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Danièle Capt et Pierre Wavresky

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Determinants of direct-to-consumer sales on French farms

Danièle CAPT, Pierre WAVRESKY***

* AgroSupDijon, UMR1041 CESAER, F-21000 Dijon, France
e-mail: daniele.capt@dijon.inra.fr
** INRA, UMR1041 CESAER, F-21000 Dijon, France

Abstract – *This article aims to identify the influences of a variety of factors on the practice of agricultural direct-to-consumer sales activities. Using data from the 2007 Farm Structure Survey, representative of the all the farms in France, it shows that the propensity to sell directly to consumers is significantly influenced by several factors both internal to the agricultural sector (farms' economic size and farm type, product quality, agrotourism and contract work activities, and the work team characteristics of family and hired labour, gender, educational level, farm-head age) and external to it (market characteristics, including local markets). It makes an original contribution to the literature on the subject, highlighting that beyond the traits they have in common, farms in direct-to-consumer sales present differentiated characteristics depending on the type of product they produce.*

Keywords: *direct-to-consumer sales, short food supply chains, food products, geographic location of activities, farms*

Les déterminants de la vente directe dans les exploitations agricoles en France

Résumé – Cet article a pour objet de cerner l'influence de différents facteurs sur l'exercice d'une activité de vente directe dans les exploitations agricoles. Mobilisant les données de l'enquête de structures de 2007, représentatives de l'ensemble des exploitations agricoles françaises, il montre que la propension à faire de la vente directe est influencée significativement par plusieurs facteurs internes au secteur agricole (dimensions économiques des exploitations et types d'agriculture, qualité des produits, association à une activité d'agrotourisme et de prestation de services, caractéristiques des collectifs de travail: emplois familiaux et salariés, genre, niveau de formation des actifs, âge du chef d'exploitation) et par des facteurs externes (caractéristiques des marchés, entre autres du marché local). Il apporte une contribution originale à la littérature sur le sujet en soulignant qu'au-delà de traits qui leur sont communs, les exploitations en vente directe présentent des caractéristiques différenciées selon le type d'agriculture.

Mots-clés : vente directe, circuits courts, produits alimentaires, localisation des activités, exploitations agricoles

JEL Classification: Q12, Q13, R32

1. Introduction

Attention to local products and the re-localization or re-regionalization of food systems (known as local food systems) in industrialized countries has come into prominence in the scientific literature. The evolution of consumer preferences arising from their growing distance from the food supply—the lengthening of production chains, multiplication of intermediaries, evolution of food production and processing methods, and their impacts on human health and the environment—are prompting reconsideration of the relationship between urbanization and the agro-industrial system in favour of more diversified and shorter food supply chain (Donald *et al*., 2010; Gaigné, 2011).

Literature on the subject makes some distinctions between different types of markets for local products, especially between markets based on direct transactions between producers and consumers (direct-to-consumer) and markets based on transactions between producers and (depending on the country) a single intermediary (the notion of the "short food supply chain" (*circuit court*) in France) or one or more intermediary (direct-to-retail or direct-to-foodservice in Anglophone countries). Some researches have aimed to identify the characteristics that consumers attribute to local products and, more generally, the characteristics of local product demand, while other works have focused on the supply of local products by looking at the diversity of local product sales chains and producer characteristics (Ilberry and Maye, 2005; Martinez *et al*., 2010; Low and Vogel, 2011). Taking this second orientation, this article focuses on direct-to-consumer sales between producers and consumers in France and contributes to understand such sales chains in two different ways. For one thing, while most researches are qualitative, centered on a given sale chain, and conducted on the local scale, this article gives a representative view of all the French farms and the long-term development of direct-to-consumer sales by using census and survey data on farms since 1979. In addition, it addresses a question that has long been studied in various industrialized countries, *i.e.* researches about the characteristics associated with practices of a direct-to-consumer sale activity, which have been organized into two categories. The first category involves internal characteristics of the agricultural sector, *i.e.* farms (especially their size and production type) and farm households (family member characteristics, employment), and the other category gathers external characteristics of the farming sector, especially the influence of market opportunities and public policy. Thanks to recent access to an individual data base of a representative sample of all French farms, this article goes beyond previous works in France and makes an original contribution to the literature on the question. Unlike extant works carried out in other countries, our analysis begins with the hypothesis that factors influencing the practice of a direct-to-consumer sale activity are different or have variable effects depending on the farm type (specialized in a particular crop or production, or unspecialized) and the

characteristics of the products sold directly to consumers, due to the variety of resources and technologies mobilized and the terms of market competition. This approach allows us to show that although all types of farm share certain factors associated with the practice of direct-to-consumer sale activity, others vary by farm type.

In order to build an empirical analysis based on French farms, the following section of the article reviews research, primarily from the Anglophone literature, and identifies its contributions to our understanding of the characteristics associated with a farm's practice of a direct-to-consumer activity. Section 3 presents the data we mobilized and its limits, and the method adopted for estimating the influence of various factors on the practice of a direct-to-consumer sale activity according to farm type, in this case a binomial logit integrating the interactions of farm type with other factors. The following sections are devoted to the presentation and discussion of results: section 4 provides indicators on the long-term evolution in the number and percentage of farms in direct-to-consumer sales and the spatial variations of this phenomenon in France, and section 5 presents and discusses the results of the model's estimates. The study's main conclusions are developed in the sixth and final section.

2. Literature review

2.1. Sale of local products, direct-to-consumer or via intermediaries: definitions and scope

Measurements showing the evolution of the number of farms selling local products (either directly or through one or more intermediaries) and their sale figures are nonexistent or incomplete in most countries, due to gaps in the statistical sources representative of all the farms. Only a handful of countries are the exceptions. In addition, depending on the country, data sources may concern exclusively comestible goods (human food), all comestible and non-comestible goods combined, or even services such as agricultural tourism.

To take European Union (EU) countries as an example, although European policy since the 1980s encouraged the diversification of farm and farm household activities, and despite the existence of EU-wide harmonized statistical sources, successive adjustments of the Farm Structure Survey (EUROSTAT) did not integrate questions on direct-to-consumer sales until 2008[1] (EC, 2008; OECD, 2009), because they did not consider direct-to-consumer sales to be a diversification activity, in contrast with

[1] Since the 2008 farm structure survey adjustment, EU country censuses should include a question on the final destination of production by identifying farms in which final sales to consumers represent over 50% of their total sales.

on-farm processing.[2] Consequently, the data vary from one EU country to the next one. For example, in Great Britain the farm census contains no question on direct-to-consumer sales, but the Farm Business Survey, which concerns farms' physical characteristics and economic performances, identifies the development over time of farms practicing a diversifying activity (including direct-to-consumer sales) and the income drawn from these activities – but the sample is not representative of all farms, since small farms are excluded. In contrast, in France direct-to-consumer sales have been singled out since the 1979 agricultural census, but the economic scale of this activity is not specified; the same goes for the French data from the FADN (the Farm Accountancy Data Network, compiling economic data from a representative sample of farms over a given size threshold).

2.2. Factors in play in the propensity of farms and farm households for direct-to-consumer sales

In most industrialized countries, the question of which factors influence the practice of a direct-to-consumer sale activity has been included in a general approach to agricultural activity diversification that rarely distinguishes direct-to-consumer sales from other activities (agro-tourism, building rentals, services offered, *etc.*). Most of this literature is devoted to the influence of factors that are internal to the agricultural sector, and holds that the decision to diversify farm activity can not be adequately explained without taking account of factors influencing the farm household's labour distribution decisions: activity on- and/or off-farm by the farm-head, his/her domestic partner, other members of the family, and recourse to salaried employment. The economic and social specificities of family farming have been studied for some time now (Gasson *et al*., 1988). The familial character of farms remains, although the allocation of family labour to farming activities is declining in relation to decreasing endogamy in agriculture, the opening of professional activities to women in connection with their rising educational levels, and generational change; this trend correlates with greater recourse to paid labour (Benjamin and Kimhi, 2006; Blanc *et al.,* 2008 for France).

One leading issue in this literature concerns the motives bringing farm households to diversify their activities on- or off-farm. It turns out that the quest for better income is the primary motivation for farm diversification, although such activities seem to make only limited contributions to the great majority of these households' incomes (Ilbery, 1991; Bowler *et al.,* 1996; McNally, 2001). According to these authors, priority is given to increasing returns on limited available resources, re-allocating resources from agricultural production (family labour, buildings, equipment)

[2] According to the 2007 farm structure survey in France, fewer than half of farms in direct sales declare doing on-farm processing (7.3% out of 15.6%).

to more profitable non-agricultural uses, reducing risks associated with agricultural activities, or taking advantage of market opportunities. Some researches emphasize that practicing a diversification activity also depends on non-economic goals, such as the search for a lifestyle or meeting other people, and argue that producers may choose to maximize their satisfaction within a system of preferences rather than simply maximizing their income (Hunt, 2007; Barbieri and Mahoney, 2009). Yet the interactions between economic and non-economic goals, and how these goals relate to farm and farm household characteristics have barely been studied with few precious exceptions (cf. Barbieri and Mahoney, 2009).

Concerning farm characteristics, all researches highlight the influence of the farm's size, but their conjectures and conclusions differ. Some suggest that large farms are better off diversifying their activities because they have greater access to financial and non-financial resources (land, infrastructure) whereas on small farms, the lack of resources (land, capital) very often prompts the deployment of available family labour off the farm (Ilbery, 1991). Other works show, on the contrary, that the propensity to diversify is greater in small farms because they have a relative abundance of manpower that may be profitably mobilized into these activities (Damianos and Skuras, 1996; McNally, 2001).

Most works have also paid attention to the connection between the practice of a diversification activity and the type of agriculture on the farm, showing that direct-to-consumer sale is less common on specialized farms than on diversified farms (Ilbery, 1991; McNally, 2001) and that its presence varies according to the type of agricultural product, but their conclusions differ. Like Bowler *et al*. (1996), the propensity for direct-to-consumer sales is more pronounced on grain-producing farms, because of the availability of manpower related to the seasonal character of production, and less pronounced on very labour-intensive dairy farms; for others (McNally, 2001; Martinez *et al*., 2010), it is stronger on market gardening (produce) and horticultural farms because they can more easily sell their products directly to consumers than farms producing grains or animal products because they require processing in order to sale their products on local markets.

Only a few studies questioned whether product quality might have a positive influence on the propensity to sell products directly to consumers: Martinez *et al*. (2010) and Detre *et al.* (2011) conclude that this is indeed the case for farmers in organic agriculture in the United States.

Although this literature holds that farm household characteristics are highly influential in the decision to diversify, this subject is less well explored due to the complexity of factors bearing on farm and farm households' work decisions. Some of the literature have demonstrated that diversification very often concerns farm-heads working full-time on the farm (Damianos and Skuras, 1996; McNally, 2001; Low and Vogel, 2011), and with even greater frequency according to the number of family members active on the farm whose labour may be exploited (Damianos and Skuras, 1996; McNally, 2001;

Capt and Dussol, 2004) – although this observation is not universal (Monson *et al.,* 2008). Some point out that the propensity to diversify varies according to the phase in the family's life cycle, especially when children reach working age or are ready to take over from the previous farm-head (Capt, 1994).

Some researches have looked at the influence of the farmer's age and educational level, supposing that younger farmers are more highly educated, more inclined to adopt new technologies, and more likely to look into more remunerative strategies, but these studies have led to contrasting conclusions: some show that the farmer's age has no influence (McNally, 2001; Low and Vogel, 2011), but others conclude that there is a meaningful positive effect, though of small amplitude (Detre *et al.,* 2011). While some studies do not detect a meaningful influence from the farmer's educational level, others conclude that education has a clear effect (Capt and Dussol, 2004) because these activities mobilize more knowledge and skills, and, more broadly speaking, more social capital from the placement of family members in professional and social networks (Capt, 1994; Ilbery and Maye, 2005; Chiffoleau, 2009).

The farm-head's gender (male or female) and the farmer's partner's activities (when the farm belongs to a couple) have attracted considerable attention in literature on the agricultural sector. But while certain studies bring to light a significant influence of women in the establishment and conduct of diversification operations, especially in agro-tourism and retail sales (Ilbery, 1991; McNally, 2001 for England), others detect no influence (Detre *et al.*, 2011; Low and Vogel, 2011 for the US).

Finally, one last characteristic of farm operators in direct-to-consumer sales concerns their professional and social itineraries. One dominant trait in the agricultural sector across Europe, as varied as it is, is the low degree of professional and social openness of the agricultural sector to people who are not brought up in it. This trait is first explained by the control that farm families exercise over access to land, such that farmers' children benefit from a "family advantage" (Blanc and Perrier-Cornet, 1999). Nevertheless, the obstacles to entry into direct-to-consumer sale activity for people from non-farming backgrounds may to a certain extent be lesser because it can usually be exercised with limited land resources. In France this is the case for goat farming (Capt, 1994) and vegetable production at a distance from urban areas (Gauche *et al*., 2011). On the other hand, establishing oneself to raise cattle and sell through short food supply chains is difficult for people who do not come from agricultural backgrounds, even in areas distant from urban centers, because this system needs more land and access to dairy production quotas that are linked to acreage.

Compared to the literature devoted to the influence of factors internal to farms and their production decisions, the literature relative to external factors is smaller, addressing the influence of market opportunities and public policies.

As for the influence of public policy, few scientific works have sought to estimate the influence of all measures encouraging agricultural diversification activities implemented by public authorities in OECD member countries. Some studies suggest (more than they actually demonstrate) that farms' political environments have little effect on their decisions to diversify or not (Turner *et al*., 2003). The variety of measures (the type of instruments used) and whether they are coordinated or not have a combined effect on diversification that is difficult to measure (Turner *et al.,* 2003; OECD, 2009).

Concerning the influence of food product market characteristics, most studies take a spatial approach. This work emphasizes the influence of the physical distance between consumers and producers on the geography of supply, and has shown that engagement in direct-to-consumer sales is higher in suburban spaces than elsewhere (Bowler *et al.,* 1996 for England, Martinez *et al*., 2010; Low and Vogel, 2011 for the US). Only a few studies demonstrate that spatial differences are not only the result of an effect of demand and proximity to urban areas, but that they also come from other spatial factors related to supply: unequal spatial distribution of productions and production structures; the historical rootedness of specific local products; the ways that producers organize themselves (Capt and Schmitt, 2000); and logistical and distribution infrastructures (King *et al*., 2010; Martinez *et al.,* 2010; Low and Vogel, 2011).

Few researches have explored the relationship between the variability of farm supply by food product type and the economic conditions under which small farm businesses may access to human food markets, which have become largely oligopolistic in industrialized countries. Yet by studying how competition works in markets affected by product differentiation and by seriously considering the effects of technology and demand (the nature of the differentiation and dispersion of consumer preferences), economists have demonstrated that there are, in fact, market structures where a kernel of large firms co-exists with a "competitive fringe" of small firms. Applied to the field of agriculture, this approach allows us to demonstrate that the differentiation of farm products in relation to competitors' supply, the presence or absence of technologies adaptated to smaller scales, the level of these technologies' fixed costs, and the qualifications necessary to master them are great or small obstacles to entry into (and departure from) markets, and may show that the relative presence of farms in particular markets varies according to the type of food product in question (Capt, 1997; Martinez *et al*., 2010).

The importance given to this last type of explanatory factor motivates the choice taken in the following empirical analysis to estimate the influence of the factors presented in this literature review on the practice of a direct-to-consumer sale activity, by including their interactions in the analysis along with the type of farm and products sold directly to consumers.

3. Data sources and methods

This article is based on data from French agricultural censuses (RA) from 1979 up to the latest Farm Structure Study (FSS) in 2007 in order to give some indications of the long-term evolution of direct-to-consumer sales. It does not include the 2010 census, which did expand the range of questions on the subject but also introduced a gap in the data by replacing, among other things, the concept of direct-to-consumer sales with that of short food supply chains (*circuits courts*), rendering comparison difficult over time (Table 1). Between 1979 and 2007, one question allows us to identify whether a farm sells its agricultural products directly to consumers, and whether those products are destined for human consumption or not. Yet this data source has significant limitations, because it lacks indicators of the amount or proportion of direct-to-consumer sales as well as of which products are sold directly, by which sales chains, or where products are sold.

Table 1. **Definition of the fields of direct-to-consumer sales* and short food supply chains** in French censuses and Farm Structure Studies**

	Indirect sales	
Direct-to-consumer sales	**Only one intermediary**	**More than one intermediary**
On-farm (Pick-your-own, stand)*	Restaurant businesses*	Industry
Markets (streetfairs, farmers' markets)*	*Cafeterias***	Wholesalers
Stores owned by groups of producers*	*Retail resellers*** (*grocer, butcher, cheese shop*. . .)	Agents
Home delivery or rounds*	*Grocery stores, supermarkets***	
Mail-order (Internet)*		
Food box systems (CSA, other)*		
Expositions and salons*		

* In censuses and structure studies prior to the most recent 2010 agricultural census, "direct sales" included all forms of direct-to-consumer sales as well as sales to restaurants and bars (restaurant businesses).

** In the 2010 agricultural census, sales through short food supply chains also included other forms of sales with only one intermediary.

The article next turns to estimate the influence of various factors on the practice of a direct-to-consumer sale activity. This estimate is based on the statistical and economic treatment of individual data from a sample of 69,856 farms surveyed in 2007. These farms come from an initial sample of 80,000 farms representative of all farms in mainland France surveyed by the French agricultural census 2000 and questioned biennially until 2007 (FSS). It should be pointed out that in France as anywhere else in the European Union, structure studies retained a broad definition of "farm", including all farms

with at least one hectare of Utilized Agricultural Area (UAA), or as little as 0.2 hectare if it is devoted to specialized crops or certain kinds of animals.

In consideration of this article's basic question, we opted for a binomial logit model that takes account of interactions between variables (Ai and Norton, 2003; Brambor *et al*., 2005), in this case, farm type with other variables. Since the sources we used lack indicators of the types of products being sold directly to consumers, we considered farm type to be a proxy for them, at least for most of the specialized farms, because empirical observations have shown that farms specialized in field crops and non-specialized farms set themselves apart from the rest by a greater range of products sold directly to consumers. Nine farm types were designated (following the European Community farm holdings typology; European Commission, 1985): eight types of specialized farming plus a ninth for all non-specialized farm types. The results for farms specialized in flowers and ornamentals are not presented here because our analysis concerns only direct-to-consumer sales of food products. In order to better work out the influence of household characteristics, farms with commercial, cooperative, non-profit, or public statuses, as well as those where the farm-head is an employee, were excluded from the study. Having thus eliminated a portion of the cases, the final sample counted 68,269 farms.

The dependent variable depends on whether a direct-to-consumer activity is practiced on farms of each type or not. Based on prior research, and taking account of the limits of the exploited data source, we retained the interplay between the following explicative variables that address factors internal to the agricultural sector (farm and farm household characteristics) and those external to it (market characteristics).

Six variables concern farm characteristics. The first is an indicator of economic size defined in terms of Standard Gross Margin,[3] broken down into six size classes ranging from below 12 hawe for the smallest to a minimum of 150 hawe for the largest. Two other variables concern product quality, respectively accounting for productions with and without product quality labels (organic, AOC/AOP, and French *Label Rouge*). The last two account

[3] Since European Union statistics (Eurostat) do not collect monetary values, the economic size of farms cannot be found with a variable such as total sales. Thus, until 2008, it was estimated using the Standard Gross Margin (SGM). A concept similar to value-added, SGM is the balance between the value of the production and the value of the intermediary consumption likely to be affected by production. The calculation consists of multiplying the hectares of the crop or the number of head of livestock for a potential gross margin coefficient, by product and by region. The SGM is expressed in European size units (ESU). To help comprehension, ESU may also be expressed in "hectares wheat-equivalent" (hawe), where in France an ESU is approximately 1.5 hawe. When using this basis, then, the economic size of farms in direct-to-consumer sales proves to be under-estimated, even more when the proportion of their direct-to-consumer sales is high, because calculation of a product's SGM coefficient is based on wholesale prices that are much lower than those of products sold directly to the consumer.

for whether the farm hosts agro-tourism or contract work activities (of an agricultural or other kind).

Ten variables account for farm household and work characteristics. There are three indicators of the amount of labour mobilized: the farm-head's engagement in multiple professional activities, how many family members work on the farm, and the extent of paid labour (measured in terms of equivalency to full-time employment).

One particularity of French farms (see Appendix 1) lies in the significance of family-based business forms (GAECs, EARLs between spouses, and other joint-ownership arrangements for multiple partners[4]), which are accounted for in the retained indicators. Thus for "age," that of the farm-head or the youngest farm operator was retained. As an indicator of educational level, we chose the highest degree (in either general or agricultural studies) held among all members of farm partners' families, thinking that the educational level of the farm-head or farm partners is not the only one influencing the choice to sell directly to consumers. As an indicator for women's labour on the farm, we chose the presence of a female family member working at least half-time on the farm (instead of using the wife's employment status—working on-farm or off, or not professionally active—he indicator chosen by most studies), because a family farm may include multiple wives, sisters or daughters age over 16. This indicator has been supplemented with another bearing on the presence of at least one non-family-member paid employee (regardless of the hours he or she devotes to work on the farm, since this data is not available in the database). For the same reason, the indicator most studies generally consider favoring the practice of direct-to-consumer activities – the number of years of experience the farm-head has – was not retained, since the available data only concerns the farm-head who responded to the survey, and not other farm associates, should there be any. In addition, the data set only provides the number of years the respondent has officially been head of the farm, without accounting for any years of professional agricultural activity in other contexts. Lastly, three other variables are considered to be indicators that a farmer has a more marked engagement in professional networks: whether they use the internet for farm needs, have signed subsidy contracts with the state guaranteeing specific production methods (CTE, CAD), or benefitted from state assistance for young farmers (DJA)[5]

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[4] *Groupements agricoles d'éxploitation en commun* (Shared Farming Groups): a legal status allowing multiple farmers to go into group ownership of a farm. *Exploitations agricoles à responsabilité limitée* (Limited Responsibility Farms): a legal status allowing spouses to share farm ownership.

[5] CTE: *Contrat territorial d'exploitation*, Territorial Farming Contract, a subsidy contract offered between 1999 and 2002 for a five-year engagement to meet specified production criteria. CAD: *Contrat d'agriculture durable*, Sustainable Agriculture Contract, offered 2004-2007 for a five-year engagement in environmentally beneficial practices. DJA: *Dotation jeune agriculteur*, Young Farmer Allocation, one-time State financing at the beginning of professional activity for fledgling farmers up to age 39.

Lastly, concerning factors external to the agricultural sector, we were unable to take measure of the influence of public support on diversification activities due to the limits of our data sources. The influence of the proximity and size of a local market was estimated using a single indicator: population density in a 30 km radius around the town where the farm is based.[6] A radius of 50 km was also tested, but proved to be less useful. This indicator was preferred to that of distance from the nearest urban or rural center because close observation of a great number of farms in direct-to-consumer sales showed that most of them sold their products in a variety of places most often located in a radius of 20 to 50 km around the farm (Capt *et al.,* 2011a).

Table 2 presents the variables retained for the econometric estimate and the characteristics of the reference group. Appendix 1 lists the descriptive statistics of these variables according to farm type.

Analysis using this base encountered two main limitations. The first is the absence of several data points in the database, which limits the field of variables that can be used in the estimate from among the variables judged pertinent for addressing the central question of this article (section 2), such as the amount or percentage of direct-to-consumer sales in farms' gross income, the kinds of products being sold directly, the diversity of farms' sales chains, farm operators' career histories, and their professional engagements.

The second limit concerns the interpretation of the binomial logit results integrating interactions between farm type and other variables. Aiming to shed light on the debate over the kinds of agriculture concerned by the supposed development of direct-to-consumer sales in France (in market gardening, for example), the data on the farm types retained for the estimate have very different sample sizes, so the results for the smallest samples (such as in the market gardening and granivore specializations) present interpretive difficulties.

4. The extent of direct-to-consumer sales in mainland France

4.1. Partial indicators

The number of French farms practicing direct-to-consumer sales has been in steady decline since 1979, but they still represent a significant share of the totality of farms. From 1979 to 1988 (Table 3) their number decreased less rapidly than that of other kinds of farms, for which their percentage climbed from 19 to 27%. Nevertheless, their number declined much more rapidly between 1988 and 2000, then at the same pace until 2007: their share in the

[6] Source: Odomatrix, INRA UMR1041 CESAER Dijon.

Table 2. **Definition and descriptive statistics of the model's variables**

Characteristics	The variable takes the value of 1 for the corresponding class; otherwise the value is 0.	Relative frequency of farms (%) in the sample
Farm type	Field crops specialization (reference)	27,2
	Market garden cropping specialization	1,7
	Flowers and ornamentals specialization	1,7
	Vineyards specialization	12,6
	Other permanent crops specialization (arboriculture)	4,2
	Grazing livestock specialization: cattle – dairying, rearing and fattening (dairy, meat)	22,7
	Sheep, goats and other grazing livestock specialization (Other herbivores)	8,0
	Granivore specialization	3,0
	Non-specialized	18,9
Farm economic size	SGM < 12 hawe (footnote 4) (reference)	11,2
	SGM 12 to < 24 hawe	6,2
	SGM 24 to < 60 hawe	16,4
	SGM 60 to < 150 hawe	39,0
	SGM > 150 hawe	27,2
Product quality label	Certified organic (or in the certification process) (reference = 0)	2,4
	AOC (Origin-controlled) and VDQS (quality wine) certification (reference = 0)	17,0
	French *Label Rouge* quality designation (reference = 0)	6,6
Diversification	Touristic or artisanal activity (reference = 0)	3,8
	Contractual work (reference = 0)	6,9
Farm-head off-farm activity	Farm-head having a primary or secondary activity off-farm (reference = 0)	12,5
Family-member operators (over age16)	Only one family-member operator on farm (reference)	37,6
	Two family-member operators	42,0
	At least three family-member operators	20,4
Full-time employee equivalents on farm	No employee (reference)	52,5
	Less than one full-time employee (or person-hour equivalent)	30,3
	1 to < 2 employees, or equivalent	8,4
	At least two employees, or equivalent	8,7
Age of farm-head (or of youngest farm partner)	Under 40 years old (reference)	27,1
	From 40 to 50	32,6
	From 50 to 60	28,5
	60 and over	11,8
Highest educational level (general or in agriculture) among family member operators	< BEP[7] (reference)	11,3
	Short secondary education (BEP)	38,5
	Full secondary education (Baccalaureat)	28,5
	Higher studies (BTS,[8] engineer. . .)	11,8
Women's labour	Presence of at least one half-time female family member-operator on the farm (reference = 0)	34,2
	Presence of non-family female employee(s) on the farm (reference = 0)	4,9
Professional engagements	Uses Internet for farm-related applications (reference = 0)	45,0
	Contrat Territorial Exploitation, Contrat Agriculture Durable (reference = 0)	14,1
	Beneficiary of a *Dotation Jeune Agriculteur* since 1994 (reference = 0)	18,3
Population density in a radius of 30 km around the farm	< 100,000 inhabitants	36,3
	From 100,000 to 250,000 inhabitants (reference = 0)	39,0
	From 250,000 to 500,000 inhabitants	17,3
	From 500,000 to 950,000 inhabitants	7,4

[7] BEP: *Brevet d'études professionelles*, a vocational diploma obtained prior to completion of secondary school.

[8] BTS: *Brevet de technicien supérieur*, a vocational degree based on two years of post-secondary education.

Table 3. **Number and percentage of farms in direct-to-consumer sales between 1979 and 2007 and farms in short food supply chains in 2010**

	RA 1979*	RA 1988*	RA 2000*	FSS 2007*	RA 2010**
Number of farms in direct-to-consumer sales*, in short food supply chains **	400,000	275,469	102,200	79,114	90,212
Percentage of farms in direct-to-consumer sales*, in short food supply chains **	19.0%	27.1%	15.4%	15.6%	18.5%

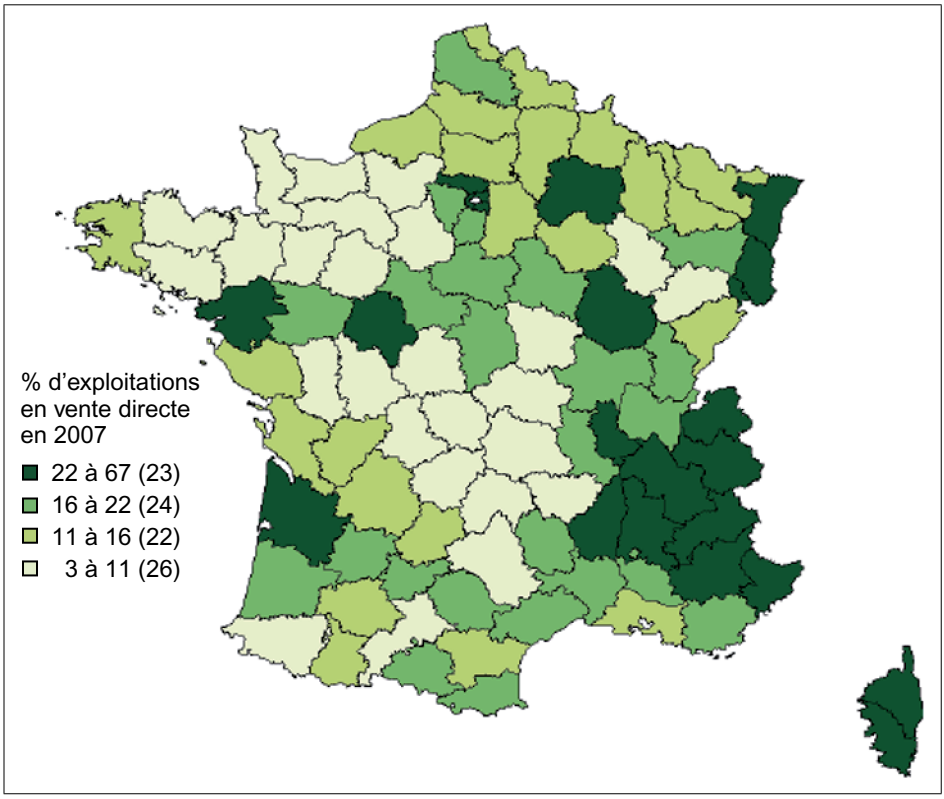
Source: Agreste, RA 1979, 1988, 2000 and 2010; FSS 2007.

whole farms thus dropped to 15.4% in 2000 to then hold steady (15.6% in 2007).

Two effects might explain the irregular evolution between 1979 and 2000. Between 1979 and 1988, the slow decline of farms in direct-to-consumer sales may be explained by the development of consumer demand, which might have led to the introduction of a direct-to-consumer sale activity on farms that did not previously have one, but it might also come from a statistical artefact: in 1979 the presence of direct-to-consumer sales may have been under-declared because this activity, largely women's business, was still little socially valued, which would later change with the attention it garnered in the 1980s.

Between 1988 and 2010, the sudden decline in the number of farms in direct-to-consumer sales may be interpreted as being the result of a statistical artefact (due to a change in data collected in the 2000 RA), but more important, it may be understood as a major evolution of farm structures with the accelerating disappearance of farms in general (Butault and Delame, 2005), especially the smallest farms that were more likely to sell directly to consumers. Indeed, at the beginning as well as at the end of this period, direct-to-consumer sales concerned a small proportion of farms as their acreage increased (Capt and Dussol, 2004): from 18% of farms under 20 ha surface area to 10% of those over 100 ha in 2000. This structural effect is compounded by the impact of increasing requirements for product processing and packaging, particularly for animal products, which require heavier material investments (buildings and equipment) as well as immaterial investment, especially training to master technical processes and skills (Capt, 1997). An observation backs up this interpretation: from 1988 to 2000, the sudden drop in the percentage of farms in direct-to-consumer sales took place almost exclusively among farms raising livestock (specialized in cattle, other herbivores or granivores, or non-specialized) – 64% of all farms in 1988 and 60% in 2000—where direct-to-consumer sales predominantly concerned processed products—whereas the percentage of farms in direct-to-consumer sales held steady or even increased among farms specialized in vegetal productions.

Map 1. **Percentage of farms in direct-to-consumer sales in 2007, by administrative department, mainland France**



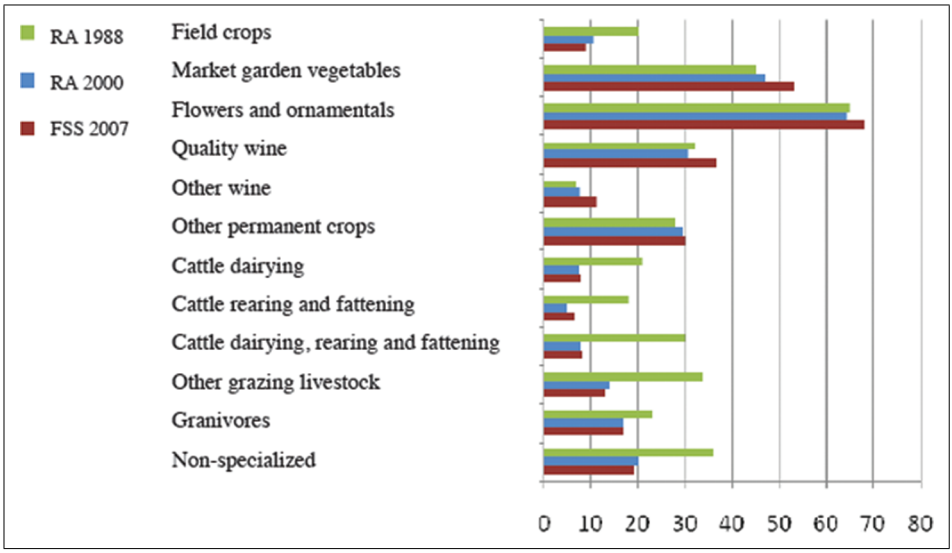
Source: Agreste, FSS 2007, IGN.

We would like to emphasize, however, that we can not draw conclusions on the relationship between the drop, then leveling out, in the percentage of farms in direct-to-consumer sales and the evolution of the size and share of the market of products sold directly, because these markets might have held steady or have even grown if the sales of farms ceasing activity (or direct-to-consumer sales) were compensated for (or surpassed by) the sales of farms that created or developed a direct-to-consumer sale activity. Additionally, developments may vary according to product type, as indicated by recent studies on two kinds of products, cow-milk cheeses and vegetables (Capt *et al.*, 2011a; Gauche *et al.*, 2011).

4.2. Some important spatial differences

In 2007, there were significant regional contrasts (Map 1). The percentage of farms in direct-to-consumer sales was much higher in the Northeast, Rhône-Alpes, Ile-de-France, Pays-de-la Loire, and in most administrative departments of the Southwest, where it surpassed 30% in some departments.

Table 4. **Percentage of farms in direct-to-consumer sales by farm type, in 1988, 2000 and 2007**



Source : Agreste, RA 1988 and 2000; FSS 2007.

In comparison, it represented a small proportion of farms (less than 10%) in western France, especially in Brittany, Haute and Basse Normandy, and the Massif Central.

These spatial differences may partly be attributed to an effect of demand (proximity and size of the local market) but they also come from an important supply-side effect related especially to the unequal spatial distribution of farms and production systems (Cavailhès and Wavresky, 2007; Capt and Schmitt, 2000) and their varying propensities to practice a direct-to-consumer sale activity (Table 4). The results of the econometric tests presented in the next section will allow us to estimate the significance of these two kinds of effect. These differences may also be linked to a persistent historically based attachment to specific products in certain areas (Capt, 1994; Capt *et al.,* 2011a), organizational factors (the ability of farmers to work together in collective undertakings, the characteristics and density of relational networks) and institutional factors (local public policies). This article does not include an estimate of these factors' influence due to the limitations of the mobilized database.

5. Characteristics associated with direct-to-consumer sales

The binomial logit results are given in Table 5. Since the logit model's coefficients only give the direction of the explanatory variable's effects, they are presented in exponential form ("odds ratio") in order to show how changing one modality for a qualitative variable modifies the relationship

Table 5. **Estimate by binomial logit of the influence of different factors on the probability of doing direct-to-consumer sales within each farm type and between farm types**

	Farm specialized in							Non specialized farms
	Field crops	Market gardening	Vineyards	Arboriculture	Cattle	Other herbivores	Granivores	
Number of observations	18548	1147	8577	2881	15521	5485	2060	12894
Variable	Odds p1	Odds p1 p2	Odds p1 p2	Odds p1 p2	Odds p1 p2	Odds p1 p2	Odds p1 p2	Odds p1 p2
Economic size 12 < 24 hawe	0,99	0,47 ** °°	1,04	1,68 ** °°	1,38 *	1,71 *** °°°	0,23 *** °°°	0,96
Economic size 24 < 60 hawe	0,93	0,36 *** °°°	1,49 ** °°	1,68 *** °°°	0,83	1,06	0,09 *** °°°	0,57 *** °°°
Economic size 60 <150 hawe	0,53 ***	0,14 *** °°°	1,67 *** °°°	1,13 °°°	0,48 ***	0,54 ***	0,03 *** °°°	0,20 *** °°°
Economic size ≥ 150 hawe	0,24 ***	0,13 ***	1,39 ** °°°	0,93 °°°	0,25 ***	0,48 *** °°	0,02 *** °°°	0,10 *** °°°
Certified organic	4,56 ***	6,94 ***	3,33 ***	1,54 ** °°°	4,48 ***	3,18 ***	1,36 °°	5,26 ***
AOC - AOP	3,01 ***	0,82 °°°	2,39 ***	0,79 ** °°°	1,49 *** °°°	1,15 °°°	1,42	1,68 *** °°°
Label rouge	1,46 ***	0,20 °°	1,29	0,63 * °°°	0,84 * °°°	0,47 *** °°°	0,89 °°	0,94 °°°
Agro-tourism	2,81 ***	1,85	2,13 *** °	2,67 ***	2,78 ***	1,86 *** °°	4,65 ***	3,62 ***
Contractual work	1,24 ***	6,71 ** °°	0,59 *** °°°	2,84 *** °°°	1,39 **	2,23 *** °°°	1,62	1,17
Farm-head pluriactivity	0,55 ***	3,27 *** °°°	0,53 ***	0,76 ** °°	0,81 * °°°	0,64 ***	0,66 *	0,72 *** °°
Family-member operators : 2	1,50 ***	0,99 °°	1,09 °°°	1,34 ***	1,30 ***	1,32 ***	1,15	0,96 °°°
Family-member operators : 3 or more	2,32 ***	1,49 * °	1,36 *** °°°	1,36 ** °°°	1,84 *** °	1,18 °°°	1,93 ***	1,39 *** °°°
Full time employee equivalent < 1	2,16 ***	0,82 °°°	1,58 *** °°°	0,94 °°°	1,69 *** °°°	1,40 *** °°°	1,09 °°°	1,45 *** °°°
Full time employee equivalent 1< 2	2,88 ***	0,71 °°°	3,08 ***	0,98 °°°	2,19 *** °	1,42 * °°°	1,31 ***	2,12 *** °°
Full time employee equivalent 2 or more	3,82 ***	0,32 *** °°°	5,73 *** °°	0,76 * °°°	5,49 ***	1,29 °°°	2,07 *** **	3,28 ***
Farm-head (partner) < 40 yrs	1,78 ***	1,13	1,29 ** °°	0,88 °°°	1,58 ***	1,20 °°	1,45	1,30 ** °
Farm-head (partner) 40 < 50 yrs	1,67 ***	1,43	1,30 *** °	1,19 °	1,54 **	1,45 ***	1,54	1,33 ***
Farm-head (partner) 50 < 60 yrs	1,42 ***	1,21	1,18 *	1,15	1,32 *	1,32 **	1,14	1,39 ***
Short secondary education (BEP)	1,06	1,44 *	1,48 *** °°	1,19	1,49 *** °	1,54 *** °°	1,31	1,56 *** °°°
Long secondary education (bac)	0,98	1,49	1,36 ** °	1,12	1,93 *** °°°	1,65 *** °°°	1,47	2,01 *** °°°
Higher education	0,95	1,16	1,60 *** °°°	1,38 * °	2,41 *** °°°	2,12 *** °°°	1,54	2,19 *** °°°
At least 1 h-1 family female operator	1,86 ***	1,44 **	1,64 ***	1,40 *** °°	1,38 *** °°°	1,40 *** °°°	1,52 ***	1,46 *** °°°
Presence of non-family female employee	2,38 ***	1,73 ***	1,72 *** °	2,31 ***	3,50 ***	1,75 ***	1,81 **	2,57 ***
Internet	1,01	1,00	2,40 *** °°°	1,38 *** °°°	1,38 *** °°°	1,15	0,99	1,08
Signed CTE or CAD	1,13	1,55	0,81 ** °°°	1,23	1,37 *** °	1,21 *	2,21 *** °°°	1,24 ***
Received DJA	1,17 *	1,15	1,18 *	1,87 *** °°°	1,19 **	1,14	1,28	1,06
Population < 100000	0,94	1,52	0,92	0,74 *** °	0,72 *** °°°	0,88	1,40 ** °°	0,99
Population 250000 - 500000	1,30 ***	0,53 *** °°°	1,11 *	0,79 ** °°°	1,34 ***	0,96 °	0,75 °°	1,35 ***
Population 500000 - 950000	2,15 ***	0,96 °°°	1,56 *** °°	1,52 *** °°	3,84 *** °°°	1,51 *	2,21 ***	3,23 *** °°°
Percent Corroborating	73.8	77.6	81.9	67.5	72.9	70.7	82.3	73.8
Pseudo R^2 = 0,20								
Likelihood ratio = 15045 ***								

***: Significant at the threshold of 1%; **: 5%; *: 10%.
°°°: Significant at the threshold of 1%; °°: 5%; °: 10%.
Legend: The results in this table are to be interpreted according to the reference. Example: concerning the influence of the economic size on whether a farm does direct-to-consumer sales or not, the reference is the smallest farm size (less than 12 hawe). For field crop farms, the odds ratio of 0.53 for the moderate farm size of 60-150 hawe means that the probability of doing direct-to-consumer sales (as opposed to not doing it) is, for a farm of this size, 0.53 times that of a small farm (under 12 hawe), all other things being equal. This difference is significant from the threshold of 1%.
The circles (°, °°, °°°) indicate the significance of the difference between the concerned farm type and the field crop specialization. Thus, once again using the example of a farm from 60 to 150 hawe, the odds ratio for market gardening (0.14) is statistically different from that for the field crops specialization (0.53), at a threshold of 1% (°°°).

between probabilities (the odds) under study[9]. The pseudo R^2 is 0.20 and the hypothesis that modelling has no explanatory power is rejected (likelihood ratio). The estimated rate of concordance, which ranges from nearly 70% to 80% depending on the farm type, shows that the adopted model correctly predicts the probability of doing direct-to-consumer sales.

The analysis of the results starts with the influence of farm characteristics, then proceeds to labor and family characteristics followed by the influence of the market, before concluding on a general interpretation of the observed differences.

5.1. Farm characteristics

An initial logit estimate comparing the characteristics of all the farms that deal with direct-to-consumer sales to those not dealing with direct-to-consumer sales (Capt and Wavresky, 2011b) first of all revealed that farm surface area dimensions have a significant influence on the probability of doing direct-to-consumer sales in 2007, a probability that, all other things being equal, consistently decreases as the farm's area increases: selling directly to consumers is indeed a way to compensate for the handicap of low real estate availability. But surface area only partially accounts for a farm's economic size, production *per* hectare varying considerably according to the type of vegetal or animal production practiced. Retaining economic size instead of the surface area dimension, and estimating its influence according to farm type, does not entirely contradict the preceding interpretation, but it does modify it. Thus in most farm types, the probability of being in direct-to-consumer sales declines significantly above a certain level of economic size, re-enforcing the proposition that direct-to-consumer sales are a way to increase incomes on farms of small economic size. But this interpretation should be nuanced according to farm type. In field crop, cattle and other herbivore specializations, the odds decrease by half for farms between 60 and 150 hawe compared with the smallest farms' (<12 hawe) odds. This decrease is significantly steeper in market gardening and granivore specializations: over the threshold of 12 hawe, the odds are reduced by half in market gardening and by even more for granivores (poultry and pork), and the extent of the drop is pronounced at

[9] Either the probability of an event (doing direct-to-consumer sales) in a certain situation (being a farm between 12 and 24 hawe), the odds are equal to p/(1-p). The odds ratio is the relationship between two odds: one compares the odds of farms between 12 and 24 hawe to those of the situation of reference (here, farms of under 12 hawe). An odds ratio is from 0 to $+\infty$. An odds ratio of 1 means that there is no effect (farms with dimensions between 12 and 24 hawe behave no differently than farms under 12 hawe); and odds ratio over 1 means that farms with 12 to 24 hawe present the event relatively more often than those under 12 hawe (all other things being equal); an odds ratio below 1 (including from 0 to 1) means that the farms with a dimension from 12 to 24 hawe present the event relatively less often than those under 12 hawe (all other things being equal).

both extremes of farm economic size. Selling direct-to-consumer is above all a practice of very small economic size farms. Yet on farms specialized in vineyards and arboriculture, the propensity for direct-to-consumer sales increases with the economic size, and it only begins to decline at 150 hawe for the former, and 60 hawe for the latter. These differences between farm types indicate that there are other motivations for direct-to-consumer sales beyond compensating for the handicap of a small economic size.

As expected, since a share of consumers values the quality in its food products, producing goods certified in official quality designations positively and significantly influences the probability of being in direct-to-consumer sales, but unevenly according to the type of quality designation. For almost all farm types, the adoption of organic farming practices exerts a very positive significant influence. Thus, in six of eight farm types, the probability of doing direct sales is at least three times higher than that of farms which are not certified organic, but this influence is the strongest (odds ratio around 7) in the market gardening specialization. Only farms specialized in granivores have an odds ratio that is not significantly different than one, probably because of the low number of farms of this type in organic farming. Among farms with a production qualified for an AOC, only those specialized in field crops, vineyards and cattle and non-specialized farms have a significantly higher probability (odds ratio between 1.5 and 3, inclusive) of being in direct-to-consumer sales, which is consistent with the prevalence of these products in these farm types.[10] On the other hand, the probability of doing direct-to-consumer sales is not significantly different between farms with a production certified for *Label Rouge* quality designation and farms without one in the farm types most concerned by this label[11] (farms raising livestock; Table 1 in the Appendix), which are more associated with an industrial supply chain logic and less with *terroir*.

The probability of being in direct-to-consumer sales rises significantly when it is associated with another diversification activity, even more when it is combined with agro-tourism, and this holds true across nearly all farm types. The low number of observations of market gardening specialized farms practicing direct sales prevents us from being able to conclude on its positive influence (despite an odds ratio of 1,85). It also rises, though at a lower rate, when it is associated with the offer of services (contract work), at least in some farm types (specializations field crops, arboriculture, cattle, other herbivores). In these cases, interpretation is complicated in the absence of data on the

[10] Of approximately 570 AOCs in 2007, 470 were in wine, nearly 50 in dairy products, and fewer than 40 for all other agricultural products. Some filed crop and non-specialized farms have vines and animal product processing facilities that are part of a strategy to raise returns by participating in an AOC.

[11] As most *Label Rouge* designations concern animal products (poultry, cattle, pigs), the percentage of concerned farms is very low across all farms specializing in vegetal crops (Table 1 in the appendix).

nature of the services offered, which depend on different logics according to whether they take advantage of available equipment (the case for agricultural work businesses) or family labour having specific qualifications (intensive service in qualified labour).

5.2. Characterizing farm households

Our previous work has shown that one of the main characteristics of farms in direct-to-consumer sales is that they stabilize and create more employment for family members and very often take recourse to hired labour (Capt and Dussol, 2004), but until now we have been unable to dissociate the effects of several characteristics. Testing the 2007 data allows us to specify the particular effects to different characteristics of labour and the extent of this influence according to farm type.

Consequently, we now see that the labour-intensive character of direct-to-consumer sales (processing, packaging and product sale tasks, in addition to production) leads to a significantly lower probability of being in direct-to-consumer sales when the farm-head has an off-farm activity (either primary or secondary), in all farm types but market gardening (odds ratio higher than three), for which direct-to-consumer sales proves to be more of a supplementary income for farms of very low economic size. In addition, the propensity for direct-to-consumer sales grows significantly according to the number of family-member operators in all farm types, and is higher with three family-member operators than it is with two, except in arboriculture and other herbivores specializations. To the significant influence of the number of family-member operators, we add the influence of employees: in five farm types (specialized in field crops, vineyards, cattle, granivores and non-specialized), the propensity for direct-to-consumer sales increases even more strongly according to the number of employees (in terms of person-hour equivalents) than it does with the number of family operators. Yet it is not stronger, and even weaker, in farms specializing in market gardening and arboriculture. The extent of the influence of employees indicates that direct-to-consumer sales is not only found on farms seeking work for family members, with the possibility of adding employees (less than full-time equivalent), but also happens on farms with a business logic that relies on a significant hired labour base. This logic is especially developed in field crops, vineyards, cattle and in non-specialized farms (odds ranging from greater than three to greater than five).

While most prior studies conclude that there was no generational effect, analysis of the French data reveals an influence that varies according to farm type. In most farm types (excluding market gardening, arboriculture and granivores, for which no significant difference was detected), the presence of a farm-head or a partner under age 60 significantly increases the probability that the farm does direct-to-consumer sales, but depending on the farm type, it is higher for farmers under 50 than for those between 50 and 60 years

old (specializations in field crops, vineyards and cattle), with the exception of non-specialized farms. As Detre *et al*. (2011) show for the United States, the age indeed influences the practice of direct-to-consumer sales, but of low amplitude when compared to the number of farm operators and employees.

Farms in direct-to-consumer sales also set themselves apart from others by the education and socio-professional careers of family-member operators. Even in 1988, they were more educated, more integrated into agricultural professional networks, and more likely to spend a lot of time with people from other social *milieux*, either after having practiced another kind of work before setting themselves up in farming in the case of those from farming backgrounds, or due to their non-farming backgrounds (Capt, 1994). If, in 1988, the effect of education alone could not be dissociated from that of generation (farm-head age), it is present in the model adopted here. Thus, in 2007, the probability of being in direct-to-consumer sales increases as the educational level of family-member operators rises: those with higher educational levels on farms specialized in vineyards, cattle, other herbivores and non-specialized farms do considerably more direct-to-consumer sales than their peers with lower educational levels. The fact that they produce goods that must be processed (wine production, transformation of milk into dairy products, meat butchering and processing) confirms the hypothesis that their knowledge and skills have an important role in the mastery of the technological processes of these systems. In contrast, in farm types where direct-to-consumer sales concerns non-processed products, as with field crops, market gardening and arboriculture, the probability of selling direct-to-consumer is not significantly different according to the educational level of family-member operators.

As for the influence of women's labour on the practice of direct-to-consumer sales, our study makes a specific contribution in not limiting its estimates to that of the farm-head's spouse, as it has been done in analyses in other countries. Thus, in addition to the number of family-member operators, the probability of doing direct-to-consumer sales increases significantly when there is at least one family female member working half-time on the farm, regardless of farm type (the odds ratio ranging from 1.4 to 1.9). In addition, the probability of doing direct-to-consumer sales rises significantly when non-family female employee labour is appealed in all farm types.

Lastly, using the Internet for farm needs, which we assume to be a sign of a more developed commercial sense, only proves to be significantly more marked in direct-to-consumer sales farms specialized in vineyards, arboriculture and cattle, but we are not in a situation to be able to interpret these differences. The probability of having had a CTE or CAD or having benefitted from a DJA—characteristics taken to be expressions of farmers' more advanced integration into professional networks—is not significantly different between farms with or without direct-to-consumer sales in most farm types. But in the farm types where the difference is significant, this result makes sense when combined with the influence of other characteristics that will be presented in the conclusion.

5.3. Market characteristics

In section 2 we saw that the terms of food product market competition influence farms' positions according to the type of food product they sell on these markets. An earlier presentation of this study, based on the estimate of a binomial logit integrating farm type as explanatory variable (Capt and Wavresky, 2011b), argued that the probability of selling direct-to-consumer is significantly lower when farms raise livestock (specialized in cattle, other herbivores, granivores and non-specialized), all other things being equal. This difference with farms in vegetal productions can not be solely explained by the more intensive nature of work on livestock farms, as it has been very often emphasized in work in other countries (McNally, 2001); it may also be interpreted as the result of production constraints and the sales of processed animal products direct to consumers, which tends to confirm the increasing probability of doing direct-to-consumer sales as family-member operators' educational levels rise in these farm types.

Our analysis moreover confirms the influence of geographical proximity to markets where the population is concentrated, but nuances the conclusions of previous works on the subject. For most farm types, the probability of selling direct-to-consumer proves to be significantly higher for farms located in densely populated areas. All farm types but market gardening sell significantly more in a zone of over 500,000 inhabitants than in a zone with 100,000 to 250,000 inhabitants (odds ratios going from 1.5 to 3.8). Compared with farms specializing in field crops, the effect is significantly amplified in cattle specialization (odds ratio of 3.8 compared to 2.2) and in non-specialized farms (odds ratio of 3.2), while it is significantly lower in arboriculture and other herbivores (odds ratios are at 1.5 compared to 2.2). On the other hand, contrary to what is generally believed from media coverage of CSA (Community Supported Agriculture)-type systems in urban areas, the probability of farms specialized in market gardening being in direct-to-consumer sales is not significantly different in very densely populated or moderately dense zones. We suppose that these differences in the influence of consumer living near farms are linked to interactions between local supply and demand: spatial distribution of producer and product types being quite unequal (Capt and Schmitt, 2000; Cavailhès and Wavresky, 2007), more the density of producers of a given product is greater, more the percentage of selling this product directly to local consumers is lower. This might explain why the propensity for direct-to-consumer sales in the market gardening specialization does not differ significantly to the population density in a 30-km radius, when it rises significantly between the densely and very densely populated zones in cattle specialized farms, and it rises much more than in the field crops specialization.[12]

[12] 22% and 39% of all market garden-specialized farms are located, respectively, in very dense zones (over 500,000 inhabitants in a radius of 30 km) and dense zones (250,000-500,000) the contrary of farms specialized in cattle (respectively 3% and 9% in such spaces).

6. Discussion and conclusion

This article aimed at identifying the influence of a variety of factors on the propensity of farms to practice a direct-to-consumer sale activity. Analysis of our estimates' results corroborates some previous findings and provides new information, emphasizing that beyond traits common to most farms in direct-to-consumer sales, some contrasting traits emerge when farms are studied by farming type.

Concerning traits that are shared by most farm types, our results suggest that selling direct-to-consumer is a way to improve income, especially for farms of small economic size, and answers concerns about better remunerating family members, while also mobilizing more employee labour, probably due to the labour demands associated with direct-to-consumer sale activities. Consequently, it mainly concerns farm-heads working full-time on the farm, increases with the number of family-member operators, and mobilizes more female labour; farm-head age (except the oldest) has little influence. As for product characteristics, producing for a quality designation only goes hand in hand with a greater propensity for direct-to-consumer sales for certified organic and AOC-producing farms, not those in *Label Rouge*. Lastly, in line with other researches, we conclude on the positive influence of a farm location in densely populated areas, but with variations according to farm type.

Indeed, beyond these common traits, our study shows significant differences between farm types, suggesting the following interpretations. Technological barriers to entry into food product markets (of variable importance according to food product type, material capital holdings in buildings and equipment, specific knowledge and skills) may explain why selling direct-to-consumer is more widespread on farms with products requiring little processing (market gardening, flowers and plants, other permanent crops) and much less on farms producing products needing more processing (in vineyard and livestock specializations). In addition, since they need to master specific skills, the latter are in the hands of more highly educated members of the farm family or families.

The observed differences between farm types may also be interpreted as expressions of the variable co-existence of different strategies pursued by farms selling directly to consumers. Thus, in comparison with farms specialized in field crops, farms specialized in market gardening are more likely to sell directly to consumers if they are of very small economic size, have a farm-head with multiple professional activities, have no hired-in labour, and do contract work, suggesting that the direct-to-consumer sale of vegetables is more common among people having another professional and social base and other revenue sources. On the contrary, vineyard farms are more likely to be in direct-to-consumer sales if they are from moderate to large size and call on a significant amount of employee labour, yet they mobilize less female labour (in-family or out), revealing a more widespread business logic. On the other hand, direct-to-consumer sales in cattle and field crop specialized farms involve above all from very small to moderate size farms and those with

large family operator groups (several farm partners), but as with vineyards, the positive and rising influence of the number of employees indicates that the business logic is more widespread here, especially in the cattle specialization because of its more intensive labour demands. This interpretation needs further study that surpasses the limits of the data source mobilized here, which does not allow us to distinguish between farms according to the volume and characteristics of direct-to-consumer sales in their overall strategies.

Lastly, beyond the observation that direct-to-consumer sales is positively influenced by being located in densely populated zones in most farm types, spatial differences between farms in direct-to-consumer sales in mainland France lead us to wonder to what extent they are also determined by interactions between local supply and demand, especially by spatial variations in farm structure and farm types (which influence the propensity for selling directly to consumers), as well as factors both organizational (capacity of producers to organize locally) and institutional (local public policies). The diversity of factors in play in localizing these activities requires a model that allows the effects stemming from these various factors to be captured, opening a nearly unexplored field of research.

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Appendix 1

Table 6. **Descriptive statistics of variables for each type of farm**

Number of observations in the sample and % of farms in each type of farming (data extrapolated)	Farms specialized in							Non specialized farms
	Field crops	Market gardening	Vineyards	Arboriculture	Cattle	Other herbivores	Granivores	
Number of observations	18548	1147	8577	2881	15521	5485	2060	12894
Direct-to-consumer activity	9	53	28	29	7	13	17	19
Physical farm size (ha)								
0 ha							21	2
0 < 20 ha	26	90	76	78	18	64	41	35
20 <50 ha	19	8	18	16	25	17	24	17
50 < 100 ha	22	2	5	5	36	11	13	24
100 < 200 ha	25	1	1	1	18	5	2	18
≥ 200 ha	8	0	0	0	3	2	0	5
Economic farm size								
< 12 hawe	20	16	18	46	17	68	12	30
12 < 24 hawe	10	13	10	8	9	8	9	7
24 < 60 hawe	18	27	17	14	28	13	21	14
60 < 150 hawe	31	24	25	17	38	10	25	28
≥ 150 hawe	22	20	31	15	8	1	32	21
Farm status								
Individual	69	73	73	82	70	90	54	69
GAEC	5	5	3	3	15	4	4	12
EARL sole ownership	14	11	7	6	6	2	19	8
EARL between spouses	4	4	3	2	7	2	10	6
Other EARL	3	3	2	2	1	0	3	2
Association	1	1	0	1	0	0	0	1
Civil society	6	3	9	4	2	1	10	2
Product quality label								
AOC (origin-controlled)	2	2	73	18	6	7	1	8
French Label Rouge	2	1	1	2	10	6	12	8
Certified organic	2	9	2	4	2	2	1	2
Other activity								
Touristic or artisanal activity	2	3	4	4	2	6	3	4
Contractual work	10	1	4	3	3	1	3	5
Farm-head with an off-farm primary or secondary activity	24	6	19	21	12	29	10	14
Family-member operators (over age 16)								
Only one family-member operator on farm	55	36	44	50	37	59	40	39
Two family-member operators	35	51	42	40	44	33	49	43
At least three family-member operators	10	13	14	10	19	8	11	18
Employees on the farm (person-hour equivalent)								
No employees	69	47	31	49	73	80	46	65
Less than one full-time employee	22	21	48	29	24	17	36	27
1 to < 2 employees	6	9	10	7	3	2	10	6
2 to < 3 employees	1	6	5	4	0	0	4	1
At least three employees	1	18	6	11	0	1	4	1
Age of farm head (or of the youngest farm partner)								
Under 40 years old	19	19	20	14	28	16	23	23
From 40 to 50	29	30	28	25	31	23	38	29
50 to 60	33	35	26	27	29	29	34	27
From 60 and over	18	17	26	34	13	32	5	21
Highest educational level (general or in agriculture) among familiy member operator								
< BEP	17	23	14	20	19	28	9	20
Short secondary education (BEP)	40	41	38	35	43	37	41	39
Full secondary education (Baccalaureat)	21	21	20	22	24	17	29	22
Higher studies (BTS, engineer...)	23	16	28	24	14	18	21	19
Women's labor								
Presence of at least one half-time family female-operator on the farm	17	43	25	22	37	21	44	32
Non-family female employee	1	15	7	4	1	2	9	2
Professionnal engagements								
Use Internet	40	31	32	25	31	19	50	34
Signed CTE/CAD	9	2	6	6	16	8	5	12
Received DJA	11	9	8	6	22	9	13	16
Population density in a radius of 30 km around the farm								
< 100,000 inhabitants	29	8	17	31	45	47	25	34
From 100,000 to 250,000 inhabitants	44	31	43	34	43	38	59	45
From 250,000 to 500,000 inhabitants	19	39	31	25	9	12	13	15
From 500,000 to 950,000 inhabitants	8	22	9	10	3	3	3	6