Does the Existence of Market Power Affect Marketing Loan Programs?

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Abstract

The paper analyzes the effects that a demand with oligopsonistic power may have on the operation of a marketing loan program (especially on the program cost). We measure these effects using a model for the US peanut market where evidence indicates that the demand is highly concentrated. Our results show that the USDA strategy of keeping a repayment rate above the market-clearing price set by the demand is not a sustainable strategy, since the demand can follow a hand-to-mouth strategy, postponing its purchases of peanuts, letting USDA accumulate stocks and forcing it to reduce the price.

Keywords: Market Power, Oligopsony, Marketing Loan Programs, Peanuts

I. Introduction

Marketing loan programs are an important element of the US agricultural policy. Although commodity loans have operated in the US since the 1930s, the marketing loan programs and deficiency payments in their current form were introduced by the 1985 Farm Act. While initially applied to rice and upland cotton, the marketing loan programs were extended by the 1990 Farm Act to soybeans, other oilseeds (sunflower, canola, rapeseed, safflower, mustard seed, and flaxseed), wheat and feed grains (corn, sorghum, barley, oats). The 1996 Farm Act continued these programs and recently, under the Farm Security and Rural Investment Act of 2002 (2002 Farm Act, hereafter), it has been extended to peanuts, graded and non-graded wool, mohair, honey, small chickpeas, lentils, and dry peas (Westcott and Price, 1999, USDA-ERS, 2002).

1 Paper prepared for the 2003 AAEA Annual Meeting, Montreal, Quebec, July 27-30. The authors are Post-Doctoral Research Associate, and Professor, respectively. National Center for Peanut Competitiveness, Department of Agricultural and Applied Economics, College of Agricultural and Environment Sciences, Griffin Campus, University of Georgia, Griffin, GA 30223-1797. Corresponding e-mail: revoredo@griffin.uga.edu. We would like to thank Dr. John Allison for his help and valuable discussions.
Three prices are important in the operation of a marketing loan program: the marketing loan rate, the loan repayment rate, and the market price. A producer that receives a marketing loan can repay it by paying the lesser of the marketing loan rate plus interests, or the repayment rate set by USDA, designed to minimize loan forfeiture, government-owned stocks, and storage costs.

The importance of the market structure for the marketing loan program comes through its role in the market price determination. It is interesting to note that, although the demand for several farm products tends to be concentrated with few purchasers, the effects of marketing loans have been normally analyzed in the context of perfect competition (see, for instance Westcott and Price, 2001). Under perfect competition, the market price can be above or below the loan rate, depending on the specific supply and demand conditions. However, under market power, specifically oligopsony, one would tend to observe market prices under the loan rate, implying a permanent support for the farmers.

The purpose of this paper is twofold. First, it analyzes the effect that imperfect competition, specifically a situation where the demand possesses oligopsonistic power, may have on the operation of a marketing loan program. Second, it illustrates the effects of the imperfect competition in the case of the peanut market where, according to the existing literature, the demand (i.e., shellers/processors) is highly concentrated.

We start the paper with a model for an industry where the purchasers of the agricultural raw material have market power and where a marketing loan program is in

2 See Rogers and Sexton (1994) for an assessment of the importance of oligopsony in agriculture.
operation. Although the model refers to the peanut market, it can be applied to any other industry. The next section introduces the peanut market as an illustrative example. We present the available evidence on demand concentration in this market and also the changes in policy from the 2002 Farm Act. Then, we estimate and calibrate the relationships required for the model and perform some simulations to assess the effect of market power. Finally, we present some conclusions.

II. Marketing Loan Program in the Presence of Market Power

In its basic version (see Westcott and Price, 1999) when the marketing loan rate is above the market price, the marketing loan program ensures a minimum per-unit revenue to farmers. The loan rate, however, is not a "floor price" since the purchases of the commodity are made at a price equal to the repayment rate, which normally reflects market prices. The wedge between demand and supply prices is the level of support per unit offered by the government. It is important to note that the market price can be above the marketing loan rate (as shown by Westcott and Price, 1999 for several commodities) in which case the marketing loan program only offers a source of short term liquidity to farmers.

If the demand is concentrated with only few purchasers, the market price does not reflect competitive conditions. On the contrary, it will tend to be below the loan rate, implying constant support to producers. Furthermore, a concentrated demand may offer a low price for the commodity, and if the repayment rate is set based on this non-competitive market price, the situation would imply a larger cost of the program for the government compared to what would be expected under a perfect competition situation.
Let us consider two vertically related markets of the peanut industry: the shelled peanut market and farmer stock peanut market peanut. While the market for shelled peanuts appears competitive (or in any case, double oligopolistic), the market for farmer stock peanuts can be characterized as oligopsonistic.

We will represent the supply of peanuts as lagged one year. The planned supply equation is a stable function (i.e., \( H(\bullet) \)) that depends on the expected price paid for the peanuts (i.e., \( E_{t-1}\left[P_t^W\right] \)). In the presence of a marketing loan program, the price received by the farmer cannot be lower than the loan price, (i.e., \( p^L \)). The planned supply function is given by (1):

\[
H_t = H\left(E_{t-1}\left[P_t^W\right], p^L\right)
\]

The production of shelled peanuts, as shown in equation (2) is characterized by a quasi-fixed proportion production function. This function has been extensively applied to agricultural processing firm (see for instance, Heien, 1980, for the food industry, Brorsen, Chavas, Grant, and Schnake, 1985, for the flour industry; and Durham and Sexton, 1992, for California’s processing tomato market). In (2) the variable \( L_t \) is a composite good that represents all other factors of production different than peanuts (i.e., \( M_t \)). The function \( \phi(\bullet) \) relates the composite good with the output, and it is strictly concave (i.e.,

\[
\frac{\partial \phi(\bullet)}{\partial L_t} > 0, \text{ and } \frac{\partial^2 \phi(\bullet)}{\partial L_t^2} < 0.
\]

\[3\] Strictly speaking in the case of multiplicative disturbances, the supply depends on the expected marginal revenue, which is different than the expected price, which is the case when the disturbances are additive, see Wright 1979. To simplify the text we call it simply expected price.
From (2), the quantity of peanuts demanded by shellers will be \( \lambda Q_t \), where \( \lambda \) is a technical coefficient that gives the requirement of peanuts to produce \( Q_t \) units of the processed good.

The availability of peanuts (i.e., \( A_t \)) is given by the realized supply (i.e., \( (1 + e_t)\hat{H}_t \), where \( e_t \) is a multiplicative random shock) and by the amount of commodity carried by the USDA under the marketing loan program (i.e., \( G_{t-1} \)). We will assume that the US market will remain protected by a tariff rate quota that limits peanut imports to a minimum access (see Skully, 1999). USDA's stocks represent an excess of supply, which is the amount forfeited and becomes USDA stock under the marketing loan program (i.e., \( G_t \)). Equation (3) represents this relationship.

\[
G_t = G_{t-1} + (1 + e)\hat{H}_t - \lambda Q_t
\]

Equation (3) indicates that, unless the demand for peanuts is flexible to adjust to supply shocks, which is the only randomness that we are going to consider in the paper, the peanut market will be in disequilibrium and USDA stocks will absorb it.

The situation when the demand is not flexible poses a problem to the price determination when the demand possesses market power (i.e., monopsony/oligopsony),

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4 We will assume that shellers will not carry speculative inventories of the commodity because of the market power assumption given later in the paper. Under market power they can let USDA to handle the inventories and afford the storage cost and just purchase them later at the repayment rate. Therefore, the only inventories that they may carry are pipeline inventories that we are not modeling in this paper.
because of the lagged response of the supply. In the typical monopsony/oligopsony models, purchasers face the current supply (spot), and they can manipulate, through the quantity purchased, the price and also the quantity offered. In the case of an annual commodity, the supply at the time of the purchasing decision is perfectly inelastic, therefore the static monopsony/oligopsony model would predict a price equal to zero. In addition, the monopsony/oligopsony models do not consider the presence of inventories.

In the case of disequilibrium we need to include the way that prices are going to adjust to the excess of supply. We propose that they adjust according to equation (4):

\[
(4) \quad p_t^W = p_{t-1}^W - \gamma \cdot \left( (1 + e_t) \hat{H}_t + G_{t-1} - \lambda Q_t \right)
\]

where \( \gamma > 0 \) is an adjustment parameter that relates the change in peanut prices with respect to the excess of supply. Accordingly, we have \( \frac{\partial p_t^W}{\partial A_t} < 0 \) and \( \frac{\partial p_t^W}{\partial Q_t} > 0 \).

Examples of this adjustment mechanism can be found in two sources: in the economic literature that tries to explain how prices converge to the equilibrium (see, for instance Baumol, 1952, Arrow, 1959) and in the literature of market disequilibrium (see, for instance Grossman, 1974, Salanie, 1991).

We will solve the problem where the oligopsonists collude and behave as if they were a monopsony.\(^5\) If the shellers realize that their current decisions are going to affect their future profits through inventories carried by the government, they are going to

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\(^5\) While the assumption of an oligopsony seen as a monopsony is not trivial, since oligopsony models can produce rich dynamics in the form of processes of collusion and "wars" between firms with market power such as in Porter, 1983, we consider that assuming colluded oligopsonists does not modify the central idea of the paper and simplifies significantly the model.
choose their output in order to maximize their intertemporal profits. Therefore, the intertemporal shellers problem is given by the following expression, where \( w_1 \) is the price of the composite input, which is assumed to be exogenous for the industry.

\[
\begin{align*}
\text{Max} & \quad E[\pi] = \sum_{t=1}^{T} \beta^{t-1} \left\{ P^S_t \cdot Q_t - w_1 \cdot \phi^{-1} \left( Q_t \right) - P^W_t \cdot \lambda Q_t \right\} \\
\text{s.t.} & \quad \lambda \sum_t \phi^{-1} (Q_t) + \lambda Q_T = 0 
\end{align*}
\]

(5)

We will assume that shellers know the price adjustment mechanism, then we can write \( P^W_t \) using recursively (3) and (4) and assuming that \( P^W_0 \) and \( G_0 \) are given and a terminal period \( T \), such as in (6):

\[
\begin{align*}
P^W_t &= P^W_0 - tG_0 - \sum_{i=1}^{T} \left( t-i+1 \right) \left[ (1+e_i) \cdot \hat{H}_i - \lambda Q_i \right] \\
\text{and assuming that} \quad P^W_0, G_0 \text{ are given and a terminal period } T 
\end{align*}
\]

(6)

The solution of problem (5) yields the sequence of a plan of processed good supplies, \( \{ \hat{Q}_1, ..., \hat{Q}_T \} \) (and therefore the demand for peanuts \( \{ \lambda \hat{Q}_1, ..., \lambda \hat{Q}_T \} \)). The first order conditions for (5) are given by (7) for \( t = 1, ..., T \):

\[
\begin{align*}
\frac{\partial E[\pi]}{\partial Q_t} &= P^S_t - w_1 \cdot \phi^{-1} \left( \hat{Q}_t \right) - \lambda \left[ \gamma \lambda \hat{Q}_t + P^W_t \right] - \sum_{i=t}^{T} \beta^{i-1} \left\{ (i+1) \gamma \lambda \right\} = 0 \\
\end{align*}
\]

(7)

Since in (7) the term \( -\sum_{i=t}^{T} \beta^{i-1} \left\{ (i+1) \gamma \lambda \right\} \) is negative, the shellers will have incentives to decrease their current production and increase their future production, as the effect of the inventories carried by the government tends to depress future prices of...
peanuts. If we drop the last term in (7), we would have a case where the oligopsonists only can exercise their power in the current period; that would be the case when all the excesses of supply are destroyed or exported (in which case the government will lose \((p^L - P_t^*)G_t\), where \(P_t^*\) is the world price at which peanuts (in-shell) can be sold). For completeness sake in this case (7) becomes (8):

\[
(8) \quad \frac{\partial E[\pi]}{\partial Q_t} = P_t^S - w_1 \cdot \phi^{-1}(\dot{Q}_t) - \lambda \{\lambda \dot{Q}_t + P_t^W\} = 0
\]

One should observe that USDA can set the repayment rate \(P_t^R\) above the price the oligopsonists would be interested to pay \(P_t^W\), in order to reduce the cost of the marketing loan program. However, since \(P_t^R\) is greater than \(P_t^W\), this may reduce shellers' purchases of peanuts and thus increase USDA carryover. In addition, it may generate an explosive situation where stocks in the hands of USDA keep growing since there is no interaction between the farmer stock peanut market and the shelled peanut market, since the oligopsonists buy the peanuts at the exogenous repayment rate, and the peanut production is governed by the loan rate. When the government sets \(P_t^R\), condition (7) become (9):

\[
(9) \quad \frac{\partial E[\pi]}{\partial Q_t} = P_t^S - w_1 \cdot \phi^{-1}(\dot{Q}_t) - \lambda P_t^R = 0
\]

Condition (9) corresponds also to the competitive case when \(P_t^R\) corresponds to the market price, exogenous to the shellers. It is also possible to extend the previous analysis about the intertemporal oligopsonists to the case when shellers know that USDA
cannot carry more than a certain level of inventory, say $\overline{G}$, after which USDA will have to resale its inventories (i.e., go back to a market determined situation). In this case, if for instance USDA sets the repayment rate in time period 1, the oligopsonists may find it convenient to purchase as little as possible in order to regain control over the peanut price.\footnote{Certainly, the goal of making USDA to carry $\overline{G}$ stocks can be reached not necessarily in the first period but certainly since intertemporal profits are discounted, shellers would like to reach the goal in the least number of periods.} In this case, we should have $G_1 = \overline{G}$ and $Q_1 = \frac{(1+e_t)\overline{H}_1 + G_0 - \overline{G}}{\lambda} \geq 0$, in which case, the intertemporal profit function becomes (10):

$$\text{Max}_{Q_1, \ldots, Q_T} E[\pi] = \left\{ P_1^S \cdot \overline{Q}_1 - w_1 \cdot \phi^{-1}(Q_1) - P_1^R \cdot \lambda \overline{Q}_1 \right\} + \frac{\sum_{t=2}^{T} \beta^{-1}(Q_t - P_t^W \cdot \lambda Q_t)}{\sum_{i=2}^{T} (t-i+1) \phi^{-1} \left[ (1 + e_i) \cdot \overline{H}_i - \lambda Q_i \right]}
$$

In this case $P_t^W$ is given by (11):

$$P_t^W = P_t^R - (t-1)\gamma \overline{G} - \sum_{i=2}^{T} (t-i+1) \phi^{-1} \left[ (1 + e_i) \cdot \overline{H}_i - \lambda Q_i \right]
$$

The first order conditions of (9) are the same with those given by (7) but for periods $t = 2, \ldots, T$. It is clear that the shellers will follow strategy (10) if and only if it maximizes their intertemporal profits.

In the previous discussion we have assumed the repayment rate to be an exogenous price, which is partially true since it is set by USDA; however, the 2002 Farm Act defines it as "a USDA-determined repayment rate designed to minimize loan forfeiture, government-owned stocks, and storage costs" (USDA-ERS, 2003), which "provides" the criteria of how the repayment rate should be set. It should be noted that minimization of loan forfeitures and government own stocks are basically the same
objective since once forfeited the loan, the collateral becomes government-owned stocks. Also, the minimization of the objective is somewhat trivial because it is minimized by selling at the price that the market wants to pay, since at that price USDA would not carry stocks. Certainly, if the shellers have market power, such an objective is worrisome since it would tend to increase the cost of the program. Instead of the previous objective, let us consider that USDA wants to minimize the cost of the marketing loan program. This is given by (13):

\[
\text{Cost}_t = \left( p^L - p^R_t \right) \left[ (1 + e_t) \cdot \hat{H}_t - R_t \right] + \left( G_{t-1} + R_t \right) \left( \frac{r}{1+r} p^L + ku \right) \\
+ \left( p^L - \frac{E_t[p_{t+1}]}{1+r} \right) \left( G_{t-1} + R_t \right)
\]

Where \( G_{t-1} \) is USDA initial stock at period \( t \) (accumulated through forfeitures) and \( R_t \geq 0 \) is the collateral from forfeited loans that becomes part of USDA stocks. Cost (13) in period \( t \) can be broken into three components: the first term, i.e., \( \left( p^L - p^R_t \right) \left[ (1 + e_t) \cdot \hat{H}_t - R_t \right] \) represents the direct program cost and it decreases as \( p^R_t \) increases. The second term, i.e., \( \left( G_{t-1} + R_t \right) \left( \frac{1}{1+r} p^L + ku \right) \), represents the storage and financial costs of carrying the inventories, which increases with \( p^R_t \) (\( ku \) is the marginal storage cost for unshelled peanuts, assumed constant, and \( r \) is the interest rate). The third term, i.e., \( \left( p^L - \frac{E_t[p_{t+1}]}{1+r} \right) \left( G_{t-1} + R_t \right) \), represents the (expected) change in the value of the inventories, assuming that they are sold during the next period. Since there are no speculative inventories, the effect of increases in \( p^R_t \) will increase \( R_t \) and
\( P_t^W \), and depress \( E_t[P_{t+1}] \), reducing the expected value of the inventories carried by USDA. Summarizing, increases in \( P_t^R \) reduce the first term in the cost expression, but would increase the last two\(^8\). In addition, it is important to note, as shown in the annex, that increasing \( P_t^R \) does not necessarily decrease the cost (13).

To close the model, we need to specify a utilization (i.e., consumption) demand for shelled peanuts (i.e., \( C_t^S \), which is the sum of shelled peanuts destined to food products, exports, and crushing, i.e., peanut oil and meal). The demand in its inverse form is given by (14):

\[
(14) \quad P_t^S = P^S(C_t^S)
\]

In addition, because we assume that the shelled market is competitive and, therefore inventories and prices of shelled peanuts follow the well-known "arbitrage conditions" (see Williams and Wright, 1991), such as (15), that express that no profits are made from carrying inventories (where \( k_s \) represents the marginal cost of storing shelled peanuts, assumed also constant).

\[
(15) \quad P^S(Q_t + I_{t-1} - I_t) + k_s \geq \left( \frac{1}{1 + r} \right) E_t[P_{t+1}^S] \quad I_t \geq 0
\]

Finally, if the peanut market is perfectly competitive, the arbitrage conditions also have to be satisfied by the peanut prices, such as in (16), where \( S_t \) are the peanut stocks

\[8\] In the case of perfect competition, under the presence of private inventories, the increase in the government inventories would be accompanied by a decrease in private inventories (i.e., crowding out effect) leaving \( E_t[P_{t+1}] \) unchanged until private inventories were exhausted, after which \( E_t[P_{t+1}] \) would start to decrease."
carried to the next period. In the competitive case under a marketing loan program, the repayment rate would be set equal to that price that clears the market.

\[
(16) \quad \left(1 - \frac{1}{\lambda}\right)\left[p^S_t - w_1 \cdot \phi^{-1} \left[\lambda \cdot (A_t - S_t)\right]\right] + ku \geq \left(\frac{1}{1+r}\right)E_t[p^W_{t+1}] \quad S_t \geq 0
\]

Summarizing, we have 3 models. The first one is the oligopsonistic model with repayment rate set equal to the price set by the oligopsonists, model with at least three variations: intertemporal optimization, period by period optimization (i.e., myopic), and the situation when USDA has a maximum possible stock before reverting to the oligopsony set case. The second model describes the case when USDA sets the repayment rate and has no commitment about the maximum stock that it can carry. Finally, the third model is the perfect competition model. We will concentrate the analysis of the next section on the oligopsony with intertemporal optimization and the perfect competition case (for comparison purposes).

III. Illustrative Case: The US Peanut Market

We illustrate the previous situation for the case of the peanut market. The 2002 Farm Act modified significantly the US peanut program by eliminating the marketing quota system and introducing a marketing loan program available to all peanut producers. The marketing loan rate for peanuts is fixed at $355 per short ton. Producers can pledge their peanuts as collateral and repay the loan at a rate that is either lesser of $355 per short ton plus interest or a USDA-determined repayment rate designed to minimize loan forfeiture, government-owned stocks, and storage costs. Alternatively, the producer may forgo the marketing loan and opt for a loan deficiency payment at a payment rate equal to the difference between the loan rate and the loan repayment rate. Figure 1 presents the
loan rate and the repayment rate for each peanut variety since the beginning of the program.

Figure 1: Loan Rates (LR) and Repayment Rates (RR) by Peanut Variety

Source: USDA-FSA, 2002

With respect to the existence of market power in the demand for peanuts, first it is important to acknowledge that there is little information about the peanut industry. This fact may render it difficult to determine the presence of market power. However, the existing evidence points out that the industry has followed a concentration process. According to Kamerschen (1998), in 1992 Golden Peanuts Company bought Dothan Oil representing together 38.3 percent of the total peanut purchases in Georgia (the main state producer of peanuts). In addition, Stevens/Cargill and Mc Cleskey Mill merged, reaching together 25 percent of the purchases in Georgia. In 2000, Cargill Peanut Products joined Golden Peanuts as a partner. Considering the 1992 shares, the companies would represent together 63.3 percent of the total purchases in Georgia. Similar evidence can be found in Epperson et al. (1988). According to them, the top four shellers purchase about 80
percent of the peanuts in all major production areas, with the exception of Georgia where
the percentage is about 60 percent.

The statistical information after the elimination of the marketing quota for peanuts
may give more evidence about the existence of market power in the purchase of peanuts.
On the supply side, the production of peanuts went down during the 2002/2003 crop year
by 22.4 percent with respect to the previous crop year (with a decrease in the harvested
acreage by 8.2 percent and in yields by 15.5 percent). On the demand side, despite the
significant decrease in the price paid for peanuts destined to the food industry, the
consumption of peanuts for milling decreased by 3.1 percent. Under the marketing quota,
peanuts destined to the food industry were paid US$ 610 per short ton. After the
elimination of the quota, the repayment rate of peanuts has fluctuated around US$ 320
per short ton, which is almost half the previous price for peanuts. Furthermore, in contrast
with the behavior of the repayment rate, the price of US peanuts abroad (using the 40/50
size CIF prices in Rotterdam for US peanuts) have increased steadily since August 2002
as shown in figure 2. Therefore we may interpret the behavior of the sheller sector as an
attempt to keep repayment prices low.
It is also worthy to consider how USDA peanut stocks under the marketing loan program have evolved since October 2002 (month when the marketing loan program started effectively to operate). Westcott and Price (1999) point out that, during the mid-1980s, market soybean prices fell below the loan rates, and the marketing loan program supported the prices. In 1985, loan placements reached 25 percent of the production and 60 percent of those placements were forfeited (i.e., 15 percent of the production). As of January 31, 2003 (last day to place peanuts under the marketing loan program), 39.4 percent of the production were placed under the loan, although as of April 30, 18.4 percent of these peanuts still remains under loan.

**Simulations**

The first step towards the simulation part of the paper was to estimate or calibrate the relationships to be used in the model. Table 1 presents the relationships used in the simulation. These are: the aggregate consumption demand for shelled peanuts by...
manufacturers, crushers (i.e., oil and meal), and exporters, a planned supply/harvest function for peanuts and the production function of shelled peanuts.

It is important to note that the estimation of economic relationships for the peanut market presents problems not only due to the fact that the 2002 Farm Act represents a structural change, but also because the effects that the previous legislation had on the sector. In fact, each Farm Act since 1977 has introduced modifications to the peanut sector in order to reduce its cost, although keeping the marketing quota for peanuts.

While it is possible to estimate the demand for peanuts based on information of the previous program, this information does not allow estimating the planned supply function. The main difficulty relates to the heterogeneity of peanut producers (i.e., those producing for the marketing quota, and those producing peanuts above the quota, i.e., "additionals") and to the lack of information about what proportion of the production was sold to each marketing segment (i.e., quota and additionals). Without this information, it is not possible to know the effective price received by the producer. Therefore, we have used a simple calibration procedure to compute the planned supply (see Revoredo and Fletcher, 2002). The errors around the supply were calibrated in order to obtain a similar distribution (based on mean and variance) to that observed for the peanut harvest for the period 1996-2002.

We assume that the production function for shelled peanuts was equal to

\[ \min\left\{ \frac{M_t}{\lambda}, a_1(L_t)^{a_2} \right\} \].

In the absence of information for the shelled peanut industry (i.e., inputs, costs, etc.), we calibrate the production function using condition (9), i.e., the profit maximization for a given price. We set the value of the price of the aggregate inputs equal to 1 and the elasticity (i.e., \( a_2 \)) to 0.5 and computed the value of \( a_1 \) based on the average information for peanut prices, shelled peanut prices and production of shelled
peanuts for the period 1996 to 2002. The technical coefficient $\lambda$ was set based on USDA's conversion factor from farmer stock peanut to shelled peanuts, i.e., 1.33.

For the coefficient of price adjustment (i.e., $\gamma$) we used the information about the repayment rate set by USDA and the outstanding stock of peanuts under the marketing loan. Based on these data and using equation (4) we computed the average coefficient, which is presented in table 1.

**Table 1: Functions and parameters used in the baseline scenario**

<table>
<thead>
<tr>
<th>Planned supply of peanuts function (net weight)</th>
<th>Intercept</th>
<th>Expected price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inverse demand function from processors $1^/$</td>
<td>1860.50</td>
<td>60.74</td>
</tr>
<tr>
<td><strong>End. Var.</strong>: average shelled peanut price (1990-92 Cents/Lb.)</td>
<td>490.30</td>
<td>-0.21</td>
</tr>
<tr>
<td>Shelled peanut production function (Mill. Lb.)</td>
<td>$a_1$ 158.10</td>
<td>$a_2$ 0.50</td>
</tr>
<tr>
<td>Price adjustment coefficient ($\gamma$)</td>
<td>0.003</td>
<td></td>
</tr>
<tr>
<td>Minimum import access (Mill. Lb.)</td>
<td>151.60</td>
<td></td>
</tr>
<tr>
<td>Interest rate (6 months-percentage) $5^/$</td>
<td>3.02</td>
<td></td>
</tr>
<tr>
<td>Storage cost (Cents/Lb.) $6^/$</td>
<td>1.62</td>
<td></td>
</tr>
<tr>
<td>Loan rate (Cents/Lb.)</td>
<td>17.75</td>
<td></td>
</tr>
<tr>
<td>Price of other inputs</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>Harvest errors (multiplicative, all with the same probability)</td>
<td>-0.248, -0.124, 0, 0.124, 0.248</td>
<td></td>
</tr>
</tbody>
</table>

$1^/$ Based on the following regression estimated by TSLS for the period 1983-2002.

<table>
<thead>
<tr>
<th>Endogenous variable: Demand for Shelled Peanuts (Mill. Lb)</th>
<th>Coefficients</th>
<th>t statistics</th>
<th>Mean values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>1,506.92</td>
<td>4.70</td>
<td>58.54</td>
</tr>
<tr>
<td>Average price for shelled peanuts (1990-92 Cents/Lb.)</td>
<td>-4.76</td>
<td>-1.66</td>
<td></td>
</tr>
<tr>
<td>Demand lagged one period</td>
<td>0.40</td>
<td>2.35</td>
<td>1,959.48</td>
</tr>
<tr>
<td>Dummy year 1991</td>
<td>446.38</td>
<td>3.58</td>
<td></td>
</tr>
<tr>
<td>Dummy year 1996</td>
<td>-170.97</td>
<td>-1.31</td>
<td></td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.57</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Durbin h</td>
<td>-1.47</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$2^/$ Baseline scenario considers situation under TRQ.

3/ Total imported peanuts (source: USDA-FAS).
5/ Six month treasury bill interest rate (six month rate) (source: Federal Reserve Bank of St. Louis).
We built the dynamic stochastic simulation model. To solve the model we assumed that expectations in the model where rational in the sense of Muth i.e., deduced from the model. To find the rational expectation equilibrium we solve the model backwards from a determined final period, for which final conditions were assumed. Due to the computational burden of the model, we considered the solution of a two years model. We present first the perfect competition results to use them as a baseline. The oligopsony model proved especially sensitive to the initial price and to the rate of price adjustment; therefore, we simulated the oligopsony solution for the several values of these variables. Table 2 presents the results of the simulations.

As shown in table 2, the oligopsony model implies lower levels of production of shelled peanuts and also of peanuts (although these ones are protected by the marketing loan rate) in comparison with the perfect competition model and, therefore for most cases, a higher price for shelled peanut prices.

It should be noted that depending on the combination of price adjustment coefficient and initial peanut price, the oligopsony price for shelled peanuts may be lower than in the perfect competition price. However, the peanut price and the ratio of shelled peanut prices to peanut prices will be lower than in the competitive case.

---

9 The routine, written in Gauss 5.0, is available upon request from the authors.
Table 2: Comparison of results between the competitive and oligopsony models 1/

<table>
<thead>
<tr>
<th></th>
<th>Farmer stock peanut market 2/</th>
<th>Shelled peanut market 3/</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Production</td>
<td>Price</td>
</tr>
<tr>
<td>Competitive situation 4/</td>
<td>4,282.2</td>
<td>26.9</td>
</tr>
</tbody>
</table>

Oligopsonistic situation 4/

\[ PW_0 = 20 \]

<table>
<thead>
<tr>
<th>( \gamma )</th>
<th>0.003</th>
<th>0.004</th>
<th>0.005</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price</td>
<td>13.5</td>
<td>10.6</td>
<td>7.4</td>
</tr>
<tr>
<td>Inventory</td>
<td>1,666.9</td>
<td>1,839.2</td>
<td>1,992.3</td>
</tr>
<tr>
<td>Production</td>
<td>3,756.1</td>
<td>3,756.1</td>
<td>3,756.1</td>
</tr>
</tbody>
</table>

\[ PW_0 = 25 \]

<table>
<thead>
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<th>0.005</th>
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</thead>
<tbody>
<tr>
<td>Price</td>
<td>18.2</td>
<td>15.3</td>
<td>12.1</td>
</tr>
<tr>
<td>Inventory</td>
<td>1,720.6</td>
<td>1,891.7</td>
<td>2,043.8</td>
</tr>
<tr>
<td>Production</td>
<td>3,756.1</td>
<td>3,756.1</td>
<td>3,756.1</td>
</tr>
</tbody>
</table>

\[ PW_0 = 30 \]

<table>
<thead>
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<th>0.004</th>
<th>0.005</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price</td>
<td>21.6</td>
<td>19.4</td>
<td>16.6</td>
</tr>
<tr>
<td>Inventory</td>
<td>2,014.7</td>
<td>2,013.5</td>
<td>2,095.4</td>
</tr>
<tr>
<td>Production</td>
<td>3,989.0</td>
<td>3,822.1</td>
<td>3,756.1</td>
</tr>
</tbody>
</table>

1/ Quantities are in millions of pounds and prices in cents per pound.
2/ Initial inventories equal to 20 million pounds.
3/ Initial inventories 600 million pounds.
4/ Situation corresponds to the results for the first period.
5/ Inventories carried by the government.

On the effect of the adjustment coefficient, the greater this is, the lower will be the peanut price, and the higher will be the shelled peanut price. This indicates that larger adjustment coefficients give shellers greater possibility for extracting surplus from USDA (or taxpayers), which is, at the end, the one who will absorb the loss. In addition, it should be noted that, since exports of peanuts are not forbidden, the minimum price that shellers can pay for US peanuts is given by the world price for in-shell peanuts.

As shown in table 2, the oligopsony model implies significant higher inventories than the competitive case. These inventories are the result of disequilibrium in the peanut market with oligopsonists producing significantly less than in the competitive market and
the production of peanuts almost exogenous depending on the marketing loan rate. With peanut prices decreasing due to the amount of inventories, shellers prefer to reduce their current production for producing the next period when the peanut price will be lower. This is why the decrease in peanut prices is also accompanied by a decrease in production and not by an increase, as one would expect. However, this strategy of sending production to the future is explosive since farmers are forfeiting, in the simulation, about 40 to 50 percent of the crop. In addition, since production of shelled peanuts occurs in the period (i.e., it is not lagged), it is not profitable for shellers to carry stocks of shelled peanuts but rather leave the government carry peanuts and process them according to the needs in the shelled peanut market.

In terms of a marketing loan program, an oligopsonistic demand implies that USDA will have to carry a significant inventory, and the costs of the program will tend to increase over time. In this context, setting a repayment above the price the demand wants to pay may minimize the cost of the program (see the annex for the conditions), since it will break the intertemporal movement in the production of shelled peanuts and reduce the difference between the marketing loan rate and the repayment rate. However, the possibility for setting a repayment rate is lost as soon as the border protection, represented by the TRQ is eliminated.

IV. Conclusions

The purpose of the paper has been to analyze the effect that market power on the demand for an agricultural commodity may have on a marketing loan program. With this purpose we built a model, having as a reference the US peanut industry where, according
to the available literature, the purchasers of farmer stock peanuts demand may have market power.

The main difficulty in modeling an oligopsony (or a monopsony, since we are assuming a collusive situation) is that the standard static models ignore the observed lags in production that make the supply inelastic at the current period and the presence of inventories. This poses a problem in terms of price determination. Since in the model the quantity demanded of peanuts is set by the oligopsonists, and the supply of peanuts is driven by the marketing loan program that sets a minimum revenue per unit of output given by the loan rate, the resulting model is a disequilibrium model, where prices adjust to excesses of supply.

We estimate and calibrate some relationships for the peanut market and simulate two market structures: perfect competition and oligopsony. Our results indicate that under oligopsony the production levels of shelled peanuts and also of peanuts (although these ones are protected by the marketing loan rate) will be lower than in perfect competition, and therefore shelled peanut prices are going to be higher (we assumed that the shelled market for peanuts is competitive).

The model is sensitive to the initial price and to the price adjustment coefficient. On the one hand, the greater the initial peanut price, the lower will be production of shelled peanuts. On the other hand, the greater the adjustment coefficient, the lower will be the peanut price and the higher will be the shelled price. With peanut prices in future periods decreasing due to the high inventories, shellers prefer to reduce their current production and increase their production during the next period. This is why the decrease in peanut prices is also accompanied by a decrease in production.
In terms of inventories, the oligopsony implies higher inventories that are carried by USDA and no speculative inventories of shelled peanuts, since production of shelled peanuts occur during the period and therefore it is cheaper to let USDA carry the stocks and then buy its inventories to produce the shelled peanuts. In this context, setting a repayment above the price the demand wants to pay may minimize the cost of the program, depending on some conditions, since it will break the intertemporal allocation of production of shelled peanuts. However, the possibility for setting a repayment rate is lost as soon as the border protection, represented by the TRQ is eliminated, since in that case, the world price and the domestic price will be equal (or differentiated only by shipping costs or by a quality margin) and attempts of setting a repayment rate higher than the world price will be offset by trade movements.

V. References


Annex. First and second order conditions for USDA to minimize the cost of the marketing assistance program

USDA has to solve the following problem:

\[(a.1) \quad \text{Min } \text{Cost}_t = \text{Cost}_t^t + \text{Cost}_t^2 + \text{Cost}_t^3 \]

Where:

\[
\text{Cost}_t^1 = \left(p^L - p_t^R\right) \left((1 + e_t) \cdot \hat{H}_t - R_t\right)
\]

\[
\text{Cost}_t^2 = \left(G_{t-1} + R_t\right) \cdot \left(\frac{r}{1+r} p^L + ku\right)
\]

\[
\text{Cost}_t^3 = \left(p^L - \frac{E_t \left[p_{t+1}^W\right]}{1+r}\right) \left(G_{t-1} + R_t\right)
\]

The first order condition for a minimum is:

\[(a.2) \quad \frac{\partial \text{Cost}_t}{\partial p_t^R} = -\left((1 + e_t) \cdot \hat{H}_t - R_t\right) + \left(p^L - p_t^R\right) \left(\lambda \cdot \frac{\partial Q_t}{\partial p_t^R} - \lambda \cdot \frac{r}{1+r} p^L + ku\right) 2 \cdot \gamma \cdot \lambda \cdot \frac{\partial Q_t}{\partial p_t^R} \equiv 0
\]

Where the condition was obtained using the following expressions:

\[
\frac{\partial G_t}{\partial p_t^R} = \frac{\partial R_t}{\partial p_t^R} = -\lambda \cdot \frac{\partial Q_t}{\partial p_t^R}
\]

\[
\frac{\partial p_t^W}{\partial p_t^R} = -\gamma \left(\frac{\partial G_t}{\partial p_t^R}\right) = -\gamma \left(-\lambda \cdot \frac{\partial Q_t}{\partial p_t^R}\right) = \gamma \cdot \lambda \cdot \frac{\partial Q_t}{\partial p_t^R}
\]

\[
\frac{\partial E_t \left[p_{t+1}^W\right]}{\partial p_t^R} = \frac{\partial p_t^W}{\partial p_t^R} - \gamma \cdot \frac{\partial G_t}{\partial p_t^R} = \gamma \cdot \lambda \cdot \frac{\partial Q_t}{\partial p_t^R} + \gamma \cdot \lambda \cdot \frac{\partial Q_t}{\partial p_t^R} = 2 \cdot \gamma \cdot \lambda \cdot \frac{\partial Q_t}{\partial p_t^R}
\]
Since from the first order conditions for the processed output we have:

\[
ff = \frac{\partial E[\pi]}{\partial Q_t} = P_t^S - w_1 \cdot \phi^{-1}(Q_t) - \lambda P_t^R = 0
\]

\[
\frac{\partial\bar{Q}_t}{\partial P_t^R} = -\frac{\partial ff}{\partial Q_t} = -\frac{(-\lambda)}{\left(\frac{\partial P_t^S}{\partial Q_t} - w_1 \cdot \frac{\partial \phi^{-1}(\hat{Q}_t)}{\partial Q_t}\right) - w_1 \cdot \frac{\partial \phi^{-1}(\hat{Q}_t)}{\partial Q_t} < 0
\]

\[
\frac{\partial^2 Q_t}{\partial P_t^R^2} = 0
\]

The second order condition is given by (a.3):

\[
(a.3) \quad \frac{\partial^2 \text{Cost}_t}{\partial P_t^R^2} = \lambda \frac{\partial Q_t}{\partial P_t^R} - \gamma \cdot \lambda^2 \left(\frac{\partial Q_t}{\partial P_t^R}\right)^2 + 4 \cdot \gamma \cdot \lambda^2 \left(\frac{1}{1+\gamma}\right) \left(\frac{\partial Q_t}{\partial P_t^R}\right)^2 = \lambda \frac{\partial Q_t}{\partial P_t^R} + 3 \cdot \gamma \cdot \lambda^2 \left(\frac{\partial Q_t}{\partial P_t^R}\right)^2
\]

Which is greater than zero if only and if (a.4) is satisfied:

\[
(a.4) \quad \left|3 \cdot \gamma \cdot \lambda \left(\frac{\partial Q_t}{\partial P_t^R}\right)\right| > 1
\]