Risk in Government Program Decisionmaking: The Case of the Conservation Reserve

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Most recent analyses of agricultural program risk approach the problems of risk and uncertainty from the perspective of farmers or farm sector performance. A number of these have assessed the riskness of or risk-reduction options posed by farmer participation in agricultural programs (eg: Kramer and Pope; Musser and Stamoulis). Others have explored the impacts of policy alternatives on aggregate stochastic variables such as farm income, income distribution, and price stability (Gardner).

A characteristic of these studies is that government intervention is viewed as an exogenous force, not an integral part of a decision process. These studies also tend to ascribe to the government decisionmaker goals, such as stability and risk management, that are consistent with those of the affected farming population.

Viewing the government as a benevolant, exogenous force may be useful for static, short-term, farm-level decisionmaking under a long-term, inflexible set of farm program parameters. However, the 1981 and 1985 Farm Bills give the Secretary of Agriculture increased discretionary power to make periodic adjustments in program instruments within a flexible set of policy guidelines. The Administration is obliged to make more program decisions. At the same time, farm legislation is evolving to more directly address societal objectives which may not be viewed as primary goals of the farm population. Also, budget constraints and a

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recent history of farm program cost overruns make program cost minimization an important concern of program decisionmakers. Thus, the Administration may use its increasing discretionary powers to meet objectives that are different from, or even conflicting with farmer objectives.

Given this agricultural policy environment, it seems especially important to directly address the government as a program decisionmaker. In doing this, it is necessary to correctly specify the program decisionmaker's objectives and to recognize the sources and implications of uncertainty in selecting appropriate program implementation strategies (Brainard). Rausser (1982) suggests that this be achieved by specifying a political preference function which reflects the multiplicity of objectives faced by agricultural policy decisionmakers and incorporates a weighting mechanism to represent the relative political importance of the various objectives. In an empirical application of this approach to Filipino rice policy decisionmaking, Rausser and Yassour find that: (1) in attempting to achieve targets for most of its multiple objectives, the government is risk averse; (2) policy effectiveness is heavily dependent upon the probability distribution of state varibles and expected response to different levels of price policy instrumentation; and (3) policy performance is highly sensitive to the value of weights placed on each of the multiple objectives.

While this approach directly addresses the government's decision problem, it treats the farm sector as an exogenous source of uncertainty. But, one must question whether, in a flexible, dynamic, program decisionmaking framework, it is appropriate to view either the government or the farmer as an independent decisionmaker. The public sector's and private sector's decisions in this sort of environment are heavily dependent upon, and thus closely linked to, expectations about each other's behavior. Recognizing this linkage is especially important when public and private objectives differ or are in conflict with one another. When uncertainty about behavior is layered upon this periodic, 2-sector, interactive decisionmaking process, adaptive control becomes an attractive approach to solving either or both parties' decision problems. Rausser (1978) lists among "some potentially rewarding applications of adaptive control,... periodic agricultural as well as natural resource management decisions concerned with the effect of alternative input combinations

and land allocations". This quite appropriately describes the Conservation Reserve Program (CRP) decision problem.

In the material that follows, I broadly characterize the CRP decisionmaking process as an adaptive control problem, provide a conceptual framework for examining the government portion of the CRP decision problem (Boggess develops the private CRP decision problem), and discuss the sources and implications of risk in deriving reasonable, periodic CRP decision rules for the program's administrators.

Overview of Conservation Reserve Program Decision Problems

Boggess, Dicks, and Reichelderfer review the salient features of the conservation reserve program and plans for the first year of its implementation. A few of these features warrant reiteration to expose the series of critical decision points.

Over the next 5 years, USDA program administrators must make annual decisions that affect the eligibility and profitability of farmers' participation in the CRP. Following annual announcements of the CRP rules and regulations, eligible farmers face a competitive bidding process for which they must decide both whether to bid, and what bid level to offer. Over the longer run, the Secretary of Agriculture also has discretion to permanently or temporarily release program participants from their contractual committment to keep land in conservation uses for a full 10-15 years. This is a new and unique program. While the Soil Bank Program of 1956 provides some historical precedence, that former program did not involve periodic decisionmaking to vary eligibility and profitability.

At the CRP's outset (year 1=1986), the government has little or no information on which to base its expectations of farmer receptivity or response to the program's offer. The potential bidder is perhaps even more in the dark. He or she has no historical base for predicting the government's behavioral pattern over a multi-year, flexible program sign-up period. The bidders also may take into account the knowledge that, in some way or another, the program's administration will fall into the hands of a new set of actors midway through the 5-year period of program recruitment. Both the government

and the farmers face uncertainty about the future states of the farm and macroeconomies.

Bayesian learning plays an especially critical role in the dynamic path of sequential adjustment when two or more sets of interacting decisionmakers are placed in a foreign or untested situation (Backus and Driffill). Figure 1 shows the symmetrical information feedback pattern that will lead to learning on the part of CRP administrators and potential participants over the next 5 years. The observed decisions by each, in a given time period, will be used as a basis for the other's formation of behavioral expectations in making the succeeding time period's critical decisions. As the government and farmers gain better and better knowledge of each other's behavior over time, one might expect a cobweb configuration of decisionmaking to converge on an optimal level of CRP participation that satisfies the objectives of each set of decisionmakers, as constrained by the other's agenda. This, however, presumes that objectives do not vary over time and that observed decisions are accurate indicators of behavioral motivation.

In the following section I specify the government portion of the decisionmaking process and identify factors that affect the degree to which an optimal outcome may be expected.

The Government's Decision Problem

Administrators of the CRP are faced with making a number of annual and intertemporal choices mandated by the discretionary aspects of the CRP's underlying legislation. Their decision problem is characterized by: (1) a multi-year planning horizon; (2) annual decisionmaking; (3) multiple objectives; and (4) a budget constraint. The problem may be conceptualized as follows.

A Conceptual Model

CRP program administrators must annually select both an operational definition of "highly erodible", which defines eligibility of land for placement in the CR, and a strategy for elicitation and selection of bids.

This suggests 3 control variables:

C_1 = total number of eligible acres

C_2 = maximum bid level accepted 1/

C_3 = size of pool for bid selection 2/

The selection of a set of control variable levels results in an action, a_i.

Actions are selected on the basis of their performance in addressing a multiple attribute political preference function. The language of the CRP enabling legislation clearly indicates that the CRP is intended to both (1) reduce soil erosion; and (2) reduce surplus crop production. But, Gramm-Rudman-Hollings legislation is likely to impose a constraint on the funds available to achieve those objectives. Thus, we have 3 performance measures:

X_1 = total program outlays (dollars in year t)

X_2 = tons/year of soil erosion reduction

X_3 = reduction of program crop supply

These variables are hypothesized to contribute in the following way to political preference:

$$U(a_i) = EU\ (X_2, X_3 \mid X_1^*)$$

where EU is expected utility, and X_1^* is a program cost constraint.

1/ Note: C_2 may be some function of a bid selection strategy

2/ The bid pool is a regional delineation of the area(s) that will receive acreage allotments for total bid quantities. Control involves deciding whether to solicit and select bids from a national pool, or from sets of regional, state, or substate pools.

The form of $U(a_i)$ is critically dependent upon the weights associated with each of the two objectives for which X_2 and X_3 measure performance. These weights, in turn, are a function of both the administration's goals and the effect of political pressure in modifying those goals. One might assume that these preferences will be revealed by the government's selection of control variable levels in the first year of the CRP, and then $U(a_i)$ may be estimated. I show later why this may be a poor assumption.

Figure 2 represents the CRP decision parameters in terms of hypothetical indifference curves. Lines AH and ML are alternative budget constraints (X_1*). Their slopes reflect the assumption that unit costs of placing the most highly erodible acres in the reserve will be less than those for the most highly productive acres. Achievement of performance levels C and F under a restrictive budget constraint and a preference function represented by the indifference family I, II, requires an action (a_i) that favors erosion reduction over supply reduction. If preferences are better described by the set of indifference curves represented by I* and II*, then, for the same budget constraint, relatively more weight would be placed on achieving supply reduction.

Control variables can be manipulated to achieve more or less reduction in each of the performance measures, subject to the budget constraint. For example, limiting eligibility for the CRP by employing a restrictive definition of "highly erodible" will lower the number of acres eligible (C_1). The lower the level of control variable C_1, the greater erosion reduction (X_2) will be relative to supply reduction (X_3). Also, limiting eligibility to fewer and more marginal acres will, ceteris paribus, reduce program outlays (X_1). Likewise, a low maximum accepted bid level (C_2) would limit budget outlays and favor X_2 over X_3. In this case, erosion reduction would be favored over supply reduction because of the (assumed) lower rents associated with highly erodible vis-a-vis highly productive land.

Because soil erodibility is a regional phenomenon, use of the largest possible bid pool size--a national pool--provides the greatest flexibility in targeting highly erodible acreage for the CRP. The most highly erodible acres drawn from a national pool could be clustered in relatively few locations. However, as bid pool size (C_3) is decreased, the supply

reduction performance measure receives more weight because total CRP acres would be more evenly distributed nationwide.

In a certain environment, modeling the government's decision problem would be a fairly straightforward procedure. However, various sources of risk and uncertainty affect the extent to which control variables can be expected to successfully achieve desired performance.

Sources of Risk and Uncertainty

All 3 performance measures are dependent upon the state of the economy and farmer response patterns.

Bid levels. Part of the farmers' CRP decisionmaking process involves calculation of breakeven rents (Boggess). The resultant average calculated rent level has direct bearing on the average level of bid offers faced by CRP administrators. Average net rent incorporates in a single measure the risks and uncertainties inherent in both agricultural production and macroeconomic performance. Because the government routinely forecasts commodity price levels, crop yields, interest rates, and land values, CRP administrators possess a sufficient amount of information to estimate a prior probability distribution for this stochastic variable. Its mean and variance may subsequently be used to modify decisions regarding the maximum accepted bid level control variable.

Quantity of bids received. Bidders may be assumed to demonstrate strategic behavior in their response to the CRP offer. But, because the CRP is a new program, it is difficult to predict what form this behavior will take. Thus, in any year, the volume and regional distribution of bids received are stochastic variables that directly affect the government's performance measures. Prior probabilities can be assigned on the basis of observed willingness of various sizes, types, and locations of farm units to participate in other farm programs, given the state of the farm economy. In other words, it should be possible to estimate a risk function such that:

$$X_i = f\left[\sum_{j=1}^{n} P_j\,(D_j) \mid P\,(S)\right]$$

where: X_i are the performance measures; D_j is a state variable describing farmer behavioral response in terms of the

number of acres in region j for which bids are received; S is a state variable describing expected average net rents, as derived from farm economic conditions; and P represents prior probabilities. The validity of the priors will be tested and their values can be revised following the first round of bidding. This risk function will modify the effect of all 3 control variables on all 3 performance measures.

Bid distribution. Greater uncertainty arises in attempting to predict the distribution of bids by soil erosion and productivity classes--both important variables that directly impact performance in terms of erosion and supply reduction. No historical data exist for estimating these distributions. For the first round of bidding, it is probably adequate to modify the risk function (above) by further summing across the absolute distributions of each region's acreage by erosion and productivity classes.

Budget constraint. Until and unless more definitive rules for reducing the Federal budget deficit are devised, a great deal of uncertainty will exist with regard to the maximum amount of funding that can be devoted in any one year to any given program, including the CRP. The program budget constraint may be explicit or implicit and incorporates tradeoffs among a large set of other alternative government programs. Because the CRP is exempt from sequestration procedures, the full risk of cost overruns rests with the government. Bidders do not share that risk.

The current degree of budget uncertainty is probably great enough to preclude derivation of a reasonable probability distribution for the CRP budget constraint. Empirical application of the conceptual model could be achieved, however, through parametric analysis of the uncertain budget constraint. Testing the sensitivity of program performance to budgetary considerations might be interesting in and of itself.

Political pressure. In selecting a set of control variables for CRP implementation, the government risks offending private interest groups that place a high priority on one objective over the others. Offended groups may then apply political pressure that results in revised weights for objectives and, thus, modifies the polictical preference function from one time period to the next. This is an area which, while highly

unpredictable, has considerable influence on the way that the CRP decision process can be expected to resolve itself.

Implications

Even though the conceptual model presented herein is a simplification of the governmental CRP decisionmaking process, that model is still complex and may prove difficult to estimate and solve. A few general implications can be drawn from the conceptual outline of the problem.

First, because the Administration is compelled to meet legislative mandates, is uncertain about the responses of its constituency to a given program option, and can experience a variety of penalties for failing to satisfy objectives, the government can be assumed to be risk averse. Its political preference function is likely to take a quadratic form. Further, if one assumes that, in general, soil erosion and productivity are inversely related, the multiple attribute nature of the preference function implies that performance in meeting one objective must be sacrificed vis-a-vis the other. Solution of the preference function as a quadratic function implicitly provides weights for trading off expected values, variances, and covariances of erosion and supply reduction objectives for each budget level.

The particular solution of the government's CRP decision problem obviously depends upon the weights imbedded in the political preference function. Herein lies a major problem for the analyst (as well as for the farmer): these weights cannot be assumed to remain constant over the 5-year CRP recruitment period. Changes in program administration and/or selective political pressure by special interest groups may shift the focus of the program towards one objective over the others. In this case, preferences that are "revealed" by decisions in one period cannot be used to estimate a preference function that necessarily applies in subsequent time periods.

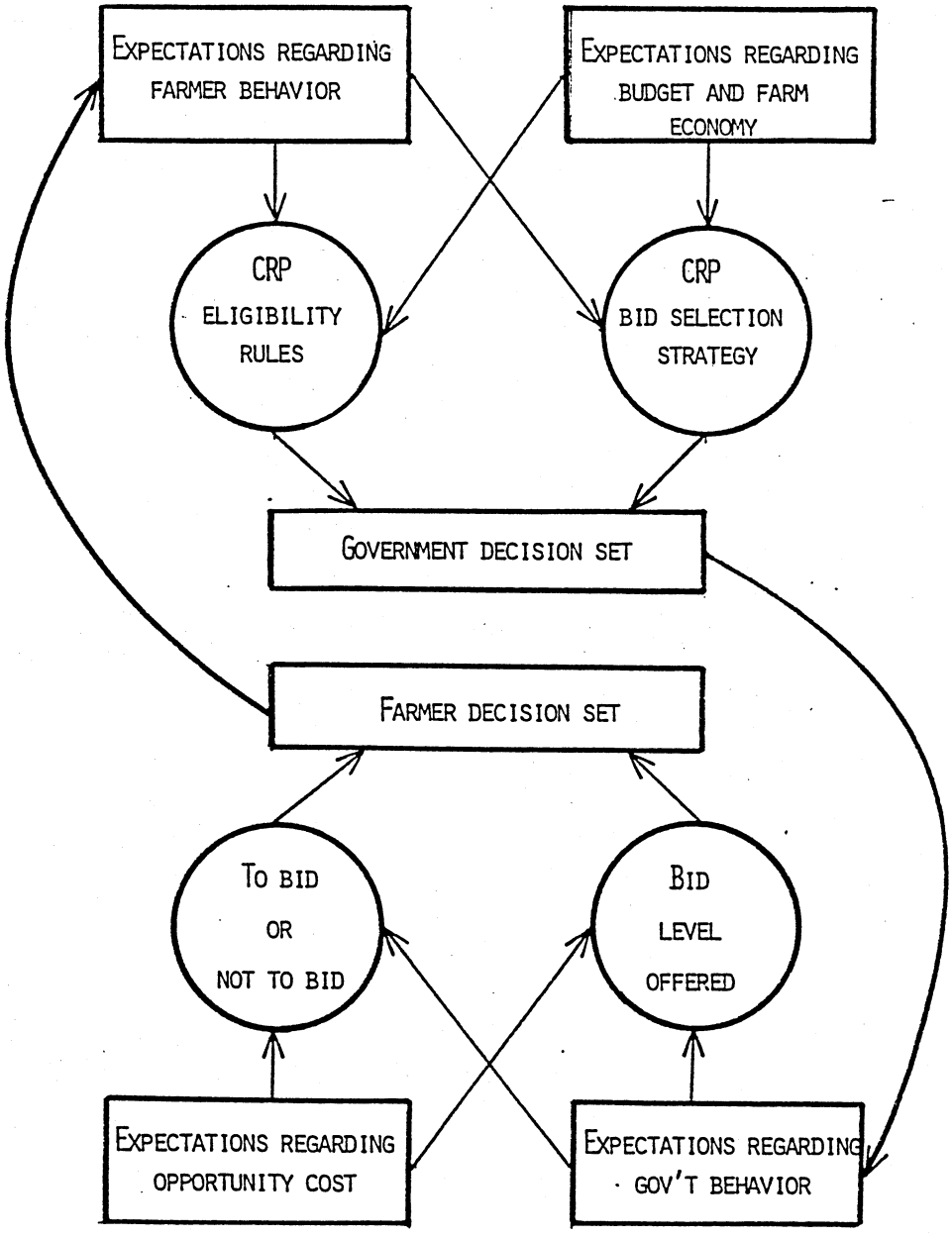
Although difficult to estimate, the political preference function is not inconsequential to the actual or targeted performance of the CRP. Note from figure 2 that the optimal amount of erosion reduction (C) for a restrictive budget (AH) and a preference for erosion reduction vis-a-vis supply reduction (I) can be greater than that (D) for a generous

budget (ML) and a relative preference for supply control (II*).

Within each year, the government's specific preferences lead to decisions that can be expected to vary according to the probability distributions associated with each set of stochastic variables. The risk averse government agent is likely to make the most conservative decisions when variances surrounding expected values of the performance measures are greatest. This implies: (1) a restrictive definition of "highly erodible", which limits eligibility; (2) either a low maximum bid level or a bid selection strategy that minimizes cost; and (3) a small bid pool size to reduce the probability of political pressure from regionalized interest. As the government learns more about the expected response of its constituency, the variance associated with expected erosion and supply reduction will decrease, and decisions on control variables will become a more direct function of budgetary constraint. Wide variance in expected net rents and/or a high degree of uncertainty about the program's budget would tend to reinforce the conservative choice of control variables.

Over the next 5 years, a fascinating experiment in adaptive decisionmaking will unfold through the implementation of and response to the new Conservation Reserve Program. A major point of this paper is that the administrators of that program have objectives and constraints that are clearly distinct from those of the program's potential participants. The unique risks faced by the government will have a major impact on resolution of the CRP decisionmaking process.

Figure 1: Adaptive Decisionmaking Framework



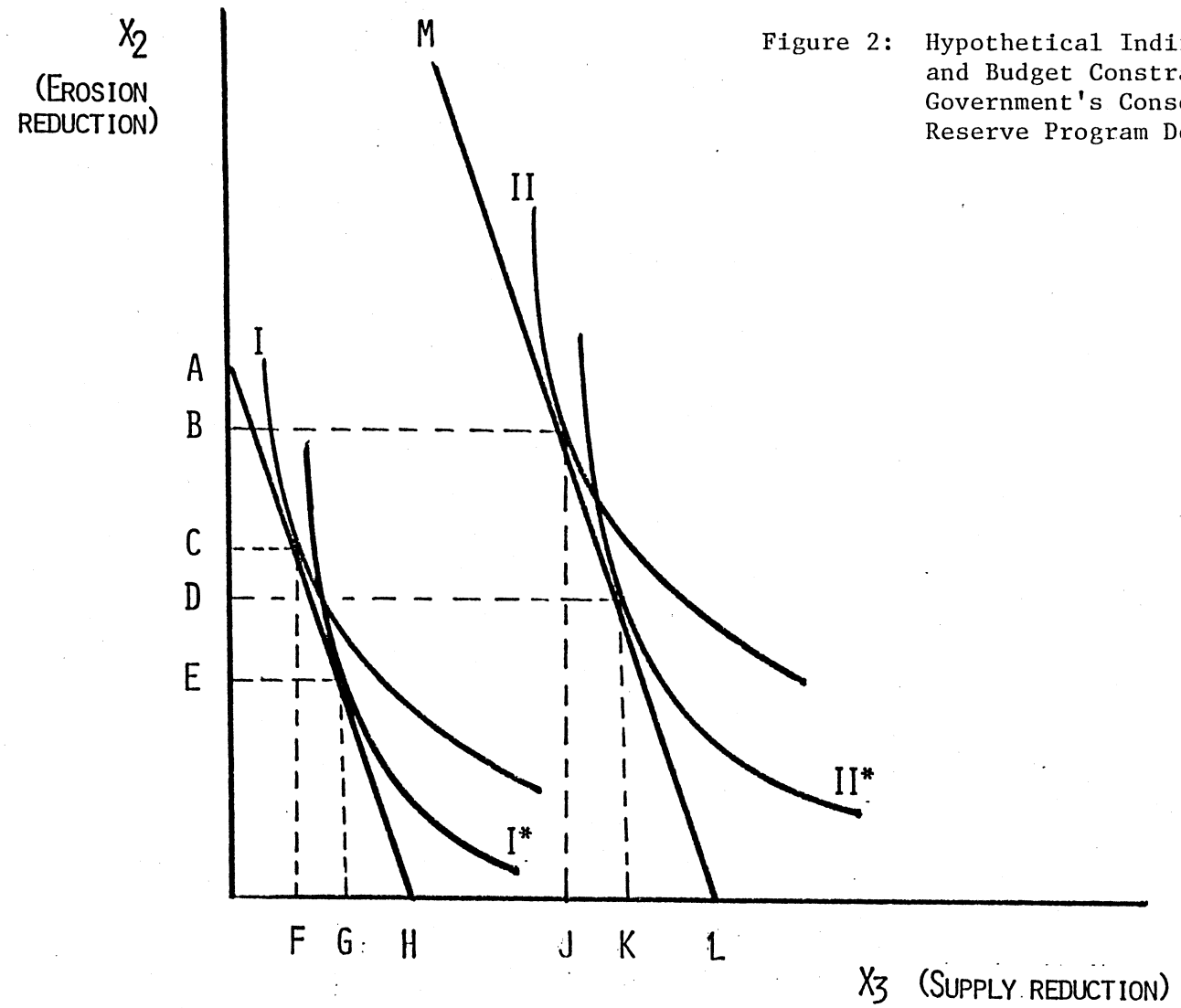


Figure 2: Hypothetical Indifference Curves and Budget Constraints for Government's Conservation Reserve Program Decisions

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