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LAND RIGHTS AND LAND MARKETS IN THE WEST AFRICAN SAHEL

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Rethinking the Demand for Institutional Innovation:
Land Rights and Land Markets in the West African Sahel

A large and growing body of literature, notably punctuated by the recent writings of Douglass North[1], argues that institutions are vital to robust economic performance. The centrality of institutions does not of course mean that they are exogenous, nor that they can be arbitrarily manipulated or created. The somewhat independent but ultimately intertwined work of North and Robert Thomas[2] and Vernon Ruttan and Yujiro Hayami[3] represented an initial effort to articulate an economic theory of institutional change, or what Hayami and Ruttan came to call the theory of induced institutional innovation. Taking a cue from work on induced technological change, this early work emphasized how changes in aggregate factor proportions and prices create incentives for the innovation of institutions which lead to better or more efficient use of increasingly scarce factors. As recounted by North, this efficiency view of institutions eventually foundered on evidence of persistent institutional inefficiency. The subsequent evolution of the induced institutional change literature has left largely untouched the definition of, and demand for, efficient institutions and has instead focused on the theories of the state, or of collective action or learning which explain whether and to what extent the supply of efficient institutional arrangements is forthcoming.[4]

This paper inverts the approach taken to the problem of institutional innovation in the recent literature. Rather than focusing on the political economy of collective action and institutional supply, this paper deepens the economics of demand for institutional innovation. Focusing on the alienability of land rights in the West African Sahel, this paper demonstrates the use of dynamic stochastic general equilibrium methods to study the demand for institutional innovation. The focus on West Africa is particularly warranted because, while long considered a land abundant region, increasing population densities have created marked land scarcity in certain areas. In addition, observers of this region have begun to note the demise of a number of social institutions which have traditionally managed risk in the region.[5] In the formal model used here to study this confluence of factors, agents are distributed across a two dimensional

endowment space, and their preferences for institutional innovation reflect a full dynamic rationality, including an understanding of how the land market and the land price distribution would endogenously evolve following the institutional change. These preferences are formally captured by the novel use of a dynamic programming value function under alternative institutional scenarios. The fact that the value function incorporates information about the institutional environment in which agents maximize is exploited to derive an intertemporally accurate measure of the option value of institutional change to heterogenously endowed agents.

This microeconomic approach to the demand for institutional innovation deepens the theory of institutional innovation along several dimensions. First, in contrast to the representative agent or aggregate benefit-cost approaches used to derived the demand for institutional innovation in much of the literature, this paper explores the heterogeneity of demand across agents, and the reasons for this heterogeneity. These conventional approaches are most glaringly problematic in those instances in which heterogeneous behavior is central to the functioning of an institution, as it is when the innovation of private and marketable property rights to productive assets creates the basis for a market in a means of production. Without agent heterogeneity (willing buyers *and* sellers), such a market is obviously without economic meaning. The analysis of market development put forward here explores the circumstances under which the dynamic rationality of differentially endowed agents would lead them to differentiated asset-market behavior, and ultimately to a differential valuation of an institutional regime which permits recourse to that market.

Second, the microeconomic approach to institutional demand developed here shows that, in West Africa at least, the demand for marketable property rights is likely to rest on more than generalized land scarcity. Indeed, in terms of this paper's dynamic option value metric, the strongest demand for a land market emanates from the desire of low wealth agents to use the market to buffer unmediated production risk. Correctly locating the source of the demand for institutional change is of practical import, for as

Bruce Koppel[6] notes, the economics of induced institutional innovation have been used as much to direct institutional change in the policy present as to explain the historical past. In the particular case of marketable property rights, a land scarcity theory of the demand for full and marketable private property rights in land has been used to argue for institutional midwifery which hurries the birth of fully privatized and marketable property rights in areas of Sub-Saharan Africa[7]. The analysis here suggests that potentially strong demand among certain classes for marketable property rights can be occasioned by the collapse of customary risk management functions, functions which even competitive markets are ill-prepared to fill given the reality of information and other transactions costs. The demand for marketable rights, and indeed the appearance of some land transactions, may ultimately reflect a displaced demand for the innovation of contingency and other financial markets. In this second best environment, a policy of land privatization may be dominated by a policy that addresses those elements in the economic and institutional environment which create the sharp (displaced) demand for marketability rights.

This remainder of this paper is organized as follows. Section 1 explores the economics of induced institutional innovation as it applies to property rights and markets in land. It focuses on the role of agent heterogeneity in the development of an asset (land) market, in particular exploring how endowment heterogeneity maps into heterogeneity in the individual shadow price of an asset. Section 2 then employs a formal dynamic simulation model--calibrated on the contemporary West African reality of environment, technology and evolving social structure--to explore individual demand for institutional innovation in an environment of individualized, asset-based risk-coping. Section 3 concludes the paper with reflections on policy implications.

I. Generalized versus Specific Asset Scarcity and the Demand for Marketable Property Rights

A number of authors have applied an induced institutional change perspective to contemporary policy analyses of land rights. A unifying feature of these analyses is that they identify increasing (generalized) land scarcity as the factor which disequilibrates existing institutional regimes and generates the social gains to be had from the innovation of privatized land rights regimes. This section argues that it is important to decompose private property rights in land into two components: the long term *security* of use and income rights to land (for the relevant decision-making agent); and the *marketability* of those same rights. The economic value of security emanates from the generalized scarcity of land as a productive asset. The economic value of marketability emerges from the specific or individually heterogeneous scarcity value of land. Distinguishing between the two components launches the economic analysis of induced institutional change upon the microfoundations of specific individual interests, rather than upon disembodied notions of the aggregate social benefits and costs of institutional change.

Generalized Asset Scarcity and the Demand for Secure Property Rights

Legal analysis identifies a number of separable attributes or incidents which might describe a particular property rights regime. Economic analysis of property rights over productive assets has most frequently focused on the "use and income rights" which directly shape production and investment incentives, and on the "right to the alienate" which is a precondition for a market in the asset.

In a paper focused on property rights in land, Gershon Feder and David Feeny formally model the economic value of secure use and income rights[8]. Their analysis focuses on what might be called the horizon-truncation problem which confronts the representative agent who utilizes land to produce income. Horizon truncation results when the agent has an uncertain ability to claim the full stream of income produced through his or her use of the land (be it to the end of a single production cycle, or to the end of a long-lived sunk investment in land improvement). Private incentives and willingness to invest or combine other resources with land are dampened by truncated horizons. In addition, this same uncertainty reduces

the collateral value of the asset and with it the supply of investment credit by financial intermediaries. Together these two factors may conspire to generate an underinvestment in land and a social cost (in the form of foregone net output) to insecure use and income rights.

Feder and Feeny use their representative agent model to define the net private benefits to an institutional innovation which eliminates the uncertainty of asset rights as the concomitant increase in the expected net present value of the asset to the agent.[9] Keeping with tradition of the induced institutional change literature, Feder and Feeny hypothesize that changing factor proportions have and are leading to demand for secure private rights in land. Higher population density is seen to raise the generalized economic scarcity value of land and create incentives to intensify input use per unit of land.[10] Because many forms of intensification (e.g., irrigation systems and contour bunding) have a long-lived impact and their full payoff occurs over a number of production cycles, the economic cost from truncated horizons increases with relative land scarcity. Correspondingly the social benefits to, and the private demand for, institutional innovation increase with increasing generalized economic scarcity of the asset.[11]

As Jean-Philippe Platteau suggests, this perspective on generalized asset scarcity and the demand for secure rights raises the policy issue of whether development agencies ought to be engaging in institutional mid-wifery, hurrying the birth of private land rights, or whether waiting for induced institutional change to go full term is the wiser policy. However, this perspective glosses over several important theoretical issues, all with significant policy implications. These issues include the aggregation rule for adding up individual benefits; the relationship of the distribution of benefits (or initial endowments) to eventual general equilibrium prices; and the relationship between secure use rights and secure marketability rights. While the issues of aggregation and of indirect, general equilibrium effects are clearly crucial to a fuller theory of institutional innovation, and to the evaluation of the benefits of institutional innovation in practice, they are largely beyond the scope of this paper[12]. More central to the argument here

is the third failing of the existing literature on induced institutional innovation, namely the blurring of the line between secure use rights in land and the right to alienate--or freely market--those use rights.

Specific Asset Scarcity and the Demand for Marketable Property Rights

If land is to be transferred among agents, and especially if such transactions are to be efficiency-enhancing, then they must be motivated by differences across agents in the value of land, or "specific" asset scarcity. Yet, the demand for marketability rights in land has been subjected to much less rigorous analysis than the demand for secure income and use rights, and in fact, many authors confound the two. Feder and Feeny note that "the lack of transferability rights adversely affects productivity," but they do not formally model this adverse effect as they do for secure income and use rights. As mentioned above, analysis of the demand for marketability rights, and per force, analysis of the induced innovation of land or other asset markets, must begin with some concept of specific or heterogeneous asset scarcity as opposed to generalized social scarcity or the representative agent approach characteristic of much the analysis of induced institutional change.

In broad terms, there are three sources of potential agent heterogeneity which could generate the sort of specific asset scarcity necessary to motivate transactions among agents. First, are differences in endowments of human capital across agents. Since markets for disembodied human capital are imperfect where they exist at all, it is believed that active land markets will permit the transfer of land from less productive to more productive users. Though subject to only cursory economic analysis, the perception that land marketability rights will generate socially beneficial transfer of land from less to more productive farm operators has been an important part of the land policy debate in Africa and elsewhere. In an often quoted statement, the architect of British colonial land policy in Kenya wrote that reform of the customary tenure system would permit the more industrious and productive farmers to buy out the less productive, and place Kenya on a "normal" path of economic development[13]. Contemporary calls for land tenure reform

which provides full marketability rights continue to rely on notions of specific asset scarcity based on skill or human capital heterogeneity. While the potential for such an institutionally-generated windfall is certainly real, it should be noted that especially in Africa and East Asia, institutions such as work-sharing and farming contests already exist to facilitate the spread of human capital.

A second source of heterogeneity in specific land shadow values lies in structural differences in how land is used by farmers of different farm sizes. The empirical regularity of an inverse relationship between farm size and land productivity is perhaps the best known indicator of that heterogeneity. Most theoretical (and empirical) accounts identify informationally imperfect capital or labor markets as the factor which explains heterogeneous land use and land productivity in the presence of constant returns to scale technologies. In this tradition, Mukesh Eswaran and Ashok Kotwal[14] and Gershon Feder[15] theoretically derive increasing land productivity as a function of wealth, over a certain range of land holdings. Imperfect factor markets drive size-stratified factor-intensities and associated agricultural productivity. As explored by Michael Carter and Frederic Zimmerman[16], an asset market in land in an inegalitarian economy will tend to be quite active as agents with heterogeneous land endowment use the land market to realize gains from the exchange of land exploited with heterogeneous factor intensities. Such exchanges tend to be productivity enhancing for the economy, though the efficiency implications are ambiguous since agents respond to factor shadow prices which deviate from social costs.[17] Differences in land shadow values that arise out of the peculiar institutional structure of information-constrained factor markets will be called structural heterogeneity. The belief that structural heterogeneity unambiguously favors small farmers underlies the notion that activation of land markets can be used to redistribute in economies such as South Africa's[18].

Finally, heterogeneous risk management capacity is the third source of specific asset scarcity. Avishay Braverman and Joseph Stiglitz have, for example, speculated that even in the presence of structural factors which would seem to create pressure for land exchange, small scale farmers will be

reluctant to alienate land unless stochastic outcomes compel them to do so[19]. Desperation sales are in fact a common form of land transfers in developing areas. Indeed, in the relatively egalitarian economies characteristic of much of Africa, Eastern Europe and East Asia, structural heterogeneity may be relatively unimportant as the basis for specific asset scarcity. As Michael Carter explores econometrically, the relatively narrow band of asset inequality observed in West Africa maps into a quite broad range of risk exposure, where risk exposure is understood as the probability that food production falls below subsistence requirements[20]. Risk-coping heterogeneity as the basis for differential asset use (and potentially valuation) receives a thorough econometric treatment by Mark Rosenzweig and Hans Binswanger[21] who use South Asian data to show that increasing risk dampens the relative productivity of the lower- wealth individuals who are exposed to higher levels of consumption risk.

Note that in contrast to both structural and human capital-based specific asset scarcities, asset transactions based on differential risk coping need not be productivity enhancing. In addition, note further that the potential demand for marketability rights in this context is really a displaced demand for independent instruments to deal with risk. In other words, the demand for marketability rights and asset markets may in fact be a displaced institutional innovation.

Which of the three sources of differentiation in agent-specific land shadow values (human capital differences, structural heterogeneity, or risk) is most important is crucial to the form that an eventual institutional innovation will take. It is also crucial to what, if any policy response might be appropriate to either foster or complement institutional developments. If, for example, non-marketable differences in human capital are the most prominent source of differences in individual shadow values of land, then it may be worth assisting the development of a land market with a land-titling agency and a government-financed cadastral survey. On the other hand, if differences in individual land shadow values are driven primarily by different individual needs to use land to buffer consumption against risk, then the modest productivity gains of a land market may not justify the legal and institutional expense needed to support it.

These alternatives highlight one of the central arguments of this paper, namely that the equity and efficiency implications of induced institutional change depend heavily on the pre-existing institutional environment, and cannot be assumed to be positive, but rather must be explored explicitly for a specific situation. The articulation of the microeconomics of institutional change is in this sense a move away from a teleological view of institutional change. Institutional change might not always be a first-best response to institutional disequilibria, but to the extent it is not, unpacking the reasons for the change can permit policy to improve and assist welfare-enhancing change.

II. Risk, Scarcity and Land in the West African Sahel

A dominant feature of West African agriculture is its riskiness. Yield variance is typically 20-70% of mean yield even under optimal crop management, and few formal or informal risk-coping mechanisms exist[22]. In the past relative land abundance meant that households could compensate for this riskiness by recourse to very extensive agriculture, and reliance on social support mechanisms[23]. However, increasing land scarcity has lead to a breakdown in traditional risk-coping institutions and concomitant problems[24].

Compounding the problems of high risk and poor risk management ability are low margins of subsistence. Households whose mean yields give them very little surplus over consumption requirements face greater risk-related danger than do households facing a similar distribution of yields but with a higher mean (or lower subsistence requirements). In a recent paper, Carter[25] uses plot level data from ICRISAT's multi-year village level studies to decompose and measure the covariate and idiosyncratic components of risk in this region. His results show that the relatively low levels of agricultural productivity and the high levels of environmental instability would combine to expose the average agricultural household in the region to a 10% probability of a food subsistence shortfall in any given year *if* the household were to utilize its resources in a risk-oblivious, income maximizing way. Households do

not of course cultivate in such a manner, and Carter goes on to estimate the ability of households to manage that risk through a variety of mechanisms. While the risk literature often distinguishes insurance mechanisms between those based on social reciprocity and those based on self-insurance, Carter argues that in West Africa both historically have been intimately intertwined with the customary social and land tenure system. He also goes on to show that even across the relatively narrow range of asset inequality observed in West Africa, the degree of risk exposure is extremely broad if individuals are treated as socially isolated units without recourse to reciprocity devices.

Whatever the importance of such social reciprocity in the past, current evidence suggests that such schemes leave considerable levels of risk unmediated. Recent work by Thomas Reardon, Christopher Delgado and Peter Matlon reveals that, in six villages of Burkina Faso, transfers account for less than 4% of income[26]. Robert Townsend does not measure transfers directly, but regresses year-to-year individual consumption changes on year-to-year indvidual income changes and on year-to-year group consumption changes. If year-to-year individual consumption changes do not depend on year-to-year individual income changes, then perfect within-group income-pooling may be said to exist. Using this method, Townsend finds evidence for partial risk-pooling, but also significant evidence of unmediated risk[27]. Recent work by Christopher Udry (1990) and by Susan Lund (1996) suggest that the form such risk-pooling takes may be informal credit with state-contingent terms. Such informal loans occur within narrow networks--often families--in which individuals have similar wealth profiles. Significantly, as Lund's (1996) evidence reveals, poorer households tend to be less well served by such mechanisms than wealthier households[28].

Formal insurance and credit markets, which are notoriously missing or inaccessible to most households, are also ineffective as means for coping with risk. Households must therefore rely on various forms of portfolio management to manage risk. This portfolio management can take the form of *ex-ante*, income-smoothing adjustments in the use of productive assets or inputs, or it can take the form

of *ex-post*, consumption-smoothing adjustments in the levels of buffer stocks[29]. Income-smoothing mechanisms include adjusting the quantity of purchased inputs; adjusting the diversity and quantity of labor sold (against labor used on farm); and adjusting the mix of productive assets[30]. Consumption-smoothing mechanisms include the adjustment of savings (in grain, cash, and sometimes productive assets) in the wake of an income shock[31].

The considerable body of theoretical and empirical literature on income- and consumption-smoothing suggests that the risk that is unmediated by social networks or by formal markets is considerable. Jonathan Morduch, in a back-of-the-envelope calculation suggests that households may be willing to forego up to 25% of their (theoretically maximum) income to achieve fully stable consumption. Within this context, the marketability of assets is important not only for production purposes, but for risk-coping reasons as well.

III. The Demand for Marketable Property Rights as A Displaced Institutional Innovation

To explore the sources of demand for the innovation of marketable property rights, this section analyzes a dynamic asset portfolio model under a variety of assumptions about property rights and risk[32]. Agents in the model may hold two types of assets: a productive asset ("land"); and, an unproductive, but directly consumable asset ("grain"). Following each year's production, agents decide how much to consume; how much to save; and, when land is fully marketable, how to allocate their savings between land and grain. The model described below is set up to capture the following conditions:

(A1) *Generalized Land Scarcity*: Expected income is strictly increasing in land for all agents. Tenure security is presumed not to be a problem as no agent faces risk of expropriation of, or expulsion from, his or her land.

(A2) *Structural Heterogeneity*: Agents in the model are given different initial endowments of land and grain. The initial distribution of endowments is based on the asset distribution data in the ICRISAT village level data set for Burkina Faso. In order to capture differences in resource productivity and use which typify smaller versus larger peasant households, the production process is specified to exhibit modestly decreasing returns to scale.

Note that conditions (A1) and (A2) create a type of specific asset scarcity and a structural basis for land transactions between heterogeneously endowed agents as discussed in Section 1 above. In addition to this basis for asset transactions, the model is analyzed under the following assumptions about risk which can create an additional source of specific asset scarcity:

(A3) *Autarchic Consumption Smoothing of Residual Income Fluctuations*: Missing contingency markets, imperfect social reciprocity and residual income risk force agents to autarchically rely on their savings and assets in order to smooth consumption against residual income fluctuation. These residual income fluctuations are specified in the model to have a coefficient of variation of 25%, a value which falls in the middle of the range of values given in Reardon et al. (1995) for Burkina Faso.

(A4) *Covariate Shocks and Endogenous Asset Prices:* Following the estimates of Michael Carter, the shocks which generate the residual income fluctuations have both an idiosyncratic and covariate components. When land is marketable, it is assumed that the land market is localized, both because land itself is immovable and because the economy is presumed not to be highly integrated across villages. Because the land price must adjust to clear the local land market each period, the way is opened to asset price covariance, meaning that the land price may move with the covariate shock, as would tend to happen if numerous agents sold off land in order to smooth their consumption in the face of a covariate shock.

Note that assumption (A3) is similar to analysis presented in Deaton, except that here agents have a portfolio choice over land and grain which influences the moments of the distribution which generates their future income realizations[33]. In addition, assumption (A4) adds a novel level of complexity and realism to the savings and portfolio composition decisions through the inclusion of asset price risk.

Finally, the model makes the following two behavioral assumptions:

(A5) *Subsistence Constraints*: Agents have standard, risk-averse, concave preferences defined over the quantity of the consumption good which they consume, as long as the amount of that good exceeds a subsistence minimum. However, if consumption in any period falls below that minimum, agents are assumed to suffer an irreversible loss of productive capacity (if not life) which permanently reduces their capacity for future utility.

(A6) *First and Second Moment Rational Expectations*: Agents' rationality extends to full information over the distribution of idiosyncratic shock, and the joint distribution of the covariate production shock and the endogenous land asset price.

After summarizing the formal structure which conforms to these assumptions and specifications, this section will return to the analysis of the demand for marketable property rights in land.

A Dynamic Model of Consumption Smoothing and Asset Management

Using the assumptions and features outlined above, a model of a 100-household village economy was assembled. The model is first discussed under the assumption that land is fully marketable and that well defined local land market exists as described in (A4) above. Each agent enjoys an initial endowment of land (T_0) and grain (M_0) as described in (A2) above. Starting at time 0, each agent must choose period 0 consumption and a sequence of asset accumulation trajectories ($\underline{T}_1$ and $\underline{M}_1$) in order to solve the following dynamic choice problem:

$$\underset{(\underline{c}_0,\underline{T}_1,\underline{M}_1)}{Max} \; E_0\{\sum_{t=1}^{\infty}\delta^t u(c_t) \mid \Omega_0\} \tag{1}$$

where Ω_0 represents the agent's information set at time 0 as described in (A6) above and the agent's utility for the t-th period is given by the following utility function:

$$u(c_t) = \begin{cases} (c_t/R_0)^{\varepsilon} \text{ if } c_t \geq R_0 \text{ and } c_s \geq R_0 \text{ For all } s \in \{1,2,...t\text{-}1\} & \varepsilon < 1 \\ 0 \quad \text{otherwise} \end{cases} \tag{2}$$

where R_0 is the subsistence minimum described in (A5) above. Production in period "t" is given by:

$$F(T_t,\theta_{it},\theta_{vt}) = \theta_{it}\theta_{vt}D\cdot(T_t)^{\sigma} \tag{3}$$

where T_t is the unit's holdings of land asset in period "t;" θ_t and θ_t are the idiosyncratic and covariate shocks described in (A4) above; and, D is a land productivity parameter and σ is an output elasticity parameter which represents decreasing returns.[34] The agent's consumption and asset accumulation choices each period are constrained by the following budget constraint:

$$c_t \leq F(T_t,\theta_{it},\theta_{vt}) + \mu M_t - P_{Tt}(T_{t+1}-T_t) - (M_{t+1}-M_t) \tag{4}$$

where M_t is the household's holding of the non-productive asset ("grain") in period t; andμ is the rate of return on grain.[35] P_{Tt} is the endogenous price of land which adjusts to clear the market in every period t. Note that as described above, the two assets, T and M, are distinguished both by whether their returns are stochastic, and by whether they are subject to price risk in their conversion to consumable goods.

The maximization problem given in (1) above defines a true value function:

$$J^*(T_0, M_0|\Omega_0) \equiv E_0\{\underset{(c_0,\underline{T}_1,\underline{M}_1)}{Max} \sum_{t=0}^{\infty} u(c_t)|\Omega_0\} \qquad (5)$$

where $J^*(T_o,M_o)$ gives the utility value to the household (in discounted expected present value terms) of the initial asset combination (T_o,M_o) when the household optimally chooses its future time path of consumption and asset accumulation.

A Dynamic Option Price Measure of the Demand for Institutional Innovation

The true value function defined in (5) provides a basis for an analytical measure of the value of a discrete institutional innovation, such as the creation of fully marketable property rights in land. Among other things, this value function, and the dynamic optimization problem on which it rests, depend on the institutional structure of the economy faced by the individual, most particularly on the ability of the agent to buy and sell the productive asset of land. By constraining the problem so that households cannot adjust their holdings of the productive asset, and then comparing the resulting true value function to the true value function of the unconstrained problem, a measure of the value of the market in the productive asset can be obtained.

More formally, let G*(T,M) be the value function which corresponds to the problem (1) with the additional constraint imposed that agents cannot adjust their holding of land (i.e., individuals can only consume and save or dis-save grain stores). The dynamic option value of marketability rights to land can

then be defined as the certain grain transfer, Z(T,M), which would just make the constrained true value function equal to the unconstrained. That is, Z(T,M) is defined such that:

$$J^*(T^o,M^o) = G^*(T^o,M^o + Z(T^o,M^o)) \qquad (6)$$

Note that Z(T,M) will always be non-negative since G*(T,M) arises out of a constrained version of the problem which, when unconstrained, yields J*(T,M). The value of Z(T,M) would be zero for an agent who never required recourse to the land market, whereas it could be quite high for an agent who expected to benefit from exploiting differences in his or her specific valuation of land versus the market price.

Three characteristics of the dynamic option value measure defined by (6) render it particularly attractive and powerful as an instrument for institutional analysis. First, it captures the full dynamic value of the institution, including, in this instance, the expected value of having recourse to the institution to smooth consumption in response to shocks and to adjust and balance an asset portfolio. Second, because it is defined in terms of an initial endowment position (T,M), the option value measure Z(T,M) provides a natural way to admit and analyze the potentially heterogeneous institutional preferences of differentially endowed agents. Finally, because it is defined on the basis of rational understanding of price asset price evolution and covariance, the measure reflects an equilibrium valuation of the institution. That is, because the dynamic problem is defined conditional on a (correct) understanding of the price evolution which will be generated by the interactions of the multiple agents who comprise the economy, institutional preferences are not misstated by myopic or other incorrect understandings of how the market will endogenously operate when all agents autonomously act and interact in future periods.

Dynamic Simulation Analysis of the Option Price of Marketable Land Rights

The endogeneity of the productive asset price implies that the price in any period depends upon the full distribution of (both types of) assets. Because of the assumption of rational expectations, this price endogeneity in turn implies that the maximization problem of each individual household depends

on the distribution of assets in the present, as well as on accurate expectations about that distribution in the future. Accordingly, the value function cannot be solved analytically, but can only be solved numerically, in a "guess and verify" fashion. The value function (5) can be estimated numerically over a grid of points in <T, M> space. Because the form of the value function is recursive, optimization over the choice variables of the objective, incorporating the estimated value function as an argument, will generate a new, pointwise more accurate estimate of the value function. When successive iterations of such optimization reify the value function, then the resulting value function must be the true value function[36]. Once the true value functions are determined for each of the institutional variants (i.e., with and without asset marketability rights), it is a simple matter to derive the option value of marketability rights as per (6).

Figures 1 and 2 show the two dimensional asset space of land and grain stocks. Figures 1 and 2 both project onto that two dimensional endowment space the contour mapping that represents the option price measure, Z(T,M), for each initial endowment position. Any particular initial endowment position defines a point in that space. When land rights are fully marketable, agents can over time move in any desired direction through that space, subject of course to the budget and other constraints given in equations (2) through (4) above. When land rights are not marketable, agents are restricted to north-south movements in that space. That is, they can accumulate grain stocks, but cannot adjust their holdings of the productive land asset.

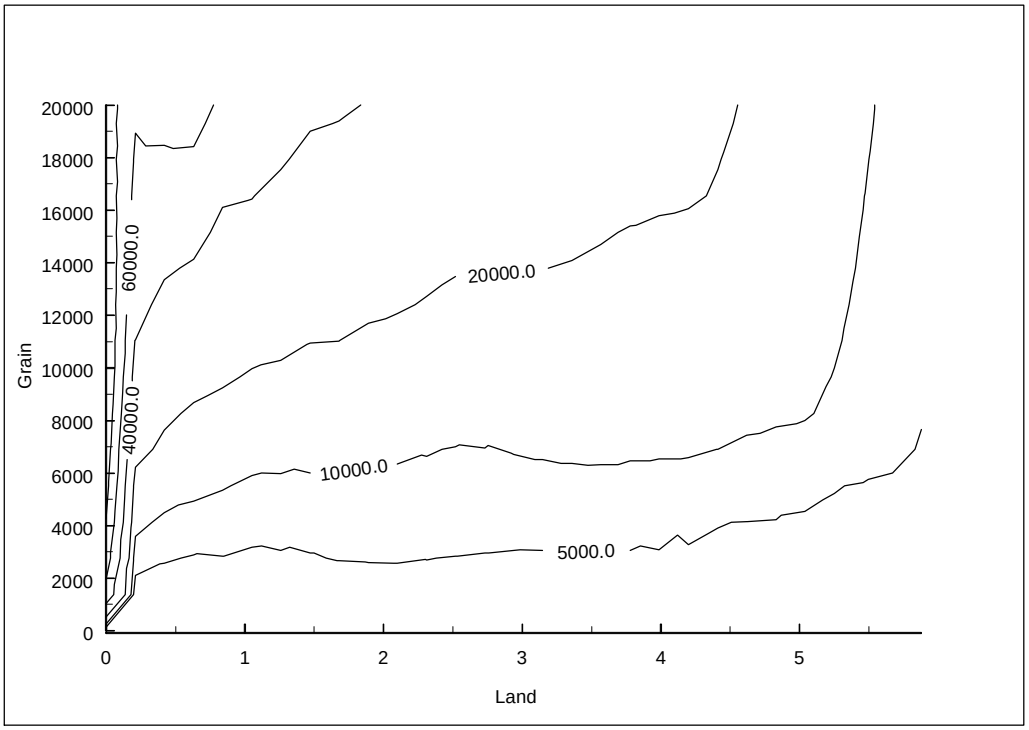

FIG. 1.--Option Value of marketability rights given no risk or subsistence constraints

Figure 1 shows the option price measure for the special case in which risk and subsistence constraints have been eliminated from the model. Under these assumptions, structural heterogeneity is the only source of differential specific land scarcity in the model. That is, the only basis for land transactions in this version of the model is the higher production value of land for smaller farm units, as described in assumption (A2) above. As the contour map in Figure 1 shows, the option price value of the institutional innovation of marketable property rights is highest for agents with negligible initial endowment of land. These agents would have to be given something on the order of 60,000 units of grain to render them as well off in utility terms with alienable property rights as they are without those

rights. The option price of the marketable land rights diminishes swiftly for initial endowment positions to the east and southeast in the asset space. For agents with land abundant portfolios, the option price of the marketable property rights is only 5000 units of grain. Absent risk considerations, this differential valuation of alienable property rights reflects the fact that without recourse to a land market, agents with negligible land endowment have no options to increase their level of consumption over time. However, with recourse to that market, their relatively high productivity of land permits them to bid land away from less productive agents at a relatively favorable price. Land sales at that price render agents with proportionately greater land endowments better off, but only modestly so since the sale of land permits these agents to cash in some of their land at a favorable price and hold the foregone future production (plus some) as a grain stock. Note that land sales motivated by this sort of differential specific asset scarcity would in general restructure the agrarian economy into a more productive asset distribution.

The option price map for alienable property rights changes radically when production risk and subsistence constraints are added to the model, as Figure 2 shows. Under risk, alienable property rights offer two potential advantages. First they may permit agents to buffer consumption against income fluctuations through sales of a productive asset--i.e., agents do not necessarily have to lock their wealth up in a low yielding grain stores in order to stabilize consumption in the face of random income shocks. However, the desirability of using land as a consumption buffer depends critically on asset price movements. If the land prices falls in the wake of an unfavorable covariate shock (as would be expected if agents indeed try to smooth consumption with land sales), then agents would face a very precarious situation in which they would consistently sell land cheap (following an unfavorable covariate shock) and buy it dear (following a favorable shock).[37]

The second potential advantage offered by marketable land rights in a risky world is that they permit agents to adjust their portfolio of grain and land not only to more productive combinations (as was the case in the model without risk), but also to more stable or lower variance combinations. The

desirability of the latter sort of portfolio adjustment is of course potentially quite high for low wealth agents who would fall below the subsistence minimum in bad years if they hold primarily land assets. More grain-intensive wealth portfolios would free agents of the land price covariance trap described above. Avoiding this trap would be particularly important for low wealth agents whose exposure to a subsistence crisis would make them particularly vulnerable to unfavorable land distress sales, suggesting that these agents would attach a relatively low (or highly discounted) price to land. Note, however, that portfolio-balancing transactions of this sort would in general permanently reduce the productivity of the agrarian economy as it would shift land to lower productivity, large scale producers.

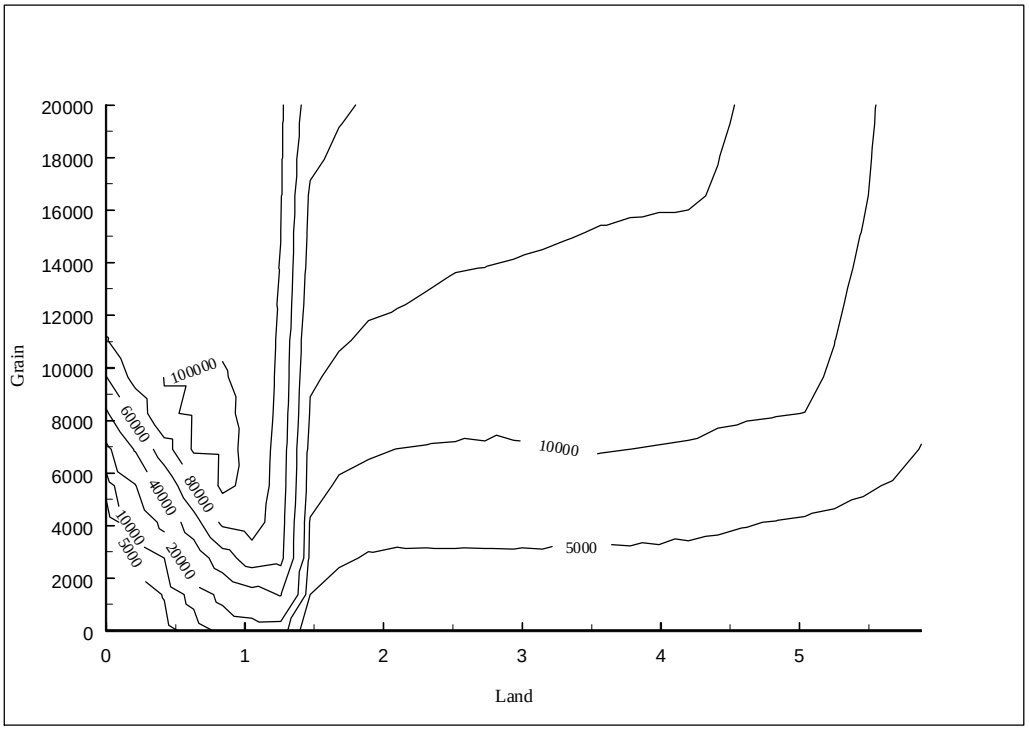

FIG. 2.--Option Value of Marketability Rights given risk and subsistence constraints

As Figure 2 shows, under risk and subsistence constraints, the option price surface now reaches a peak of over 100,000 units of grain at an initial endowment position of about 1 hectare and 8000 units of grain. Agents in this portion of the endowment space are precisely those subject to risk of a subsistence shortfall. In contrast, the value of marketable property rights to wealthier agents located further out in the endowment space is almost identical to that which obtains in the risk-free world.

This impact of risk on the valuation of and potential demand for the institutional innovation of marketable property rights reveals something very important about the process of institutional innovation. Writers such ask Ruttan and Hayami and Feder and Feeny (see notes 3 and 8 respectively) have suggested that as asset scarcity increases, its shadow value increases and there is induced demand for an institutional innovation. Yet the contrast between Figures 1 and 2 provocatively demonstrates that the demand for alienable property rights in a world of scarce land, incomplete social sharing and missing markets may in large part represent a displaced demand for the innovation of risk management devices. In addition, the differentiated impact of risk across the asset space also speaks to the importance of developing more microeconomically nuanced models of institutional change.

IV. Conclusion

This paper has presented a microeconomic analysis of the demand for a particular institutional innovation, namely the development of alienable property rights to productive land in West Africa. The analysis stressed individualized, asset-based risk-coping, and agent heterogeneity as the components which create an economic constituency for the demand for institutional innovation. The analysis has shown that the institutional constraints matter greatly to the interpretation and aggregation of the benefits of institutional innovation. Simply using a representative-agent model to calculate the benefits of a change is as inadequate for institutional change as it is for other types of economic changes. Moreover in the actually existing world of missing markets, demand for institutional change cannot be presumed to be demand for

institutions which are productivity and growth enhancing. While the analysis here has not returned to the political and collective action questions which have vexed much of the contemporary writing on institutional change, its effort to provide a deeper economic understanding of the distribution and intensity of demand for innovation provides a logical starting point from which to explore the operation of collective choice which must somehow weigh (or ignore) those demands.

An important component of a fuller political economy of institutional change is accordingly the ability to decompose the value of such change to heterogeneous members of society. A major contribution of this paper is the recognition that the value function of dynamic programming--a function that relates the holdings of given levels of assets to present utility--contains important information about the utility value to individual agents of the institutional environment. The analysis here capitalizes on this feature by developing an explicit option-value measure of institutional change that varies over with wealth, an important dimension of agent heterogeneity[38].

Prior use of standard induced institutional innovation theory to evaluate the usefulness of land markets have conceptualized the potential demand for land markets in terms of total net social demand. Their frequent assumption that the demand for land security (which arises out of an increasing average shadow price) necessarily implies a demand for land marketability (which arises out of increasing heterogeneity in the shadow price of land across different producers) is erroneous. To the extent that heterogeneous land productivity is addressed, the assumption is often that heterogeneity is due to native differences in how well people use the land, rather than to market imperfections (in capital access, human capital formation, risk, etc.). Such misplaced assumptions can lead to incorrect policy advice: that a land market will enhance aggregate production and that it therefore should be encouraged. It is indeed one of the more interesting theoretical findings of this exercise that under certain covariate risk realizations, poorer and marginally more efficient producers can sell land to wealthier and marginally less efficient producers, as discussed above.

The analysis here shows that there is a component to the potential demand for land markets that represents a displaced demand for the innovation of insurance or financial markets, or social substitutes for them. This demand for insurance and credit markets, when not satisfied, can become pressure for alienable land rights. While this analysis marshals strong, if somewhat abstract, evidence for the importance of these financial constraints, a broader point here is of course not about the exclusive importance of risk and subsistence constraints in land transactions, but rather that institutional peculiarities play an important role in how institutional innovations are valued by agents in a world constrained by multiple market imperfections. The demonstration that a land market may represent in part a displaced demand for an institutional innovation does not gainsay the important productivity-enhancing role of a land market in the presence of other forms of heterogeneity. Instead, the recognition by policy-makers of that risk shapes the demand for and use of land markets can enable them to accompany land market development with inducements to develop advances in insurance or credit markets that will better enable a land market to fulfill its output-enhancing role. While direct innovation of substitutes for missing credit and insurance markets is notoriously difficult, the analysis here suggests that both yield stabilization (e.g., through more drought-resistant crops or better irrigation infrastructure) and asset price stabilization policies could play a fundamental role in bolstering productivity enhancing features of markets in land. The microeconomics of institutional innovation are therefore important both to the development of better measures of the welfare effects of institutional change, as well to answering policy questions about the implications for welfare of the institutional environment taken as a whole.

Notes

1. Douglass C. North, *Institutions, institutional change and economic performance*, (The Political Economy of Institutions and Decisions series; Cambridge; New York and Melbourne, Cambridge University Press, 1990); Douglass C. North, "Economic Performance through Time," *American Economic Review* 84, (1994): 359-68.
2. Douglass C. North and Robert Thomas, "An Economic Theory of the Growth of the Western World," *Economic History Review* 23 (1970): 1-17; Douglass C. North and Robert Thomas, *The Rise of the Western World,* (Cambridge, New York and Melbourne: Cambridge University Press, 1973).

3. Vernon W. Ruttan and Yujiro Hayami, "Toward a Theory of Induced Institutional Innovation," *Journal of Development Studies* 20, (1984): 203-23.
4. The retrospective essays in Bruce M. Koppel, ed., *Induced innovation theory and international agricultural development: A reassessment*, (Baltimore and London, Johns Hopkins University Press, 1995) offer a view complementary to North's of the direction taken by induced institutional innovation theory. See also C. Ford Runge, "The Innovation of Rules and the Structure of Incentives in Open Access Resources," *American Journal of Agricultural Economics* 67, (1985): 368-72 for a view of how agents cooperate to institutionally innovate.
5. This confluence of factors suggests that the institutional disequilibrium arises out of both traditional factor-scarcity reasons--emphasized by North and others--as well as out of a change in production relations from those typical of a land abundant economy (described by Hans P. Binswanger and John McIntire, "Behavioral and Material Determinants of Production Relations in Land-Abundant Tropical Agriculture," *Economic Development and Cultural Change* 36, (1987): 73-99) to those of a land scarce economy (described by Hans P. Binswanger and Mark R. Rosenzweig, "Behavioural and Material Determinants of Production Relations in Agriculture," *Journal of Development Studies* 22, (1986): 503-39).
6. See note 4.
7. See the discussion in Jean-Philippe Platteau, "Small-Scale Fisheries and the Evolutionist Theory of Institutional Development," in *Fishing for development: Small-scale fisheries in Africa*, ed. I. Tvedten and B. Hersoug, (Uppsala: Scandinavian Institute of African Studies; distributed in the U.S. and Canada by Red Sea Press, Trenton, N.J., 1992).
8. Gershon Feder and David Feeny, "Land Tenure and Property Rights: Theory and Implications for Development Policy," *World Bank Economic Review* 5, (1991): 135-53.
9. Because they assume all agents are homogenous, Feder and Feeny express these private asset valuation as the equilibrium market price of the asset.
10. See also Gershon Feder and Raymond Noronha, "Land Rights Systems and Agricultural Development in Sub-Saharan Africa," *World Bank Research Observer* 2, (1987): 143-69. Jean-Philippe Platteau, "The Evolutionary Theory of Land Rights as Applied to Sub-Saharan Africa: A Critical Assessment," *Development and Change* 27, (1996): 29-86 gives a critical review.
11. A number of authors have empirically explored the induced institutional change perspective articulated by Feder and Feeny by examining whether or not the private and social gains to securing income and use rights outweigh the costs of innovation. The work by Gershon Feder et al., *Land policies and farm productivity in Thailand*, (Baltimore and London, Johns Hopkins University Press for the World Bank, 1988) suggests that they do in the case of Thailand, while the various studies reported in Shem Migot-Adholla and et al., "Indigenous Land Rights Systems in Sub-Saharan Africa: A Constraint on Productivity?," *World Bank Economic Review* 5, (1991): 155-75 suggest the opposite to be the case much of sub-Saharan Africa.
12. The importance of the question of aggregation is highly sensitive to the distribution of benefits across individuals. If all individuals benefited equally from a change, then a representative agent model would be appropriate, and the aggregation question would be moot. On the other hand, most institutional changes (financial market innovations, land tenure reforms, legal reforms) have a decided bias in which agents they benefit, and indeed are sometimes explicitly designed to benefit certain classes of agents and not others. Because of the inherently political nature of institutional change, it is not clear whether the relevant aggregation rule would involve dollar votes, or the adding up of individual benefits, or political votes, i.e., one vote for every person who would get a positive net benefit from the change. The particular allocation of benefits across agents may have important price effects in equilibrium. A change that, for example, benefits exclusively large producers of export agriculture will affect food prices quite differently than an institutional change that benefits exclusively small farmers. In ascertaining the net social benefits of an institutional change, therefore, it is essential to consider the indirect effects of such a change, which may significantly alter the net social cost to net social benefit ratio.
13. Swynnerton, *A Plan to Intensify the Development of African Agriculture in Kenya*, (Nairobi, Government Printer, 1954).
14. Mukesh Eswaran and Ashok Kotwal, "Access to Capital and Agrarian Production Organisation," *Economic Journal* 96, (1986): 482-98.

15. Gershon Feder, "The Relation between Farm Size and Farm Productivity: The Role of Family Labor, Supervision and Credit Constraints," *Journal of Development Economics* 18, (1985): 297-313.
16. Michael R. Carter and Frederic Zimmerman, "Does It Take More than Liberalization to Generate Broadly Based Growth? Financial Markets and the Micro-Dynamics of Agrarian Growth and Transformation." (University of Wisconsin: Mimeo, 1993).
17. Michael Carter, "Reshaping Class Competitiveness and Trajectories of Agrarian Growth with Well-Sequenced Policy Reform," (University of Wisconsin: Mimeo, 1994) econometrically explores some of these ambiguities in the context of Paraguayan land markets which shift land to larger scale farmers.
18. See Hans P. Binswanger and Klaus Deininger, "South African Land Policy: The Legacy of History and Current Options," *World Development* 21, (1993): 1451-75.
19. Avishay Braverman and Joseph E. Stiglitz, "Credit Rationing, Tenancy, Productivity, and the Dynamics of Inequality," in *The economic theory of agrarian institutions*, ed. P. Bardhan, , (Oxford; New York; Toronto and Melbourne: Oxford University Press, 1989).
20. Michael R. Carter, "Environment, Technology and the Social Articulation of Risk in West African Agriculture," *Economic Development and Cultural Change*, (forthcoming).
21. Mark R. Rosenzweig and Kenneth I. Wolpin, "Credit Market Constraints, Consumption Smoothing, and the Accumulation of Durable Production Assets in Low-Income Countries: Investment in Bullocks in India," *Journal of Political Economy* 101, (1993): 223-44.
22. Thomas Reardon, Christopher Delgado and Peter Matlon, "Determinants and Effects of Income Diversification amongst Farm Households in Burkina Faso," *Journal of Development Studies* 28, (1992): 264-96.
23. Hans P. Binswanger and John McIntire, "Behavioral and Material Determinants of Production Relations in Land-Abundant Tropical Agriculture," *Economic Development and Cultural Change* 36, (1987): 73-99.
24. Daniel W. Bromley and Jean-Paul Chavas, "On Risk, Transactions, and Economic Development in the Semiarid Tropics," *Economic Development and Cultural Change* 37, (1989): 719-36; Claude Raynaut, "Transformation du système de production et inégalité économique: le cas d'un village haoussa (Niger)" (Transformation of the production system and economic inequality: the case of a Haussa village (Niger)), *Revue Canadienne des Etudes Africaines* X, (1976): 279-306; Claude Raynaut, *Recherches Multidisciplinaires sur la Région de Maradi: Rapport de Synthèse* (Interdisciplinary Research in the Maradi Region: Executive Summary), (Paris, D.G.R.S.T., 1980).
25. See note 20.
26. Thomas Reardon, Peter Matlon and Christopher Delgado, "Coping with Household-Level Food Insecurity in Drought-Affected Areas of Burkina Faso," *World Development* 16, (1988): 1065-74.
27. See the review of his work in Robert M. Townsend, "Consumption Insurance: An Evaluation of Risk-Bearing Systems in Low-Income Economies," *Journal of Economic Perspectives* 9, (1995): 83-102.
28. Christopher Udry, "Risk and Insurance in a Rural Credit Market: An Empirical Investigation in Northern Nigeria," Review of Economic Studies 61, (1994): 495-526; Susan Lund, *Informal Credit and Risk-Sharing in the Philippine Uplands*, Unpublished Ph.D. dissertation, Food Research Institute, Stanford University (1996).
29. See the review in Jonathan Morduch, "Income Smoothing and Consumption Smoothing," *Journal of Economic Perspectives* 9, (1995): 103-14.
30. Christopher Bliss and Nicholas Stern, "Productivity, Wages and Nutrition: Part I: The Theory," *Journal of Development Economics* 5, (1978): 331-62; Thomas Reardon, Christopher Delgado and Peter Matlon, "Determinants and Effects of Income Diversification amongst Farm Households in Burkina Faso;" Mark R. Rosenzweig and Hans P. Binswanger, "Wealth, Weather Risk and the Composition and Profitability of Agricultural Investments," *Economic Journal* 103, (1993): 56-78; Mark R. Rosenzweig and Kenneth I. Wolpin, "Credit Market Constraints, Consumption Smoothing, and the Accumulation of Durable Production Assets in Low-Income Countries: Investment in Bullocks in India;" Thomas S. Walker and James G. Ryan, *Village and Household Economies in India's Semi-Arid Tropics*, (Baltimore and London, Johns Hopkins University Press, 1990).
31. Michael Watts, "On the Poverty of Theory: Natural Hazards Research in Context," in *Interpretations of Calamity*, ed. K. Hewitt, , (Boston: Allen and Unwin, 1983); Christopher Udry, "Risk and Saving in Northern

Nigeria," *American Economic Review* 85, (1995): 1287-1300; Angus Deaton, "Household Saving in LDCs: Credit Markets, Insurance and Welfare," in *Savings behavior: Theory, international evidence and policy implications,* ed. E. Koskela and J. Paunio, , (Scandinavian Journal of Economics series.; Cambridge and Oxford: Blackwell, 1992).
32. Frederic Zimmerman and Michael R. Carter, "Dynamic Portfolio Management Under Risk and Subsistence Constraints," (Stanford University: mimeo, 1996) present the core model in detail.
33. Angus Deaton, "Household Saving in LDCs: Credit Markets, Insurance and Welfare," in *Savings behavior: Theory, international evidence and policy implications,* ed. E. Koskela and J. Paunio, , (Scandinavian Journal of Economics series.; Cambridge and Oxford: Blackwell, 1992); Angus Deaton, "Saving and Liquidity Constraints," *Econometrica* 59, (1991): 1221-48.
34. The production function parameters are calibrated to production data from Burkina Faso. The parameterization of this risk structure is based on empirical estimates of risk in Burkina Faso. Full details are given in Zimmerman and Carter, "Dynamic Portfolio Management Under Risk and Subsistence Constraints."
35. The rate of return on grain (μ) is included in the model's specification to underline the fact that this asset can have a positive, zero, or negative return. In the simulations reported below, μ is assumed to be zero. (It should be noted, however, that the substance of the model's results was unchanged when μ was set equal to 3% and to 5%.) Again, the low rate of return on the grain asset is one feature that sets it apart from land. The other is the assumption--reflected in the budget constraint--that grain is not subject to price risk in its conversion to consumable food.
36. Frederic Zimmerman and Michael R. Carter, "Dynamic Portfolio Management Under Risk and Subsistence Constraints," provide full details on this method.
37. Based on field work in Niger, Michael Watts, "On the Poverty of Theory: Natural Hazards Research in Context," presents a rank-ordered list of the asset alienation strategies individuals prefer to follow in order to deal with draught-induced (covariate shock-induced) food shortfalls. Matching the insights of the work here, Watts' study shows that people do their best to avoid the alienation of productive assets.
38. The value function could just as easily be defined over any other dimension of agent heterogeneity.