PROTECTING CONTRACT GROWERS OF BROILER CHICKEN INDUSTRY

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1. Introduction

Broilers have been produced under contract since mid-century, and today, 85 percent of chickens are grown under contract. Judged by their prevalence, contracts are an integral part of organizing poultry production. Most of the broiler contracts use "two-part piece rate tournaments" payment structure consisting of a fixed base payment per pound of meat produced and a variable bonus payment based on the grower's relative performance. Current literature on tournaments emphasizes their role in reducing moral hazard on the grower side and other contracting costs (Goodhue;Knoeber; Knoeber and Thurman, 1994; Knoeber and Thurman, 1995**;** Vukina and Foster)**.** It is claimed that the contracts have benefited farmers by offering opportunities to earn income with relatively low capital requirements. It has alleviated typical cash flow problems for the small farms, and induced enterprise diversification on the farm. It is argued that the significant gains from contracts comes through the reallocation of risk from the farmers to integrators who have means to act upon uncertain outcomes (Knoeber and Thurman1995)

Despite their favorable properties, many broiler growers are dissatisfied with the existing pay-structure.They have repeatedly expressed their concern about the relative performance payment structure based on tournaments. What they believe is that it is unfair to compare their production costs with those of other growers in determining their payments. They consider this pay-structure unfair, may be, because they face group composition risks in it which arises from the homogenous treatment of the grower's ability even though they are heterogeneous. They have complains that gains from contract arrangements are largely being appropriated by the integrators through that unfair relative payment structure, while they receive only small, or even negative, returns from contract production.

Out of such concern for grower discontent, a number of states have made some failed attempts to protect growers. On the federal level, in 1997 the Grain Inspection, Packers and Stockyards Administration(GIPSA) of the US Department of Agriculture announced that it was considering "the need for issuing substantive regulations to address concerns in the poultry

industry with respect contract payment provision tied to the performance of other growers."(Federal Register,P.5935) which implies that policy makers are taking such concerns seriously and moving forward to take necessary steps to protect contract growers. But the most relevant question is –what policy suggestions do they have to protect growers? Perhaps, none. In reality, public policy in this area needs sufficient guidance, which, in effect, requires extensive research to be conducted on integrator practices. But whatever the policy suggestions are , they might impose restrictions on the privately held transactions between the integrator and the contract growers. Imposed restrictions or regulations of any type on the privately held transaction may affect different parties differently, may be at the cost of the efficiency.

The closely related literature on franchising has generally been very critical of government regulation, on the grounds that any regulation will interfere with the ability of economic parties to negotiate efficient agreements (Beales and Muris; Brickley, Dark and Weisbach). Lewin**,** on the other hand**,** advocates in favor of regulation to allow the unionization of growers that would increase their bargaining power; she also favors the regulation of contract duration.

In a recent paper, Tsoulouhas and Vukina (2001) look at the welfare effects of a widely advocated regulatory measure restricting integrators from using tournaments replacing them with the payment structure based on the fixed standard. They have shown that , absent any other rules, the mandatory replacement of tournaments with fixed performance standards can decrease grower income insurance without raising welfare. But income insurance and welfare can simultaneously be increased provided that the slope of the bonus payment scheme, the so called "piece rate," is also regulated. Moreover, the enforcement of fixed performance standards absent any rules for the magnitude of the piece rate will result in an unambiguous reduction in social surplus, but regulation accompanied by a rule determining the magnitude of the piece rate may or may not reduce social surplus, depending on the technology and preferences.

From the grower's perspective, even though the replacement of the tournaments by fixed performance standard eliminates the group composition risk it adds common production risk which is larger than group composition risk (Levy and Vukina). And ,also, as Tsoulouhas and

Vukina showed, switching from a tournament to a fixed performance standard is not making growers better off without further regulation. But the question is –is there any way to regulate the existing contract which is welfare improving for the growers and implementable ? If we can find any, then we don't have to throw out the existing contract which is in place for the last half century. This is the question that I want to address in this paper. The regulator solves the integrator's problem as a social surplus maximizer, and then designs the mechanism in such a way that the integrator implements social surplus maximizing contract.

In case of the relative payment structure based on the tournaments regulator may be able to increase the welfare of the growers regulating the average performance standard upward.If there is budgetary constraint then the regulator may be restricted severely in doing so.The paper is organized as follows. In the next section, I describe the model. The results are obtained and discussed in section 3. In the fourth section, I try to solve the problem with budget constraint. In the final section, I summarize the results.

2. The Model

Based on the earlier work of Tsoulouhas and Vukina, we model the contractual relationship between a single integrator and a number of growers. They assume that each grower receives the same number of chicks that he is supposed to raise to the same target weight. Hence, the number of pounds produced is roughly the same for all growers and the performance differs depending only on the feed used. The amount of feed utilized by a grower stochastically depends on his own effort. By exerting effort, the grower can speed up the growth of animals that will reach market weight by consuming less feed. The integrator cannot directly observe the effort level of each grower, that is, there is "hidden action" moral hazard. The integrator can only observe the feed used and the output obtained by each grower.

The sequence of moves is as follows. At the beginning, the integrator offers a take-it-or-leave-it contract to each grower specifying a payment schedule. Depending on this pay

schedule, the growers decide whether to accept or reject the offers. If the growers accept the offers, then they exert effort and outcomes (feed use) are realized. The integrator observes outcomes and makes the payment. If they reject the offers, each party receives his reservation payoff.

As mentioned above, the output target for each grower is set to $\bar{y}$. This is so because the integrator treats all the growers homogeneously, *ex ante*, avoiding adverse selection problem. Feed used by grower, x^i, $i \in N = \{1,2,...,n\}$ is in the interval $[x_L, x_H]$. Let $x \equiv (x^1,...,x^n)$ and $x^{-i} = (x^1,..., x^{i-1}, x^{i+1},..., x^n)$ denote the feed levels obtained by all growers including i and excluding i, respectively. To derive the optimal utility payments, we characterize the incentive-efficient scheme assuming that there are only two types effort e_L and e_H. with where $e_L < e_H$.

Let $\mathbf{e} = (e^1,..., e^n)$ and $\mathbf{e}^{-i} = (e^1,..., e^{i-1}, e^{i+1},..., e^n)$ denote the efforts exerted by all agents including i and excluding i, respectively. In the presence of common shocks, the distributions of feed are dependent. Let $c(\mathbf{x}/\mathbf{e})$ denote the joint density function of x given the actions of the growers, $h(x^i/\mathbf{e})$ denote the marginal density obtained from $c(\mathbf{x}/\mathbf{e})$, and $H(x^i/\mathbf{e})$ denote the distribution function. The density $h(x/\mathbf{e})$ has full support, that is $h(x^i/\mathbf{e})>0$ for all e and all x, x^i. It is assumed that $H(x^i / e_L, \mathbf{e}^{-i}) \leq H(x^i / e_H, \mathbf{e}^{-i})$ with $\bar{e}^i < e^i$ for every x^i, with strict inequality for a set of values of x^i with positive probability, and for every $\mathbf{e}^{-i}$ and i. These are *first-order stochastic dominance* conditions saying that the probability that the feed used by a grower exceeds any given level decreases with his effort.

The grower is assumed to have a von Neumann-Morgenstern utility function of the form $U(r^i)-c(e^i)$, where r^i is the grower's remuneration and $c(e^i)$ is his disutility of effort. The function $U(\cdot)$ is twice continuously differentiable, with $U'(\cdot)>0$, $U''(\cdot)<0$. The disutility of effort shows $c'(\cdot) >0$ and $c''(\cdot) >0$. The principal is risk-neutral with respect to profit. The output market is assumed to be competitive, the price of output p is deterministic and the price of feed is normalized to one.

An optimal contract offered to grower i specifies a payment r^i depending on observed feed levels **x**, r^i (**x**). Let $u^i(\mathbf{x})=U[r^i(\mathbf{x})]$ denote utility payments and the inverse $U^{-1}[u^i(\mathbf{x})]= r^i(\mathbf{x})$ denote equivalent income. Since U(·) is increasing and strictly concave, U^{-1} is increasing and strictly convex. To derive the optimal utility payments, we characterize the incentive-efficient scheme assuming that the integrator benefits by implementing effort e_H for the growers. Hence , the incentive-efficient scheme u'(x) solves the following problem:

$$\underset{u^i(x), i\in N}{Max} \; p\bar{y} - \int_{x_L}^{x_H} \ldots \int_{x_L}^{x_H} U^{-1}[u^i(x)]c(x/e=e_H)dx^1 \ldots dx^n$$

$$+\omega\,[\int_{x_L}^{x_H} \ldots \int_{x_L}^{x_H} u^i(x)c(x/e=e_H)dx^1 \ldots dx^n - c(e^i=e_H)]$$

subject to

$$\int_{x_L}^{x_H} \ldots \int_{x_L}^{x_H} u^i(x)c(x/e=e_H)dx^1 \ldots dx^n - c(e^i=e_H) \geq 0 \quad \forall i \quad (3')$$

$$\int_{x_L}^{x_H} \ldots \int_{x_L}^{x_H} u^i(x)c(x/e=e_H)dx^1 \ldots dx^n - c(e^i=e_H) \geq \int_{x_L}^{x_H} \ldots \int_{x_L}^{x_H} u^i(x)c(x/e^i=e_L, e^{-i}=e_H)dx^1 \ldots dx^n - c(e^i=e_L) \quad \forall i \quad (4')$$

where ω is welfare weight on the grower's utility and $E(x^i/e)$ is the expected feed utilization by grower i given effort **e** for all growers. Also where the constraints in (3) are *individual rationality constraints,* and those in (4) are *Nash incentive compatibility constraints*

3. Results

Since from conditional probability we know that c (**x**/**e**)= $h(x^i/\mathbf{e})\; g(\mathbf{x}^{-i}/x^i, \mathbf{e})$ it can be shown that the optimum incentive efficient scheme satisfies:

$$U'(r^i(x) = \frac{1}{(l+w) + m[1 - \frac{h(x^i/e^i=e_L, e^{-i}=e_H)g(x^{-i}/x^i, e^i=e_L, e^{-i}=e_H)}{h(x^i/e=e_H)g(x^{-i}/x^i, e=e_H)}]} \quad \forall x, i \qquad (5)$$

where λ and μ are multipliers for constraints (3) and (4).

Now, if we set ω=0,then the problem will be the one for the integrator instead of the regulator. Then the condition (5) boils down to

$$U'(r^i(x) = \frac{1}{l + m[1 - \frac{h(x^i / e^i = e_L, e^{-i} = e_H) g(x^{-i} / x^i, e^i = e_L, e^{-i} = e_H)}{h(x^i / e = e_H) g(x^{-i} / x^i, e = e_H)}]} \quad \forall x, i \qquad (5')$$

Now, if we compare equation (5) and (5') it is obvious that $r^i(x)$ is larger in case of regulator's scheme for any feed realization, since U(.) is concave and $(l + w) > l$. For the same effort $\mathbf{e_H}$, $r^i(x)$ is larger for the regulator's problem. Hence, if the regulator impose this pay structure on the integrator, the grower's welfare will be larger because of larger payment for any feed realization.. But the reverse is true for the integrator.

Integrator's case

Since the distributions of feed are not independent because of the presence of common uncertainty, individual feed utilization is not a sufficient statistic for x^i with respect to individual effort; the density $g(\mathbf{x}^{-i} | x^i, \mathbf{e})$ depends on e^i. Hence, the feed levels obtained by the rest of the group convey information about common production uncertainty and, as a result, the effort choice of any given grower. In this case, condition (5′) implies that the optimum compensation rule for grower i must depend not only on x^i,but also on the feed levels obtained by all other growers, $\mathbf{x}^{-i}$.

To solve this problem, it requires the precise knowledge of distributional forms. However, as shown by Tsoulouhas and Vukina and Tsoulouhas, rule (5′) can be simplified without distorting the incentives. For sufficiently large the number of growers, the average feed used by all growers except i, $\bar{\mathbf{x}}^{-i}$ can convey information about the common production uncertainty, which suggests that the payment to each grower can depend only on the feed he

utilized and $\bar{\mathbf{x}}^{-i}$ Given the output produced by all growers except i, the optimum compensation rule for grower i can be approximated by a Taylor series expansion at $\mathbf{x} = \grave{}\mathbf{x}^{-i}$ which provides

$$r^i(.)=b_o+\beta_o(\bar{\mathbf{x}}^{-i}-x^i) \qquad (6)$$

where a grower is paid a base payment b_o , to provide incentives to participate, adjusted by a positive or negative amount that depends on his relative performance ($\mathbf{x}^{-i}$-x^i) and the magnitude of the "piece rate" $0<\beta_o<1$. The variable part provides incentives to exert effort. That's the way how common uncertainty is removed from the grower's responsibility.

Regulator's case

Now, the question is what rule do we get when we look at equation (5),i.e., when we look at the regulator's problem? Only additional term that we have is the welfare weight ω. If we rewrite (5), we have

$$U'(r^i(x)=\frac{1}{(l+w)+m[1-\frac{h(x^i/e^i=e_L,e^{-i}=e_H)g(x^{-i}/x^i,e^i=e_L,e^{-i}=e_H)}{h(x^i/e=e_H)g(x^{-i}/x^i,e=e_H)}]} \quad \forall x,i$$

Given the distribution and the preferences, for any realization of (x^{-i}, x^i), denominator of the right hand side of (5) is higher that that of (5′). That means right hand side is smaller in regulator's case. Hence, concavity of utility function gives us larger $r^i(x)$ for the regulator's case. Since this happen for any realization of (x^{-i}, x^i), the optimum compensation rule for grower i can be approximated by a Taylor series expansion at $\mathbf{x} = (1+\psi(\omega))\grave{}\mathbf{x}^{-i}$ which provides

$$r^i(.)=b_o+\beta_o[(1+\psi(\omega))\ \bar{\mathbf{x}}^{-i}-x^i] \qquad (6')$$

where $\psi'(\omega)>0$. Now, for the feed realization of ($\bar{x}^{-i}$, x^i) where $\bar{x}^{-i} = x^i$,the bonus payment is zero according to the existing rule adopted by the integrator. Whereas for the same realization of feed use, the regulator's contract gives bonus of $\beta_o\ \psi(\omega)x^i$. This happens because the regulator cares about the welfare of the growers. As a result, she gives part of the surplus to the growers. But the question is how to implement the contract and where to set the value of the

welfare weight, ω? The implementation procedure is simple. Say, for ψ(ω)=ω and ω=5%. Then (6′) will give us

$$r^i(.)=b_o+\beta_o[(105\% \ \bar{\mathbf{x}}^{-i} - x^i] .$$

Which shows that the standard is merely others' average. Instead, it is 105% of others' average. In case of existing pay structure, growers know their own average and others average. Only thing they need to do is to adjust others average by 105% provided the regulatory rule is in place.

Setting the value of ω is the political issue.

4. Feasibility

So far it is assumed that there will be no budgetary constraint. That means the integrator can pay that additional amount from his profits. But if this is not the case and the regulator has some money (B) to spend on it, then the problem changes. If the budget constraint is

$$p\bar{y} - \int_{x_L}^{x_H} \ldots \int_{x_L}^{x_H} U^{-1}(u^i(x))c(x/e)dx^1 \ldots dx^n - E(x^i/e) \le B \tag{7}$$

Now, the derived condition is

$$U'[r^i(x)] = \frac{1+\dfrac{g}{h(x^i/e=e_H)g(x^{-i}/x^i, e=e_H)}}{(l+w)+m[1-\dfrac{h(x^i/e^i=e_L, e^{-i}=e_H)g(x^{-i}/x^i, e^i=e_L, e^{-i}=e_H)}{h(x^i/e=e_H)g(x^{-i}/x^i, e=e_H)}]} \tag{5''}$$

Where g is the multiplier for the budget constraint. In this case, g plays vital role in In the determination of the $r^i(x)$. If the budget is not binding we get the similar results as described above. But if the budget is binding then depending on the value of g ,the regulator's Problem differs from the integrator's problem. For some values of g ,both may have the similar results. In that case regulator may not be able to affect privately held transactions.

5. CONCLUSION

In case of the relative payment structure based on the tournaments regulator may be able to increase the welfare of the growers regulating the average performance standard upward.If there is budgetary constraint then the regulator may be restricted severely in doing so.

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