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Determinants of the U.S. Wheat Producer  
Support Price: A Time Series Analysis

by

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DETERMINANTS OF THE U.S. WHEAT  
PRODUCER SUPPORT PRICE:  
A TIME SERIES ANALYSIS

by

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Abstract

Determinants of the U.S. Wheat Producer Support Price.

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Public choice in agriculture is an emerging field in agricultural economic research. The paper's focus is on the determinants of the U.S. wheat producer support price. The econometric time-series analysis suggests that this price is largely determined by the previous price, the expected U.S. share in world exports, and expected program costs. Presidential elections also influence U.S. wheat price policies. All other things being equal, the support price tends to be lower in election years than in other years. This suggests that small interest groups' relative political economic power may be smaller in election years if they do not succeed in positioning themselves on the political economic market such that they contain the potentially decisive voter.

# Determinants of the U.S. Wheat Producer Support Price:

## A Time Series Analysis

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### 1. Introduction

Throughout the world, agriculture is subject to more or less intense government intervention. There is a characteristic pattern of government involvement in the course of economic development. In less developed countries, where agriculture represents the majority or at least a large fraction of the population, agriculture is often heavily taxed. In developed countries, such as the United States, agriculture is only a small sector of the economy but tends to be subsidized (e.g. Peterson, 1979; Bale and Lutz, 1982).

Typically, government market intervention is characterized by various adverse allocative and distributive effects. Not surprisingly, U.S. agricultural and trade policy has drawn much criticism over the years (e.g. Cochrane, 1985). Although a number of proposals for a more or less drastic policy reform have been put forward (e.g. Rausser and Foster, 1986; Ruttan, 1986; Runge and Halbach, 1987), the more than 50 year old U.S. price and income policy is still being continued in principle. Of

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course, there have been quite remarkable policy changes such as the introduction of deficiency payments or measures of domestic supply management. However, the principle of U.S. agricultural policy, namely to provide income support to farmers via a government regulated minimum price has remained the same. While the system of government intervention in grains has fluctuated only gradually over time, the level of real producer price support has changed quite remarkably since the early 60's (figure 1).

Applications of public choice theory to the analysis of agricultural policy formation have led to valuable general insights into the determinants of agricultural policy decision making in various parts of the world (e.g. Bates, 1981; Anderson and Hayami, 1986; Olson, 1986; Hayami, 1988).<sup>1</sup> However, knowledge of the determinants of U.S. agricultural policy decisions is still limited (Schuh, 1981; Spitze, 1986).

Agriculture in the United States has become increasingly open and operates in an increasingly international economic environment. The core of public choice theory, however, is still largely domestic in character. "International aspects are rarely dealt with in public choice as evidenced by their complete neglect in surveys and textbooks. On the other hand there is a 'demand' for a public choice analysis in this area by international trade theorists....." (Frey, 1984).

Analyses of the determinants of U.S. agricultural policies have followed several lines of research. First, there are studies that incorporate endogenous government behavior into traditional market models (e.g. Dixit and Martin, 1986). Typically, the public choice part of these models is heuristic in character and focuses on domestic policy determinants. Second, there are formal models that are in the main stream

of public choice literature. The main focus of this type of analysis is on domestic aspects of policy formation. The empirical results tend to support the central hypotheses of public choice theory for U.S. agricultural policy (Gardner, 1987). Third, there are studies that explain international trade on selected markets with endogenous government decisions in major trading countries including the United States (e.g. Abbott, 1979; Sarris and Freebairn, 1983). Although these studies explicitly capture important international aspects of national agricultural policy formation, the results are naturally too general to yield more specific and detailed insights into the determinants of U.S. agricultural price policy decisions.<sup>2</sup>

Here we will develop a formal model that specifically focuses on U.S. wheat policy decisions. It will be based on public choice theory and will incorporate some international aspects of endogenous national policy decisions. The model is of the reduced form type and aims at explaining U.S. producer price support for wheat over time. It represents a supply-side approach to agricultural policy modeling in the tradition of Stigler (1970), Posner (1974), and Peltzman (1976) in that it is based on the political economic calculus of the regulator, i.e. the agricultural policy decision maker as the supplier of a minimum producer price.<sup>3</sup> Following, we will first develop the conceptual framework and then test the model empirically. The study concludes with some implications for international interactions of endogenous national agricultural policy decisions in the context of the present round of multilateral trade negotiations in the General Agreement on Tariffs and Trade (GATT).

## 2. Conceptual Framework

Hayami (1987) describes the central elements of political economic markets in agriculture, based on classical public choice theoretical analyses such as those by Buchanan and Tullock, (1962), Downs (1957), Olson (1965) and Stigler (1970). According to this framework, an equilibrium on any given political economic market prevails when the policymaker's marginal political economic costs (loss of political support or votes) equal the marginal benefits (gain in political support or votes) resulting from a change in a government regulated price. Our theoretical considerations follow this framework (see also Riethmuller and Roe, 1986).

One central element of U.S. wheat policies in the last few decades has been the loan rate which provides a price floor to producers. In the early 60's producer prices were 'decoupled' from the loan rate. Beginning in 1963/64 the loan rate was supplemented by direct payments. In 1974/75 a target price was introduced where the difference between target price, and loan rate or market price is a deficiency payment.

Other measures of market intervention have been employed as well such as 'payment in kind' subsidies or acreage reduction programs.<sup>4</sup> Although it may be desirable to incorporate some of these instruments into an analysis of U.S. wheat price policy decisions we have elected to focus only on the level of producer price support.<sup>5</sup>

For the purpose of this study, it should be emphasized that the producer price during the period analyzed here has been 'decoupled' from consumer price. That is, non-agricultural households are not directly affected by producer price support in the form of a target price. However, they are affected indirectly as price support results in budgetary expenditures. Consider the following strictly concave criterion

function (W) that a single agricultural policymaker maximizes in every period t, by setting a producer price.

$$(1) W_t = W (Y_t, B_t)$$

s. t.

$$(2) Y_t = Y (P_t)$$

$$(3) B_t = B (P_t)$$

where

Y = producer income

B = budgetary expenditures caused by producer price support

P = producer price

t = time index

In eq. (1), income of producers can be interpreted as a determinant of the decision makers' political support from this group. Budgetary expenditures (revenues) caused by a government regulated price represent the loss (gain) of political support from the rest of the electorate. If the producer price (the target price) were equal to the consumer price it would be necessary to add  $P_t$  as an argument to eq. (1). In this case, the welfare of non-agricultural households would be directly affected by the supported producer price.

Maximizing eq.(1) subject to the constraints in eqs. (2) and (3) yields the optimum condition for the government controlled price in eq. (4). Its political economic interpretation is obvious. The agricultural policy decision maker sets the price such that marginal political benefit equals the marginal cost.

$$(4) (\delta W_t / \delta Y_t) \cdot (\delta Y_t / \delta P_t) + (\delta W_t / \delta B_t) \cdot (\delta B_t / \delta P_t) = 0$$



where

$$\delta W_t / \delta Y_t > 0,$$

$$\delta Y_t / \delta P_t > 0,$$

$$\delta W_t / \delta B_t < 0,$$

$$\delta B_t / \delta P_t > 0.$$

As the criterion function is assumed to be strictly concave, there is a solution to this problem for  $P_t$ . The structural parameters, however, cannot be identified unless the parameters of the criterion function and the constraints are known. Denote the optimal price in period  $t$  by  $\tilde{P}_t$ , and let the solution to this problem

be:<sup>6</sup>

$$(5) \tilde{P}_t = \alpha_0 + \alpha_2 Y_t + \alpha_3 B_t$$

Usually policymakers are not perfectly free to adjust a regulated price over time as there are various contractual policy constraints. The time cost of decision making tend to increase with increasing extent of price adjustments. Major price adjustments may even require special legislation. Moreover, policymakers may be constrained by bills that cover several periods and may restrict policy adjustments. U.S. farm bills represent examples of these types of constraints as farm bills contain at least some guidelines for annual price adjustments.

A common way to account for such constraints is the Nerlovian partial adjustment approach (Nerlove, 1958). In our case it implies that the actual difference of the producer price between two periods is a constant fraction of the difference between the optimal price and the past price.

$$(6) P_t - P_{t-1} = c(\tilde{P}_t - P_{t-1}) + u_t \quad 0 < c < 1$$

In eq. (6),  $u_t$  represents an error term that is assumed to be normally and independently distributed. Combining eqs.(5) and (6) yields:

$$(7) P_t = \beta_0 + \beta_1 P_{t-1} + \beta_2 Y_t + \beta_3 B_t + u_t$$

where

$$\beta_0 = c\alpha_0, \beta_1 = 1-c, \beta_2 = c\alpha_2, \text{ and } \beta_3 = c\alpha_3$$

As mentioned earlier, this analysis attempts to capture national as well as some international aspects of policy formation. The right-hand side of eq. (7) contains variables which, at first glance, may be perceived as domestic in nature. However, the wheat sector has been very export oriented during the time period analyzed here. Generally, exports and incomes are closely related on such markets. Exports in turn are influenced not only by domestic variables but also by such variables as world market prices or exchange rates. Similarly, budgetary expenditures caused by deficiency payments are also influenced by the world market price. A relatively high (low) world market price of wheat (if it exceeds the loan rate) reduces (increases) the deficiency payment per bushel of wheat produced and thus the budgetary expenditures caused by the supported wheat producer price.

The model developed here focuses on the level of the domestic producer support price. An alternative and more common approach would be to use the domestic price relative to the world market price (e.g. nominal rate of protection) as an endogenous variable. On the one hand, this would make international aspects of domestic policy formation more explicit. On the other hand, it would, however, complicate the empirical analysis and would render its interpretation more difficult. The central problem in this regard is that a variable such as the nominal rate of protection changes not only as a consequence of a change in the level of the

government supported price but also with changes in the world market price or the exchange rate. For instance, even if the domestic price remains unchanged the nominal rate of protection would change when the world market price changes. National policies are pursued mainly for domestic reasons but they are influenced by various international variables. In our example, the endogenous variable would change although the domestic producer support price did not. Consequently, one would have to account for this change by a suitable right hand side variable. This in turn would complicate the empirical analysis and may result in multicollinearities as both agricultural incomes and budgetary expenditures may be affected by world price changes. Therefore, we have elected to base the analysis on the level of the domestic producer price support.

Olson's (1965) analysis of the relative political power of interest groups on political economic markets has stimulated a large number of studies, suggesting that relatively small interest groups, such as agricultural commodity groups in developed countries, tend to be more successful at least until some threshold is reached (e.g. Becker, 1983; Anderson and Hayami, 1986; Gardner, 1987; Hayami, 1987). While there is plenty of evidence supporting this view, the change in interest groups' success over the election cycle has not received much attention. It may immediately appear to be counterintuitive that small interest groups have a relatively more powerful political economic bargaining position in election than in non-election years as only a relatively small number of votes may be gained by allocating political favors to such groups. In fact, policymakers may be better off concentrating their efforts on relatively large groups where more votes can be potentially gained (e.g. Downs, 1957; Breton, 1974).

However, if a small interest group succeeds in positioning itself such that it contains the median (or the decisive) voter, small interest groups may well be even more successful in extracting rents in election years than in non-election years. As Frey (1984) has noted, public choice models that are based on the policymakers' maximization of political support or votes may, in fact, be misspecified if they neglect election cycles, "... because between elections a democratically chosen government may well yield to the pressures of the organized groups, in particular because it needs their support to carry out its economic policies successfully, and also because it is interested in their financial support in view of future elections."

If the above considerations are correct, then the question of the changing relative political power of smaller interest groups, such as agricultural producer groups, represents, in fact, an empirical problem. In many cases one would expect the relative political economic power of small interest groups to be lower in election years. The government may still enjoy the support of these groups as they have learned from past experience that they will be compensated by more political favors in non-election years. Only if an interest group consistently succeeds in positioning itself on the political economic market such that it contains the median (or the decisive) voter will it consistently extract relatively more political economic rents in election years than in non-election years. Some interest groups may succeed in being decisive in some elections and may fail to do so in others. In this case an empirical analysis would be very difficult unless one is able to find an explanation for this phenomenon.

The above considerations of the changing relative political power of small interest groups do not contradict one of Olson's basic hypotheses, namely that such groups tend to be relatively more successful on political economic markets. Our considerations imply, however, that the success of interest groups may change systematically over the election cycle. In the following empirical analysis we will test whether this is the case with regard to U.S. wheat producers.

### 3. Empirical Analysis

#### 3.1 The Empirical Model

In eq. (7), the producer price for  $t$  is determined by the agricultural policymaker at some prior time. Let this be at  $t-1$ . At this time the policymakers know neither  $Y_t$  nor  $B_t$ . Hence,  $Y_t$  and  $B_t$  have to be substituted by their respective expected values  $B_t^*$  and  $Y_t^*$ . Economic theory suggests that economic agents form expectations based on the available information at the time of the decision which is commonly denoted as:

$$(8) Y_t^* = E (Y_t \mid I_{t-1})$$

$$(9) B_t^* = E (B_t \mid I_{t-1})$$

Moreover,

$$(10) Y_t = Y_t^* + v_t$$

$$(11) B_t = B_t^* + w_t$$

Substituting eqs. (10) and (11) into eq. (7) and including  $E$  yields:

$$(12) P_t = \beta_0 + \beta_1 P_{t-1} + \beta_2 Y_t^* + \beta_3 B_t^* + \beta_4 E_t + \epsilon_t$$

We are now in a position to discuss the expected signs of the parameters. According to the theoretical analysis the sign of  $\beta_0$  is not determined a priori. In developed countries where agriculture tends to be

subsidized, such as in the United States, one would expect the signs of both  $\beta_2$  and  $\beta_3$  to be negative. That is, a relatively low (high) expected agricultural income or relatively low (high) expected budgetary expenditures lead to a relatively high (low) producer support price. As  $0 < c < 1$ ,  $\beta_1$  can be expected to be positive. A presidential election year will be accounted for by a dummy variable (E). It is 1 in an election year and 0 in all other years. Hence, if the relative political power (i.e. the producer support price) of wheat producers is systematically lower (higher) in election than in non-election years, the sign of the dummy variable will be negative (positive).

The nature of the error term in eq. (12) deserves some further discussion. As Nelson (1975) has noted, the error term typically results in some complications when exogenous variables have to be substituted by their anticipations. A closer look at  $\epsilon_t$  reveals that this is the case here. As  $\epsilon_t = u_t - \beta_2 v_t - \beta_3 w_t$ , the use of OLS would yield inconsistent estimates. In essence, this problem requires suitable instrument variables for the anticipations (e.g. Wallis, 1980; McCallum, 1969).

The empirical analysis is over the time period 1963/64 to 1983/84. The data used are from USDA publications. All monetary variables have been deflated by the CPI. Detailed information on the specific income situation of U.S. wheat farmers is not available. As policymakers do not have such information either, a proxy can be used without a major risk of biased estimates. A number of different proxies for Y could be used in principle such as overall farm income or farm income in major wheat producing states. We have elected to use the U.S. share in world wheat exports for the following reasons. The U.S. wheat sector has been very export oriented during the time period analyzed here. The U.S. share in

world exports is commonly perceived as a good indicator of the income situation of wheat farmers. It also makes the international aspects of wheat farming more explicit.

### 3.2 Empirical Results

The instruments for the anticipations  $Y_t^*$  and  $B_t^*$  were estimated via autoregressions. A one-period lag was chosen for each time series based on the significance of the coefficients. The results are summarized in the appendix.

The empirical test of eq. (12) in which  $E_t$  was alternatively used to account for presidential election years gave the following results:<sup>8</sup>

$$(13) P_t = 4.207 + .6362P_{t-1} - .0808Y_t^* - .6049B_t^*$$

$$(2.90) \quad (5.21) \quad (-2.73) \quad (-2.59)$$

$$\bar{R}^2 = .853$$

$$\rho = -.291 (-1.16)$$

$$(14) P_t = 5.376 + .5798P_{t-1} - .1028Y_t^* - .8542B_t^* - .2755E_t$$

$$(5.449) \quad (6.798) \quad (-5.15) \quad (-5.25) \quad (-3.25)$$

$$\bar{R}_2 = .891$$

$$\rho = -.728 (-4.40)$$

Based on the results of the regression analyses, the central hypotheses developed in this paper cannot be rejected. The coefficients for  $Y_t^*$  and  $B_t^*$  have the expected negative signs and are highly significant in both eq. (13) and eq. (14). This is, a relatively low (high) expected share in world wheat exports (proxy for wheat producer income) or relatively low (high) budgetary expenditures result in a comparatively high (low) wheat producer support price, *ceteris paribus*. These results are similar to those obtained in time series analyses of the determinants of agricultural price support in other developed countries such as Japan or the European Community (e.g. Riethmuller and

Roe, 1986; von Witzke, 1986), suggesting that in developed countries fluctuations in agricultural price support over time are predominantly driven by producer incomes and budgetary expenditures caused by price support.

Overall, the results of eq. (14), which also contains  $E_t$ , are statistically somewhat stronger than those of eq. (13). The sign of  $E_t$  is negative and highly significant. All other things being equal, producer price support in wheat is about 27 cents per bushel lower in presidential election years than in other years. This suggests that, during the period analysed here, U.S. wheat producers have not been able to position themselves on the political economic market such that they contain the median or the decisive voter.

As mentioned above, not much is known about the relative political economic success of interest groups over the election cycle. Hence, this study's empirical findings in this regard can not be generalized. It may turn out that the pattern found in this study is typical of many relatively small pressure groups in democracies, but it is as well possible that the fluctuation of small interest groups' relative success over the election cycle depends crucially on various other group characteristics and/or on specific institutional arrangements that may vary from one country to the other, or even within a country from one industry to the other. At any rate, the phenomenon of changing relative success of interest groups over the election cycle certainly deserves some further attention and could lead to deeper insights into the dynamics of political decisions.

The fact that the U.S. wheat producer support is relatively lower in presidential election years than in other years appears to be not



implausible, however. First, wheat producers represent only a very small fraction of the electorate and probably play only a marginal role in the political economic calculus in presidential election campaigns. Second, wheat producers are predominantly located in states that do not have a large number of electoral votes, such as Kansas and some other Great Plains states. Political favors tend to be allocated (or promised to be allocated) to larger states where more electoral votes are at stake such as California, Florida or New York.<sup>9</sup>

#### 4. Summary and Conclusions

As has been shown, the U.S. producer price support in wheat is endogenous rather than exogenous. The results of the empirical analysis suggest that the structure underlying wheat price support was relatively stable during the period analyzed. Producer price support in wheat could be explained largely by policymakers' expectations of the U.S. share in world exports, by price policy related budgeting expenditures, and by presidential election years. The hypothesis that interest groups' relative power changes characteristically over the election cycle could not be rejected by the empirical analysis. All other things being equal, price support in wheat is lower in presidential election than in non-election years. This suggests that U.S. wheat producers have not been able to position themselves on the political economic market such that they contain the decisive voter.

The results of this study have some interesting implications for international interactions of national agricultural policy decisions in various countries. At present, another round of multilateral negotiations on the reduction of international trade barriers under the

GATT. One of the central issues of this round of negotiations is distortions of agricultural trade. While previous GATT rounds have been rather successful in reducing barriers to trade in general, this has not been the case with regard to agricultural trade policy measures and other instruments that distort international agricultural trade.

Two main actors in the Uruguay round of GATT negotiations are the United States and the European Community (EC). Both political entities support their farmers via agricultural price policy. Some authors have argued that the potential benefits of a unilateral reduction in producer price support by the United States (and many other countries) are large and, therefore, the United States would be well advised to pursue this strategy irrespective of the outcome of the GATT negotiations (Paarlberg, 1987). This assessment is certainly valid. Others have argued that only a coordinated strategy of major trading countries would be politically feasible, as a unilateral support price reduction would be counteracted by other trading countries' policy adjustments (Karp and McCalla, 1983; Runge, von Witzke, and Thompson, 1987). An application of the results in this paper to wheat price support by the United States and the European Community, may help to shed some more light on this controversial discussion.

Assume the United States were to phase out producer price support unilaterally. As the United States is a large country in terms of exports in wheat and other important agricultural commodities, the resulting decline in production and exports would increase world market prices, *ceteris paribus*. This in turn would reduce the export subsidies per unit in the Community and thus budgetary expenditures there. As has been shown, declining budgetary expenditures result in relatively higher

agricultural support prices in the EC which in turn would reduce world market prices (von Witzke, 1986). Therefore, in the absence of an agreement on agricultural policy adjustment toward lower support prices, U.S. agriculture would have to carry the main burden of adjustment. The Common Agricultural Policy (CAP) of the European Community would benefit, as the reduced U.S. price support acts to alleviate budgetary pressure on the CAP.

This in turn would lead to a relatively higher support price level there. As the EC is a large wheat producer (and exporter) as well, the growth in exports would reduce the world market price and result in relatively higher adjustment costs in the U.S. wheat industry. The argument with regard to a unilateral price reduction is analogous, mutatis mutandis. As the 1988 declaration by an international group of agricultural and trade economists states: "(I)t is correctly perceived that concerted action on a comprehensive basis to reduce the distortions produced by national farm support policies and illiberal food trade arrangements will substantially reduce the adjustments required for each country's agriculture."

## Footnotes

- 1) For a comprehensive survey see Rausser, Lichtenberg and Lattimore (1982).
- 2) For a discussion of international aspects of national agricultural policy formation see e.g. Wallerstein (1980), Karp and McCalla (1983), von Witzke (1986).
- 3) Rent-seeking activities as in the approaches by Krueger (1974), Bhagwati and Srinivasan (1980) and Bhagwati (1982) are implicitly captured. See below.
- 4) While it may be defensible to neglect most of the other instruments employed in grains and to focus on the producer price only it may be less so with regard to the base acreage for deficiency payments. However, producer price support and base acreage are not unrelated which can be seen to be reflected in eq. 2 (see below).
- 5) As the knowledge of the determinants of agricultural policies is still rather limited, it appears reasonable to restrict the analysis to a less comprehensive problem.
- 6) Or a linear approximation.
- 7) As Nelson (1983) notes with regard to U.S. policymakers' attitudes towards agricultural policy: "A Secretary of Agriculture loses decision making authority when he advocates farmers' interest because a strong farmers' advocate is not a credible decision maker when major trade-offs among non-farm as well as farm constituencies are concerned."
- 8) t-values in parentheses. The wheat support price  $P$  is in \$/bushel; the US share in world wheat exports is in per cent; and budgetary expenditures of wheat price policy are in \$1000.
- 9) I owe this argument to Daniel W. Bromley.

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Appendix: Estimates of the Instrument Variables.

$$(1a) \ Y_t = 23.09 + .4385 Y_{t-1}$$

(2.79)      (2.21)

$$\bar{R}^2 = .151$$

$$(2a) \ B_t = 204,233 + 448.93 B_{t-1}$$

(1.88)      (1.98)

$$R^2 = .123$$



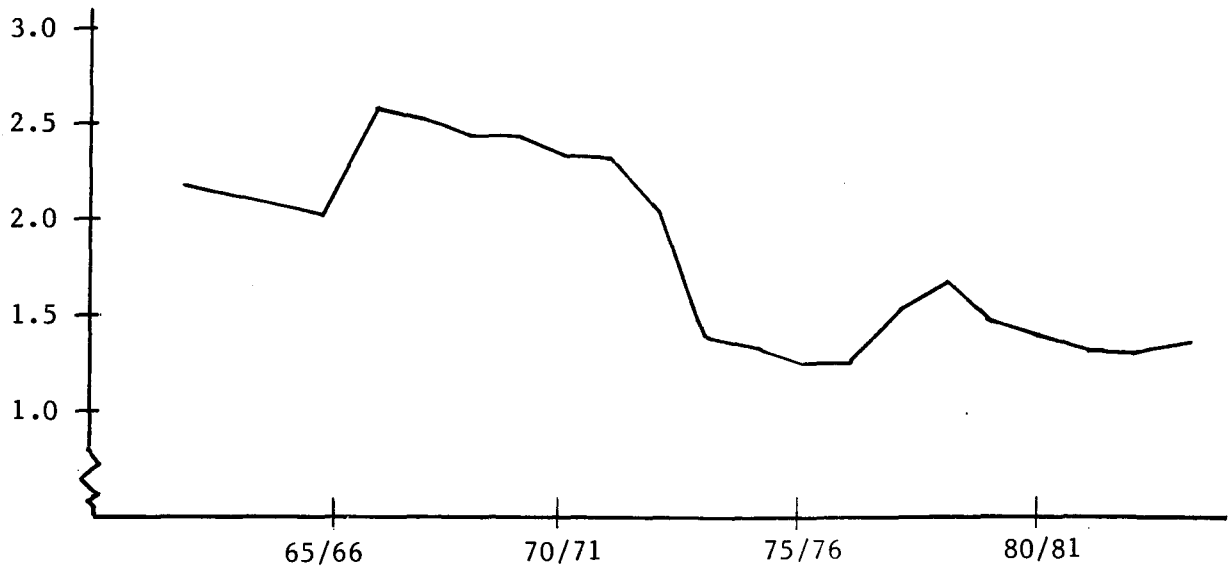


Figure 1. The Real U.S. Wheat Producer Support Price (\$/bushel), 1962/63 - 1983/84.

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