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## Promoting local foods in small island states: The role of information policies



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### ABSTRACT

Ensuring the success of agriculture is at the heart of food security, and it is necessary to examine strategies that tackle agricultural development through the production and consumption of sustainable food products. One way to increase food security in small island states is to develop local food sectors by increasing consumers' awareness about local products with sustainable characteristics. We designed an economic experiment to assess consumers' willingness-to-pay (WTP) for yams with sustainable characteristics: the origin, the intrinsic quality of an alternative variety and the mode of production. The results showed that labelling significantly changes consumers' valuation of the different yam profiles. Consumers' WTP for local yams (2.85 € kg<sup>-1</sup>) was significantly higher than for imported yams (1.80 € kg<sup>-1</sup>), while the organic mode of production derives a significant premium if information on production methods has been disseminated. The results also suggested that organoleptic characteristics of new varieties should not be overlooked. We conclude on how the labelling strategy could be facilitated through a policy targeting the development of the local food sector.

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### Introduction

In many parts of the world, food security is becoming a major issue due to sensitivity to climate change and market volatility in a globalised economy (Mimura et al., 2007; Reed, 2012). Concerns regarding food security are particularly valid for small island states, which have characteristics that make them especially vulnerable to the effects of climate change (for example sea-level rise) and extreme events (Wisner, 2004). From an economic point of view, small islands states have particular economic characteristics that make them more exposed to external shocks (such as extreme events and climate change) than larger countries because many of them rely on limited economic activities such as tourism or fisheries (Grynberg and Remy, 2004).

Whereas the need for improved food security is newly broached by climate change and economic globalisation, the historical shift from subsistence agriculture to agro-exportation has also reduced food security in small island states. Indeed, for centuries, small island states traditionally depended upon subsistence for survival. The colonisation process induced a shift in food production that

was oriented towards the development of cash crops for export at the expense of other traditional agricultural sectors targeting local markets. As a consequence, these territories rely heavily on imports for a major part of their food supplies (Delcombel, 2005; Redondo, 2006). In Guadeloupe (French West Indies) for example, the internal market coverage for food is only 20%. Imports from France, Dominican Republic and Costa Rica cover the gap between local production and demand and a third of the 80,000 tonnes per year of the fruits and vegetables that are consumed in Guadeloupe are imported (Chambre d'Agriculture de la Guadeloupe, 2014; Direction de l'Alimentation, de l'Agriculture et de la Forêt de Guadeloupe, 2010). While subsistence agriculture used to ensure food security, cash crops such as sugar cane, banana and forest products, are mostly exported for profit in foreign markets. However, exports depend upon preferential access to major developed country markets, which is gradually eroding. This situation has led many island states to experience a decrease in Gross Domestic Product contributions from agriculture, partly due to the drop in competitiveness of cash crops, cheaper imports from larger countries, and the increased costs of maintaining soil fertility (FAO, 2004). Cheaper imports also compete with local production forcing small-scale producers out of agriculture and therefore undermining island states' capacity to sustain their own food needs

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(Beckford, 2012). Small island states are experiencing a nutritional transition that takes them away from their traditional diets towards western-style ones. As a consequence, food systems of these islands rely more than before on imported products and are less self-sufficient. Additionally, even if it is not the only identified reason for the nutritional transition experienced by island states, imported food conveys western food consumption habits that contribute to the increase in non-communicable diseases such as diabetes and obesity (Hughes and Lawrence, 2005). This increased food vulnerability is particularly true for the Caribbean islands despite the fact that the natural environment offers extraordinary conditions for the development of a rich diversity of flora and fauna that should normally form the basis for balanced diets (Beckford, 2012; Watts, 1984). Because food security partly arises from sustained food production, ensuring the success of agriculture is at the heart of food security.

In small tropical islands, the competition for space between human activities and agriculture is particularly important. The increase of demography generates more food demand but also results in urban expansion which generates a high pressure on agricultural land. Commercial banks consider agriculture to be a high-risk sector and are therefore reluctant to invest in food production (Angelucci and Conforti, 2010). Because small island states often have unique biodiversity through high endemism (that is, with regionally restricted distribution) caused by ecological isolation, the intensification of agriculture through chemical inputs does not appear to be a sustainable way to achieve higher levels of food security. It is therefore necessary to examine strategies that tackle agricultural development through the production and consumption of sustainable local food products.

In this paper, we make the assumption that one way to increase food security in small island states is to develop local food sectors by increasing consumers' awareness about local products with sustainable characteristics. Labelling is a way to highlight those characteristics. Consequently, we claim that increasing the demand for local products is a way to ensure profitability at the farmer level and therefore to maintain a sufficient amount of land dedicated to food production for local populations. However, defining which food policy will succeed in increasing the willingness of consumers to purchase local products requires first a look at the best options for labelling production. Here, we test for the hypothesis that differentiating products on the market by highlighting their origin, their intrinsic quality and their mode of production is one way to increase consumers' awareness about locally produced food.

Our study is applied to the yam sector (*Dioscorea* sp.) in Guadeloupe, a small island state located in the Lesser Antilles. In Guadeloupe, the yam sector suffers from the following:

(i) Heavy constraints on production, primarily due to parasitism and high production costs, (ii) poor organisation of the sector and (iii) a decrease in yam consumption over the last 40 years due to changes in people's diets and a lack of consumer confidence in the sanitary quality of local yams. This last point is due to the contamination of some areas of the island by a persistent pesticide (Cabidoche and Lesueur-Jannoyer, 2012). This pesticide has been used in the south western part of the island (south Basse-Terre) in order to control the banana weevil (*Cosmopolites sordidus*). Yam cannot be grown anymore on these contaminated soils which represent 10% of agricultural area of the island, but still can be grown on rest of the island. However, lack of information on product traceability as well as the importance of informal market, make consumers suspicious about yam's sanitary quality. In this context and more than ever, promoting yams with sustainable characteristics and information about sanitary quality are critical factors to push production forwards and reduce food vulnerability in Guadeloupe. In our study, local yams participate to the sustainability of agriculture in the following three ways: (i) reviving the

agricultural sector by providing local employments, (ii) maintaining cultural diversity since yam, as a traditional dish, is intimately linked to Guadeloupe history and (iii) reducing the environmental impact of agriculture through a reduced pesticide use.

Little literature has focused on yam consumption. Existing studies highlighted the role of consumers' socio-demographic characteristics as determinants of yam consumption (Nwachukwu et al., 2011) and the role of product quality (freshness, size, shape, colour of the flesh) in price formation (Amegbeto et al., 2008). To the best of our knowledge, no study has addressed the question of yam qualification. Our research aim is to examine the way consumers respond to yam characteristics and to different types of labels, in order to define the best food policy options for improving the sustainability of the yam sector in Guadeloupe. This study contributes to the literature by providing an orientation to identify viable value chains with a positive impact on food sovereignty in small island states. It also abounds the field of the genericity of value measurement methods by providing evidence from a tropical insular population, since many of the recorded studies have been conducted on European or North American settings so far.

To achieve our research goal, we conducted an economic experiment to measure the impact of information about the origin of yams, the mode of production and a new variety on consumers' willingness-to-pay (WTP) for local yams. Experimental methods are now frequently used in the literature on applied demand analysis to estimate consumer valuation of specific characteristics. By precisely controlling the information on products, it is possible to compare various levels of consumers' WTP for a small variation in the characteristics of otherwise identical products. This comparison allows one to identify substitution relationships among product characteristics.

The rest of the paper is as follows. In the second section, we introduce the theoretical background and literature survey on consumer choice. The background of the empirical application, the experimental protocol and the econometric strategy used to measure consumers' willingness to pay for different yam profiles are presented in Section 'Background and experimental protocol'. Then, we present the empirical results obtained. Finally we discuss their implications for designing policy options to ensure the sustainable development of the yam sector in Guadeloupe and introduce generic recommendations to foster food security in tropical islands.

### Consumer choice and preferences for local food

When making choices about food products, consumers not only respond to their immediate need to sustain themselves, but they also wish to satisfy a set of values and beliefs. Lusk and Briggeman (2009) listed eleven values that govern food consumption and that explain why consumers are sensitive to one particular product over another. Therefore, releasing information about a product that addresses those values, in particular through product labels, is one way to highlight the specific characteristics of that product and to help consumers to notice it.

Few studies have focused on the impact of plant variety on consumers' valuation of food products. In a study about wine, Combris et al. (2009) could not draw a definitive conclusion from a comparison of consumers' willingness to pay for wines from different grape varieties. Rickard et al. (2011) examined differences between varieties of apples but only considered the impact of the name of the variety on participants' WTP: the impact of the sensory component is not addressed. Looking at non-food agricultural products, Davis (1993) showed that consumers give a different value to Christmas tree characteristics across species. Additionally, the people who knew the different species gave a different value to the trees' characteristics than those who did not.

The positive impact of labelling products' quality attributes on rural development has been highlighted in the literature (Lorenzini, 2010; Tregear et al., 2007). These authors have primarily focused on the social and economic dynamics created by country-of-origin labels and territorial marks in specific territories. Other studies have measured consumers' WTP for different qualifications to produce recommendations regarding the best options for product differentiation and the creation of niche markets (Loureiro and Hine, 2002).

A number of studies in consumption analysis have focused on the impact of the origin and the mode of production on consumers' valuation of products. As far as the origin is concerned, those studies reveal that consumers place a higher value on country-of-origin labels than private brands in regard to food safety (Roosen et al., 2003) and favour products with national or state origin over products with foreign or out of state origin (Chern and Lin, 2012; Hu et al., 2012). Additionally, products that benefit from labels offering geographic indications yield higher premiums than conventional products (Disdier and Marette, 2012; Loureiro and McCluskey, 2000).

As far as the mode of production is concerned, consumers are willing to pay for pesticide reduction and for no use of pesticides at all in the production of agricultural goods (Bazoche et al., 2013; Marette et al., 2012).

Comparison and ranking of different types of quality labels or credence attributes revealed that consumers do not equally value products' attributes. Indeed, examining quality labels, Aprile et al. (2012) found that consumers valued the 'protected denomination of origin' (PDO) label most, followed by the organic farming label, then a quality cue describing the product and finally a 'protected geographical indication' (PGI) label. In a review, Moser et al. (2011) found that the 'local attribute' is always preferred to the 'organic attribute'.

Looking at the drivers of those preferences, Grunert (2005) and Northen (2000) have shown that consumers' motivations towards country-of-origin labels are closely linked to their understanding that those labels imply food safety for the labelled products. Lim et al. (2013) confirm this result and show that the perceived food safety level contributes to a lower WTP for imported products.

The trade-offs for consumers on these characteristics (origin, variety, safety) are not so definitive. Both safety issues and environmental issues arise in yam production. Due to the previous safety crisis in the yam sector, the positive correlation between local origin and quality is not as clear and should be explored.

## Background and experimental protocol

### Case study: the yam sector in Guadeloupe

Yam is the first food crop both in area (450 ha) and production (6300 t) in Guadeloupe, an insular overseas territory located in the French West Indies (16°15N, 61°35W). Today, local yams cover 78% of the territory's demand, the gap between local production and demand being covered by imports. Yams are also the most demanded staples on the external market since their imports represent 85% of the total volume of the imported staples (Chambre d'Agriculture de la Guadeloupe, 2014). In the last forty years, the production and cultivated area have been divided by five and three respectively therefore revealing the decline of the sector (Agreste, 2009). In the meantime, the demand for yam also declined since the consumption of local yam decreased from 23 kg to 15 kg per person per year between 1985 and 2006 respectively (consumption per capita calculated from official statistical sources on population and yam production (Agreste, 2009; Insee, 2005)). During this period of time, the production and consumption of yams has been highly impacted by the discovery of long-lasting soil pollution by chlorde-

cone, a pesticide used from 1972 to 1993 by banana planters in the south west of the island. The pollutant does not diffuse homogeneously in all crops, but edible parts of tuber crops – if grown in contact with polluted soil – are more contaminated if the soil pollutant content is high; this has led to recommendations of restrictive, if any, cultivation (Cabidoche and Lesueur-Jannoyer, 2012). The maximum residues limit (MRL) in food products was established at 20  $\mu\text{kg}^{-1}$  of fresh weight. On the demand side, all of these events increased consumers' mistrust towards local yams. Therefore, becoming informed about consumers' receptiveness to new labels or types of products could act as an incentive for farmers to adopt more sustainable crop management systems; it could also encourage non grower farmers to start growing yams.

A recent study about food habits in Guadeloupe revealed that yam is consumed by only a small proportion of the population, which has adopted a diet based on a European model and food that can be prepared more easily (Observatoire Régional de la Santé de Guadeloupe, 2010) compared to other imported fruits and vegetables such as apples or potatoes, yam suffers from a lack of marketing that could enhance its value. Today, the typical consumer does not know about the great diversity of species and varieties that can be found on farms, and for him, yam is a fairly basic product (Merlo, 2007). This lack of information leads the consumer to believe that the overall quality of the product is not reliable even though the differences that can be observed at the cooking and eating stages are simply due to differences between species and varieties. Local yam is marketed through not less than five different marketing chains that span from direct sale (from farmers to consumers with no intermediary) to longer chains that count two intermediaries. Most of it is sold through small marketing chains (one intermediary at the most). Observations on local markets made it clear that little information is available to consumers about yam varieties, the mode of production, or the origin and cooking characteristics of these varieties. At the same time, the traceability of yam in local supermarkets is not always warranted and misleading uses of variety names and origins have been reported. Nevertheless an inter-professional agricultural association has been created in 2009 in order to better organise fruits and vegetables sectors (among which the yam sector). One of the aims of this association is to encourage local production and increase the visibility of local products on the markets. In this context, implementing quality in the yam value chain thanks to labels appeared to be a valuable mean to increase consumers' awareness regarding the product and a relevant way to federate yam farmers.

### Design of the economic experiment

#### Preliminary focus on the determinants of yam consumption

In a preliminary survey, we organised six focus group discussions to elicit the main determinants of yam purchases and consumption and to assess consumer receptiveness to different types of marketing innovations including labelling. The number of participants to each group ranged between five and six (for a total of 31 participants). Participants were yam eaters and buyers and were randomly selected irrespective of socio-economic profiles, see below. There were 15 women and 16 men; aged between 24 and 58; and household size varied from one to six persons. The results showed that from an organoleptic point of view, participants had a very broad definition of the quality of yams, which reflects the heterogeneity of their preferences. Origin and price were among the four first criteria out of eleven considered at the purchasing stage. Asked about innovations in the product, participants were reluctant to endorse industrial processing of the raw product but were receptive to the labelling of yams provided that it did not increase their purchasing cost too much. The two labelling options considered – local origin and organic

production-held their attention, and the participants declared that they were interested in these options.

Considering these results, we decided to test whether consumers would value a 'local origin' and an 'organic' label on yams and to quantify the consumers' valuation of each option. Additionally, given that the very high genetic diversity of yams can be considered to be one way to get around one of the major limitations<sup>1</sup> to production, we also tested whether consumers would value a new high performing variety that allowed farmers to use less pesticide. This last variety was defined by experts as having a particularly good taste that would hold consumers' attention.

#### Sample of participants

Consumers were randomly selected from the phone directory, within a radius of 30 km around the site of the experiment. Beyond that distance, we suspected that people would be less inclined to show up to the experiment because of difficult traffic conditions. Six districts would fall within that distance: Abymes, Baie-Mahault, Lamentin, Petit-Bourg, Pointe-à-Pitre and Sainte-Rose. These districts cover both urban and rural areas and are representative of the biophysical and socio-economic contexts that can be found in Guadeloupe. A total of 1090 telephone numbers were randomly selected from the directory in those six districts according to a protocol developed by Lange et al. (1999). Out of these, 500 numbers were randomly selected and dialled. Out of the dialled numbers, 83 consumers answered positively to the invitation and 56 eventually took part in the experiment. All participants were pre-interviewed by phone to determine whether they were yam eaters and whether they took part in the household food purchases. The participants were selected on the basis of their eating yam at least once a month, their taking part in the food purchases at home at least every two months and on their giving a correct price for 1 kilogram of yams, that is, a price less than 5 euros. People were also informed on the phone that they would have to taste yams and that they would perhaps have to buy yams at the end of the evaluation process. All participants agreed on that principle.

Five evaluation sessions were organised for the purpose of the experiment. These were held in a restaurant in the district of Lamentin. Out of the 56 persons who took part in the experiment, two individuals were discarded from the analysis because of extreme values for their willingness to pay for the different yam profiles and missing data. Therefore, the analysis is based upon a sample of 54 individuals. Apart from the absence of people aged 75 years old and over, the sample represented relatively well the diversity of socio-economic profiles that can be encountered in Guadeloupe (Table 1).

Within our sample, smaller incomes are slightly under represented while bigger incomes are over represented, when compared to the Guadeloupean population.

#### Experimental protocol

As hypothetical methods are often criticised (List and Gallet, 2001; Lusk and Shogren, 2007; Murphy et al., 2005) and because laboratory behaviour is a good indicator of behaviour in the field (Levitt and List, 2007; Lusk and Fox, 2003; Smith, 1980), we decided to conduct an economic experiment based on the protocol developed by Lange et al. (2002) and adopted by Bougherara and Combris (2009).

We used the Becker–DeGroot–Marschak (BDM) procedure to elicit WTP for different yam profiles because it is incentive compatible and therefore allows us to elicit consumers' WTP in a non-hypothetical setting (Becker et al., 1964). The literature also shows significant results using a mechanism that involves real transactions

**Table 1**  
Socio-demographic characteristics of the participants.

Variable		
<i>Sex</i>		
Women		62%
Men		38%
<i>Profession</i>		
Farmers		3.6%
Craftsmen, traders, company managers		7.3%
Executive, superior intellectual professions		7.3%
Intermediary professions		34.5%
Employees		16.4%
Workers		3.6%
Retired people		12.7%
Others, unemployed		14.5%
<i>Education</i>		
No diploma		1.8%
Less than the bachelor degree		18.2%
Bachelor degree		9.1%
2 years after bachelor degree and more		70.9%
<i>Age</i>		
20–29		7.3%
30–44		36.4%
45–59		32.7%
60–74		23.6%
+75		0.0%
<i>Number of people in the household</i>		3.0
<i>Household with children</i>		
Yes		35%
No		65%
<i>Household income (€/year)</i>	<i>Percentage of the general population</i>	<i>Percentage of the sample</i>
Up to 10,800 €	20	7.4
10,801–15,400 €	20	11.1
15,401–18,300 €	10	20.4
18,301–22,700 €	10	3.7
22,701–35,500 €	20	18.5
35,501–50,600 €	10	16.7
More than 50,601 €	10	22.2

for eliciting consumers' choices (Bougherara and Combris, 2009). This procedure was selected over the Vickrey Option and an *n*th-price auction because its learning process is easier and also because it generates fewer group effects providing that communication between participants is controlled (Combris et al., 2007). In the BDM procedure, each participant reveals his or her maximum price to buy one unit of a good, and the selling price is randomly drawn. If the selling price is lower than the maximum price, then the participant buys the product (at the selling price); if the selling price is greater than the maximum price, the subject cannot buy the product. When provided with a description of the procedure and a trial, the participants could understand the valuation mechanism rather rapidly. Two people sat at the same table and were separated by a partition to restrict communication between them. The participants received a 25 € fee for taking part in the experiment.

In order to introduce people to the different activities they would take part in, we used a Power Point® presentation. This introduction aimed to explain the evaluation process to them (and so the incentive mechanism) and to train them to evaluate products with different profiles. During each session, people evaluated different yam profiles and completed a structured socio-demographic questionnaire to assess the following: (i) their personal and household characteristics, (ii) their purchasing and consumption habits and preferences regarding yams, and (iii) their experience and opinions regarding local and organic yams. Details about the yam profiles are provided in the next section.

#### Willingness to pay for yam profiles and impact of labels

We evaluated whether consumers were responsive to different cues about yams: (i) the intrinsic quality of an uncommon yam

<sup>1</sup> One limitation is the sensitivity of cultivated *Dioscorea alata* yam species to anthracnose, a fungal disease caused by the agent *Colletotrichum gloeosporioides*.

**Table 2**  
The four yam profiles used in the experiment.

Yam code	Variety	Origin	Mode of production
ConvLK	Kabusah	Imported	Conventional
ConvLK	Kabusah	Local	Conventional
ConvLG	Goana	Local	Conventional
OrgLK	Kabusah	Local	Organic

**Table 3**  
Products' conditions and information delivered to the participants at the different stages of the protocol.

Stages of the protocol	Products' condition and information delivered to the participants
Stage1	Tasting of cooked samples of yam (50 g each) with no information
Stage2	Full yam tubers with no information
Stage3	Yam tubers (1 kg each) + labels mentioning the variety, origin and mode of production
Stage4	Yam tubers (1 kg each) + labels + information about the use of pesticides
Stage5	Yam tubers (1 kg each) + labels + information about the use of pesticides + information about positive economic returns for the country of origin
Stage6	Yam tubers (1 kg each) + labels + information about the use of pesticides + information about positive economic returns for the country of origin + tasting of cooked samples of yam (50 g each)

variety resistant to one of the major pests (good tasting variety), (ii) information about the origin and (iii) information about the mode of production.

We tested four different profiles; a profile is defined as being a set of three attributes of interest: the variety, the origin and the mode of production. The attribute levels are the available options for each of the attributes of interest. Every single pair of profiles differed by only one attribute at a time, so that we could deduct the consumers' valuation of each attribute by examining the difference in valuation between two profiles. Table 2 summarises the four yam profiles that we tested. Given that yam profiles are characterised by three attributes (variety, origin and production methods), a full factorial design should include 8 products (two levels for each attribute). Unfortunately, it was not feasible to find some of these products because they are not available on the Guadeloupean market (for example, imported yams are available for conventional production methods only and the Goana variety is not locally produced using organic methods), so we conducted the experiment with the only profiles available.

The evaluation process consisted of six stages. Table 3 provides details on the products' presentation conditions and the information delivered to the participants at all stages. The first stage was only dedicated to evaluate the yams from a sensory point of view, the second stage revealed the evaluation of the physical aspect of the yam tubers and the third stage introduced labels informative of the origin (local or imported), variety (Kabusah or Goana) and mode of production (organic or conventional). We can consider that the third stage is the usual purchase condition. At the fourth stage, we introduced information on pesticides' uses according to each certification scheme. At the fifth stage, we also added information on local (or foreign) economic returns. Finally, at the sixth stage, participants had to evaluate the yams with all information (labels + pesticides' use + economic returns) and with the sensory characteristic. The informational sheets that were provided to the participants are available in Supplementary material.

To avoid participants becoming concerned about the presence of chlordecone (pesticide contamination) in the tubers they evalu-

ated, we specified their region of production within Guadeloupe (all among regions that were chlordecone free). Given the generalised awareness of the Guadeloupean population about pesticide contamination risk in polluted areas, we assumed that everybody knew the regions that were chlordecone free.

The cooked samples of yam were displayed in small plastic dishes that were labelled with different yam identification numbers (ID) used by the participants to identify and evaluate them. Yam tubers also had stickers indicating their ID and were displayed on plastic trays. Between Stage1 and Stage2, we changed the ID of the different yam profiles so that participants could not recognise them and be influenced by their sensory perception when evaluating yam tuber profiles further in the process.

The arrangement of the different yam samples from one participant to the other differed to control for the order effect.

At each stage, participants received an evaluation form on which they were invited to note the maximum price they were willing to pay for a kilogram of the specific type of yam, which they could either taste or observe and manipulate. Every evaluation form was collected before the next was distributed to prevent people from reconsidering their previous evaluation. At the end of the evaluation process, we proceeded to the selling of yams according to the Becker–De Groot–Marschak procedure (Becker et al., 1964).

#### Model estimation

We used a two-step approach as is usual in consumer analysis. In the first approach, we showed how the information context influenced each yam valuation. In the second approach, we investigated within a global framework of information which variable (namely, information or socio-demographic variable) influenced consumers' WTP.

We considered the willingness to pay to be a function of the information people received at the different stages of the protocol, of the intrinsic characteristics of the different yam profiles (origin, mode of production and variety) and of the socio-demographic characteristics of the participants. Because some responses were coded as zero, we had to control for the problem of a censored dependent variable (the WTP). Furthermore, because there are repeated observations for the same respondent, our sample cannot be considered to be independently distributed, and we must control for unobserved individual heterogeneity.

A convenient way to address both issues simultaneously is to consider a random-effect Tobit model (see Wooldridge, 2010). We included interaction terms between stage variable and profile variable (yam types) in order to differentiate the impact of information on the willingness-to-pay according to types of yam.

The estimating equation is:

$$\begin{aligned}
 \text{WTP} = & \beta_1 + \beta_2 \text{ConvLK} + \beta_3 \text{OrgLK} + \beta_4 \text{ConvLG} + \beta_5 \text{Stage2} \\
 & + \beta_6 \text{Stage3} + \beta_7 \text{Stage4} + \beta_8 \text{Stage5} + \beta_9 \text{Stage6} \\
 & + \beta_{10} \text{Stage2} \times \text{ConvLK} + \beta_{11} \text{Stage2} \times \text{OrgLK} \\
 & + \beta_{12} \text{Stage2} \times \text{ConvLG} + \beta_{13} \text{Stage3} \times \text{ConvLK} \\
 & + \beta_{14} \text{Stage3} \times \text{OrgLK} + \beta_{15} \text{Stage3} \times \text{ConvLG} \\
 & + \beta_{16} \text{Stage4} \times \text{ConvLK} + \beta_{17} \text{Stage4} \times \text{OrgLK} \\
 & + \beta_{18} \text{Stage4} \times \text{ConvLG} + \beta_{19} \text{Stage5} \times \text{ConvLK} \\
 & + \beta_{20} \text{Stage5} \times \text{OrgLK} + \beta_{21} \text{Stage5} \times \text{ConvLG} \\
 & + \beta_{22} \text{Stage6} \times \text{ConvLK} + \beta_{23} \text{Stage6} \times \text{OrgLK} \\
 & + \beta_{24} \text{Stage6} \times \text{ConvLG} + \beta_{25} \text{sex} + \beta_{26} \text{Income} \\
 & + \beta_{27} \text{Age} + \beta_{28} \text{Fwchi} + \beta_{29} \text{Education} + \beta_{30} \text{Regcons} \\
 & + \beta_{31} \text{Prichigh} + \alpha + \varepsilon,
 \end{aligned} \tag{1}$$

**Table 4**  
Definition of the socio-economic variables.

Socio-economic variables	Definition
Sex	Sex
Income	Income
Age	Age
Fwchi	Household with children
Education	Level of education
Regcons	The participant is a regular consumer (he eats yam at least once a week)
Prichigh	The participant thinks that the price of local yam is too high

where  $\alpha$  and  $\varepsilon$  respectively denote the respondent individual effect and an i.i.d. (independently and identically distributed) error term. The random-effect Tobit estimation of model parameters is performed by Maximum Likelihood, based on the normality assumption and separate regimes for positive and zero dependent variables, while (numerically) integrating out the individual effect (Skrondal and Rabe-Hesketh, 2004). The variables of information as well as the profile variables were defined earlier. We introduced socio-demographic variables in order to reduce the (observed) heterogeneity between participants. While gender, income, age and education are variables that are commonly used in this type of analysis (Krystallis and Chrysohoidis, 2005; Skuras and Vakrou, 2002), we introduced the variable Fwchi (family with children) in order to capture the influence of the presence of children on households' consumption of yam. The variable Regcons (regular consumer) aims to capture differences between two types of people. On the one hand, people who eat yam on a regular basis might consider it as a staple like rice for example and be willing not to pay too much for it. On the other hand, people who eat yam occasionally might consider it a special dish and be willing to pay more for it. In Table 4, we provide a definition of the socio-demographic variables used in the model specifications.

## Results and discussion

### Sample and data

The sample consisted of 1296 observations on prices provided by the respondents, (54 respondents  $\times$  6 stages of evaluation  $\times$  4 yam profiles). The average WTP was 2.41 €. A total of 75% of the sample was between 1.80 € and 4.80 € (price range of 3.00 €). These WTPs were consistent with current market prices for yam. The minimum WTP was 0.00 € (which corresponded to a decision of no purchase) and the maximum was 6.50 €, with a standard deviation of 1.13 €. This standard deviation is fairly high when compared to average WTP, but it reflects the price differentiation that exists between species and varieties on the market as well as differences in participants' purchasing power.

Participants were allowed to refuse to buy a product in which case they would indicate a purchasing price equal to zero. Table 5 describes the frequency of zero prices. Only 2.93% of the revealed prices were zero. Even if it represents a small part of the

**Table 5**  
Frequency of zero prices by yam and by stage.

Yam profile	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6	Total
ConvIK	1	0	3	5	6	6	21
ConvLG	3	1	0	1	2	2	9
ConvLK	1	0	0	1	2	0	4
OrgLK	2	0	0	0	0	2	4
Total	7	1	3	7	10	10	38

observations, we can see that the imported yam was more rejected than the other yams.

### Influence of the information context on yam valuation

Fig. 1 shows the 95% confidence intervals and average WTP for each profile in each situation. This graphical representation provides a concise overview of the results of Eq. (1) shown in Table 6. At first glance, we observe that the information context influenced the valuation. Indeed, in the blind tasting situation (Stage1), participants were less able to differentiate the products than in the other situations and the WTP for the conventional local yam (ConvLK) was significantly higher in stages 3, 5 and 6 than in stage 1. Indeed the introduction of information with labelling increased the WTP (+0.27 € kg<sup>-1</sup>) for the ConvLK but this increase was cancelled when the information about pesticides' uses was provided. However when the information on economic returns was added (in stage 5) it seemed that consumers were ready to pay a +0.24 € kg<sup>-1</sup> premium (10% significance). We note that the WTP for the ConvLK was the higher at stage 6 (+0.36 € kg<sup>-1</sup> premium relatively to the blind tasting situation). This result confirms that the food valuation by consumers is clearly a combination of information characteristics and sensorial characteristics (Combris et al., 2009).

The effect of the informational context varied according to yam profiles. We observe in graph 1 that the WTP of imported yam (ConvIK) was clearly impacted by information on its origin. Indeed, while its WTP was not significantly different from the WTP of the ConvLK at the first two stages (sensorial and visual aspects only), it decreased when the origins of the other yams were provided (note that at stage 3, the ConvIK was the only yam proposed without a label). The most impacting stage was Stage 3, in which we examined the impact of the label on participants' WTP for the different profiles. In stage 3, the increase of WTP due to the informational context was largely counter-balanced by the cross effect of the information and the imported yam (ConvIK). The WTP for the ConvIK profile decreased significantly by - 0.78 € kg<sup>-1</sup> compared to stage 1.

For the OrgLK profile, additional information in Stage 4 and 5 had a significant impact since the cross effects of organic yam with these stages are positive at the 1% level of significance.

The Goana variety (ConvLG) was less valued in the first stage (significant negative impact at the blind testing) and was not much impacted by the informational context (Table 6 doesn't show any significant interaction between ConvLG and informational contexts). This tends to show that this variety was less appreciated than Kabusah, mainly due to a lower sensorial quality.

These results showed that participants were sensitive to labels on yam giving them information about origin and production mode (organic or conventional). Therefore, labelling yams would act as a powerful tool to discriminate between yams on the market and to enable consumers to make informed food choices fitted to their needs and convictions.

### Impact of the yam profile on consumer WTP

Table 6 presents the specification that we retained to explain participants' WTP for yams. Information about the use of pesticides

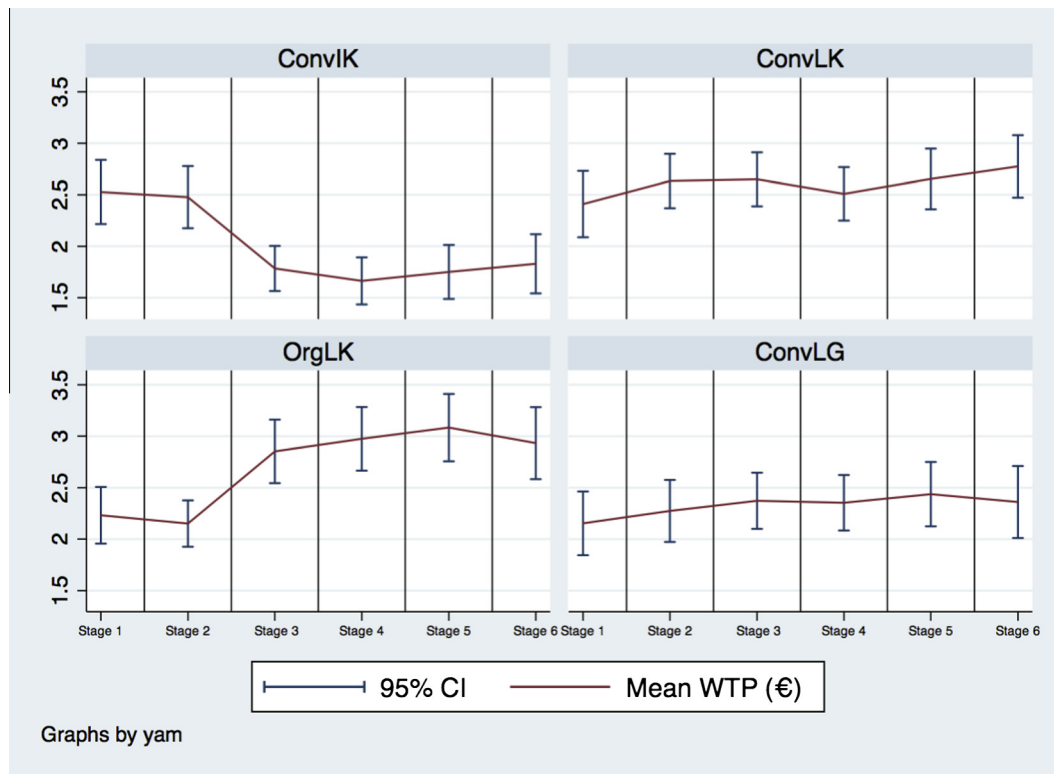


Fig. 1. Average willingness to pay and 95% confidence interval around the mean for the different yam profiles at all stages ( $n = 324$  observations).

generated no significant impact on consumers' WTP for ConvLK, whereas information about positive economic returns for the country of origin had a significant positive impact at the 10% level of significance. As previously mentioned, depending on the informational context, the ConvIK profile may have a negative impact on WTP. The premium for the imported yam (relatively to the conventional yam at stage 1 and at the 1% level of significance) was contained between  $-1.076 \text{ € kg}^{-1}$  and  $0 \text{ € kg}^{-1}$ . This negative impact mainly occurred when the labels were introduced. This means that the tasting quality of this imported yam was not under-evaluated by consumers compared to the conventional local yam. If we pay attention to the visual aspect of the yam, there is no significant difference with the local yam at 5% level, but at 10% level there exist a negative premium for the imported yam (this result appears also for the organic yam).

The depreciation of the ConvIK profile was consistent with consumer views elicited during the focus group discussions in the preliminary survey as well as with results obtained from the socio-demographic questionnaire completed by participants after the evaluation process. In particular, participants were not confident about the mode of production for imported yams. This depreciation of the imported yam profile reflects what [Sharma et al. \(1995\)](#) defined as consumers' ethnocentrism, which leads consumers to disvalue products that are of foreign origin when they come into competition with locally produced products. Therefore, participants supported locally produced yams. This result testifies all the more for the need of a greater traceability of yams because traders in the markets were reported to be selling imported yams as local ones. It is a positive signal to take into account while advocating for the development and survival of local food sectors. Indeed, it means that the local population still makes the difference between imported and local food and wishes to preserve a traditional food basis.

The ConvLG generated no significant impact on the WTP, excepted at the first stage where it was depreciated by consumers.

This was an unexpected result because experts led us to choose the Goana as a higher quality alternative to the common<sup>2</sup> variety Kabusah. One reason for this depreciation could be that participants tasted the variety for the first time, while being very used to the taste of the common Kabusah variety that we used as a reference in our protocol. In other words, participants were not ready to change their tastes on the first attempt. Another reason could be that the experts we selected were not properly qualified to make statements on sensorial acceptance. Further investigation on sensorial characteristics of this new variety and on consumers' taste preferences should be done. In the case of origin-based labels, [McCluskey and Loureiro \(2003\)](#) found that consumers must perceive the high quality of the product for it to yield a price premium. [Combris et al. \(2009\)](#) highlighted the importance of the sensory component because people revised their willingness to pay according to their sensory valuation of the product. Sensory perception remains a major determinant of the decision to purchase and should not be overlooked when considering the introduction of a new variety even if it is a high-performing variety (in our case allowing low pesticide use). The success of variety selection and improvement will depend on matching consumers' expectations.

The impact of the OrgLK profile on consumers' WTP appeared to be different according to the informational level. In this case, we can clearly distinguish the sensory valuation from the other informational situations. Basically, since labels were available for valuation, the OrgLK profile had a significant positive impact on WTP at 1% level of significance. When a positive premium for the OrgLK existed (compared to the ConvLK in the same informational condition, at the 1% level of significance), it was contained between  $+0.58 \text{ € kg}^{-1}$  and  $+0.62 \text{ € kg}^{-1}$ . From the sensorial point of view, the OrgLK appeared to be tasty and perceived at the same level

<sup>2</sup> The common variety here can be found year round because it is imported from Costa Rica, unlike other varieties. It is among the cheapest varieties on the market.



**Table 6**

Tobit estimations of the willingness to pay for the different yam profiles. Standard errors are in parentheses.

Variables		Variables		Variables	
ConvLK	<i>ref</i>	Stage 2 × ConvLG	−0.071 (0.40)	Stage 6 × ConvLG	−0.135 (0.75)
ConvIK	0.142 (1.13)	Stage 3 × ConvIK	−1.047 (5.87) <sup>***</sup>	Sex	−0.140 (0.61)
OrgLK	−0.158 (1.25)	Stage 3 × OrgLK	0.318 (1.78) <sup>*</sup>	Income	0.086 (1.53)
ConvLG	−0.260 (2.06) <sup>**</sup>	Stage 3 × ConvLG	−0.013 (0.07)	Age	0.003 (0.35)
Stage 1	<i>ref</i>	Stage 4 × ConvIK	−1.017 (5.69) <sup>***</sup>	Fwchi	−0.424 (1.76) <sup>*</sup>
Stage 2	0.213 (1.69) <sup>*</sup>	Stage 4 × OrgLK	0.618 (3.47) <sup>***</sup>	Education	−0.235 (0.89)
Stage 3	0.267 (2.12) <sup>**</sup>	Stage 4 × ConvLG	0.111 (0.62)	Regcons	−0.079 (0.33)
Stage 4	0.099 (0.79)	Stage 5 × ConvIK	−1.076 (6.02) <sup>***</sup>	Prichigh	−0.418 (1.84) <sup>*</sup>
Stage 5	0.243 (1.93) <sup>*</sup>	Stage 5 × OrgLK	0.577 (3.23) <sup>***</sup>	Constant	2.583 (4.40) <sup>***</sup>
Stage 6	0.357 (2.84) <sup>***</sup>	Stage 5 × ConvLG	0.039 (0.22)	Sigma_u	0.784 (10.10) <sup>***</sup>
Stage 2 × ConvIK	−0.311 (1.75) <sup>*</sup>	Stage 6 × ConvIK	−1.098 (6.15) <sup>***</sup>	Sigma_e	0.655 (48.60) <sup>***</sup>
Stage 2 × OrgLK	−0.315 (1.77) <sup>*</sup>	Stage 6 × OrgLK	0.302 (1.69) <sup>*</sup>	Rho	0.589

Number of obs = 1296, Number of groups = 54.

Wald chi2(30) = 453.98, Prob &gt; chi2 = 0.0000.

Log likelihood = −1401.8665.

AIC = 2869.73, BIC = 3040.24.

<sup>\*</sup>  $p < 0.1$ .<sup>\*\*</sup>  $p < 0.05$ .<sup>\*\*\*</sup>  $p < 0.01$ .

than the conventional yam (ConvLK) but visually the OrgLK seemed to be the least appreciated yam (negative value of the parameter Stage 2 × OrgLK at the 10% level of significance). It is worth noticing that the OrgLK was never rejected, see Table 5.

The organic attribute was not valued at the same level in all contexts. Indeed, its value was maximised when consumers were informed about pesticides' use and economic return since interaction terms Stage4 × OrgLK and Stage5 × OrgLK were significant at the 1% level of significance, with relatively higher estimated parameters. The price premium for the organic yam profile over the conventional one was contained between 0 € kg<sup>−1</sup> and +0.62 € kg<sup>−1</sup> at the 5% level of significance. Nevertheless a negative premium (−0.315 € kg<sup>−1</sup>) appeared at the 10% level of significance in the absence of the label (stage 2). This result should be interpreted as a negative impact of the visual aspect of the OrgLK on consumers' valuation. On the opposite, the price premium could achieve 24% in the best informational context (compared to the WTP for ConvLK at stage 1); therefore the label could be an incentive for farmers to change their actual practices to organic ones. Today, organic yams area is a niche market in Guadeloupe since it is difficult to produce organic yams with low enough production costs and therefore, only few consumers can afford these products. The current market price of 3.50 € kg<sup>−1</sup> for organic yams is greater than the estimated willingness to pay for the organic profile (3.25 € kg<sup>−1</sup>) in the best informational context in our experiment. Unless strong information on the production methods and their impacts is offered, it is likely that organic yam production will remain a niche market (the estimated WTP for OrgLK with label without additional information is around 3.16 € kg<sup>−1</sup>).

One could then conclude that information on production methods (and their consequences) is important for consumers. This conclusion is consistent with results from the preliminary survey in which people appeared to worry about the pesticide contamination of yam tubers and declared that they would buy them from outside the contaminated area. This finding is also consistent with

the experimental results on willingness to pay for organic products, which mitigate the level of an "organic premium" compared to the declarative studies and which underline the impact of information on production methods and pesticide use on consumers' preferences (Bazoche et al., 2013; Marette et al., 2012). Additionally, 50% of the respondents declared that the yams they bought were produced without using pesticides, whereas 35.7% of them declared that pesticides were used only when necessary. Considering that a large proportion of the participants (83%) declared that they bought local yams, this response rate means that participants tended to believe that local yams were already produced with low, if any, chemical inputs. They would therefore consider local products to be organic or almost organic. This possibility was confirmed by Galliot et al. (2013) who found that a proportion of Guadeloupean consumers had a low level of knowledge regarding the Organic Agriculture label and considered local products to be organic. Moser et al. (2011) found similar results when observing that the 'attribute local' was an implicit guarantee of product quality for consumers. Lusk et al. (2014) showed how WTP estimations rely on consumers' beliefs; in the case of yam consumption it seems relevant to inform consumers on actual practices.

#### Impact of the socio-economic characteristics of participants

An analysis of the impact of socio-demographic variables on consumers' WTP showed that the WTP also decreased when participants belonged to households with children (negative impact of the *fwchi* variable at the 10% level of significance) or when they thought that the price of local yams was too high (negative impact of the variable *prichigh* at the 10% level of significance). In both cases, participants were willing to pay a −0.42 € kg<sup>−1</sup> premium to purchase yams. On the one hand, the negative impact of the *fwchi* variable could be linked to the fact that some children are reluctant to eat yams. Indeed, Merlo (2007) found that in 5% of

the households he interviewed ( $n = 136$ ), children were the main limitation to higher yam consumption since they are not particularly keen on yam. Within those households, parents insisted that their children eat local products but had to compromise about the composition of the diet, introducing other sources of carbohydrates along with yam. Another reason for that negative impact could be that families with children were more budget-constrained than those without children and could not afford the same level of food expenditures. This was confirmed by [Govindassamy and Italia \(1999\)](#) and [Loureiro and Hine \(2002\)](#) who found that the number of individuals or the presence of children aged under 18 within the household, had a negative impact on the willingness to pay premiums for organic and local products.

On the other hand, price was an important criterion for 58% of the participants at the purchasing stage, and half of the participants thought that the price of local yams was too high. This finding draws our attention back to the fact that the price is one of the main determinants of food consumption and that whatever the quality of a product, some people will be able or willing to purchase it while others will not ([Lusk and Briggeman, 2009](#)). This finding suggests further agricultural research to decrease production costs and achieve an appropriate selling price for yams. Costs could be reduced either by selecting higher yielding varieties or by introducing innovations aiming at reducing the costliest management practices. We could also imagine policy incentives and support targeting producers or consumers for the latter to gain increased access to yams at a convenient price.

#### *Limitations of the laboratory experiment*

The main constraint of our study was the small sample size, which limited the number of socio-demographic variables. Nevertheless, the defection rate for participants who agreed to come to the experiment and did not show up was lower than that usually recorded in marketing studies conducted in Guadeloupe. While this rate oscillates between 43% and 67% (based on personal communication from an event organiser and a marketing consultant), we recorded a defection rate of only 35%. Despite this limitation, we could detect the effect of some socio-demographic variables. Including a greater number of participants in the future could help us to highlight the effect of the usual place of food purchase on the valuation of the different profiles. This detail could help us design an adequate type of labelling policy and target the right people in the right place.

Another limit of our protocol stemmed from the type of yam profiles we used to conduct our experiment. Laboratory experiments are interesting because they are grounded in reality; therefore, we used the only yam profiles that were available on the market. However, we might have been able to detect a clearer effect from the mode of production had the design been orthogonal. For example, such experimental design could have made it possible to have data on WTP for an organic imported yam, which is not available yet in Guadeloupe. To go behind the limitations of offering only the product characteristics that exist on the market, we could use a choice experiment setting and examine the potential for innovative characteristics ([Loureiro and Umberger, 2007](#)).

#### *Implications of the study*

Our study showed that the implementation of food safety and country-of-origin labels could help increase consumer's willingness to purchase sustainable local yams. Therefore, a food policy aiming at converting this strategy into reality should include (1) the organisation of the supply-chain for traceability control, (2) the information of local population on the benefits of local yams and (3) a set of appropriate incentives and extension services to

help farmers in managing yam quality. That being said, one might wonder how labelling could be implemented on staples such as yams, which are mostly sold in short marketing chains and in the context of a small tropical island like Guadeloupe. Indeed, the development and implementation of quality certification has been characterised by increased levels of coordination among actors in the value on high value added products so far ([Demont and Neven, 2013](#)). When it comes to considering staple value chains, similar development seems less obvious because of the lower value added of staples and the higher numbers of traders involved in their marketing chains ([Swinnen et al., 2010](#)). Nevertheless, [Egg et al. \(2006\)](#), reported in several case studies that such collective actions are emergent in staple value chains in response to consumers demand and are made possible under certain conditions such as: (i) a minimum size of the farmers' group involved in the certification scheme; (ii) trust and neighbourhood relationships among the group and; (iii) effectiveness of the penalties if farmers fail to respect their commitment in terms of quality and traceability. [Swinnen et al. \(2010\)](#) add to those conditions, the necessity for agents to collaborate through contract farming schemes and to set up interlinkages of sales contracts to input services targeting farmers. This advocates for a greater organisation of yam farmers and increased coordination in the sector.

Although other tropical island states may differ from Guadeloupe with respect to population's standard of living, yam production and importance in the daily diet, we believe that our findings could have implications for other islands similar to Guadeloupe. Roots and tubers are indeed largely consumed and are culturally important in the Caribbean (for example in Martinique, Dominica, Barbados and Jamaica) and in the Pacific. These islands are subject to the same development issues as Guadeloupe: vulnerability of agriculture, dependence on imported products, sensibility to international markets, environmental damages. In these contexts, developing local organic food seems to be a promising way to achieve sustainable development of resilient food systems. The success of such strategy however depends on consumer willingness to pay for these products and the farmers' ability to move on to agro-ecological systems. Measuring these abilities with experimental tools like the one presented in this study could therefore be of interest for other small tropical islands that would like to develop local food consumption. More generally, the case of small island states is of interest, as it is an extreme case of countries where appropriate food policies have to be found to achieve food sovereignty.

#### **Conclusion**

In this paper, we made the assumption that one strategy to increase food security in small island states is to involve consumers in the sustainable development of staple food sectors. To do so, we elicited consumers' willingness to pay for the labelling of sustainable attributes of yams in Guadeloupe. Our work improves our understanding of consumers' valuation of food products in Guadeloupe and provides methodological aspects to do so in other contexts. Our results showed that consumers were responsive to the labelling of yam. They were supportive of the local and the organic yam profiles; both of these profiles, given their characteristics, could contribute to the sustainability of the food sector. Consumers were not supportive of the high-performing yam profile (conventional local Goana) because they did not appreciate its taste. Price was also an important determinant of yam purchases. This work demonstrates that labelling could help consumers make food choices tailored to their needs and that, in the process of variety improvement, plant breeders must make sure that new varieties meet consumers' taste. In the future, improving the sustainability of the yam sector could be achieved via a food

policy focused on the development of organic and locally grown yams. To this end we suggest to act simultaneously on the supply chain and the demand side. Keeping those perspectives in mind, future prospects would be to adjust production to demand and determine how much the market could absorb of each yam profile.

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## Appendix A. Supplementary material

Supplementary data associated with this article can be found, in the online version, at <http://dx.doi.org/10.1016/j.foodpol.2015.09.003>.

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