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Chapter 13

Endogenizing Government Behavior

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Introduction

The purpose of this study was to endogenize government behavior; that is, to acknowledge the political setting in which agricultural policy is made.[1] We sought to answer the following questions: (1) Why does the U.S. Government choose the policies it does? (2) What factors influence policymakers' decisions--economic, political, domestic, and/or international factors?

We chose the dairy industry for this analysis because it has historically been politically powerful and has had strong domestic and international markets. Dairy is the only commodity with both a price support program and a marketing order program. We focused on policymakers' choice of the price support level for manufactured dairy products (MDP) as our policy variable to endogenize. The price support level is set by the Government and underpins other dairy prices.

Comparison of Models

Economists differ on the approach used to endogenize government behavior. Rausser, Lichtenberg, and Lattimore (1982) identified two types of models: (1) the behavioral model and (2) the criterion function (or policy preference) model. Both models endogenize Government

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[1] More detail of this analysis is provided in Marchant and McCalla (1990).

behavior. Rather than choose between these two approaches, our research developed models using both approaches. In the behavioral model, the policymakers' decisionmaking rule is unknown. In the criterion function model, the policymakers' decisionmaking rule is known and equals the model's objective function, also referred to as the policy preference function. The behavioral model does not contain political weights. Political weights do exist in the criterion function model, and these weights measure the political influence of each special interest group. Both models include a commodity component consisting of supply, demand, stock, and Government cost and revenue equations.

The models differ regarding the process used to obtain the policy equation. In the behavioral model, the policy equation is directly specified and estimated. Inclusion of independent variables is based on both economic and political economic theory. The behavioral model consolidates empirical results of other studies (such as budgetary concerns and policy inertia) as discussed below. The policy equation in the criterion function model is analytically derived (equaling the first order necessary condition) and then estimated. The criterion function model is a constrained optimization problem, where policymakers choose the optimal price support level that maximizes the policy preference function subject to constraints in the commodity component. This model is transformed into an unconstrained optimization problem by substituting equations from the commodity component into the objective function. The first order necessary condition is then obtained by differentiating the unconstrained objective function with respect to the policy variable; such as the price support level for manufactured dairy products (MDP). Next, the price support level is isolated and this policy equation is then estimated.

Presented below are two models of the U.S. dairy industry which attempt to quantitatively test the influence of economic, political, domestic, and international variables on the U.S. support price for manufactured dairy products (butter, cheese, and nonfat dry milk, aggregated on a milk-equivalent basis). Results from both models endogenize Government behavior by identifying variables which potentially influence policymakers' choices. Results of the criterion function model also identify which special interest group--consumers, processors, or taxpayers--most influences policymakers' decisions.

Behavioral Model

The behavioral model consists of two components: (1) a commodity component describing the supply, demand, stocks, and Government revenues and costs associated with the U.S. dairy industry and (2) a policy component describing policymakers' choice of the support price for MDP. A general description of the model follows (where variable definitions are presented in the appendix):

Commodity Component

$$\hat{S} = \hat{\alpha}_0 + \hat{\alpha}_1(P^{Spt}) + \hat{\alpha}_2 P^{Farm} + \hat{\alpha}_3 P^{Inputs} \quad (1)$$

$$P^{Retail} = P^{Spt} + M \quad (2)$$

$$\hat{D} = \hat{\beta}_0 + \hat{\beta}_1(P^{Spt}) + \hat{\beta}_2 Y + \hat{\beta}_3 POP + \hat{\beta}_4 P^{Margarine} \quad (3)$$

$$SR = (Sales) + (Dntns) \quad (4)$$

$$Stocks_t = (Stocks)_{t-1} + (SA)_t - (SR)_t \quad (5)$$

$$GR_t = (Sales)_t(1.1 * P^{Spt})_t \quad (6)$$

$$GC_t = (SA)_t(P^{Spt})_t + (Stocks)_t(SC) + (Dntns)(DC) \quad (7)$$

Policy Component

$$P_t^{Spt} = f\left[P_{t-1}^{Spt}; (Stocks); (GR - GC)^{US}; Y^{Farm}; X; SIG \right] \quad (8)$$

Processors' supplies of MDP are specified in equation (1). Equation (2) describes the marketing margin between processing and retail prices. Equation (3) specifies derived demand for MDP by U.S. consumers. Stock removals from the Commodity Credit Corporation (CCC) stockpiles equal the sum of sales and donations as identified in equation

(4). Domestic and international outlets are included for both sales and donations. Equation (5) is a market-balancing equation, where current Government stocks equal carryover stocks plus additions to stocks minus stock removals. Government revenues and expenditures on the dairy support program are specified in equations (6) and (7).

Equation (8) describes the policy component in its most general form. A more detailed form is described in equation (A).[2] The support price is a function of six general groups of variables based on economic and political economic theory: (1) **Institutional inertia,** following the hypothesis that once a policy is in place, it does not dramatically change (Allison, (1971); Lavergne, (1983); von Witzke, (1990); and Young, (1987)); thus, we expect a positive relationship between the support price in the current year and the support price in the previous year. (2) **Stocks,** as represented by the following variables: (a) actual carryover stocks from the previous year, (b) actual and (c) forecast additions to stocks, and (d) actual stock levels. We expected stocks to be negatively related to the price support level; that is, as stocks rise, policymakers should lower the guaranteed minimum support price level in an effort to reduce overproduction and the build-up of costly stockpiles of MDP's. (3) **Net Government costs** accounting for budgetary concerns (Infanger, Bailey, and Dyer, (1983); de Gorter, (1983); and von Witzke, (1990)). This variable was represented by the Federal budget deficit, and the cost share for the agricultural sector and the dairy industry. A negative relationship is expected; that is, as the budgetary costs rise, the price support level should fall. (4) **Domestic farm income,** following the hypothesis that one means to achieve the domestic goal of raising farm incomes is to increase the support price (Dixit and Martin, (1986); and Gardner, (1987)). Again, a negative relationship is expected; that is, as farm income level falls, policymakers may attempt to improve farm incomes by raising the price support level. (5) International variables, following the hypothesis that policymakers consider the international market when choosing domestic policy instruments (Lattimore and Schuh, (1979); Sarris and Freebairn, (1983); Paarlberg, (1983); Paarlberg and Abbott, (1986); and von Witzke, (1990)). International variables were represented by the U.S. trade balance and export shares for agricultural exports and MDP exports. (6) **Special interest groups,** following the hypothesis that political influence, as measured by campaign contributions or economic rent can influence policymakers' decisions (Welch, (1974); Caves, (1976); Sarris

[2] Equations (A), (B), and (C) are from Marchant and McCalla (1990). Equation (A) is reproduced in the appendix to the chapter. Equations (B) and (C) follow in the text.

and Freebairn, (1983); and Krueger, (1974)). A positive relationship is expected; that is, the greater the campaign contribution and/or potential for economic rent generated from the proposed policy decision, the greater the influence of special interest groups on policymakers' decisions.

Empirical Estimation of the Behavioral Model

Data was obtained from the U.S. Department of Agriculture, the Bureau of Labor Statistics (BLS), and the Federal Election Commission (FEC). Many different estimations were run, for example, real versus nominal data; using different data sets to represent variables, for example, stocks were represented in three ways--actual additions to stocks, forecast additions to stocks, and actual stock levels. We omitted the lagged dependent variable. In addition to the above regressors, equation (A) was estimated using a time trend variable and a dummy variable for years in which Congress enacted farm legislation. Estimations used ordinary least squares (OLS) on annual time series data for 1951-87, depending on data availability for specific variables. Presented below are examples of the best estimations based on the following overall criteria: correct signs, high coefficient of determination and F-statistic, significant variables, and lack of autocorrelation.

$$\hat{P}_t^{Spt} = \underset{\substack{(0.17)\\2.3}}{.391} + \underset{\substack{(0.026)\\42.8}}{1.13}\ P_{t-1}^{Spt} - \underset{\substack{(0.008)\\-5.3}}{0.043}\ Exp\,(Stk_t) - \qquad \text{(B)}$$

$$\underset{\substack{(0.009)\\-2.2}}{0.022}\ Y_{t-1}^{Farm} + \underset{\substack{(0.002)\\3.7}}{0.008}\ (GR - GC)_{t-1}^{US}$$

$$R^2 = 0.9935 \quad F = 1152 \quad h = 0.4547 \quad n = 31$$

(C)

$$\hat{P}_t^{Spt} = \underset{(0.19)}{\underset{0.03}{0.005}} + \underset{(0.04)}{\underset{32.6}{1.31}}\ P_{t-1}^{Spt} + \underset{(0.002)}{\underset{2.87}{0.005}}\ (GR - GC)_{t-1}^{US} -$$

$$\underset{(0.009)}{\underset{-6.0}{0.053}}\ \left[\frac{GC^{MDP}}{GC^{Ag}}\right]_{t-1} - \underset{(0.11)}{\underset{-5.8}{0.62}}\ (P^{Spt} - P^{Wld})$$

$$R^2 = 0.9957 \quad F = 815 \quad h = -0.299 \quad n = 15$$

Equation (B) was estimated at an aggregate level using nominal prices, where (1) expected stocks were measured as actual additions to Government stocks equaling CCC purchases of MDP and (2) farm income was measured as the change in net farm income. The difference between equations (B) and (C) was that equation (C) has fewer observations but includes four more independent variables, of which only two were significant. These four variables with a smaller available data set included (1) the ratio of the Government costs of the dairy program relative to Government costs of total agricultural programs, (2) the ratio of MDP exports relative to total agricultural exports, (3) the difference between the retail price and the world price for MDP, and (4) the difference between the support price and the world price for MDP.

Thus, in equation (B), the variables that significantly affected policymakers' choice of the support price for manufactured dairy products were (1) the support price in the previous year, (2) expected additions to CCC stocks, measured as actual additions to stocks, (3) change in net farm income, and (4) the U.S. Federal budget deficit.

In equation (C), the variables that significantly affected policymakers' choice of the support price for manufactured dairy products were also (1) the support price in the previous year and (2) the U.S. Federal budget deficit. In addition, (3) the cost share spent on the dairy industry and (4) the difference between the support price and the world price, measuring the price distortion, were also significant.

Summary and Interpretation of Empirical Results for the Behavioral Model

Estimations of the policy component in the behavioral model were performed using both nominal and real prices. Empirical results indicated a common set of explanatory variables which appeared to affect policymakers' choice of the support price. Estimations using either nominal or real prices indicated that policymakers appear to be influenced by the following: (1) the support price in the previous year, supporting the hypothesis that institutional inertia is important, (2) the cost share of Government expenditures on the dairy program, as measured by the ratio of Government costs of the dairy program relative to Government costs of agriculture, as a whole sector, where, as the cost share increased in the previous period, the support price fell, and (3) the difference between the support price and the world price, where a positive price distortion resulted in lowering the support price. In addition, in the nominal case, the support price also appeared to be influenced by the following: (4) expected additions to CCC stocks, that is, as stocks increased, the support price fell, (5) change in net farm income (that is, as farm income fell, support prices rose), and (6) U.S. Federal Government deficit (as the deficit increased, the support price fell).

Criterion Function Model

Criterion function models, which analytically derive and then estimate policy instruments, include Rausser and Freebairn (1974), Zusman (1976), Zusman and Amiad (1977), Sarris and Freebairn (1983), Paarlberg (1983), Paarlberg and Abbott (1986), Riethmuller and Roe (1986), and Lopez (1989). Empirical results of the criterion function model identify (1) variables that significantly influence policymakers' decisions of the policy variable and (2) the political power of the special interest groups.

The criterion function model also consists of two components: (1) a policy preference function describing U.S. policymakers' decisionmaking role in choosing the price support level for MDP and (2) a commodity component similar to that used in the behavioral model. A general description of the model follows (where the same variable definitions hold as identified in the behavioral model):

Policy Preference Function

$$\underset{\{P^{Spt}_t\}}{Max\ PPF} = Max\ [\Gamma_1(CS) + \Gamma_2(PS) + (GR - GC)] \tag{9}$$

Commodity Component

$$\hat{S} = \hat{\alpha}_0 + \hat{\alpha}_1(P^{Spt}) \tag{10}$$

$$\hat{D} = \hat{\beta}_0 + \hat{\beta}_1(P^{Spt}) \tag{11}$$

$$SR = (Sales) + (Dntns) \tag{4}$$

$$Stocks_t = (Stocks)_{t-1} + (SA)_t - (SR)_t \tag{5}$$

$$GR_t = (Sales)_t (1.1 * P^{Spt})_t \tag{6}$$

$$GC_t = (SA)_t (P^{Spt})_t + (Stocks)_t (SC) + (Dntns)(DC) \tag{7}$$

Equation (9) describes the policymakers' preference function (PPF) which consists of four economic agents, each with its own objective: (1) consumers, who maximize consumers' surplus (CS), (2) processors, who maximize producers' (processors') surplus (PS), (3) taxpayers, who maximize (minimize) net Government revenue, GR-GC, (net Government expenditures, GC-GR) on the dairy support program, and (4) policymakers, who maximize a policy preference function, which is a weighted sum of all other agents' objectives. The weights (Γ_i, i=1,2) measure the political influence of each interest group as perceived by members of Congress, where the political weight associated with taxpayers is set equal to one; that is, the numeraire. This objective function is similar to that used by Paarlberg (1983), Sarris and Freebairn (1983), Rausser and Freebairn (1974), and Zusman and Amiad (1977).

Equations (10), (11), and (4) through (7) compose the commodity component of the criterion function model, similar to those in the behavioral model. The equations describing stock removals (4), stocks

(5), and Government revenues (6) and costs (7) are identical to those in the behavioral model. The difference occurs in the equations describing supply and demand. Now, both the supply equation (10) and the demand equation (11) are solely functions of the support price. The reason behind this stems from the mathematical process (discussed below) used to recover the political weights, (Γ_i, i=1,2) associated with the special interest groups.

The estimated policy equation of the criterion function model was analytically derived. The criterion function model was transformed from a constrained into an unconstrained optimization problem by substituting the commodity component constraints into the objective function. The optimal support price was analytically obtained from the first order necessary condition and equals equation (12). It is the policy equation of the criterion function model, comparable to the policy equation (8) in the behavioral model.

$$\hat{P}_t^{Spt} = \left[\frac{\left[(-\Gamma_1\hat{\beta}_0\hat{\beta}_1) - (\Gamma_2\hat{\alpha}_0\hat{\alpha}_1)\right]}{\left[(\Gamma_1(\hat{\beta}_1)^2 + (\Gamma_2(\hat{\alpha}_1)^2\right]}\right] + \left[\frac{1}{\left[(\Gamma_1(\hat{\beta}_1)^2 + (\Gamma_2(\hat{\alpha}_1)^2\right]}\right] \left[SA - (1.1 * Sales)\right] \quad (12)$$

In the criterion function model, policymakers' choice of the optimal support price for MDP is dependent on (1) estimates of the political weights associated with each economic agent (Γ_i, i=1,2), which are currently unknown, (2) previously estimated parameter estimates from the supply and demand functions (α_j and β_j, j=0,1), and (3) exogenous variables related to the net change in stocks, [SA - (1.1*Sales)], a known variable.

In more general terms, equation (12) can be written as:

$$\hat{P}_t^{Spt} = \left[\hat{\lambda}_1\right] + \left[\hat{\lambda}_2\right] \left[SA - (1.1 * Sales)\right] \quad (13)$$

$$\left[\hat{\lambda}_1\right] = \left[\frac{\left[(-\Gamma_1\hat{\beta}_0\hat{\beta}_1) - (\Gamma_2\hat{\alpha}_0\hat{\alpha}_1)\right]}{\left[(\Gamma_1(\hat{\beta}_1)^2 + (\Gamma_2(\hat{\alpha}_1)^2\right]}\right] \quad (14)$$

$$\left[\hat{\hat{\lambda}}_2\right] = \left[\frac{1}{\left[(\Gamma_1(\hat{\beta}_1)^2 + (\Gamma_2(\hat{\alpha}_1)^2\right]}\right] \tag{15}$$

Note that in the criterion function model, the policy equation is a function of one independent variable, net change in stocks. This equation is estimated to obtain parameter estimates of λ_k, (k=1,2). Results indicate whether the net change in the stocks variable significantly influences policymakers' choice of the optimal price support level. Equations (14) and (15) show the relationship between the estimated coefficients of λ_k, (k=1,2) and the embedded parameters, (Γ_i, i=1,2) and (α_j and β_j, j=0,1). The λ's, the α's, and the β's are known, having all been estimated. The Γ's are unknown. Thus, we must solve equations (14) and (15) for the unknown political weights, Γ's.

The math problem arises in the recovery of the political weights. Note that only two political weights are unknown (Γ_i, i=1,2). To obtain unique solutions from a just-identified system, the supply and demand equations must be functions solely of the intercept and the support price variable. For estimation purposes, these equations were estimated in their expanded form, as specified in the behavioral model (equations (1) and (3)), to obtain unbiased and consistent parameter estimates. Intercept and support price slope parameter estimates were then used in the criterion function model. Restrictions imposed on the number of independent variables in the supply, demand, and policy equations in order to recover the political influence weights, are among the limitations of the criterion function model.

Once all parameters were estimated, (α_j, β_j, λ_k; j=0,1 k=1,2), the political influence weights, (Γ_i, i=1,2), were analytically recovered from equations (14) and (15). This solution, describing the political influence weights for each special interest group in matrix notation, is the following:

$$\begin{bmatrix} \hat{\hat{\Gamma}}_1 \\ \hat{\hat{\Gamma}}_2 \end{bmatrix} = \begin{bmatrix} (\hat{\hat{\lambda}}_1(\hat{\beta}_1)^2 + (\hat{\beta}_0\hat{\beta}_1) & (\hat{\hat{\lambda}}_1(\hat{\alpha}_1)^2 + \hat{\alpha}_0\hat{\alpha}_1) \\ (\hat{\hat{\lambda}}_2(\hat{\beta}_1)^2) & (\hat{\hat{\lambda}}_2(\hat{\alpha}_1)^2) \end{bmatrix}^{-1} \begin{bmatrix} 0 \\ 1 \end{bmatrix} \tag{16}$$

where Γ_1 measures the political influence of consumers and Γ_2 measures the political influence of processors. Now, we will look at estimation results remembering that the criterion function model tells us (1) whether or not the net change in stocks independent variable significantly influences policymakers' choice of the price support level for MDP and (2) which special interest group is most politically powerful.

Criterion Function Model Estimation Results

The general form of the estimated policy equation was:

$$\hat{P}_t^{Spt} = \left[\hat{\hat{\lambda}}_1\right] + \left[\hat{\hat{\lambda}}_2\right] \left[SA - (1.1 * Sales)\right] \qquad (13)$$

Estimations were performed using (1) both nominal and real prices, (2) a variety of specifications such as first differences, lags, inclusion of a trend variable and a dummy variable for years in which farm acts were passed, and (3) different data sets measuring the net change in stocks (one data set included donations).

One would expect, a priori, that the support price would be negatively related to the variable (SA - 1.1*Sales). That is, if (SA - 1.1*Sales) is positive, whereby additions to Government stocks exceed sales, and stocks are increasing, then one would expect a decrease in the support price level. If (SA - 1.1*Sales) is negative, such that sales exceed additions to stocks, then the stockpile is decreasing and, if the level of stocks is low, one would expect the support price to increase. A sample of results are presented below:

Case One

$$\hat{P}_t^{Spt} = \underset{(1.1277)}{-9.5420} + \underset{(0.034101)}{0.078578}\,(SA - 1.1 * Sales) + \underset{(0.047014)}{0.66649}\,Time \qquad (21)$$

$$\underset{-8.4617}{} \qquad \underset{2.3042}{} \qquad \underset{14.176}{}$$

$R^2 = 0.9653 \quad n = 16 \quad F = 210 \quad D.W. = 1.0557$

Case Two

(22)

$$\Delta \hat{P}_t^{Spt} = 6.4566 - 0.20905\,(SA - 1.1 * Sales)$$
$$(3.5270) \quad (0.20912)$$
$$1.83067 \quad -.99968$$

$$R^2 = 0.4136 \qquad F = 12 \qquad \hat{\rho} = 0.65194$$
$$Runs\ Stat. = 0.9869$$

Empirical results were generally disappointing. The net change in stocks variable either had (1) the wrong sign and was significant (*case one*) that is, as stocks increased, the price support level also increased, or (2) had the correct sign but was insignificant (*case two*); that is, as stocks increased, the price support level decreased. Thus, the criterion function model gives ambiguous empirical results in regard to the impact of stocks on policymakers' support price decisions. Using these results, political influence weights were calculated.

Political Weights of the Policy Preference Function

The second empirical result from the criterion function model focused on the political weight of each special interest group. It identified which special interest group is most influential using the above policy parameter estimates. As shown in equation (16), political weights for each special interest group were calculated using the demand, supply, and policy parameter estimates. Results were calculated for the two cases presented above:

Case One

(23)

$$\hat{\hat{\Gamma}}_1 = 2.105112 \qquad \hat{\hat{\Gamma}}_2 = 2.110020 \qquad \Gamma_3 = 1.0$$

Given: $\hat{\alpha}_0 = 58.132$ $\quad \hat{\alpha}_1 = 2.1424$

$\hat{\beta}_0 = 55.863$ $\quad \hat{\beta}_1 = -1.202$

$\hat{\hat{\lambda}}_1 = -9.542$ $\quad \hat{\hat{\lambda}}_2 = 0.078578$

Case Two

(24)

$$\hat{\hat{\Gamma}}_1 = -1.510873 \qquad \hat{\hat{\Gamma}}_2 = -0.5666011 \qquad \Gamma_3 = 1.0$$

Given: $\hat{\alpha}_0 = 58.132$ $\quad \hat{\alpha}_1 = 2.1424$

$\hat{\beta}_0 = 55.863$ $\quad \hat{\beta}_1 = -1.202$

$\hat{\hat{\lambda}}_1 = 6.4566$ $\quad \hat{\hat{\lambda}}_2 = -0.20905$

Political influence weights under *case one* (incorrect sign) indicated that processors were the most influential special interest group and taxpayers were the least influential on policymakers' choice of the support price (Γ_2 exceeded Γ_1 and Γ_3). This result supports Stigler's (1971) theory regarding the dominance of producer (in this case, processor) interest groups. In *case two* (correct sign), taxpayers were the most influential group (Γ_3 exceeded Γ_1 and Γ_2), while both consumers and processors appeared to have a negative influence on policymakers' choices. But, in a relative ranking, the processors' weight, (Γ_2), again exceeded the consumers' weight, (Γ_1), in accordance with Stigler's hypothesis.

Empirical results for *case one* are highly questionable because Government stocks and the support price move together. The bottom line is an empirical model with explosive, unstable results: as stockpiles increase, policymakers exacerbate the problem by increasing the support price which encourages overproduction, generating a larger surplus that is ultimately purchased and stored by the Government.

Empirical results for *case two*, however, indicated that taxpayers have the most influence on policymakers' decisions when stocks and the support price move in opposite directions; that is, as stocks increase, the support price falls. In this case, Government-cost-minimizing taxpayers are politically effective, and profit-maximizing processors are not. As stockpiles increase, policymakers will decrease the support price level, which discourages overproduction and reduces additions to CCC stocks. Thus, Government costs, financed by taxpayers, are reduced, as are processors' profits. The problem with *case two* is that it is based on the statistically insignificant net additions to stocks variable of equation (22), although this variable has the correct sign.

Criterion Function Model Empirical Results Summary

Empirical results of the criterion function model specify (1) the influence of the net change in stock variable on policymakers' choice of the optimal support price and (2) which special interest group had the most political influence. Empirical results were ambiguous. For *case one*, which had the wrong sign but significant results (that is, stocks were positively related to the support price), the processors were the most influential special interest groups. For *case two*, which had the correct sign but

insignificant results (that is, stocks were negatively related to the support price level), taxpayers were the most politically influential.

Perhaps these results do make sense. In *case one*, as the change in stockpiles increase with an increase in the support price level, that processors were the most influential special interest group makes sense. The policy may seem irrational, but it definitely benefits processors. In *case two*, as the change in stockpiles increase with a fall in the price support level, that taxpayers were the most influential special interest group makes sense. This policy is more rational and definitely benefits taxpayers.

What Have We Learned?

What conclusions can be drawn from the empirical results of the criterion function and behavioral models? Empirical results for the behavioral model were good in terms of statistical significance and properties and reinforced other empirical results. Significant explanatory variables which appeared to influence policymakers' choice of the support price level for MDP can be categorized into the following general groups: (1) political variables, including (a) inertia, as measured by the lagged support price (Lavergne, (1983); Allison, (1971); von Witzke, (1990); and Young, (1987)) and (b) the change in net farm income, as a proxy variable representing the domestic goal of increasing farm income (Gardner, (1987)) and Dixit and Martin, (1986)) and (2) budgetary concerns as measured by (a) the Federal budget deficit, (Infanger, Bailey, and Dyer, (1983); von Witzke, (1990)) and de Gorter, (1983); (b) the share of Government expenditures on the dairy program, (von Witzke, (1990)) (c) the difference between the support price and the world price, (Sarris and Freebairn, (1983); and Krueger, (1974)) and (d) the expected additions to Government stocks in time 't+1,' generated by policymakers' support price decision in time 't'.

Empirical results for the criterion function model were ambiguous. For case two (correct sign) the taxpayers' interest dominated, which is consistent with behavioral model results in that Government cost variables were significant. The criterion function model is theoretically appealing, but much was sacrificed in its use. The estimated policy equation of the criterion function is too simplistic, due to imposition of theoretical restrictions. To obtain this analytically derived policy equation

much was sacrificed. Restrictions were imposed on the number of independent variables in the supply, demand, and policy equations. Thus, empirical results of the criterion function policy equation refer to the influence of only one variable--the net change in Government stocks--on policymakers' decisions. Statistical results were insignificant for this variable, indicating that it did not influence policymakers. Also, the estimated policy equation is dependent on the structure of the policy preference function. If its specification changes, so does the estimated policy equation. For instance, the objective function in this research consisted of economic welfare associated with the following economic agents: consumers, processors, taxpayers, and policymakers. This model could be respecified to include dairy farmers. As a result, the mathematics used to derive the policy equation would increase in complexity and impose even more theoretical restrictions. Thus, although the criterion function model is theoretically appealing, the policy equation in the behavioral model is more realistic.

In contrast, the behavioral model allowed for a larger set of independent variables to be tested for their influence on policymakers' determinations of the support price for MDP. Empirical results of the behavioral model yielded estimates that were statistically significant and supported existing empirical findings. Although the model does not follow an explicit economic paradigm, it appears to be a more realistic model of policy choice.

Implications for Future Research

Future research will examine a process of reestimating the criterion function model without imposing restrictions. In addition, as data become available, policy equations will be estimated using updated data, specifically for campaign contributions. Finally, empirical results of the behavioral model identified significant explanatory variables affecting policymakers' choices. Research could use these results to work backwards to obtain a criterion function decisionmaking rule that yields this policy equation, upon deriving its first order necessary condition.

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Appendix: Variable Definitions

S = Supply of MDP produced in the United States.

P^{Spt} = Support price for MDP, set by policymakers; the output price realized by processors and the derived demand price paid by consumers as well as the purchase price paid by the Government for surplus MDP and the "trigger price" for the sale of MDP from Government stockpiles. (The trigger price equals 110 percent of the support price.)

P^{Farm} = Price paid by processors to dairy farmers; the input price.

P^{Inputs} = Price of other processing inputs.

P^{Retail} = Retail price of MDP.

M = Marketing margin between processing and retail prices.

D = Derived demand for MDP by U.S. consumers.

Y = U.S. disposable personal income.

POP = U.S. population.

$P^{Margarine}$ = Retail price of margarine (a substitute for butter).

SR = Stock removals from Commodity Credit Corporation (CCC) stockpiles; such as domestic and international outlets for sales and donations.

Sales = Sales of CCC MDP stocks, either domestic and/or international (export) sales.

Dntns = Donations from CCC MDP stockpiles, either domestic or international (Public Law 480-title II and section 416 of the Agricultural Act of 1949).

Stocks = Surplus MDP stored by the CCC equaling carryover stocks plus stock additions (SA) minus stock removals (SR).

SA = Additions to CCC stockpiles.

GR = Government revenue domestically or internationally obtained from sales of MDP stocks.

GC = Government costs of the dairy support program associated with purchasing domestic surpluses, storing surpluses in stockpiles, and distributing surpluses as donations.

SC = Storage costs associated with Government storage of surplus manufactured dairy products.

DC = Distribution costs associated with distributing donations (both domestic and international donations are considered).

$(GR - GC)^{US}$ = This net Government expenditures variable can be thought of as a general variable which includes both net U.S. Government expenditures associated with the Federal budget as well as net Government expenditures on the dairy program (GR - GC).

Y^{Farm} = Income received by U.S. farmers.

X = International variables; such as, value of U.S. exports, trade balance.

SIG = Special interest group variables, for example, campaign contributions to politicians from dairy lobbying groups.

The general form of the estimated policy equation in the behavioral model was:

Behavioral Model: Equation (17) and Variable Definitions

(A)

$$P_t^{Spt} = f\left\{P_{t-1}^{Spt}; (Stk_{t-1}, \text{Exp}(Stk_t)); Y_{t-1}^{Farm};\right.$$

$$\left[\left(\frac{X}{GNP}\right)^{US}, (X - M)^{US}, \left[\frac{X^{Ag}}{X^{US}}\right], \left[\frac{X^{MDP}}{X^{Ag}}\right]\right]_{t-1};$$

$$\left.\left[\left[\frac{GC^{MDP}}{GC^{Ag}}\right], \left[\frac{GC^{Ag}}{GC^{US}}\right], GC^{US}, (GR - GC)^{US}\right]_{t-1};\right.$$

$$\left[\left(P^{Spt} - P^{Wld}\right)_{t-1},\ \left(P^{Rtl} - P^{Wld}\right)_{t-1},\ CC_t\right]\Big\}$$

where:

P^{Spt} = MDP support price level chosen by Congress at the farm level.
Stk = Government (CCC) stocks of MDP on a milk-equivalent basis.

Exp(Stk) = Expected CCC stocks or additions to CCC stockpiles. Three different data sets were used: (1) Actual additions to stocks equaling CCC purchases of MDP on a milk equivalent basis. (2) Forecast additions to CCC stocks based on supply and demand estimates. (3) Actual CCC stock levels of MDP on a milk-equivalent basis.

Y^{Farm} = Income of the farm sector measured using a variety of specifications: (1) The change in net farm income (NFI) which is defined as gross farm income (GFI) minus production expenses. (2) NFI, lagged. (3) The percentage change in NFI. (4) The ratio of per capita personal farm income from farm sources only, relative to per capita nonfarm personal income. (5) The difference between per capita nonfarm income and per capita farm income.

(X/GNP^{US}) = The ratio of the value of U.S. exports to the U.S. gross national product (GNP), measuring the relative importance of the export market.

$(X - M^{US})$ = The value of the U.S. net trade balance, exports minus imports.

$(X^{Ag} / X^{US}$ = The ratio of the value of U.S. agricultural exports relative to the value of total U.S. exports, measuring the relative importance of the agricultural export market compared with the U.S. export market.

(X^{MDP} / X^{Ag}) = The ratio of the value of U.S. dairy exports relative to the value of U.S. agricultural exports, measuring the relative importance of dairy exports compared with agricultural exports.

(GC^{MDP} / GC^{Ag}) = The ratio of Government costs associated with the dairy program relative to total Government costs associated with the

agricultural sector, measuring relative expenditures on the dairy program compared with agricultural expenditures.
(GC^{Ag} / GC^{US}) = The ratio of Government costs associated with the agricultural sector relative to total U.S. Government expenditures, measuring relative expenditures on agricultural programs compared with total Government expenditures.

$(GR\text{-}GC)^{US}$ = Net U.S. Government expenditures, Government revenue minus Government costs.

($P^{Stp} - P^{Wld}$) = MDP support price minus the MDP world price.

($P^{Rtl} - P^{Wld}$) = MDP U.S. retail price paid by consumers minus MDP world price.

CC = Campaign contributions by political action committees (PAC's) to congressional and presidential candidates.

(SA - 1.1*Sales) = Net change in Government stocks of MDP, aggregated on a milk-equivalent basis and equaling stock additions (SA) minus total sales (domestic and international).