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**Do the “Poor but Efficient” Survive in the Land Market?  
Capital Access and Land Accumulation in Paraguay**

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Michael R. Carter and Pedro Olinto

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\* The authors respectively are Professor, Department of Agricultural and Applied Economics, University of Wisconsin-Madison, and Economist, Rural Research Division, the World Bank. They gratefully acknowledge financial support for this work from the World Bank. Seminar participants at the University of Wisconsin, the University of Natal and at the November 1997 MacArthur Inequality Network meeting provided many useful and thought provoking comments. The views presented in this paper are the sole responsibility of the authors and should not be attributed to the World Bank.

## Do the “Poor but Efficient” Survive in the Land Market? Capital Access and Land Accumulation in Rural Paraguay

### 1. Land Policy and the “Post-Washington Consensus”

The search for what Joseph Stiglitz (1998) calls a “post-Washington Consensus” is emblematic of the renewed priority given to economic development policies that explicitly redress poverty and inequality. At one level, the continuing development of the micro- and macroeconomic theory of the economic costs of inequality has renewed attention to poverty and inequality.<sup>1</sup> At another and more fundamental level, this renewed attention reflects the reality of post-liberalization growth in Latin America that has done little to eradicate stubbornly long-lived economic inequalities, especially in the rural sector (see Carter and Coles, 1998, and de Janvry and Sadoulet, 1996). While agrarian structure no longer corresponds to the stark dualism of the traditional latifundia/minifundia structure (Kay, 1995), the evolving land access of the rural poor (the “agrarian question”) remains an economically vital, often politically explosive issue (see de Janvry, Sadoulet and Wolford, this volume).

Despite the renewed prominence of these issues, the traditional policy instrument of state-mandated redistributive land reform is decidedly off the agenda in most Latin American countries.<sup>2</sup> Contemporary land policy is primarily comprised of two instruments: (1) Land titling, including the assignment of individual, marketable land titles to the beneficiaries of earlier redistributive reforms; and, (2) Negotiated or market-assisted land reform (see Deininger, this volume). Both instruments can be theoretically argued to address rural inequality and answer the agrarian question in favor of improved land access for the rural poor. Whether or not they do so in practice depends critically on the way liberalized land market functions in the actually existing world of imperfect rural markets. Are small holders—including the now individualized beneficiaries of earlier reforms—competitive in Latin America’s liberalized agricultural economies? If not, then land titling and other efforts to improve tenure security and facilitate land transactions may simply move small holders out, and negotiated land reform may prove to be an elaborate subsidy scheme that slowly decapitalizes its beneficiaries.

Not surprisingly, there are strongly divergent opinions concerning the function of the land market. The goal of this paper is to evaluate the functioning of liberalized land markets, first by carefully considering the theory of small holder land market competitiveness, and then by examining the recent experience of three Latin American

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<sup>1</sup> Bowles, Bardhan and Gintis (1998) summarize the microeconomic literature that has grown from the economics of imperfect information, while the more macroeconomic literature has emerged from the endogenous growth literature (*e.g.*, Alessina and Rodrik, 1994).

<sup>2</sup> Exceptions are Nicaragua and El Salvador where de Janvry et al. (this volume) note that  
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economies. The remainder of this paper is organized as follows. Section II summarizes and modestly extends the relevant theoretical literature. For the reader who wants to skip over the theoretical details, section 2.6 summarizes its implications. Section 3 then builds on that theoretical analysis and econometrically estimates the functioning of the land market in Paraguay. Section 4 concludes the paper (with competitiveness/post-WC ideas).

## 2. Class Competitiveness in the Land Market

Market transactions require that there be individuals willing to both buy and sell at a single price. In other words, market transactions require agent heterogeneity. This paper privileges four types of agent heterogeneity that are crucial to shaping the distributional impacts of land markets:

- Differential endowments of conventional productive factors, land and labor;
- Differential skill, or technical efficiency;
- Differential access to capital; and
- Differential dynamic risk bearing capacity.

Drawing on the theory of rural markets, this section develops a number of propositions about the impacts that these forms of agent heterogeneity will have on land market behavior. This section will also explore the possible effects of land titling on the land market competitiveness of different strata or classes of producers.

### 2.1 *The Shadow Price of Land in the Presence of Class and Idiosyncratic Heterogeneity*

The model sketched out in this section (which is a modest modification of the production period model in Carter and Zimmerman, 1998) captures both class and idiosyncratic sources of heterogeneity. Idiosyncratic heterogeneity refers to differences that are individually specific and not correlated with wealth, whereas class heterogeneity refers to differences that are systematically related to an agent's physical wealth or endowment position. The model itself belongs to a broad class of models that have explored the impact of imperfect markets on resource allocation in the agrarian economy (e.g., Feder 1985, Eswaran and Kotwal 1986 and Kevane 1996).

Given endowments of land ( $T^0$ ), Labor ( $L^0$ ), and money ( $M^0$ ), we assume that each agent attempts to maximize household income defined as:

$$P \equiv \{ p_c Q - w L^d - F P_f - I[z + iB] \} + \{ w f(L^s) \} + \{ iS \} \quad (1)$$

where the first term in curly brackets gives the net-income from agricultural production, the second term gives labor market earnings, and the third gives returns to money invested in a bank over the production cycle. Note that  $i$  is the interest rate that for simplicity is

assumed to be the same on both savings and borrowings. Agricultural output is produced with a constant returns to scale technology,

$$Q = \mathbf{t}f(F, T^0, L) \quad (2)$$

where  $F$  measures inputs purchased at a price  $P_f$ ,  $T$  is the land stock, and  $L$  is labor measured in quality-adjusted, efficiency units, and  $0 \leq \mathbf{t} \leq 1$  is an index of technical efficiency. Efficiency labor is produced according to the following technology:

$$L = L^h + \mathbf{g}(T, L^h)L^d \quad (3)$$

where  $L^h$  is family labor devoted to home on-farm production, and the function  $\mathbf{g}$  gives the amount of efficiency labor extracted from an input  $L^d$  of hired labor. The employment function,  $\mathbf{f}(L^s)$  gives days employed as a function of days of labor supplied to the off-farm job market. We assume that  $\mathbf{f}(L^s) \rightarrow L^s$  as  $L^s \rightarrow 0$ , and that  $0 < \mathbf{f}' < 1$  to capture the notion that employment becomes increasingly difficult to obtain as increased desire to sell labor forces one to search for employment in the slack season. Note that this specification can be seen as a less extreme form of Chayanov's (or Sen's, 1966) assumption that off-farm sales of labor are impossible.

Maximization of (1) is further constrained by an *ex ante* working capital constraint:

$$wL^d + P_f F + P_c R_0 \leq M^0 - S + w\mathbf{f}(L^s) + l[B - z] \quad (4)$$

which simply says that the agent needs sufficient cash on hand to finance cash costs of production plus family subsistence over the rainy season ( $P_c R_0$ ). Working capital can be obtained from money endowments that are not saved in a bank ( $M^0 - S$ ), from contemporaneous off-farm wage earnings, and from the net proceeds of any loans taken out by the household,  $l[B - z]$ , where  $B$  is the gross loan amount,  $z$  is a fixed transaction cost and  $l$  is a indicator taking the value of one if  $B$  is positive. Finally, each agent faces a borrowing ceiling tied to the amount of land owned,

$$B \leq \mathbf{b}T, \quad (5)$$

and the following miscellaneous non-negativity restrictions:

$$(L_0 - L^h - L^d), S, L^d, B \geq 0 \quad (6)$$

The agents objective is thus to maximize (1) subject to (2)-(6) and we denote the optimum value function corresponding to this problem as  $\mathbf{p}^*(T^0, M^0, \mathbf{t})$  to emphasize its dependence on wealth and idiosyncratic skill endowments.

This income maximization problem gives prominence to the intrinsic (asymmetric information-based) capital and labor market imperfections that have been extensively discussed in the context of developing country agriculture. The working capital constraint (3) makes the specification of the rules of access to capital of primary importance. While some would argue that because of asymmetric information, small farmers are completely rationed out of credit markets (e.g., see Eswaran and Kotwal, 1986 and Carter, 1988), we more conservatively assume that all agents have equal access to credit at a given market rate of interest. Borrowers do, however, face a fixed transactions cost,  $z$ , that is associated with the cash and opportunity costs of loan application, investigation and approval. The fixity of  $z$  makes small loans unattractive for all agents (rich or poor). Note that because of these transactions costs and the consequent reluctance of some agents to borrow, the shadow price of the working capital constraint (3)—which we denote as “ $m$ ”—will endogenously vary over the endowment space even though there is a parametrically given market rate of interest.

The second feature of the production problem is that output depends on inputs of labor effort, not just labor time. The non-contractability of labor effort in spatially disperse, biologically based production process has a long history in agricultural economics (e.g., see Brewster, 1950), and we follow Bowles (1985) in specifying labor extraction technologies (2) that transform labor power or time into labor effort. Family labor may be used for supervision, but consistent with the findings of Frisvold (1994), the efficacy of family labor supervision diminishes as farm size grows and family labor becomes spread too thinly over a large area. Specifically we assume that  $g(T, L^h) < 1$  for all values, that  $\partial g / \partial T \leq 0$  and that  $\partial^2 g / \partial T^2 \geq 0$  such that beyond some farm size,  $g$  flattens out.<sup>3</sup>

As with the shadow price of capital, the effect of this labor market specification is to make the effective or shadow price of labor endogenous to the individual’s choices and, ultimately, their endowments. The end result is an analogue to the Chayanovian world in which the opportunity cost of labor is subjectively (or endogenously) determined. While the more recent literature on household models tends to characterize an endogenous shadow price of labor as reflecting a non-separability between consumption and production decisions (e.g., see Singh, Squire and Strauss, 1986), it results here, as in those household models, from the fact that labor markets are thin or otherwise imperfect.

One way to explore these countervailing market failures and aggregate their cross-cutting economic impacts on the land market is to examine their impact on the shadow price of land assuming self-cultivation:

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<sup>3</sup> This assumption is meant to simply account for the switch to a hierarchical supervision model that would be anticipated to occur as the efficacy of informal, family labor supervision diminishes with operational farm size (see Carter and Zimmerman, 1998 for a more complete specification).

$$r = \partial \mathbf{p}^*(T, M, \mathbf{t}) / \partial T \quad (7)$$

If we capitalize an infinite stream of the income increments given in (7), we arrive at a possible measure of the shadow asset of price of land that we will refer to as the net present production value (NPPV) of land:

$$\mathbf{r} = \sum_{t=1}^{\infty} [r(T^0, M^0, \mathbf{t})] / (1 + \mathbf{m}(T, M))^t \quad (8)$$

where the discount rate,  $\mathbf{m}$  is the shadow price of the capital constraint given in expression (3) above. Note that this expression will not in general be independent of relative factor prices and technology, as these two things effectively shape how costly any particular market failure is. To keep matters simple, we will assume that market prices and technologies persist indefinitely into the future so that  $\mathbf{D}$  does not change over time.

## 2.2. *The Chayanovian Base Case and Peasant Hyper-Competitiveness in the Land Market*

Using the model just developed, this section explores the operation of the land market under a simplifying base case scenario in which the shadow price of capital defined by the working capital constraint (expression 3 above) simply equals the market interest rate “ $i$ ” for all individuals. Under this scenario, maximization of (1) departs from a standard, perfect markets profit maximization problem only in terms of the labor market imperfections described above.

The top panel of Figure 1 displays the qualitative nature of the relationship between the shadow land valuation measure (expression 7 above) and the land-labor endowment ratio,  $T^0/L^0$ . The solid, base case line in the figure is drawn conditional on average technical efficiency or skill endowment,  $\bar{\mathbf{t}}$ , and is of course conditioned on the assumption that the shadow price of capital equals the market rate,  $\mathbf{m} = i$ . This case exhibits what might termed “peasant hyper-competitiveness” in the sense that those units with the lowest relative land endowments have the highest shadow price for land. The shadow price curve flattens out as shown given the assumption above that beyond some point, the efficiency of labor extraction bottoms out at some constant rate.

Given a market rental rate for land,  $p_r$  (and assuming, for the moment, that there are no transactions costs), the lower panel in Figure 1 displays the desired land transactions as a function of the endowment ratio. Let  $\mathbf{D}^*$  denote desired land transactions. A production unit with endowment ratio  $\bar{t}$  would have a shadow rental rate exactly equal to the market rate and would have no incentives to make any transactions. Units with endowment ratios below  $\bar{t}$  would tend to rent land in until their operational

land-labor ratio equaled  $\bar{t}$ , while those with more abundant land endowment would rent land out.

As shown by the dashed line in Figure 1, the net present production value of land under self-cultivation (expression 8 above) would exactly mirror the shadow price  $r$  in this base case scenario where the shadow price of working capital is assumed to equal the market rate for all agents. If there were no land rental market at all, and the market price of purchasing land was  $p_r$ , then agents would face incentives to use the land sales market to expand or contract their land holdings to  $\bar{t}$ . If there were a land rental market, then the incremental annual income an agent could get from owning additional land would never fall below the rental rate. If the land market were perfect (in the sense that its operation was uninhibited by transactions costs, credit constraints and agency problems associated with share contracts), then the mapping between endowment ratio and the net present value of land would be the same for all agents. In the intermediate case in which rental markets exist but are imperfect, then the ownership value of land under self-cultivation would be higher than rental return, at least for agents with small enough endowments. In this more realistic case, the mapping from endowments to  $r$  would continue to mirror that shown in Figure 1. We will refer to the mapping between endowment ratio and the shadow price of land as the “class competitiveness regime.”

Now consider what happens to the shadow rental rate and desired transactions for units that enjoy a higher level of technical efficiency or skill,  $\bar{t} > \bar{t}$ . Other things equal, the shadow price of land for these units would lie above that for units of average technical efficiency, as shown by the dashed line in the top panel of Figure 1. Given a market rental rate of  $p_r$ , the higher efficiency units would want to expand or contract their operational farm size until their land-labor endowment ratio matched  $\bar{t}$ . If there were no land rental markets, then the NPPV asset value of land would mirror the shadow rental value curve, and high efficiency units would have incentive to expand through the land purchase market up to farm size  $\bar{t}$ .

To summarize, in this Chayanovian base case, the class competitiveness regime favors low wealth, peasant producers. In addition, technically more efficient agents are also competitively favored in the land market.

### 2.3. *Countervailing Capital Constraints and Land Market Competitiveness*

The base case scenario in the prior section assumed that all units faced a shadow price of capital equal to the market rate of interest. Other things equal, capital-constrained units with a shadow price of capital in excess of the market interest rate ( $m > i$ ) will be described by a shadow rental rate curve similar to the dotted line in Figure 1 and they would tend to an operational farm size such as  $\bar{t}^{cc}$ . The decrease in the shadow price of land results of course from the inability of capital constrained agents to produce with the

same factor intensities as unconstrained agents.<sup>4</sup> The shadow price of land curve for technically more efficient, but capital-constrained producers (i.e., those with  $t = \bar{t}$  and  $m > i$ ) would lie somewhere between the dotted and dashed lines. While it is not possible without additional assumptions or information to say anything more about the relative competitiveness of different types of producers, note that it would be possible for a technically efficient, low wealth producer to have a shadow price of land below that of less efficient, but better capitalized and better endowed unit. Moreover, since the net present production value of land,  $r$ , is found by discounting a stream of single period shadow prices at the rate  $m$ , capital constraints doubly dampen competitiveness in the land purchase market.<sup>5</sup>

Unlike the Chayanovian base case in which low land wealth assured competitiveness, in this more general model, the competitive survival of the “poor but efficient” is not guaranteed in the sense that better endowed and less efficient producers, but capital unconstrained, producers may have higher shadow prices of land. Indeed, since the net present production value of land,  $r$ , is found by discounting a stream of single period shadow prices, any differences between discounted

#### 2.4. *Land as an Asset and the Dynamics of Accumulation*

While informative about the core income factors that shape the willingness to pay for land, the net present value approach to land valuation used so far overlooks both risk and intertemporal considerations (the trade off between current and future consumption) which influence a household’s willingness to pay for land. These additional considerations create two opposing forces, one increasing the relative valuation of land by poor households, and the other diminishing it.

In simplest terms, the addition of dynamics to the land valuation problem gives the household one more degree of freedom by permitting it to trade off current consumption for future assets. Resource-poor households may have a greater incentive to forego current consumption and accumulate assets because these assets carry what might be termed a strategic value beyond increased future income. The strategic value lies in the extent to which additional accumulation of assets permits households to (eventually) circumvent market failures (for example, credit rationing) that constrain their income.

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<sup>4</sup> The first order conditions that describe optimal factor allocation for the maximization problem given above equate the marginal value product of each input to its effective factor cost marked up by the shadow price of capital. For example, the first order condition for fertilizer is:  $p_c \partial Q / \partial F = p_f (1 + m)$ . Units with higher shadow prices of capital will thus use less labor and fertilizer per-hectare than capital unconstrained units.

<sup>5</sup> Discounting future income at a rate other than  $m$  would be economically irrational as it would imply a different rate of return on farm intensification versus farm extensification.



Carter and Zimmerman (1998) explore the impact of these dynamic considerations in a theoretical model which allows households to allocate income earned in each production period between consumption and accumulation of the stocks of two assets, liquid savings and land. One obvious accumulation strategy for capital-rated, resource-poor households is to suppress current consumption, accumulate liquid savings in order to better capitalize their production process, and work around the countervailing capital market failure which limits their land valuation according to the simple net present value criterion. Numerical simulation of this model shows that there is indeed a tendency for the economy to eventually move toward a more egalitarian distribution. However, the process is slow, and there are likely other dynamic factors that inhibit this redistribution of wealth.

Risk is one of those dynamic factors. In multiple asset models, such as Carter and Zimmerman's, risk can differentially affect portfolio choice according to a household's initial wealth level. Resource-poor households may allocate a disproportionately large share of their wealth to safer, liquid savings, while wealthier households may acquire more entrepreneurial portfolios (see Rosenzweig and Binswanger, 1993, Carter and Boucher, 1995, and Murdoch, 1995). Indeed, it can be shown that households value discount land based on the severity of their risk aversion and risk exposure.

Zimmerman and Carter (1997) derive asset accumulation trajectories from the simulation of a dynamic stochastic general equilibrium model similar in structure to the non-stochastic model described above. Each individual in this economy receives a common, or covariate, shock each period (e.g., weather), as well as an individual, or idiosyncratic, shock. Each period, individuals allocate their wealth between consumption, productive assets and safe savings. Savings are assumed to be in-kind (grain store), and the productive asset (land) will generate an expected positive, but risky, rate of return. The asset price is endogenous to supply and demand each period. Households maximize an infinite stream of (expected) utility with rational expectations on price distributions.

In this model, the economy bifurcates toward two stable asset positions: Wealthier households accumulate land, assembling a riskier, but higher returning portfolio, while poorer households shy away from land accumulation and accumulate in-kind savings.<sup>6</sup> Central to the operation of this model is the covariance between the land price and the common, or covariate, shock. That is, resource-poor households are driven toward safe but low-yielding portfolios not just because of production risk, but also because endogenous land price movements make it hard to use the land to smooth consumption (for example, when the weather is bad, land prices tend to be low, and when the weather is good, land prices tend to be high). If they instead tried to smooth consumption using land assets, poor households would find that distress sales, coupled with those covariate land price swings, would render their asset position indefensible over time. Market-based land sales in this model actually leads the economy to a position of lower aggregate productivity. However, perhaps the important point of this theoretical analysis is that risk

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<sup>6</sup> The results presume the existence of a subsistence minimum, below which consumption is presumed to irrevocably damage future utility possibilities.

and land prices are both affected by the severity of covariate risk and the breadth of the market in which land can be sold. Together these considerations suggest that poor household's willingness to pay for land as an asset, and their land market competitiveness, may be less than that suggested by the simpler net present value criterion.

## 2.5. *Land Titling and Land Market Competitiveness*

As described in Section I above, land titling is one of the primary instruments in contemporary Latin American land policy. This section explores its possible impacts on peasant competitiveness and the land market.

When an agent holds land under an insecure form of tenure, their shadow price of land (in the net present value terms introduced in equation (1) above) can be written as:

$$\mathbf{r} = \sum_{t=1}^{\infty} [(1 - \mathbf{f})^t r(T^0, M^0, \mathbf{f})] / (1 + \mathbf{m})^t \quad (9)$$

where the new term,  $0 < \mathbf{f} < 1$ , is the single-period probability that the household will be dispossessed of its land. Assuming that this probability is constant over time,  $(1 - \mathbf{f})^t$  gives the probability that the household will still be in possession of their land at the end of period  $t$ . As  $t$  increases,  $(1 - \mathbf{f})^t$  decreases, reflecting the uncertainty-based discounting of future earnings, and hence an undervaluation of land as reflected in a lower  $\mathbf{r}$ . To the extent that this tenure insecurity depresses fixed capital investment in land, incremental earnings from land,  $r(T^0, M^0, \mathbf{f})$ , will be depressed, further eroding the shadow price of land.

Tenure insecurity may not be identical for all individuals. To the extent that less well-off individuals are politically weaker and more vulnerable to land loss, tenure insecurity may disproportionately reduce their competitiveness in the land market relative to wealthier and politically better-connected individuals. Under this circumstance, a program of land titling that equalizes tenure security for all individuals may actually bolster the land market competitiveness of landless and near-landless people.

Tenure insecurity may also make the land market thin and inactive. Current land occupants may (uniquely) enjoy relatively great security, while other individuals—potential buyers—may not. In this case, transactions will be discouraged as everyone except the current occupant will heavily discount earnings, making it less likely that a mutually beneficial transaction can take place. Similarly, such asymmetric tenure security may apply to distinct groups of individuals. Individuals resident in the same community (and social situation) as a current land holder may enjoy a similar amount of tenure insecurity. Outsiders, however, may not. Property rights reform (e.g., land titling) that secures the land rights of all agents might thus be expected to activate the land market.<sup>7</sup>

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<sup>7</sup> Even when land rights are well-defined and marketable, there are two categories of transactions costs that potentially affect the ability of resource-poor households to participate in land markets. Conventional fixed costs may make small transactions

Exactly how an activated land market works of course depends ultimately on the underlying class competitiveness regime.

Finally, land titling may have a credit supply effect. To the extent that (1) Insecurity rests most heavily on smaller scale producers; and, (2) Titling suffices to boost credit supply, then land titling may help boost the competitiveness of small landless and near landless households by helping them get on to the unconstrained reservation price and land demand curves shown in Figure 1. However, to the extent that credit markets remain biased against low wealth agents irrespective of the legal collateralizability of their land (see Barham *et al.*, 1996), then land titling may have no or even perverse effects upon the relative land market competitiveness of small farm households.

## 2.6 *Summary of the Theoretical Model and Hypotheses to be Tested*

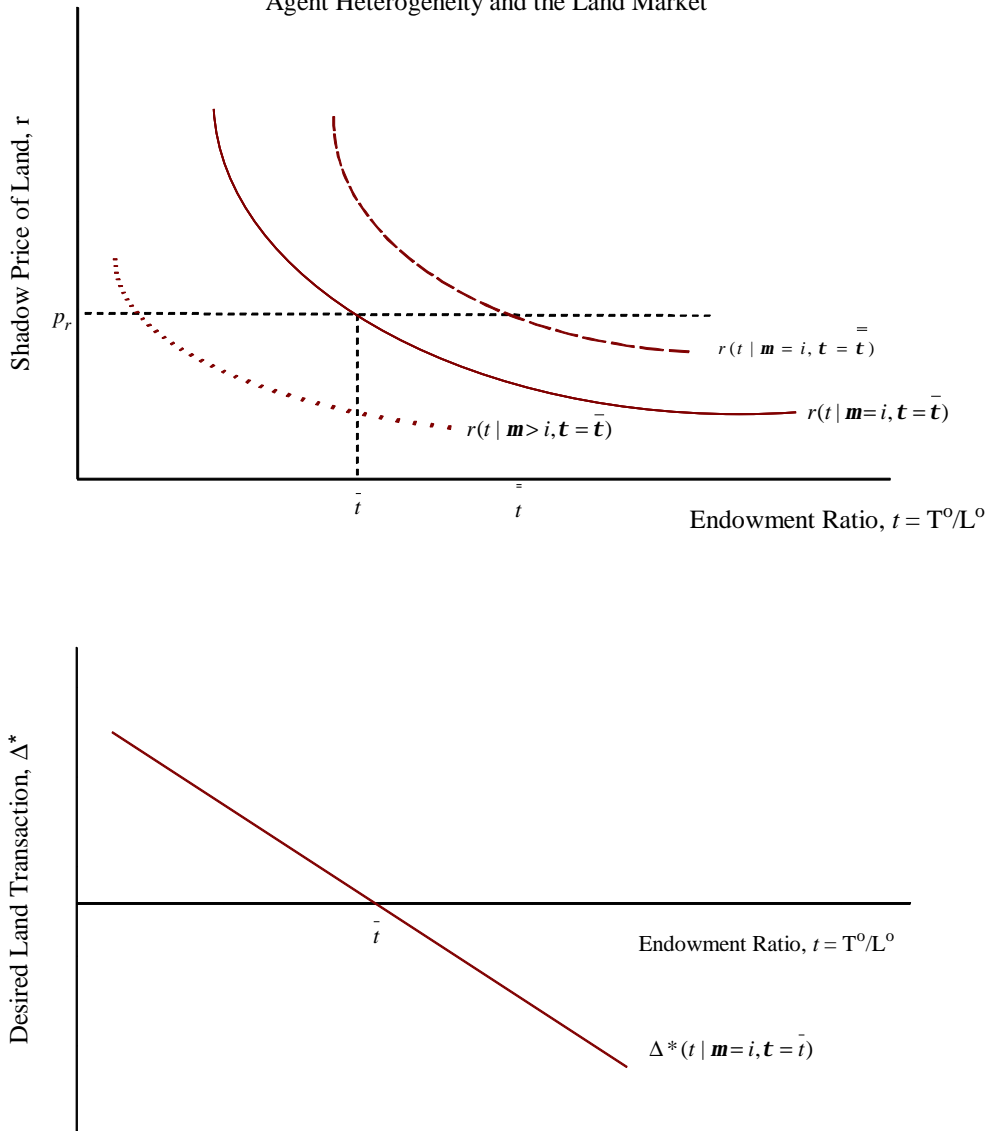
A single period model drawn from the literature on agrarian markets suggests that other things equal, a household's desired land purchases are decreasing in its land-labor endowment and increasing in its technical efficiency. However, other things are often not equal, especially between households of different wealth levels. In particular, capital constraints have the capacity to blunt the competitive advantage of low wealth or technically efficient producers. Moreover these effects are magnified in the land asset market, as compared to the land rental market. Finally, dynamic models show us that intertemporal and portfolio considerations have an ambiguous effect on the relative land market competitiveness of the land poor. However, as risk increases the competitiveness dampening effects of credit constraints are likely to be enhanced. Ultimately, whether or not low wealth, peasant producers are competitive is an empirical question whose answer is likely to vary across agro-ecological environments. Finally, while there is reason to expect that land titling programs may bolster the relative competitiveness of small scale producers and accelerate land market activity, transaction costs may continue to discriminate against small purchasers and inter-class transactions between rich and poor may be difficult. In short, from a theoretical perspective there can be no easy presumption

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prohibitively expensive and weigh heavily against the land market participation of landless and near-landless people. In addition, bargaining and subdivision or agglomeration cost—which are related to the degree of heterogeneity between trading partners—may discourage what might be termed inter-class transactions in which the poor buy from the rich or the rich from the poor. If sufficiently severe, these costs may segment the land market such that the market for a small piece of land is really a different market than that for a large piece of land (Stringer and Lambert, 1989 and Lambert and Stanfield, 1990 present evidence of segmentation for Guatemala and Ecuador, respectively). Such land market segmentation would obviously pose a barrier to inter-class land transfers, including those which are potentially efficiency enhancing and poverty reducing. Presuming that resource-poor households would purchase land in small lots, their competitive advantage in the land market would have to be strong enough to overcome any systematic net price differentials generated by these various transactions costs.

that liberalized land markets will suffice to resolve the agrarian question in favor of the landless and near landless households.

Figure 1:  
Agent Heterogeneity and the Land Market



### **Section 3. A Microeconometric Analysis of the Land Market in Paraguay**

In contrast to the cases of Honduras and Chile to be discussed below, Paraguay has not recently experienced any major reform or redistribution of agrarian property rights. Colonization projects, primarily launched in the 1960s and 1970s, did assign legally secure, but initially unmarketable property rights to their beneficiaries. Those rights became fully marketable once the individual had paid off his or her colonization debt. More generally, however, rural Paraguay has been typified by a wide variety of tenure regimes, including significant informal squatting that developed given the country's historically long period of extreme land abundance. From an analytical perspective, Paraguay thus gives us an (uncontrolled) experiment that we can use to explore the operation of the land market and the impact of land titling upon it.

In order to study these questions, this paper draws upon the panel data utilized by Carter and Olinto (1996) to study the impact of land titling on investment demand and credit supply. As detailed in that earlier study, the data emerged from a stratified, multi-stage random sample of 300 producer households distributed across three distinctive regions of rural Paraguay: The traditional core "minifundia" zone of Paraguarí; the colonization zone of San Pedro; and, The department of Itapúa, located in the frontier region with Brazil which has seen both significant immigration and agro-export growth. The producer households were first interviewed in 1991, and again in 1994. Whenever possible, households which exited farming between 1991 and 1994 were replaced by successor units which were found in 1994 to be cultivating at least some portion of the land resources of the exiting household. Both interviews collected full production and income information as well as a detailed accounting of the modes of land access and land transactions.

#### *3.1. A Descriptive Statistical Portrait of the Operation of the Land Market*

In order to get an initial feel for the operation of the land market in rural Paraguay, Table 1 presents descriptive indicators for the household production units that were included in the initial 1991 survey stratified according to their position in the land rental and sales markets. For each production unit it is possible to

**TABLE 2**  
**Characteristics of Land Sales and Rental Market Participants**

	<i>Rental Market</i>			<i>Sales Market</i>		
	Rented-in, 1991	Non-Participants 1991	Rented-out, 1991	Net Buyers 1991-94	Non-Partic. 1991-94	Net Sellers 1991-94
# Households	72	159	48	20	217	42
1991 Net Rental	16.48	0.00	-4.56	6.17	3.24	3.36
1991-94 Mean Net Purchases	0.38	-0.22	-2.29	18.49	0.00	-11.60
Mean Owned Land (Median)	13.65 (0.88)	32.85 (10.0)	43.71 (20.0)	88.76 (12.75)	26.45 (10.0)	18.83 (10.0)
Mean Family Labor Force (Median)	3.19 (2.75)	3.70 (3.0)	4.02 (4.0)	3.75 (3.75)	3.68 (3.0)	3.31 (2.50)
Mean Endowment Ratio (Median)	5.20 (0.29)	10.12 (3.42)	11.77 (6.31)	19.13 (2.89)	8.81 (2.88)	6.07 (5.0)
Mean Operated Land(1991) (Median)	31.14 (6.0)	32.85 (10.0)	43.80 (20.0)	95.43 (12.75)	30.73 (10.0)	23.60 (10.0)
Mean Age of HH Head	44.65	49.64	57.88	46.00	50.57	47.43
Mean Credit Constraint Probability (Median)	0.74 (1.0)	0.56 (0.53)	0.39 (0.33)	0.51 (0.55)	0.57 (0.60)	0.66 (0.84)
Median Technical Efficiency	0.84	0.82	0.85	0.87	0.84	0.83

calculate both owned<sup>8</sup> and operated area for 1991, with the difference between the two being net rentals for 1991. In addition, using the 1994 data, each household can be classified based on whether it increased, decreased or did not change its land ownership between 1991 and 1994. The full data required for the analysis were available for only 279 of the 300 units covered in the original survey.<sup>9</sup>

The descriptive statistics in Table 1 give some idea about the relationship between changing land access and various household characteristics that the discussion in Section 2 suggests may create heterogeneous land valuation. In terms of the land rental market, the descriptive statistics reported in Table 1 suggest that households exhibiting high owned land to labor endowment ratios are indeed more likely to rent land out. While, the mean (median) endowment ratio of the group of households renting land in is 5.2 (0.29) hectares per family worker, for households renting land out the figure is 10.12 (3.43). Therefore, those who rent land in tend to be relatively land scarce, while those who rent it out are relatively land abundant. The mean endowment ratios do follow the pattern suggested in the conceptual discussion in the previous section. Older farmers also appear more likely to rent out land. The average age of the heads of the households renting land out is 58, while for those renting land in, the average age is 45. At this level, there are no apparent differences in the technical efficiency among those who rent land in versus those who do not.<sup>10</sup>

Farmers renting land out also seem to enjoy better access to formal credit. The mean (median) of the estimated credit constraint probabilities for households renting land in is 0.74 (1.0), for households renting land out it is 0.39 (0.33). These credit constraint probabilities derive from the disequilibrium credit market model that Carter and Olinto (1997) estimate using unobserved switching regression methods for this Paraguayan panel data set. Having estimated the notional demand ( $D_{it}^*$ ) for and supply ( $S_{it}^*$ ) of formal credit, Carter and Olinto are able to calculate the probability that a particular household  $k$  in period  $t$  is credit rationed at the observed market rate of interest:

$$\Pr[D_{kt}^* - S_{kt}^* \geq 0 | Q_{kt}, \phi_{kt}, X_{kt}, Z_{kt}], \quad (10)$$

where the conditioning variables are observed borrowing ( $Q_{kt}$ ), household endowments that influence demand ( $X_{kt}$ ) and supply ( $Z_{kt}$ ) of credit, and the percent of own land that is

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<sup>8</sup> Here “owned” is used loosely to mean that the household either owns the plot with legally recognized title or is a squatter on the plot, meaning that other agents (the state or private individuals) could contest that individuals rights to the plot.

<sup>9</sup> There was some attrition from the sample between 1991 and 1994. Farm units which exited were when possible replaced by a successor farm unit which was found to be using at least one of the plots or parcels of land cultivated by the 1991 unit.

<sup>10</sup> The measures of relative technical efficiency were generously provided by Diana Fletschner. The details on the computation of these non-parametric measures of relative technical efficiency can be found in Fletschner (1995).

titled ( $\phi_{kt}$ ). It is these estimated probabilities that are used to derive the descriptive statistics in Table 1. Because these probabilities are also important to the estimation and interpretation of the econometric model of the land market below, Figure 2 portrays the estimated pattern of credit constraints.<sup>11</sup> As a function of the household land-labor endowment ratio, Figure 2 portrays the estimated probability of being credit constrained when the owned land is both titled (the solid line) and untitled (the dashed line). As can be seen, land title has no impact on credit constraints for households with fewer than 2 hectares of land per-family worker, and even for households with up to 5 hectares of titled land per-family worker, the estimated probability of being credit-constrained still exceeds 50%. We thus see that although land titling has the potential to level access to capital and thus to serve as an instrument to enhance small farm land market competitiveness (see 2.5 above), it does not seem to function in this fashion in the case of rural Paraguay.

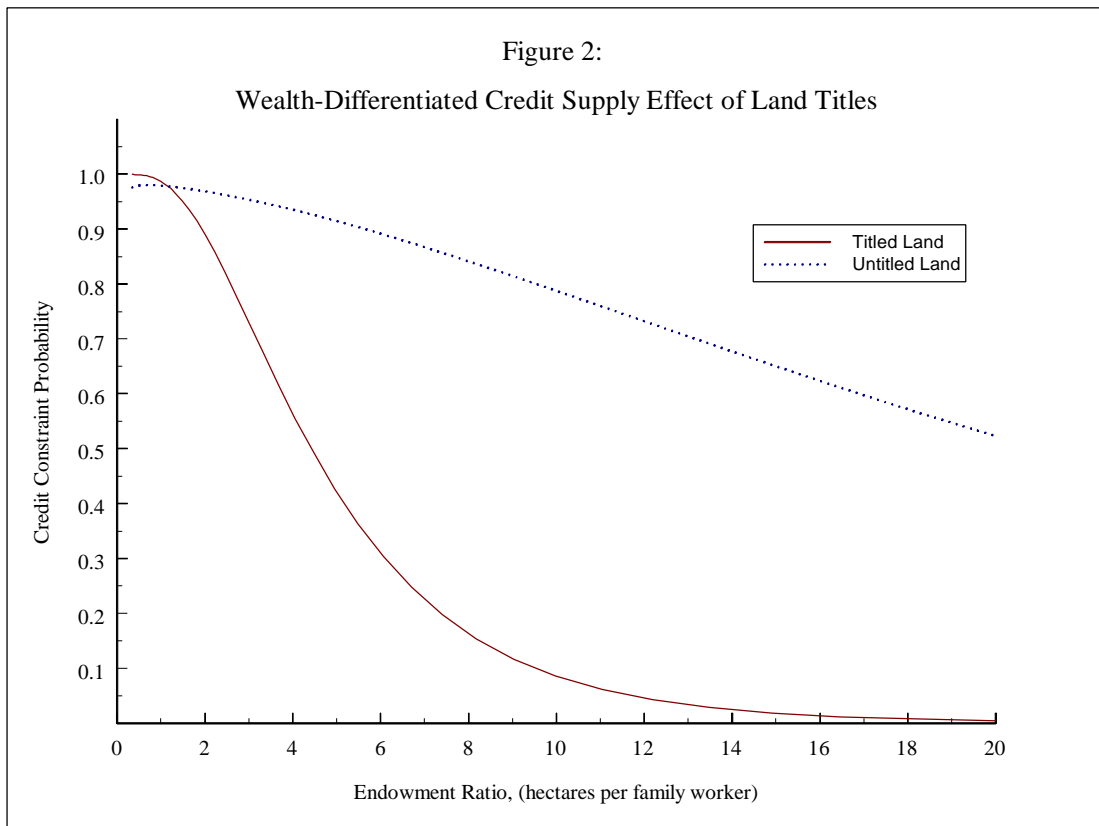


Table 2 also gives descriptive statistics for households based on their position in the land sales market. While the mean of the land/endowment ratio for net buyers is three times larger than the mean for net sellers (respectively, 19.13 and 6.07 hectares per family worker), the median is smaller (2.89 and 5.00 hectares respectively). This may indicate that while net sellers belong to a more homogeneous class of farmers, there are probably

<sup>11</sup> Figure 2 is drawn for a household with a median labor endowment of 3 workers.



two types of buyers: (1) labor abundant farmers, who exhibit a high willingness to pay for land because of their competitive advantage in the labor market; (2) land rich farmers, for whom better access to formal credit may put them in a better financial position to acquire land from possibly financially distressed farmers. The statistics on total owned land somewhat confirm this distinctive heterogeneity between buyers and sellers. While the median owned areas are similar across buyers, sellers and non-participants (12.75, 10 and 10 hectares, respectively), the mean owned size for buyers (88.76 hectares) is substantially larger than for sellers (18.83 hectares) and non participants (26.45 hectares).

Matching the predictions of the theoretical model above, net buyers of land also appear to enjoy a better access to institutional credit. The mean (median) of the estimated probabilities of being credit constrained is larger for sellers than it is for buyers. The descriptive statistics again reveal little apparent impact of technical efficiency differences, nor does age appear to be much of a factor distinguishing land sellers from land purchasers at the descriptive level.

### 3.2. *Econometric Estimates of the Land Market*

The theoretical model presented above suggests the following switching regressions specification:

$$\Delta_k^* = \begin{cases} \mathbf{b}^c x_k^c + \mathbf{e}_k^c & \text{if } \mathbf{m}_k > i ; \\ \mathbf{b}^u x_k^u + \mathbf{e}_k^u & \text{otherwise,} \end{cases} \quad (11)$$

where  $\Delta_k^*$  is household  $k$ 's desired net purchase of land over the 1991 to 1994 period of the panel; and where the regression switches depending on whether or not the household is constrained in the formal credit market ( $\mathbf{m}_k > i$ ) and the superscript  $\mathbf{b}^c$  refers to parameters and variables for the capital constrained case and the superscript  $\mathbf{b}^u$  for the unconstrained case. Included in the vector,  $x_k$ , of explanatory variables are measures of the factors (other than capital constraints) hypothesized above to influence land valuation, including a measure of technical efficiency (derived from non-parametric, data envelopment techniques), the households land-labor endowment ratio, age of household head (included to adjust the land labor ratio for the presumably lower effective labor supply of older people). Note that we have no measure of risk-bearing capacity or desired portfolio holdings, although we expect them to be correlated with both endowment wealth and credit constraints.

Econometrically, the impact of the fixed transactions costs discussed above would be to censor the regression relationship. Following the econometrics of so-called "friction models" (e.g., see Madalla, 1985), and letting  $\mathbf{D}_k$  denote the actual, or censored net-purchase, the switching regression system (10) above can be rewritten as:

$$\begin{aligned}
& \left[ \Delta_k^* \text{ if } \Delta_k^* < -\mathbf{a}^j \Rightarrow \mathbf{e}_k^j < -(\mathbf{a}^j + \mathbf{b}^j x_k^j) \right. \\
\mathbf{D}_k = & \left\{ 0 \text{ if } -\mathbf{a} < \Delta_k^* < \mathbf{a}^j \Rightarrow -(\mathbf{a}^j + \mathbf{b}^j x_k^j) < \mathbf{e}_k^j < (\mathbf{a}^j - \mathbf{b}^j x_k^j) \right. \quad (12) \\
& \left. \left[ \Delta_k^* \text{ if } \Delta_k^* > \mathbf{a}^j \Rightarrow \mathbf{e}_k^j > (\mathbf{a}^j - \mathbf{b}^j x_k^j) \right. \right.
\end{aligned}$$

where  $j=c, u$  indexes the credit and unconstrained regimes.

Carter, Olinto and Fletschner (1997) estimate the endogenous switching regression specification in (12) using the estimated credit constraint probabilities in a two stage procedure.<sup>12</sup> The estimated parameters are presented in the appendix below. The graphs in Figure 3 present the most important results from that estimation. The graphs in the top panel display estimated relationships between the probability that a household rents in land as a function of its land-labor endowment ratio. That is, it estimates the probability that

$$\Pr[\mathbf{e}_k^c > (\mathbf{a}^c - \mathbf{b}^c x_k^c)]. \quad (13)$$

The complementary probability is divided between the events that either the household rents out land, or that they do not participate at all in the land rental market (given transactions costs that discourage small adjustments). The non-participation probability is

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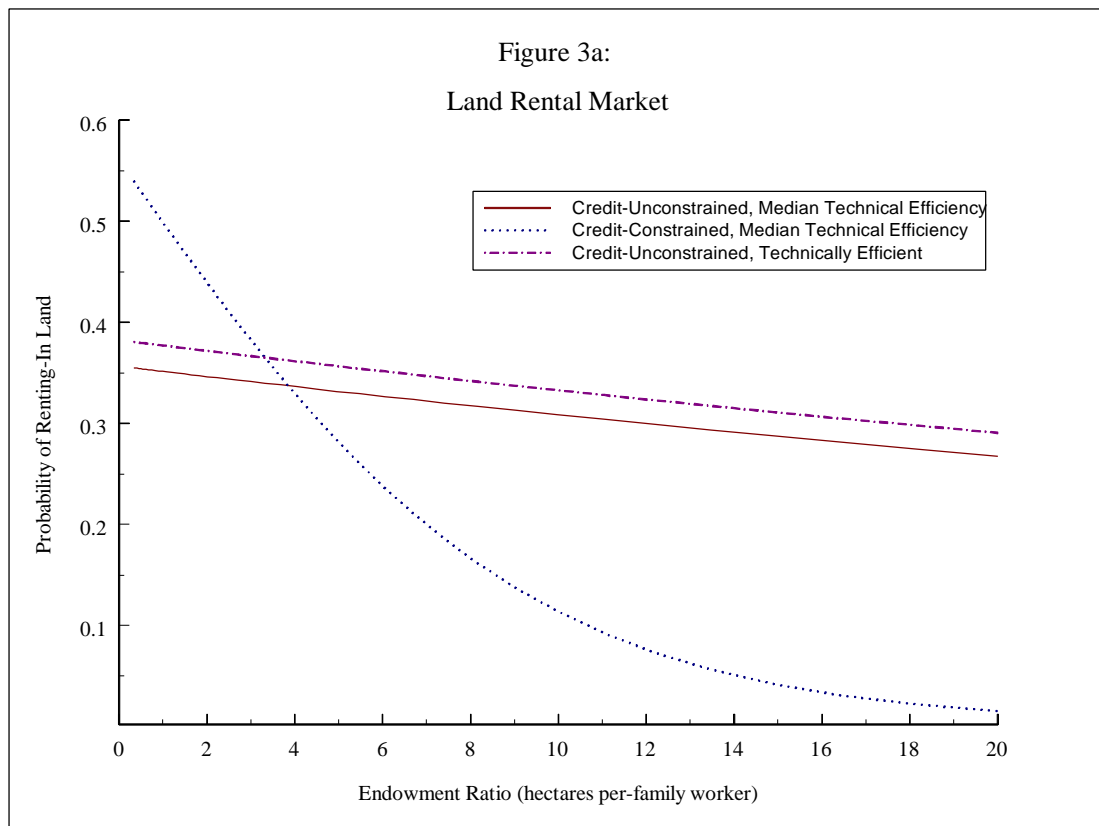
<sup>12</sup> The parameters in (11) may be estimated via a switching ordered Probit specification. Assuming for the moment that credit constraint status is observed and orthogonal to  $\mathbf{e}^j$  ( $j=c, u$ ), and letting the indicator variable  $I_k$  equal one for credit constrained observations, and zero for unconstrained observations, and assuming that  $\mathbf{e}^j$  ( $j=c, u$ ) is normally distributed normal with variance  $\mathbf{s}^{2j}$ , the overall likelihood for the problem can now be written as:

$$\begin{aligned}
L(\beta^c, \beta^u, \alpha, \sigma) = & \\
& \left\{ \prod_{k \in G_1} \Phi\left(\frac{-\mathbf{a}^c - \mathbf{b}^c X_k^c}{\mathbf{s}^c}\right) \times \prod_{k \in G_2} \left[ \Phi\left(\frac{\mathbf{a}^c - \mathbf{b}^c X_k^c}{\mathbf{s}^c}\right) - \Phi\left(\frac{-\mathbf{a}^c - \mathbf{b}^c X_k^c}{\mathbf{s}^c}\right) \right] \times \prod_{k \in G_3} \left[ 1 - \Phi\left(\frac{\mathbf{a}^c - \mathbf{b}^c X_k^c}{\mathbf{s}^c}\right) \right] \right\}^{I_k} \\
& \times \\
& \left\{ \prod_{k \in G_1} \Phi\left(\frac{-\mathbf{a}^u - \mathbf{b}^u X_k^u}{\mathbf{s}^u}\right) \times \prod_{k \in G_2} \left[ \Phi\left(\frac{\mathbf{a}^u - \mathbf{b}^u X_k^u}{\mathbf{s}^u}\right) - \Phi\left(\frac{-\mathbf{a}^u - \mathbf{b}^u X_k^u}{\mathbf{s}^u}\right) \right] \times \prod_{k \in G_3} \left[ 1 - \Phi\left(\frac{\mathbf{a}^u - \mathbf{b}^u X_k^u}{\mathbf{s}^u}\right) \right] \right\}^{1-I_k}
\end{aligned}$$

where  $G_1$  is the set of observations with negative net-purchases;  $G_2$  is the set of observations with zero transactions;  $G_3$  is the set of observations with positive net-purchases; and  $\Phi(\cdot)$  is the cumulative density function for the standard normal distribution. Because the credit constraint indicator variable,  $I_k$  is not observed we replace it with its expected value derived from the disequilibrium credit market model estimated by Carter and Olinto (1997).

in fact quite large for all endowment ratios. The probability estimates in the top panel are conditional estimates in the sense that they condition on, or control for the credit constraint regime.

Consistent with the predictions of the Chayanovian base case, the probabilities for both credit-constrained and unconstrained regimes are decreasing in the land-labor endowment. Somewhat surprisingly, the predicted probabilities are higher for the credit-constrained case for farm units with a land-labor ratio below 5 hectares per-worker (or about 15 physical hectares for a household with a median endowment of 3 family workers). Perhaps these units are in fact using rental relationships to access capital that otherwise would not be available to them. Note also that predicted rental probability decreases very little as the endowment ratio increases for households in the unconstrained regime. Finally, note that the rental probability increases with estimated technical efficiency in the credit-unconstrained case, as predicted. In the credit-constrained case, the estimated impact of technical efficiency is both numerically small and statistically insignificant.



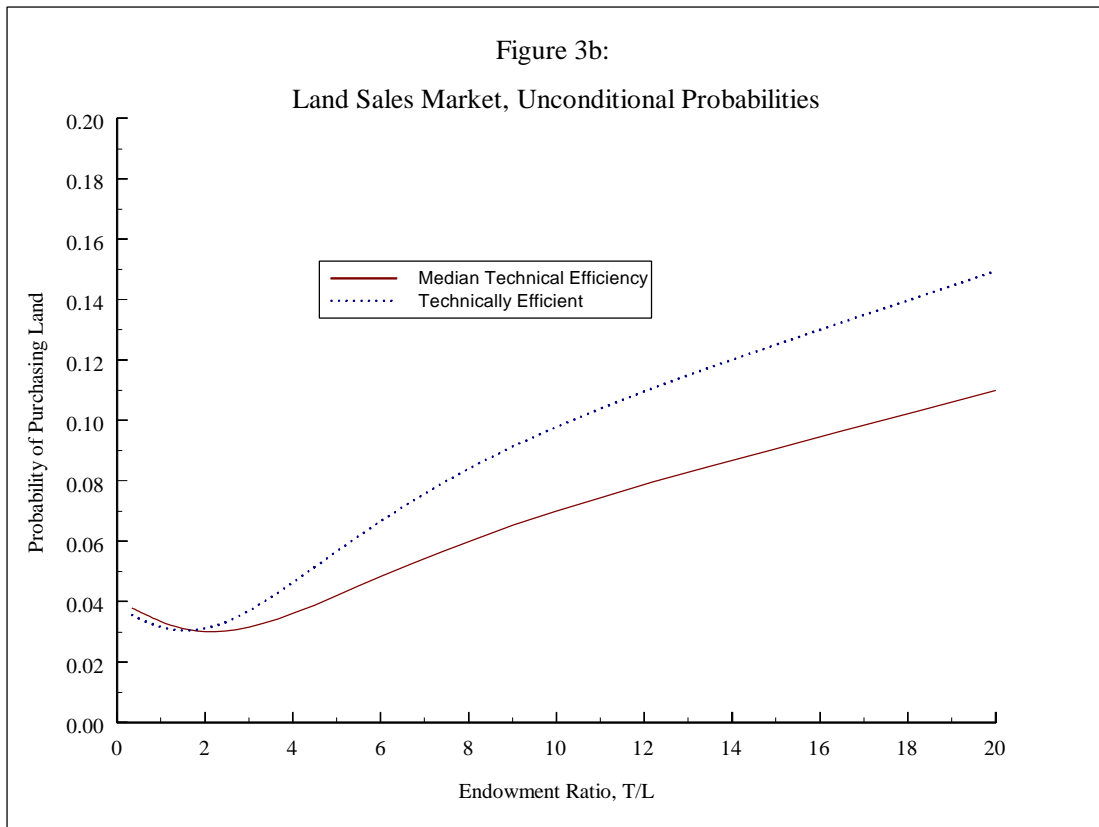
The bottom half of Figure 3 shows unconditional land purchase probabilities as a function of the land-labor endowment. These probabilities are unconditional in that they weigh together the conditional probabilities for the credit-constrained and unconstrained regimes by the probability that a household of the indicated endowment level is in the

indicated regime. As shown in Figure 2 above, households with endowment ratios below 5 hectares per-family worker are estimated to more likely be in the credit constrained regime. These unconditional estimates thus give insight into the actual sorts of structural incentives that there are for land purchase by farms of different sizes. In addition, the figure has been constructed on the assumptions that all households hold full, marketable title to their land. The figure can thus be read as an indicator of the operation of the land market following a full land titling program.

In sharp contrast to the land rental market estimates, we see that the estimated land purchase probability increases sharply with land-labor endowment.<sup>13</sup> Technically efficient producers with relatively large land endowments are estimated to enjoy a (statistically significant) boost of 10 percentage points in the probability that they will purchase land (as compared to an otherwise identical household with the median level of technical efficiency of 80%). In contrast, the “poor but efficient” producer (who is also most likely credit constrained) is estimated to have no chance of participating in the land market as a buyer. In short, these estimates indicate that the land purchase market is not a realm in which landless and near-landless households are likely to be competitive.

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<sup>13</sup> The estimated effect an incremental increase in the land-labor endowment ratio on the probability of a household participating in the land sales market as a buyer, evaluated at the median values of the explanatory variables, is 0.22, which is significantly different from zero at the 5% level of significance (the Wald statistic for the restriction  $\partial \Delta_i^* / \partial (T_i/N_i) = 0$  is 5.41). For the households in the credit-constrained regime, the estimated effect of  $T_i/N_i$  on  $\Delta_i^*$  is slightly negative, but not significantly different from zero at any of the conventional levels.



In addition to its deleterious impact on factor allocation and hence on the shadow value of land defined in equations (7) and (8) above, there are two other effects of borrowing constraints that might be contributing to these results: a transactions costs effect and a portfolio effect. While the transaction costs effect influences households' ability to buy land in the increments that they can self-finance, the portfolio effect influences their dynamic willingness to pay for land. In Paraguay, there is no credit for land purchases for most households—including rich ones. A household's inability to meet its working capital needs (which is what the credit constraint indicator variable measures, is surely correlated with its ability to finance land purchases. Moreover, transactions costs discourage the purchase of land in tiny incremental amounts. It might be the case that a household desiring to increase its land holdings by 10 hectares would not be able to do so by purchasing small amounts, say 1 hectare for the next 10 years. Instead, the household must save enough to purchase chunks of 5 hectares. That is, because land cannot be purchased in small incremental amounts, households need first to accumulate enough liquid wealth in order to become able to bid for a given parcel of land. And yet it is precisely a scarcity of liquidity that the credit constraint variable signals.

In addition, a portfolio effect could be caused by the precautionary behavior of credit-constrained households. Households identified as credit constrained econometrically may in fact perceive themselves as having difficulty in accessing

institutional credit in the future. Therefore, depending on the magnitude of the effect that land wealth has on access to institutional credit, constrained households may prefer to hold more liquid portfolios, with less land and more livestock and/or grains. Thus, this portfolio effect—highly correlated with current working capital constraints—is caused by the household’s expectation of facing borrowing constraints in a future in which income is uncertain.

In summary, while this section’s results give evidence that land rental markets are a medium of land access for land scarce households, they also show that there is little hope that the land purchase market can work in favor of small scale producers, even in the wake of property rights reform that provided legally clear and marketable title to all land owners. Capital and financial market constraints appear to lie at the heart of this result. In particular, the failure of land titles to bolster the formal capital access of small holders appears to be a key breakdown in the linkage between land titling and improved land access of the less well-off. In short, land titling appears to be an insufficient instrument to bolster the competitiveness of the poor and turn the land market into an arena in which the agrarian question is resolved in favor of peasant land access. The concluding section of this paper will return to some of the policy implications of these observations.

#### **Section 4      Policy Implications**

Despite renewed the renewed attention to income distribution issues within official development circles, land policy in contemporary Latin America is largely dedicated to making property rights secure and the land market more active. The analysis here has asked whether a more active land market is in fact desirable—that is, does it increase the productivity and equity of the rural economy?

The econometric results presented here offer a strong and interesting portrayal of how the land market works. Most pointedly, the results suggest that the land rental and land sales markets work in fundamentally different ways. Whereas the land rental market appears to somewhat function as a mechanism of land access for labor abundant, capital constrained households, the latter does not. One would in fact expect that capital and constraints and insurance constraints would most heavily display their influence in the sale market (e.g., see Carter and Olinto 1996b). Not expected, but of potentially great policy import, is the finding that only when agents are capital unconstrained does their relative technical efficiency actually appear able to express itself as effective demand for more land. Hence, while part of the interest in land titling and other tenure-oriented policies is in activating a market which it is hoped will shift land to the more efficient, there seems to be little indication that land markets in Paraguay at least work that way. Coupled with earlier results showing that land titles do little to relax capital constraints for small producers (Carter and Olinto 1996a,b), these new findings give further priority to matching land market reform with policy dedicated to the innovation of institutions capable of relaxing financial market constraints. Then, and only then, do these results

suggest that enhanced operation of the land market will create the fully beneficial productivity and distributional goals laid out for it.<sup>14</sup>

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<sup>14</sup> This comment can of course be read as an application of the theory of the second best.

## Appendix: Econometric Estimates of the Land Market Model

TABLE A.1

### Maximum Likelihood Estimates of Household Land Market Participation

	NET LAND RENTALS		NET LAND PURCHASES	
<i>Explanatory Variables</i>	<i>Parameter Estimates</i>	<i>(Std. Errors)</i>	<i>Parameter Estimates</i>	<i>(Std. Errors)</i>
<i>Credit Unconstrained Regime:</i>				
$\alpha$	0.925**	(0.076)	1.442**	(0.113)
Frontier Region Dummy	0.023	(0.289)	-0.342	(0.285)
Colonization Region Dummy	-0.196	(0.246)	-0.340	(0.244)
Intercept	2.198*	(1.204)	-3.340*	(1.942)
Technical Efficiency Index	0.340	(0.403)	0.941*	(0.506)
Age	-0.067	(0.044)	0.109*	(0.067)
Age <sup>2</sup>	0.0004	(.0004)	-.0011**	(.0005)
Endowment Ratio (Owned Land/Labor Force)	-0.014*	(0.008)	0.024**	(0.010)
Squared Endowment Ratio	.00007	(.00005)	-.0001**	(.00004)
<i>Credit Constrained Regime:</i>				
$\alpha$	0.995**	(0.074)	1.281**	(0.099)
Frontier Region Dummy	-0.550**	(0.213)	-0.051	(0.192)
Colonization Region Dummy	-0.765**	(0.208)	-0.016	(0.135)
Intercept	4.299**	(0.973)	-2.241**	(1.096)
Technical Efficiency Index	-0.226	(0.393)	-0.147	(0.480)
Age	-0.097**	(0.035)	0.092**	(0.045)
Age <sup>2</sup>	0.0007**	(.0003)	-.0009**	(.0004)
Endowment Ratio (Owned Land/Labor Force)	-0.156**	(0.033)	-0.095	(0.067)
Squared Endowment Ratio	0.002**	(.0009)	0.003	(0.004)
Log-likelihood	-232.7		-173.5	
Number of Observations	279			



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