EFFICIENCY OF AGRICULTURAL CONTRACTS: THE CASE OF WHEAT PRODUCTION IN SOUTH-PYRENEES

Contracts play a more and more important role in agriculture. Few microeconomic studies have been made in France and Europe up to now. After analysing all the contracts signed between a cooperative and its wheat producers over four years, the implementation of a structural microeconomic model of contract helps demonstrate that contracts may become an effective tool to favour production of quality by encouraging producers of the best grain to increase their yields.

The evolution of the CAP reducing guaranteed outlets, the increase in characteristic requests for specific products or the increase in requests for traceability speak in favour of an expansion of contracts. However, in France and Europe, few microeconomic studies are dedicated to the economic analysis of agricultural contracts, which remains a top research subject in agro-industrial economics. There are several empirical questions to look at, from the assessment of the importance and diversity of these contractual relations to the analysis of their performances (risk-sharing, incentives, investment) according to regional productions and characteristics.

In the present context of agricultural price fluctuations, formalizing certain productions by contracts may help reduce farmers’ income risks. In general, these contracts concern agricultural products of specific quality. By orientating production through incentives, formalization through contracts may be a way to widen the offer, integrating clients’ desired qualitative standards and bringing traceability and health guarantees. One of the advantages of production formalized by contract is that the link created between a farmer and another partner (be it a cooperative or any other sort of organisation) helps take into account the distinctive features of the environment in which this production takes place. Even if there happens to be regularity in the contractual forms used over areas, countries and productions, in general, each contract has its specificities and allows adaptation of the terms of exchange (risk-sharing, incentives, investment) according to regional productions and characteristics.

Economic modelling helps avoid endogenous bias in order to assess the effects of these contractual links and their efficiency according to areas and particular contexts.

In our work, we analysed all production contracts for hard and soft wheat signed between a cooperative and its members. The longitudinal dimension of the data and the precise observation of contracted methods of payment allow the assessment of a structural microeconomic model of contracts with incentive to make efforts (because of the asymmetry of information between farmer and cooperative on growing efforts), that is to say a model integrating the farmers’ behaviour.

These contractual links are represented by a structural model of behaviour with information asymmetry of moral hazard type (Dubois and Lavergne (2004)), a notion which refers to the fact that in order to maximize his yield, the farmer under contract undertakes a whole set of actions that the cooperative cannot observe. The empirical results of our econometrical estimations help show better efficiency of these contractual links and measure the importance of these incentives according to every farmer’s geographical and ecological characteristics.

**Hard and soft wheat production contracts in South-Pyrenees**

Cultivations of superior quality, such as superior bread-making wheat of good baking value, are often the object of contracts between storage organisations and farmers. The guarantee of quality, the farmers’ loyalty and mastery over supply and collection (among which the use of certified seeds), the orientation of productions and varieties are also recognized advantages. Our survey is based on four years of data on hard and soft wheat contracts in South-Pyrenees (see
frame 1). In the monitoring of these production contracts, the cooperative observes farming methods in detail in order to control them. As a general rule, for example, farmers sow at the end of October. Farmers follow recommended split applications of nitrogen. For hard wheat, supplies averaged 190 units of nitrogen per hectare over three years in four passages and for soft wheat about 170 units of nitrogen per hectare in three passages. As for fungicides, on average they are spread twice on hard wheat and once on soft wheat. However, the best productivity results are noted when farmers make three passages of fungicide for hard wheat and twice for soft wheat. The best yields are observed on deep soils. These empirical facts show that the conditions (lands, quality of soils, exposure and skills) are highly heterogeneous. They also show that the farmers’ room for manoeuvre is more on the yield side while as far as quality is concerned the very heterogeneous results are imposed by the fixed characteristics of their plots and the strict technical recommendations of the cooperative (particularly checked by cooperative with plot-visiting and follow-up of cultivation index cards).

Economic and econometrical analysis

Cooperative production contracts stipulate a quite frequent form of payment where the price (per quintal) paid for every delivered quantity depends on the qualitative production characteristics. These types of payment encourage yield in a differential way, according to quality. For all varieties of hard and soft wheat, a unit price depending on various indexes of production quality is paid. The selected quality indexes depend on varieties: specific weight, rate of proteins, of variety pureness, of various impurities, of grain impurity, of crushed grains, of mitadin, Hagberg falling numbers. Such are all the contracts that the unit price is higher if a certain number of quality indexes exceed a threshold determined by contract. For instance, as far as the Brindur variety is concerned, a higher unit price (therefore including a bonus) is given if the rate of protein is higher than 13.5%, the specific weight higher than 76%, the rate of mitadins lower than 56%, the rate of crushed grains lower than 10% and the rate of impurities lower than 10%. Incentives to increase yield are thus stronger if farmers anticipate that they can obtain a quality bonus since those who can get good quality indexes are allowed a price per extra quintal. These questions of discriminations and incentives may be modelled and estimated thanks to longitudinal data on contract characteristics, on given qualities and on productions and yields. Frame 2 describes a microeconomic model assessed using the collected data.

The concept of modelling consists in using the fact that the observation of the quality indexes and exact terms of the contract allow us to observe and find the quality values anticipated and achieved by farmers as well as the unit price (per quintal) finally paid to the farmer.

We consider a moral hazard model on the farmer’s production effort since the cooperative cannot observe this effort. Thanks to knowledge of the exact terms of the contract, we can determine what price per quintal is anticipated by the farmer according to wheat quality criteria and therefore take into account the yield incentives provided by the contract. We can, then, assess the effect of the farmer’s unobserved effort due to contractual incentives in the unknown terms of the yield equation. Without a structural model, the complete model cannot be identified because of the unobserved effects modifying yields.

The results of the empirical estimations of frame 2, which are not detailed here, clearly show that the discrimination operated by contracts offering unit prices or bonuses according to quality criteria, generate, for contracting farmers, incentives to produce more. Indeed, the regressions show that the higher the unit price per quintal, the greater the effect of the contracted area on the yield. This result can be interpreted by the fact that effort incentives are higher per unit of contracted area when the promised price is higher. Moreover, it is not at all a mechanical effect of scale return which would involve a correlation between contractual area and yield. If this type of scale return is assessed by valuing the effect of the area on yield without having the yield interact with the contractual expected unit price, no scale return is found and the estimated parameter of the contracted area is null.

The presence of unobserved specific effects in the equation (5) shows that the contract incentive effect on yield is much higher for farmers with better quality products than for others, and this over and above the unobserved effects affecting yields and possibly correlated to quality ones. These unobserved specific effects represent all the fixed characteristics related to land and farmer which affect the yield and the grain quality, which can only be identified thanks to the repeated observation of farmers’ individual productions over several periods. These unobserved effects represent a certain measure of the farmers’ skills and of the intrinsic qualities of their land and location on the performances in term of quality and yield. These unobserved variables may, a priori, be correlated and thus could explain the conditional correlations of yields and indexes of quality. However, structural estimations help show that, even when these effects are taken into account, the contract bonus has an incentive effect on the producer’s behaviour.

Contracts meet cooperative objectives well by giving different incentives according to grain quality. Moreover, equations (1) and (5) allow us to assess specific effects ($\theta_i$ and $\theta_l$). The estimation shows that these effects are positively correlated. In this way, there is no opposition between competences on quality and yield: the best farmers in terms of quality are also the best in terms of yield. There is also no opposition between competences for certain terms of quality in comparison with others.

Empirical results also help assess the geographical distribution of these specific effects as well as their correlation to certain farmers’ characteristic variables. An uneven geographical distribution may be observed in such a way that these effects are significantly correlated to town or department indicators. This is how, over three years, the area of Lavaur, Puylaurens and Gaillac seems more adapted to soft wheat cultivation while the area of Castres (where farms are of mixed farming-livestock type) is the least adapted.

Last, after showing that these contracts affect yield incentives in a differential way according to grain quality, we may study the risk-sharing properties of these contracts. The difference (free of storage costs) existing between the
average crop real prices (under contract) and the prices after storage (out of contract) shows that it would be more profitable for farmers to store their production and sell it afterwards. However, in case of storage, most farmers need to manage risks to limit unfavourable price risks and cash-flow development (banking interests to finance storage costs, for instance). Average crop prices determined by contract are on average lower than prices after storage (between 4% and 13% according to years). Therefore, these differences also show that there is a risk premium that farmers implicitly accept to pay through cooperative contracts in order to limit their income risk.

Conclusion

This survey helped show that the contracts drawn up by the cooperative with its members effectively encourage farmers to increase their yields, especially for higher quality productions (fulfilling certain quality criteria defined by the cooperative). The observation of technical performances showed that agronomical and bioclimatological conditions (lands, soil quality, exposure) were decisive and that the farmers’ room for manoeuvre is more on the yields side than the quality side, imposed by intrinsic characteristics of plots of land and by technical instructions given by the cooperative. One of the consequences of these effort incentives is that those who obtain quality bonuses have a yield advantage of 1.4 quintal per hectare.

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For further information

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