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AGRICULTURAL POLICY PREFERENCES:

WHEAT IN THE UNITED STATES,

1981-1990

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Abstract

This paper outlines DEBET (Decision Based Economic Theory), a method for determining revealed preferences of governments. DEBET is applied to US wheat policy decisions in the 1980s. This method has a number of advantages over alternative approaches to the analysis of revealed preferences of governments. It makes use of information contained in policy alternatives contemplated but not agreed upon, and it is suitable for modelling the discrete - continuous choice problem of policy makers in a multi-instrument context.

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1. Introduction

The analysis of government behavior in agriculture has increasingly attracted the attention of agricultural economists. Analyses have employed a variety of methods ranging from simple policy reaction functions to attempts at developing structural models of the political economic markets in agriculture (e.g. Rausser et al., 1982). One of these approaches which appears to have been very popular in the past is based on policy preference functions of the agricultural policy decision maker(s) (e.g. Riethmuller and Roe, 1986), where policy preferences can be obtained either by interviewing policy makers (Frisch, 1971) or via econometric estimation processes.

In this paper, we will develop an alternative approach to determine policy preference functions. We refer to this approach as DEBET (Decision Based Economic Theory). The central feature of this approach is that it makes use not only of actual policy decisions but also of information contained in policy alternatives, and that it facilitates modelling the complex discrete - continuous choice problem of policy makers in a multi-instrument framework (Oskam, 1988).

The remainder of this paper will be structured as follows. First, we will briefly discuss the principle pros and cons of standard methods used in the analysis of government behavior and compare them with DEBET

(section 2). In section 3 we will apply DEBET to US Wheat policy decisions between 1981 and 1990. We will conclude with a brief summary of this analysis' results.

2. The Principles of DEBET

The analysis of relationships between policy objectives and policy instruments has a long and successful history in the economics profession (Tinbergen, 1952). In order to determine policy preference functions numerous methods have been developed and applied in empirical analyses.

One avenue of research has focused on analyzing the answers of policy makers to questionaires in which they were asked to reveal their policy preferences either by offering them a number of alternative policy scenarios (Frisch, 1971) or through interactive optimization (Wallenius et al., 1978). The main shortcomings of this approach are that policy makers may not reveal their true policy preferences in interviews, and that the policy alternatives offered by the interviewer may not capture the full range of scenarios considered relevant by the policy makers. Due to these drawbacks this method for the analysis of policy makers' preferences has not been widely used in agricultural economic research.

The main competing methodological alternative, namely to estimate policy preference functions econometrically, has been employed numerous times. (e.g. Rausser and Freebairn, 1974; Frey, 1978; Riethmuller and Roe, 1986; von Witzke, 1990). Its advantages are obvious. One can easily derive testable hypotheses from public choice theoretical models of policy decision makers who are assumed to maximize the value of their preference function. Suitable data for such analyses are usually available without

major difficulty. However, frequent changes in the structure of policy making limits the applicability of this method because the time periods between structural changes may be very short for econometric analyses. Moreover, policy preference functions are difficult to derive theoretically and to estimate empirically if more than one policy instrument is employed.[1]

As we shall discuss below, DEBET has a number of advantages over the standard methods of endogenous policy analysis mentioned above. It can be applied without major difficulties in the multi-instrument case, and it can be employed in the analysis of relatively short periods of time, as it makes use of additional information not commonly used in the analysis of revealed preferences of governments.

The central reason for this is that DEBET also uses the information contained in alternative instruments and/or instrument levels which have been considered but have not been agreed upon. More specifically, DEBET uses information not only of actual decisions but also of what we will refer to as 'non-decisions'. Actual decisions include not only decisions to introduce or discontinue a policy instrument or to change the level of an instrument but also decisions that result in no change, provided that changes have been considered. Non-decisions represent alternatives which have been considered but which have been rejected in the decision making process. Of course, the informational content of non-decisions is the higher the closer they are to actual decisions. This is well known from the general theory of revealed preferences (e.g. Varian, 1982).

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[1] For details see Ancot et al. (1982).

DEBET only requires an ordinal preference ranking of alternatives in the form of decisions and non-decisions. This has an obvious advantage. However, the drawback is that one needs a larger number of observations to determine the preference function. Hence, DEBET's comparative advantage in the analysis of government behavior is in cases in which the number of actual decisions for a given political economic structure is small relative to non-decisions.

Let

$$v = f(x_1, \ldots\ldots, X_n; w) \qquad (1)$$

where

v = value of the objective function

x_i = objective variable; i=1,...,n

w = parameter vector.

If for two vectors of objective variables one is strictly preferred over the other, e.g. if $\bar{X}_1,\ldots\ldots,\bar{X}_n$ is strictly preferred over $\tilde{X}_1,\ldots\ldots,\tilde{X}_n$, it follows that

$$f(\bar{X}_1,\ldots\ldots,\bar{X}_n; w) > f(\tilde{X}_1,\ldots\ldots,\tilde{X}_n; w) \qquad (2)$$

The parameter vector (w) is not necessarily determined by any given ordering of policy preferences. Depending on the particular form of the objective function and the nature of the empirical observations it may as well be that w is not determined, i.e., that there is an infinite number of feasible parameter vectors, or that w is over-determined. In this case there would be no feasible solution for w. Over-determination of the policy preference function may be due to a variety of reasons such as observational errors and other random effects or imperfect information of

policy makers regarding the actual economic impacts of policy decisions.

One way to derive the parameters of the objective function is to minimize the inconsistencies in decision making via linear or non-linear optimization. For this purpose we define the following inconsistency parameters:

$$a_j \leq f(\bar{X}_{1j},.....,X_{nj};w) - f(\tilde{X}_{1j},.....,\tilde{X}_{nj};w) \qquad (3)$$

A solution to the problem can then be found by minimizing the sum of inconsistencies:[2]

$$\min \sum_{j=1}^{J} a_j \qquad (4)$$

such that

$$v(\bar{X}_{1j},.....,\bar{X}_{nj};w) - f(\tilde{X}_{1j},.....,\tilde{X}_{nj};w) + a_j \geq 0 \qquad (5)$$

$$a_j \geq 0; \qquad j=1,.....,J$$

Moreover, the elements of w have to be normalized to prevent a trivial solution (Oskam, 1988).

The optimal solution of this programming problem yields:

(i) the parameters of the objective function;

(ii) the total inconsistency for the functional form of the objective function; of course, the theoretical minimum value of the total inconsistency is zero; and

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[2] If the objective function is non-linear in the parameters the different function needs to be differentiable and quasi concave in w (for details see Oskam (1988).

(iii) information on those decisions which are inconsistent.

The DEBET approach to endogenous policy modelling can be illustrated graphically. For simplicity of illustration assume a linear objective function and two decisions. Assume further that $w_i \geq 0$, $i = 1,2$.

$$X_{11} \cdot w_1 + X_{21} \cdot w_2 \geq 0 \qquad (6)$$

$$X_{12} \cdot w_1 + X_{22} \cdot w_2 \geq 0 \qquad (7)$$

$$X_{ij} = \bar{X}_{ij} - \tilde{X}_{ij}\ , \quad i = 1,2;\ j = 1,2 \qquad (8)$$

Eqs. (6) and (7) define the preference space. As mentioned above, one of the following three outcomes will result:

(1) The relative parameter values are not determined (figure 1).

(2) The relative parameter values w_1 and w_2 are just determined (figure 2).

(3) The relative parameter values are over-determined (figure 3). The preference spaces overlap. A solution as is (2) can then be obtained by adding an inconsistency variable (Oskam 1988).

Fig. 1: Undetermined preference function

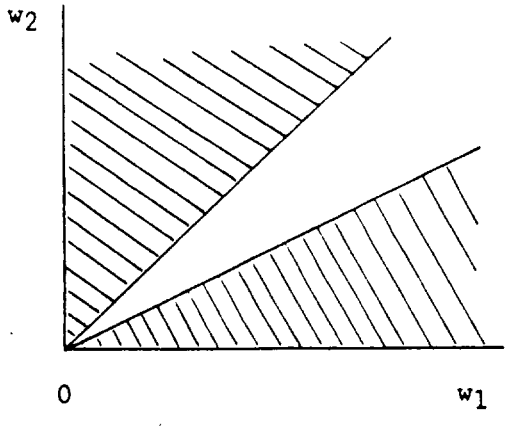


Fig. 2: Just determined preference function

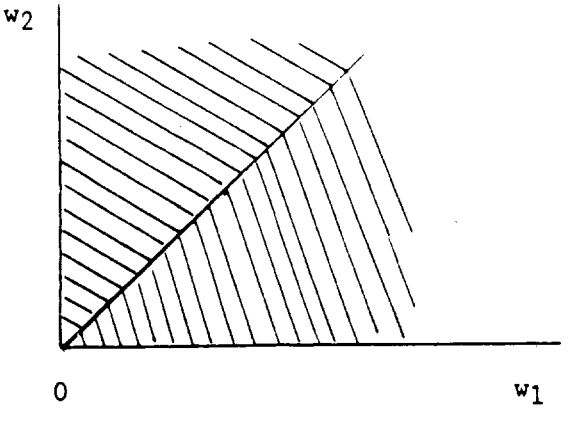
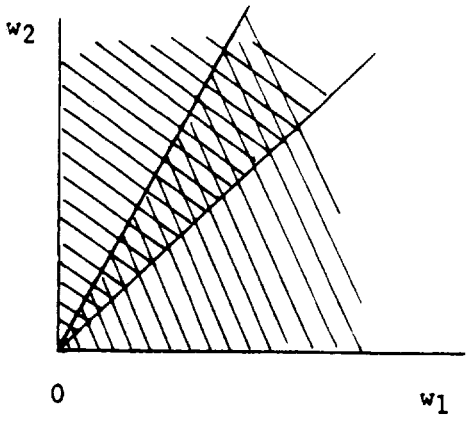


Fig. 3: Overdetermined preference function



3. Empirical Analysis

The application of DEBET requires the determination of relevant policy objectives. The following objectives have consistently been mentioned by close observers of US farm policy (e.g. Gardner, 1987; Rausser et al., 1982; Cochrane and Ryan, 1976; Hathaway, 1963):

(1) Agricultural income support;

(2) Restricting budgetary expenditures caused by agricultural policy interventions;

(3) Maintaining reasonably low food prices, especially for low income households.

Besides these main objectives a number of additional goals has been mentioned. They include the following:

(4) High volume of production; this may be an important variable for agricultural policy decision making because input and food processing industries' as well as trading companies' profits depend on the volume of production;

(5) High export volume or high share in world exports;

(6) Stability of producer and consumer prices;

(7) Development assistance such as Food Aid;

(8) Soil conservation.

In the following analysis we will consider objectives (1) to (5). The functional form of the objective function is assumed to be linear.[3] Hence:

$$v = \sum_{i=1}^{5} w_i X_i \qquad (9)$$

Wheat policy instruments included in the empirical analysis are:[4]

(1) Loan rate,[5]

(2) Deficiency payment,

(3) Export subsidies,

(4) Base acreage and program yields,

(5) Acreage diversion/land conservation and set aside programs,

(6) CCC-storage operations (destocking),

(7) Farmer owned reserve (FOR) programmes,

(8) Payment limitations,

(9) Disaster payment,

(10) Crop insurance,

(11) Food aid under PL-480,

(12) Food stamps programs.

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[3] We have chosen a linear objective function here due to a lack of a priori information. Of course, linear objective functions can be employed in empirical analyses without major problems. As we shall see, the linearity assumption yields quite reasonable results.

[4] For a survey of US wheat policies in the 1980s see Harwood and Young (1989).

[5] Including the Findley adjustment.

Decisions on these wheat policy instruments and their levels have been made in the course of regular agricultural policy decisions as well as in Farm Bills. During the time period analyzed here, two Farm Bills were passed, namely the Agriculture and Food Act of 1981 (AFA '81) and the Food Security Act of 1985 (FSA '85). Farm Bills are usually rather comprehensive packages, changing the mix of policy instruments as well as the level of instrument use, while decisions between Farm Bills tend to affect only instrument levels.

Decisions and non-decisions included in the analysis and their effects are depicted in table 1. A brief description of both decisions and non-decisions is contained in the Appendix. The economic effects exhibited in table 1 have been calculated based using WHEATSIM (Chattin et al., 1985). WHEATSIM is a simulation model of the United States wheat market, designed to analyze domestic wheat policy alternatives. The model consists of a supply block distinguishing between acreage and yield, a demand block with domestic and export demand, and a block dealing with stocks including commercial stocks, CCC stocks and farmer-owned reserve. The main policy instruments of WHEATSIM are:

(1) price policy instruments such as loan rate and deficiency payments,

(2) different types of acreage reduction and soil conservation programs,

(3) stock management by the CCC and farmer-owned reserve.

The model contains a deterministic part and a stochastic part. In this paper only the deterministic part has been used.

Table 1: US Wheat Policy Decisions and Non-decisions, 1981-1990.

Decision or Non-decision	Change in Producer Surplus	Consumer Surplus	Budgetary Expenditure	Export	Production
	(in bln dollar)			(in bln dollar)	
1981 Agriculture and Food Act	-1.71	0.40	1.60	0.09	-0.24
1982 annual decision	-0.89	-	0.92	-	-0.09
1983 annual decision	0.39	-	-0.33	-	-0.13
1984 annual decision	-1.17	0.41	0.85	0.09	-
1985 annual decision	-1.62	0.65	1.09	0.14	0.03
1985 Food Security Act	-2.87	3.58	2.46	1.08	-0.09
Harkin-Gephardt Proposal	6.88	-13.52	6.41	-3.07	-2.22
Administration Proposal	-4.66	-0.01	4.75	-0.01	-0.01
1986 annual decision	-0.83	0.35	0.57	0.07	-0.05
1987 annual decision	-0.43	0.13	0.33	0.05	-0.01
1988 annual decision	-0.27	0.05	0.22	0.02	-0.02
1989 annual decision	0.48	0.31	-0.78	0.07	0.18
1990 annual decision	-0.03	0.06	-0.03	0.02	0.04

Source: see appendix.

Based on the economic effects of policy decisions and non-decisions the policy preference function can be determined based on the theoretical framework discussed in section 2. The results are exhibited in table 2. The weights of the preference function are normalized on the budget such that this weight is equal to one. Not surprisingly, the weight attached to producers exceeds one, while the weight attached to consumers is clearly below 1. The volume of production does not appear to be an important policy objective while the volume of exports is. Quite remarkably, the policy inconsistency observed is zero during the time period analyzed here.

Table 2 Parameters of the U.S. wheat policy preference function, 1981-1990.

Policy objective	Weight
Producer income (dollar)	1.02
Consumer income (dollar)	0.70
Budget (dollar)	1.00
Export (bushel)	1.13
Production (bushel)	0.19
Policy inconsistency (bln dollar)	0

4. Summary and Conclusions

It is appealing to analyze the differences in the results between our estimates of political weights and those found by other authors. However, this is not possible at this early stage of scientific penetration of the problem. There are a number of reasons for this. The time periods on which the various analyses are based differ and political weights may change over time. Moreover, the functional form used in this analysis differs from those in other analyses. Unlike other analyses on this issue, our analysis includes more than one wheat policy instrument as well as information on non-decisions.

The empirical results obtained through DEBET for US wheat policy (and earlier for EC dairy policy (Oskam, 1988)) are interesting and certainly plausible. We feel, however, that further comparative analyses of alternative approaches to deriving policy preference functions are necessary in order to better evaluate DEBET's suitability for the analysis of endogenous policy decisions.

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Appendix: Selected US Wheat policy decisions and non-decisions, 1981-1990.

1. The Agriculture and Food Act of 1981 (AFA '81) contained only minor policy changes, such as reducing the loan rate and increasing acreage diversion, relative to the trend between 1977 and 1981. Assumed changes in the loan rate (for 1982, 1983, and 1984 repectively): 0, 0, -40 cts per bushel; target price -5, -10, -12 cts per bushel; unpaid diversion rate +5%, +5%, +10%; paid diversion rate 0, +10%, +5% (Based on adjusted version of WHEATSIM).

2. Annual decision of 1982. The set aside requirements were raised to 15% for those participating in the government programs.

3. Annual decision of 1983. Introduction of paid diversion of max. 20 % of the base acreage with a diversion payment of 2.7 dollar per bushel (PIK program).

4. Annual decision of 1984. Reduction in the loan rate and the target price compared with levels suggested in AFA '81. Basic loan rate decreases from 3.70 dollar per bushel to 3.30 dollar per bushel; target price from 3.45 to 3.38 dollar per bushel. A reduction of the paid land diversion from 20 to 15 % of the base acreage.

5. Annual decision of 1985. Reducing the basic loan rate and the target price compared with the indicated levels in the AFA '81. Basic loan rate decreases from 3.95 to 3.30 dollar per bushel; target price from

4.65 to 4.38 dollar per bushel. Further reduction of the paid land diversion from 15 to 10 % of the base acreage.

6. Food Security Act of 1985 (FSA '85); The instruments of this act, such as loan rates, target prices, set aside, etc. have been compared with a continuation of the instruments used in 1985. Instruments have been set at actual levels over the period 1986-1989. This is also the evaluation period. Based on the original version of WHEATSIM.

7. Harkin-Gephardt proposal. This proposal uses a slightly adjusted version of WHEATSIM to evaluate the proposal over the period 1986-1990. The main elements of this proposal are: (1) to increase the loan rate to 71% (and up to 80%) of the parity price, (2) to increase mandatory set-aside and diversion and (3) to drop deficiency payments. Set aside and diversion have been made more effective (coefficient 0.7). Additional reduction of production costs due to long term set-aside. This proposal failed in the decision making process. Although the long-term effects of this policy proposal are very important, we evaluated the proposal only over a five year period.

8. Administration proposal. A further reduction of the basic loan rate and the target price of 10%. Evaluation over the period 1987-1989. This proposal failed in the decision making process.

9. Annual decision of 1986. Reducing the basic loan rate from 3.30 dollar per bushel to 3 dollar per bushel. Small increase of the set-aside

from 20 to 23 % of the base acreage. Reduction in the paid diversion (from 10 to 5 %) and the diversion payment.

10. Annual decision of 1987. Introduction of the Findley adjustment scheme; its main feature is a reduction of the loan rate. Increase in set aside requirement to 28% of the base acreage. Reduction of paid land diversion.

11. Annual decision of 1988. Further reduction of the basic loan rate from 2.85 to 2.71 dollar per bushel; Findley adjustment continues. Reduction of the target price from 4.38 to 4.23 dollar per bushel.

12. Annual decision of 1989. Decreasing the basic loan rate from 2.76 to 2.58 dollar per bushel and the target price from 4.23 to 4.10 dollar per bushel. Reduction of set aside requirement to 10 % of the base acreage.

13. Annual decision of 1990. Reduction of set aside requirement to 5 % of the base acreage.