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Marketing channels and the adoption of organic certification in the French fruit sector

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Abstract

This paper examines why farmers adopt organic farming once they have chosen a marketing channel. We study French fruit production since this sector is an intensive user of pesticides. We use a representative survey of French farms which provides an overview of marketing channels and phytosanitary practices for all fruits. We show that all types of marketing channels positively influence the adoption of organic farming by farmers when intermediaries and recipients of the production are identified.

Keywords: organic farming, marketing channels, food supply chain, fruit production, France

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Introduction

Recent sanitary crises have strengthened the requirements of consumers in terms of food safety and quality management. The entire food supply chain has thus been impacted from the producers to the consumers, resulting in the emergence of alternative food networks (Venn *et al.*, 2006). These networks revisit the whole organization and functioning of the food supply chain (Goodman *et al.*, 2012). Such an evolution is characterized inter alia by the development of quality standards (Giraud-Héraud *et al.*, 2006), the promotion of organic farming (Sylvander and Schieb-Bienfait, 2006; Tuomisto *et al.*, 2012) and the development of alternative food supply chains (Penker, 2006; Renting *et al.*, 2003).

As the first link in the chain, the producer remains a key player. In particular, he has to take two major decisions, which are the choice of both the type of farming and the marketing channels (Hazell *et al.*, 2010). The former is related to production practices, i.e. conventional farming, with the use of phytosanitary products, versus organic farming while the latter is related to selling practices, which can take several forms such as producer organizations, supermarkets, direct selling and processing.

Echoing the existing literature, these two dimensions appear to be closely linked (Aubert and Enjolras, 2016). Indeed, they provide information on the nature and quality of agricultural products and processes (Richards *et al.*, 2013). For instance, the type of farming is associated with labels when production is organic (Moustier and Thi Tan Loc, 2013). So are short food supply chains (Kottila and Rönni, 2008). A combination of practices may help reduce asymmetric information effects regarding product quality (Akerlof, 1970).

The road to organic farming takes the form of a process which leads to certification (Burton *et al.*, 2003; Heckman, 2006). From conventional to organic practices, there are several indicators related to the adoption of environmentally-friendly practices. Pesticide use is measured either through the quantities of pesticide used (Aubert and Enjolras, 2014), the adoption of integrated pest management techniques (Fernandez-Cornejo, 1996; Fernandez-Cornejo and Ferraioli, 1999; Galt, 2008; McNamara and Keith Douce, 1991) or even the adoption of labelled organic farming practices (Aubert and Enjolras, 2016).

The adoption of a type of farming is driven by several factors. The aforementioned studies consider a set of explanatory variables which take into account the farm structure (acreage and production), its financial situation (profitability and indebtedness) and the farm holder's characteristics (age and education). The marketing channel is sometimes used as an explanatory variable, with an emphasis mainly on short food supply chains (Broderick *et al.*, 2011; Galt, 2008; Maréchal and Spanu, 2010; Souza Monteiro and Caswell, 2009; Zhou *et al.*, 2011). Consequently, there is insufficient consideration of the influence of marketing channels other than direct and retail selling on the adoption of a type of farming. More precisely, to the best of our knowledge, no work considers the diversity of marketing channels available to producers.

This paper aims to fill this gap by studying the influence of the choice of one or several marketing channels on the adoption of organic farming by French fruit producers. Fruit production is a relevant case study because the sector is at a crossroads. In recent years, many producers have adopted organic farming. At the same time, marketing channels have evolved

towards a higher proportion of short food supply chains. This evolution changes practices in a sector which used to be a very intensive consumer of phytosanitary products.

Our analysis uses data from the ‘Orchard Survey’ (*Enquête Vergers*), carried out in 2012 by the French Statistical and Forecasting Service (SSP). This sample of farms provides detailed information relating to both the adoption of organic farming and marketing channels. In addition to the study of the overall population of fruit farms, we differentiate all forms of fruit production in order to take account of their particularities. Hence, while apples correspond to a national and storable production, apricots are more regional and perishable. The influence of the marketing channels on the type of farming, namely organic farming, is measured through an econometric model which considers the diversity of marketing channels for each type of production mentioned above.

This article is structured as follows. In the first section, we develop a literature review. In the second section, we present both the empirical approach and the empirical strategy. In the third section, we present the results using descriptive statistics and econometric models. In the fourth section, we conclude and provide some perspectives.

1. Literature review

In this section, we present a literature review which emphasizes the potential influence of the choice of marketing channel, the status of the farm and key control variables on the adoption of organic farming. Testable hypotheses are then formulated which will be tested using empirical modelling.

1.1. Short supply chains and organic farming

Short food supply chains are defined by the existence of no more than one intermediary between the producer and the consumer. This definition corresponds primarily to direct selling where there is no intermediary, the producer thus selling his production directly to consumers. It also includes indirect selling where there is only one intermediary in the chain, for instance when the producer sells his products to supermarkets and hypermarkets.

Given the longstanding trend in favor of the adoption of organic farming, it has been observed that farmers receive a price premium when they obtain access to organic markets (Läpple and Rensburg, 2011). A similar premium exists for farms selling through short food supply chains because of the small number of intermediaries in the chain (Hardesty and Leff, 2010). Consequently, farmers adopting both short food supply chains and organic farming exhibit higher profits (Uematsu and Mishra, 2012).

Similarly, organic farming and short food supply chains share social and territorial values appreciated by producers (Renting *et al.*, 2003). Costa *et al.* (2014) show that these values are also shared by consumers who are looking for produce complying with certain quality requirements. Demand would then lead to an increased quality of supply, directly through marketing channels. In this context, both farmers who sell their produce directly and retailers who sell this produce indirectly drive the development of organic farming (Smith, 2006).

According to the French Orchard Survey, direct selling currently represents about 5% of the volumes marketed in France. However, this marketing channel is rapidly expanding given

the virtues attributed to it in terms of sustainability (Moati and Ranvier, 2005; Cavaliere *et al.*, 2016). As indirect channels, supermarkets allow to a large number of customers to purchase organic produce because of their capacity to propose a wide range of these goods (Martinez *et al.*, 2010). They therefore create incentives for farmers to propose differentiated produce to consumers.

From this literature review, we observe that most studies consider short food supply chains without differentiating direct from indirect selling. Hence, because these two marketing channels are supposed to have similar effects on the adoption of organic farming, we assume the following research hypotheses.

H1a. Direct selling supports the adoption of organic farming

H1b. Indirect selling supports the adoption of organic farming

1.2. Long supply chains and organic farming

Long food supply chains include more than one intermediary between the producer and the consumer. They encompass identified long channels where production is destined to be processed. Even if there are several intermediaries, the producer is aware of the final destination or use of his produce. These chains also include unidentified long channels whereby the producer sells his produce to producer organizations, wholesalers and forwarders. In this case, the producer does not know the final destination or intended use of his production. Whatever the channel, long supply chains are governed by specifications which impose quality and traceability standards (Scandella and Christy, 2011).

Long food supply chains include producer organizations (POs), accounting for about 50% of volumes marketed in France according to the Orchard Survey. POs generally organize the traceability of produce and provide the necessary means for the implementation of good agricultural practices (Dubuisson-Quellier *et al.*, 2006). Wholesalers represent about 25% of volumes traded. As intermediaries in the fruit and vegetables sector, wholesalers implement a residual control plan for pesticide residues. They ensure the traceability of their supplies by imposing specifications on their suppliers (Michel, 2014). Another important marketing channel is that of forwarders, accounting for 15% of traded volumes. Because they are very often involved in the importation of goods, they usually set up a voluntary self-monitoring plan designed to minimize health risks (Rouvière and Latouche, 2014). Less than 5% of the produce marketed is intended to export or processing.

Michelsen (2001) emphasizes that organic farming is now enforced by public regulations, in addition to self-regulation. Such regulations pave the way for the development of organic farming through long marketing channels. Ilbery *et al.* (2014) show that short food supply chains are a favored means of adopting organic farming. However, consumers' expectations may also lead to demand for organic produce through long national chains when enough information is provided on the organic produce.

Just as the literature on short food supply chains considers direct and indirect selling in an identical manner, this review examines the relationship between long food supply chains and organic farming, without taking account of the fact that some long supply chains can be qualified as identified while others can be qualified as unidentified. We therefore assume the following research hypotheses.

H2a. Long identified supply chains support the adoption of organic farming

H2b. Long unidentified supply chains support the adoption of organic farming

1.3. Farm status and organic farming

Because individual farms are easier to manage, they may be better suited to complying with organic farming regulations (Läpple and Rensburg, 2011). This is confirmed by Darnhofer *et al.* (2005) who assert that the conversion to organic farming is an individual decision.

H3. Individual farming is more likely to support the adoption of organic farming than farms operating within a group.

1.4. Control variables and organic farming

Burton *et al.* (1999), Läpple and Rensburg (2011) and Aubert and Enjolras (2017) found that farmers who operate small farms are more likely to adopt organic farming. The reason for this lies in the structure of these farms, which are mostly family-owned. However, Diederer *et al.* (2003) showed that innovation is more commonly adopted by larger farms while Chakrabarti *et al.* (2011) noticed that all firms are concerned regardless of their size.

H4. Small farms support the adoption of organic farming

Ilbery *et al.* (2014) explain that organic farming is mainly associated with consumers' expectations, which differ from one region to another. They also argue that the choice of marketing channel is driven by regional considerations, which is in line with observations made by Barham *et al.* (2004).

H5. The adoption of organic farming differs according to regional particularities

Darnhofer *et al.* (2005) show that farm specialization is less important than the farmers' personal values in the choice of organic farming. When a farm converts to organic farming, all crops are concerned (Buck *et al.*, 1997) and no distinction should be made between the specific types of produce (Lamine, 2011). With regard to fruit production, practices do not emphasize differences between orchard products when adopting organic farming (Lind *et al.*, 2004; Weibel, 2002).

H6. The adoption of organic farming does not differ according to fruit specializations

The research hypotheses are summarized in Figure 1.

Figure 1. Research hypotheses

2. Empirical approach

In this section, we present recent developments in French fruit production. We will then present the specific database used and its importance in understanding farmers' choices concerning marketing channels. We also illustrate the econometric model to be estimated.

2.1. Recent developments in French fruit production

French fruit production encompasses a broad spectrum of products ranging from the most perishable ones (e.g. apricots, peaches) to storable ones (e.g. apples, nuts). Similarly, farms are very diverse in terms of species, variety, quality and quantity of produce.

Food supply chains have undergone significant change in recent years, displaying remarkable dynamics in favor of short food supply chains. In 2010, 27% of fruit producers were selling all or part of their produce through these marketing channels (French Ministry of Agriculture, 2010). This trend encompasses regional disparities linked to the main local produce. However, producer organizations remain the predominant marketing channel used by fruit-producing farmers because they improve producers' competitive conditions (Camanzi *et al.*, 2011).

Fruit production also faces a challenge relating to its ecological sustainability. While fruit represents less than 1% of the agricultural area farmed nationwide, it accounts for more than 5% of phytosanitary expenditure. With pesticides expenses of close to €600 per hectare, this sector is the most intensive consumer of pesticides (Butault *et al.*, 2012). Phytosanitary requirements have therefore been increasing following the implementation of the EcoPhyto I (2008) and Ecophyto II (2015) frameworks, the objectives of which are to reduce the intensity of pesticide use in French agriculture.

In practice, the level of pesticide expense has not changed significantly, while many producers have been converting to organic farming. According to recent data from the Agence Bio (2017), the market share of organic farming produce in 2016 represented about 17% of total production of fruit and the most commonly consumed vegetables in France. Specialty stores sold the largest share (45%), while supermarkets accounted for 37% and direct selling 13%. If we consider only fruit production, specialty stores accounted for 45%, mass retailers for 31% and direct selling for 23%.

2.2. Database

The empirical analysis developed in this paper is based on an 'Orchard Survey' (*Enquête Vergers*), carried out in 2012 by the French Statistical and Forecasting Service (SSP). This survey is designed to meet one of the main objectives of the EcoPhyto framework: the characterization of phytosanitary practices. Hence, this database makes it possible to assess both the level of use of phytosanitary products (through the number of treatments) and the implementation of alternative practices.

All farms producing fruit are considered and the sampling technique is quite complex to ensure that results are representative of a specific fruit in a specific region. Two sub-populations are considered: on the one hand farms producing apples, apricots, peaches, kiwis, citrus fruits, nuts or plums and on the other hand farms producing pears, cherries and table grapes. For each type of produce, farms are surveyed if they farm at least 2.47 acres for the former and at least 1.24 acres for the latter.

For each farm, the database references both the produce farmed and the associated marketing channels. We then know the acreage and the volumes sold using each channel. In addition, the database provides information on the individual farms such as the usable agricultural area, the geographical location (administrative region), and the status (Table 1).

Table 1. List of variables

This database is both the most precise available at the farm and plot levels and the most comprehensive and recent available to us. We consider and differentiate all types of fruit in our empirical approach, irrespective of their relative importance in terms of area farmed. One exception that should be highlighted is the case of citrus fruits, because of the low number of producers surveyed. To guarantee the confidentiality of citrus fruit producers, we decided not to analyze this population.

We consider each type of fruit production in an independent manner. The aim is to analyze to the extent to which the adoption of organic farming certification is conditioned by marketing channels, regardless of the fruit considered. Considering potential fruit particularities enables us assess the validity of results from one type of produce to another. As a matter of fact, some fruits are non-perishable and can be stored, such as apples, while others are perishable and therefore require a local marketing, such as apricots. We also distinguish stone fruits and pome fruits. The results may also be interpreted in terms of fruit production as a whole; whereby global trends are emphasized.

The marketing channels considered in the database include producer organizations, wholesalers, direct selling, supermarkets and hypermarkets, forwarders and processing. Based on these categories, we decided to classify them in terms of ‘distance’, measured by the number of intermediaries between consumers and producers (Ritchie and Brindley, 2000).

Two categories are therefore identified: short food supply chains and long food supply chains. Each of these categories can in turn be divided into two subcategories according to our research hypotheses. Within short food supply chains, we differentiate direct from indirect selling and within long chains, identified from unidentified long channels. Since the destination of the produce is not necessarily exclusive, producers can sell all or part of their production to one channel or decide to combine several channels. Accordingly, we take a dichotomous approach to each channel. We then differentiate farmers according to the marketing channels they use to sell their produce.

Finally, the database provides information about the adoption, or not, of organic farming certification. No additional information is provided about the relative importance of the farmed area dedicated to organic farming.

2.3. Econometric modelling

The adoption of organic farming is considered through a dummy indicator. In order to understand the extent to which farmers are more likely to adopt this certification, we implement a logit model.

Formally, the model considered can be defined as follows:

$$\begin{aligned} \text{Organic farming} = & \alpha + \beta * \text{direct selling} + \theta * \text{indirect selling} \\ & + Z * \text{identified long-channel} + W * \text{unidentified long-channel} \\ & + \zeta * \text{farm status} + \gamma * \text{acreage} + \delta * \text{location} + \varepsilon \end{aligned} \quad (1)$$

where: α represents the constant, β , θ , Z and W are the coefficients associated with the marketing channels, and more precisely with direct selling, indirect selling, identified long-channels and unidentified long-channels respectively, ζ is the coefficient associated with farm status, γ and δ are the coefficients associated with control variables (acreage and geographical location respectively) and ε are the residuals.

While the marketing channels and farm status are at the heart of our study, we also consider certain control variables (acreage and location), because these factors are highlighted by the literature as leading to the adoption of certification.

3. Results

The results take into account the variety of the French fruit production by considering each type of fruit as well as the overall production. They show that the adoption of organic farming certification varies from one type of produce to another. Some farmers appear to be more inclined to implement such certification. Apples, pears, kiwis and citrus fruits would seem to be more prone to such certification than other types of produce such as cherries, peaches and plums (Table 2).

Table 2. Characterization of each type of fruit production

The marketing channels also differ from one type of produce to another. Since producers can sell through different channels, the relative importance of each one is measured through the volume sold through each channel (Tables 3 and 4). By considering both organic farming certification and the marketing channels, we observe that conventional farmers are over-represented in the “unidentified long channel”. Farmers involved in organic farming appear to be relatively more involved in short food supply chains and in identified long-channels.

Table 3. Relative importance of types of fruit in total fruit acreage

Table 4. Marketed quantities according to the marketing channel, produce and type of farming

The distribution of organic farming among the French regions highlights certain differences (Table 5). For instance, organic apple production tends to be under-represented in the major fruit producing regions. This result is similar for overall fruit production, which can be linked to the importance of apple production in total fruit production. Conversely, organic apricot production is concentrated in certain regions, such as Languedoc-Roussillon and Provence-Alpes-Côte d'Azur, which are located in the South of France. For all types of produce except apples, farms are for the most part not operated individually, and this proportion increases for organic farms. Quality farming tends to rely on a personal initiative. Because apple production is mainly sold through producer organizations, it would appear that there is a kind of collective dynamics for farmers involved in organic farming.

Table 5. Farm location and status

To go beyond this analysis, an econometric model is implemented which confirms the results presented above (Table 6). Whatever the fruit considered, econometric results confirm that some marketing channels are more likely to go hand with hand with organic farming certification.

Table 6. Econometric models

Short food supply chains, defined both in terms of direct and indirect selling, positively influence the adoption of organic farming certification (H1a and H1b validated). This result is in line with previous observations made in the literature. Even long channels with an identified destination of the produce generate the same effect (H2a validated). This result reflects the fact that when a farmer knows the destination of his produce, he is more involved in the quality of the produce and more likely to adopt more environmentally-friendly practices.

The only channels where the effect can sometimes be the opposite are the unidentified long channels (H2b partly validated). This result has to be put into perspective with the collective policy of producer organizations (POs). The aims of these organizations is to match supply and demand. Because supply is subject to several certifications, specifications, or references such as TESCO certification which is necessary to sell on the English market, POs assign and allocate specific markets to producers (Silva et al., 2014). Because one single producer cannot meet the total suppliers' requirements, POs allow producers to meet the supply needs collectively. Conversely, a farmer who sells all or part of his production to POs is not necessarily likely to adopt this certification even if the organic certification is requested by some suppliers.

The results also confirm that the status of the farm has an impact on the adoption of organic farming certification, especially for apricots and table grapes. For these products, farmers are more likely to implement more environmentally-friendly practices since their farms operate on an individual basis (H3 validated). We also notice that these farmers benefit from a larger acreage (H4 not validated). This might be explained by the perishability and associated production and marketing risk of these specific products.

The results also show that, for the most part, location has no specific influence on the adoption of organic farming (H5 not validated). A few regions are more commonly associated with organic farming, such as Limousin and Rhône-Alpes. Similarly, few differences exist between fruit specializations (H6 validated). This result is salient regarding the influence of the marketing channel, which is consistent for short food supply chains and for identified long channels. They indicate that fruit producers display similar behavior at the national scale, whatever their production. Such a result may emphasize the influence of public policies on the adoption of organic farming.

Conclusion

In this article, we have endeavored to analyze the link between the choice of marketing channel and the adoption of organic farming. The existing literature emphasized a strong link between these two main aspects of farm production processes. The question is important for fruit production, a sector which is an intensive consumer of phytosanitary products and which is prone to the adoption of alternative supply chains.

This study focused on French fruit-producing farms, considering both overall fruit production and the different types of fruit produce. Data was taken from the 2012 ‘Orchard Survey’, a census representative of French farms that provides a detailed overview of marketing channels and phytosanitary practices, as well as key indicators of the farm structure.

The results were twofold. First, they confirmed the existence of a strong and positive relationship between short food supply chains and organic farming, these two strategies being oriented toward increased produce quality. Second, they highlighted that some long channels (supermarkets) were also associated with the development of organic farming when the destination of the product is known. Consequently, an information requirement is necessary not only for consumers but also for producers.

These results proved the importance of marketing channels in the adoption of new production chains, oriented towards quality and environmentally-friendly practices. It would be interesting to extend the analysis to other crops, and more precisely annual ones. Because most farmers are able to combine marketing channels, an analysis of the interaction between them would also be relevant. Such an analysis would allow us to enjoy a more precise understanding of farmers’ choices relating to marketing channels by linking them to the suppliers’ phytosanitary requirements. In terms of public policies, a more in-depth knowledge of marketing strategies suitable for organic farming may improve the way by which farms are able to adopt new production strategies.

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Appendices

Table 1. List of variables

| Variables | Definition | Unit |
|-----------------------------------|--|-------------|
| Organic farming | The farmer adopts organic farming certification | Dummy |
| <i>Marketing channels</i> | | |
| Direct selling | The producer sells all or part of his produce directly to consumers | Dummy |
| Indirect selling | The producer sells part or all of his produce to supermarkets or hypermarkets | Dummy |
| Identified long channel | The producer sells all or part of his produce to processors | Dummy |
| Unidentified long channel | The producer sells all or part of his produce to intermediaries: producer organizations, wholesalers or forwarders | Dummy |
| <i>Farm status</i> | | |
| Status | The farm is individual or operates within a group of farms | Dummy |
| <i>Farm location</i> | | |
| Aquitaine | The farm is located in Aquitaine | Dummy |
| Languedoc-Roussillon | The farm is located in Languedoc-Roussillon | Dummy |
| Limousin | The farm is located in Limousin | Dummy |
| Midi-Pyrénées | The farm is located in Midi-Pyrénées | Dummy |
| Centre-Val de Loire | The farm is located in Centre-Val de Loire | Dummy |
| Provence-Alpes-Côte d'Azur | The farm is located in Provence-Alpes-Côte d'Azur | Dummy |
| Rhône-Alpes | The farm is located in Rhône-Alpes | Dummy |
| Other region | The farm is located in another region | Dummy |
| <i>Farm specialization</i> | | |
| Main production | Apples, apricots, pears, peaches, plums, cherries, kiwis, table grapes, citrus fruits | Dummy |
| <i>Other control variables</i> | | |
| Acreage | The physical size of the farm | Hectare |

Table 2. Characterization of each type of fruit production

| | Apples | Apricots | Pears | Peaches | Plums | Cherries | Kiwis | Table grapes | Citrus fruits | All fruits |
|------------------------------|---------------|-----------------|--------------|----------------|--------------|-----------------|--------------|---------------------|----------------------|-------------------|
| Acreage (%) | 36.80% | 12.60% | 4.99% | 10.90% | 17.11% | 7.76% | 3.45% | 4.82% | 1.58% | 100.00% |
| Number (%) | 21.99% | 12.91% | 9.40% | 7.74% | 13.55% | 18.81% | 5.02% | 9.53% | 1.04% | 100.00% |
| Organic producers (%) | 9.81% | 6.95% | 8.45% | 4.09% | 5.10% | 3.33% | 11.34% | 7.30% | 10.50% | 5.90% |

Source: Orchard Survey (2012)

Table 3. Relative importance of types of fruit in total fruit acreage

| | | Direct selling | Indirect selling | Identified long channel | Unidentified long channel | Total |
|--------------|-----------------|----------------|------------------|-------------------------|---------------------------|---------|
| Apples | Conventional | 29.00% | 6.49% | 15.58% | 48.93% | 100.00% |
| | Organic farming | 36.69% | 10.07% | 25.47% | 27.77% | 100.00% |
| Apricots | Conventional | 15.66% | 5.90% | 5.62% | 72.82% | 100.00% |
| | Organic farming | 19.03% | 7.08% | 16.37% | 57.52% | 100.00% |
| Pears | Conventional | 29.61% | 6.48% | 12.90% | 51.02% | 100.00% |
| | Organic farming | 39.72% | 7.48% | 18.22% | 34.58% | 100.00% |
| Peaches | Conventional | 34.20% | 7.58% | 3.12% | 55.10% | 100.00% |
| | Organic farming | 29.07% | 9.30% | 12.79% | 48.84% | 100.00% |
| Plums | Conventional | 8.92% | 2.50% | 2.45% | 86.13% | 100.00% |
| | Organic farming | 20.90% | 4.48% | 0.75% | 73.88% | 100.00% |
| Cherries | Conventional | 25.15% | 4.14% | 2.92% | 67.79% | 100.00% |
| | Organic farming | 33.33% | 7.80% | 8.51% | 50.35% | 100.00% |
| Kiwis | Conventional | 14.10% | 6.06% | 0.70% | 79.14% | 100.00% |
| | Organic farming | 27.66% | 14.18% | 4.96% | 53.19% | 100.00% |
| Table grapes | Conventional | 12.81% | 4.19% | 8.26% | 74.73% | 100.00% |
| | Organic farming | 25.47% | 9.32% | 10.56% | 54.66% | 100.00% |

Source: Orchard Survey (2012)

Table 4. Marketed quantities according to the marketing channel, produce and type of farming

| | | Direct selling | | Indirect selling | | Identified long channel | | Unidentified long channel | |
|--------------|----------------------|----------------|---------------|------------------|---------------|-------------------------|---------------|---------------------------|---------------|
| | | Mean | Std deviation | Mean | Std deviation | Mean | Std deviation | Mean | Std deviation |
| Apples | Conventional farming | 236.8 | 637.4 | 171.2 | 1,276.0 | 99.7 | 821.7 | 3,496.2 | 7,738.5 |
| | Organic farming | 215.9 | 501.2 | 98.3 | 401.1 | 125.8 | 508.5 | 1,914.1 | 6,777.0 |
| | Significance level | | *** | *** | *** | | *** | *** | *** |
| Apricots | Conventional farming | 16.0 | 70.7 | 33.2 | 253.5 | 4.8 | 34.9 | 583 | 1139 |
| | Organic farming | 10.9 | 31.5 | 10.2 | 53.1 | 5.2 | 15.2 | 166.5 | 227 |
| | Significance level | * | *** | *** | *** | | *** | *** | *** |
| Pears | Conventional farming | 45.7 | 129.1 | 31.6 | 185.6 | 25.4 | 122.7 | 524.9 | 1,070.9 |
| | Organic farming | 40.1 | 71.0 | 17.9 | 108.2 | 29.7 | 180.9 | 391.8 | 808.0 |
| | Significance level | | *** | | *** | | | * | *** |
| Peaches | Conventional farming | 86.9 | 441.4 | 153.2 | 2,123.8 | 15.7 | 245.1 | 1,258.6 | 3,422.4 |
| | Organic farming | 41.5 | 95.5 | 7.3 | 33.0 | 10.2 | 41.5 | 585.1 | 973.9 |
| | Significance level | *** | *** | *** | *** | | *** | *** | *** |
| Plums | Conventional farming | 5.3 | 39.2 | 5.6 | 102.9 | 11.3 | 258.7 | 505.2 | 917.5 |
| | Organic farming | 7.9 | 25.4 | 8.6 | 51.4 | 0.1 | 1.1 | 277.8 | 771.1 |
| | Significance level | | *** | | *** | *** | *** | *** | ** |
| Cherries | Conventional farming | 5.6 | 24.0 | 2.1 | 19.5 | 4.9 | 61.3 | 59.87 | 174.1 |
| | Organic farming | 3.3 | 7.6 | 1.3 | 8.7 | 1.0 | 4.4 | 29.71 | 74.21 |
| | Significance level | *** | *** | | *** | *** | *** | * | *** |
| Kiwis | Conventional farming | 25.0 | 188.7 | 18.7 | 118.9 | 0.1 | 1.8 | 620.6 | 1181.1 |
| | Organic farming | 55.6 | 145.3 | 48.5 | 159.7 | 0.8 | 4.6 | 448.2 | 716.9 |
| | Significance level | *** | *** | *** | ** | | | ** | *** |
| Table grapes | Conventional farming | 7.3 | 38.1 | 4.8 | 43.0 | 7.9 | 45.6 | 236.9 | 390.3 |
| | Organic farming | 12.1 | 36.3 | 11.1 | 56.4 | 6.5 | 36.2 | 139.4 | 233.4 |
| | Significance level | | | | *** | | *** | *** | *** |

Source: Orchard Survey (2012).

Note: Exporters have been omitted because the number of observations is not sufficient for the statistical analysis.

Key: *, ** and *** denote significance at the 10%, 5% and 1% levels respectively.

Table 5. Farm location and status

| | | Location | | | | | | | | Status |
|--------------|----------------------|-----------|----------------------|----------|---------------|---------------------|----------------------------|-------------|--------------|-----------------|
| | | Aquitaine | Languedoc-Roussillon | Limousin | Midi-Pyrénées | Centre-Val de Loire | Provence-Alpes-Côte d'Azur | Rhône-Alpes | Other region | Individual farm |
| Apples | Conventional farming | 7.50% | 5.93% | 7.82% | 13.09% | 13.23% | 20.19% | 16.09% | 16.14% | 44.15% |
| | Organic farming | 6.03% | 6.44% | 3.26% | 12.46% | 14.66% | 15.13% | 17.14% | 24.88% | 48.61% |
| Apricots | Conventional farming | | 29.07% | | 2.64% | | 14.80% | 51.91% | 0.81% | 59.80% |
| | Organic farming | 1.98% | 43.67% | | 1.28% | | 20.24% | 32.19% | 0.64% | 53.57% |
| Pears | Conventional farming | 3.80% | 4.98% | 1.83% | 4.61% | 13.09% | 31.56% | 23.66% | 16.46% | 46.13% |
| | Organic farming | 2.17% | 3.20% | | 1.52% | 19.06% | 32.07% | 23.92% | 18.06% | 47.22% |
| Peaches | Conventional farming | 6.69% | 35.86% | | 11.55% | | 15.16% | 25.96% | 3.51% | 49.37% |
| | Organic farming | 3.80% | 49.16% | | 1.83% | 1.83% | 14.85% | 24.86% | 3.67% | 49.46% |
| Plums | Conventional farming | 47.24% | 2.22% | | 27.84% | | 4.12% | 4.84% | 13.07% | 51.41% |
| | Organic farming | 52.00% | 2.49% | | 19.97% | 1.66% | 10.71% | 2.65% | 10.52% | 58.75% |
| Cherries | Conventional farming | 1.95% | 14.57% | | 12.33% | 2.27% | 21.28% | 39.21% | 8.33% | 60.78% |
| | Organic farming | 7.39% | 27.78% | | 6.98% | 2.01% | 22.20% | 26.79% | 6.85% | 53.05% |
| Kiwis | Conventional farming | 54.10% | 4.80% | | 21.05% | | | 9.89% | 8.18% | 44.16% |
| | Organic farming | 34.59% | 8.68% | | 9.43% | 4.04% | 5.05% | 25.53% | 12.68% | 50.08% |
| Table grapes | Conventional farming | 2.96% | 11.02% | | 30.08% | | 53.08% | | | 66.43% |
| | Organic farming | 5.16% | 19.28% | | 21.34% | | 48.41% | 3.34% | 2.47% | 54.61% |

Source: Orchard Survey (2012)

Table 6. Econometric models

| | Apples | Apricots | Pears | Peaches | Plums | Cherries | Kiwis | Table grapes | All fruits |
|---|------------|-----------|-----------|-----------|------------|-----------|-----------|--------------|------------|
| <i>Marketing channels</i> | | | | | | | | | |
| Direct selling | 0.2808*** | 0.2489 | 1.0836*** | 0.4312 | 1.4338*** | 0.9798*** | 0.8447*** | 1.1331*** | 1.0462*** |
| Indirect selling | 0.1822** | 0.4620 | 0.0622 | 0.8558** | 0.6619 | 0.9632*** | 0.7999** | 0.9347*** | 0.5994*** |
| Identified long channel | 0.3898*** | 1.7827*** | 0.5805*** | 2.1823*** | -1.4139 | 1.6895*** | 1.0529* | 0.4816* | 0.9157*** |
| Unidentified long channel | -0.2180*** | 0.2904 | -0.2994 | 0.9814** | -0.1008 | 0.4213* | 0.1782 | 0.2496 | 0.3983*** |
| <i>Farm status</i> | | | | | | | | | |
| Individual farm | 0.1670 | 0.6763*** | 0.0606 | 0.1462 | -0.2635 | 0.4783 | 0.0817 | 0.8606*** | 0.2945*** |
| <i>Farm location (reference: Other regions)</i> | | | | | | | | | |
| Aquitaine | 0.0198 | -1.9539 | 0.4935 | 0.8707 | -1.0460*** | -1.8593 | 0.5042 | -0.4652 | -0.0541 |
| Languedoc-Roussillon | 0.0715 | -1.1918 | -0.3202 | 0.2658 | -0.7996 | -1.1179 | 0.0201 | -0.4511 | -0.3177** |
| Limousin | -0.2598 | | 13.8687 | 13.5240 | 10.3376 | 8.9516 | | | 0.6975** |
| Midi-Pyrénées | 0.0981 | -0.3343 | 0.9432 | 2.1722* | -0.4405 | 0.0801 | 0.8593* | 0.2131 | 0.0234 |
| Centre-Val de Loire | 0.0291 | | -0.4333 | -1.2692 | -1.0639 | -0.2735 | -0.7223 | 9.9362 | -0.0948 |
| Provence-Alpes-Côte d'Azur | 0.0363 | -0.9039 | -0.6788** | 0.6407 | -1.6919*** | -0.5509 | -1.0342 | 0.00874 | -0.1014 |
| Rhone-Alpes | -0.1518* | -0.1643 | 0.0602 | 0.8982 | 0.0524 | 0.00379 | -0.6655* | -0.7392 | 0.4459*** |
| <i>Other control variables</i> | | | | | | | | | |
| Acreage | 0.0000 | 0.0003*** | 0.0000 | 0.0001 | 0.0000 | 0.0000 | 0.0001** | 0.0002** | 0.0001 |
| Acreage² | 0.0000 | -0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | -0.0000 | -0.0000 | _0.0000 |
| Intercept | 2.0038*** | 2.8713** | 3.0111*** | 3.3650*** | 3.9136*** | 4.1279*** | 1.8774*** | 2.2442*** | 3.1852*** |
| Concordance rate | 68.9% | 73.7% | 66.4% | 72.9% | 64.5% | 72.6% | 73.0% | 68.6% | 74.1% |
| Number of obs. | 3,821 | 2,244 | 1,634 | 1,346 | 2,355 | 3,269 | 873 | 1,657 | 14,334 |

Keys: Estimates significant at the 10 % (*), 5 % (**) and 1 % (***) thresholds.

Source: Orchard Survey (2012)

Figure 1. Research hypotheses

