Learning process in marketing contract choice: the case of cereals in the Paris Basin

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In the last two decades, the institutional environment of European cereal markets remarkably evolved, faced to the deregulation of the agricultural common markets and the subsequent emergence of new forms of internal and external competition. Until the beginning of the 20th century, the Common Agricultural Policy (CAP) was implemented as a buffer protecting producers against price volatility on international commodity markets thanks to guaranteed floor prices. Since the reform of this regulation, we observe the development of various types of contracts aiming at managing risk and uncertainty for the different stakeholders in the chain. This article aims to contribute to the scarce empirical literature dealing with marketing contract choices. Drawing on a large original data base describing the transactions between cereal producers and a French cooperative over 10 years (2007-2016) in the Paris Basin, we describe the strategies of producers and conclude that inertial behaviors are a very important factor explaining marketing choices. However, determinants relative to quality and performance matter, in an increasingly competitive international context.

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Abstract

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Introduction

The institutional environment on the European cereal markets deeply evolved in the last two decades. Liberalization of markets replaced suddenly a highly regulated framework designed by the European Common Agricultural Policy (thereafter CAP). In fact, until the beginning of the 2000s, the CAP was shaped as to protect the European producers from the price volatility on international commodity markets though the establishment of floor prices. Since the removal of this support policy, European cereal producers have to cope with high price fluctuations in addition to the risks incurred at the production level. Numerous authors analyzed the effects of this political change on the agricultural practices, especially practices related to marketing. They show that the development of a large range of contract formats allow producers to choose more precisely their marketing patterns according to their productive characteristics and their risk aversion. The international cereal market experienced an increase in the global supply and a smoothing in the harvesting and marketing calendars implying increasing constraints in the adjustment of supply and demand: transactional processes therefore evolved at the level of large marketers, as well as at the production level. Market requirements and price variations are translated up in the chain: we study the evolution of market governance in the common wheat (thereafter wheat) value chain in France focusing on the producers' marketing decisions.

France produces more than 70 million tons of cereals in a typical year. It ranks thus third among the largest cereal producers (including rice) after China and the US (sources: Passion Céréales). Common wheat accounts for almost half of the cereal production in France. More than half of this production is directed towards exports to third countries, in particular Northern African countries (Algeria, Morocco, Egypt …). Those outlets are particularly requiring in terms of quality.

We raise the question of the characteristics and evolution of transactions between producers and collecting and storage companies. What is the role of the range of marketing contracts offered to the producers by storage companies in their marketing choices? The economic analyses have often hypothesized that contractual arrangements adapt smoothly and quickly to short-term market conditions faced by agents, and to the expectations on future events. We propose that the inertial behavior of individuals may affect their current choices, even more in a context from increasing complexity.

We contribute to the literature by taking into account the potential inertial behavior of producers regarding their marketing contract choices. Furthermore, we consider that contractual relations may be affected by the quality of wheat even though it is most of the time considered as a commodity.

The first part of the paper presents the empirical background and the theoretical approach we propose. The second part develop the econometric analysis of the determinants of contract choices and discusses the results.

1. Marketing contracts on the French wheat market: theory and evidence

1.1. Evolution of the French wheat market and the role of contracts

France is a major cereal producer at the international level. With more than 70 million tons of cereals produced yearly, France is the first producer of the European Union and ranks third in the World. Common wheat accounts for around half of the total production, followed by maize and barley (Agricultural Census, 2010). According to the Agriculture Census 2010 around 200,000 producers are involved in common wheat production[1].

The French cereal market underwent recently large changes regarding exposure to international competition. The Common Agricultural Policy reform of 2003 decided to remove subsidies coupled to cultivated area. Moreover, a higher price volatility is observed since the peak of 2008.

Those global changes in the supranational institutional environment went along with national reforms. In France, the Law of Modernisation of Agriculture and Fishing[2] enacted 2010 sets that all the transactions concerning agricultural products should be formalized in a contract. This obligation was applied differently according to the products and bears different functions across in the value chains. In fact, in the first place, the contract is designed in order to formalize and secure the transactions, namely the transfer of property rights over the product. However, the contract entails further attributes: it stands for an agreement between a number of parties that commit to adopt reciprocal behaviors (Brousseau and Glachant, 2002). This commitment is not necessarily written (Masten, 2000). As a means of coordination between agents, it specifies four items (Lanotte and Traversac, 2017): (i) investments that are specific to the cooperation; (ii) rules of coordination; (iii) safeguards procedures; and (iv) rules of repartition of the quasi-rent extracted from the transaction. MacDonald et al. (2004) explain this specific type of commercial coordination by underlying a subsequent decrease in transaction costs compared to a spot market transaction: in fact, the contracts increase the coordination of production functions and trade flows between upstream and downstream stakeholders in the marketing channel.

We can distinguish between two types of contracts based upon the expected degree of coordination: (i) production contracts refer to schemes of quasi-integration promoted by the agroindustry (e.g., pork, poultry, open-field vegetables …) and (ii) marketing contracts refer exclusively to the coordination of trade flows between various entities. Our study will be restricted to the latter type of contracts.

Knoeber (2000) defines a production contract as a contract imposing sharing the decisions at the production level, with each party agreeing on the procurement of inputs and on the investment. For instance, a processor could procure a producer with seeds in exchange for the provision of labor and capital (land, machinery, buildings and know-how …), under the condition that the producer strictly conform to specific requirements prescribing the crop

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[1] As a means of comparison, the total number of registered agricultural producers is around 660,000.
[2] Loi n° 2010-874 de modernisation de l'agriculture et de la pêche

management sequences decided by the principal. This type of contracts leads to the increasing vertical integration of the value chain, poultry being one of the most advanced sector in this case (Knoeber, 2000). These contracts are seen by firms as a leverage for competitiveness (eg Fisher et al., 2008) as they share risk across parties, increase individual performances through coordination and transaction cost reduction (Balmann, 2006) and contribute to technology transfer (Cholez et al., 2017).

Hardwood et al. (1998) define an agricultural marketing contract as an oral or written agreement between a seller and a buyer: a price and an outlet are decided upon prior to the harvest or before the date when the commodity can be marketed, if transformed. In France, the transactions of wheat have to be formalized in a contract whether the contract is signed before or after the harvest. The price does not have to be mentioned in the contract; depending on the contract, it can be referred to a price setting mechanism depending on the effective market price at a fixed future date. The most important clauses of the contract are, for a bunch of products – a lot - , the agreement on a volume, a minimal quality level and a delivery period when the property rights on the lot will be effectively transferred to the buyer. Therefore, in the remainder of the text, we will define a marketing contract for common wheat as a written agreement between a seller and a buyer specifying a price setting mechanism for a given volume, quality and delivery period. The literature presents four types of marketing (Bégué-Thuron et al, 2017):

- The spot market, namely the direct sell of the production.
- Forward contracts when the commitment on the price setting mechanism and the period of effective sale are shifted in time.
- Pooling contracts when the price is calculated relatively to the average performance of the buyer (the collecting and storage company, which may be a cooperative or a broker) on the entire season. In this case, the producers delegate the decisions of the outlet of their production to the buyer.
- Contracts on futures markets.

1.2. Choice of marketing contracts and risk management

Paulson et al (2010) and then a range of further authors (e.g. Bouamra-Mechemache et al, 2015) classify the agricultural contracts usually observed in France according to the way they address the question of risk management (see Table 1).

Table 1: Risks and marketing contracts for wheat

Term	Advantages in terms of risks	Disadvantages in terms of risk
Pooling contract (average sale price)	Pooling of the risk of price variation through a smooth marketing collective strategy across the year.	Benchmark
Fixed-price contract (spot or forward)	Hedging operation to cover the risk of price fluctuation. Visibility on expected cash revenues.	Risk of non-compliance on the quantity or quality (risk beard by the producer) Hold-up risk in the case of price variation
Price-indexed contracts	Price setting mechanism decided ahead	Risk of non-compliance on the quantity or quality (risk to the producer) Hold-up risk in the case of price variation

Adapted from Bouamra-Mechemache et al. (2015)

The economic literature assumes that those contract types propose different ways to manage risk. Contractual items (price setting mechanism, decision rights …) offer different levels of risk-bearing capacity. Producers' characteristics (farm structure, socio-demographic indicators, preferences and expectations) play a significant role in marketing choices (eg, Reynaud and Ricome, 2010; Roussy et al., 2017).

Moreover, statistical strategies aiming at assessing the role of those determinants evolved. A first strand of the literature focused on the volumes of products directed to each contract type – with censored linear Tobit-type regression (Shapiro and Brorsen, 1988; Goodwin and Schroeder, 1994; Sartwelle et al., 2000; Roussy et al., 2017). A second strand of literature concentrated on the determinants of producers' hedging strategies with futures and forward contracts. In fact, Goodwin and Schroeder (1994) and Musser et al. (1996) led part of their analysis with no distinction between the two types of contract, focusing thereby solely on their hedging function. Faced to the increasing diversity of the supply of contract's types, the literature began, at the beginning of the 2000s, to propose precise typologies of those contracts and study separately each category of contract (Sartwelle et al., 2000; Roussy et al., 2017). Katchova and Miranda (2004) underline the limits of those econometrical applications which analyze simultaneously the decision to adopt a type of contract and the quantity of production dedicated to it. They show that the same exogenous variable could influence differently the adoption of a contract and the marketed quantity when choosing a two-step approach. In particular, the ratio debt to capital endowment turns out to influence positively the decision to use forward contracts in order to guarantee a minimal revenue, whereas it influences then negatively the quantity of product under forward contracts. In this way, the producer escapes the risks of default on quantity or quality, two characteristics which are binding in the case of forward contracts. Two methods were presented in order to overcome

this issue. Some authors (Vergara et al., 2004) restrict their analysis to the contract choice and apply then a multivariate analysis. Other authors turn to two-step modeling: in a first step, the adoption of a specific contract is explained. In a second step the quantity of product directed to the contracts is determined knowing that the contract was chosen in the first step (truncated Tobit model) (Katchova and Miranda, 2004; Reynaud and Ricome, 2010; Franken et al, 2012). Reynaud and Ricome (2010) compared the results drawn from a censored Tobit and a truncated Tobit. They conclude that truncated Tobit should be preferred to censored Tobit.

However, the different types of contracts are still analyzed separately. The next section will explain why the strategies adopted by the producers for a specific type of contract should not be separated from the ones chosen as regards the other types of contracts.

1.3. Marketing strategies of French common wheat producers

We observe from the qualitative field studies that a producer only rarely relies on a single contract type. The most frequent strategies are a mix of different contract types. Velandia et al. (2009) put forward this characteristic: they highlight the simultaneous choice of various tools for managing risk, including insurance, forward contracts, spreading sales … They show that the uses of different tools are correlated, suggesting that the use of some of those tools are complementary.

Hence, we drop the idea to study each contract as such, but characterize global strategies built by producers as portfolios of marketing contracts. Following Starwelle et al. (2000) and Roussy et al. (2017), we propose a typology of the producers' strategies built on the proportion of the total quantity contracted with the cooperative under pooling contract.

We led 30 in-depth face-to-face interviews from March to July 2017 with producers, cooperative managers and traders, state agencies. Two zones were targeted according to their weight in total production of common wheat (see figure 1). In the North of Paris, the area Aisne and in the South, the area Beauce. 15 producers were interviewed based on a semi-structured questionnaire. They were selected on a "snowball" method with the help of agricultural management agencies and universities. 15 further interviews were implemented with various stakeholders of the chain (see Appendix 1 for a description).

Figure 1: proportion of total common wheat production in France (average 2011-2016)
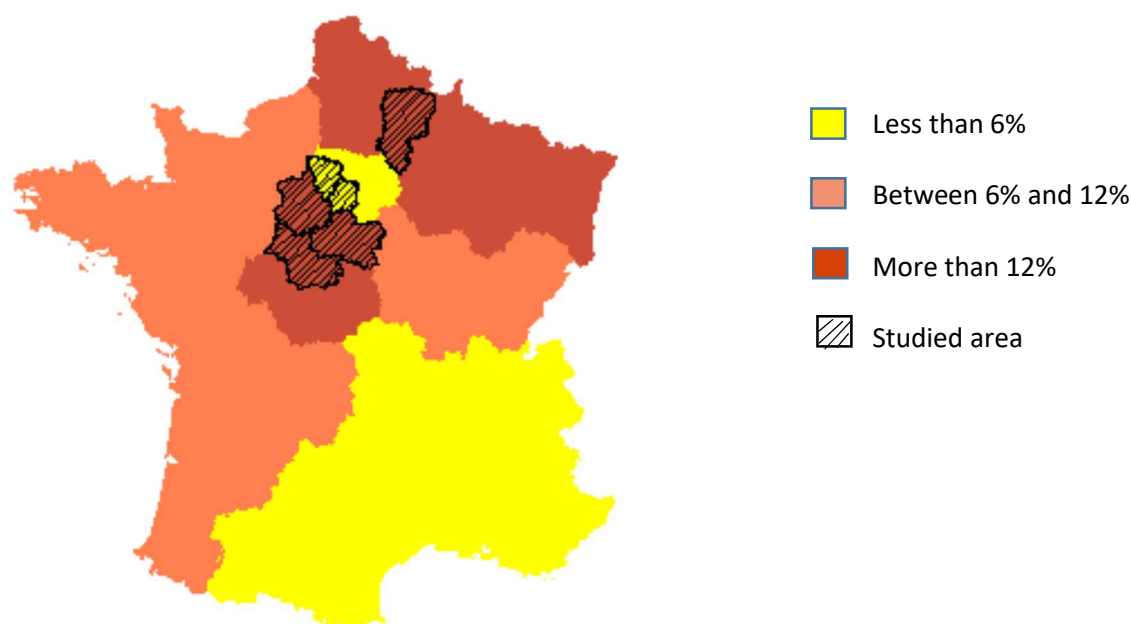
France AgriMer (2011-2016): authos' own calculations

On the basis of the qualitative surveys, we identified four marketing strategies (Table 2).

Table 2: Marketing strategies of wheat producers in Paris Basin

Pooling strategy	100% of the quantity of wheat delivered to the cooperative is under pooling contract
Mixed pooling strategy	More than 50% of the quantity is under pooling contract, the remaining part under fixed-price or price-indexed contracts
Mixed self-management strategy	More than 50% of the quantity is under fixed-price or price-indexed contracts, the remaining part under pooling contract
Self-management strategy	100% of the quantity of wheat delivered to the cooperative is under fixed-price or price-indexed contracts.

The strategies of "pooling strategy" and "self management strategy" can be viewed as "pure player" strategies. The pure pooling strategy is often observed among the cooperative members who are also pooling their investment in the cooperative, namely physical investments (storage and logistic) and investments in commercial promotion. This could be considered as a cooperation strategy. The pure self-management strategy is less frequent: it requires a specific expertise and an evolution in attitude and practices in order to learn

complex and risky actions in line with the management of production. Training sessions and individual advice provided by information agencies are available in addition to public economic bulletins and services provided by buyers.

We split the mixed strategy into two sub-strategies: a mixed pooling strategy where the producer contracts the major part of his sales under pooling price; and the mixed self-management strategy which is the symmetrical strategy. In fact, the qualitative survey led in the Paris Basin highlight different motivations among the producers belonging to these two mixed strategies: some producers use the pooling contract as an insurance to secure part of their total revenues by pooling the risk at the collecting and storage company level (a cooperative, in our case). It could also be used as a means to access associated advantages given by the cooperative: up-front payments, extension services etc …

On the basis of these four strategies, we turn to the analysis of the producers' choices.

2. Quantitative analysis on the determinants of contract choices

2.1. Data

The data are drawn from a medium-sized cooperative located in the Paris Basin. They display all the transactions between the cooperative and its members between 2007 and 2016, namely 10 agricultural seasons. For each transaction, they provide: the transaction date, volume, price, type of contract, quality measures of the lot, quality premium and premium for compensation of logistic costs beard by the producer, if any. Moreover, we have some structural information on the producers for the year 2014 to 2016: size, diversification into different cereals or beets, livestock production, year of membership to the cooperative, location.

Those quantitative data were complemented by the qualitative data presented above that were aimed to assess the general question and to support the interpretation of the results.

We end up with 1853 producers having delivered common wheat to the cooperative at least once during the period 2006-2017; namely 728 producers who delivered wheat each year, representing then the calibrated panel. Appendix 2 reports the presence (number of members delivering the cooperative) of the producers across years. We note large movements in and out of the sample. We will provide later in the text a test for the presence of attrition.

We study the marketing strategies of producers by distinguishing four categories that allow to combine different types of contracts for the same season (see description table 2). Those strategies refer to the results of the interviews and to the literature (Sartwelle et al., 2000; Velendia, 2009; Roussy et al., 2017). Appendix 3 summarizes the distribution of the proportion of the total quantity under pooling contract (pooled data at the holding level). We observe the two points representing the two pure strategies (at 0% and 100%). And we see that the

distribution of variable is relatively even between 0 and 100 (being excluded) so that we do not expect any threshold problem in the definition of the mixed strategies.

Figure 1 shows the distribution of the four categories of strategies across years (cross-section data, entire sample).

Figure 1: evolution of strategies across years (holding level, unbalanced sample)
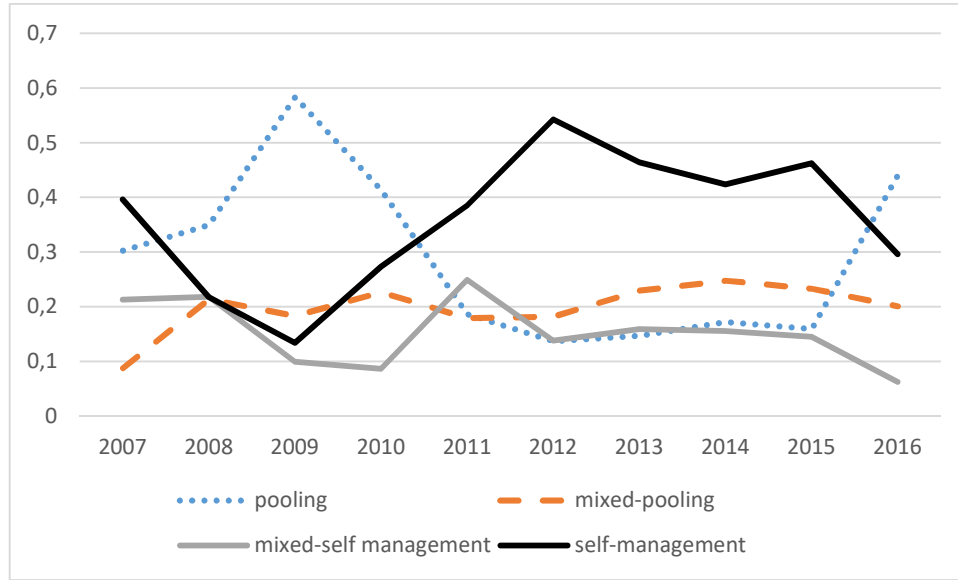
We observe a large variability in the marketing contract choices across years at the holding level for the entire sample. This observation is, to a lesser extent, valid for the sub-sample of the producers delivering wheat each year to the cooperative (calibrated panel).

2.2. Econometric model

In order to study the dynamics of the contract choices over the years, we use a fixed-effect multinomial Logit model (computation, Stata 13.1, Pforr, 2014).

$$y *_{itj} = x_{it}\beta_j + c_i + u_{itj}$$

Where i is the individual and t the time – namely the two panel dimensions –, j is the choice of contract (4 contract types), y^* is the latent variable for the outcome and x a set of exogenous variables; c_i the individual fixed effect and u_{itj} the residuals.

Then

$$\forall j \in \{1,2,3,4\}, \forall k \in \{1,2,3,4\} \quad y_{itj} = 1 \text{ if } \quad y *_{itj} > y *_{itk} \quad \forall k \neq j$$

$$y_{itj} = 0 \text{ otherwise}$$

Based on the literature and our specific question, the exogenous variables (*x*) are the following:

Quantity (t): the total quantity of wheat delivered to the cooperative (in tons) during the season t. We believe that the size of the transaction may affect choice of contract type as self-management is a costly and time consuming strategy that is probably not profitable for marketing small quantities.

Protein content (t): the average rate of protein weighted by the quantities of the different lots delivered during the season t.

Test weight (t): the average test weight of the different lots delivered during the season t. The test weight is the weight of a cereal standard volumetric unity. It is a predictor of flour extraction rate.

With those two variables, we test if quality is a determinant of the contract choice. In our case, the quality of wheat can be fairly predicted during the growth period. If quality is high, the producer may seek for the outlet which would reward quality the most.

Individual performance (t-1): difference between the average price received by the producer (including all types of contracts and including price premiums/discounts) and the pooling price during the season t. If the producer experience a bad (or good) outcome with the (at least) partly self-managed strategy, this may affect his current behavior.

Internal performance of the cooperative (t-1): difference between the average price received by producers who did not delegate marketing to the cooperative and the average price paid by the cooperative during the season t. If the producer knows that those choosing not to engage in pooling contracts earn more (or less) than others, this may affect his current behavior.

External performance of the cooperative (t-1): difference between the average cooperative price (including premiums) and the average price paid at the harbor of Rouen[3] during the season t.

The **marketing strategy adopted by the producer during the season t-1**: we investigate if there is an inertial behavior regarding contracting choice.

Descriptive statistics for balanced and unbalanced panels are shown in appendix 4.

We used fixed effects in order to control as far as possible for producer's characteristics that are time invariant (date of birth, experience, and most of the time cultivated area and specialization in various crops – rotation – or livestock). However, we tested the fixed effects panel against pooled data with an Hausman test and conclude that fixed effects should be preferred.

Last fixed effect estimation with unbalanced panel can lead to problems of attrition: due to the presence of different cooperatives and brokers, producers can go through other partners and not deliver wheat to the cooperative. We face a problem of incidental truncation, namely

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[3] Average price of FOB price for the three categories of wheat (when data available) exported in Rouen.

some of the variables are not observed for some of the years due to the decision not to deliver to the cooperative or not to produce wheat (Wooldridge, 2002). Several tests can be used to know if there is a selection bias. If the attrition is random, there is no need to correct the estimation. We ran the test suggested by Nijman and Verbeek (1992) consisting in introducing in the regression on the unbalanced effect the lagged selection indicator such as

$$y_{it} = x_{it}\beta + c_i + u_{it}$$

Where *i* is the individual and *t* the time – namely the two panel dimensions – *y*, the outcome and *x* a set of exogenous variables; c_i the individual fixed effect and u_{it} the residuals. The selection indicator is such as s_{it}=1 if (y_{it} , x_{it}) is observed, and zero otherwise.

In our regression $s_{i,t-1}$ turns out to be highly non significant in our specification. Under the null hypothesis u_{it} is uncorrelated with s_{ir} for all *r*. We conclude that there is no attrition bias.

2.3. Results

Table 3 reports the regression results of the fixed effects multinomial Logit estimation explaining the choice of a marketing strategy. Odds-ratio are reported with the pooling strategy as reference.

Table 3: fixed effects multinomial Logit estimation (odd ratios reported)

Pooling strategy (t)	Reference	
Mixed pooling strategy (t)	**Coeff**	**(std.)**
Quantity (t)	1.005***	(0.000)
Protein content (t)	0.916	(0.053)
Test weight (t)	0.952***	(0.015)
Individual performance (t-1)	0.993**	(0.003)
Internal performance of the coop (t-1)	0.969***	(0.006)
External performance of the coop (t-1)	0.973***	(0.002)
Pooling strategy (t-1)	Reference	
Mixed pooling strategy (t-1)	0.853*	(0.080)
Mixed self-management strategy (t-1)	1.574***	(0.193)
Self-management strategy (t-1)	1.400**	(0.190)
Mixed self-management strategy (t)		
Quantity (t)	1.006***	(0.000)
Protein content (t)	0.959	(0.071)
Test weight (t)	0.972	(0.020)
Individual performance (t-1)	0.997	(0.003)
Internal performance of the coop (t-1)	0.950***	(0.006)
External performance of the coop (t-1)	0.947***	(0.002)
Pooling strategy (t-1)	Reference	
Mixed pooling strategy (t-1)	1.090	(0.161)
Mixed self-management strategy (t-1)	2.109***	(0.319)
Self-management strategy (t-1)	2.832***	(0.458)
Self-management strategy (t)		
Quantity (t)	1.003***	(0.000)
Protein content (t)	1.017	(0.065)
Test weight (t)	0.924***	(0.016)
Individual performance (t-1)	1.004	(0.003)
Internal performance of the coop (t-1)	0.929***	(0.006)
External performance of the coop (t-1)	0.956***	(0.002)
Pooling strategy (t-1)	Reference	
Mixed pooling strategy (t-1)	1.393**	(0.209)
Mixed self-management strategy (t-1)	2.410***	(0.371)
Self-management strategy (t-1)	4.057***	(0.479)

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

N=8807

LL = -4386.2

Pseudo R^2 = 0.151

2.4. Discussion

Quantity matters even though its influence is relatively small on the choice of a strategy. For instance, the increase in the delivered quantity by 1 ton increases the probability to belong to the category "mixed pooling strategy" by 0.5% compared to the category "pooling strategy" (the reference). The magnitude of the influence is relatively similar throughout the strategies other than "pooling". This result, even though small, tends to corroborate the hypothesis according to larger volumes of sales are more likely to be at least partially self-managed, presumably due to the costs faced by the producer (training, collecting information etc.).

Quality matters: some of the indicators of quality we added in the specification turned out to influence positively the probability to adopt a pooling strategy everything else equal. Hence, the test weight turns out to diminish by 4.8% the probability to choose mixed pooling rather than pooling strategy. For this category, the odds ratio affected to Protein Content is significant at only 12% level but tend also to diminish de probability by 8.4%[4]. This leads us to think that the cooperative managed to set up efficient contractual incentives to procure high quality product in the case of pooling price. In fact, premiums are stipulated for quality product and producers are effectively rewarded. Sorting is provided by the cooperative in distinct storage buildings. Moreover, the leftovers of the product volumes that do not meet the quality standard specified in the contract are directed by the producers to other outlets, like animal feed.

As regards performance indicators, we clearly see that the cooperative internal and external performance the year prior to the observation of the outcome has a negative influence on the choice of all strategies relatively to the pooling strategy. The highest influenced is observed for the self-management strategy where the increase by 1 point of the performance of actual pooling contract price compared to the average price received by those not choosing polling decreases the probability to be in the self-management category by 7.1%. We should note that there is a relative transparency on the prices receive by the cooperative members for their transactions. Interestingly, the individual performance the year prior to the observed strategy has no influence on the current choice but for the mixed-pooling strategy where the effect is very slight (0.7%). We will come back to this observation below.

Last, the influence of the choice of a strategy at time (t-1) is most of the time significant. For instance (coefficient 0.853*, mixed pooling strategy equation (2)) : a producer who adopted a mixed-pooling strategy at time (t-1) has a probability of 14,7% less than a pooling strategy at time (t-1) to be in the mixed pooling category at time (t) than in the pooling strategy at time (t), at the significant level of 10%. It shows that those in the mixed-pooling strategy in (t-1) tend to come back to a pooling strategy. This result first shows that it was pertinent to split the mixed strategies into two different strategies, one of them oriented towards pooling the other towards self-management. Second, this result supports the qualitative surveys we led

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[4] The test weight coefficient is also significant in the mixed self-management level, but only at 15% level.

at the producer level: some of them decided to experience self-management for a small part of the quantity delivered whereby securing most their revenues by choosing the pooling contract for the rest of their sales. This sub-group is therefore very volatile across the years.

For the other coefficients, we observe a relative inertia in the choices – the producers are tending to remain from year to year in the same strategy (2.109 for mixed self-management and 4.057 for self-management) and this effect is stronger when moving towards the pure self-management strategy.

Last, all the coefficient the coefficients reflecting the movements towards a higher level of self-management are either non-significant or positive: for instance, a adopting mixed self-management strategy in t-1 rather than pooling strategy has a positive effect on the probability to be in a self-management strategy in t rather than in the pooling strategy (odds ratio, 2.140).

We believe therefore that the category of mixed-pooling strategy is the most instable one with some producers coming back to the pooling strategy and others moving orienting towards self-management. This result should be linked to the fact that the producers belonging to the mixed-pooling strategy are the only ones to be sensitive to their own individual strategy. Short term consideration may thus be at stake.

Conclusion

We defined global strategy of producers' marketing their common wheat production in the Paris Basin based on their choice of delivering all or part of the total of the quantities under pooling contracts. On this basis, we studied the determinants of their choices on a 10 year period focusing on the dynamic aspect of the choices made each year. We find that the performance of the cooperative in the year prior to the decision year influence positively the probability to choose a pooling contract – for which the decision to market to the next buyer is delegated to the cooperative. Furthermore, quality has an importance on the choice of a strategy for the producer, contrarily to the intuition according to which common wheat is a commodity, allowing therefore for thin differentiation possibilities. The pooling contract seems to be the most attractive to producers delivering high quality wheat. Last, we observe a relative inertial behavior of the producers: they reproduce similar strategies from year to year. However, we identify the category of those choosing to adopt a self-management strategies for a minor part of their production to be the most mobile either towards the pooling strategy or to higher level of self-management.

These results raise several questions. The peculiarity of the category of mixed pooling strategy is of interest. It appears as a potential transition category towards self-managed strategy. But, it can as well be understood as a position where the probability to come back to a pooling strategy is very high. Targeting this category for information and training would potentially lead to the stabilization of this group. And, finally, this study reveals the evolution of the French cooperatives: in fact, the supply in contracts and services they provide is almost the

same as observed among brokers and traders. Moreover, the obligation of exclusive delivery to the cooperative when being a member was removed: therefore the supply to the cooperative is very volatile. We can then wonder which are the specificities of the cooperative system, still the dominant one for wheat in France.

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Appendix 1: In-depth interviews

| Institution	Interviewees (some of them in teams)
FranceAgriMer (National Institute for Agricultural & Sea Products)	• Head of the division: Cereal markets • Deputy head of the division: Field crops
Ministry for Agriculture and Food	• Manager of the division: Field crops
Coop' de France (Association of French cooperatives)	• Co-manager: grain businesses
Regional Federation of Agricultural Cooperatives – Nord-Pas-de-Calais	• Head • Manager: Sustainable Agriculture
Cooperative 1	• Former commercial officer
Cooperative 2	• Chief • Executive Officer
Federation for Agricultural Trade	• Project manager: grain market

Appendix 2: Statistics on attrition

Presence of producers, cross-section, entire sample

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Number of producers	1156	1144	1239	1222	1260	1362	1358	1347	1337	1250

Number of years the producers are present in panel

Years	1	2	3	4	5	6	7	8	9	10	Total
Freq.	194	120	103	103	165	92	82	105	161	728	1853

Appendix 3: distribution of holdings according to the proportion under pooling contract relatively to the total quantity delivered (holding level, pooled panel data)
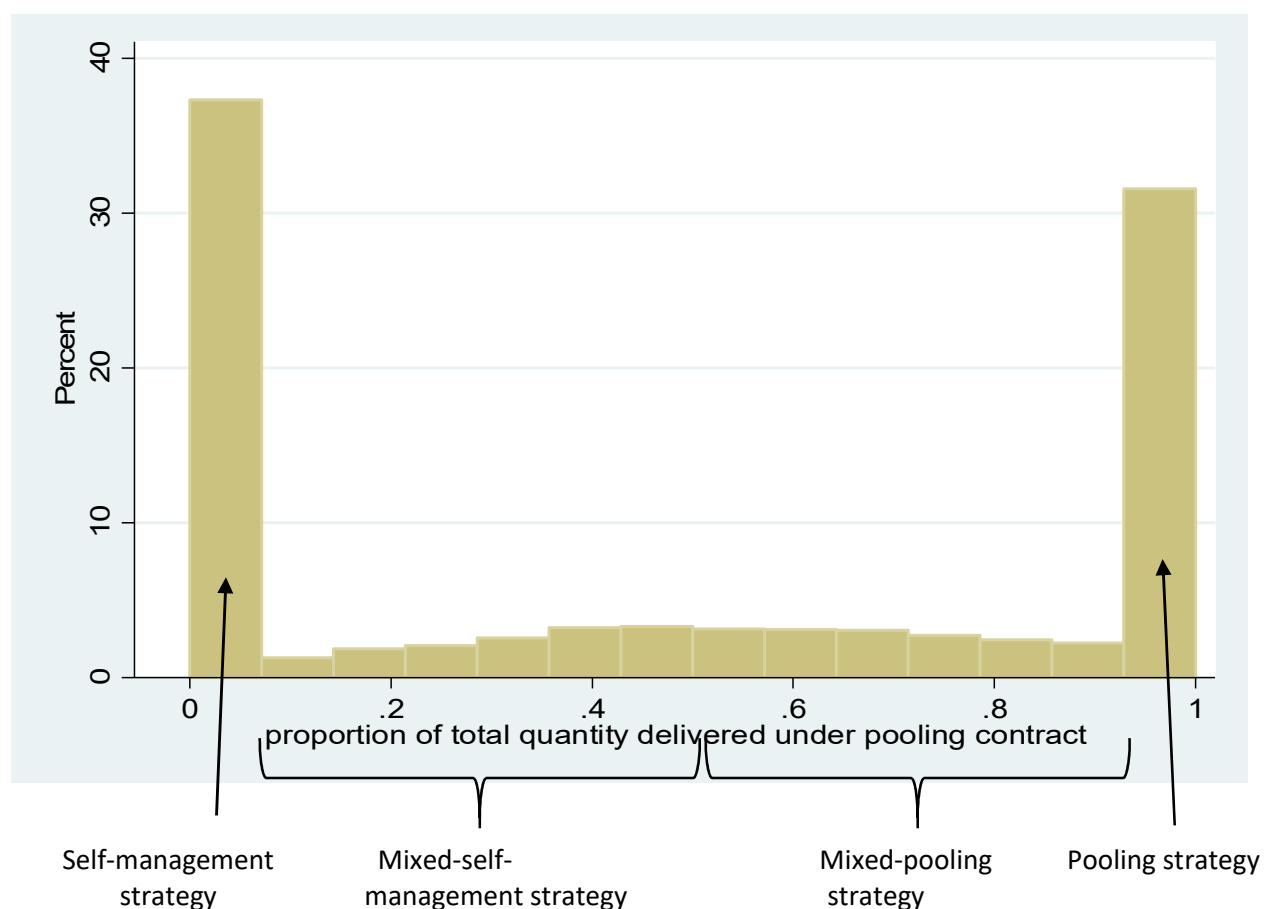
Appendix 4: descriptive statistics on uncalibrated and calibrated panels

	Uncalibrated panel		Calibrated panel	
	mean	(std)	mean	(std)
Pooling strategy	0.262	(0.439)	0.272	(0.445)
Mixed pooling strategy	0.214	(0.410)	0.265	(0.442)
Mixed self-management strategy	0.173	(0.378)	0.203	(0.402)
Self-management strategy	0.352	(0.477)	0.259	(0.438)
Quantity (t)	286.126	(265.392)	350.792	(270.616)
Protein content	11.535	(1.067)	11.529	(0.918)
Test weight	76.575	(4.710)	76.674	(3.224)
Individual performance	2.885	(15.441)	1.806	(13.942)
Internal performance of the coop	-6.694	(8.490)	-6.476	(8.634)
External performance of the coop	-24.214	(19.046)	-24.289	(19.368)