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PEANUT ACREAGE DECISIONS UNDER MARKETING QUOTAS AND YIELD UNCERTAINTY

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Mandatory production controls for agricultural commodities are often advocated by those who believe that it is better to transfer wealth from consumers than from taxpayers. In general, Congress has not been persuaded to adopt mandatory supply controls as a provision in the major commodity programs. The two significant exceptions are the tobacco and peanut programs. Both programs use marketing quotas to control supply and raise quota owners' incomes.

In implementing the two marketing quota programs, provisions have been made to account for production uncertainty. With stochastic yields the probability that a producer can exactly meet a production goal is zero. When production is below a farm's quota, both the peanut and the tobacco programs allow the unused quota to be carried over to the following year.[1] The tobacco program also allows producers to market up to 103 percent of a farm's quota, with the overmarketings being subtracted from the following year's quota. The peanut program provides for production in excess of a farm's quota by a two price market.

To be eligible to sell peanuts into the high-priced domestic edibles market, producers must have a marketing quota. The quota specifies the number of pounds of peanuts that can be sold as quota peanuts. Quota peanuts are eligible for nonrecourse loans backed by the Commodity Credit Corporation. Non-quota peanuts can be produced freely and sold at a price that is no less than the "additionals" support price, which is roughly one-fourth the support price for quota peanuts. Additional peanuts are sold in the export market as edible peanuts, in the crush market for meal and oil, and they can be brought back into the high-priced domestic edibles market in years of short supply.[1]

Marketing quotas do not complicate the production decisions of peanut farmers in a world of certainty. Production will increase until marginal costs rise above marginal returns. In this world of certainty a producer will plant only enough peanuts to meet the quota if marginal costs are between the quota support price and the price for additional peanuts. If marginal costs are below the additionals price, the producer will also plant some acreage for the additionals market.

But peanut farmers operate in an uncertain production environment. Yields are random because of the influence of weather fluctuations and random pest infestations. Random yields result in random marginal returns. Typical peanut producers in North Carolina find that their marginal cost of production is generally below the price of quota peanuts but above the price of additionals. For such a typical farmer, production below the quota implies that too few resources were devoted to meeting the quota. Profits could have been increased by enlarging the scale of production. Production above the quota implies that too many resources were used to produce the quota. If storage is feasible, the excess production could be stored and sold the following year, with an accompanying scale-back of production in the second year. The producer would save the cost of producing part of the following year's quota while paying storage costs. However, the storage of peanuts in the form that is allowed for off-farm sales is quite costly for individual growers. Peanuts are highly perishable unless they are processed into peanut products, or kept under refrigeration with a stringent quality inspection regimen.

The purpose of this paper is to begin the development of a theory explaining producer behavior under mandatory controls and yield uncertainty. Attention will be devoted only to how producers choose the number of acres to plant. It is assumed throughout that yields are the only source of uncertainty. It is also assumed that producers have no control over the moments of their per-acre yield distributions through their selection of variable input levels.

Choosing Acreage under a Marketing Quota

In this section the peanut acreage decision will be modeled under the assumption that unused quota cannot be carried forward to the following year. Let Q represent a marketing quota for a particular farm. Production up to Q can be sold at a quota price, P_q. Production over Q can be sold at an excess production price, P_e. It will be assumed that both prices are known with certainty at planting time.[2] Let y denote per-acre yield, with a corresponding density function f(y). Farm output then is Ay where A is the number of acres planted. It will be assumed that the farmer's problem is to maximize the expected utility of farming profits where the only random variable is per-acre yield. Expected utility of profits is given by

$$EU(\pi) = Pr(Ay<Q)E[U(\pi)|Ay<Q)] + Pr(Ay>Q)E[U(\pi)|Ay>Q]$$

or

$$(1) \qquad EU(\pi) = \int_0^{Q/A} U[P_q Ay - C(A)]f(y)dy + \int_{Q/A}^{\infty} U[P_q Q + Pe(Ay - Q) - C(A)]f(y)dy$$

where U is the utility function, with $U' > 0$ and $U'' < 0$; E is the expectations operator; and C(A) is the cost function, with $C'(A) > 0$. The producer chooses A to maximize expected utility. Note that the choice of A determines the probability that production will be below the quota level. The necessary condition for maximizing (1) is

$$(2) \qquad P_q F(Q/A)E^-[U'(\pi^-)y] + Pe[1-F(Q/A)]E^+[U'(\pi^+)y] - EU'(\pi)C'(A) = 0,$$

where $F(\cdot)$ is the cumulative distribution function corresponding to $f(y)$, E^- and E^+ are conditional expectations given that y is below and above Q/A, and π^- and π^+ are the corresponding profit levels.[3] Writing (2) in terms of means and covariances results in:

$$(3)\quad F(Q/A)\frac{E^-U'(\pi^-)}{EU'(\pi)} P_q E^-(y) + [1-F(Q/A)]\frac{E^+U'(\pi^+)}{EU'(\pi)} P_e E^+(y) +$$

$$F(Q/A)P_q\frac{\text{cov}^-[U'(\pi^-),y]}{EU'(\pi)} + [1-F(Q/A)]P_e\frac{\text{cov}^+[U'(\pi^+),y]}{EU'(\pi)} = C'(A).$$

where cov^+ and cov^- are conditional covariances. Before looking at the effects of risk aversion on output decisions, it is instructive to compare the acreage decision of a risk-neutral firm facing production uncertainty with the firm that faces production certainty. Under risk neutrality, (3) becomes

$$(4)\qquad F(Q/A)P_q E^-(y) + [1-F(Q/A)]P_e E^+(y) = C'(A).$$

Suppose that a producer knows that per-acre yield will be $\bar{y}$. Assume that $P_q > C'(A)$ and that $P_e = 0$. How many acres will be planted? The straightforward answer is that enough acres will be planted to hit the quota, namely $A^* = Q/\bar{y}$. Now suppose that production is stochastic, with mean output equal to $\bar{y}$. Does the optimal number of acres increase, decrease or stay the same? The first-order condition (4) reduces to

$$(5)\qquad P_q\int_0^{Q/A} yf(y)dy - C'(A) = 0.$$

A quick examination of (5) does not immediately reveal if acreage (and expected output) with stochastic production is greater or less than with production certainty. It depends on the relationship between expected marginal revenue and marginal costs. If the left-hand side of (5) is positive when it is evaluated at $A = Q/\bar{y}$ (the solution with certainty), namely that expected marginal revenue is greater than marginal costs, optimal acreage will be greater than that under production certainty.[4] But, if expected marginal revenue is less than marginal costs, optimal acreage will be less than under production certainty.

The implications of risk-averse behavior on the acreage decisions of farmers operating under marketing quotas can be seen by comparing (3) and (4). The most apparent difference are the two covariance terms in (3). Because high draws of y are associated with high draws of both π^- and π^+, both conditional covariances are negative. Thus, the first effect of risk-averse behavior is that risk-averse firms tend to plant fewer acres than their risk-neutral counterparts. This finding is analogous to the results of Sandmo and Pope and Kramer that risk-averse firms will do less of an activity that increases risk.

This "scale of production" risk is not the only source of risk facing producers. Note that conditional expected marginal revenue in the two production states (over and under the quota) are given different weights in (3) and (4). Under risk neutrality they are weighted by the probability of occurrence. Under risk aversion they are further weighted by the ratio of conditional expected marginal utility to unconditional expected marginal utility.

For any given level of A, profits are lower when production is below the quota than when production is above the quota because costs are the same and revenue is lower with smaller production levels. Therefore, $E^-U'(\pi^-) \geq E^+U'(\pi^+)$, which implies that $E^-U'(\pi^-) \geq EU'(\pi)$ and $E^+U'(\pi^+) \leq EU'(\pi)$. This means that the risk averter puts a greater (lesser) weight on expected marginal revenue when production is less (more) than the quota than does the risk-neutral producer. When expected marginal revenue conditional on being below the quota is greater than expected marginal revenue being above the quota, weighted expected marginal revenue of the risk averter is greater than weighted expected marginal revenue of the risk-neutral producer for any given level of A. In this situation the risk-averse producer will tend to plant more acreage than the risk-neutral producer. Risk aversion induces the producer to reduce the risk of falling in the low profit, high marginal utility state. When expected marginal revenue conditional on being below the quota is less than expected marginal revenue above the quota (either because of a low differential between P_e and P_q or a highly skewed yield distribution), the risk-averse producer will tend to plant less acreage than the risk-neutral producer. In this case weighted expected marginal utility is less for the risk-averter than for the risk-neutral producer at a given acreage level.

The two risk aversion effects can work in opposite directions or they can reinforce one another. If expected marginal revenue when production is above the quota is greater than expected marginal revenue when production is below the quota the two effects of risk aversion both work to decrease the planted acreage of the risk-averter below that of the risk-neutral firm. In this case both sources of risk are increased by increased acreage. The result that risk averters will tend to produce less than risk-neutral firms, when increased production increases risk, holds. But when increases in acreage levels increase one risk faced by farmers while lowering another, it is not necessarily true that risk-averters will have lower expected output levels than risk-neutral firms. This is the situation for typical North Carolina peanut producers. There generally is a wide enough differential between P_e and P_q to make expected marginal revenue below the quota much greater than expected marginal revenue above the quota.

Effects of Allowing the Carryover of Undermarketings

Once farmers have chosen the number of acres to plant, they have also chosen the probability that their production levels will be below their allowable quota. A feature of the peanut program is that unused quota in a given year, called undermarketings, can be added to the next year's quota. Allowing the carryover of undermarketings adds a time dimension to the acreage decision of producers: what they do this year may affect their actions in the future.

Assume that the producer has a two year planning horizon. The objective is to maximize the discounted stream of expected utility by choosing acreage in year one and year two. It will be assumed that the prices of both quota peanuts and additionals are constant for the two years. The acreage decision in year one will affect profits in year two if production in year one is less than the marketing quota. Let $Q_2^* = Q_2 + (Q_1 - A_1y_1)$ denote the quota in year two if there are undermarketings in year one. Given that there is a carryover, profits in the two years are:

$$\pi_1 = P_qA_1y_1 - C(A_1)$$

$$\pi_2 = \begin{cases} P_qA_2y_2 - C(A_2) \text{ if } A_2y_2 \le Q_2^* \\ P_qQ_2^* + P_e(A_2y_2 - Q_2^*) - C(A_2) \text{ if } A_2y_2 > Q_2^*. \end{cases}$$

If production in year one exceeds the quota level, there is no carryover and profits in the two years are:

$$\pi_1 = P_q Q_1 + P_e(Q_1 - A_1 y_1) - C(A_1)$$

$$\pi_2 = \begin{cases} P_q A_2 y_2 - C(A_2) \text{ if } A_2 y_2 \le Q_2 \\ P_q Q_2 + P_e(A_2 y_2 - Q_2) \text{ if } A_2 y_2 > Q_2. \end{cases}$$

Let the superscripts - and + on π once again define profits when production is below or above the relevant quota. The objective function can then be written

$$(6)\ \max_{A_1, A_2} \int_0^{Q_1/A_1} \left\{ U[\pi_1^-] + \frac{1}{1+\theta} \int_0^{Q_2^*/A_2} U[\pi_2^-] f(y_2) dy_2 + \frac{1}{1+\theta} \int_{Q_2^*/A_2}^{\infty} U[\pi_2^+] f(y_2) dy_2 \right\} f(y_1) dy_1$$

$$+ \int_{Q_1/A_1}^{\infty} \left\{ U[\pi_1^+] + \frac{1}{1+\theta} \int_0^{Q_2/A_2} U[\pi_2^-] f(y_2) dy_2 + \frac{1}{1+\theta} \int_{Q_2/A_2}^{\infty} U[\pi_2^+] f(y_2) dy_2 \right\} f(y_1) dy_1,$$

where θ is the one period discount rate.[5] The decision rule to follow the first year is obtained by differentiating (6) with respect to A_1. This yields

$$(7)\ F(Q_1/A_1)\ P_q \frac{E^- U'(\pi_1^-)}{EU'(\pi_1)} E^-(y_1) + [1-F(Q_1/A_1)]\ P_e \frac{E^+ U'(\pi_1^+)}{EU'(\pi_1)} E^+(y_1)$$

$$+ P_q F(Q_1/A_1) \frac{\text{cov}^-[U'(\pi_1^-), y_1]}{EU'(\pi_1)} + P_e[1-F(Q_1/A_1)] \frac{\text{cov}^-[U'(\pi_1^+, y_1)]}{EU'(\pi_1)}$$

$$- C'(A) + \frac{(P_e - P_q)}{1+\theta} \frac{F(Q_1/A_1)}{EU'(\pi_1)} E^- \int_{Q_2^*/A_2}^{\infty} y_1 U'(\pi_2^+) f(y_2) dy_2 = 0.$$

The effect of allowing producers to carry over undermarketings is captured by the last term in (7). The other terms are identical to the necessary condition for expected utility maximization with no allowance for undermarketings (see equation (3)). Rewriting this term yields

$$\frac{(P_e - P_q)}{EU'(\pi_1)(1+\theta)} F(Q_1/A_1) \cdot \{E^-(y_1) E^- g(\pi_2^+) + \text{cov}^-[y_1, g(\pi_2^+)]\},$$

where $g(\pi_2^{\dagger}) = \int_{Q_2^*/A}^{\infty} U'(\pi_2^{\dagger}) f(y_2) dy_2$.

There are two effects from allowing a risk-averse producer to carry over undermarketings. The first is the effect on expected marginal revenue of profits. With probability $F(Q_1/A_1)E^{-}[1-F(Q_2^*/A_2)]$ there will be a production short-fall in year one and production in year two is greater than Q_2^*. Given that this occurs, an increase in A_1 results in a decrease in quota carryover, which implies a decrease in the quantity that can be sold at P_q, and an increase that can be sold at P_e in year two. The amount of production that will be transferred from quota sales to non-quota sales for each unit of A_1 is expected yield in year one, conditional on yield being below Q_1/A_1. The loss in revenue is discounted by θ and weighted by the ratio of conditional expected marginal utility of profits in year two to unconditional expected marginal utility in year one. This marginal revenue effect is negative, implying that acreage in year one will tend to be below what it would be without the carryover provision. The intuition behind this result is that the ability to carry over undermarketings gives farmers a second opportunity to sell year one's quota. This second chance lowers the opportunity cost of not using the entire quota in year one. Consequently, less resources will be devoted to avoiding production shortfalls in year one.

The second effect from the carryover provision reinforces the marginal revenue effect. Differentiating $g(\pi_2^{\dagger})$ with respect to y_1 reveals that the two are positively correlated. High draws of y_1 are associated with high draws of expected marginal utility conditional on being above the quota in year two. But, because these correlated draws are valued by a negative number $(P_e - P_q)$, this positive covariance also tends to decrease acreage in year one.

The preceding qualitative analysis of carryovers has ignored how the level of A_2 affects the level of A_1. Because A_2 determines the probability that production in year two is greater than Q_2^*, a guess about the likely level of A_2 must be made before the optimal level of A_1 is calculated. The best guess in the first year about what the level of A_2 will be is found by differentiating (6) and solving the two first-order conditions simultaneously. Of course, the actual level of A_2 chosen in year two will not equal this best guess since y_1 will be observed before A_2 is chosen. Only when the optimal level of A_1 must be determined numerically will it be necessary to derive a solution to A_2.

Optimal Acreage Levels for a Hypothetical North Carolina Peanut Farm

Qualitative analyses of the decisions of economic agents give very little insight into the relative importance of changes in exogenous variables. In this section, an attempt is made to ascertain which factors are most important in determining the acreage levels of a hypothetical North Carolina peanut farmer. The first step is to obtain a yield distribution for this producer. The mean of the yield distribution is set equal to the mean of the county average yields for the six largest peanut growing counties in North Carolina for the period 1980 - 1987. The variance of the distribution is set equal to the mean of the variances of county average yields of the same counties over the same period.[6] The resulting mean is 2600 pounds per acre and the variance is 289,000. The normal density defined by these two moments is taken to be the distribution facing the farmer. The cost function is defined by assuming that costs are linear in acreage. A low-cost farmer is obtained by using variable cost data from the 1989 North Carolina enterprise budget for peanuts. It is assumed that it costs the low-cost producer $520 per acre to produce peanuts. A per-acre cost of $598 will define a high-cost producer. The 1989 quota support price for Virginia-type peanuts is $.305 per pound. This price is taken as the price for quota peanuts. Two typical prices for additional peanuts are used to illustrate the sensitivity of optional acreage levels to the price of additionals. The two prices are $.18 pound and $.15 per pound.

Four risk aversion levels are used to illustrate how different attitudes towards risk affect optimal acreage levels. The four selected levels correspond to Binswanger's classifications of risk neutrality, slightly risk averse, moderately risk averse, and intermediate risk aversion. Constant absolute risk aversion is assumed to reflect adequately the utility function of the producer.

To integrate the utility function, a 20 point gaussian quadrature procedure was used. It proved reliable to about six significant figures. To find the optimal acreage levels, a modification of the Davidon-Fletcher-Powell method was used.[7] (See Bard for a description of the method.)

Table 1 presents the expected utility maximizing acreage levels assuming that the carryover of peanut quota is not allowed. The farm is assumed to have 195,000 pounds of quota, which at 2600 pounds per acre, implies that 75 acres is needed to just meet the quota at mean yields. First, with reference to the top half of Table 1 (with an additionals price of $.18 per pound), note that at all risk aversion levels, the low-cost producer plants significantly more acreage than that necessary to hit the quota at a yield of 2600 pounds acre. The relative high price received for excess production imposes very little penalty on producers for over-planting. At this high level of production the scale of production risk is greater than the risk of not meeting the quota. So as risk aversion increases, optimal acreage declines.

The impact of increasing production cost can be seen by noting the sharp decline in optimal acreage for the high-cost producer in the top half of Table 1. The cost of over-planting relative to the benefits is now much less. The risk-neutral producer now accepts almost a 50 percent chance that the farm quota will be unmet. Again, the scale of production risk is greater than the risk of not meeting the quota, so optimal acreage declines as risk aversion increases. For the intermediate level of risk aversion, the expected utility maximizing acreage plan of the high-cost producer is to accept a 82 percent chance of not meeting the quota.

The effects of lowering the price of additional peanuts can be seen in the bottom half of Table 1. A 17 percent drop in the price for additional peanuts causes approximately a 13 percent drop in optimal acreage for the low-cost, risk-neutral producer. At the risk-neutral solution the risk of not meeting the quota is given less weight than the scale of production risk. Hence, optimal acreage increases as risk aversion increases from risk neutrality. Eventually, however, more weight is given to the scale of production risk, and the optimal acreage level again declines.

For the high-cost producer, the decline in the price of additional peanuts also significantly decreases optimal acreage levels. The risk-neutral producer now finds it most profitable to under-plant--accepting a 60 percent chance of not meeting the farm quota. The path of acreage levels as risk aversion increases is similar to that of the low-cost producer.

Allowing producers to carry over quota significantly alters optimal acreage levels. Table 2 reports the expected utility maximizing acreage levels for the same two marginal cost levels and two prices for additional peanuts used in Table 1. The pre-carryover quota for year two is kept constant at 195,000 pounds. The discount rate θ is set to .05.

When the price of additional peanuts is $.18 per pound, the risk-neutral, low-cost producer plants 71 acres. This is approximately 20 percent less than the corresponding acreage levels in Table 1. The farmer finds that it pays to gamble more the first year. The costs of a low-yielding year are substantially lessened because of the provision for quota carryover. As risk aversion increase to a moderate level, the farmer is less willing to take the gamble. At this level of risk aversion a smoother time path of utility is preferred, so acreage levels increase to the point where the probability of not meeting the quota are again less than 0.5.

The situation is similar for the high-cost producer, except now the marginal profitability of peanut farming is substantially less. The risk-neutral producer finds that the acreage level that equates expected marginal revenue with the now higher marginal costs is approximately 17 percent less than the optimal acreage without the carryover provision. At this acreage level, there is an 82 percent chance of not meeting the farm's quota. As risk aversion increases to a moderate level, a smoother utility time path is again preferred, so acreage is increased the first year. And, at the next higher level of risk aversion, utility is smoother yet, but because the scale of production risk is greater at a marginal cost of $598 per acre than at $520 per acre, the optimal acreage level is set relatively low.

For each year one acreage level presented in Table 2, there is a corresponding expected quota level for year two. The second year's acreage levels reported in Table 2 are found assuming that no quota carryover would be allowed to year three. These second year acreage levels should be interpreted accordingly.

The effects of decreasing the price of additional peanuts to $.15 are shown in the bottom half of Table 2. First, because the costs of over-planting are now higher, optimal acreage levels in year one are now lower. A 17 percent drop in the price of additional peanuts induces approximately a 10 percent drop in acreage levels for the risk-neutral, low-cost producer. The profitability of growing peanuts is now quite lower for the high-cost producer. The probability of being below the quota is now almost 90 percent.

Discussion and Concluding Remarks

The use of mandatory marketing quotas imposes a discontinuity in marginal revenue. The results developed here suggest that producers' reactions to the discontinuous marginal revenue function depend on the relationship between expected marginal revenue and marginal cost. Production levels for profit-maximizing producers under yield uncertainty will be either higher or lower than under production certainty, depending on the relationship between expected marginal revenue and marginal costs evaluated at the acreage level that just hits the quota at mean yields. The effects of risk aversion depend on whether expected marginal revenue conditional on being below the quota is greater or less than expected marginal revenue conditional on being above the quota. If there are significant price penalties imposed for production over a farm's quota, a risk-averter will tend to plant more acreage to insure against not foregoing relatively high marginal utility levels. When this occurs, the standard result that risk-averse firms produce less than risk-neutral firms may not hold.

The peanut program provision that dictates how undermarketings are to be handled result in predictable reactions from optimizing producers. The ability to carry over undermarketings to the following production year is shown to lead to significantly decreased acreage levels.

The application to a hypothetical peanut farm illustrates which factors are most important in determining optimal acreage levels for a typical North Carolina farm. It is shown that differences in marginal costs and the price for additional peanuts create a large range of optimal acreage levels. Increases in risk aversion from risk neutrality to intermediate aversion also have some effect on optimal acreage levels, particularly when quota carryover is considered.

The results developed here serve two purposes. First, they show how producers may choose expected output levels when they are operating under marketing quotas. Knowledge about the probability distribution of output and production costs can allow policy makers to better predict national output levels. Such knowledge is valuable if policy makers need to set the national quota level to clear the market near the government support price.

The second purpose is normative. Extension decision aids based on the optimizing conditions developed here can be used to help producers evaluate the relative efficiency of their acreage decisions. The elicitation of producers' subjective probability distributions of output can be utilized in combination with their own costs of production and risk attitudes to come up with more informed acreage decisions.

Work that builds on the fundamental results developed here is plentiful. Perhaps the most important next step is to examine the role of other production inputs in determining the moments of the per-acre probability distribution of output. It is likely that marketing quotas and the program provisions concerning under and over production have a large effect on the use of risk-affecting inputs, such as crop insurance, fertilizer, and pesticides.

NOTES

1. The full amount of peanut underproduction can be carried forward to the next year unless national undermarketings sum to more than ten percent of the national poundage quota. If aggregate undermarketings in a given year are greater than ten percent of the national quota, individual farmers can carry over ten percent of their farm quota or their actual undermarketings, whichever is smaller.

2. As a rough approximation, the assumption of certain output prices may not be too untenable. The price for quota peanuts is known with certainty. It is simply the quota support price. When the production of quota peanuts is below the national quota, which would lead to upward price pressure, additional peanuts are "bought-back" into the quota peanut market until the quota price drops back to the support level. (See Rucker and Thurman for a detailed examination of the buyback provision of the peanut program.) The buyback provision introduces uncertainty into the price for additional peanuts. More buybacks increase the price for additionals. However, farmers have the opportunity to enter into contracts that specify the price for additionals early in the growing season. Treating the price of both quota peanuts and additionals as known, thus implicitly assumes that the farmer contracts out the additional peanuts. Joint treatment of price and yield uncertainty awaits further examination.

3. The second-order sufficiency condition to achieving a maximum is

$$P_q^2E^-[U''(\pi^-)y^2] + P_e^2E^+[U''y^2] - 2C'(A)[P_qE^-(U''y) + P_eE^+(U''y)] +$$
$$(P_e-P_q)Q^2/A^3f(Q/A)EU'(\pi) - C''(A)\ EU'(\pi) + [C'(A)]^2EU''(\pi) \leq 0.$$

4. Differentiating expected marginal revenue with respect to A yields $-P_q Q^2/A^3 f(Q/A)$, which is unambiguously negative.

5. The actual provisions of the peanut program are more complex than that assumed here. Unused peanut quota can be carried forward indefinitely. Peanut farmers' time horizons are therefore longer than two years. The essence of the effects of the carryover provision, however, are captured by the simple two period model if the second year's decision is treated as a compilation of all future effects of not meeting the first year's marketing quota.

6. The six counties used to calculate the mean and variance are Northampton, Halifax, Bertie, Martin, Hertford, and Edgecombe.

7. The algorithm used to find optimal acreage levels is currently being transformed into a microcomputer decision aid for use in county extension offices in North Carolina. The decision aid will focus on calculating expected profit levels, the probability of not meeting a farm's quota, and expected quota carryover from producer-supplied information the distribution of yields, planned acreage levels, costs, and prices for additional peanuts. The farmer's plan will then be compared to the "optimal" acreage plan that maximizes expected profits.

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Table 1. Optimal Peanut Acreage Not Allowing the Carryover of Quota

	Risk Aversion Level*			
	Risk Neutral	Slight	Moderate	Intermediate
Additional peanuts price of $.18				
		Low-Cost Producer		
Land: Year 1	89.14	88.74	87.04	79.10
Prob. of being below the quota	.22	.23	.25	.40
		High-Cost Producer		
Land: year 1	75.69	75.66	74.83	63.26
Prob. of being below the quota	.49	.49	.50	.82
Additional peanuts price of $.15				
		Low-Cost Producer		
Land Year 1	79.03	79.24	80.15	76.76
Prob. of being below the quota	.40	.40	.39	.46
		High-Cost Producer		
Land year 1	71.40	71.51	71.31	62.72
Prob. of being below the quota	.60	.59	.60	.83

*The values for the absolute risk aversion coefficient for these calculations are 6.0e-6, 4.0e-5, and 1.1e-4 for slight, moderate, and intermediate risk aversion.

Table 2. Optimal Peanut Acreage Allowing the Carryover of Quota

	Risk Aversion Level*			
	Risk Neutral	Slight	Moderate	Intermediate
Additional peanuts price of $.18				
		Low-Cost Producer		
Land: Year 1	71	73	80	78
Prob. of being below the quota	.61	.55	.38	.43
Year 2: Expected quota	215,981	213,385	206,427	208,109
Year 2: Land	101	99	92	81
		High-Cost Producer		
Land: Year 1	63	63	68	63
Prob. of being below the quota	.82	.82	.69	.82
Year 2: Expected quota	229,463	229,463	220,496	229,463
Year 2: Land	89	89	83	65
Additional peanuts price of $.15				
		Low-Cost Producer		
Land: Year 1	64	65	71	74
Prob. of being below the quota	.80	.77	.61	.53
Year 2: Expected quota	227,504	226,522	215,981	212,197
Year 2: Land	91		88	79
		High-Cost Producer		
Land: Year 1	59		61	62
Prob. of being below the quota	.91	.91	.87	.84
Year 2: Expected quota	238,801	238,801	238,598	231,495
Year 2: Land	91		88	64

*The values for the absolute risk aversion coefficient for these calculations are 6.0e-6, 4.0e-5, and 1.1e-4 for slight, moderate, and intermediate risk aversion.