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THE SIDE-EFFECTS OF SUPPLY CONTROLS:

EXPORT MARKET EFFECTS OF DOMESTIC PEANUT POLICY

Randal R. Rucker

and

Walter N. Thurman

Department of Agricultural and Resource Economics

North Carolina State University

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Abstract

The focus of the U.S. peanut program is the domestic market for edible uses, where marketing quotas, price supports, and import restrictions maintain high prices. However, the rules restricting sales onto the domestic edible market also have important, albeit indirect, effects on the export supply of U.S. peanuts.

I. Introduction

The primary focus of the U.S. peanut program is the domestic market for edible uses, where marketing quotas, price supports, and import restrictions are used to maintain high prices (see Rucker and Thurman, 1990). The program also has important effects in related markets. In particular, the rules restricting sales onto the domestic edible market indirectly affect both the supply of U.S. peanuts for export and the supply of U.S. peanuts to be crushed into oil and meal. In this paper we examine the effects on peanut exports. Although the peanut program has been discussed in recent GATT negotiations and International Trade Commission hearings, there exists no previous systematic analysis of the effects of this complex program on export markets.

II. The Effects of the Peanut Program in the Domestic Edible Market

The description and analysis of the U.S. peanut program in this section is drawn from Rucker and Thurman (1990). The key features of the current peanut program include: (1) marketing quota, (2) a support price for peanuts sold with quota, (3) a ban on imports of peanuts for domestic edible purposes, and (4) a "buyback" provision that allows non-quota peanuts to be sold in the edible market should the quota peanuts be insufficient to meet demand at the support price.

We capture these features of the peanut program in a model of the post-1985 program that makes the following assumptions. (1) there are two uses for peanuts (edible and crush) and two qualities of peanuts (edible grade and crush grade). Edible-grade peanuts are the higher quality, and they can be used either for edible purposes or crushed into oil and meal. Crush-grade peanuts are suitable for crush use, but cannot be used for edible purposes. U.S. peanut producers grow only edible-grade peanuts. Foreign producers grow both edible-grade and crush-grade peanuts. (2) the foreign prices of crush-

and edible-grade peanuts are exogenous to domestic markets.[1] (3) imports for edible use are prohibited. (4) private exports of edible grade peanuts are not restricted and there are no effective restrictions on the import or export of crush grade peanuts.

Figure 1 displays the domestic demand for edibles, D_e, the domestic demand for crush, D_c, the foreign price of edible grade peanuts, P_e^f, the price of crush grade peanuts, P_c, and the domestic supply of peanuts, S^d. In the absence of government restrictions and given our assumption that only edible grade peanuts are grown in the United States, the domestic edible and crush markets equilibrate separately at prices P_e^f and P_c. The entire domestic crop of Q_e^s is sold for edible uses. Domestic consumption of edibles is Q_e^d, and net edible exports are X_0. Q_c^d pounds of crush-grade peanuts are imported for domestic oil and meal uses.

In figure 2, a support price of P_s and a quota level of Q_q are imposed which imply an excess demand for peanuts. In recent years, this situation has been typical. If the quota is set at Q_q then the market-clearing price for edibles is P_o. In this situation, however, the "buyback" provision of the peanut program takes effect. This provision allows for the buying back of nonquota peanuts into the domestic edible market at a price of P_s. Handlers can request as many buybacks as they wish. With a support price of P_s, they request buybacks of $Q_B = Q_q^o - Q_q$. The supply of peanuts for the domestic edible market therefore is shifted from Q_q to Q_q^o.

In the edible market, buyback simply serves to fix supply at Q_q^o, but in the crush and export markets its effects are more complex. To understand

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[1]Exports of U.S. peanuts comprise a relatively large share of the total world market. Because of this, we examine below the implications of dropping this assumption.

these effects requires consideration of the two marketing options open to producers of additionals (non-quota peanuts): These additionals can be contracted for sale into the export market or they can be put into a pool of additionals operated by the growers' association. Additionals in the pool are either bought back into the edible market for P_s or sold onto the unregulated domestic crush market. Participants in the pool receive profits from the pool in proportion to their peanut contributions. This implies that the average price for peanuts in the pool is a weighted average of P_s and the crush price.[2] The weights of the weighted average price vary with placements into the pool, but the weighted average cannot fall below its lowest constituent. Therefore, the price received from participating in the growers' association pool dominates the crush price. Because all growers with additionals face the same marketing choices, there should be no crush sales by individuals. The entire domestic supply of crush will come from the growers' association pools.

Consider next the equilibrium determination of the quantity of additionals produced and the portion of that production that is placed into the growers' association pools. Assuming that some peanuts are exported with the program in effect, the relevant marginal price of peanuts is the export (foreign edible) price. Peanut growers will produce to the point where marginal cost equals the export price. Given that production, the quantity of quota determines how much is sold directly in the edible market. Farmers will place remaining additionals into the growers' association pool until the average price for pool peanuts (P_A) is equal to the export price (P_e^f). This

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[2]See Rucker and Thurman (1990) for details on the procedures for paying pool participants.

average price of pool peanuts is

(1) $P_A = (Q_B/Q_T)P_s + (Q_c/Q_T)P_c$

where Q_B is the quantity of buybacks, Q_c is the quantity of pool peanuts sold as domestic crush, $Q_T = Q_B + Q_C$ is the total quantity of peanuts placed in the pool, and the price variables are defined as above.

Because pool contributors all receive the same price, the average pool price is decreasing in the total quantity of peanuts in the pool. At the margin, then, equilibrium requires equality between marginal cost of production, foreign edible price, and the average price of additionals in the growers' association pool.

Figure 3 shows the determination of equilibrium in the crush market. Q_B is the quantity of buybacks ($Q_q^o - Q_q$ in figure 2) which is determined exogenously by policy "errors." All Q_B peanuts receive P_s. Beyond Q_B, P_A declines with Q_T and asymptotically approaches P_c. The equilibrium condition that $P_e^f = P_A$ defines an equilibrium quantity of additional peanuts placed in the pool, Q_T^*. Q_c^*, the quantity of domestic edible grade peanuts used for crush, is simply $Q_T^* - Q_B$.

The Q_c^* peanuts crushed domestically result in peanut oil and meal. Because trade in oil and meal is unrestricted, the domestic prices for oil and meal will equal the exogenous world prices of oil and meal (ignoring shipping costs). Therefore, domestic consumption of oil equals the domestic quantity demanded at the world price. Net exports of oil (which may be positive or negative) are the difference between the oil from the Q_c^* crushed peanuts and domestic consumption. The same is true for net exports of meal.

The dissipation of pool rents is an equilibrium condition. The

expression equating P_A, defined in (1), with P_e^f can be written as:

$$(2) \quad Q_B(P_s - P_e^f) = (Q_T - Q_B)(P_e^f - P_c).$$

The left-hand side of this expression represents the benefits available to growers from buybacks. The right-hand side represents the costs to growers from placing more than Q_B additionals into the cooperative pool, thereby receiving P_c rather than P_e^f for these edible grade peanuts.

The direct and obvious effects of the peanut program are the increase in the domestic edible price and the associated reduction in domestic edible consumption. The indirect, or side, effects are those that affect the U.S. supply of peanuts for export and the U.S. supply of peanut oil and meal. We now turn to these side effects in the export market, allowing for the possibility that the U.S. is not small in the world market for edible peanuts.

III. Supply Shifts in U.S. Export Markets

In this section we relax the assumption that the foreign demand for edible exports is elastic. Although published estimates of the export demand elasticity are large (Dobson and Martin report -20, Nieuwoudt, Bullock, and Mathia report -32) the fact that the United States is the world's leading exporter of peanuts suggests that it is important to consider the program effects if the edible export demand curve is downward sloping.

Under the peanut program, U.S. peanuts are sold into three different markets: domestic edible, foreign edible, and crush. Figure 4 shows how demand in these three markets, along with domestic supply, determine equilibrium under the program. The edible support price, P_s, determines a domestic edible quantity demanded of Q_q^o. The point (Q_q^o, P_s) lies on the domestic edible demand curve (not show). Domestic production beyond Q_q^o is

allocated between exports (through preharvest contracts with growers) and the crush market (through sales from the growers' association pools).

As argued in section II, and in equilibrium, growers are indifferent between placing their peanuts into the pool and selling them on the export market. Therefore, the average price received for additionals placed in the growers' association pools, P_A, will equal the export price, P_e^f. For any given quantity of additionals sold on the domestic edible and domestic crush markets, the P_A curve shows the price domestic growers receive for peanuts placed in the association pool. For output levels greater than Q_q^o, the P_A curve can therefore be viewed as the domestic demand for peanuts under the program. The total demand for domestic production beyond Q_q^o is the horizontal summation of P_A and D_e^f, labeled D^* in Figure 4.

Equilibrium under the program is determined by the intersection of D^* with S^d. The equilibrium price of edibles is P^*. The equilibrium quantity produced domestically is Q^*. This price and quantity satisfy both the production equilibrium condition that the marginal cost of production equals the market price and the pool equilibrium condition that $P_A = P_e^f$.

The quantities of peanuts going into the export market and into the crush market can be determined from D_e^f and P_A. In figure 4 the quantity of edible grade peanuts exported is $Q_1 - Q_q^o$ and the quantity placed in the crush market by the association pool is $Q_2 - Q_q^o$.

One question of interest is: Does the program affect the world price and, if so, how? The program both increases the supply of U.S. peanuts for export by prohibiting domestic edible sales at prices less than P_s, and decreases that supply by indirectly encouraging the placement of U.S. edible grade peanuts onto the domestic crush market. The net effect is not a priori

clear. It is, however, analyzable.

The demand for domestic peanuts under laissez faire is

$$D_e^I(P) \equiv D_e^f(P) + D_e(P).$$

The demand for domestic peanuts under the peanut program (figure 4) is

$$D^*(P) \equiv D_e(P_s) + D_e^f(P) + Q_c(P), \qquad \text{where } P_c \leq P \leq P_s.$$

The argument P refers to the common value of the export edible price and the average price received for pool peanuts, and $Q_c(P)$ is the level of growers' association sales into the crush market consistent with an average price to the pool of P. $Q_c(P)$ is found by inverting formula (1) for average price:

$$Q_c(P) = \frac{P_s - P}{P - P_c} Q_B, \qquad Q_c'(P) < 0.$$

Define the difference between quantities demanded under the program and under laissez faire at a given price as:

$$\Delta(P) \equiv D^*(P) - D_e^I(P) = D_e(P_s) + Q_c(P) - D_e(P),$$

and consider the behavior of $\Delta(P)$ for $P = P_s$, and as P falls below P_s.

First, note that $\Delta(P_s) = 0$, i.e., if supply conditions dictated a price of P_s the total demand for U.S. peanuts would be the same with the program as without it.

Next, calculate the first derivative of $\Delta(P)$.

$$\frac{\partial \Delta}{\partial P} = \frac{\partial Q_c(P)}{\partial P} - \frac{\partial D_e(P)}{\partial P} = \frac{P_c - P_s}{(P - P_c)^2} Q_B - \eta_e \frac{D_e(P)}{P},$$

where η_e is the domestic edible demand elasticity. Evaluating this derivative at $P = P_s$ yields:

$$\frac{\partial \Delta(P_s)}{\partial P} = - \frac{Q_B}{P_s - P_c} - \eta_e \frac{Q_q^o}{P_s} ,$$

where $Q_q^o \equiv D_e(P_s)$.

Some rearranging of this expression yields:

$$(3) \quad \frac{\partial \Delta(P_s)}{\partial P} \gtrless 0 \text{ as } \frac{\alpha_B}{1-\alpha c} \lessgtr - \eta_e$$

where $\alpha_c = P_c/P_s$ and $\alpha_B = Q_B/Q_q^o$. α_c is the ratio of crush price (both foreign and domestic) to support price; α_B is the proportion of domestic edible consumption bought back from the association pool.

Because $\Delta(P)$ is zero at $P = P_s$, the sign of $\partial\Delta/\partial P$ evaluated at P_s will determine whether demand for U.S. peanuts is larger under the program than under laissez faire for prices near (and below) P_s.

To determine the sign of this expression, look at table 1 which is based on empirical measures of α_B and α_C. The average value of $\alpha_B/(1-\alpha_c)$ for the period 1982-1986 is .10.[3] An estimated value of the domestic edible elasticity of demand is -.09 (Rucker and Thurman, 1990). From these estimates and condition (3), one can conclude that at the edible support price $\partial\Delta/\partial P$ is approximately zero, i.e., the slopes of the demand curves with and without the program are approximately equal. For small reductions in price below P_s, the demand for domestic peanuts is about the same with the program as without. Equivalently, and again approximately, for quantities produced larger than Q_q^o,

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[3]Examination of table 1 indicates that in 1984 buybacks were much larger than in any other year during the period. Conversations with people in the industry indicate that this was the result of unusual events during that year. 1984 values are therefore excluded from the calculation of this average.

but near Q_q^o, the world price of peanuts is not affected by the program.

The discussion to this point is for prices near P_s. Do the conclusions hold for all prices between P_s and P_c? To answer this, examine the second derivative of Δ:

$$(4) \qquad \frac{\partial^2 \Delta(P)}{\partial P^2} = \frac{2(P_s - P_c)Q_B}{(P-P_c)^3} - \frac{\partial^2 D_e(P)}{\partial P^2} .$$

Evaluated at $P = P_s$ the second derivative becomes

$$(5) \qquad \frac{\partial^2 \Delta}{\partial P^2}(P_s) = \frac{2Q_B}{(P_s - P_c)^2} - \frac{\partial^2 D_e}{\partial P^2}(P_s).$$

This expression will be positive if the demand curve for edibles is not too convex at P_s. In fact, Rucker and Thurman's estimates of the edible demand curve indicate that, for the sample range of prices a linear specification is the best fit. This ensures that $\partial^2\Delta/\partial P^2$ is positive at $P = P_s$ and, therefore, that demand for edibles is increased by the program. The program therefore increases the equilibrium foreign price. Estimating the magnitude of this increase requires estimates of the elasticity of the free market supply of peanuts -- a task currently in progress.

The positivity of expression (5) ensures that edible demand with the program exceeds edible demand without the program for equilibrium prices near and below P_s. If that expression remains positive for prices lower than P_s, then it can be said that the program increases edible demand for all prices below P_s. Referring to the general expression (4) it can be seen that the second derivative is positive for all prices above P_c as long as edible demand is not too convex. Again, if edible demand is linear then (3) is assured of

being positive and the program increases edible demand for all prices between P_s and P_c. Therefore, the effect of the program on the foreign market is to raise the price of edible peanuts and reduce exports.

V. Concluding Comments

The "primary" effect of the U.S. peanut program is to increase the price of peanuts sold in the domestic edible market. The program also, however, has potentially important "secondary" effects on international trade in edible- and crush-grade peanuts. Although a correct analysis of such secondary effects requires detailed information on the myriad provisions of the peanut program, knowledge of the direction and magnitude of these effects is necessary to conduct informed discussions of the effects of changes in this program on international trade patterns.

Our analysis of the effects of the U.S. peanut program on U.S. exports of edible-grade peanuts suggests that different features of the program have opposing effects on exports. Key parameter values suggest, however, that the program acts to increase the total demand for U.S. peanuts, thereby increasing the world price of peanuts and reducing the level of exports.

Table 1

Determining the Effects of the U.S. Peanut Program on the Total Demand for Peanuts

Year	Q_q	Q_B	α_B	P_c	P_s	α_c	$\alpha_B/(1-\alpha_c)$	$-\eta_e$
1982	2058	191	.09	.108	.311	.35	.14	.09
1983	2027	68	.03	.203	.300	.68	.09	.09
1984	2111	972	.46	.142	.289	.49	.90	.09
1985	2247	102	.05	.103	.285	.36	.08	.09
1986	2174	132	.06	.091	.304	.30	.09	.09

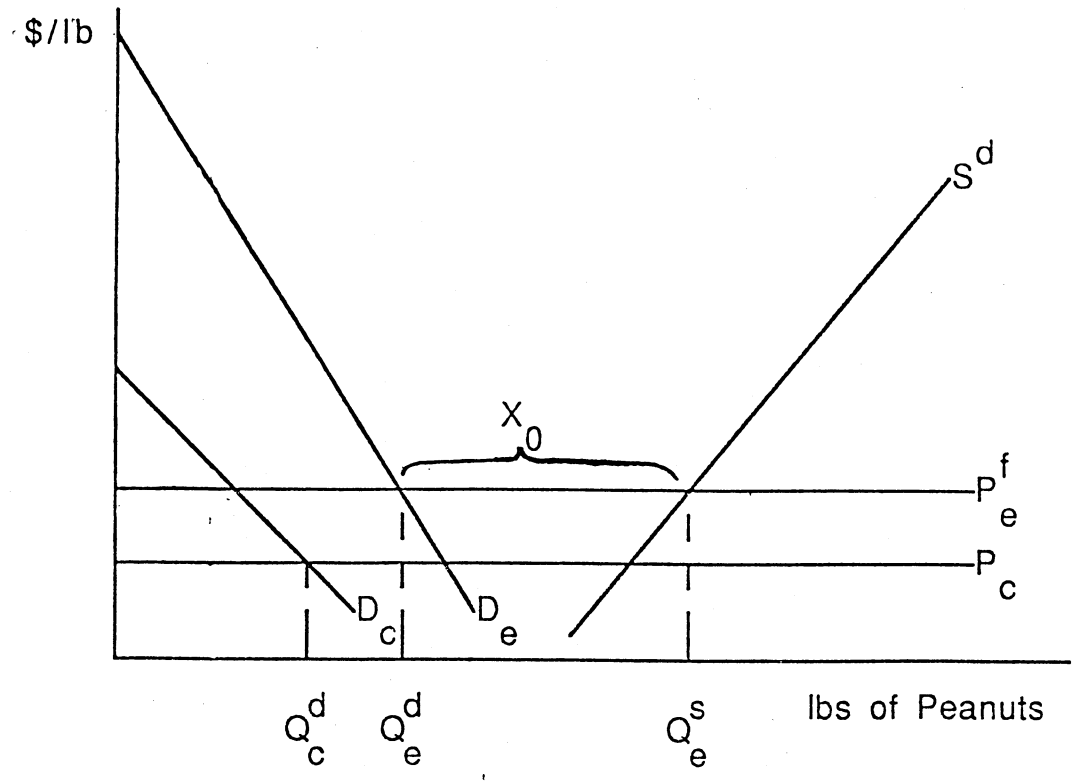

Figure 1
Aggregate Effects of the Peanut Program

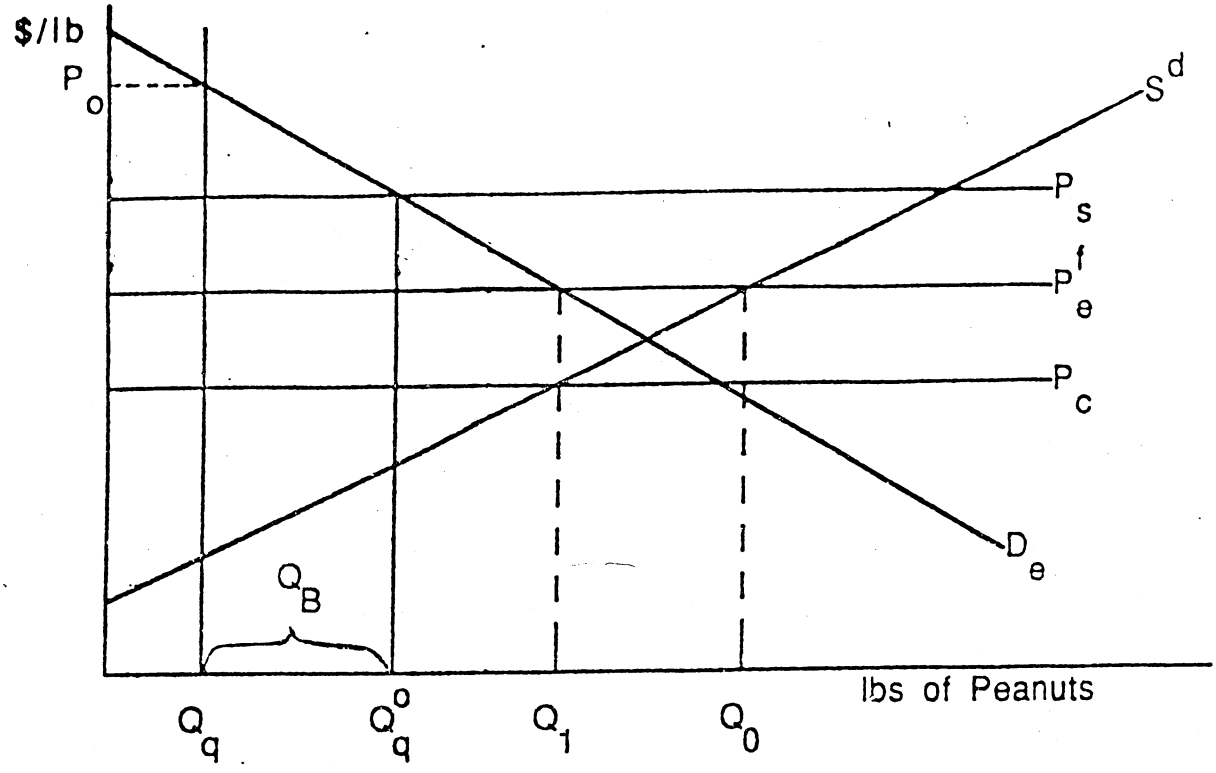

Figure 2
The Aggregate Effects of the Peanut Program

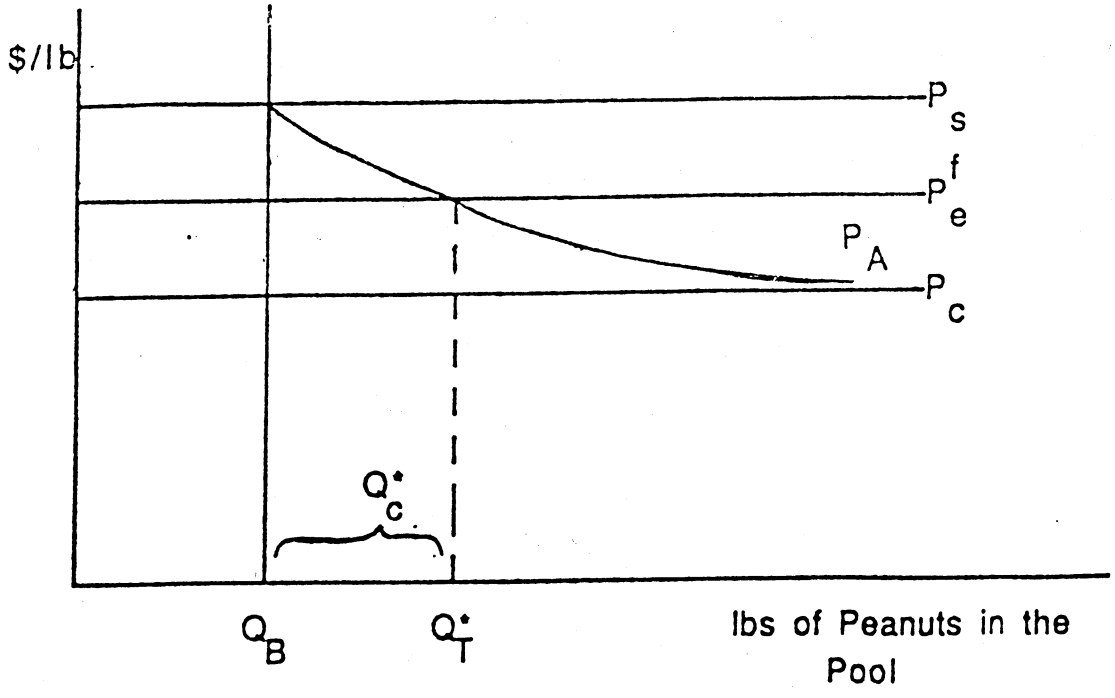

Figure 3

Buybacks, Profit Sharing and the Placement of Additionals in the Association Pool

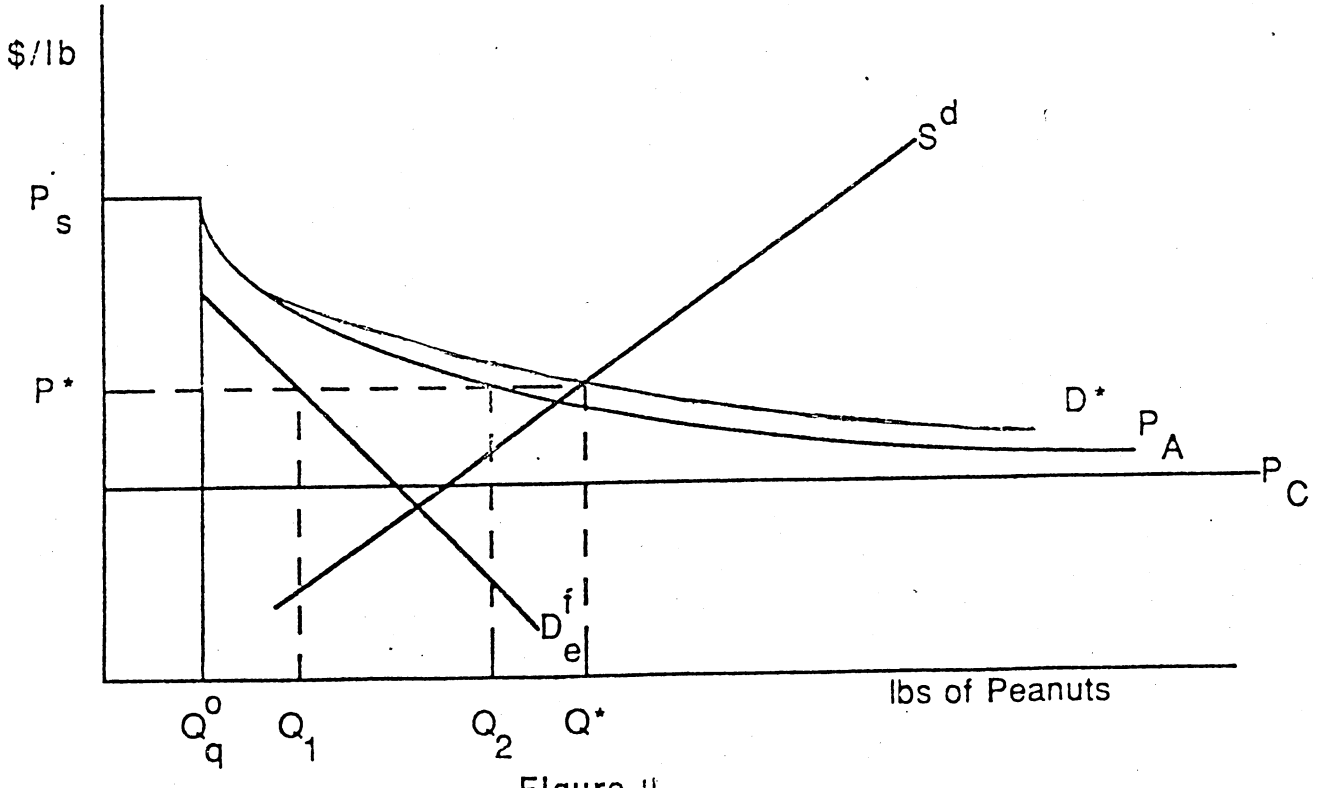

Figure 4

Equilibrium in the Market for Edible Peanuts with Peanut Program and Downward-Sloping Foreign Demand for Edibles

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