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ENDOGENIZING U. S. MILK PRICE SUPPORTS

by

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1. Introduction

Agricultural commodity price supports are a central feature of many developed countries' farm income and stabilization programs. These programs play a dominant role in market dynamics. Differences between various short-run economic forecasts often depend less on the internal functioning of markets than on different assumptions regarding future price support policies [Rausser (1982)]. Any serious student of public policy in agriculture has recognized the linkages, both forward and backward, between economic markets and the formation of public policy. These linkages are neglected in conventional treatments of agricultural markets and government policy; most econometric models that have been specified are conditional on particular settings of policy instruments and do not admit the linkage between economic markets and the formation of public policy. In fact, there are very few studies that derive formal analytical and empirical methods to explain the primary determinants of price-support policy interventions.[1]

The purpose of this paper is to develop a microframework to explain the systematic forces, both economic and political, determining price supports and to present an empirical test of this framework to the level of milk prices. Accordingly, agricultural price supports for the U. S. milk market will be endogenized. The vast majority of econometric models that exist for the U. S. milk industry are misspecified largely because they treat the level of price supports as an exogenous variable. Second, the model will formally recognize the joint interactions that are implied by the "iron triangle" of the public policy process in the United States. This will involve jointly determining the role of interest groups, congressional voting on specific legislation, and the implementation of that legislation by the Executive Branch. Finally, the framework developed in this paper confronts directly the problem of incompletely observed data. One of the reasons that few applications exist

on the behavior of governments in setting public policy is because of the inadequacy of available data. In our case the probabilities of voting and lobbying resources devoted to particular congressmen are only incompletely observed.

The constructed model of the policy-making process involves lobbying activities by dairy producer groups, voting by congressmen on price support bills introduced into the legislature, and the setting of final price supports by the Executive Branch represented by the U. S. Department of Agriculture (USDA). The discrete choice by congressmen in voting for or against price supports is modeled simultaneously with the discrete/continuous choices of the producer lobby and contributing resources to individual congressmen. Once the possible range of allowed price supports is determined from the joint interaction between Congress and the dairy producer lobby, the continuous choice of the Executive Branch in setting price supports is captured. The decision to contribute to an individual politician depends, in part, on the anticipated vote of that politician in Congress. Likewise, the voting decision depends, in part, on the anticipated level of resource contributions of the dairy support lobby. The probability of reelection impacts both resource contributions and voting behavior on price supports. Each of these influences must be formally incorporated in any realistic empirical analysis.

A consensus in the literature has emerged that campaign contributions buy favors and influence or only gain access to politicians rather than affecting policy outcomes directly [Jacobson (1980)]. Models on decisions by interest groups in making resource contributions focus on the evaluation of a politician's probability of winning reelection and the ensuing net benefits accruing to the interest group as a result of legislative decisions taken by the politician in their favor [Hinich (1972)]. The probability of reelection is dependent on both the campaign contributions and the voting decisions by congressmen on policy positions taken in the legislature [Kau, Keenan and Rubin (1982), Chappel (1982)]. It has been demonstrated that interest groups act strategically by contributing more resources to politicians who are in close electoral races, to incumbents, to politicians who

tend to favor their interests, or to politicians with seniority and powerful committee positions in Congress [Welch (1974, 1980), Palda (1975), Durden and Silberman (1976), Abrams (1977)].

Once the legal minimum price support is determined, the Executive Branch sets the actual value for the year. Studies analyzing the setting of economic policy instruments by the Executive Branch focus on reaction functions in explaining the behavior of the Administration regarding economic policy [Frey and Schneider (1978)]. Frey and Schneider show that the government (the President) influences the state of the economy in order to stay in power. In their study, reaction functions are estimated for several economic policy instruments and are found to be influenced by constraints or deficits in both the economy (budget) and by reelection of the President (popularity).

The political process in determining agricultural price supports in the United States is outlined in fig. 1. Either Congress or the Executive Branch can introduce a new price support bill to the legislature. If the bill is rejected in the agenda setting process, then the previous minimum price support, $PMIN_{t-1}$, remains in effect.[2] Otherwise, individual congressmen vote on it and are influenced by the level of political resources received from interest groups. If Congress votes against the new bill, then the legal minimum price support of the previous year remains in effect. In either case, the Secretary of Agriculture sets the actual price support, P_t, once the outcome on the legal minimum is determined from congressional action.

The framework for analyzing this political-economic interaction among participants in the policy-making process in determining price supports is outlined in fig. 2. Politicians are postulated to maximize their probability of reelection with two critical inputs to achieve their objective: resource contributions to be used in electioneering practices, etc., and voting on price support bills which impacts the economic welfare of voters. Both of these inputs directly affect the level of political support for the politician from the electorate. Politicians use these political resources to change the image or attitudes and information set

of the voters toward both the specific economic policy of interest to contributors and to the individual politicians themselves.

2. A model of producer lobbying, congressional decision making, and executive branch implementation

The behavioral model incorporates three major components: (a) producer lobbying, (b) congressional decision making, and (c) Executive Branch implementation of any legislation that might be passed by the Congress. The first component explains the milk lobby's decision to contribute resources to individual congressmen; the second explains congressmen's voting decisions for or against a change in price supports; and the third explains the Executive Branch's (USDA) setting of actual support prices given, of course, the legal minimum determined by the second component.

2.1. Producer lobby's contributions

Here, the producer lobby's decision on whether or not to contribute to an individual politician and on the level of a contribution is considered. The lobby's decision variables are whether to contribute to the *i*th politician (i.e., a congressman representing constituents in the *i*th district)—represented by a binary variable T_i ($i = 1, ..., N$) where $T_i = 1$ indicates a positive contribution and $T_i = 0$ indicates no contribution to the *i*th politician—and the quantity of political resource contributions, denoted by R_i. Anticipated profits Π from such an investment are equal to the product of the probability of passage of the high price support (λ) and profits Π_1 in that state of the world (with R_i representing a cost) plus the product of the probability of the high price support not passing ($1 - \lambda$) and the profits Π_2 in that state of the world:

$$\Pi = \lambda(\Pi_1 - \sum_i R_i) + (1 - \lambda)\Pi_2(\Pi_2 - \sum_i R_i). \qquad (1)$$

The probability of passage is equal to the probability that one-half or more of the members of Congress will vote for the higher price support, i.e.,

$$\lambda = \Pr\left[\frac{\sum_i Y_i}{N} > \frac{1}{2}\right],$$

where Y_i represents the votes on the price support equal to one to indicate a "yes" vote in favor of higher price supports and equal to zero for a "no" vote, i.e.,

$$Y_i = \begin{cases} 1 & \text{with a probability of } Y_i^* \\ 0 & \text{otherwise,} \end{cases}$$

where Y_i^* is the probability of the *i*th politician to vote in favor of the higher price support. The necessary condition for an optimal profit-maximizing level of lobbying contribution is $(\partial\lambda/\partial R_i)(\Pi_1 - \Pi_2) = 1$.

This optimal selection problem generates a "contribution supply" function of the general form:

$$R_i^* = R_i^*(Y_i^*, \Pi_1 - \Pi_2, S_i), \tag{2}$$

where S_i is a vector of sociopolitical characteristics of the politician. Likewise, a contribution strategy decision function by producers is also generated of the form

$$T_i^* = T_i^*(Y_i^*, \Pi_1 - \Pi_2, S_i), \tag{3}$$

and a maximized total profit function for producers

$$\Pi^* = \Pi^*(Y_i^*, \Pi_1 - \Pi_2, S_i). \tag{4}$$

The producer lobby decision process can be summarized as follows:

$$T_i = \begin{cases} 1 & \text{if } \Pi > 0 \\ 0 & \text{otherwise,} \end{cases} \tag{5a}$$

$$R_i = \begin{cases} 0 & \text{if } T_i = 0 \\ R_i^*(\bullet) & \text{otherwise .} \end{cases} \qquad (5b)$$

If stochastic terms are added to the functions in (5a) and (5b), then a set of switching regressions result which can be estimated with a Tobit model.

2.2. Congressional voting behavior

To analyze the choice made by individual congressmen in voting for or against a high price support, a twice-differentiable utility function, U_{ij}, defined over the *j*th alternative (j = 0 if the vote is for a higher price support, j = 1 if the vote is against) is presumed, *viz.*,

$$U_{ij} = V(W_{ij}^k, R_{ij}, A_{ij}, S_i) + \xi_{ij}, \qquad j = 0, 1, \qquad (6)$$

where V and ξ are real valued functions with V(•) linear in the unknown parameters. The function V(•) represents the systematic component reflecting the mean utility common to each politician while ξ_{ij} is the stochastic component reflecting dispersion and is unique to each politician. This latter term is due to unobserved characteristics and attributes of the alternatives (to vote for or against a high price support) and to varying preferences of politicians which cannot be determined from the available data. This induces variations in the observed choice among the individual politicians facing the same alternative as a unique unobserved level of utility for each politician results. The vector W_{ij}^k reflects the perceived change in economic welfare of the *k*th interest group if the *i*th congressmen's vote, j, prevailed (i.e., was the final overall outcome where k = 1 represents producers and k = 2 represents consumers/taxpayers). Politicians are offered two alternatives with respect to producer resource contributions: zero resources if you vote against higher price supports (i.e., $R_{i1} = 0$) and R_{i0} resources (which might be zero) if you vote for them. The vector A_{ij} contains the attributes associated with the alternative price support *excluding* the

economic effects of the price support on the voters (constituents) and the amount of resource contributions forthcoming.

Only the discrete choice of congressmen (yes or no vote) is observed. Accordingly, there must be a critical threshold level of utility which determines the decision of the politician. The utility maximizing congressmen will vote for higher price supports if

$$V(W^k_{i0}, R_{i0}, A_{i0}, S_i) + \xi_{i0} > V(W^k_{i1}, R_{i1}, A_{i1}, S_i) + \xi_{i1}. \qquad (7)$$

Since the utility values are stochastic, the condition in (7) will occur with some probability P_r denoted by Y^*_i,

$$Y^*_i = P_r\{\xi_{i1} - \xi_{i0} < V(W^k_{i0}, R_{i0}, A_{i0}, S_i) - V(W^k_{i1}, R_{i1}, A_{i1}, S_i)\}. \qquad (8)$$

The expression in (8) represents the probabilistic "vote production" function. To estimate the model parameters, one must choose a distribution for (ξ_{ij}), $j = 0, 1$, which implies a specification for equation (8). The form of model employed in this study is a logit model which specifies the cumulative distribution function of $\xi_{i0} - \xi_{i1}$ as logistic. Specifically,

$$Y^*_i = \frac{1}{1 + e^{-Z_i}},$$

where

$$Z_i = U_{i1} - U_{i0}.$$

2.3. Simultaneous interactions

The contribution supply function (2) and the vote production function (8) lead to a discrete-continuous empirical model with structural relations that simultaneously determine congressmen's voting decisions, Y_i, and the level of resource contributions from producers R_i:

$$Y_i^* = X_{1i}\alpha_1 + T_i\beta_1 + R_i^*\zeta_1 - \delta(P_i^* - P)^2 + \xi_{1i}, \qquad (9)$$

$$R_i^* = X_{2i}\alpha_2 + Y_i\beta_2 + \left(\left\{\left['1/(Y_i^* - .5)\right]^2 + B\right\}1/\tilde{E}_i\right)\zeta_2 + \xi_{2i}, \qquad (10)$$

where:

Y_i^* = latent variable indicating the difference in preferences of a congressman between the two alternatives (to vote in favor of the higher price support or not),

R_i^* = latent variable indicating the contributions of producers to the *i*th congressman which is observed only when $R_i > 0$,

Y_i = dummy variable equal to one to indicate a yes vote (i.e., in favor of the producer's favored alternative) and equal to zero for a no vote,

R_i = actual level of resource contributions by producers to *i*th congressman,

T_i = dummy variable equal to one to indicate a positive contribution from producers and equal to zero otherwise,

B = constant,

X_{1i} = vector of exogenous variables indicating constituency characteristics and the fixed attributes of congressman *i*,

X_{2i} = vector of exogenous variables indicating the attributes of congressman *i*,

P_i^* = ideal (unobservable) level of milk price support for the congressman whereby the economic welfare of the constituents is at a level such that the probability of reelection is maximized,

P = level of the milk price support voted on in the legislature and, hence, implicitly incorporates economic welfare W_i,

$\tilde{E}_i$ = electoral margin indicating the chances of reelection of the *i*th congressman,

α_1, α_2 = vectors of coefficients,

$\beta_1, \beta_2, \zeta_1, \zeta_2, \delta$ = scalar coefficients, and

ξ_{1i}, ξ_{2i} = random error terms with distributions specified as follows: ξ_{1i} follows the logistic distribution, $\xi_{2i} = N(0, \sigma^2)$ independently for each $i = 1, ..., N$ politicians, and $\text{cov}(\xi_{1i}, \xi_{2j}) = \sigma_{12}$ if $i = j$; zero otherwise.

Equation (9) is the logit model, and equation (10) is the Tobit model summarized by equations (5a) and (5b). The variables Y_i^* and R_i^* are incompletely observed where the former is observed only in sign (discretely) and the latter is only partially observed. Consequently, the observed part of the model is as follows:

$$R_i = \begin{cases} R_i^* & \text{if } R_i^* > 0 \\ & \text{Tobit equation} \\ 0 & \text{otherwise} \end{cases} \qquad (11a)$$

$$Y_i = \begin{cases} 1 & \text{if } Y_i^* > 0 \\ & \text{logit equation} \\ 0 & \text{otherwise} \end{cases} \qquad (11b)$$

$$T_i = \begin{cases} 1 & \text{if} R_i > 0 \\ & \text{indicator variable} \\ 0 & \text{otherwise} . \end{cases} \qquad (11c)$$

This model described in (11) is the econometric representation of a simultaneous discrete-continuous model and illustrates the two conceptually distinct roles for dummy

variables: as indicators of latent variables that cross thresholds and as direct shifters of behavioral functions [Heckman (1978), Nelson and Olson (1978)]. The propensity of a congressman to vote for a price support is postulated to be affected by resource contributions discretely, T_i, and in a continuous fashion, R_i^*. Likewise, resource contributions are affected either discretely by whether or not the *i*th congressman votes yes or no, Y_i, or continuously by his/her intensity of preference for the price support, Y_i^*.

The logit equation (9) explaining votes on the price support is specified as an "ideal point" model [Davis, Hinich and Ordeshook (1970)] represented by the term $(P_i^* - P)^2$. Each congressman is postulated to have an ideal level of a price support P_i^*. Equation (9) implies that a yes vote occurs when the unobserved latent variable, Y_i^*, exceeds a threshold level of zero; a no vote occurs otherwise. Any deviation by the price support to be voted on from the ideal P_i^* results in a decrease in the intensity of preference or utility of the congressman. This effect is described in fig. 3 where Y_i^* is an indicator of the intensity of preference or utility of the *i*th congressman. Any deviation from this ideal price support has a negative effect on the congressman's utility and, hence, on his/her probability to vote in favor of the price-support bill. Since P_i^* is not observable, one must hypothesize the structure and variables that affect each congressman's ideal price. The structure determining ideal prices is represented by

$$P_i^* = X_{3i}\alpha_3 + \varepsilon_{3i}$$

where X_{3i} is a vector of exogenous variables indicating factors that affect the ideal level of price support for the *i*th congressman, α_3 is a vector of coefficients, and ε_{3i} is a random error term. The exogenous variables in X_{3i} determine the ideal price support of the *i*th congressman and include the characteristics of producers (percent of population in rural areas, value of milk production in rural areas, value of milk production, and number of dairy farms) and consumers (population and level of incomes). Substitution of the above into equation (9) gives

$$Y_i^* = X_{1i}\alpha_1 + T_i\beta_1 + R_i^*\xi_1 - X_{3i}^2\alpha_3 + X_{3i}\alpha'_3 + \xi'_{1i}, \qquad (9')$$

where $\xi'_{1i} = 2X_3\alpha_3\xi_{3i} - 2\delta P\xi_{3i} + \xi_{3i}^2 + \xi_{1i}$. The exogenous variables in X_{1i} affect the domain of tolerance or width of range of the politicians' sentiments toward price supports and include such factors as party, ideology, and electoral margin. For example, one might expect that the higher the electoral margin of a congressman (indicating the chances of reelection or how "safe" his/her seat is), the narrower the tolerance for the price supports.

The Tobit equation (10) explains producer resource contributions. The explanatory variables in X_{2i} include seniority of congressmen, party affiliation, membership on key committees affecting dairy legislation outcomes, and measures on the importance of the dairy industry in each district. The probability of a congressman voting in favor of price supports, Y_i^*, is hypothesized to have a nonlinear impact on R_i^* as represented by the term $\left\{\left[\left(1/Y_i^* - .5\right)^2 + B\right]1/\tilde{E}\right\}$ in equation (10). The constant B ensures that R_i does not tend to infinity as Y_i^* tends to 0.5. This relationship between Y_i^* and R_i^* can be described by fig. 4. If the probability of a congressman voting in favor of price supports is close to 0.5, then it is certainly in the best interest of producers to contribute more resources to influence the outcome. However, if the propensity of a congressman to favor price supports is either very high or very low, then resource contributions will have minimal effects and, subsequently, less resources will be expended. In addition, contributors must also evaluate the chances of reelection for each congressman in conjunction with their preference for price supports. This joint interaction between the chances of reelection, $\tilde{E}_i$, and the propensity to favor price supports, Y_i^*, is illustrated in table 1. The expected level of contributions for each combination of Y_i^* and $\tilde{E}_i$ is given in each cell of the above table. This phenomenon is captured empirically by the functional form specified in equation (10).

2.4. Executive branch setting of price supports

An additional component of the analysis is the decision by the President (USDA) in setting actual support prices once the legal minimum is determined by Congress. Frey and Schneider (1978) argue that governments react to deficits in both their popularity and budget by altering policy instruments so as to increase the probability of reelection.

The effect of popularity on the setting of support prices is indeterminate *a priori*, but it is postulated to be negative since producers are directly affected by price supports while the impact on consumers is more disperse. Hence, a decrease in an administration's popularity is expected to prompt a rise in price supports. However, this concomitant rise in popularity due to higher prices must be traded off with the increase in the budget deficit when the administration assesses its prospects for reelection.

Since the price chosen cannot go below the price support voted on in Congress, a Tobit equation is postulated to determine the government's "reaction function,"

$$P_t = \begin{cases} X_{4t}\alpha_{4t} + \varepsilon_{4t} & \text{If } P_t > PMIN_t \\ PMIN_t & \text{otherwise ,} \end{cases}$$

where t = 1, ..., T time periods; X_{4t} is a vector of exogenous variables containing the level of the minimum price support, the popularity deficit, and the budget deficit; and ε_{4t} is a random error term.

3. Empirical Results

The empirical estimates of the "vote production" function is given for the roll-call vote by members of the U. S. House of Representatives on the Frank-Findlay Amendment to reduce the legal minimum price supports for Class II milk in 1982. In the following empirical analysis, $Y_i = 1$ denotes a vote against the Frank-Findlay Amendment (a vote for higher price supports) and $Y_i = 0$ denotes a vote for the Frank-Findlay Amendment (a vote for lower price supports). The simultaneous estimation of the "resource contribution"

function is given for the total campaign contributions from January, 1981, through June, 1982, by the political action committees of three major dairy groups (Associated Milk Producers, Inc.; Mid-America Dairyman, Inc.; and Dairyman, Inc.) to House members.

Equations (9)-(11) represent a simultaneous equation system with dummy endogenous variables. Hence, standard simulations equation procedures will yield inconsistent estimators. The estimation procedure follows the one suggested by Heckman (1978), which shows that consistent estimates can be derived by using reduced-form coefficient estimates to generate instruments which are then applied on the structural equations using the instrumental variables techniques. For the logit equation explaining votes in favor of higher legal minimum dairy price supports, $\hat{Y}_i$—the ideal point formulation developed in equation (9)—the explanatory variables include a constant; resource contributions from producers, $\hat{R}_i$; a dummy variable equal to one if a member of the Democratic Party, PAR_i; value of milk production, SAL_i; population, POP_i; the Reagan electoral vote margin, REA_i; consumer incomes, INC_i; and proportion of the population in rural areas, RUR_i.

$$\hat{Y}_i = 5.97 + 0.00066\,\hat{R}_i + 0.719\,PAR_i + 1.47\,SAL_i - 3.74\,POP_i + 0.018\,REA_i$$

$$(1.71)^a \quad (4.58)^b \quad (2.31)^a \quad (2.13)^a \quad (-2.04)^a \quad (2.09)^a$$

$$[.47] \quad [.24] \quad [.24] \quad [-1.20] \quad [.08]$$

$$- 0.924\,INC_i + 0.84\,RUR_i + 0.036\,INC_i^2 - 0.025\,RUR_i^2 - 0.049\,INC_i * RUR_i$$

$$(-1.53)^c \quad (1.80)^a \quad (1.34)^c \quad (-3.07)^a \quad (-1.08)$$

$$[-5.53] \quad [1.75] \quad [2.18] \quad [.45] \quad [.85]$$

Log likelihood = 188. Percent correct forecast = 80.

[a]Significant at the 0.05 level.

[b]Significant at the 0.01 level.

[c]Significant at the 0.10 level.

where $\hat{R}_i$ is the instrumental variable prediction of R_i. The estimated asymptotic t statistics are given in parentheses, and elasticities at sample means are given in brackets. The definition, source, and units of each variable are given in the Appendix. The last five variables comprise the ideal point component of the model [X_{3i} in equation (9')] while the remaining explanatory variables (except for $\hat{R}_i$) reflect the range of tolerance for price supports held by the individual congressman around his/her ideal level.

The results show that the propensity of an individual congressman to vote in favor of higher dairy price supports (or to vote against the Frank-Findlay Amendment) is positively related to the amount of political resource contributions received, R_i, and to affiliation with the Democratic Party, PAR_i. Indicators of constituent preferences on interest (reflected by population, POP_i, for consumers and value of milk production, SAL_i, for producers) are important and significant factors in affecting voting decisions with the expected signs prevailing.

The ideology of congressmen, ADA_i, was found to be an insignificant determinant of voting decisions and, hence, is not reported in the above equation. This finding is contrary to that in voting studies by Kau and Rubin (1979), Chappel (1982), Welsh (1982). However, the electoral vote margin for Reagan, REA_i, in the Presidential election was used as a measure of constituent ideology (as opposed to the ideology of the politicians themselves) and was found to be a significant determinant of congressional voting decisions. This insignificance of the ideology of an individual congressman in his/her voting decisions reaffirms the constraints and overriding concerns in serving the interests of constituents.

The level of consumer incomes, INC_i, has a negative impact on congressional support for higher milk prices while the proportion of the population in rural areas, RUR_i, affects votes positively. These two terms are significant determinants of voting decisions and represent the interests of consumers and producers, respectively, and also comprise the

ideal point of the model. These variables, as well, have the correct sign with only the interaction terms being insignificant at the 0.10 level.[3]

In the Tobit equation explaining resource contributions, $\hat{R}_i$, the explanatory variables include a constant; the interaction of a congressman's preference for the price support, $\hat{Y}_i$, with his/her chances of reelection, $\tilde{E}_i$; a dummy variable equal to one if the politician voted in favor of price supports, Y_i; an index of importance if a member of the House Agriculture or Appropriation Committees, COM_i; party affiliation, PAR_i; and seniority, SEN_i.

$$\hat{R}_i = 2023.6 + 18.34\left\{\left[\left(1/\hat{Y}_i - 0.5\right)^2 + 1\right]1/\tilde{E}_i\right\} + 2583.9\ Y_i + 1007.6\ COM_i$$

$$(-5.34)^a \quad (1.76)^b \qquad\qquad (7.57)^a \quad (6.15)^a$$

$$[.13] \qquad\qquad [.39] \quad [.29]$$

$$+ 537.4\ PAR_i - 77.9\ SEN_i$$

$$(1.75)^a \quad (-3.47)^a$$

$$[.28] \quad [-.52]$$

[a]Significant at the 0.01 level.

[b]Significant at the 0.05 level.

The sign and significance of the second coefficient reported above confirms the hypothesis that contributions are positively related to the proximity of $\hat{Y}_i$ to .5 and to the proximity of $\tilde{E}_i$ to zero. The results indicate that resource contributions are positively related to Democratic Party affiliation, PAR_i, while negatively related to seniority, SEN_i. This latter result is contrary to that of Chappel (1982). The negative sign on seniority apparently indicates that contributors direct resources—designed to obtain influence—to less experienced politicians while they are in an impressionistic stage of their career.

Indeed, seniority and committee membership is probably positively correlated. If a congressman has seniority and is not on a committee, then they are of limited use and one may as well invest in younger congressmen. In addition, the higher level of the seniority may reflect how safe an electoral seat is in the legislature; a politician with such tenure is unlikely to face a strong electoral opponent and hence requires less resources.

The variable indicating the power of the committee members, COM_i, is highly significant and has the expected sign. Variables reflecting the interests of dairy producers (value of milk production, SAL_i, and number of dairy farms, FAR_i) were found to be statistically insignificant in affecting producer resource contributions. This is somewhat surprising in that one would expect that these contributions would be negatively related to constituencies with high milk production or number of farms since direct votes should provide an incentive for the representative politicians to vote in favor of price supports.

In the Tobit equation explaining the choice of price support by the Secretary of Agriculture, a new variable was created, SP_t, representing the difference between the price support, P_t, set by the Administration and the legal minimum price support, PMIN.[4] In estimating this Tobit equation, the explanatory variables include a constant; the deficit in popularity of the President in September of the previous year (in percent), PUL_t; the federal government's budget deficit, BUD_{t-1}; and the previous year's price support differential, SP_{t-1}.

$$\begin{array}{lccccc} SP_t = & 0.10 & + 0.000116\ PUL_t & - 0.00506\ BUD_{t-1} & + 0.324\ SP_{t-1} \\ & (91.17) & (3.43) & (-2.30) & (2.26) \end{array}$$

NOBS = 32: 1952-1983,

where $SP_t = P_t - PMIN_t$.

The findings of Frey and Schneider (1978) indicate that the popularity deficit, PUL_t, is significantly reduced when the general rate of unemployment and/or of inflation falls and is significantly increased when the growth rate of private consumption falls. Hence, the effect of these macroeconomic impacts on the government's decisions in setting dairy price supports is partially incorporated in the term PUL_t. Since producers are directly affected by price supports while the impact on consumers is more disperse, a decrease in an administration's popularity will prompt a rise in price supports which must be traded off with the aggregate government budget deficit. Therefore, the government reacts to deficits in both its popularity and budget by altering price supports so as to increase its probability of reelection.

4. Concluding Remarks

An overview of the policy-making process reveals that price determination in the dairy sector simultaneously involves factors affecting lobbying by producers, voting by politicians in Congress, and the setting of actual price supports by the USDA. A politico-econometric model which embodies a structural framework to determine prices in the dairy sector is formulated and involves the estimation of simultaneous equations with both discrete and continuous endogenous variables.

A model of spatial competition among politicians [following Davis, Hinich and Ordeshook (1970)] is specified with logit analysis to explain votes on dairy price supports in Congress. The value of milk production and proportion of total population in rural areas (reflecting the interest of producers) and median incomes and total population (reflecting consumer interests) are found to be significant constituency factors affecting voting decisions. In addition, political characteristics, such as a party affiliation, ideology of constituents, and producer resource contributions are significant factors affecting votes for price supports.

Dairy producer resource contributions to politicians in Congress in 1980-1982 is empirically tested by evaluating using a Tobit model. A unique term is created to capture the interactive effects of the individual politician's chances for reelection and propensity to vote in favor of higher price supports. The empirical results confirmed the importance of this effect and also indicated that political characteristics, such as party affiliation, seniority, and membership on committees, were significant factors affecting resource contributions.

The level of price supports by the USDA are found to be a function of the popularity of the President and the level of the federal government's budget deficit. This empirical result indicates that the government reacts to deficits in its budget and popularity by altering instruments so as to increase its probability of reelection.

The model presented in this paper of the interaction between producer lobbyists, Congress, and the Executive Branch in determining agricultural support prices gives particular insights into the political economy of agricultural policy-making in the United States. The empirical estimates for the U. S. dairy industry appear promising in explaining government intervention so prevalent in commodity markets. Given the simplicity of the model developed and its preliminary character due mostly to data limitations, the empirical estimates do lend support, however, to a more fruitful avenue of research in agricultural policy analysis.

Appendix

Definition of Variables Used in the Empirical Results

(Sources of data are indicated in parentheses)

Variable name	*Definition and source of data*
ADA	Ideological rating by the Americans for Democratic Action (a liberal group). The rating is scaled from 0 to 100 to indicate increasing liberalism (AAP).
BUD	The federal government budget deficit in billions of dollars (ERP).
COM	Dummy variable equal to one if a member of the House Standing Committee on Agriculture or the House Appropriations Committee; equal to two if a chairman of an appropriations subcommittee; equal to three if a member of the Agriculture Subcommittee on Dairy; equal to five if chairman of Dairy Subcommittee on Agriculture and if on an Agricultural Appropriations Committee; otherwise equal to zero (AAP).
T_i	Dummy variable equal to one if a congressman received a contribution from dairy producer interest groups; otherwise equal to zero.

$\tilde{E}$	Electoral margin of congressman in previous congressional election in percent (AAP).
FAR	Number of dairy farms in congressional district in thousands (calculated from CBA).
INC	Per capita median incomes in millions of dollars (AAP).
PAR	Dummy variable equal to one if a member of the Democratic Party; otherwise equal to zero.
POP	United States population in millions (AAP).
PMIN	Minimum Class II milk price support set by Congress in dollars per hundredweight (DOS).
P	Class II milk price support set by the Secretary of Agriculture in dollars per hundredweight (DOS).
PUL	The squared deficit in popularity of the President in September of the previous year in percent (GP).
REA	Reagan electoral vote margin in 1980 Presidential election in percent (AAP).
RUR	Percent of population in rural areas in percent (AAP).

SAL	Value of milk production in thousands of dollars (calculated from CBA).
SEN	Years of seniority in Congress (AAP).
Y_i	Dummy variable equal to one if voted in favor of higher price supports ("no" on Frank-Findlay Amendment in 1982); otherwise equal to zero (CQ).
R_i	Campaign contributions from the Associated Milk Producers, Inc., Mid-America Dairymen, Inc., and Dairymen, Inc., in thousands of dollars (FEC).

Abbreviations

AAP	Barone, Michael, Grant Ujifusa, and Douglas Matt (eds.), *Almanac of American Politics* (Boston: Gambit, 1982).
CBA	U. S. Department of Commerce, Bureau of the Census, *Census of Agriculture, 1978* (Washington, D. C.: U. S. Government Printing Office, 1981).
CQ	Congressional Quarterly, Inc., *Congressional Quarterly Almanac* (Washington, D. C., various issues).
DOS	U. S. Department of Agriculture, Economic Research Service, *Dairy Outlook and Situation* (Washington, D. C., various issues).
ERP	Economic Council of Advisers, *Economic Report of the President* (Washington, D. C., various issues).
FEC	Federal Election Commission, *Reports on Financial Activities, 1980-82* (Washington, D. C.: various unpublished reports).
GP	Gallup, George H., *The Gallup Poll: Public Opinion, 1950-1981* (Delaware: Scholarly Resources, Inc., 1982).

Footnotes

[1]For a few studies which examine these determinants, see Rausser, Lichtenberg and Lattimore (1982) and Gardner (1987). The institutional setting and activities of farm lobbyists and politicians are, however, well documented. This documentation may be found in Cochrane and Ryan (1976) and Knutson, Penn, and Boehm (1983).

[2]In fact, Congress also specifies a maximum allowable price support. However, that price has not been a binding constraint to the President in the past and, hence, is not evaluated in this study.

[3]The dummy variable, T_i, and the electoral margin, $\tilde{E}_i$, were found to be insignificant in congressional voting decisions. The latter finding is not in accord with that found by Kau, Keenan, and Rubin (1982) and rejects the earlier hypothesis that $\tilde{E}_i$, reflecting the chances of reelection, affects the range of tolerance on price supports.

[4]This makes estimation procedures easier since the threshold in the Tobit equation becomes zero.

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Table 1

Chances of reelection, $\tilde{E}_i$	Probability of favoring price supports, Y_i^*		
	Low	0.5	High
Low	Medium	High	Medium
High	Low	Medium high	Low

FIGURE 1. POLITICAL PROCESS DETERMINING AGRICULTURAL SUPPORT PRICES IN THE U.S.

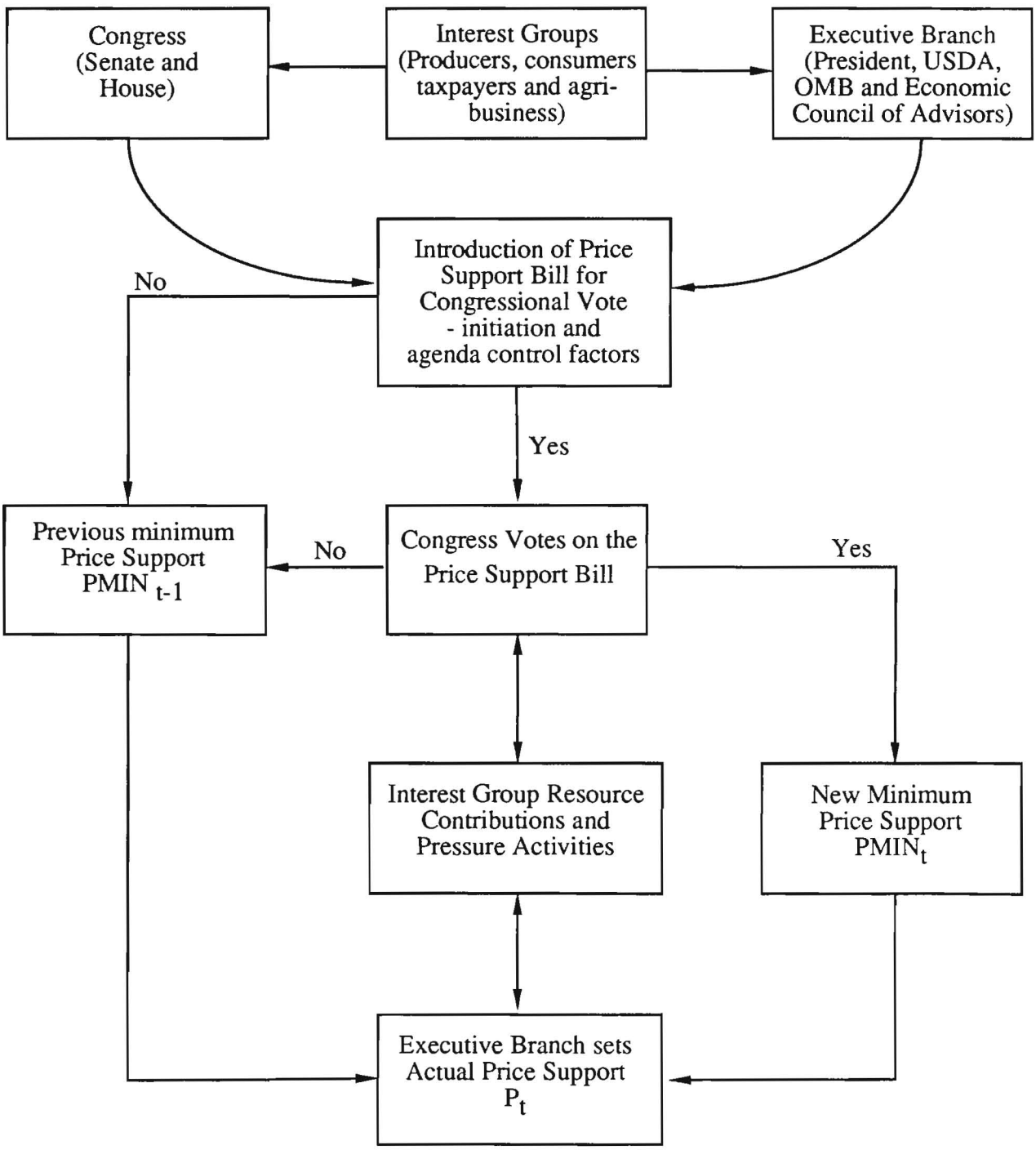

FIGURE 2. THE INTERACTION OF POLITICIANS, PRODUCERS AND VOTERS IN DETERMINING AGRICULTURAL PRICE SUPPORTS

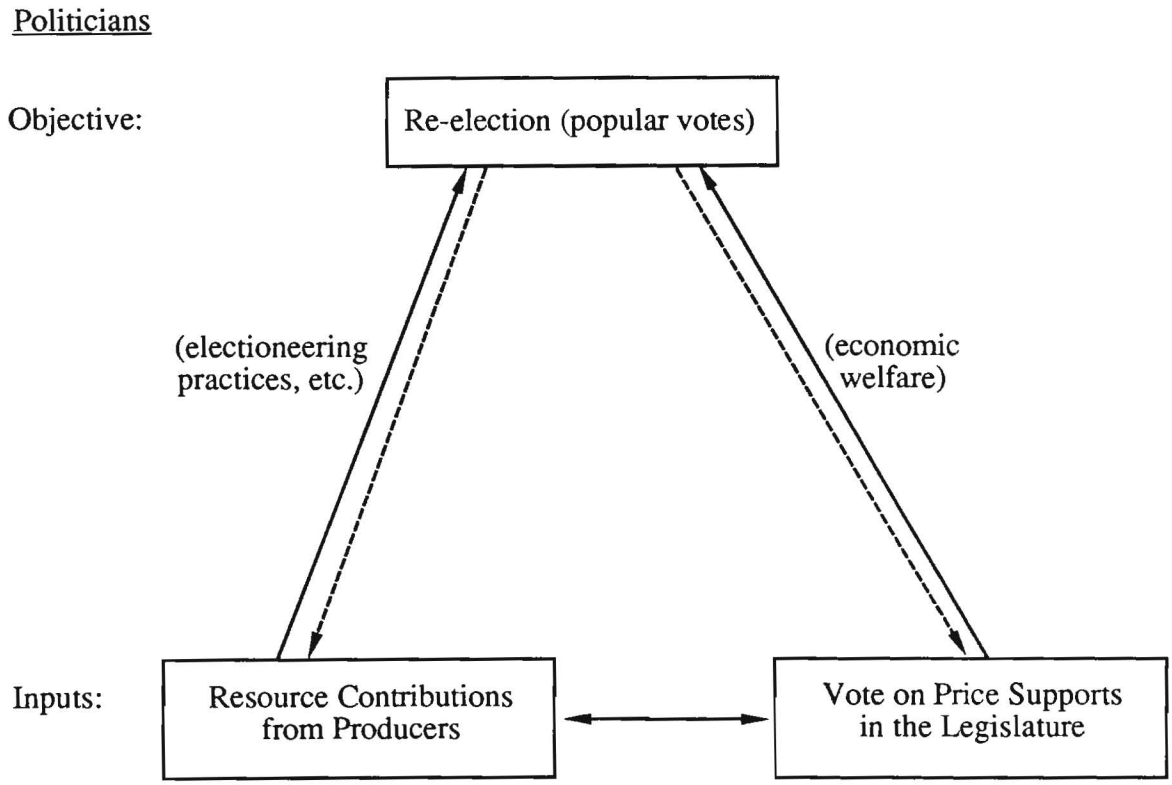

Figure 3