



AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search

<http://ageconsearch.umn.edu>

aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

Marketing Contracts and Risk Management for Cereal Producers

Caroline Roussy¹, Aude Ridier², Karim Chaib³, Marie Boyet⁴

¹ ADEME UMR SMART-LERECO, F-35000 Rennes, France, roussy.caroline@gmail.com

² Agrocampus Ouest, SMART-LERECO, F-35000 Rennes, France, aude.ridier@agrocampus-ouest.fr

³ EI PURPAN-INPT, University of Toulouse, F-31000 France, karim.chaib@purpan.fr

⁴ Agrocampus Ouest, SMART-LERECO, F-35000 Rennes, France, marie.boyet@gmail.com

**Contribution presented at the XV EAAE Congress, “Towards Sustainable Agri-food Systems:
Balancing Between Markets and Society”**

August 29th – September 1st, 2017

Parma, Italy



**UNIVERSITÀ
DI PARMA**



Copyright 2017 by [Caroline Roussy] [Aude Ridier] [Karim Chaib] and [Marie Boyet]. All rights reserved. Readers may make verbatim copies of this document for non-commercial purposes by any means, provided that this copyright notice appears on all such copies.

Marketing Contracts and Risk Management for Cereal Producers

Abstract

This article presents an analysis of risk management by French cereal farmers. Producers are subject to market and production risks and to environmental restrictions. The paper analyses cereal farmers' strategies to manage risks through marketing contracts and production decisions. Three main categories of marketing contracts are adopted bearing different risk levels: forward contracts, average price contracts and spot contracts. A hundred wheat producers are surveyed in South-West France. The quantitative analysis of their contractual choices shows that risk perceptions and the farmer's level of education have an influence on contractual choice while crop diversification is negatively correlated with forward contracts.

Keywords: Marketing contracts, risk management, durum wheat sector, Tobit

1- Introduction

France is a leading durum wheat player on the world market. From 2010 to 2012, the country produced on average nearly one-third of the 8.4 million tonnes of durum wheat grown in the European Union, the world's number one supplier. Yet durum wheat areas are steadily shrinking across all four French production areas. Producers have a number of risks to manage: the production risk, the market risk and the quality risk particular to durum wheat farming. Production risks are due to climatic hazards, plant disease and pest infestation, all of which reduce yields and product quality. Yet quality is key because durum wheat is grown for human consumption (pasta, semolina, etc.). A drop in quality can break producers' compliance with contractual arrangements set with coops and processors. Cereal growers are also exposed to market risks due to the volatility of cereal and input prices. This risk is exacerbated by the intensive use of inputs to attain the quality required to process durum wheat. In this environment of amplified risks, now combined with the prospect of having to reduce the use of chemical inputs in farming practices (low-input farming), we look into the resources available to durum wheat producers to balance their quality targets with their quantity targets.

The risk management tools available to farmers include on-farm-specific tools (diversification and precaution) and risk externalisation tools. Diversification builds a portfolio of activities to offset losses and profits. Diversification may concern farm's crops and products. Farmers can also build their own precautionary savings to cope with income fluctuations over time. Externalisation tools consist of taking out financial coverage with a third party. This may take the form of an insurance policy or securing income on the financial markets. Farmers' marketing contracts with storage agencies are also defined as market risk externalisation instruments.

This paper studies the marketing and production choices made by cereal producers specialised in durum wheat-sunflower cropping and identifies the role of risk in their decisions. It draws on earlier studies that analyse how sector contracts for field crops can manage the different risks (production, market and quality risks) (Section 2). An analytic table of contracts in the durum wheat sector is proposed, it is based on a range of contracts offered to farmers today by a number of co-operatives, including two of the major co-operatives of the French durum wheat market. It proposes a qualitative analysis of farmers' exposure to the different risks (Section 3). Lastly, a survey of a hundred producers in South-West France forms the basis of a quantitative analysis of the variables that influence the marketing choices reported by producers, especially the role played by the characteristics of the farm and the farmer and his risk perception (Section 4).

2- Theoretical framework: risk and contracts

2.1 What risks?

Farmers are generally adverse to the risk of loss. This means they prefer a lower, certain income to a higher, uncertain income. They are prepared to reduce their activity or take on additional costs, corresponding to a “risk premium”, to reduce their risk exposure (Hardaker et al. 2004; Harwood et al. 1999). However, the level of risk acceptance can vary from one farmer to the next, giving rise to different management choices (diversification, precaution, insurance, contracts, etc.). Farmers are exposed to two main types of risks: production risk and market risk. Production risk takes the form of i) yield or harvest variability, due to climatic hazards and disease and of ii) quality risk associated with the deterioration in the product’s attributes due to cropping and storage conditions. Where farmers have a contractual commitment, a drop in yield or quality can itself generate a risk of non-compliance with their contract. In the case of a contractual agreement, farmers are then exposed to a counterparty default risk if they cannot honour their contract (in terms of quality, volume, etc.). Cereal producers are also exposed to market risk. They have to anticipate output selling prices and input purchasing prices when they make their production decision. Yet these prices fluctuate from one year to the next, and even from one period of the year to the next. Production risk and market risk combine to expose farmers, more generally, to income risk. This paper analyses two types of instruments that farmers can use to manage their exposure: marketing-based externalisation and on-farm crop diversification.

2.2 Marketing and risks

Contracts between field crop farmers and storage agencies guarantee farmers a market outlet and processors a supply (MacDonald and Korb 2011). Contracts also meet many agricultural sector goals, especially in terms of performance incentives, sharing market power and spreading risk (Bouamra-Mechemache et al. 2015; Mallory et al., 2015). On this last point, the transfer of risks between buyer and seller can vary depending on the structure of the contract. We focus on how contract structure spreads the different types of risks identified between the parties: production risk, market risk and quality risk (of non-compliance).

As regards production and yield fluctuation risks, contracts based on a rather than tonnage transfer the producer’s yield risk to the storage agency. The latter can share the risks, especially climatic risks, among their members in different climate areas in their collection area.

Exposure to market risk depends on three components analysed by Sykuta and Parcell (2003) in the case of “quality” contracts in the certified GMO-free soybean sector. Basically, the contract establishes the allocation of three elements between the contracting parties: value, risk and decision rights. Yet depending on the period covered by the concluded contract, interference exists between risk exposure and the allocation of value and decision rights. So price-based contractual arrangements influence the spread and nature of the risk. The transaction bears little uncertainty if the merchandise is sold for that day’s market price and delivered with ownership physically transferred the same day. If the contract is concluded prior to harvest, the farmer’s exposure to price volatility depends on the price arrangements. So if the price agreed is the price on the day of delivery, decision rights on delivery day constitute an important strategic issue for both parties (and depend, among others, on their storage capacities). The longer the period between the contracting date and delivery, the greater the exposure to risk. If the price is set when the contract is signed, the producer is protected against price fluctuations, but may forego the opportunity of a potentially higher price between the contracting date and delivery (Sykuta and Parcell, 2003).

Contractual arrangements spread the quality risk for the two parties in a number of ways. A premium may be specified to remunerate output that meets quality standards. The question of the amount of the premium refers to the problem of measuring the effort producers have to make to reach quality. In the presence of strong soil-climate heterogeneity and a high climatic risk causing quality to fluctuate, producer effort and end product quality are not necessarily perfectly correlated and an end product

quality-based premium is not necessarily much of an incentive mechanism and could even prompt opportunistic behaviour. This is why the premium system is accompanied, wherever possible, by technical specifications laying down production factors and stages able to be checked. Another question with regard to the quality risk is product particularity in terms of quality. If the product does not generate any particular, sustainable value-added on the market compared with a lesser quality product, it is less advisable for the producers to make an effort.

The hypothesis could be made that given the role played by the different types of marketing on the level of risk, a contract's characteristics (allocation of value, risk and decision rights) and the contracting parties' characteristics (especially their attitude to the risks) will play a role in the adoption of these contracts (Paulson et al. 2010). A brief summary of the empirical literature on the determinants of the adoption of field crop marketing contracts is proposed in Franken et al. (2012). Empirical studies of field crop marketing-related risk management all concern the United States, with the exception of Jordaan and Grove (2007). These studies usually take small to medium-sized samples of producers, focusing on fifty (Franken and Pennings 2009; Musser et al. 1996; Shapiro and Brorsen 1988) to hundreds of producers (Goodwin and Schroeder 1994; Sartwelle et al. 2000). These studies generally analyse the choice of risk coverage either by means of marketing contracts prior to harvest – whether forward contracts or futures contracts – or after harvest on the spot market. Few studies consider sales intensity by marketing type (Franken and Pennings 2009) or marketing frequency (Goodwin and Kastens 1996). The farm's size in hectares, its debt and a low level of diversification are virtually always positively correlated with the adoption of forward contracts (Pennings et al. 2008; Sartwelle et al. 2000; Shapiro and Brorsen 1988). To a lesser extent, some studies mention that the adoption of forward contracts can be positively correlated with risk aversion (Franken et al. 2012; Goodwin and Schroeder 1994; Musser et al. 1996; Pennings et al. 2008). Age and experience play a more ambiguous role in the use of contract-based risk management instruments (Reynaud and Ricome 2010).

3- Contract and risk exposure analysis

3.1 Structure of the different contracts available to farmers

A study was made of the contracts available to durum wheat producers in the main production areas in France. Semi-structured interviews were conducted with experts, together with the marketing and quality managers of a number of French cereal co-operatives, including the two durum wheat sector leaders¹. A typology was drawn up of the marketing means available to farmers based on the standard contracts reported and interviews conducted. Each type of marketing method identified was then qualified with respect to the different risks defined in the previous section. This analysis was then validated by the six experts in the survey. All the contracts studied feature the following elements: i) a level of commitment to and remuneration for quality; ii) a level of commitment to the volume delivered; iii) a delivery date; iv) a price; and v) a storage method. The contracts are first divided into primary contracts and secondary contracts. Primary contracts are bound to the marketing method whereas secondary contracts concern additional commitments such as production method and quality.

The “production” contracts or sector contracts (Row 1, Table 3) are secondary contracts not found in all co-operatives. Only co-operatives with what are called “quality” production areas practise them, such as those in the traditional durum wheat production areas in South-East and a small part of South-West France. These sector contracts are signed at sowing time, committing the farmer to a variety capable of meeting the required quality criteria and a technical method that reduces the risk of non-compliance (e.g. certain previous crops are excluded to prevent the development of fusarium wilt). The farmers who sign these contracts are guaranteed to sell their production at least at the co-

¹ Arterris and Axérial co-operatives.

operative's average price, plus a premium per tonne. This type of contract is proposed in specific areas where the soil-climate conditions are optimal to meet the required quality levels. Production contracts therefore concern a very small proportion of farmers.

There are three main types of primary marketing contracts: forward contracts, average price contracts and spot contracts. Forward contracts set the selling price prior to harvest. Under the average price contract, farmers are paid on account at harvest with increments paid over the marketing season. This is the historical French co-operative marketing method. Co-op farmers not bound by any other contract sell, by default, their production at the average price made by the co-operative during the marketing season. The third type of contract covers post-harvest transactions at the price of the day on the spot market (Table 3).

Pre-harvest fixed price forward contracts (Row 2, Table 3) offer a range of price-setting options depending on the organisation. Either the price is set or a "target price" is agreed. The durum wheat market deals in relatively small volumes and, unlike other cereal markets, there is no futures market. The storage agencies can set a price for a given quality and volume to guarantee a minimum flow downstream. The co-operative can then offer this price to producers for a given volume on a pre-harvest contract. Other pre-harvest contracts between co-operatives and farmers set a target price. The price for the contracted volume is set for a limited period (in months) and the contract becomes null and void if the merchandise does not find a buyer by the end of this period. To help them negotiate their price, farmers have access to information published daily by co-operatives often available online and/or given by the co-operative's technicians. The co-operative puts together its price information from its knowledge of the market (which is, as already mentioned, a small market with few operators) and information from brokers. The price is set based on the value of business handled at the time of signing. When traded volumes are low, the soft wheat price serves as the reference price. Other pre-harvest contracts are index-linked to the soft wheat futures market. The price paid on delivery is ultimately adjusted to reflect observed quality and increases/reductions on the price set on signing, in keeping with the co-operative's own scales (protein content, broken grains and loss of vitreous aspect).

The average price marketing method² includes the average price contract (Row 3, Table 3) and the average price transaction (Row 4, Table 3). Average price contracts are signed at the end of April, at the latest, for durum wheat and are bound to a given tonnage. Payment is made on account at delivery and then by price increments based on market observations over a number of periods decided by the co-operative board. Price projections are made at different moments in the year to distribute the price increment based on progress with downstream sales. The final price paid to the producer is therefore averaged over the co-operative's annual sales, i.e. the marketing season period from the date of signing to the following year's harvest. This type of remuneration limits exposure to the risk of in-year price fluctuations. If farmers have not signed a pre-harvest commitment, they can sell their production at "average price" in certain co-operatives (contract in Row 4 of Table 3). They consequently do not commit to the volume to be delivered. The payment method is identical to the average price contract, but the evaluated average price is calculated over a shorter period (from delivery), which means that producers do not benefit from periods of high prices at the beginning of the marketing season when durum wheat is still scarce on the markets.

The third category of transaction is post-harvest marketing at the observed current price (or spot price) (Row 5, Table 3). In this case, no commitment is made to either volume or quality prior to harvest. The price is set at sale, based on observed quality. The absence of a pre-harvest volume commitment also means that farmers have no guarantee that their merchandise will be able to be stored in the co-

² Called different names depending on the co-operative: pool price, season average price, etc.

operative's silos when they want to deliver it. So the farmers who choose this type of marketing method need to have a fluid logistical chain with storage capacities, when needed.

To sum up, in theory, durum wheat producers have at best four options : i) seek a price paying for quality, averaged over the year, by signing a production contract paid at the average price offset by a premium; ii) choose a pre-harvest fixed price contract strategy bound to a higher quality, but without a production contract (and no premium); iii) delegate marketing to the co-operative by means of a contract or average price on delivery in order to smooth market fluctuations over the year and across co-operative members; and iv) sell after harvest without a production contract commitment. In this latter case, with on-farm storage and equivalent quality, the farmer can seek a higher price than the average price although with greater exposure to price volatility.

3.2 Contracts and risk exposure

Each type of contract is analysed to find the extent to which the farmer is exposed: i) to a production risk, i.e. production volume fluctuations due to adverse weather and/or plant health hazards; ii) a quality risk, which can trigger a risk of non-compliance; iii) a market risk; and iv) a counterparty default risk if one of the parties defaults on their commitments to deliver or buy output.

3.2.1 Yield risk

Farmers who commit to a given tonnage are generally exposed to a greater yield risk. Contracts signed prior to harvest, forward contracts and average price contracts can potentially exacerbate the farmer's production risk. Adverse weather, disease and pest hazards can affect yields and farmers may not be able to honour the volumes to which they have committed.

3.2.2 Quality and contractual non-compliance risk

Exposure to this risk is somewhat variable across the contracts stipulating quality. Quality is remunerated by a premium or a price per quality class. The premiums stipulated in the upstream contracts are the same as in the downstream contracts. Prior to harvest, the processors and collectors agree on the specified volumes, the quality standard and a clause to revise the standard in the event of a particularly poor harvest. Following the harvest, the processors set more precise quality criteria based on which the prices are set for the different grades or classes. Whereas Canada has a fixed grain grading scale³, French co-operative scales change from one marketing season to the next. Durum wheat is first graded by the technicians at delivery and then sorted in the silos by observed quality. Once approximately 5% of total production has been collected, a first quality check is conducted to establish the quality class criteria and sort the wheat (separating out the very high quality lots). Sector contracts have the highest quality requirements, but the quality risk is not really any greater than another type of contract given that the producers on these contracts are in low-risk climate areas. In addition, the premium is a "guarantee" of compensation to quality-producing farmers in the event that the average price observed on the market for this quality is no higher than for average quality. When the wheat is marketed after harvest at spot price, remuneration is calculated to reflect observed quality and market price at delivery.

3.2.3 Price risk

Pre- and post-harvest average price transactions pool the risk of in-year price fluctuations among co-operative members (for a period that varies depending on the type of marketing chosen). Farmers are therefore exposed to less risk of in-year price fluctuations, but benefit less from upward price volatility. Pre-harvest fixed-price and target-price forward contracts with bound volumes imply the use of on-

³ Canadian Western Amber Durum (CWAD) has five set grades.

farm or co-operative storage. The co-operative bears the price risk, hence protecting the farmers from future downward fluctuations. In the case of post-harvest spot price transactions, the farmer alone bears the risk of in-year and cross-year downward market price fluctuations. However, he can equally benefit from potential price upturns.

Average price transactions, pre-harvest fixed-price forward contracts and spot price transactions account for approximately one-third each of the volumes sold depending on the co-operative and the year. Some co-operatives report slightly more volume in average price transactions while others report more spot price sales. A minority of durum wheat volumes limited to a specific geographic area is produced on “sector contracts”, but these are secondary contracts subordinate to the average price marketing contract. They steer practices towards greater quality. Producers may also opt to produce high-quality durum wheat without a production contract, using another marketing method wherein they are more exposed to the negotiation (price fixed prior to harvest) and the risk of upward and downward volatility (post-harvest spot price).

4- Farmers’ contract choices and risk management

Marketing contracts are one of the ways in which farmers hedge against the different risks (market, quality and production). This section analyses the factors that influence marketing choices. The literature cites three types of factors likely to influence farmers: i) the farmer’s characteristics, ii) the farm’s characteristics including its level of diversification, which can change its risk exposure, and iii) the farmer’s psychological characteristics such as risk aversion approximated by direct or indirect revealed preferences for such elements as insurance contract choices.

A survey was conducted in 2014 among 100 cereal farmers specialised in durum wheat in South-West France (Table 3). This is a historical durum wheat production area. The surveyed farmers are specialised in wheat-sunflower production (over half of their harvest) and are randomly selected from a list provided by a major durum wheat co-operative market player. Each farmer filled in the questionnaire individually. The survey collected information on the socioeconomic characteristics of the farmers and their farms, their marketing and production choices, and their attitude to risk. On this last point, the farmers were asked about their perception of the market risk and the production risk attached to the crops they grow.

4.1 Farmer survey data

The farmers surveyed are an average of 51 years old, which is the regional average (Midi-Pyrénées regional extension services 2011). They have been farm holders for 23 years on average. They have a higher level of education than French farmers on the whole, with 27% having a post-secondary level as opposed to 17% for the French agricultural population as a whole. Lastly, 39% of the farmers have diversified their sources of income with off-farm work (30% of multiple jobholding farmers in the Midi-Pyrénées region). With respect to farm structure, the farmers in the survey have larger farms than the regional average: 140 hectares versus 110 hectares on average across the region. They work 100 hectares per manpower unit and own over half of their agricultural area.

The farmers’ price and yield risk perceptions were analysed using a self-reported visual impact method (Hardaker and Lien 2010). This method produces distributions of yields and prices perceived by the farmers over the last ten seasons. Two of these distributions’ indicators are subsequently used in the analysis: expectation and the coefficient of variation. With respect to price perceptions, the farmers report a price expectation of €23 per quintal. For the yields, the farmers expect an average yield of 54 quintals per hectare, close to the regional average. The farmers appear to perceive yields as being more variable than prices, with a coefficient of variation of 9% and 14% respectively.

The analysis singles out two types of strategy: an in-house farmer-specific risk management strategy to reduce risk exposure (diversification) and a risk externalisation strategy (insurance and contracts). The “insurance” variable indicates whether the farmers have taken out multiple risk insurance (yes/no binary variable). In terms of risk management, farmers can also choose to diversify their production to offset profit and loss where there is little correlation between the risk distributions for the different outputs. On average, the level of diversification in our sample is low with just 10% of agricultural income reported as being from a production unit other than field crops (livestock farming, market gardening, arboriculture, etc.). Yet in terms of diversification of cropping patterns and number of crops, nearly one-quarter of the plot on average is given over to crops other than durum wheat and sunflower (durum wheat-sunflower rotation being the reference rotation).

The farmers in the survey reported on the percentage of their field crop production (all production combined) sold using the three types of marketing methods proposed: i) pre-harvest forward contract, ii) average price contract or sale, and iii) spot market sale (Table 1). The forward category covers contracts signed prior to harvest, which partially or fully fix purchasing price for the farmer’s production. On average, the sample’s farmers sell 17% of their production prior to harvest. Nearly one-third of the grain is sold at the season average price. The majority of the volumes sold, i.e. nearly 50%, are sold on the spot market at the price of the day.

An Agglomerative Hierarchical Cluster Analysis (AHCA) is performed on the farmers’ reported marketing methods to identify types of marketing portfolios, i.e. combinations of different marketing methods. The AHCA clusters individuals with similar behaviour in homogeneous clusters. Clusters are merged based on the most commonly used Ward method, which minimises inertia in each cluster (Saporta 2006). The first type of spot-oriented portfolio covers 28 of the 100 farmers in the survey (Table 2). On average, the farmers in this category sell nearly 90% of their production on the spot market. The second type of portfolio concerns the farmers who sell an average half of their production on pre-harvest forward contracts and the other half on the spot market. This portfolio concerns fewer farmers (16% of the sample). The strategy of the farmers in this category is to secure part (half) of their income and try to take advantage of market volatility for the other half of their production. The third type of portfolio covers the largest proportion of individuals in the survey whose marketing strategy is dominated by average price sales. The farmers in this category sell over half of their production to the co-operative at the average price (56.7% on average) and divide the sale of the rest of their production between the spot market (approximately 30%) and forward contracts (15%).

4.2 Empirical analysis and main results

4.2.1 Choice of Logit and Tobit models to analyse the marketing choice

Two methods are used to evaluate the factors affecting farmers’ marketing choices. First of all, a censored Tobit model is used to analyse the factors affecting the quantity of production sold for each marketing method: i) before harvest (forward), ii) average price, and iii) spot market (Table 4). A Tobit model is evaluated because the use of a classic linear regression would generate inaccurate estimates since the dependent variables are bounded at between 0 and 100 (Tobin 1958). So the censored Tobit model equations are written as follows (1) : $Y_i^* = X_i b + \mu_i$

$$Y_i = Y_i^* \text{ if } L_{inf} < Y_i^* < L_{sup}, Y_i = L_{inf} \text{ if } Y_i^* < L_{inf}, Y_i = L_{sup} \text{ if } Y_i^* > L_{sup} \quad (1)$$

Y_i is the bounded dependent variable for individual i , X_i is the vector of explanatory variables for individual i , b is the parameter for the type of marketing method chosen (spot, forward or average price), μ_i is the error term, and L_{inf} and L_{sup} are the lower and upper observation bounds for the dependent variable.

A second analysis of the choice of marketing portfolios is performed on the three previously identified strategies (Table 5). A multinomial Logit model is used with a dependent variable made up of three categories. Basically, individual i adopts strategy j from among the three marketing strategies: forward-oriented, diversified (forward + spot) and average price-oriented strategy. The probability that individual i adopts strategy j is as follows (2) : $P(j/X_i) = F(X_i b_j)$ (2)

X_i is the vector of explanatory variables for individual i and b_j is the vector of parameters for strategy j . The probability of being in category j is expressed in the form of a logistic cumulative distribution function.

4.2.2 The results

Results of the Tobit model

Having a post-secondary level of education is positively correlated with the percentage of volume sold on an “average price” contract (Table 4). Experience does not significantly affect the choice of marketing method, irrespective of the type of marketing method considered. Therefore, as in many other former studies, it cannot be concluded here that the human capital variables collected clearly affect the choice of risk management tool. Off-farm work, however, is positively correlated with sales on the spot market. It could be assumed that farmers with a fixed off-farm income can afford to take greater risks in order to take advantage of market fluctuations.

Turning to the perception of risk, durum wheat yield expectation is positively correlated with spot sales and negatively correlated with average price sales. Exposure to market risk, which is greater in the case of spot market sales, would therefore appear to be offset by high yield expectation, generating a potentially higher margin and hence a risk premium.

The share of plot diversification in total utilised agricultural area is negatively correlated with the adoption of forward contracts. More specialised farmers may want to protect themselves against risks by choosing marketing methods that give them a guaranteed price before harvest.

Results of the Logit model

The results obtained for the multinomial Logit model were analysed taking the “average price oriented” marketing strategy as the reference category (Table 5). The results are similar to those obtained using the Tobit model in terms of the influence of the level of education, off-farm work and yield expectation variables. The most highly educated farmers seem to prefer an average price marketing strategy, which smooths prices over the year. Conversely, farmers with off-farm work and high yield expectations opt for riskier marketing strategies (spot market).

The production risk, evaluated by the durum wheat yield coefficient of variation, also plays a positive and significant role in the adoption of portfolio strategies dominated by forward contracts or by spot+forward diversification. A greater perceived production risk appears to steer farmers toward safer marketing strategies, including contracts that fix the price prior to harvest.

These results show that farmers make different marketing strategy choices depending on their risk perceptions, among other things. However, the analysis does have its limitations. First of all, the literature points up the effect of financial variables such as turnover and debt ratio. Yet few farmers agreed to provide this accounts information, which prevented these variables of interest from being included in the analysis. Secondly, although the farmers surveyed crop durum wheat on the majority of their farm, they reported the percentage of production volume sold by contract type for all crops combined in the questionnaire. Consequently, this analysis cannot assess the particular marketing patterns for durum wheat production or, more specifically, the quality risk borne by farmers for this

crop. Thirdly, the analysis is based on farmers' marketing choices in past years. Economic and climate conditions may have affected farmers' choices. To limit this bias, Anastassiadis et al. (2014) analyse German cereal producers' choices to cover risk with forward contracts under controlled test conditions using a discrete choice method.

5- Conclusion

Durum wheat producers have a number of different risk management tools available to them. Grain marketing strategies can protect them from the risks they run (yield risk, quality risk and market risk). Three main types of marketing strategies are identified: average price contracts, forward contracts signed prior to harvest and post-harvest spot price transactions. Marketing information is taken on 100 durum wheat producers to identify three marketing profiles within the sample. These profiles prioritise one of the three types of contract: i) average price-dominant strategy; ii) spot-dominant strategy; and iii) a combination of two contract types in the form of a forward+spot strategy. The results of the empirical analysis show that a perceived yield risk and a perceived durum wheat price risk have significant effects on marketing strategies. Our analyses do not find an option where farmers choose to combine the two risk management tools studied: marketing and diversification. So highly specialised farmers with a low level of diversification would appear to tend to adopt a marketing strategy that reduces their exposure to price risk (forward contracts signed prior to harvest). The choice to sell the grain at average price (by pre-harvest contract or post-harvest transaction) is dominant in some surveyed cooperatives. This strategy protects against in-year price fluctuations, but does not enable farmers to make the most of upward price fluctuations. In other cooperatives, the spot price sales strategy dominates. In our analyses, this type of marketing choice is associated with the farmers' risk perceptions. Risk taking in this type of marketing strategy remains entirely the producer's responsibility.

References

- Anastassiadis, F., Jan-Henning F., Musshof O., & Schilling P. (2014), Analysing farmers' use of price hedging instruments: an experimental approach, *Journal of Agricultural & Food Industrial Organization*, 12 (1), 181-192.
- Bouamra-Mechemache, Z., Duvaleix-Tréguer, S., & Ridier, A. (2015), Contrats et modes de coordination en agriculture, *Économie Rurale*, 345 (1), 7-28.
- Franken, J. R. V. & Pennings, J. M. E. (2009, july), *What Drives How Much Crop Producers Sell in Spot, Forward, and Futures Markets?* Paper prepared for presentation at the Agricultural & Applied Economics Association & ACCI Joint Annual Meeting, Milwaukee, Wisconsin, USA.
- Franken, J. R. V., Pennings, J. M. E., & Garcia, P. (2012), Crop production contracts and marketing strategies: what drives their use? *Agribusiness*, 28 (3), 324-340.
- Goodwin, B. K. & Schroeder, T. C. (1994), Human capital, producer education programs, and the adoption of forward-pricing methods, *American Journal of Agricultural Economics*, 76 (4), 936-947.
- Goodwin, B. K. & Kastens, T. L. (1996), An Analysis of Marketing Frequency by Kansas Crop Producers, *Review of Agricultural Economics*, 18 (4), 575-584.
- Hardaker, J. B. & Lien, G. (2010), Probabilities for decision analysis in agriculture and rural resource economics: The need for a paradigm change, *Agricultural Systems*, 103 (6), 345-350.
- Harwood, J. L, Heifner, R., Coble, K., Perry, J, & Somwaru, A. (1999), *Managing risk in farming: concepts, research, and analysis*, Market and Trade Economics Division and Resource Economics Division, Economic Research Service, U.S. Department of Agriculture, Agricultural Economic Report No. 774.
- Jordaan, H. & Grove, B. (2007), Factors affecting maize producers adoption of forward pricing in price risk management: the case of Vaalharts, *Agrekon*, 46 (4), 548-565.
- Katchova, A. L. & Miranda, M. J. (2004), Two-step econometric estimation of farm characteristics affecting marketing contract decisions, *American Journal of Agricultural Economics*, 86 (1), 88-102.

MacDonald, J. M. & Korb, P. (2011), Agricultural Contracting Update: Contracts In 2008, Economic Research Service U.S. Department of Agriculture, *Economic Information Bulletin* 72, February.

Mallory, M. L., Zhao, W., & Irwin, S. H. (2015). The Cost of Post-Harvest Forward Contracting in Corn and Soybeans, *Agribusiness* 31, 47-62.

Musser, W. N., Patrick, G. F., & Eckman, D. T. (1996), Risk and grain marketing behavior of large-scale farmers, *Review of Agricultural Economics* 18(1), 65-77.

Paulson, N. D., Katchova, A. L., & Lence, S. H. (2010), An empirical analysis of the determinants of marketing contract structures for corn and soybeans, *Journal of Agricultural & Food Industrial Organization*, 8 (1).

Reynaud, A., & Ricome, A. (2010, December), *An Empirical Analysis of the Determinants of Marketing Contract Choices in France*, paper presented of the 4th JRSS meeting INRA-SFER-CIRAD, Rennes, France.

Sartwelle, J.D., O'Brien D.M., Tierney Jr.W.I.,&Eggers T.(2000), The effect of personal and farm characteristics upon grain marketing practices, *Journal of Agricultural and Applied Economics*, 32 (01), 95-111.

Shapiro, B. I. and Brorsen, B. W. (1988), Factors affecting farmers' hedging decisions, *North Central Journal of Agricultural Economics*, 145-153.

Sykuta, M., & Parcell, J. (2003), Contract structure and design in identity-preserved soybean production, *Review of Agricultural Economics*, 25 (2), 332-350.

Tobin, J. (1958), Estimation of relationships for limited dependent variables, *Econometrica*, 26(1), 24-36.

Tables and figures

Table 1: Percentage of production sold by type of marketing method

| Type of marketing method | Average | Std dev | Min | Max | N |
|--------------------------|---------|---------|-----|------|----|
| Forward contract | 17.1% | 23.3% | 0% | 100% | 99 |
| Average price | 33.6% | 30.9% | 0% | 100% | 99 |
| Spot market | 49.2% | 32.7% | 0% | 100% | 99 |

Source: 2014 survey of co-operative members in South-West France

Table 2: Characteristics of the marketing strategies

| Marketing strategy | N | Forward | | Average price | | Spot | |
|------------------------------|----|---------|--------|---------------|--------|-------|--------|
| | | Av | Sd dev | Av | Sd dev | Av | Sd dev |
| Spot oriented | 28 | 0.7% | 2.6% | 11.5% | 12.6% | 87.7% | 12.5% |
| Diversified (spot + forward) | 16 | 50.1% | 23.6% | 1.5% | 4.3% | 48.3% | 23.5% |
| Average price oriented | 49 | 15.8% | 18.3% | 56.7% | 23.8% | 27.5% | 21.1% |

Av : average ; Sd dev : standard deviation

Table 3: The different contracts available from French durum wheat co-operatives (2012-2014)

| Contract type | Contracting date | Quality commitment/penalties | Volume commitment/penalties | Pricing | Delivery | Storage |
|-------------------------------------|--------------------------------------|---|------------------------------------|---|-----------------|---|
| Secondary contract | | | | | | |
| 1- Sector contract | Pre-harvest at sowing time (October) | Set varieties Previous crops prohibited Higher quality standard | Tonnage ⁴ | <i>Season average price + premium</i> | July to July | Delivery at harvest Farm storage ⁵ or co-op storage. ⁶ |
| Primary contracts | | | | | | |
| <u>Pre-harvest</u> | | | | | | |
| 2- Forward contract | Oct-June | Standard norm or quality standard | Tonnage | <i>Fixed price or Target price</i> | May to June | Delivery at or after harvest. Farm storage |
| <u>Average price</u> | | | | | | |
| 3- Average price contract | Oct- April | Standard norm ⁷ | Tonnage | <i>Account at delivery + increments</i> | May to June | Delivery at or after harvest. Farm storage |
| 4- Average price transaction | Post-harvest July-June | Standard norm | - | <i>Account at delivery + balance at season end (June)</i> | July to July | Delivery at harvest Farm storage Co-op storage |
| <u>Post-harvest</u> | | | | | | |
| 5- Spot price transaction | July-June | Observed quality | - | <i>Price reflecting observed quality and market</i> | July to July | Delivery at harvest Farm storage Co-op storage |

⁴ All contracts with a tonnage commitment stipulate sown surface areas, estimated yields, the percentage of bound production and the level of penalties.

⁵ In certain co-operatives, although the grain is stored by the farmer, the farmer receives a premium. If delivery is made directly to the processor without going through the co-operative's silos, the farmer receives an additional bonus.

⁶ Storage contracts stipulate: quantities, costs (fixed + monthly), penalties in the event of withdrawal, and the grain release requirement (buyer's call).

⁷ Classic durum wheat commitments giving rise to increases and reductions in keeping with Regulation (EC) No. 687/2008 are: moisture content, grain purity, piebald grains, minimum weight, minimum protein content and Hagberg falling number. The quality analysis is conducted on a sample of a maximum of three lots for a given variety. If grain quality does not meet the health standards, the merchandise is withdrawn. If the merchandise contaminates a lot (a very rare event), a penalty is charged on the entire contaminated lot.

Table 4: Results of the censored Tobit models for the three types of marketing methods

| | Average price | | Spot | | Forward | |
|--|----------------------|--------------------|-------------|--------------------|---------------------|--------------------|
| | Coeff. | Standard deviation | Coeff. | Standard deviation | Coeff. | Standard deviation |
| Age | -0.28 | 0.76 | 0.31 | 0.74 | -0.19 | 0.97 |
| Experience | 0.26 | 0.73 | -0.51 | 0.70 | 0.76 | 0.92 |
| Post-secondary education (yes) | 36.43** | 11.01 | -28.75* | 11.02 | -2.57 | 14.24 |
| Off-farm work (yes) | -5.03 | 9.53 | 19.53* | 9.69 | -24.01 ⁺ | 12.69 |
| Percentage income ex. field crops | 0.44 ⁺ | 0.26 | -0.36 | 0.26 | -0.50 | 0.35 |
| UAA/MPU | 0.14 | 0.10 | -0.02 | 0.11 | -0.14 | 0.14 |
| Plot diversification/UAA | 54.43 | 29.25 | -4.34 | 28.85 | -64.30 ⁺ | 38.34 |
| Owned UAA/UAA | -0.16 | 0.15 | 0.12 | 0.15 | -0.10 | 0.19 |
| Durum wheat yield expectation | -2.62* | 1.22 | 3.06* | 1.20 | -2.09 | 1.55 |
| Durum wheat price expectation | 0.79 | 2.90 | 1.05 | 2.91 | -2.30 | 3.56 |
| Durum wheat yield coeff. var. | -1.77 ⁺ | 0.90 | 1.07 | 0.81 | 0.19 | 0.99 |
| Durum wheat price coeff. var. | 2.55 ⁺ | 1.4 | -1.92 | 1.45 | 0.22 | 1.74 |
| Insurance (yes) | 7.68 | 10.25 | -12.42 | 10.34 | 5.19 | 13.13 |
| Constant | 124.28 | 102.61 | -131.34 | 102.27 | 195.16 | 128.49 |
| Sigma | 34.33 | 3.85 | 35.38 | 3.64 | 40.51 | 5.62 |
| N | | 75.00 | | 75.00 | | 75.00 |
| Pseudo R² | | 0.05 | | 0.04 | | 0.03 |
| Log likelihood | | -260.79 | | -294.71 | | -201.57 |

*Key: ***, **, * and ⁺ are respectively significant at less than 0.1%, 1%, 5% and 10%*

Table 5: Results of the multinomial Logit model for the marketing strategies

| | Average price oriented | | Spot oriented | | Diversified (spot + forward) | |
|--------------------------------------|-------------------------------|--|----------------------|--------------------|-------------------------------------|--------------------|
| | | | Average | Standard deviation | Average | Standard deviation |
| Age | - | | 0.03 | 0.05 | -0.07 | 0.07 |
| Experience | - | | -0.05 | 0.05 | 0.06 | 0.07 |
| Post-secondary education | - | | -2.45** | 0.93 | -2.38* | 1.16 |
| Off-farm work (yes) | - | | 1.50* | 0.70 | -1.26 | 1.01 |
| Plot diversification/UAA | - | | -1.90 | 1.17 | -2.22 | 2.43 |
| Owned UAA/total UAA | - | | 0.02 | 0.01 | 0.03* | 0.02 |
| Durum wheat yield expectation | - | | 0.30** | 0.10 | 0.23 ⁺ | 0.12 |
| Durum wheat price expectation | - | | 0.21 | 0.24 | -0.31 | 0.25 |
| Durum wheat yield coeff. var. | - | | 0.15* | 0.07 | 0.14 ⁺ | 0.08 |
| Durum wheat price coeff. var. | - | | -0.13 | 0.11 | -0.24 ⁺ | 0.14 |
| Insurance (yes) | - | | -1.08 | 0.74 | -0.50 | 1.06 |
| Constant | - | | -22.57** | 8.07 | -4.25 | 9.09 |
| N | | | 80.00 | | | |
| Pseudo r² | | | 0.31 | | | |

*Key: ***, **, * and ⁺ are respectively significant at less than 0.1%, 1%, 5% and 10%*