# Impact of the consumer's environment on the demand for organic food in France

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**Abstract**

The central question of this paper is whether, in addition to individual determinants influencing the consumption of organic food products, it is relevant to talk about collective territorial factors. We posit that the collective territorial determinants reflect the regional dynamics of the supply of organic products, downstream processing, and retail network and do affect consumer preferences and their ability to express these preferences. This work relies on a bundle of products and the methodology used (Heckman method) takes two distinct decision processes into account: the binary decision of whether or not to buy organic products and the budget share that a household allocates to organic food. The results show that factors related to the household's environment (kinds of local sales channel, portion of agricultural area used for organic farming and the number of organic operators in the living area) impact on the household's propensity to purchase organic products.

**Key words:** Organic agriculture, consumer's behaviour, econometrics

**JEL Classifications**: D12, Q18, C25.

# I. INTRODUCTION

The distinctive feature of the organic market is a strong growth rate. The global organic food market more than quadrupled over twelve years, reaching 65.4 billion dollars (50.5 billion euros) in 2012. The global area cultivated with organic methods was multiplied by 2.4 between 2000 and 2011 (15.7 million hectares in 2000 and 37.2 million hectares in 2011), with 33% of this area located in Oceania, 29% in Europe, 18% in South America and 10% in Asia. The geography of organic consumption is very different from that of supply: 48.5% of world consumption takes place in North America and 44% in Europe. Germany is the first European organic market (32% of the turnover of this market), followed by France (19%), Italy (10%) and the UK (9%).

Faced with the rapidly growing food sector, the empirical literature endeavours to analyse the motivations and characteristics of consumers who buy organic foods. On the one hand studies are conducted to know why consumers purchase organic food (mainly health, environment and quality reasons), and on the other hand numerous studies examine the links between demographic characteristics (education level, income, presence of children, etc.) and the likelihood of buying organic products.

In this paper we focus on the French demand for organic products. Domestic organic consumption represented about 2.4 per cent of households' food budget in 2012 (Agence Bio, 2013), compared with 1.3% in 2007. Between 2011 and 2012, purchases by final consumers grew by 9% in value and 8% in volume. To study the profile of the organic food consumer we adopt a more general approach than the usual one. Indeed, the central question of this paper is whether, in addition to prices and individual attributes influencing the consumption of organic products, it is relevant to talk about collective territorial determinants. Collective territorial determinants appear to reflect the regional dynamics among the supply of organic products, downstream processing, the retail sector and households' consumption of organic products. These factors may have a direct effect on consumers' purchases (*e.g*., the availability of organic products in the distribution network) and/or an indirect effect, acting as advertisements that influence consumers' preferences (*e.g.,* presence of organic processors or organic farms in the neighbourhood).

Besides considering these collective elements, another originality of this paper lies in performing a bundle analysis rather than a product-by-product analysis. We deal with an annual bundle of fourteen staple goods that are widely bought through mass retail channels. The analysis is based on several databases aggregating information on different territorial levels in order to combine consumers' characteristics with territorial factors.

The methodology used (Heckman method) takes two distinct decision processes into account: the binary decision of whether or not to buy organic products and the budget share households allocate to organic products. The findings broaden our understanding of the consumer's behaviour with respect to organic food. The marginal effects indicate that, besides the individual household's characteristics, the territorial context plays a role in the likelihood of buying organic goods.

The paper is organised as follows: Section II reviews the literature on consumer motivations for purchasing organic products; Section III describes the data; while Section IV presents the econometric model used to estimate the impacts of price, household characteristics, sales channels, and the local extent of the organic sector on the budget share allocated to organic products. The results are discussed in Section V, and Section VI presents the conclusions.

## II. BACKGROUND

The economic literature analyses household purchases of organic product in two complementary ways, by focusing either on the motivation of households or on the influence of socio-demographic characteristics.

A literature review by Hughner *et al.* (2007) examined 33 studies, all published between 1990 and 2004, of organic purchasing behaviour in the US and various European countries. They found that considerations related to health, product quality, and environmental protection constituted the three main reasons for buying organic products. However, there was no consensus on the ranking of these reasons. More recently, Mondelaers *et al*. (2009), Griffith and Neishem (2013) and Kriwy and Mecking (2012) consider health to be the main reason. Abrams *et al.* (2010) have shown that consumers associate the organic label with high quality. In contrast, studies by Durham

(2007), the CSA/Agence Bio (2012) and Monier-Dilhan and Bergès (2013) indicate that consumers of organic products are primarily concerned about environmental considerations. In addition, Monier-Dilhan and Bergès (2013) emphasize that socio-economic characteristics can modify the ranking of motivations related to health and product quality.

Several studies have dealt with the influence of households' socio-economic characteristics on their propensity to buy organic products. Except for the level of education, the findings are conflicting, depending on the products taken into account and the country in which the study is conducted. Consumers with higher levels of education are more likely to purchase organic products or be more willing to pay more for organic products (Magnusson *et al.*, 2003; Wier *et al.*, 2008; Hassan *et al.*, 2009; Dettmann and Dimitri, 2010; Dimitri and Dettman, 2012). According to the results of Magnusson *et al.* (2003) and Thompson (1998), the head of household's age has no impact on organic food consumption, whereas Wier *et al.* (2003) stress that the impact of age follows an inverted U-shape, peaking at 50 years. Hassan *et al.* (2009) have found that age has a positive effect on sensitivity to the organic label; this has been confirmed by the Research Group on Sustainable Consumption (GRECOD, 2012). Some studies conclude that the probability of buying organic products is positively influenced by income (Dettman and Dimitri, 2010; Dimitri and Dettman, 2012; Hassan *et al.*, 2009) whereas others lead to the conflicting finding that income is unrelated to the likelihood of buying organic food products (Thompson, 1998; Durham, 2007). However, few studies focus on territorial determinants of organic consumption, despite the fact that there is some evidences that the spatial distribution of organic food consumption is uneven.

Figure 1 illustrates the geographical heterogeneity of organic food consumption in France.

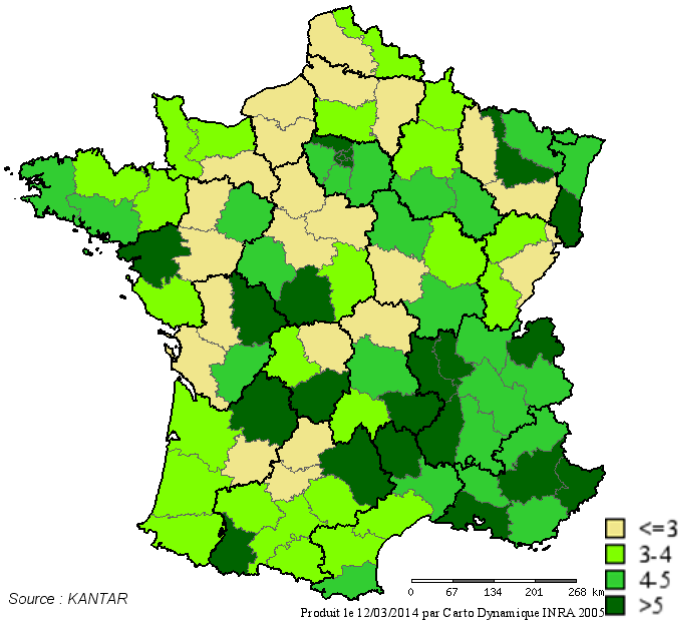


**Figure 1. Distribution of the average organic market share (in value) for a selection of 14 products[1] (source: Kantar 2010)**

The geographical heterogeneity of organic food consumption may be due to territorial factors. These factors can be linked to the heterogeneity of aggregated individual factors between territories, such as socio-economic characteristics and personal motivations: For example, a higher level of education among population may be connected with higher market share for organic products. On the other hand, this heterogeneity can be explained by some specific features and dynamics of a territory, which are collective more than individual (Anselin, 2002), acting on the population's propensity to consume organic. First, the relation between organic practices and regional supply chains has often been highlighted, given that the link between organic regional supply and demand is often stronger than in conventional agriculture. This link can be explained in two ways: Either a dynamic local demand encourages farms to convert to organic or a significant supply incentivizes the consumption of organic products. Based on an exhaustive study on the distribution of organic products in a region located in the south of France, Géniaux *et al.* (2009) stress the importance of proximity between organic producers, retailers and consumers in the organisation of the organic chain, and highlight at the same time the heterogeneous and shifting character of the relations between retailers and local producers. The local supply area,

[1] More details on the choice and description of these products selected from the Kantar database follow below.

which on average is situated within a range of 30 km, has different characteristics (related to volume, range of supply, product type, nature of the contracts, etc.) depending on the type of retailer, the structure of local production, and the more or less rural/agricultural context. There is a stronger tendency to supply locally in those territories where agriculture dominates. In the case of the US, Eades and Brown (2006) have identified clusters of organic production close to large urban centres. Other studies also show the positive impact that proximity to urban centres has on organic production in countries such as Denmark (Frederiksen and Langer, 2004), Norway (Koesling *et al*., 2008) and France (Allaire *et al*., 2015). However, this result does not hold for Germany (Schmidtner *et al.*, 2012). Second, the intensity of organic consumption may result in part from the retail network. François *et al.* (2002) illustrate how the determinative character of the organic supply partly explains the quantitative and qualitative differences in the consumption of organic products between two French regions (Île-de-France and Pays de la Loire). Sirieix *et al.* (2009) show the concern that consumers (both in specialised organic shops and in medium and large supermarkets) and retailers have for regional organic products. It is essential to consider the link between the organic sector and local markets from a consumer's perspective as well. While the supply of organic products in France remains dependent on imports due to chronically low local supply relative to demand (one third of consumed products with an organic label are imported), mass retailers are playing an increasingly important role in the commercialization of organic products. In 2011, 47 per cent of these products (in value) were sold in medium and large supermarkets,[2] 24 per cent in specialised distribution networks (Biocoop, etc.) and 10 per cent in independent speciality shops (Agence Bio, 2012). Direct sales ultimately accounted for only 11 per cent of the total value, while the remaining 8 per cent was distributed equally between traditional shops (butchers', bakers', etc.) and institutional catering. We hypothesize that the available supply of organic products and the types of retailer present influence households' purchasing behaviour in respect of organic products.

Using the Nielsen Homescan dataset, Dimitri and Dettman (2012) account for access to organic food (in terms of specialised stores) as a determinant of the

[2] According to the French National Institute of Statistics and Economic Studies, 72% of households' total food purchases (excluding expenditure for commercial and collective catering) take place in medium and large supermarkets (http://www.insee.fr/fr/themes/document.asp?ref_id=ip1526).

household's likelihood of buying organic food. Such access is approximated by whether a Whole Foods store is located near from the household. They conjecture that supermarkets located near a Whole Foods store are more likely to carry a wide range of organic food products. These findings suggest that access has a significant positive impact on organic food purchasing behaviour. Cheval and Julliard (2013) have approached this issue by integrating factors related to the consumer's environment in terms of connections to nature and to agriculture. They find that the share of organic sales is higher in urban areas. However, after controlling for store access and socio-demographic factors, they observe that a rural environment has a positive effect. As a matter of fact, the presence of private gardens, local hiking trails and organic farms seems to be favourable to organic consumption. However, Cheval and Julliard did not study consumer choice on a micro-economic level; rather, they analysed the determinants of the demand for two organic products (milk and yogurt) based on cash receipts from 489 supermarkets belonging to a French supermarket chain, while taking the average value of socio-demographic variables (age, revenue, education) on the living area-level into account.

This paper extends the work already reported on in the literature by combining several datasets in order to address the relationship between propensity of buying organic foods and both demographic determinants and territorial factors. We associate individual and territorial data and analysis, using the more detailed available sources on an exhaustive level for France.

## III. DATA

To capture whether territorial factors influence households' decisions to purchase organic food we worked with supply side data (organic operators, distribution network) in addition to the usual household-level data. The data for the year 2010 come from four databases: Kantar Wordpanel, LSA (Libre Service Actualités – Self Service News), INAO (Institut national de l'Origine et de la Qualité – French National Institute for Designations of Origin and Quality) and Agence Bio (Organic Agency). The geolocation of the information in each database enabled us to link them at the *département* (corresponding to Level 3 of the Nomenclature of Territorial Units for Statistics) level or

living area level. The living area, structured according to the division established by Insee[3] in 2004, is defined as the "smallest territory in which inhabitants have access to the most common facilities and services".

The study of the household's trade-off between conventional and organic versions of a food product relies on the Kantar Worldpanel database. This database contains both purchasing and socio-demographic data for a panel of 22,359 French households. After each shopping trip, the households in the panel upload such information about their purchases as prices, quantities, retail outlet, product description, etc. Furthermore, the Kantar panel indicates the geographical code of the household's hometown and records its socio-demographic characteristics. The Kantar dataset is well suited for analysing consumer behaviour in the mass distribution channel. In contrast, the purchases made in other distribution channels (traditional shops, specialised shops, and open air markets) are under-represented due to the fact that households in the panel either shop mainly at mass retailers or do not report grocery purchases from other retail outlets fully. Due to these data limitations, we studied the behaviour of the households based on the purchases that they made in medium or large supermarkets. Given that three quarters of household food expenditure takes place in the mass distribution channel and the latter is the leading distribution channel for organic food, working from this database is not restrictive. To study the households' trade-offs between conventional and organic food products we worked on the basket level over the course of the year. We selected fourteen staple food products for which the organic version is significantly present, namely, eggs, milk, chocolate, fruit juices, fresh cheese, bread, yogurts, oil, rice, canned vegetables, cream, flour, pastry and breakfast cereals. Fruits and vegetables are frequently bought under the organic label, but could not be taken into account because the production method (organic in this case) is not well defined in the 2010 Kantar database. The organic versions of the selected products are widely available on supermarket shelves, so consumers really can choose between the two versions of the products.[4] Appendix 1 presents the statistics for each product.

[3] Insee - Institut national de la statistique et des études économiques : National Institute for Statistics and Economic Studies.

[4] Indeed the percentage of organic purchases for most of the selected products is higher than the average percentage for organic product purchases made in medium and large supermarkets (47%): 80% of

The average organic market share for the 14,197 households[5] present in the sample is 3.61 per cent. This share is higher than the national average (2.4 per cent) due to the product assortment chosen. Of the 14,197 households we dealt with, 61 per cent bought organic food, spending 6 per cent, on average, of their food budget on organic products.

For each household we calculated the price ratio index. This variable is the ratio of the value of the basket if all the products are considered to be organic over the value of the same basket with all the products considered to be conventional. The value of this price ratio index depends both on the household's basket composition and on the prices the household was charged when purchasing (organic or conventional) products. When a household did not buy an organic (respectively conventional) product, we computed the price at which the household would have been able to buy this product. To recover this price, we drew it randomly from an empirical distribution, taking the favoured distribution channel and the region of the household into account.[6] On average, the cost of the "all-organic" basket is 1.6 times that of the "all-conventional" basket. Descriptive statistics on the purchasing behaviour of the households and the costs of the basket are summarised in Table 1.

organic milk, 66% of organic fruit juice and breakfast cereals, and 60% of organic dairy product, eggs, oil and rice purchases are made in this distribution channel (Madignier *et al.* 2013).

[5] To discard occasional buyers in medium and large supermarkets, we retained only households that had consumed at least 12 of the 14 products in the course of the year, i.e. 14,197 of the 22,359 observation units.

[6] We consider the log normal distribution for which the mean and standard deviation are those of the sample (empirical values).

| | | |
|---|---|---|
| Average budget share for organic products (standard deviation) | | 3.61% (8.45) |
| Percentage of households that consume organic products | | 61% |
| Average budget share for organic products for households that consume organic products at least once (standard deviation) | | 5.96% (10) |
| Cost of average basket | Completely organic (standard deviation) | €846.84 (59.7) |
| | Completely conventional (standard deviation) | €485.61 (97.7) |
| Cost of organic basket/Cost of conventional basket (standard deviation) | | 1.62 (0.28) |

**Table 1. Purchasing behaviour and costs of product baskets (source: Kantar 2010)**

Table 2 presents summary statistics of explanatory socio-demographic variables of the model. These include household income, geographical area, household's demographic characteristics and some household habits.

| | | | |
|---|---|---|---|
| **Income class** | Wealthy | | 12% |
| | Upper middle class | | 31% |
| | Lower middle class | | 43% |
| | Modest | | 14% |
| **Geographical area** | Major urban area | | 58% |
| | Other poles | | 42% |
| **Household characteristics** | Age of panellist (standard deviation) | | 46.5 years (14.7) |
| | Number of consumption units per household [7] (standard deviation) | | 2.17 (0.8) |
| | Presence of young children (younger than 6 years) | | 22.15% |
| | Education level | Smaller or equal to *baccalauréat*[8] | 59.4% |
| | | Higher than *baccalauréat* | 40.6% |
| **Household habits** | Household shops at traditional shops | | 14.3% |
| | Household has a vegetable garden | | 37.6% |
| | Number of purchases of the 14 products (standard deviation) | | 199.8 (104.9) |

**Table 2. Household characteristics**

Consumers are classified in the database into four categories according to their income: wealthy, upper middle class lower middle class, and modest. We categorised the geographical areas as either urban or rural. On average, the panellist was 46.5 years old. There were about 2.2 consumption units per household, with children younger than 6

[7] The number of consumption units per household is defined as 1 for the first adult, then 0.7 for other adults (or children older than 16 years old) and 0.5 for children younger than 16.

[8] The "baccalauréat" is the group of exams taken by French eighteen year olds, so it could be said to be roughly equivalent to A levels in the UK or the high school diploma in the US.

years of age in 22% of the households. Education was grouped into two categories: high school graduates or less, and higher education and/or post-graduate work. Regarding household habits, we assumed that a household frequented traditional stores when we observed at least one purchase at this kind of retailer in the course of the year; 14.3% of households met this criterion. The vegetable garden cultivation variable is based on the principal or secondary residence of the household, but also on whether the household is active in another type of vegetable garden, for example a workers' garden. Considering the total number of purchases was a way to include the household's buying habits.

The potential influence of the local supply side on purchasing decisions was taken into account through the data contained in the LSA, INAO and Agence Bio datasets.

We took the local sales structure of food retailing into account as part of the parameters describing the consumer's environment. The retailers' network was characterised by both the geographical location and the store format (hypermarket, supermarket, hard-discounter, neighbourhood retailer, etc.). To determine the spatial structure of the distribution network, we used the LSA database, which collects information exhaustively on all food distribution outlets, while also indicating the address, format and size of each retailer. We supplemented this database with the INSEE database (2010) on the retail sector in order to obtain the number of traditional shops in each geographical area. For the purpose of addressing the local character of the connexion between retail network and consumption of organic products in quantitative terms, we considered the living area to be the relevant geographical level. The division of the territory into living areas, which are larger than municipalities, makes it more likely that the two anchor points of the household (*i.e.*, home and workplace[9]) will be grouped together, which is crucial to explain the household's preferred shopping places.

Additionally, the local organic food sector, such as the presence of downstream organic operators or organic farmers, is likely to modify the consumer's perception of organic products. The INAO database inventories downstream operators in 2009. All these operators are certified to process, prepare and/or distribute[10] organic products. Table 3 presents the spatial density of organic operators in the households' living areas. It makes sense to assume that the greater presence of organic farming will lead to an

[9] The Kantar database does not provide information on the workplace of the households.
[10] Operators have to be certified to distribute organic products in bulk, not for packed products. Indeed, supermarket can sell organic products without being certified.

increase in the placement of organic products in local distribution channels. Accordingly, consumers will be more aware of the organic concept and products, which should result in an increase in the budget share that households devote to the purchase of organic products. In that sense we hypothesize that collective territorial determinants do affect consumer preferences and their ability to express these preferences.

We assume that the dynamics of organic farming on the French *département* level is a proxy for measuring supply development and its impact. These features may affect the visibility of organic products in the household's environment and, consequently, influence their organic purchases. The Agence Bio database enables us to compute the percentage of agricultural land used for organic farming by *département* in 2009. Table 3 shows the statistics on variables describing the local supply side.

| Variables | Mean (standard deviation) | Source |
|---|---|---|
| Number of nearby retailers within living area/100 km² | 33.8 (53) | LSA |
| Number of hyper and supermarkets within living area/100 km² | 3.7 (4) | LSA |
| Number of hard discounters within living area /100 km² | 3.6 (4) | LSA |
| Number of organic downstream operators/100 km² | 8 (9) | INAO |
| % of agricultural acreage used for organic farming by *département* in 2009 | 2.6 (2.5) | Agence Bio |

**Table 3. Territorial supply side variables**

The average density of hyper- and supermarkets is comparable to that of hard discounters. The nearby retailers (neighbourhood shops and convenience stores) are a little more dispersed (with a coefficient of variation of 156%). On average, 2.6 per cent of the agricultural land is devoted to organic farming. The distribution of the share of organic area is depicted in Figure 2.

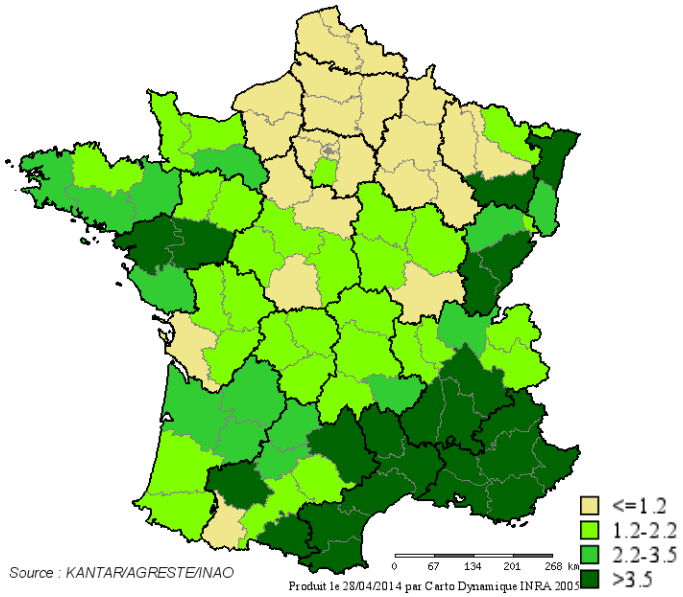


**Figure 2. Share of agricultural areas used for organic farming in 2009 (source: Agence Bio, Agreste)**

The proportion of organic agricultural land in more than half of the French *départements* is lower than the national average. There are also significant regional differences.

The comparison between Figure 1 (distribution of the average organic market share for the selection of fourteen products) and Figure 2 (share of agricultural surface areas used for organic farming in 2009) justifies the hypothesis of a connection between the spatial heterogeneity of the production and consumption of organic products. In both cases organic dynamics are more important in the south-east and the nord-west, while organic production is less developed in the north. The spatialization of organic product purchases can stem from socio-demographic heterogeneity and/or from collective territorial determinants, notably related to the production, processing and supply dynamics of organic products. We want particularly to focus on the latter statement, controlling at the same time for the effect of some main individual factors influencing organic purchases (price, household's characteristics).

## IV. EMPIRICAL FRAMEWORK

Our analysis is based on the annual budget share devoted to organic products for the fourteen staple food categories mentioned above. We aimed to quantify the significant determinants of the consumption of organic products. However, 39 per cent of the households did not consume any organic products in the period under study and computing the estimators based on the 61 per cent of the households whose budget share for organic products is positive might lead to selection bias. To deal with this issue we used the two-stage Heckman method (1979). According to this methodology, the decision to buy organic occurs in two stages: A consumer first chooses whether to purchase organic products or not; once s/he decides to buy organic, s/he then decides how much to spend on such purchases. The dependent variables used in the two stages of the model are a dichotomous variable that is set to 1 when organic products are purchased (0 otherwise) and the organic share (strictly greater than 0 by construction of the sub-sample and less than 1 because no consumer buys only organic products in mass retail stores).

The two-stage Heckman method (1979) lets us correct the regression coefficients for the potential bias that occurs in analysing non-random samples. In the first stage, we estimate a model with a qualitative latent variable that determines the purchasing decision (*i.e.*, whether or not the household purchases some organic products). In the second stage, we examine the budget share devoted to organic products, *i.e.*, the intensity of organic purchases. Sample selection is accounted for by the inverse Mills ratio (IMR) estimated in the first stage.

The first step is based on the estimation of a selection equation. We estimate a probit model with a latent variable $y$ that determines selection positivity:

(1) $$y = \begin{cases} 1 \; if \; y_i \geq 0 i = 1, \dots n \\ 0 \quad otherwise \end{cases}$$

where $Y = \{y_1, \dots y_n\}$ is the vector of budget shares for organic products of n households.

We then consider the following linear equation:

(2) $$Y = X'_1 \beta_1 + u$$

where $X_1$ is the $(n \times k)$ matrix of k explanatory variables, $\beta_1$ is the $(k \times 1)$ vector of coefficients to be estimated and $u = (u_1, \dots, u_n)$ is the $(n \times 1)$ vector of error terms. Under

the classic assumptions of independence and normal distribution of the error terms, we can estimate the probability that a household purchases organic products by

(3) $Prob(y_i = 1|x_i) = \Phi(x_i'\beta)$

where $\Phi(.)$ is the cumulative function of the standard normal distribution.

This first step enables us to correct for the potential selection bias that stems from the fact that we take only households that consume organic products, *i.e.*, households for which the budget share for organic products is positive, into consideration. The residuals of the selection equation correspond to non-measured effects and are used to construct a factor for correcting the selection bias: the inverse Mills ratio (IMR). In the second step, we integrate this correction factor into the set of explanatory variables of the model in order to address the fact that the estimation takes only a subset of observations into account.

The second equation is concerned with the budget share that each household devotes to the purchase of organic products ($0 < y_i < 1$). To be able to apply classic statistical modelling, we use a logit transformation on the households' organic budget shares. The dependent variable then becomes $ly_i = ln\left(\frac{y_i}{1-y_i}\right)$ if $0 < y_i < 1$.

This equation is estimated using a linear regression based on the sample of households that bought an organic product at least once.

(4) $lY = X'_2\beta_2 + v$

where $X_2$ is the $(n \times k)$ matrix of explanatory variables, $\beta_2$ is $(k \times 1)$ vector of coefficients to be estimated and $v = (v_1, \dots, v_n)$ is the $(n \times 1)$ vector of error terms. The IMR is then included in this set of explanatory variables. It is the ratio between the probability density function and the cumulative distribution function: $IMR_i = \frac{\phi(y_i)}{\Phi(y_i)}$. The IMR's parameter is denoted $\lambda$, and its significance indicates a selection bias. $\lambda$ is not estimated directly but is recovered from the product of $\rho$ (the correlation coefficient between the errors of the first and second stage) and $\sigma$ (the estimator of the standard error of the residuals of the second stage).

We allow for an intra-living area correlation in the estimations and use an adapted estimator of the variance-covariance matrix (clustered sandwich estimator).

To measure the impact of the X variables on the intensity of the organic market share we compute the marginal effects. These marginal effects must be adjusted to

correct for selectivity bias (Vance, 2006). This correction is given by the following equation:

(5) $\frac{\partial E(ly_i/y*0,X)}{\partial X_k} = \beta_{2k} - \beta_{1k}\rho\sigma\delta(\lambda)$

where $\beta_{2k}$ is the estimated coefficient for $X_k$ in the Step 2 equation (outcome equation), $\beta_{1k}$ the estimated coefficient for $X_k$ in the Step 1 equation (selector equation), $\rho$ the correlation coefficient between the error terms of the selector and outcome equation, $\sigma$ the root mean squared error of the outcome equation and $\delta(\lambda)$ a function of the inverse Mills ratio, obtained from the linear prediction of the selector equation, which formula is modified for the case of dummy variables.

This expression concerns the variables of equation (4), so it has to be corrected in order to measure the influence of each factor on the intensity of purchasing organic food. For assessing statistical precision we implemented the delta method to incorporate the uncertainty associated with the parameters of equation (5). The delta method works by using a Taylor series to create linear approximation of a non-linear function for calculating confidence intervals. The marginal effects are computed at the average point (see Table 4).

## V. EMPIRICAL RESULTS AND DISCUSSION

The results of Step 2 of the Heckman model are shown in Table 4. The estimation results of the probit model explaining the binary variable "purchase organic or not" (Step 1) are presented in Appendix 2. The impact (positive or negative) of each variable is on the whole similar for the two steps.

| | Variable | | Coef. | Marginal Effect (%) |
|---|---|---|---|---|
| | Constant | | -3.55*** | |
| **Price Ratio Index** | organic /non-organic price index | | -0.151*** | -0.07*** |
| **Household characteristics** | | Wealthy | 0.21*** | 0.22*** |
| | | Upper middle class | 0.08ns | 0 |
| | | Lower middle class | -0.095* | -0.09* |
| | | Modest | Reference | |
| | Age of panellist | | 0.040*** | 0.015*** |
| | (Age of panellist)² | | -0.0003*** | |
| | Number of consumption units per household | | -0.023*** | -0.01*** |
| | Presence of children < 6 years | | 0,147** | 0.1** |
| | Education level higher than *baccalauréat* | | 0.353*** | 0.4*** |
| | Household lives in urban area | | 0.088** | 0.01** |
| **Household habits** | Household shops at traditional shops | | 1.018*** | 0.5*** |
| | Household has a vegetable garden | | 0.152*** | 0.1*** |
| **Household environment** | Number of nearby retailers in living area/ area of living area | | 0.002** | 0 |
| | Number of hard discounters in living area/surface area of living area | | -0.028*** | -0.02*** |
| | Number of organic operators in living area/surface area of living area | | 0.155** | 0.01** |
| | % of agricultural area used for organic farming by *département* in 2009 | | 0.046*** | 0.03*** |
| **Heckman parameters** | I.M.R. | | 1.828*** | |
| | parameter ρ | | .946 *** | |
| | parameter σ | | 1.731 *** | |

Significance: *** at 1%, ** at 5%, * at 10% and ns non-significant

**Table 4. Estimation results of the model on purchasing intensity of organic products (Step 2)**

The baseline household considered has a modest income, without child younger than 6 years, with a high school education or less, and lives in a rural area.

The ratio between organic price index and non-organic price index plays a part in the purchasing decisions of households. The price effect has the expected sign: the larger the spread between organic and non-organic prices, the lower the percentage of households buying organic products. Nevertheless, the magnitude of the marginal effect is not very high: If we consider a drop in the price ratio from 1.6 to 1.5 (following a 6% reduction in organic prices), the organic market share among the consumers who decide to buy organic products goes from 5.96 up to 6.01.

The income effect is significant only for consumers of the highest income class (positive effect). For wealthy households the budget share devoted to organic is

0.2 percentage points higher than the average, reaching 6.16%. The marginal effect is very low for lower middle class households and nil for upper middle class ones. The impact of income is non-linear: It is positive from a specific threshold.

The age effect takes the classic form of an inverted U, with a peak at 57 year. That means it increases with increasing panellist's age up to 57 years old, and then it decreases with age.

The size of the household (*i.e.*, number of consumption units per household) has a small negative impact on the budget share devoted to organic products. However, the presence of young children increases the budget share that households spend on organic products.

The education level also has a positive impact on the organic market share: Households with an education level higher than the *baccalauréat* devote a larger part of their budgets to organic products than other households. The marginal effect of this variable (0.4%) is the strongest of all the socio-demographic variables. This finding confirms the congruent results of previous studies (Wier *et al.*, 2008; Hassan *et al.*, 2009; Cheval & Julliard, 2013).

Households that shop not only in medium and large supermarkets but in traditional shops as well are more likely to buy organic products. The marginal effect of this dummy variable is high (0.5%): On average, households that frequent traditional shops spend -in super or hypermarkets- 6.46% of their food budget on organic products. Owning a vegetable garden has a positive impact as well, which may indicate that more "natural" products appeal to the household (with a marginal effect equal to 0.1).

The density of small retailers in the living area has no effect on the household's share of organic products. The negative impact of the presence of hard discounters can be explained by the fact that the organic product range offered by hard discounters is low. The presence of organic downstream operators results in a larger organic market share. Moreover, the higher the degree of organic farming in the *département* where the household lives, the greater the household's budget share devoted to organic products. These findings may due both to an advertisement effect influencing consumers' preferences and to a competitive effect, given that mass retailers located near a specialised organic food store are more likely to offer a wide range of organic products.

Our results confirm that, besides economic constraints (prices and income) and demographic factors, reasons for buying organic products may be found in collective

territorial determinants. This result is congruent with that of Dimitri and Dettman (2012), underlining the importance of access to organic food as a determinant of the household's likelihood of buying organic food. Living in a *département* with a high percentage of organic farming has a positive effect on households' consumption of organic products. The two local characteristics (organic food suppliers and organic farming in the vicinity) may work like an advertising campaign to affect organic sales.

This work highlights the fact that consuming organic food is part of a general way of life (shopping at traditional retailers, having a vegetable garden). In addition to its nutritional value, food consumption also has an environmental and an ethical dimension. Provenance, quality and connections with a natural environment are clearly related to consumer preferences and deciding whether or not to buy organic products.

## VI. CONCLUSION

Our research consisted of an examination of the factors influencing the likelihood of buying organic products and the budget share allocated to organic food. This work was based on analysis of a shopping basket enabling us to take the consumer's behaviour into account more comprehensively. By identifying some key features of the households' environments and some household habits, this work contributes to the understanding of the consumer's decision to buy an organic product.

The results regarding the links between organic food purchases and demographic data support the main findings of previous studies, to wit: the effect of income level is not linear, the education level is an important factor and the presence of young children plays a role. Moreover, the results show that the organic-to-conventional product price ratio has a significant but low effect on the purchasing intensity of organic products. The main contribution of this work is to put forward that, in conjunction with individual factors, collective territorial determinants impact the propensity to buy organic.

A set of factors related to individual household habits and the household's environment has a significant impact on the probability of the household's buying organic products and on the budget share it devotes to organic purchases. We find a positive link between the local presence of suppliers of organic products (farms, food processors and retailers) and the purchasing of organic products.

A next step would be to expand the analysis to other network retailers, such as specialised organic retailers and direct sales. Problems of data availability are no doubt a critical constraint on doing such an analysis.

From a practical perspective, the findings of this research point out that to expand organic food consumption, information campaigns on the organic label would benefit from being associated with territorial factors and with the strengthening of contact between (potential) consumers and the local actors of the organic sector, in addition to emphasis being put on organic agriculture's environmental and sustainable development aspects. Besides the purely economic aspects, boosting the consumption of organic products must rely on general incentive measures and on actions focused on information and knowledge sharing. This is essential to achieve the overall government objective of doubling the percentage of organically farmed land from 2013 by the end of 2017 alongside an ambitious consumption growth target.

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## Appendix 1. Descriptive statistics of the 14 products considered

| Product | Annual average quantity | Market share of organic version | | Average price organic (€ per unit) *(standard deviation)* | Price organic/ price non-organic |
|---|---|---|---|---|---|
| | | *Volume (standard deviation)* | *Value (standard deviation)* | | |
| Eggs (six units) | 25 packs | 6.89% (20.8) | 7.96% (22.1) | 2.45 € (0.35) | 1.94 |
| Milk (litre) | 82.47 l | 6.1% (19.5) | 6.79% (20.4) | 1.42 € (0.26) | 1.60 |
| Chocolate (kg) | 3.60 kg | 1.10% (7.3) | 1.37% (8.3) | 19.3 € (5.54) | 1.95 |
| Fruit juices (litre) | 40.80 l | 2.75% (11.6) | 3.30% (12.7) | 2.37 € (0.55) | 1.69 |
| Fresh cheese (kg) | 9.54 kg | 1.02% (7.6) | 1.19% (8.18) | 3.72 € (0.52) | 1.51 |
| Bread (kg) | 7.55 kg | 2.06% (10.6) | 2.52% (11.7) | 5.03 € (0.94) | 1.72 |
| Yogurt (kg) | 34.50 kg | 2.30% (10.2) | 2.76% (11.2) | 3.68 € (0.94) | 1.80 |
| Oil (liter) | 6.44 l | 4.88% (16.2) | 5.82% (17.9) | 5.38 € (1.75) | 1.61 |
| Rice (kg) | 4.12 kg | 2.23% (12) | 2.51% (12.7) | 4.44 € (0.95) | 1.57 |
| Canned vegetables (kg) | 14,55 kg | 0.98% (6.6) | 1.19% (7.21) | 6.28 € (1.24) | 1.78 |
| Cream (kg) | 6,49 kg | 1.60% (9.8) | 1.95% (10.9) | 6.47 € (0.94) | 2.01 |
| Flour (kg) | 6.70 kg | 3.39% (15.2) | 3.96% (16.5) | 1.43 € (0.5) | 2.01 |
| Pastry (kg) | 2.57 kg | 1.11% (7.8) | 1.22% (8.3) | 5.43 € (0.78) | 1.41 |
| Breakfast cereals (kg) | 4.28 kg | 5.89% (19.1) | 6.03% (19.4) | 6.71 € (1.46) | 1.13 |

The annual average quantities refer to the household purchase for consumption at home. The spread between organic and non-organic prices varies by 40 to 100 per cent, depending on the product, except for breakfast cereals (13 per cent).

## Appendix 2: Estimation results of the probit model (step 1 of the Heckman model)

| | Variable | | Coef. | Significance |
|---|---|---|---|---|
| | Constant | | 0.363 | ** |
| **Price Ratio Index** | organic /non-organic price index | | -0.089 | *** |
| **Household characteristics** | Income class | Modest | Reference | |
| | | Wealthy | 0.163 | *** |
| | | Upper middle class | 0.063 | ** |
| | | Lower middle class | -0.013 | ns |
| | Age of panellist | | 0.026 | *** |
| | (Age of panellist)² | | -0.0002 | *** |
| | Number of consumption units per household | | -0.0082 | *** |
| | Presence of children < 6 years | | 0.073 | ** |
| | Education level higher than *baccalauréat* | | 0.173 | *** |
| | Household lives in urban area | | 0.013 | ns |
| **Household habits** | Household shops at traditional shops | | 0.549 | *** |
| | Household has a vegetable garden | | 0.083 | *** |
| | Number of purchases of the 14 products | | 0.003 | *** |
| **Household environment** | Number of nearby retailers in living area/area of living area | | 0.001 | ** |
| | Number of hard discounters in living area/area of living area | | -0.011 | ** |
| | Number of organic operators in living area/area of living area | | 0.006 | ns |
| | % of agricultural surface area used for organic farming by *département* in 2009 | | 0.02 | *** |

Significance: *** at 1%, ** at 5%, * at 10% and ns non-significant

The set of explanatory variables is similar to that of the model of the budget share of expenditures on organic products (except for the number of purchases of the 14 products, which is only in Step 1). The impact (positive or negative) of each variable is identical, on the whole, in the two steps. Nevertheless, neither the number of downstream operators in the living area nor the location in an urban area affects the decision of whether to buy organic products or not. However, they do affect the share of the budget that is devoted to organic purchases.