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Communication

Localised Agro-Food Systems in France and Dairy Farms performances

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Abstract:

In France, the dairy sector within the mountain areas turned strongly to a strategy of cheese production under quality signal like Protected Designation of Origin (PDO). Despite this strategy of differentiation, two strong disparities exist in the dairy farms in France over a long time: One concerns the Agricultural Income differential per dairy farm (profit before tax), close to 10 000 € per year; the other -linked to the previous disparity- concerns the renewal in agriculture. Farmers are getting older and fewer young people are entering farming. The objective of this paper is to shed light on the impact of a collective action and a substantial Gross Output to the farms' economic and social performances. We scrutinized two contrasted cases studies. For the first one (PDO Cantal), few firms have taken control on the supply chain and have chosen with the time a model based on costs leadership, imposing low milk price at farm gate. The second one (PDO Comté) is a specific model with a strong and structured collective action. We show that these two models have an impact on the dairy farms economic and social performance. Indeed, for the PDO Comté case, some business companies (farmers and their cooperatives which are agro-food processing firms), related within a localised agro-food system in Jura Mountain, have achieved to control for the better the rules which govern the PDO cheese production chain. This collective action in Jura Mountain and its market power benefit to farmers thanks to the better milk price at farm gate than in others mountain areas. Thanks to data FADN (survey concerning European Network for farm accountancy) and data from the French Agricultural Census 2010, we

bring to light the main factors of explanations of the highest economic and social performance of the dairy farms. The substantial Agricultural Income per farm is due to the substantial Gross Output. This extra Gross Output is partly saved:

- to increase the farm size and to organise regrouping of lands;
- to increase the herd and therefore the production;
- to develop technologies and assets.

These numerous actions have strongly carried farmers to develop new skills, to increase the labour productivity and to ensure greater the renewal in dairy farms. This evolution has begun for few decades.

1. Introduction

In France, the dairy farms of mountainous areas have on average an income lower (22'400€) than the farms located in plain areas (31'500€) (Chatellier & Delattre, 2003). However, this situation hides disparities within mountainous areas. Over a long time the economic performance of the dairy sector in mountainous areas is lower than in plain areas, the dairy production and the cheese-making processes are important activities for the economic development of this kind of areas in France. The dairy sector of the mountainous areas turned strongly to a strategy of cheese production under quality sign. Out of twenty-six cheeses made with cow's milk and produced in mountainous areas, fifteen cheeses benefit by a quality sign like the Protected Designation of Origin (PDO). Despite this strategy of differentiation, strong disparities of Agricultural Income per dairy farm, close to 10'000€, exist in the dairy farms in French mountainous areas over a long time. Moreover, there are income differential between the various mountain massifs. For example, the dairy farms of the Jura Mountain (Easter France) have income upper to those of the Massif Central (Middle of France). Yet, one of the important challenges in the economic development of the mountainous areas comes from the capacity of the dairy farms to have high incomes. We suggest that the ability to seek wealth is due to farmers' collective action which helps them to improve their skills and to ensure greater the renewal in dairy farms. Dairy farms renewal rate (94%) in the Jura Mountain is higher than in Massif Central.

So, this paper brings to light the determiners of the economic performance of the dairy farms observed on two French contrasted cases studies located in mountainous areas: the Jura Mountain and the Massif Central. The aim of this paper is to shed light the impact of the farmers' collective action on the Agricultural Income and renewal in dairy farms.

In a first part, we develop the theoretical framework and the methods (2.). In a second part, we describe the two case studies (3.). Then, we propose a typology of farms. Their characteristics are explained by descriptive statistics (4.). The discussion highlights the reasons why there are disparities of income and indirectly of renewal between the two PDO systems (5.), before the conclusion (6.).

2. The framework and the method

We develop this issue at the intersection of Agricultural Economics and Law and Economics.

On the one hand, the agricultural economics theory allows us to analyze the individual strategic behaviour concerning particularly the milk production from dairy farmers. This work is included in the general research on economic efficiency (Battese, 1992) which has begun by Farrell in 1957. Afterwards, development concerning economic efficiency has combined both allocative and technical efficiency. This theoretical framework deals with some factors (assets characteristic,

education, household, age, human capital) explaining the significant difference in the level of allocative generally between two groups of farmers. It is achieved when the farmer combines resources in the relevant combination to generate maximum output (technical) as well as ensuring least cost to obtain maximum income (allocative) (Chukwuji, and al., 2006).

On the other hand, our analytical framework has to be considered in the vast domain of Laws and Economics based on the observation of "Law in Action" using direct legal sources. This discipline allows to analyse the farmers collective action and its economic consequences (Kirat, 2005). The legal elements form the relevant dimensions for the stakeholders for setting and implementing a collective economical strategy while seeking to influence their institutional environment and the relations between the economic stakeholders.

For estimating the characteristics and the economic performances of the dairy farms due to collective action, two different PDO cheese supply chain strategies were studied (PDO Cantal and PDO Comté in France) at different stages (dairy farmers, cheese-makers, and cheese-ripeners) using three major sources:

(1) The first source characterizes the dynamic of each cheese supply chain over a long period. The characteristics and the evolution of the productive structures at the different stages were analyzed in order to recreate the agents' paths. To obtain the data, we conducted a survey among the stakeholders and also used documentary sources (Jeanneaux et al., 2009; Meyer, 2009). For characterizing the collective strategy of the production systems, we based the analysis on legal documents for each PDO. These documents set the content of the PDO's codes of practices and throw light on the production's organization and the constraints put on competitors. We try to analyze the value creation and the mechanism for its distribution among the different stages of the supply chain. We have identified the specific resources used, the productive structures of the supply chains (technical and social division of labour between stakeholders), the mechanisms for managing supply, as well as the fundamental inter-professional agreements that set the payment modalities for cheese.

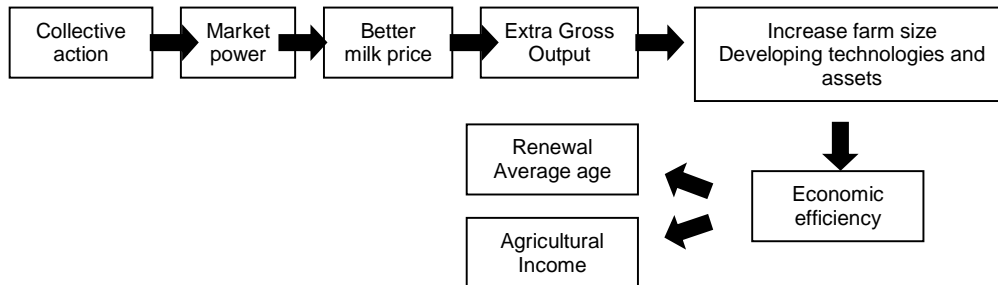
(2) The second source characterizes the performances of the dairy farms in the Massif Central and in the Jura Mountain thanks to the FADN database (Farm Accountancy Data Network; RICA in French) for the year 2007. FADN is an instrument for evaluating the income of agricultural holdings and the impacts of the Common Agricultural Policy. *"It consists of an annual survey carried out by the Member States of the European Union. The services responsible in the Union for the operation of the FADN collect every year accountancy data from a sample of the agricultural holdings in the European Union. Derived from national surveys, the FADN is the only source of microeconomic data that is harmonized, i.e. the bookkeeping principles are the same in all countries. Holdings are selected to take part in the survey on the basis of sampling plans established at the level of each region in the Union. The survey does not cover all the agricultural holdings in the Union but only those, which due to their size, could be considered commercial. The methodology applied aims to provide representative data along three dimensions: region, economic size and type of farming"*¹. FADN database brings details of the structure of the farms (surface, herd), their economic results (agricultural production, loads, subsidies, income) and their financial situation (liability). We particularly resumed for the analysis the intermediary management balances to assess the economic efficiency of the dairy farms.

(3) The third source characterizes the social performance of the dairy farm in the Massif Central and in the Jura Mountain thanks to the last French Agricultural Census carried out in 2010. This census gives information about renewal in agriculture, farmers' age, and demographic trends

¹ Source : European Union, http://ec.europa.eu/agriculture/rica/concept_en.cfm

from 2000 to 2010. This information is useful to understand relation between economic efficiency and farming transition.

Thus, the reasoning can be sum up with the diagram below:



The study concerned only the dairy farms (Otex n°41) located in mountainous areas (up to 600m) of two French regions: Franche-Comté in Jura Mountain (PDO Comté) and Auvergne in Massif Central (PDO Cantal) (see topographic map below). There are 133 dairy farms in the database in 2007: 39 for Franche-Comté and 94 for Auvergne. Consequently, the characteristics and performances of the dairy farms for both studied regions can only give an idea of the reality about the economic performances and renewal of the dairy mountains farms concerned by PDO Comté and Cantal.



Data mining were carried out on SPAD v.7.0 by descriptive statistics (minimum, maximum, mean, standard deviation) and by factorial analysis (Multiple Correspondence Analysis, and Ascending Hierarchical Classification).

We have taken into account ten variables for the Multiple Correspondence Analysis and Ascending Hierarchical Classification: Total Utilized Agricultural Area (ha); Total Utilized Agricultural Area/AWU (ha/awu); Milk price (€/l); Production for the accounting year (€/year); Production/number of dairy cow (€/cow); Production/AWU (€/awu); Farm net value added/AWU

(€/awu); Total input (€); Fixed assets/AWU (€/awu). Region (Franche-Comté or Auvergne) and EBITDA/AWU (€/awu) have been added in the analyses as illustrative variables.

Thanks to these investigations, we bring to light the existence of two opposite models of cheese making under quality signs in the French mountain's areas, which strongly influence the performance of the dairy farms.

3. Economics results of dairy farms in Jura Mountain and Massif Central

We show that these two models have an impact on the dairy farms economic performance. In a first part, we present the specificities of the two localized agro-food systems due to the nature of the collective action. Then, we present the farms' typology before to scrutinize the factors of their performance disparities.

3.1. PDO Cantal vs. PDO Comté, two relevant case studies to highlight milk price disparities

The Cantal supply chain: a French PDO cheese supply chain dominated by industrial cheese-makers

Agriculture in the mountains of the centre of France is strongly dedicated to milk production that feeds into cheese supply chains benefiting from a legal recognition through official quality labels (several PDOs: Cantal, Saint-Nectaire, Bleu d'Auvergne, Fourme d'Ambert, Salers). In 2007, these products from the Auvergne Region, brought together around 8'000 dairy farmers, producing more than 1'200 million litres of milk. Among them, 2'800 farmers produced milk necessary for 17'800 tons of PDO Cantal. Since 1990, the PDO Cantal production is stabilized around 18'000 tons.

From a historical perspective, the PDO Cantal was the most important vector to the organizational development of the cheese supply chain in the Cantal department (located in the Auvergne region). It was based, at the beginning, on a specific technical and social division of labour before a modernization turn, during which some industrial cheese-making units have taken control over the supply chain. As a result, they have drastically gained in market power, having reached the quasi-exclusive access to market. Today, two industrial processors control around 70 % of the PDO Cantal production. Finally, industrial cheese-makers have imposed a production system mostly based on cost leadership strategy to increase their competitive advantage. As a result, the dairy farmers have lost their bargaining power toward their buyers. The regional price is disconnected from the PDO Cantal cheese market price, because the farmers in the supply chain do not know in which product is processed their milk. The milk price depends as well on the bargaining skills of the dairy farmers when discussing with the cheese-makers. Because milk producers are just suppliers, their bargaining abilities are substantially restricted. Moreover, the cheese-makers must not declare their sales' volumes and selling prices for cheese to the inter-professional organization. The organization does not publish reference prices of Cantal cheese, which might help market transparency. Consequently, over the last 15 years (excepted 2007), the milk price for PDO Cantal has been the same as standard milk and has reached a 25% lower price compared to some French PDO (i.e. PDO Comté) (Jeanneaux & Meyer, 2010).

PDO Comté: A traditional and dynamic collective cheese supply chain

Agriculture in the Jura mountain is mainly dedicated to milk production that feeds into cheese supply chains benefiting from a legal recognition through official quality labels (several PDOs : Comté, Morbier, Mont d'Or, Bleu de Gex). These products originate from the Doubs and Jura Departments, gathered in 2008 3'420 dairy farmers, producing more than 760 million litres of milk. Among them, 3'000 farmers produced 52'000 tons of Comté. Since 1990, the Comté production significantly has increased by more than 15'000 tons. From a historical perspective, the PDO Comté was the most important vector to the organisational development of the cheese production system in the Jura, based on specific technical and social division of labour (Perrier-Cornet, 1986). The dairy farmers, on the one side, are organised in collective cheese-making

units (150 cheese-making cooperatives in 2005), control the processing from milk to fresh cheese (not ripened) and do not have market access. The cheese-ripeners (around 10 units in 2005), on the other side, have the quasi-exclusive access to market without being involved in the first processing stage. This labour division is still present and generates a long-lasting collective value that is safe-guarded by the successful setting of the Protected Denomination of Origin Comté.

The surplus resulting from the organization comes from the PDO code of practices (Barjolle & Sylvander, 2000). The Comté supply chain is often considered as a model of collective action. It set a powerful organization and giving extended authority for bargaining and implementing Comté supply control measures, as well as promoting the differentiation strategy, which protects the interests of the Jura dairy farmers, small-scale cheese-makers and ripening facilities. The Comté supply chain shaped the agro-food sector in this mountainous region and supported the selling price of that cheese. In 2007, the average price was 10.20 €/kg compared to 7.10 €/kg for French Emmental,² that is to say a positive price difference of 47% in favour of the Comté³.

The milk price depends as well on the bargaining skills of the dairy farmers (as they also control most of cheese-making cooperatives) when discussing within the collective organization about the calculation ratio for fresh cheeses they sell to the ripeners. Until today, the supply chain organized the surplus' distribution between « production » and « market ». The system's efficiency was based on the regulated distribution of the collective surplus that allowed dairy farmers, over the last 15 years (excepted 2007) to reach a 25% higher price for milk compared to national average (Jeanneaux & Perrier-Cornet, 2011).

3.2. The main factors of explanations of the highest economic performance of the dairy farms in Jura Mountain

After this first presentation of the two localized agro-food systems and their different collective strategies, the objective is to highlight the diversity of the farms' performance and their potential links with the specificities of each localized agro-food systems.

A first analysis: the factorial analysis, to present the disparities between farms

Thanks to a Multiple Correspondence Analysis and an Ascending Hierarchical Classification, we have identified five classes of dairy farms. This typology helps us to scrutinize the first results:

- The first class (36 farms) includes the small farms (AWU < 1.5; Total Utilized Agricultural Area < 56 ha) which produce few benefit (low milk price) and which are rather located in Auvergne (Massif Central).
- The second class (25 farms) is the class of the big farms located also in Auvergne (AWU > 1.5; Total Utilised Agricultural Area > 96ha) with a high production, partially modernized, and with a milk price intermediate.
- The third class concerns dairy farms small to average (AWU < 1.5 and Total Utilized Agricultural Area between 56 and 96 ha) with a strong benefit (FNVA/AWU > 21 062 €, high EBITDA/AWU). They have also a high production and a high milk price (33.2 €) and are preferentially located in Franche-Comté (Jura Mountain).
- The fourth class (25 farms) groups big farms (Total Utilized Agricultural Area > 96 ha) which are very efficient (FNVA/AWU > 21 062 €, high EBITDA/AWU). Theses farms have

²Source : Syndicat français de pâtes pressées cuites 2007

³Source CIGC : <http://www.comte.com/le-marche-du-comte,4,0,8,1,1.html>

high milk price and are modernized (high fixed assets). They are located also in Franche-Comté.

- Finally, the fifth class groups the farms (28) that are rather average (in terms of Total Utilized Agricultural Area) with lots of AWU (> 1.5). These dairy farms make low benefits (low FNVA/AWU and low EBITBA/AWU) even if the production and the milk price are mostly important. Moreover, these farms are not much modernized (few fixed assets).

Thanks to this analyze, we are able to distinguish two different forms of dairy farms for each region. These forms tend to oppose Auvergne and Franche-Comté. In Auvergne, the small dairy farms have not been able to invest to modernize their production system unlike the small dairy farms in Franche-Comté. Concerning the biggest dairy farms in Auvergne, they have invested, but in an expensive extensive model in terms of inputs and which valuing badly the forage resource (so the specific resources of the region).

A second descriptive statistics analysis to present the origin of the disparities

The substantial Agricultural Income per farm is due to the substantial Gross Output. Jura Mountain farm Production for the accounting year balance is up to 26'000 € than Massif Central farm. This disparity is due to a better milk price at farm gate (close to 12'000€) because of the power market ability of the Jura Mountain farmers.

This extra Gross Output on its other part is due to technical efficiency. Indeed, extra Gross Output is partly saved (cf. table 1):

- to increase the farm size and to organise regrouping of lands. Indeed, Jura Mountain farms owned 19 ha more than Massif Central farms.
- to increase the herd and therefore the production. Thanks to the access to more areas, Jura Mountain farmers can breed more cows and thus produce more milk (33'000 L) while their farms employ the same number of workers.
- to develop technologies and assets. The extra Gross Output is more invested in agricultural equipments in Jura Mountain farms than Massif Central farms (more than 25'000 €).

These numerous actions have strongly carried farmers to develop new skills and to increase the labour productivity. New technical skills are identified with the yield of the cows (750 L/cow up for Franche-Comté compared to Auvergne) and the production costs (fertilizers are less in Franche-Comté close to 10€/ha). The labour productivity is also higher for Jura Mountain farmers than for Massif Central farmers (5000 €/farmer). Consequently, the Gross operating income compared to the Gross Output is better, close to 4 points (42% compared to 38%). As a conclusion, Jura Mountain farms are more effective than Massif Central farms.

	Franche-Comté	Auvergne	Balance Franche-Comté/ Auvergne
Production for the accounting year (€)	124'791	98'396	26'395
Milk production (€) (without subsidies)	59'538	48'117	11'421
Total Utilized Agricultural Area (ha)	96	77	19
Milk production (L)	247'768	214'509	33'259

Fixed Assets by AWU (€)	170'285	144'288	25'997
Labour productivity (€)	63'583	58'639	4'944

Table 1: comparison between the two regions

We show there is a relation between economical performance and localized agro-food system. Main factors of explanations of the highest economic performance of the dairy farms could be scrutinized. The substantial Agricultural Income per farm is due to the substantial Gross Output. The origin of this extra Gross Output is partly explained to the better milk price at farm gate and partly explained by the individual strategies developed by dairy farmers. We suggest that the ability to seek wealth is due to farmers' collective action which helps them to improve their skills and to ensure greater the renewal in dairy farms. Indeed, dairy farms renewal rate (94%) in the Jura Mountain (Doubs Department) is higher than in Massif Central (79% for Cantal Department). In this last department, farmers are getting older and fewer young people are entering farming. In the Doubs Department 32% of farmers are under 40 years old, 10 points more than Cantal Department farmers (22%), and moreover 33% are over 50 years old, 10 points less than Cantal Department farmers (47%).

4. Discussion

The results bring to light two opposite models of cheese-maker production, which drive towards two farm systems and their performances.

Dairy farms of Massif Central and Jura Mountain have similar conditions of production, sell both under PDO label, but there are an important difference of performance between them. This evolution began a few decades ago and continues. We discuss the idea that two aspects can explain the differences in the agricultural incomes between the dairy farms of the different massifs.

On the one hand, the difference of income can be explained by external determinants, that is the collective strategies and the forms of coordination between the stakeholders of the cheese-makers industry and the farmers of the dairy farms (Perrier-Cornet & Sylvander, 2000). Concerning the external determinants, the farmers cannot control them directly but they can have an effect on this type of determinants in getting involved in collective strategies as dairy cooperatives. The specific rules in the codes of practices set restrictions so to give decisive advantages to small-scale enterprises thank the imposition to their competitors (large dairy industry companies and intensive dairy farmers) specific production techniques and its related costs. This constitutes a lever for imposing to the certain economic agents a certain level of production costs which corresponds to a certain type of producers/processors (Jeanneaux & al., 2010). Raising Rivals' Costs theory (Scheffman & Higgins, 2003) helps to answer the question whether the PDO cheese production costs are actually imposed to competitors by the defenders of the local PDO production system. Indeed, associations of farmers can have an impact in the price formation of milk and in the distribution of the benefits between farmers. It's not the case for PDO cantal, but true particularly within PDO Comté local agro-food system which has an impact on the dairy farms economic performance thanks to a best milk price. Thus:

- For the first one (PDO Cantal), few agro-food firms have taken control on the supply chain and have chosen with the time a model based on costs leadership, imposing low milk price at farm gate. The PDO Cantal is a local agro-food system with little structure and with few constraints of production based on a historical tradition of individual behaviour.

- The second one (PDO Comté) is a local agro-food system with a strong and structured collective action. Indeed, for the PDO Comté case, some business companies (farmers and their cooperatives which are agro-food processing firms), related within an agro-food local productive system in Jura Mountain, have achieved to control for the better the rules which govern the PDO cheese production chain. The PDO Comté is a model with a strong and structured

interprofessional structure based on a historical tradition of collective action. This collective action in Jura Mountain and its market power benefit to farmers through a better milk price at farm gate than in others mountain areas and dynamizes the Jura region.

On the other hand, the difference of income can be explained by internal determinants as the individual strategies of the farmers. However, we saw that these strategies result, at the beginning, to the capacity of the farmers to keep the Gross Output in the farm to modernize the equipments, to develop the size of the farm and to improve consequently the human skills. These numerous actions have strongly carried farmers to develop new skills and to increase the labour productivity. We know the nature of social capital (bonding and bridging) in a territory is an important factor to explain economical development disparities (Callois & Aubert, 2007). To more understand the relation between social capital, collective action and economical and social performance of dairy farms in mountainous areas some works would be developed in this way.

We are though very much aware of the limits of our approach as the hypothesis was only tested on some PDOs and it cannot be generalized. Further research is presently conducted to test this analytical grid of the collective regulation modes of localized production systems and its impact on global performance of farm in order to discuss the validity of our preliminary conclusions.

5. Conclusion

This paper shows that the collective action mode developed for managing PDO leads to different performances in PDO cheese supply chains, in regards to milk price at farm gate. With these two case studies, we show that the disparity Agricultural Income per farm (profit before tax) reaches 10000 €, and farm renewal is better in this situation. We could highlight the role of collective action which develops an incentive atmosphere right to create human, technical skills and to improve economical and social performances.

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Annexe

Criteria	Auvergne		Franche-Comté	
	Mean	SD	Mean	SD
Number of farm for Otex 41	94		39	
PRODUCTIVE CHARACTERISTICS				
Total labour input - AWU	2	1	2	1
Unpaid labour input - FWU	2	1	2	1
Age of the farmer	48	8	46	8
Average milk production per farm (L)	214'509	120'645	247'768	150'569
Average milk production per cow (HL)	49	16	60	10
Number of dairy cows	44	19	44	27
Milk production (€)	66'333	38'102	88'716	56'150
Milk price (€/l)	31	2	36	2
Forage area (ha)	69	37	96	53
Livestock unit (LU) of herbivores / ha of forage area	1	0	1	0
Total Utilised Agricultural Area (ha)	76	40	97	53

Total Utilised Agricultural Area/AWU (ha)	47	18	51	26
INCOME				
Production for the accounting year (€)	98'396	53'934	124'791	96'283
Production for the accounting year /number of dairy cow (€)	2'203	612	2'380	1'348
Production/AWU (€)	58'639	23'497	63'583	36'676
Farm net value added – FNVA (€)	28'263	20'531	40'653	42'371
FNVA/AWU (€)	14'474	12'909	16'559	12'943
Total subsidies (€)	18'216	15'745	29'178	16'350
Subsidies/ FWU (€)	11'457	5'506	17'900	4'973
Profit before tax (PBT) (€)	18'129	20'874	27'186	31'678
PBT/ FWU (€)	11'402	13'655	15'937	13'580
Gross operating income (EBITDA) (€)	47'489	27'859	64'813	48'096
EBITDA /Gross Output (%)	39	15	42	11
INPUTS				
Total Inputs (€)	39'159	26'216	38'713	23'658
Fertilizer input / LU (€)	67	36	57	30
Forage input / ha of forage area	82	60	46	26
Depreciation charge (€)	27'635	20'502	34'832	21'672
Annuities / EBITDA (%)	38	47	34	56
Fixed assets / AWU (€)	144'288	85'590	170'285	77'635
Rate of liabilities (%)	30	20	32	17

Annexe 1: characteristics of dairy farms in the two studied regions