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SUPPLY ANALYSIS FOR CORN IN THE UNITED STATES: THE IMPACT OF CHANGING GOVERNMENT PROGRAMS

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SUPPLY ANALYSIS FOR CORN IN THE UNITED STATES: THE IMPACT OF CHANGING GOVERNMENT PROGRAMS

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Feed grain policy is a cornerstone of commerical farm policy in the United States. Feed grains are the link between the crop and livestock sectors of U. S. agriculture. Remarkable advances in feed grain production technology have more than doubled per acre yields since World War II. This surge in supply has not been fully matched by demand growth. The result has been general downward pressure on feed grain prices, incomes and, through several government programs, acreage. During the post-war period, however, feed grain programs have been altered from year to year to reflect changing short-run views of economic conditions and from administration to administration to reflect changing political views of farm problems and their solutions.

This paper has two objectives: to analyze acreage supply relationships for corn, the major U. S. feed grain, during the 1948-70 period and to develop and test a general theoretical model for evaluating farm commodity program effectiveness. Hence, special emphasis is devoted to empirical measurement and analysis of the effects of government feed grain policy and programs as they have evolved since 1948.1/ Particular attention is focused on the voluntary feed grain programs of the 1960's. This is because the complex provisions of these programs are difficult to capture in empirical measures and because voluntary programs for acreage and output control in the feed grain sector appear to be the most likely form of future policy.2/

After a few comments about the economic setting in which the feed grain programs have operated, the analytical framework underlying the empirical measurements is developed. Then the results of applying this framework to the U. S. corn sector are presented and discussed.

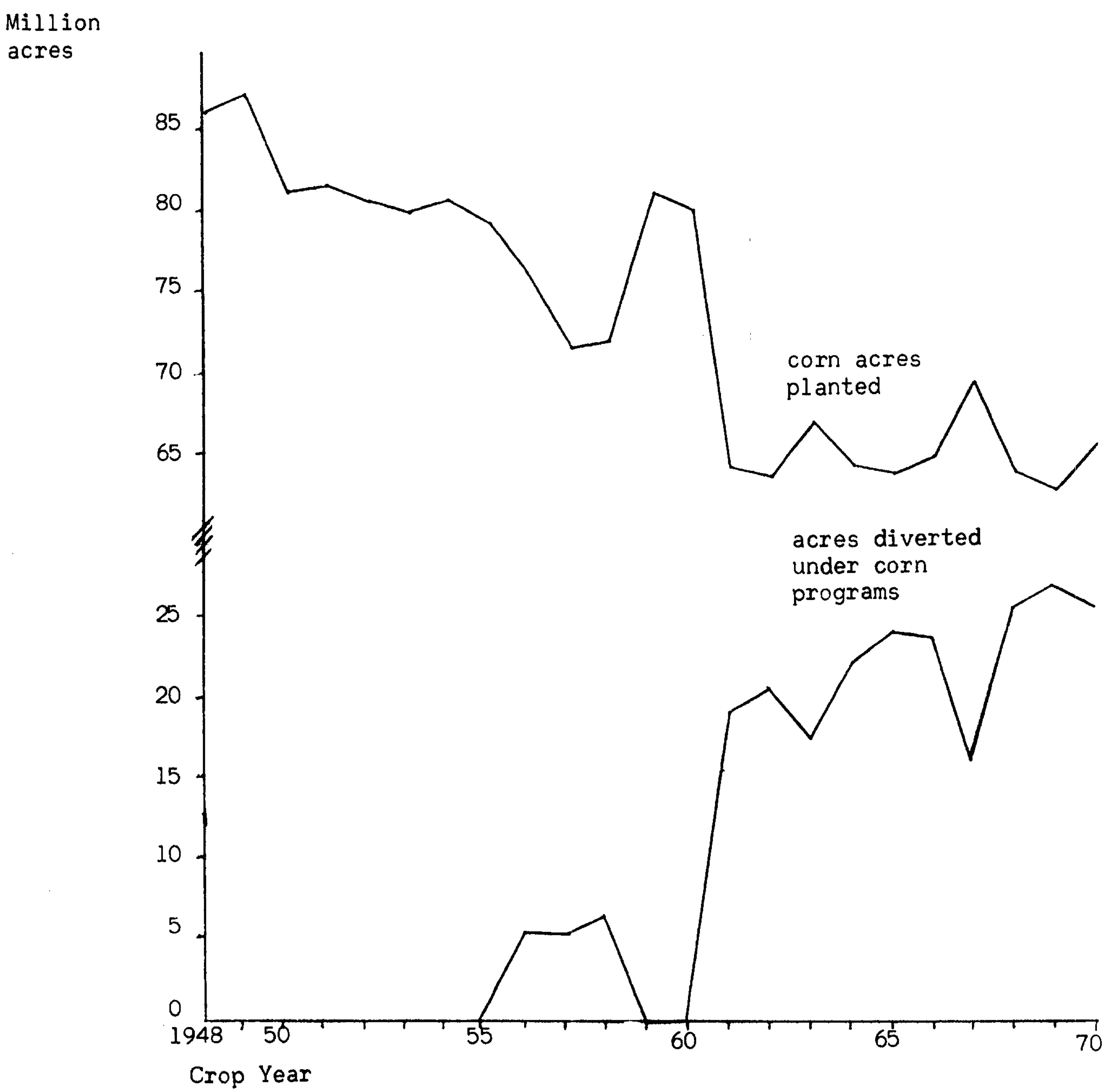
The Setting

Corn programs during the 1948-70 period assured minimum prices through loans to farmers complying with program provisions. Some form of acreage restriction was applied in all but seven years. Besides loans, qualifying farmers obtained additional payments as incentives for participation during 1956-58 and 1961-70. These supplemental payments have been either per-bushel "bonuses" on corn produced (called support payments) or "rent" for idled land (called diversion payments). In some years varying degrees of program participation were available to farmers. Thus, within a specified range, producers could choose how much land to divert from corn production. For specifics and details of the annual feed grain programs a number of official USDA publications can be consulted [7; 8, pp. 26-36; 9; 10].

Other feed grains and soybeans are major competitors of corn both for production resources and markets. Soybean acreage expanded sharply during the study period while oats acreage declined. Trends are less evident in sorghum and barley plantings. However, yearly fluctuations were substantial during the fifties, as acreage restrictions were periodically applied to corn but not to these last two competitive crops.

Land diversion from corn to conservation or other approved uses also competes with corn plantings. This substitution is clearly seen in Figure 1. The figure additionally reveals that diversion has been sizable in

Figure 1: U. S. Corn Acres Planted and Diverted, 1948-70.



recent years. The total corn acreage diversion exceeded barley acreage and sorghum acreage in most years since 1961 and oats acreage in five of the ten years.

The Analysis

A very general statement of the economic model underlying this investigation is:

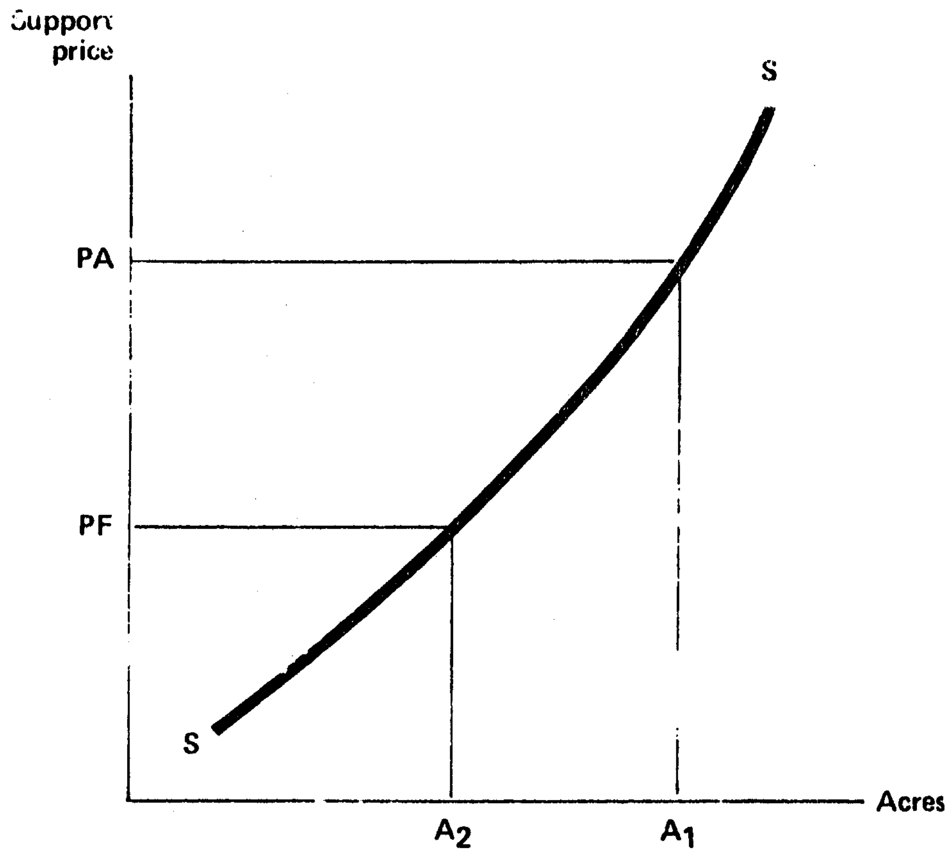
$$(1) \qquad A = f(G, M, Z)$$

where A is corn acreage planted in United States; G represents government policy provisions such as price support loan rates, direct support payments to growers, and acreage diversion payments; M consists of market influences; and Z includes all other supply determinants and random effects.3/

Theoretical Framework

First consider the components of the government policy term, G, in equation (1). In an earlier paper by Houck and Subotnik, the notion of a weighted support rate for policy-influenced crops was developed [4]. This concept was introduced as a means of expressing both acreage restrictions and announced price supports together in a single term subject to empirical measurement or estimation. Figure 2 illustrates this idea. Assume that S is a static acreage supply function for a crop at various price support levels. Acreage is measured along the horizontal axis and support price along the vertical axis. (For simplicity, assume that the position

Figure 2.



of S for a given crop year is affected by previous market prices but not current ones.) At the announced price support of PA, producers would plant A_1 if there were no restrictions or conditions attached to the price support. But if policy makers wish to reduce acreage to, say, A_2, they could drop the support rate to PF or attach acreage-restricting conditions to obtaining the higher PA so that, on balance, acreage planted falls to A_2. Then PF is the weighted support rate.

The analytical and empirical problem is to find the appropriate weight or adjustment factor to apply to PA to bring it to PF for any given set of program provisions. This adjustment factor, however calculated, is a summary measure of the acreage restricting features of a particular program. Imagine that

$$(2) \qquad PF = rPA$$

where PA is the announced support rate available to either voluntary or mandatory program participants; r is the adjustment factor expressing the acreage restrictions in the program; and PF is the weighted support rate. Generally, the range of r is between 0 and 1.0. If no restrictions are attached to obtaining PA, then r is equal to 1.0. The tighter the restrictions, the closer r will be to zero.

The existence of direct payments, as incentive for program participation, adds further complications. Both support payments and diversion payments can be introduced in at least two ways. One way is to assert that payment rates influence r. The larger the payment rate the smaller r becomes and, hence, the smaller the acreage actually planted; and _vice versa_. Another way is to assert that these payments act as shifters of the function S. An increase in payment rates shifts S to the left, and a decrease shifts S to the right. In this paper support payments are handled in the first manner and diversion payments in the second. This decision was based on the treatment of support payments in the voluntary programs up to 1966. Before then, support payments were tied to "normal" production on all planted acreage. Thus, the producer's level of support payments (above the loan rate) was a function of his acreage planting decision. Diversion payments were related explicitly to idled land in all annual programs.[4/]

Policy makers are assumed to alter program provisions from year to year to either encourage or discourage participation and thus influence corn output in line with production goals. As incentives for participation are changed, farmers move in and out of the program and participants divert more or less land. As program provisions change from year to year, changes can occur in PA, in r, and in the diversion payment schedule. Together these factors determine PF and the position of S. Once these are set, the acreage A is determined, given the underlying price-acreage relationship embodied in S.

Another government policy decision which is assumed to have a major impact on corn acreage is the price support loan rate for soybeans. Soybeans and corn compete for available production resources, including land, in the major corn-growing regions of the United States. With all else constant, a higher loan rate on soybeans will reduce corn acreage and a lower loan rate will stimulate corn acreage.

Next, consider the components of the term, M, in equation (1). For the purposes of this investigation, the estimated market relationships were not complex. Given a set of government program decisions for crop year t, the planted acreage of corn was assumed to depend upon the open market corn price in the previous crop year, t-1, and, in some specifications, the acreage of grain sorghums planted in year t.

The net effect of all other supply determinants and random effects, Z in equation (1), is assumed to be a mean-zero random variable with constant and finite variance over the sample period. Its assumed existence permits the use of ordinary least squares for measuring individual effects of the specified variables.

Empirical Measurement of Policy Variables

Two variables reflecting corn program provisions were calculated for each crop year in the 1948-70 period.[5/] The first is an indicator of the weighted price support rate (PF), calculated according to equation (2). Because the adjustment factor (**r**) cannot be observed, the proportion of the base acreage permitted for corn planting by program participants was selected as a proxy.[6/] The second policy variable is a measure of the supply shifter which reflects diversion payment rates (DP). The values of DP reflect changes in payment levels and eligible diversion acreage. An increase in either factor, holding the other constant, raises the value of DP and thus reduces corn acreage by shifting the corn acreage supply function to the left.

Programs provided for a range of permitted planting and eligible diversion acreage during most years in the 1960's. This was accounted for by averaging PF and DP for minimum and maximum permitted planting and diversion. The average is the simplest way to enable the policy variables to move when either the maximum or minimum program provisions were altered. Different program provisions in the 1950's necessitated modification of the calculations of r and DP. Similar lines of reasoning were applied and the computations are as nearly comparable with the later years as possible. Figure 3 compares PF with PA and the loan rate.[7/]

Table I. Announced support prices, calculated weighted support rates and diversion payment rates, dollars per bushel, 1948-1970.

	Announced Total Support Price (PA)	Weighted Support Rate (PF)	Diversion Payment Rate (DP)
1948	1.44	1.44	0
1949	1.40	1.40	0
1950	1.47[a]	1.15	0
1951	1.57	1.57	0
1952	1.60	1.60	0
1953	1.60	1.60	0
1954	1.62[a]	1.30	0
1955	1.58[a]	1.33	0
1956	1.50[a][b]	1.16	.043[d]
1957	1.40[a][b]	.96	.043
1958	1.36[a][b]	.86	.052
1959	1.12	1.12	0
1960	1.06	1.06	0
1961	1.20	.84	.192
1962	1.20	.84	.192
1963	1.25[c]	.88	.112
1964	1.25[c]	.81	.180
1965	1.25[c]	.81	.180
1966	1.30[c]	.80	.098
1967	1.35[c]	.99	0
1968	1.35[c]	.83	.091
1969	1.35[c]	.83	.091
1970	1.35[c]	.83	.081

Table I (continued)

a/ Loan rate in commercial corn area. Rates for non-commercial areas were \$1.10 for 1950 and \$1.22, \$1.18, \$1.24, \$1.27, \$1.02 for 1954 through 1958, respectively.

b/ Loan rates of \$1.25, \$1.10, and \$1.06 for 1956, 1957 and 1958, respectively, were available for non-compliers in the commercial area. These values did not enter into calculations for this study.

c/ Direct support payments are included. They are 18¢ for 1963, 15¢ for 1964, 20¢ for 1965, and 30¢ each for 1966 through 1970. The 30¢ payment for the last five years applied only to production on 50 percent of the allotment.

d/ This value was omitted from analyses of corn acres planted since planting occurred before the program provisions were announced.

Figure 3. U. S. Average Total Support Rate and Weighted Support Rate, 1948-1970, and Loan Rate, 1962-1970.

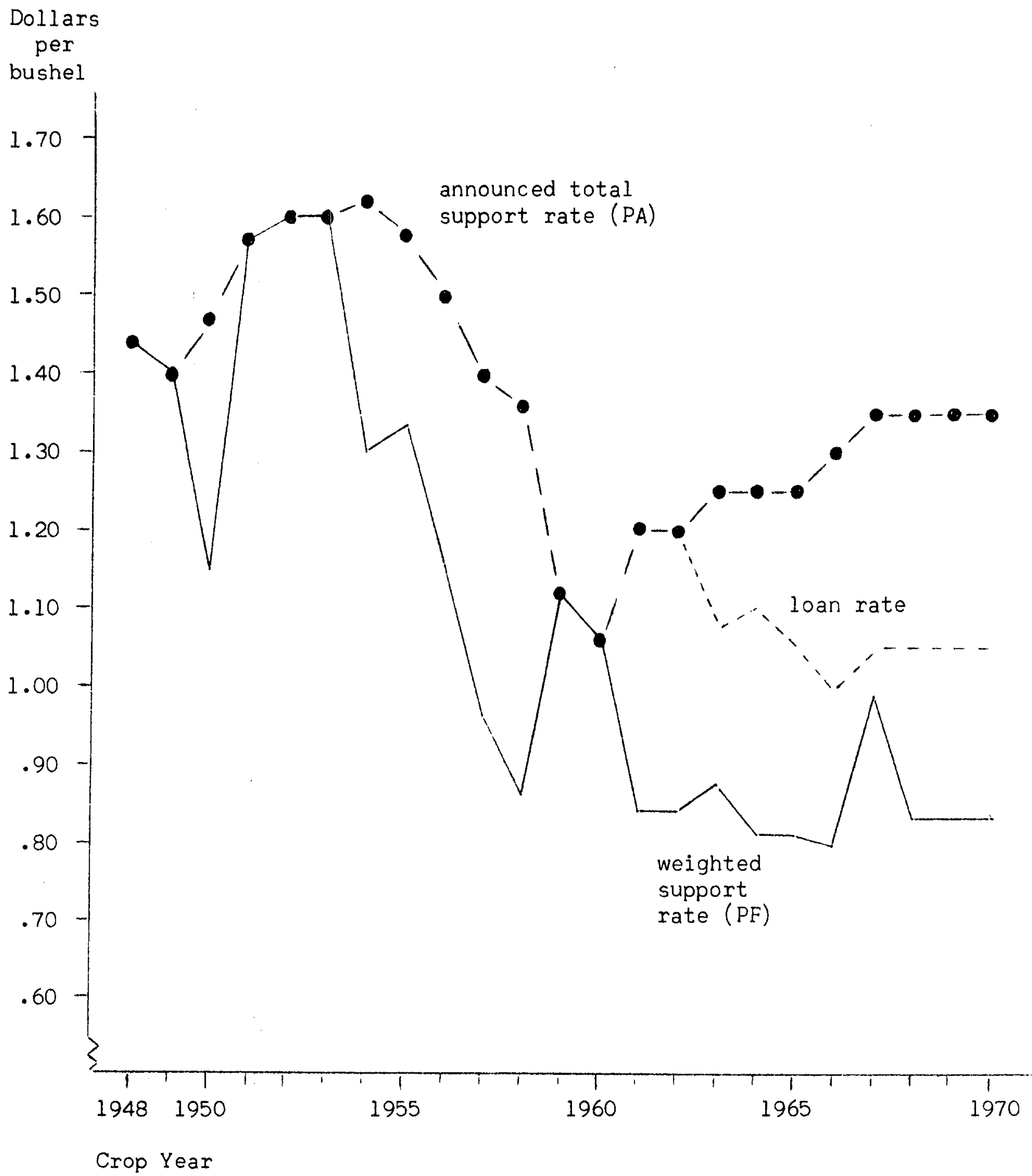


Figure 4 illustrates the relationships among PF, DP, and acreage planted. The inverse relationship between PF and DP indicates that adjustments in program features have been complementary. That is, increasing incentives to plant corn have corresponded with decreasing incentives to divert land from corn production and vice versa. Both the downward trend in acres planted and yearly changes in plantings are associated positively with PF and negatively with DP.

The validity of DP as a supply-inducing price for land diversion was established by estimating corn acres diverted as a function of DP. Equation (3) depicts the results of a least squares regression of first differences for the two variables for the 1956-70 period.8/

$$\Delta AD = 1{,}290 + \underset{(10.5)}{82{,}183}\, \Delta DP \qquad (3)$$

$$R^2 = .90$$

where

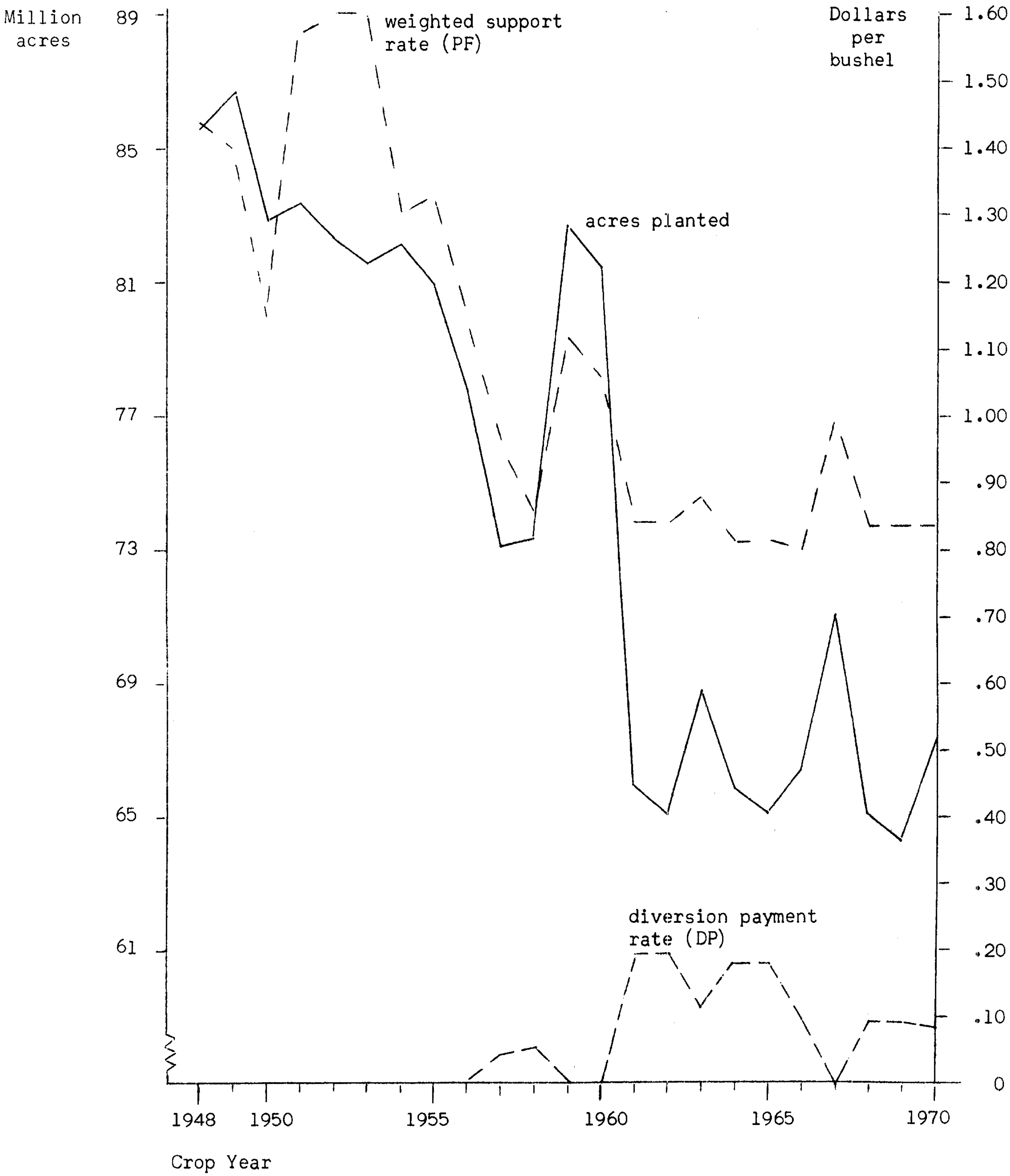
AD = Corn acreage diverted under the feed grain program, in thousand acres

DP = Diversion payment rates, weighted by eligible diversion acreage, in dollars per bushel

The t-value is in parentheses.

Estimates in Equation 3 indicate that acres diverted are increasing by nearly 1.3 million yearly due to unmeasured factors, but annual changes in diversion are closely associated with DP. A 10-cent increase in DP was associated with an increased diversion of 8.2 million acres.

Figure 4. U. S. Corn Acres Planted, Weighted Support Rate and Diversion Payment Rate, 1948-1970.



Empirical Results

Corn acreage supply functions for the United States using these policy variables were estimated by ordinary least squares. The statistical estimation encompasses 21 crop years, from 1949 through 1969. The discussion in this section of the paper begins with two special considerations which have important implications for the estimated functions. One is the historical relationship between market prices for corn and the variable PF. The other is the relationship in both acreage and policy between corn and grain sorghum.

Market prices versus support rates

In supply analyses for agricultural products, lagged market prices frequently are assumed to be the relevant supply-inducing price. In the theoretical framework of this paper, such a relationship between lagged market price and corn acreage was postulated. However, the presence of government price supports makes the net relation between lagged market prices and acreage difficult to isolate.

One reasonably successful attempt to measure separate effects of market prices and support prices involved acreage supply analyses for soybeans [4]. The results generally indicated greater acreage responsiveness to lagged market prices than to current price supports. This is not surprising since, during the period studied, soybean market prices exceeded support prices in most years.

A contrasting situation exists for corn. Since 1948, the market price exceeded the loan rate (or loan plus support payment) in only two years. Hence, as might be expected, variations in the weighted support price variable, PF, was found to explain variations in corn acreage better than the lagged market price. Moreover intercorrelation between these two independent variables reduced the significance of both when they were entered in the same regression equation. Owing to these difficulties, the statistical relationship between the two price series was examined for the 1949-69 period, equation (4).

$$(4) \qquad PF_t = .1717 + \underset{(4.9)}{.8983}\, P_{t-1} - \underset{(3.4)}{.0185}\, T$$

$$R^2 = .86 \qquad \bar{s} = .11$$

where

PF_t = support rate for corn in crop year t, dollars per bushel

P_{t-1}= market price of corn received by farmers in crop year t-l, dollars per bushel

T = linear trend (1949=1, 1950=2, etc.)

$\bar{s}$ = standard error of the estimate

The values in parentheses are t-values.

According to this estimated equation, a given change in the market price was associated with a similar change in PF in the next crop year about 90 percent as large as the market price change, adjusted for a negative secular trend.

These results suggest a possible interpretation of the policy decision-making history for feed grains. One could argue that policy makers adjust the terms of the price support program for the coming crop year largely on the basis of immediate past experience. For instance, a large crop in year t-l depresses the market price, P_{t-1}. Policy makers desire to reduce production, hence supplies, for the following year. Reducing PF_t is one tool to achieve this end.

Based on these results, the intercorrelation problem, and the analytical emphasis on policy variables, lagged market prices do not appear in the following supply equations. In future work this approach may be inappropriate if the influence of market prices continues to strengthen.

Corn-sorghum acreage substitution

Prior to 1961 sorghum acreage was not restricted. A farmer could plant any amount he wished and still obtain a sorghum price support loan. Also, farmers who reduced corn acreage as required for corn support loans could plant sorghum without restriction. During the years in which these liberal provisions applied, sorghum acreage increased sharply in some principal corn areas, especially in the southwestern portion of the Corn Belt and Southern Plains states.

Beginning with the 1961 Feed Grain Program, corn price supports could no longer be obtained by farmers if sorghums were planted on acres diverted from corn. Furthermore, sorghum acreage was restricted as a qualification for sorghum supports. These policy changes were hypothesized to alter the corn-sorghum relationship at this point in the study period.

Three analytical approaches were explored to relate sorghum and corn acreages. The basic assumption is that corn and sorghum acreage were much more substitutable before 1961 than after. Sorghum acreage rather than market or support prices were employed because of the tie between sorghum and corn support prices and programs. A fixed relationship between the two prices has been maintained by policy makers. It was decided therefore that acres planted would reflect more clearly whatever substitution existed.

The first approach involves including sorghum acreage as an independent variable prior to 1961 and then setting the variable equal to zero in the 1961-69 period. The second approach is similar except that from 1961 to 1969 sorghum acreage was set at the mean value of the previous 12 crop years. The third approach involves splitting the data into two periods and then estimating the supply equations separately. For this purpose, the 21-year study period was split between 1959 and 1960 when neither corn nor sorghum acreage restrictions applied. The first of these two "restriction free" years was included with the first period and the second with the latter period. The results are presented as part of the supply analyses, which follow.

Supply equations

Using the analytical model, the policy variables, and the sorghum-corn relationships discussed in previous sections, several nation-wide corn acreage supply equations were estimated by least squares. The results of six of these estimations are shown in Table II. Five of the equations employed actual values of the variables and one employed first differences.

Generally speaking, the signs of the estimated coefficients are consistent with prior expectations, the estimated coefficients are reasonably large relative to their calculated standard errors, and the overall fit of the equations, indicated by R^2, are good.

Corn program policy variables, PF and DP, contribute importantly to the explanation of changes in acreage planted. A 10 cent increase in PF results in an estimated 939 to 1,026 thousand acre increase in planted acreage. The estimated effect of DP is about four times greater. A 10 cent increase in DP is associated with a 4.1 to 4.5 million acre decrease in planting. When interpreting the relative effects of these constructed variables, recall that PF values are considerably greater than those of DP. Thus the influence on corn acreage of PF exceeds that of DP. However, if the effects of PF and DP are assumed to be equal but in opposite direction, the use of the PF-DP variable is appropriate. When PF-DP is used, the value of the resulting coefficient lies between the coefficients on PF and DP, estimated as separate variables. Planted acreage would increase by 1.9 million if PF-DP increased by 10 cents, according to equation (II-3). Of course, this could result from either an increase in PF, a decrease in DP, or some combination of the two.

Table II

Estimation of U.S. Corn Acreage Planted, 1949-69
(regression coefficients and t-values)

Dependent Variable = A

Equation	Time Period	No. of Observations	Constant	PF	DP	PF-DP	PSS	AGM	AGO	DV	T	R^2	$\bar{s}$
II-1	1949-69	21	100,256.34	10,226.48 (3.8)	-40,894.56 (6.7)		-11,313.21 (6.4)	-.30 (3.1)			-319.61 (3.4)	.983	1,188.92
II-2	1949-69	21	100,320.04	10,263.74 (3.6)	-41,239.72 (5.0)		-11,377.19 (5.5)		-.29 (2.6)	-5,287.55 (1.5)	-325.72 (2.4)	.983	1,230.46
II-3	1949-69	21	93,183.44			18,558.87 (9.1)	-14,321.24 (6.7)	-.20 (1.6)			-169.77 (1.5)	.968	1,603.65
II-4	1949-59	11	101,880.04			15,285.16 (6.9)	-15,167.65 (7.1)	-.34 (3.1)			-189.61 (1.2)	.964	1,030.12
II-5	1960-69	10	67,564.18			27,049.12 (9.0)	- 5,242.09 (1.7)				-491.34 (2.6)	.960	1,270.20

First Differences of All Variables

Equation	Time Period	No. of Observations	Constant	PF	DP	PF-DP	PSS	AGM	AGO	DV	T	R^2	$\bar{s}$
II-6	1949-69	21	-448.88	9,386.36 (4.3)	-45,183.79 (7.4)		- 9,932.47 (5.4)	-.25 (2.2)				.939	1,306.33

Table II (continued)

Variable Descriptions

A	=	U. S. acreage of corn planted, in thousands
PF	=	U. S. average corn loan rate (plus direct support payments, 1962-69), weighted by acreage restriction requirements, dollars per bushel
DP	=	corn acreage division payment rate, weighted by eligible diversion acreage, dollars per bushel
PF-DP	=	PF minus DP
PSS	=	U. S. average soybean price support loan rate, dollars per bushel
AGM	=	U. S. acreage of sorghums planted for 1949-60 and the mean of 1949-60 acreage for 1961-69, in thousands
AGO	=	U. S. acreage of sorghums planted for 1949-60 and 0 for 1961-69, in thousands
DV	=	0 in 1949-60 and 1 in 1961-69
T	=	linear trend (1949 = 1, 1950 = 2, etc.)
$\bar{s}$	=	standard error of the estimate

The values in parentheses are t-values of the regression coefficients.

Figure 5. U. S. Corn Acres Planted, Actual and Estimated, 1949-1969.
(Equation II-2)

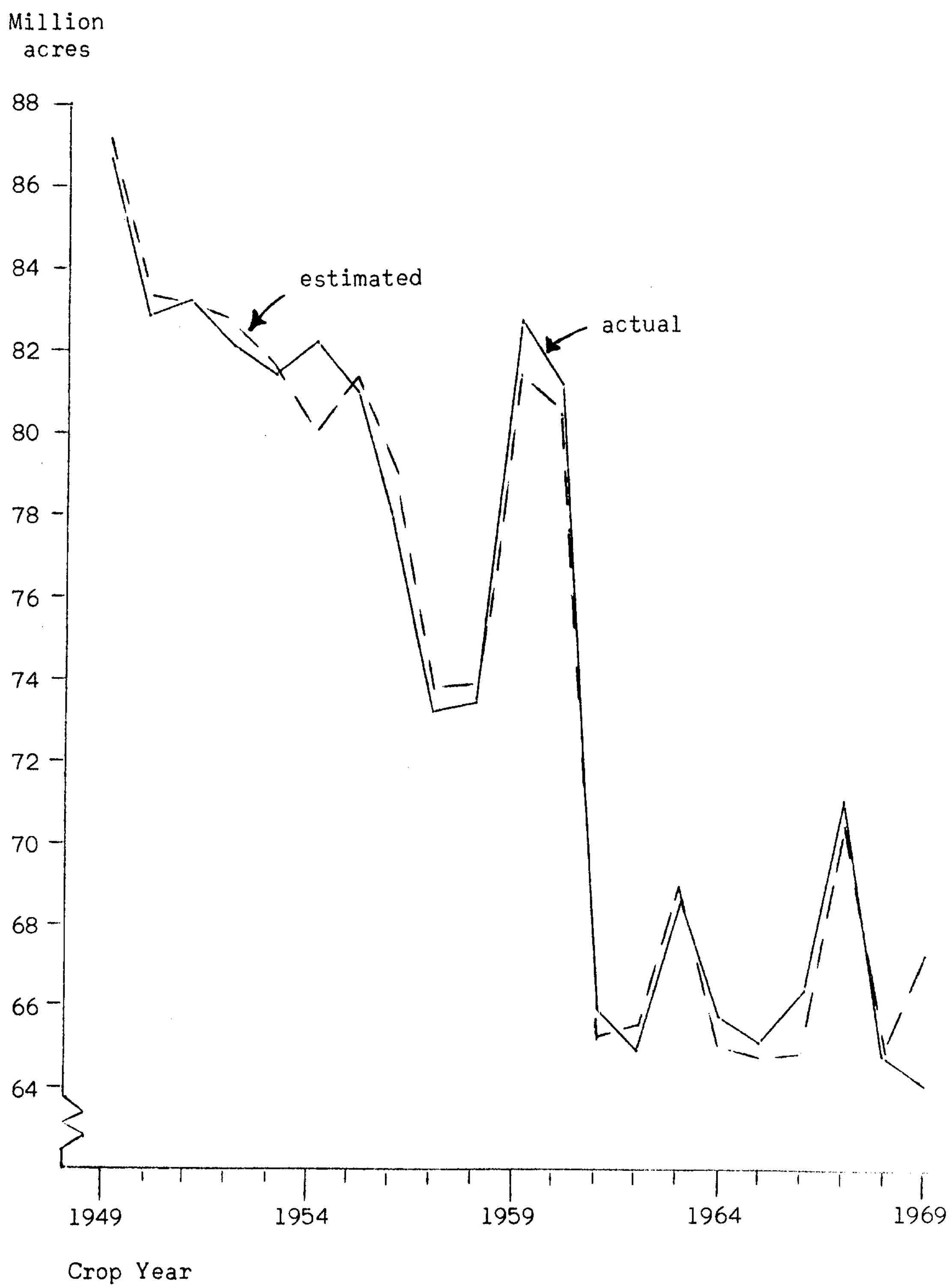
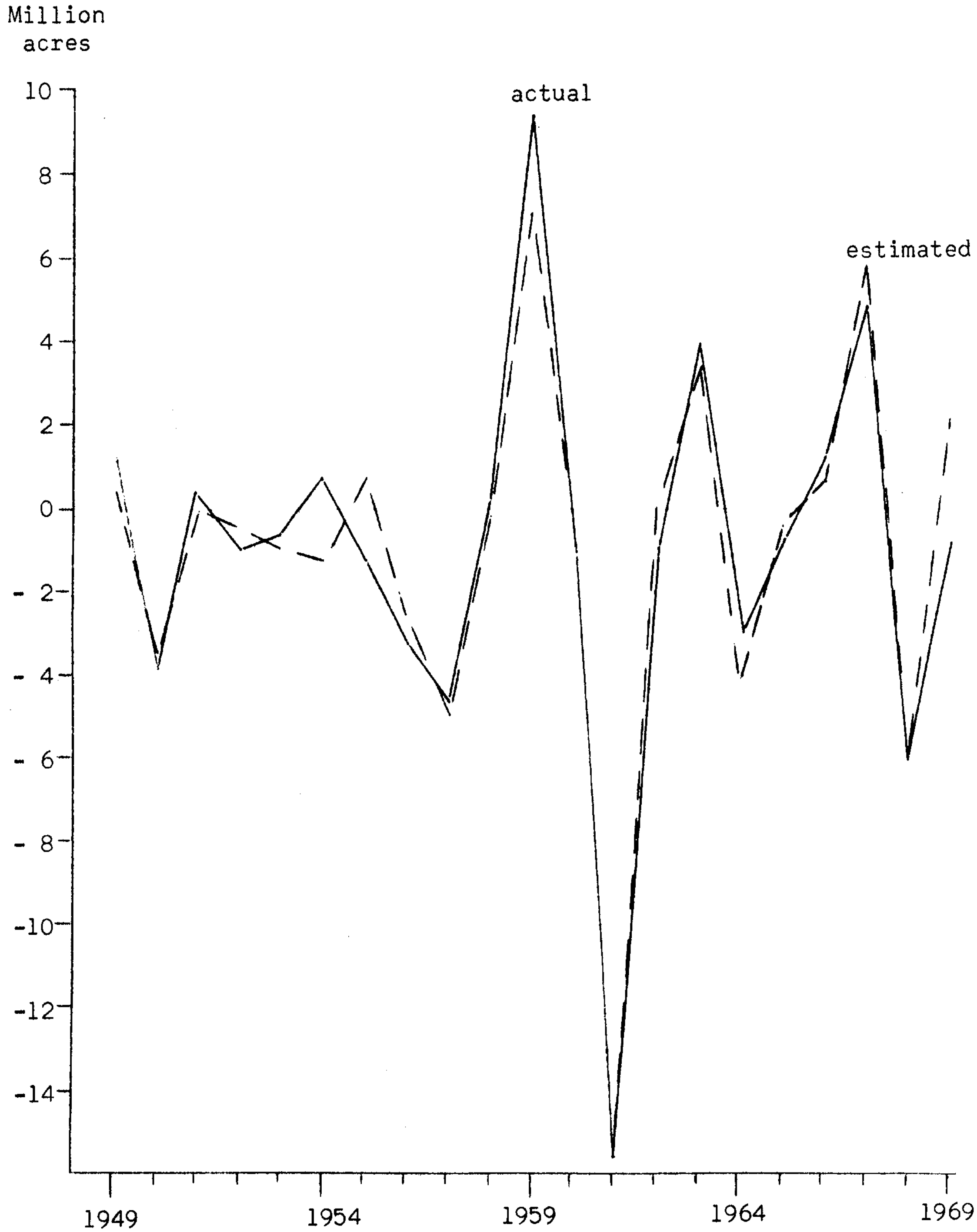


Figure 6. Annual Change in U. S. Corn Acres Planted, Actual and Estimated, 1949-1969.
(Equation II-6)



The separate estimation for 1949-59 and 1960-69, equations (II-4) and (II-5), reveal different effects in the two periods. The impact of changes in the policy variables is greater during the sixties when acreage diversion payments were more common. Low t-values were obtained when PF and DP were estimated separately for 1960-69 probably due to intercorrelation. Coefficients of PF and DP estimated for 1949-59 were approximately the same magnitude as those reported for the entire 21 years.

The magnitude of the coefficients of PF, DP, and PF-DP remain relatively constant in all specifications. Note that the effect of DP on acreage planted, Table II, is about one-half its opposite estimated effect on acreage diverted, equation (3). This is consistent with observations by USDA officials that, under the past programs, more land was diverted than the actual reduction in feed grain acreage. They call this phenomenon "slippage"[2].

Soybeans compete with corn for production resources since corn land is also generally desirable for growing soybeans. The support price of soybeans is entered in the corn supply model to measure this substitution. During this study period no acreage limitations were placed on soybeans, therefore no weighting was necessary and PSS is the announced loan rate. As estimated for the 21 year period, a 10-cent increase in PSS leads to a 1.0 to 1.4 million acre decrease in corn plantings. Estimates of PSS coefficients for the shortened time series vary between the two periods. The PSS coefficient for 1960-69 is less than half the size of other PSS estimates. However, its low t-value suggests that it is relatively less reliable than the other estimates.

Grain sorghum is another important substitute for corn. As mentioned, changes in corn and sorghum programs midway in the study period suggested the need for a detailed examination of this relationship. Sorghum acreage variables AGM and AGO assume substitutability with corn acreage prior to 1961 but not from 1961 to 1969. The results are nearly identical from both variables. They indicate that a one acre increase in sorghum planting during 1949-1960 reduced corn acreage by 0.2 to 0.3 acres. Results from the split time series, equation (II-4) are similar. This means that either AGM or AGO is an acceptable approach to the sorghum-corn substitution problem.

A dummy variable was added to equation (II-2) in which sorghum acreage was set at zero for 1961-69. Its coefficient, -5,287.55, is subtracted from the constant for the years 1961-69. The t-values for regression coefficients in equation (II-2) are smaller than those in equation (II-1). Intercorrelation between AGO and DV in equation (II-2) may be responsible. The simple correlation coefficient (r) is -.94. These smaller t-values, along with a smaller standard error ($\bar{s}$), indicate that equation (II-1) may be a slightly more reliable estimator.

A trend variable is included to account for changes occurring through time which are not reflected by the other variables. The estimated coefficients indicate an annual decrease of 170 to 326 thousand acres throughout the 21 year period. Estimates for the split series indicate that the decline in corn acreage associated with trend during the sixties was more rapid than in 1949-59.

Equation (II-6), the first difference model, in effect removes from all variables whatever linear trend is present. The constant term reflects the trend influence. The annual decrease due to trend was 449 thousand acres, larger than the effect in the models using actual values. Coefficients for the remaining variables were changed only slightly by the first difference transformation.

Concluding Comments

The major objective in this paper was to formulate and estimate U. S. corn acreage supply functions for the 1949-69 period. The principal focus was on the development and use of variables to reflect the effects of government price support and acreage restricting programs during this period. Support rates were adjusted to account for acreage controls in various annual programs. Diversion payments available to program participants also were introduced. Price supports for soybeans and measures of corn-sorghum acreage competition were employed to capture substitution relationships among the major competitors on the supply side.

Generally speaking, the variables used and the equations estimated provided encouraging results. More than 95 percent of the variation in U.S. corn acreage during this 21-year period can be associated with the selected variables. The equations and the variables are summarized in Table II. Although the estimation was based on data from 1949 to 1969, equation II-1 (Table II) was used to "predict" 1970 and 1971 corn acreage. Actual data on the independent variables were inserted in the equation and the solutions for corn acreage computed.

The estimated value was 67,409 thousand acres and the actual 1970 corn acreage was 67,352 thousand acres. For 1971, estimated and actual values were 72,148 thousand acres and 74,651 thousand acres respectively. The estimate, however, does not account for program changes in 1971 that tend to increase planting compared with previous years. Adjustments to reflect discontinuation of incentives for total acreage diversion by small farms and to account for less restrictiveness on corn planting would move the estimate quite close to actual 1971 acreage.

Footnotes

University of Minnesota Agricultural Experiment Station Scientific Journal Series, Paper No. 7817. Helpful suggestions were offered by W. W. Cochrane, K. L. Robinson, G. E. Brandow, this journal's reviewers, and several staff members of the Economic Research Service, USDA.

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1/ A recent USDA study of the economic factors affecting acreage diversion under the voluntary feed grain programs of the 1960's is quite closely related to this paper; see [6].

In an earlier study, less closely related to this research, Bray and Watkins analyzed the impact of corn price support programs on the rate of adoption of technological improvements in corn production; see [1].

Hushak analyzes the features of the voluntary corn programs within the context of welfare economics; see [5].

2/ The Agricultural Act of 1970 continues voluntary production control programs through 1973. Payments for diversion are determined like programs in the 1960's but greater flexibility in cropping patterns is allowed.

3/ The analytical framework and empirical measurements represent only one of many possible ways of investigating corn acreage variations. For instance, economic and other factors affecting changes in per acre yields are not examined in this paper. Yield changes are assumed to be determined independently of acreage changes. For a comprehensive review of trends and developments in corn yields see [3, pp. 28-32].

4/ Feed grain programs have tied eligibility for support payments to acreage cut backs, but this is not necessary conceptually nor, in fact, true for all commodities (e. g. wool). Hence support payments and the loan rate are merely two parts of the announced support price, PA, in equation (2) and Figure 2. Beginning with the 1966 program, however, corn support payments have not applied to total output allowed under the program. Therefore, since 1966, it is just as logical to consider support payments as rent for required land diversion as supplemental payments for production. This implies that both support and diversion payments may be viewed as shifters of S. This latter view may be more valid for future analyses if support payments continue to be restricted to a portion of planted acreage or are made subject only to a total acreage limitation as in the Agricultural Act of 1970.

5/ For this discussion and the analyses which follow, some special program features were not taken into account. These include modifications for small producers (those with less than 26 acres of feed grains) and cross-compliance provisions among various feed grains, wheat, and soybeans. Although these aspects are important for some producers and areas, their aggregate effect was assumed to be reasonably constant or negligible.

6/ See [4, p. 100] for some implications of this method of estimating r.

7/ The construction of the policy variables, PF and DP, of necessity are arbitrary. Many defensible methods of estimating the adjustment factor, r, and the diversion payment measure, DP, surely could be devised. Several have been suggested by reviewers and colleagues. Perhaps the most useful way to regard these constructed variables is to view them as indicators or proxies for their theoretical counterparts and not as attempts to measure them precisely. However, the empirical evidence presented here suggests that these variables as computed, contribute appreciably to the explanation of changes in corn acreage. Details of the calculations may be obtained from the authors.

8/ For a more detailed approach to this general idea see the Miller and Hargrove report; [6].

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