://www.nemesis.org.br/ .
53) Latitute, degrees, fixed for 1985 and 1996.
54) Longitude, degrees, fixed for 1985 and 1996.
55) Total population, 1980 and 1996. (IBGE/Ipeadata)
56) Total rural population, 1980 and 1996. (IBGE/Ipeadata)
57) Total urban population, 1980 and 1996. (IBGE/Ipeadata)
58) Economically active population 1985 and 1996. (IBGE/Ipeadata)
59) Economically active rural population 1985 and 1996. (IBGE/Ipeadata)
60) Economically active urban population 1985 and 1996. (IBGE/Ipeadata)
61) County GDP in R$ of 2000 (thou) (deflated), 1985 and 1996.
62) County agricultural GDP in R$ of 2000 (thou) (deflated), 1985 and 1996.
63) Number of county assemblymen elected by the main opposition party (MDB in 1982 and PT in 1996) (TSE/Ipeadata)
64) Total number of county assembly seats, 1982 and 1996.

Table A1 – Non-Instrumented Results

	Fixed Rent (%)	Sharecropper (%)	Owner (%)	Occupant (%)
Conflict per 1000 farms	0.0001	-0.0001	-0.0001	-0.000007
	(1.01)	(-0.63)	(-0.40)	(-0.05)
Frontier	-0.0003*	0.0001	0.0004**	-0.002*
	(-1.79)	(1.15)	(2.11)	(-1.81)
GDP growth 1985-1995	-0.0001	-0.0002	-0.004*	0.004***
	(-0.03)	(-0.21)	(-1.84)	(3.24)
Latitude	-0.002***	0.0007	0.004***	-0.002***
	(-3.37)	(1.57)	(3.78)	(-3.50)
Longitude	0.002**	0.001**	-0.006***	0.003***
	(2.22)	(2.02)	(-5.48)	(5.07)
Distance to state capital	-0.00003***	0.00001	0.00003***	0.00001
	(-4.02)	(1.37)	(3.07)	(1.42)
Transport cost to São Paulo	0.0000004	-0.000004**	-0.00005	0.00001***
	(0.14)	(-2.34)	(-1.17)	(3.48)
Number of train stations	0.002***	-0.0006	-0.009	-0.00006
	(2.70)	(-1.63)	(-1.17)	(-0.01)
Population density 1995	0.00001*	-0.000001	-0.00001*	0.00003
	(1.91)	(-0.18)	(-1.64)	(0.63)
Rural/Urban Population 1995	-0.0006	-0.00004	-0.001	0.002***
	(-1.05)	(-0.13)	(-1.61)	(3.99)
Population growth 1985-1995	0.006	-0.004	0.004	-0.006
	(1.28)	(1.43)	(0.55)	(-1.37)
Tractor per hectare growth 1985-1995	-0.015	0.575***	-1.022***	0.462***
	(-0.08)	(5.05)	(-3.92)	(2.94)
Cattle per hectare1995	-0.007***	-0.002	0.010***	-0.001
	(-3.86)	(-1.37)	(3.84)	(-0.91)
Cotton, % of total farm area	0.394***	0.213***	-0.718***	0.111*
	(5.02)	(4.35)	(-6.39)	(1.65)
Rice, % of total farm area	0.267***	0.252***	-0.532***	0.017
	(7.36)	(11.33)	(-10.42)	(0.56)
Coffee, % of total farm area	-0.098***	0.042**	0.055	0.001
	(-3.21)	(2.21)	(1.25)	(0.05)
Cane, % of total farm area	0.162***	0.058***	-0.209***	-0.010
	(19.95)	(11.52)	(-18.07)	(-1.48)
Beans, % of total farm area	-0.017	0.130***	-0.226***	0.114***
	(-0.67)	(7.97)	(-6.05)	(5.05)
Manioc, % of total farm area	0.002	0.082***	-0.690***	0.604***
	(0.06)	(3.24)	(-11.77)	(17.14)
Corn, % of total farm area	-0.043**	0.031**	0.006	0.006
	(-2.18)	(2.54)	(0.20)	(0.35)
Soy Beans, % total farm area	0.196***	0.026***	-0.206***	-0.016
	(-14.86)	(3.18)	(-10.91)	(-1.43)
Forest, % total farm area	-0.062***	-0.005	0.022*	0.045***
	(-6.57)	(-0.87)	(1.65)	(5.51)
Permanent crops, % total farm area	-0.047***	0.009	0.052***	-0.015
	(-3.57)	(1.19)	(2.78)	(-1.34)
Pasture, % total farm area	-0.014*	-0.002	-0.006	0.022***
	(-1.94)	(-0.33)	(-0.61)	(3.50)
Usable but not used, % total farm area	-0.025	-0.010	-0.039	0.074***
	(-1.38)	(-0.83)	(-1.49)	(4.68)
Unusable, % total farm area	-0.047	0.049**	-0.128***	0.126***
	(-1.39)	(2.33)	(-2.62)	(4.27)
Constant	-0.080	-0.036	1.233***	-0.117***
	(-1.51)	(-1.10)	(16.27)	(-2.56)
Number of observations	Total: 3564	Total: 3564	Total: 3564	Total: 3564
State dummies (27 states)	Yes	Yes	Yes	Yes
R^2	0.45	0.28	0.43	0.39
$\chi^2(16)$	2946.56	1382.49	2620.91	2256.15
Prob>χ^2	0.0000	0.0000	0.0000	0.0000

Estimated Seemingly Unrelated Regresion. t-stats in parentheses. Statistical signif.: 1% ***. 5% **, 10% *. The coefficients for all four equations are constrained to add up to 0 for every variable.