Quality Premiums and the Post-Harvest Spot Market Thinness: The Case of U.S. Peanuts

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Introduction

In the paper, we investigate the efficiency and welfare effects of the contractual structure in the U.S. markets for quality differentiated raw agricultural produce that are supported by the Marketing Assistance Loan Program, as both characteristics have important implications for efficiency and welfare. In particular, we focus on the markets for commodities that, until 2002, were regulated by supply management policies in the form of the quota system that fixed both the prices and quantities and paid little attention for encouraging production of optimal/efficient quality. These commodities are sugar, tobacco, and peanuts. As a relevant example, we consider the U.S. peanut market. The U.S. is allegedly the largest supplier of high quality peanuts to the EU but is losing its share in the world trade to the Southeast Asian and Latin American producers.

The actual markets for peanuts in the U.S., as of today, are dominated by producer-processor contracts that support the observed absence of post-harvest cash/spot markets and do not encourage socially beneficial improvement in quality by providing almost no quality differentials/premiums. Yet, unlike many other staple crops (wheat, soybeans, and corn) peanuts are highly differentiated in quality, which is confirmed by their international, particularly European, trade patterns (Revoredo and Fletcher, 2003). In an attempt to address these issues, we model the efficiency and distributional effects of introduction of two types of alternative contractual arrangements between crop growers and processors: fixed quality premium and tournament contracts. The main results are that introducing contracts with a system of quality differentials creates incentives for producer self-selection to participate in the post-harvest cash market. Moreover, in the presence of sufficiently high common production risk, tournament contracts are more efficient and preferred by the producers than the standard fixed premium schedules.

In what follows, we describe the Marketing Loan Program Operation and current marketing issues in more detail using peanuts as a concrete example, present a model of quality differentiated contracts, and discuss the results.

Legislative Background and Identification of the Issues

Under the 1996 Farm Act (and before)[1], the peanut program was a two-tier price support program, with peanut production destined to food products limited to an annually established quota designed to uphold prices fixed at US$ 610 per short ton. Above quota groundnut production was destined for the export or the domestic crushing market (oil and meal) and, in 2001, it was eligible for a support price of only US$ 132 per short ton. Thus, peanut marketing was a very regulated activity, with farmers disposing their peanuts almost at harvest either by contracting them for export or crush, selling them as part of the marketing quota, or pledging them to the CCC to receive the support price for "additional" peanuts. It goes without saying that this system prevented the formation of a spot/cash market for peanuts since the harvest was allocated through forward contracts (for export or crush) or through the CCC marketing quota program.

The 2002 Farm Act eliminated the price and quantity fixing marketing quota system that, although with several modifications, was the core of the support of the peanut (since 1933) and other crop production. The quota system was replaced by a *Marketing Assistance Loan Program* (MLP) under which producers can get a government loan at a pre-determined *Marketing Loan*

[1] For a background about the evolution of the US peanut program see Rucker and Thurman (1990).

Rate (MLR) of US$ 355 per short ton by pledging their crop as collateral. Other produces eligible for the MLP include wheat, corn, barley, oats, cotton, rice, soybeans, other oilseeds, wool, mohair, honey, lentils, and chickpeas.

During the term of the loan (9 months), producers can either forfeit the loan or repay it at the lesser of the *Loan Repayment Rate* (LRR) plus interest or the USDA-set repayment rate. Producers may repay the loan at a rate that is the lesser of (1) USDA-determined loan repayment rate (LRR) or (2) the marketing loan rate (MLR) plus interest. Alternatively, farmers can forfeit the loan. Producers that do not take the marketing loan are entitled to a so-called deficiency payment that equals the difference between the loan rate and the repayment rate.[2] The official purpose of setting the loan repayment rate is to "minimize potential loan forfeitures and storage costs, and to promote competitive marketing of peanuts both domestically and internationally". In a sufficiently “thick” (efficient) and competitive efficient market, setting the loan repayment rate equal to the current spot market price would meet these goals (Westcott and Price, 2001). However, the observed “thinness” (insufficient transaction volumes) of the peanut spot/cash market diminishes its role as a supply-demand equilibrating mechanism and makes equating the repayment rates to the observed prices meaningless. The consequence of this situation is summed up in the following comment: “USDA gives no reasoning for leaving rates [the repayment rate] at loan level [the original marketing loan rate]. The industry thought the process would be more transparent, hoping for brief weekly explanations” (the *Peanut Grower* bulletin, Jan/2004, http://www.peanutgrower.com/home/2004_JanMarketWatch.html).

Two major issues emerged as a result of the industry’s reaction to this policy change:

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[2] For a thorough review of the 2002 Farm Act and its commodity market implications, see Westcott, Young, and Price (2002).

Issue 1

During the first year of the 2002 Farm Act, two marketing contract types have been observed in peanut markets: "Delivery at Harvest" (DAH) and the "Option-to-Purchase" (OTP). While the DAH is a typical forward contract with delivery at harvest time, the OTP contract is a hybrid of a forward and an option contract.[3] The OTP contract gives the buyer (*i.e.*, peanut sheller) an exclusive right but not an obligation to purchase a certain volume of the crop from the farmer. A peculiarity of this conract is that, while in other markets the selling price is tied to either spot market price or to a basis (when futures markets exist), the OTP price base is the USDA-determined repayment rate.

With the bulk of the crop sold under these two contracts, the U.S. peanut markets are suffering from the lack of spot market transactions. This lack of spot markets has been explained by the absence of incentives for the producers to move their crop from the loan program and sell it for cash to the processors when the market prices are below the MLR. This happens because the program is designed to guarantee the producers the MLR even if the crop is never redeemed from the program. Not only is this situation detrimental to the economic efficiency of free spot markets, but it also invalidates the marketing loan repayment rate setting mechanism, which presumes that the repayment rates are set equal to the current spot market prices that equilibrate supply and demand. This has led to much confusion among the growers and crop processors, who both complained about the lack of transparency and in the repayment rate setting and market distortions resulting from it (Dohlman *et al.*, 2004). This situation is also likely to raise the program costs borne by the taxpayers.

[3] Sykuta and Purcell (2003) report similar type of contracts for soybeans, in their paper OTP contracts are called "Buyer's call"

Issue 2

Peanuts are distinguished for being more heterogeneous than the majority of other crops. Not only there are many peanut varieties, but their individual quality characteristics also differ significantly depending on the growing conditions and producer managerial effort. Poor crop management and lack of irrigation lead to increased levels of aflatoxin (a health threatening toxin for which the EU maintains very strict standards) and pre- or over-mature harvesting that impairs the crop's taste and processing qualities. However, as a legacy of the previous supply management polices that did not differentiate the products according to their quality, no well-defined system of quality premiums exists in current markets, as well as in contracts between crop growers and processors. As a result, producers of vastly different crop qualities are paid the same price. This situation has already raised concerns by the farmers and processors equally, as there is an apparent need to encourage quality in production.

It is worth mentioning that, while there may be some exceptions to the situation described above, these issues are widespread and significant enough to warrant attention and encourage research.

The Model:

For simplicity and illustrative purposes, we assume the simplest settings in the model below. However, the generality of the conclusions is not violated by introducing more complicated/realistic assumptions.[4]

[4] The models borrow from Lazear and Rosen (1981) and Green and Stokey (1983), but are modified and applied to a different market setup, which leads to different conclusions.

There is a two-period game in which competitive crop processors present growers with a contract scheme that offers specific quality premiums, and then the growers decide how much quality they want to produce by exercising costly effort and making specific investments. The crop processors are assumed to be perfectly competitive (which implies zero profits) and risk-averse. It is also assumed that the only processing input is the crop, that there are no economies of scale in processing and 1:1 conversion coefficient, and that the demand for quality of the processing output is perfectly inelastic and pays *P* per unit of quality (which, in case of peanuts, is mainly their aflatoxin content). The processors can observe the crop quality but can not ascertain the extent to which it is due to the grower effort/expenditure or random factors, such as weather and land/soil quality.

The growers are identical, risk averse, and maximize expected utility of net income. We abstract from the volume of crop production by assuming constant costs per unit of weight. Instead, we focus on the crop quality of grower i, q_i, which is a result of the level of effort/investment, x_i (a measure of time and managerial effort put into monitoring the crop and making timely decisions), an idiosyncratic (producer-specific) random variable $e_i \sim (0,\sigma_e^2)$ that is *i.i.d.* across the producers (weed infestation, decease, *etc.*), and a common random component $v \sim (0,\sigma_v^2)$ uncorrelated with e, which reflects common yield-related risks (weather, desease, etc.):

$$q_i = x_i + e_i + v$$

All the random terms are unobservable prior to deciding upon x_i, which is costly ($C'(x)$ and $C'' >$ 0). The separation of the error term into idiosyncratic and common components will be important for the rank-order tournament contract analysis.

The Marketing Loan Program (MLP) operation is also simplified in order to focus on its most important aspects. There are two periods: at- and post-harvest. During period one, harvest sales of the crop occur in a free spot market. If the equilibrium price at harvest is anything below the marketing loan rate (the price floor), the growers effectively get the marketing loan rate (MLR) for their crop, because they are entitled to the deficiency payment from the government, which is the difference between the MLR and the sale price. It is assumed that any quality premiums included in the harvest sale price do not affect the final receipt of the MLR, as soon as the sale price remains below it.

According to the stated MLP rules, the spot market prices at harvest determine the loan repayment rate (LRR) effective during the second period – the post harvest market which, in case of peanuts, lasts for 9 months, and during which the crop can be deposited by the growers in the government warehouses as collateral for the exogenous (fixed) Marketing Loan Rate. During this period, the crop can be redeemed by the growers at anytime at the current LRR and sold to the processors. If LRR<MLR (the prevailing situation), the producers also receive a deficiency payment of DP=MLR-LRR. Alternatively, the loan crop can be forfeited at no cost, again leaving the producers with the price floor of MLR.

The important feature of this model of government support is that the prices at harvest (period one prices) determine the after-harvest (period two) prices, which corresponds to the actual method that the government uses. (Actually, the repayment rate setting rule is equating the LRR to the *current* country-level prices that are updated on a weekly basis. In the final version of the model, we will accommodate this more realistically by assuming a separate subgame during the post-harvest period.) The important conclusion from this is that, when the at-harvest market prices do not beat the MLR (which is the case most of the time), the only way for the producers to get more than the price floor (MLR) is to sell during post-harvest period at the price greater than the LRR and later collect the deficiency payment DP=MLR-LRR, leaving them with gross revenue that is greater than the price floor.

Bottom line: if the market prices remain below MLR (the MLP pays more), there is no cash market and all the crop goes to either MLP without contracts or is sold under the OTP contracts. If the quality premiums are not counted by the LRR and MLR, (1) producers take the crop to the market after harvest and (2) the quality of the crop improves.

Below, we describe the models of (1) fixed premium quality standards and (2) rank order tournament contracts and their solutions. The section is followed by a discussion of the results.

Case 1: Fixed Quality Premium Standards

With the fixed quality premium contracts, the processors pay the growers fixed quality premiums regardless of their ranking relative to each other. Defining *w* as an addition to the “base” price of the crop (think about it as the per unit price for the crop with minimal acceptable quality), and *r* as the premium per unit of quality (which, in case of peanuts, is measured mainly in aflatoxin content), the processor’s problem is to pick *w* and *r* that maximize the grower’s expected utility:

$$\max_{w,r}[E(U) = \max = \int\int U(w + rx + re + rv - C(x))f(e)f(v)dedv], \quad (1)$$

where $y = w + rx + re + rv - C(x)$ and $\theta(y)$ is the p.d.f. of the grower’s income *y*.

The grower’s problem of maximizing expected utility with respect to *x* is identical to the risk-neutral case, as the error terms are independent of the effort level, yielding

$$r = C'(x) \quad (2)$$

The zero-market revenue constraint for the processor (assuming perfect competition) is that the expected revenue from selling the crop processing output is equal to the expected crop cost:

$$Px = w + rx\,. \tag{3}$$

Substituting this into the grower income equation, the optimum contract maximizes

$$\int\int U(Px(r) + re + rv - C(x(r)))f(e)f(v)dedv$$

with respect to *r,* and where *x=x(r)* satisfies (2).

Simplifying the marginal condition leads to:

$$[P - C'(x)]\frac{dx}{dr}E[U'] + E[eU'] + E[vU'] = 0 \tag{4}$$

Since risk aversion implies $E[eU'] + E[vU'] < 0$, $P > C'(x)$ in the optimum contract for risk-averse growers. It is obvious that the resulting allocation is inferior to the one that would result in a model of risk-neutral crop growers, in which case the marginal cost of producer effort would equal its social return: $P=C'(x)$ (as risk aversion implies constant marginal utility). From the social point of view, risk-aversion leads to underinvestment in quality in comparison to a risk-neutral case, which is a manifestation of moral hazard resulting from the insurance $w>0$ and $r<P$ implied by (4).

Using second order Taylor series approximation of the grower's utility function and normal densities for e_i and v, the optimum is approximated by

$$x^* = C'^{-1}\left(\frac{P}{1 + sC''(\sigma_e^2 + \sigma_v^2)}\right), \tag{5}$$

and the variance of the grower's income is

$$\sigma_y^2 = \frac{P^2}{(1 + sC''(\sigma_e^2 + \sigma_v^2))^2}\,, \tag{6}$$

where $s = U' / U''$ is the absolute risk aversion evaluated at the mean income. Clearly, the optimum r is identified by (2) and w by (3). Both optimal effort x_i and r are increasing in P and decreasing in s and $\sigma_{e,v}^2$.

Now consider the incentives that introduction of fixed quality premiums/differentials creates for post-harvest market participation under the Marketing Loan Program (MLP) operation. For simplicity, imagine only two growers whose crop qualities differ, say, because of cost differences. If the growers know the premium schedule (w and r) and can observe each other's crop qualities (or price offers from processors) then, *ceteris paribus*, the lower quality grower is indifferent between selling at harvest and entering the MLP and then either selling after harvest or not selling at all, as the Marketing Loan Rate (MLR) is guaranteed by the program design. If time is of any value, the lower quality grower will prefer to sell at harvest. However, it is optimal for the higher quality grower to sell his crop during the post-harvest (second) period for the following reason. In period one (at-harvest market), the worse quality grower sells the crop at a lower quality premium, which sets the post-harvest loan repayment rate (LRR) (see the explanation of the MLP operation above). By selling in the second period, the higher quality grower receives the LRR *plus* the premium for better quality *plus* the deficiency payment (DP=MLR-LRR), leaving him with more than the price floor *even* when the processors' demand/offer price is below it. It can be shown that the same incentives for post-harvest spot market sales exist in a model with multiple growers.

Another important implication of the Marketing Loan Program (MLP) operation is that the guaranteed price floor (the MLR) reduces incentives to invest in crop quality. This can readily be incorporated in the fixed quality premium model above showing that the privately (but not socially) optimal level of x_i will be smaller.[5] In general, however, it will still be non-negative, which will preserve the incentives for the post-harvest market participation. The general conclusion is that, while the fixed quality premium contracts encourage participation in the post-harvest spot markets, producer risk aversion and the presence of the MLP lead to allocative inefficiencies.

Case 2: Rank-Order Tournaments

As a measure that can partially remedy the lack of incentives to invest in crop quality under grower risk aversion, consider an alternative contract design – a tournament crop contract structure – in which the quality premiums depend on the *relative* positions/performances of the crop growers. So far, tournament contracts have been successfully applied only in the U.S. poultry and meat markets (Vukina et al., 2001, Roe et al., …).

For simplicity, assume two identical growers – a case that can be generalized to multiple growers and, with some effort, extended to the case of heterogeneous producers. As above, the crop processors are assumed to be competitive, with a fixed coefficients production function and facing fixed output demand that pays P per unit of quality. In this modeling exercise, we abstract from the "base" price w using the simplified processing output demand specifications, which does not affect the generality of the results, as it does not affect the optimal producer effort.

[5] An interesting corollary of this observation is that these inefficiencies can actually "thicken" the at-harvest (period one) market. For example, it can be shown that, with heterogeneous producers, the ones with higher cost of effort may not exert any effort at all, leading to more sales happening in the first period. However, it is difficult to judge whether the increased efficiency of thicker markets (resulting from more efficient price discovery) would offset the efficiency losses from lower effort. Accounting for the price floor will introduce some discontinuities and may require using numerical solution techniques.

Unlike with the fixed quality premium standards, the rules here specify a fixed prize V_1 to the winner and a fixed prize $V_2 < V_1$ to the loser, the winner being determined by the higher crop quality q_i ($i=1,2$). The notation is as in the Case 1. It is assumed that the growers can not collude, which is realistic. The model determines the competitive price/prize structure (V_1, V_2) offered by the processors, and the optimal levels of effort exerted by the growers.

The grower's expected utility function is

$$zV_1 + (1-z)V_2 - C(x)\,, \tag{7}$$

where z is the probability of "winning" the contest.

The probability that player i wins is

$$\begin{aligned} z &= prob(q_j > q_k) = prob(x_j - x_k > e_k - e_j) \\ &= prob(x_j - x_k > \xi) = G(x_j - x_k) \end{aligned}\,, \tag{8}$$

where $\xi = e_k - e_j$, $\xi \sim g(\xi)$, and $G(.)$ is the c.d.f. of $\xi \sim (0, 2\sigma_e^2)$. It is very important to note that the common shock (the common yield risk), v, does *not* affect the probability of winning the tournament.   Each player chooses x_i to maximize (8). Assuming interior solutions, this implies

$$(V_1 - V_2)\frac{\partial z}{\partial x_i} - C'(x_i) = 0$$

and (9)

$$(V_1 - V_2)\frac{\partial^2 z}{\partial x_i^2} - C''(x_i) < 0\,, \qquad i=j,k$$

We (realistically) adopt the Nash-Cournot assumption that each grower optimizes against the optimum effort of the opponent, taking it as given. For grower j then

$$\partial z / \partial x_j = \frac{\partial G(x_j - x_k)}{\partial x_j} = g(x_j - x_k)\,,$$

substituting which into (9) yields the j's reaction function

$$(V_1 - V_2)g(x_j - x_k) - C'(x_j) = 0 \tag{10}$$

and an identical function for the other grower.

Symmetry (identical growers) implies that, when the Nash solution exists, $x_j = x_k$ and $z = G(0) = 1/2$, so the outcome is purely random in equilibrium.[6] Ex ante, however, each producer/grower affects the probability of winning by exerting effort.

(Assuming, for a moment, risk averse growers yields an illustrative result that, with equal equilibrium efforts, (10) reduces to

$$C'(x) = (V_1 - V_2)g(0) \tag{11}$$

for each grower, signifying that the equilibrium efforts are determined by the spread between quality premiums (winning and losing prizes). The magnitude of the premiums only affects the decision to exert effort, which requires non-negativity of its expected benefit.)

The risk-neutral crop processor's (crop buyer's) gross receipts are $(x_j+x_k)P$, and the costs are the total of the quality premiums offered: V_1+V_2. Competition for inputs results in equality of expected receipts and costs:

$$V_1 + V_2 = (x_j + x_k)P$$

which, given symmetry, reduces to a zero-profit constraint

$$x^*P = (V_1 + V_2)/2, \tag{12}$$

i.e., the expected value of quality equals the expected premium at the equilibrium.

Thus, the optimum prize structure is the solution to

$$\max_{V_1,V_2}\Big(E(U^*) = \max_{x^*}\{zU[V_1 - C(x^*)] + (1-z)U[V_2 - C(x^*)]\}\Big), \tag{13}$$

[6] The purely random outcome is a result of assuming identical growers. Assuming heterogeneous producers will preserve the nature of the incentives. Besides, it is the random feature that is important in the tournament/contest analysis. Identical growers are assumed for simplicity of exposition.

subject to (12).

The growers' behavior can be described by

$$C'(x^*) = \frac{2\{U[V_1 - C(x^*)] - U[V_2 - C(x^*)]\}g(0)}{U'[V_1 - C'(x^*)] + U'[V_2 - C'(x^*)]} . \tag{14}$$

This implies that

$$x^* = x^*(V_1, V_2) , \tag{15}$$

and the optimum tournament contract maximizes

$$E(U^*) = \frac{1}{2}\{U[V_1 - C(x^*)] + U[V_2 - C(x^*)]\} \tag{16}$$

subject to (12) and (15). Increasing marginal costs and risk aversion guarantee a unique maximum when a Nash solution exists.

Using second order Taylor series approximation of the grower's utility function and normal densities for e_i and v, the optimum effort under the tournament contract is approximated by

$$x^* = C'^{-1}\left(\frac{P}{1 + sC''\sigma_e^2\pi}\right) \tag{17}$$

and

$$\sigma_{y^*}^2 = \frac{\pi P^2 \sigma_e^2}{(1 + sC''\sigma_e^2\pi)^2} \tag{18}$$

where

$$y^* = \begin{cases} V_1 - C(x^*) & \text{if } q_j > q_k \\ V_2 - C(x^*) & \text{if } q_j < q_k \end{cases} .$$

It is important to note the absence of the variance in the common shock tem x in (17) and (18), which contrasts with (5) and (6). The intuition behind is that the common shock (interpreted as common/weather related yield risk) does not affect the *ordinal* ranking of the producers/growers and thus does not affect their effort in improving crop quality.

It is easy to see that the logic of encouraging after-harvest spot market sales by the growers described in Case 1 applies to the tournament compensation scheme as well. The growers with better quality crop (a result of random outcome here) have an incentive (self-select) to enter the Marketing Loan Program (MLP) with a view of selling their crop in the post-harvest period, after the loan repayment rates have been set on the basis of the at-harvest season prices of inferior quality crop grown by producers who do not have incentives to participate in the MLP. As was argued before, this result is in striking contrast with the virtual (and empirically observed) absence of the post-harvest spot/cash market in the absence of quality differentials, which has been largely a consequence of the Marketing Loan Program design.

Also, as was noted in Case 1, the presence of the price floor (marketing loan rate) provided by the MLP may serve as an additional deterrent from applying effort to improve crop quality. At this time, it is enough to observe that, while the effects of a price floor on the producer incentives are the same in both cases, rank-order tournament contracts encourage more effort *ceteris paribus* and thus lead to more efficient allocation, even under the above mentioned constraint.

Discussion

Efficiency

The model above shows that allocations that result from both the fixed quality premium and tournament contracts lie in between the two extremes: the socially optimal allocation when crop growers are risk neutral ($P = C'(x^*)$) and the actual absence of quality differentials that induces minimum quality.

Considering the fact that, because both individual and common yield risks can not be completely diversified in order to attain the first-best, optimal tournament contract design offers the second-best, which in many cases is superior to the fixed quality premium contracts. Comparison of the equilibrium grower efforts under the two contract structures given by equations (5) and (17) shows that, if the common producer/yield risk (variable *v*) is sufficiently large, crop growers may prefer tournament contracts to fixed quality premium schedules. The sufficient condition for this is

$$(\sigma_e^2 + \sigma_v^2) > \sigma_e^2 \pi$$

which, when observed, results in higher expected utility under the tournament scheme that can be verified by finding the optimal *w*, *r*, and (V_1, V_2) in the model above.

Obviously, when the common production shock, *v*, is sufficiently diffuse (*i.e.*, σ_v^2 is large enough), producers will prefer tournament contracts. This is consistent with findings of Green and Stokey (1983) for labor markets and Tsoulohas and Vukina (2001) for the U.S. poultry industry, but contradicts the general results of Lazear and Rosen (1981) who did not consider common shocks in their model. The intuition behind this result is that, while all production risks matter equally to the producers under the fixed premium standards, only idiosyncratic risks affect random ranking under tournament contracts, which reduces the overall uncertainty and encourages more effort. This is confirmed by comparing the equilibrium income variability under the two regimes given by equations (6) and (18). The sufficient condition for the grower income to be more stable under tournaments is

$$1 + sC''\sigma_e^2 \pi > \pi \sigma_e^2 (1 + (\sigma_e^2 + \sigma_v^2) sC''),$$

which holds when the variance of the common shock, σ_v^2, is sufficiently larger than that of the producer specific disturbance. Thus, the tournament contracts efficiently shift part of the production risks from the risk-averse growers to risk neutral producers. Speaking of the actual situation, it is worth pointing out that, under the U.S. Marketing Loan Program, the loan repayment rates are set equal to county level spot market prices, which emphasizes the importance of the common (weather and decease) risks, thus favoring tournament contracts.

All in all, the (preliminary) analysis suggests that the absence of quality differentials has detrimental effect on economic efficiency in markets for quality differentiated products, which can be improved by introduction of producer-processor contracts that specify quality premiums. Barring the first-best allocation under grower risk aversion, optimal tournament design brings the market closer to the socially optimal allocation than the more standard fixed quality premium contracts.

We believe that these results will not change after introducing producer heterogeneity, which is planned for the final version of the paper. Heterogeneous producers will certainly choose different effort levels but, when their individual characteristics are unobservable by the crop buyers, the superiority of the tournament scheme will remain. Producer heterogeneity may also introduce adverse selection, which can be ameliorated at the expense of efficiency as suggested in previous research.

After-Harvest Spot Market Participation

Another important result of this analysis is that introduction of quality premiums encourages producer participation in the post-harvest spot/cash market sales. This is an important consideration, given the virtual absence of such markets in the U.S. peanut production after the

2002 Farm Act that introduced the Marketing Loan Program. The analysis of fixed quality premium and tournament contracts showed that both create incentives for higher quality producers to enter the Marketing Loan Program. This is because selling the crop to processors in post-harvest spot/cash markets guarantees revenue that is higher than the loan rate.

It was noted that the presence of the price floor provided by the MLP serves as a deterrent from applying effort to improve crop quality. However, while the effects of a price floor on the producer incentives are the same in cases 1 and 2, rank-order tournament contracts encourage more effort *ceteris paribus* and thus lead to more efficient allocation, even under the above mentioned constraint. This aspect is not explicitly considered in the current version of the model but will be incorporated in its final version of the paper.

In the final version of the paper, we also plan to consider the sequential aspect of tournaments, as well as a dynamic aspect of the post-harvest producer marketing decisions.

Marketing Loan Program Costs

The existence of a post-harvest spot market is essential not only for efficient price discovery (equilibration of supply and demand), but also for the costs of the Marketing Loan Program operation that are born by the taxpayers. By providing incentives to withdraw the crop from the loan program, a system of quality premiums (either tournament-based or fixed) discourages the common behavior of forfeiting the marketing loan by many producers. So far, this behavior has resulted in the government having to dispose of vast quantities of peanuts at the end of the year (at grossly inferior prices) as peanuts are a semi-storable commodity and may not be suitable for edible purposes after a year of storage. By expanding (”thickening”) the post-harvest spot market, the suggested contractual arrangements provide more precise reference point for establishing the program repayment rate, which is in accord with the declared program's objectives.

While the program costs are not discussed at length in the current version of the paper, it should be noted that accounting for them does not change the crop grower contract preferences, as soon as the rules of the program and the price floor (the loan rate) remain the same. However, departure from the stated repayment rate setting rule and more direct pursuit of the program cost minimization may affect the optimal contract design and overall efficiency.

The Role of Forward Contracts

As was mentioned in the introduction, most of the peanut crop under the loan program is currently tied in the so-called "option-to-buy", or "buyer's call" contracts that leave the timing of purchase to the contractor (processor) and specify the selling price to be equal to current loan repayment rate. A peculiar fact is that these contracts are prevalent in the majority of the U.S. crop markets under the Marketing Loan Program (Sykuta, 2004). It has been suggested that crop growers do not mind ceding their marketing rights because these contracts pay an "option" premium in excess of the guaranteed marketing loan rate. Several reasons for offering these contracts have also been suggested, ranging from improvements in supply management and efficient risk sharing to exercising market power by collusive processors (MacDonald *et al.,* 2004). In case of the market power motivation, a simple model can be constructed that shows that the "buyer's call" contracts can, at least in theory, substantially increase the costs of the marketing loan program, unless the government has a superior bargaining power *vis-à-vis* crop processing industries.

While the actual costs and benefits of these contracts still have to be estimated, it is of interest to consider alternative marketing arrangements that may be preferred by agricultural producers. The model specified in this paper suggests that, if the expected net gains from selling the crop in the post-harvest spot market exceed the existing contract's "option" premium, producers of quality differentiated crops will prefer spot transactions (either tournaments or fixed standards) that specify quality premiums.

Alternative Assumptions about Crop Processors

The model presented in the paper assumes competitive and risk-averse processors. Obviously, hardly any economic agent is completely risk-averse, and so are the crop processors. However, what matters for the results of out contract analysis is the *relative* risk aversion of processors and growers – as soon as the former are less risk averse than the latter, the ordinal results will remain the same.

References:

Contracting and Organizations Research Institute (CORI) database of agricultural contracts. Available online on the University of Missouri website at http://cori.missouri.edu/cori-ag.htm.

Dohlman, E., Hoffman, L., Young, E., and W. McBride. "*Peanut Policy Change and Adjustment under the 2002 Farm Act*." USDA-ERS Publication OCS04G01, July 2004.

Green, J.R., and N.L. Stokey. 1983. "A Comparison of Tournaments and Contracts," *Journal of Political Economy*, 91(3), 349-364.

Laffont, J., and D. Martimort. (2002). The Theory of Incentives. The Principal-Agent Model. Princeton University Press.

Lazear, E.P., and S. Rosen. 1981. "Rank-Order Tournaments as Optimum Labor Contracts," *Journal of Political Economy*, 89(5):841-864.

MacDonald, J., J. Perry, M. Ahearn, D. Banker, W. Chambers, C. Dimitri, N. Key, K. Nelson, and L. Southard. "*Contracts, Markets, and Prices: Organizing the Production and Use of Agricultural Commodities*." USDA-ERS Agricultural Economic Report No. 837, 2004.

Revoredo, C.L., and S.M. Fletcher. "Supplier Reputation and Price Premium: The Case of Groundnuts in Rotterdam". Paper presented at the 83rd EAAE Seminar, 2003.

Sykuta, M., and J. Parcell. (2003). "Contract Structure and Design in Identity-Preserved Soybean Production," *Review of Agricultural Economics*, 25(2):332-350.

Tsoulohas, T., and T. Vukina. 2001. "Regulating Broiler Contracts: Tournaments versus Fixed Performance Standards," *American Journal of Agricultural Economics*, 83(4): 1062-1073.

Westcott, Paul C. and Price, J. Michael. (2001). Analysis of the U.S. Commodity Loan Program with Marketing Loan Provisions. ERS Agricultural Economic Report No. 801., April.

Westcott, P.C., C.E. Young, and J.M. Price. (2002). The 2002 Farm Act: Provisions and Implications for Commodity Markets. USDA's Economic Research Service, Publication 778.

Wu, S., and B. Roe. 2005. "Behavioral and Welfare Effects of Tournaments and Fixed Performance Contracts: Some Experimental Evidence," *American Journal of Agricultural Economics* (forthcoming).