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## ABSTRACT

Peanut Market Structure: An Analysis of its' Influence Upon Peanut Policy Trade-offs.

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Analysis of the potential to discriminate between the edible and non-edible peanut markets indicates that opportunities to reduce treasury costs exists through peanut programs that conduct market discrimination. Consideration of market discrimination capabilities in administration of the current peanut program could reduce treasury costs while raising farm income.

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## PEANUT MARKET STRUCTURE: AN ANALYSIS OF ITS' INFLUENCE UPON PEANUT POLICY TRADE-OFFS

Treasury costs of the federal peanut program have grown steadily since it was enacted in the late 1950's. They have remained relatively high during recent years when other commodity program costs have dropped to nearly zero. This, plus the fact that peanuts have not been shifted to a target price program (as have many other crops) has drawn attention to the need for re-evaluating the current peanut program. This paper will attempt to assist efforts to re-evaluate the current peanut program by analyzing: a) the past effects of the peanut program; b) policy trade-offs obtainable with the current program; and, c) the implications of a market discriminating peanut program (two price program) versus a non-discriminating peanut program (one price program).

### The Peanut Market and Current Peanut Program

Previous studies of the peanut sector have focused on three forms of demand for peanuts: edible demand; demand for peanuts to crush; and, export demand [Badger and Plaxico, Fleming and White, Jellema, Regan, Song, et al.]. These studies adequately document that the demand for peanuts can be separated into two distinct markets, an edible market and non-edible market, with the latter non-edible market consisting of crush and export demand. Empirical results of these studies show that non-edible demand for peanuts is substantially more price elastic than edible demand for peanuts.<sup>1/</sup>

The current peanut program consists of acreage quota and price support operations. The program supports peanut prices at a level between 75 and 90 percent of parity via a loan program, and establishes a minimum national acreage allotment of 1.6 million acres. Peanuts not sold for edible use at the established support price level are acquired by the

Table 1. Historical Quantities, Prices and Costs Associated With Peanut Supply and Demand, 1970-75.

1/

Year	Peanut Production (mil. lbs.) (1)	Edible Demand (mil. lbs.) (2)	Crush (mil. lbs.) (3)	Export (mil. lbs.) (4)	Crushing Price (¢/lb.) (5)	Estimated Variable Cost of Production (¢/lb.) (6)	Support Price (¢/lb.) (7)	Total Farm Revenue (1 x 7) (8)	CCC Losses and Expenses (mil. \$) (9)
1975	3,747	1,715	1,575 <sup>4/</sup>	675	<sup>2/</sup>	9.2	19.7	738.2	<sup>7/</sup>
1974	3,668	1,650	575	750	<sup>2/</sup>	8.9	18.3	671.2	3.0 <sup>6/</sup>
1973	3,474	1,840	683	711	12.0	7.7 <sup>3/</sup>	16.4	569.7	5.0 <sup>5/</sup>
1972	3,275	1,694	850	521	8.8	6.9 <sup>3/</sup>	14.3	468.3	58.0
1971	3,005	1,623	814	522	6.5	6.5 <sup>3/</sup>	13.4	402.7	97.0
1970	2,979	1,580	799	290	6.6	6.3 <sup>3/</sup>	12.8	381.3	66.3

1/

Sources: U.S. Department of Agriculture: Fats and Oils Statistics. Prices for crushing peanuts are from USDA, ERS unpublished sources. Estimated variable cost of production are from Walter and Garst, USDA, ERS, CED.

2/

Since the origin of the "toll crush" program in 1974 crushing prices cannot be determined in a comparable manner.

3/

Backward extrapolations of 1974-76 USDA national average cost of production estimates were made based on local peanut production budget data.

4/

A large increase in peanut crushing occurred in 1975 due to increases in "toll crushing."

5/

Abnormally strong demand for peanut meal occurred in 1973 due to a shortage of high protein feeds. This resulted in low government costs for the peanut program in 1973.

6/

Does not include losses on toll crushing.

7/

Not available.

Commodity Credit Corporation (CCC). Since peanuts are not readily storeable the CCC generally resells its purchases in the export market or domestic crushing market within one crop year. In the past export and crushing prices have been approximately one half of the support price, hence the CCC has encountered considerable expenses in its peanut price support operations.

Nearly one-half of all peanuts produced have gone into the edible market (Table 1) with most of the remainder being purchased by the CCC for resale either in the crush or export market. The crush price for peanuts has been approximately equal to the estimated variable cost of peanut production, (Table 1). Both the crush price and variable cost of producing peanuts have been about one-half to two thirds of the support price for peanuts. Commodity Credit Corporation losses and expenses for supporting peanut prices have risen steadily from approximately 10 million dollars in the late 50's to a high of 97 million dollars in 1971.

#### Analytical Framework

For purposes of the analysis to be undertaken here the peanut demand model developed by Fleming and White was adopted and modified for use in conjunction with a non-linear optimization procedure.<sup>2/</sup> A nonlinear optimization procedure was used in conjunction with the model to enable solution of the model subject to alternative policy constraints, price discrimination practices, etc. By obtaining numerous solutions under alternative policy constraints a "multidimensional surface" of policy trade-off relations was obtained.

The optimization procedure used is referred to as the "Complex Algorithm" and is described by Kuester and Mize in their publication titled "Optimization With Fortran". The algorithm uses a "hill-climbing" procedure and is capable of finding the maximum value of a multidimensional non-linear surface subject to non-linear constraints.

## Analysis Results

### Policy Trade-Offs Under the Present Peanut Program

An acreage control-price support system, such as the one currently used for peanuts, requires consideration of three explicit factors in formulating policy: (1) the acreage or production level permitted, (2) the support price level, and (3) the cost of the program. With the assistance of the preceding peanut model and optimization routine, trade-offs between these policy variables and the effect of these trade-offs on net farm income were analyzed for the crop year 1975.

The following objective function was used in conjunction with the peanut model to estimate "iso-budget lines".

$$U = NET - BUDGET - CLEAR$$

where:

U - value to be maximized

NET - net income from peanut production (see footnote #3)

BUDGET - A penalty value forcing government expenditures to be less than or equal to a budget constraint, i.e.

$$BUDGET = (Budget\ Constraint - Calculated\ Gov.\ Costs)^2$$

when the budget constraint is exceeded and zero when it is not. Government costs are calculated as support price minus non-edible peanut price times the quantity of peanuts purchased by the government plus a 2.18 cent a pound handling charge for peanuts purchased and resold.

CLEAR - a penalty value forcing the market to "clear".

$$CLEAR = (Carryin\ Stocks - Estimated\ Carryout\ Stocks)^2$$

Solution of the model with the above objective function determines the production level and price support level that will maximize farm income for a given budget constraint. By constraining the budget level and varying the support price a map of "iso-budget lines" can be estimated which shows the

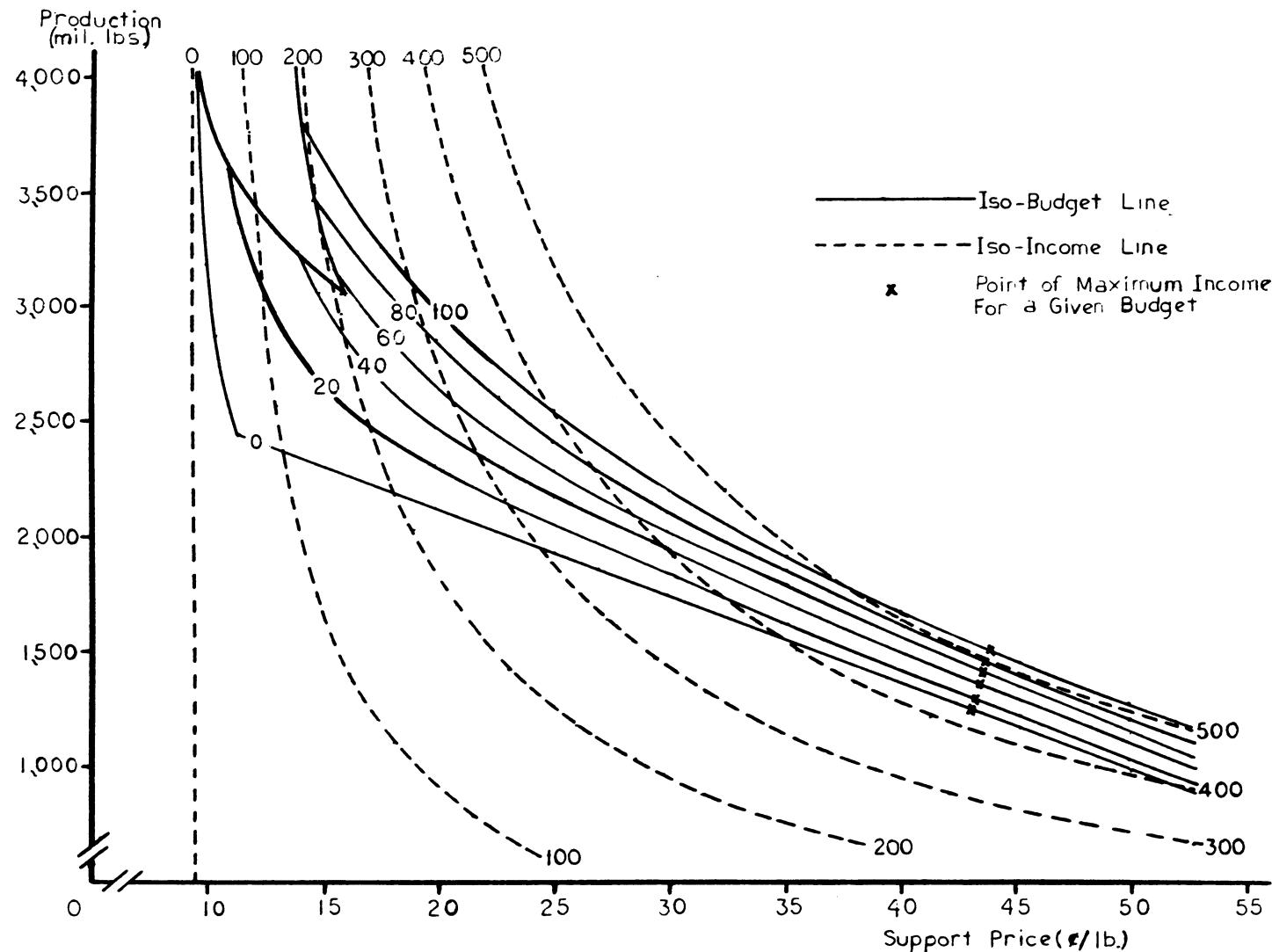


FIGURE I. TRADE-OFFS AMONG POLICY CONTROLLED VARIABLES WITH A PEANUT SUPPORT PRICE-ACREGE CONTROL PROGRAM

combination of production levels and price supports which maximize net farm income subject to a given budget. A set of iso-budget lines derived in this manner is shown in Figure 1. Iso-net farm income lines are also shown. The points of tangency between the iso-budget lines and iso-net income lines indicate the production and support price combinations that maximize net farm income from peanut production under alternative budget constraints and 1975 market conditions.

The figure can be used to answer a number of policy trade-off questions. A vertical line drawn through any support price will indicate the net income and program costs associated with alternative production allotments and a given support price. Likewise, a horizontal line drawn through any production level will indicate the net income and program cost associated with alternative support prices and a given production allotment. The intersection of any set of horizontal and vertical lines will define the estimated government cost and resulting net farm income for the represented price support and production level.

Figure 1 points out that if the sole objective of the peanut program is to provide maximum net farm income with a minimum budget, then the administrative rules and definitions presently used to establish acreage allotments and support prices are not efficient. For example, in 1975 the minimum acreage allotment of 1.6 million acres resulted in the production of 3,747 million pounds of peanuts. The support price was set at 19.7 cents or 75 percent of parity. This produced a net farm income of 393.5 million dollars. By moving downward to the right on an imaginary iso-net income line just below the 400 million dollar iso-net income line it is seen that the same income can be provided with a much smaller budget if support prices are raised and production reduced.

### Implications of Peanut Market Structure Upon Alternative Peanut Programs

Because the elasticity of demand for edible peanuts and non-edible peanuts differ greatly; the potential for market discrimination exists either through peanut programs or by a private producer group. The implications of enacting peanut programs which do not conduct discrimination activities between the edible and non-edible peanut market versus continuing a program which does, will be explored here. The characteristics of a "free peanut market" as determined via estimates with the model where all peanut program influences were removed will be used as a bases for comparing these two alternative program forms.

#### Peanut Market Discrimination Programs

The current peanut program conducts limited amounts of market discrimination and in the process of doing this increases peanut farmers' incomes (relative to free market incomes) in two ways. First, revenue received from sales in the inelastic edible peanut market are increased due to support prices maintained above the free market price. Secondly, revenues are increased due to the fact that all peanuts not sold in the edible market at the established support price are purchased (at the support price) via the current program's loan provisions. The magnitude of the higher gross revenues (relative to the free market) obtained from the higher prices in the edible market and via government purchases under the loan program can be separated and estimated with the peanut model.

Given the production level existing in 1975 and had there been a free market for peanuts, model estimates indicate that the price of peanuts would have been 9.6 cents and total revenue would have been \$360.3 million. With the peanut program, support prices for peanuts were 19.7 cents in 1975. Total revenue earned from peanut sales was \$738.2 million or \$377.9 million

higher than the estimated free market revenue from peanut sales. About 32 percent of this increase or \$122.5 million was due to increased revenue from sales of peanuts in the inelastic edible peanut market. The remaining \$255.4 million of increase was due to government support through purchases via the loan program. Table 2 presents the results of similar calculations for 1970 through 1974.

Peanut program costs to the government under the current system consist of bearing the losses and expenses of purchasing the quantity of peanuts required to maintain the support price and then reselling these peanuts in the non-edible peanut market at a lower price. Total program costs under this system and other systems which conduct market discrimination activities are likely to be less than total increases in farm income generated by the program. This is the case because part of the increases in farm income generated by such a program are obtained through the market by increasing prices in the inelastic edible peanut market. The extent to which program expenditures are "multiplied" through increasing market revenue via discrimination depends upon the degree of discrimination conducted.<sup>4/</sup>

A larger degree of market discrimination than was actually conducted in 1975 and previous years is indicated to be possible. Complete discrimination of the peanut market such as would be possible by a properly organized producer group with the objective of maximizing total revenue was simulated for the 1975 crop year. This simulation indicated that a maximum total revenue of 655.6 million dollars could have been obtained from the market by charging a price of 38.6 cents for edible peanuts and 9.35 cents for non-edible peanuts. Optimal production for purposes of market discrimination is estimated to be 2,384 million pounds of peanuts with 1,271 pounds of this production being consumed in the edible market.

Table 2. Estimated Revenue Increases and Sources of Revenue Increases Generated by a Support-Price-Acreage Control Peanut Program 1970-75.

Year	Total Farm Revenue Increases <sup>1/</sup>	Farm Revenue Increases From the Edible Peanut Market <sup>2/</sup>		Farm Revenue Increases via Loan Program Purchases <sup>3/</sup>	
		(mil. \$)	(% of total)	(mil. \$)	(% of total)
1975	377.9	122.5	32	255.4	68
1974	258.2	77.1	30	181.1	70
1973	226.4	113.8	50	112.6	50
1972	258.3	117.8	46	140.5	54
1971	190.3	84.5	44	105.8	56
1970	192.9	87.6	45	105.2	55

<sup>1/</sup>

These figures were derived by multiplying actual support prices and production levels occurring each year to obtain figures for total revenue received with price supports. Secondly, "free market" prices estimated for each year given actual production levels were taken times actual production levels to determine a "free market total revenue" estimate. The difference between these two revenue figures determines the value recorded as "Total Farm Revenue Increases".

<sup>2/</sup>

These figures were derived by multiplying actual support prices and edible peanut consumption occurring each year to obtain figures for revenue received from edible peanut sales with price supports. Secondly, estimates of free market prices and edible peanut consumption (obtained with peanut production exogenously specified at actual levels) were multiplied to obtain an estimated "free market total revenue from peanut sales". The difference between these two revenue figures determines the value recorded as "Farm Revenue Increases From the Edible Peanut Market".

<sup>3/</sup>

Determined by subtracting column 2 from column 1.

### Peanut Programs Which Do Not Discriminate

Some form of a "target price program" is the most common type of commodity program suggested for peanuts which does not conduct activities leading to peanut market discrimination. Producer response under a target price program would depend upon the exact nature of the program. A target price system similar to that currently in effect for many other agricultural commodities would be expected to lead to a "freer market" with competitive market characteristics similar to those outlined in the preceding section discussing simulation results for a "free peanut market".

In a purely competitive market prices fall until profits in the long-run are driven to zero. Under a target price system profits relative to free market profits (or more directly income), would be raised through direct payments to farmers based upon the difference between target price and free market prices. This method of income generation produces approximately one dollar of income per dollar of expense. Raising target prices while not restricting production may generate prices below average total cost of production and hence negative profits. If this were the case, the ratio of positive income generated to program costs would likely be less than one to one.

### Summary

A combined peanut demand model and non-linear optimization procedure has been used in this study to analyze the characteristics of the peanut market under alternative peanut programs. Simulation of a "free market" i.e. no peanut program in operation, indicated that if past levels of peanut production had existed and been sold in a free market, the market clearing price would have been approximately equal to the estimated cost of production for the typical farm producing peanuts during 1970 to 1975. The implication of this result is that a removal of all peanut programs

and a return to a free market would sharply reduce income from peanut production by approximately 45-50%, unless lower costs of production were obtained or production was reduced.<sup>5/</sup>

The current peanut program was estimated to have raised revenue received from peanut sales during 1970-1975 an average of 251 million dollars per year above the revenue estimated to be received for selling the same quantity of peanuts in a free market during that period. Estimated cost of obtaining this increase averaged 153 million dollars per year. The ability of the current program to obtain greater average increases in farm income than program expenditures is due to its' ability to conduct market discrimination and maintain separate markets and prices for edible and non-edible forms of peanut demand. This discrimination increases market revenue obtained from the marketing of peanuts and thus reduces program costs required to generate increases in farm income. The discrimination also has the effect of lowering consumer surplus in the edible market and increasing consumer surplus in the non-edible market. Consumers of non-edible peanuts include foreign peanut importers and users of peanut meal and oil.

Programs which do not conduct market discrimination activities nor production control such as a target price program would appear to be able to generate increases in farm income only through direct payments. Relative to the current program for peanuts or some form of two price market discrimination program, a target price program would likely increase consumer surplus in the edible consumer market, reduce consumer surplus in the non-edible market and require larger program expenditures to generate a given level of gross farm revenue from peanut production.

The analysis of this paper leads to the conclusion that the major trade-off to be considered in selecting between a two price market discriminating peanut program versus a non-discriminating single price pro-

gram, such as a target price program, involves increases in expenditures by edible peanut consumers versus increased program costs. Additionally it is concluded that the present method of determining support prices and acreage allotments can be altered so as to reduce program costs while maintaining or increasing farm income obtained from peanut production.

## FOOTNOTES

1/

The peanut demand studies reviewed and referred to here contained estimates of elasticities of demand for edible peanuts ranging from -.07 to -.44. Estimates of elasticities of demand for peanuts to crush ranged from -2.74 to -26.3. Estimates of export elasticities are not numerous but range from -.97 to as high as -32.1.

2/

Fleming and White's publication and Fleming's thesis should be consulted for a full description of the model. As adopted for use here it consists of eight equations and identities including demands for edible peanuts, crushing demand, export demand, feed and seed use, government purchases and resales and carryover stock. Supply is exogenous to the model and is assumed to be determined by policy or in long-run equilibrium consistent with an assumed cost of production.

3/

Net farm income is defined as total revenue minus total variable cost where variable cost per unit of production are defined as reported in Table 1.

4/

The potential multiplier effect of expenditures under the current program is displayed and quantified in Figure 1. Starting from a support price of approximately 17 cents per pound and a production level slightly above 2,500 million pounds, an increase of support prices of approximately 6 cents to a level of 24 cents increases net farm income by nearly 150 million dollars at an added budgetary cost of only 40 million dollars, hence the budget multiplier is approximately 3.75 to 1 in this instance. (The multiplier decreases as one moves the initial point of comparison to the extreme lower right hand corner of the figure or extreme upper left hand corner). Note that moving upward from the initial point specified does not produce a multiplier

effect. This occurs since market discrimination and the multiplier effect associated with it can only be obtained by raising support prices.

5/

This implication is consistent with Song, Franzmann, and Mead's research results but inconsistent with Nieuwondt, Bullock and Mathia's results which indicate that relative to the current peanut program, a free market would lead to increases in acres of peanuts planted, lower peanut prices and greater gross peanut sales revenue.

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