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Alternative Food Networks (AFNs): Determinants for consumer and farmer participation in Lombardy, Italy

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Abstract: Scaling up supply chains in the interest of cost-effectiveness has led to an increasing disconnection between producers and consumers in today's globalised food system. This paper assesses the agricultural and territorial drivers that influence the development of Alternative Food Networks (AFNs), where consumers and producers act together, by implementing an Ordinary Least Squares (OLS) regression. The analysis was carried out at a municipal scale in Lombardy, in northern Italy. The territorial characteristics of the local areas were less important in explaining the level of consumer and producer participation in the alternative food networks, rather than the specific factors related to the agricultural sector.

Keywords: direct sale; short supply chain; participation approach

From a consumer's point of view, the conventional globalised food system which entails scaling up supply chains in the interest of cost-effectiveness, has caused a disconnection between producers and consumers, often leading to anonymity (Philips 2006). Moreover, food crises and scandals have contributed to greater social awareness regarding facts surrounding food and have impacted on consumers' trust in the food system in general.

Alternative Food Networks (AFNs) are a possible solution to this disconnection as they bring together diets local economies and environmentally-friendly land use (Brinkley 2018). One of the most cited definitions of AFNs was published by Feenstra (1997) and describes them as "rooted in particular places, AFNs aim to be economically viable for farmers and consumers, use ecologically sound production and distribution practices, and enhance social equity and democracy for all members of the community". What is now labelled as an alternative food network is frequently traced back to social movements in the 1960s that sought to relocalise food production and consumption (Belasco 2014). AFNs have gained in popularity as a response to the sustainability issues associated with the conventional food systems (Forssell and Lankoski 2015) and as an alternative model to corporate-centric and industrialised food sectors (Renting et al. 2003). They encompass different forms of small scale, local and short food chains (Renting et al. 2003, Monaco et al. 2017).

Tudisca et al. (2014) have tried to define a taxonomy of AFNs, but the models are extremely diversified and hybridised. There are several forms of direct sales, for example on farm and online or 'pick your own', sometimes integrated with other farm activities, such as rural tourism and educational farm. In addition, there are consumers groups (e.g. Ethical Purchase Groups that engage with producers in Community Supported Agriculture (CSA), where farmers interact with consumers sometimes with the support of local government (public food procurement).

AFNs are based on sets of informal relationships among multiple actors, although, over time their organisation also entails formal mechanisms (Migliore et al. 2015). AFNs participants are also often seen as having altruistic or sustainability-related values and goals (Forssell and Lankoski 2015).

AFNs are evolving in a way that does not fully correspond to the original model of being an alternative

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to the conventional system because they have adopted some similar practices to conventional actors, and their value chains may overlap and interact with those of conventional food networks. AFNs sit squarely within the wider food system, influenced by it and influencing it, hybridising their practices and structures with the conventional food system (Mount 2012). Several forms of AFNs entail co-ownership and/or co-access to resources, goods and services for joint production and/or consumption. Other forms of AFNs, such as farmers' markets or short food supply chains (Wubben et al. 2013), do not involve co-ownership and/or co-access.

In the AFNs, the relatively direct relationship between the producer and consumer often plays a key role in the survival of these chains and implies new roles both for farmers and consumers. Farmers' direct participation and involvement in local markets are crucial for creating new opportunities. On the other hand, consumers' participation in AFNs implies a high awareness and often a higher willingness to pay than in global food chains.

Several papers have focused on the role of farmers (e.g. Migliore et al. 2015) and others on consumer participation (e.g. Siegrist et al. 2015) in AFNs. This paper assesses the agricultural and local drivers that influence the development of AFNs, in terms of being a joint effort of consumers and producers, by implementing an Ordinary Least Squares (OLS) regression. The analysis involved all 1 544 municipalities in Lombardy, one of the largest of the 20 regions of Italy.

HOW CONSUMERS AND FARMERS VIEW ALTERNATIVE FOOD NETWORKS

Consumers' point of view

In the USA and Europe, an increasing number of consumers are showing interest in local food (Ruggeri et al. 2016), and are often willing to pay higher prices for locally produced quality foods. However, very diverse motivations underlie this behaviour.

First, some consumers choose to be part of an AFN because they perceive food quality and production as a multifaced issue, including taste and safety, with social and environmental implications. AFNs may also be seen as reducing some of the conflicts in mediating between environment-related food choices and hedonic pleasure, and in satisfying both altruistic and individual eating motives (Costanigro et al. 2011).

Consumers choose AFNs because of the perception that they provide fresher, safer and healthier food, support local producers and preserve social and environmental aspects of farming (Denver and Jensen 2014).

According to Siegrist et al. (2015) more social and environmentally friendly food may also be perceived by AFN consumers as better tasting and even cheaper, because of the direct relationship between the consumer and producer.

Opting for AFNs may even have a positive impact on consumers' health because it leads to increased consumption of healthy foods such as fruit, vegetables, and wholesome foods (Hawkes et al. 2012). U.S. studies have shown that higher densities of Farmers' Markets (FM) and CSA are inversely related to individual weight outcomes (Berning 2012) and that AFNs have a negative association with obesity rates and diabetes (Bimbo et al. 2015).

Farmers' point of view

Farmers' participation in AFNs is increasing in developed countries. The number of farmers markets in the USA tripled between 1994 and 2009 (Martinez et al. 2010), and in the EU the number of different forms of AFNs is growing. Kneafsey et al. (2013) reported that farms involved in AFNs are usually small-scale businesses with less than 10 ha, typically joining in a scheme that involves less than 10 producers. Their market size is limited within given geographic boundaries and is oriented towards environmental and social friendly agriculture, by adopting sustainable techniques to produce quality foods. Depending on the particular scheme and organisation of an AFN, local farmers often supply their products directly to consumers or to local food hubs that distribute products through one or more entities (Engelseth 2016). The benefits for farmers to adhere to AFNs include increased business, diversification, networking, social and environmental motivations, development of knowledge and new skills.

The main benefit for farmers is the opportunity to internalise larger margins and to have direct access to consumers by reducing intermediation. The direct input on price allows farmers to regain control over decisions about what to produce, thus avoiding the vicious circle typical of traditional markets.

Furthermore, AFNs can be used as a complementary marketing channel, thereby enabling farmers to diversify where their food is sold and help them to survive during a financial crisis (La Trobe 2001). In fact,

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Table 1. Description of dependent variable

Variables included in dependent variable (*DEP*)	Indicator	Measurement unit	Data sources
EPG (*Ethical Purchasing Group*)	number of *EPG* in a municipality	number	Economiasolidale.net (2017)
DS (*Direct Sales*)	number of farms with direct sale activity in a municipality		ISTAT CA (2010)
AT (*Agri-tourisms*)	number of agri-tourisms' farms in a municipality		ISTAT CA (2010)
EF (*Educational Farms*)	number of educational farms in a municipality		ISTAT CA (2010)
FM (*Farmers' Markets*)	presence of farmers' markets in a municipality (during a year)		Campagna Amica (2016)

Source: different sources as indicated in the table

they can sell their products in AFNs during periods of the year when supply exceeds demand, while, at the same time, continuing to use traditional marketing channels. Profit maximisation and business growth are the main reason for a significant percentage of farmers' participating in AFNs.

Normally AFN farmers are small producers that cooperate with each other and with other actors in the food chains to supply local foods. Networking is important both inside the organisation, amongst farmers, and between farmers and food hubs and intermediaries, and farmers and consumers; and outside the organisation, such as local communities, public bodies and associations in order to develop projects and synergies in the context of local sustainable development. AFNs help farmers make social connections and enhance their role in the community and society where they can improve awareness of the environment, food safety, and rural development. Farmers that are part of AFNs contribute to protecting the environment through the short distance that the food travels from farmers to consumers, thus reducing CO_2 emissions, air pollution, traffic, accidents and noise pollution. Farmers in AFNs implement more sustainable production methods (e.g. organic) and enhance their entrepreneurial skills through the need to develop customer relationships, carry out marketing and gain business savvy by implementing the direct relationships with consumers. They also improve their technical skills by diversifying production, adopting environmental schemes, and by exchanging information and opinions with other farmers with regard to production methods and marketing.

METHODOLOGY

Conceptual framework and modelling

The study analysed some of the factors influencing the participation of consumers and farmers in AFNs in the study area. The dependent variable measures the number of participatory activities, both from the demand and supply sides (Table 1).

On the demand side, the *EPG* (*Ethical Purchasing Group*) were considered as a proxy of consumers' participation in AFNs. From the supply side, the variables included in the dependent variable are *Direct Sales* on and off farms (*DS*), *Agri-tourisms* (i.e. farms that also offer on-farm accommodation and holiday experiences) (*AT*), and *Educational Farms* (*EF*). Finally, *Farmers' Markets* (*FM*) involve both demand and supply.

The model was implemented at a municipal scale in Lombardy (northern Italy), using several databases (Table 2). Lombardy has 1 544 municipalities (ISTAT CA 2010), thus the database of the model collected 1 544 observations[1].

Table 2 reports on the participation drivers, where some explanatory variables are shown. Since the structural characteristics of agriculture in a geographical area may influence the development of certain types of the supply chain, some variables related to the primary sector were chosen. At the same time, the context

[1]The only explanatory variable with 1 541 observations rather than 1 544 is *AGE* (the average population's age), for lack of data in three municipalities (Table 3).

Agricultural Economics – Czech, 65, 2019 (6): 259–269

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Table 2. Explanatory variables description

Variable	Group name	Indicator	Measurement unit	Data sources
DEN	*Control Variables Group* (*CG*)	number of inhabitants of municipality /surface of the municipality	inhabitants/m^2	ISTAT CP (Census of Population) (2011)
UAA	*CG*	surface of *UAA* in the municipality	ha	ISTAT CA (Census of Agriculture) (2010)
ORG	*Agricultural Variables Group* (*AG*)	number of organic farms in the municipality	number	ISTAT CA (2010)
HOR	*AG*	(horticultural surface of municipality × 100) /*UAA* of the municipality	%	ISTAT CA (2010)
SMA	*AG*	number of farms in the municipality with less than 5 ha of *UAA*	number	ISTAT CA (2010)
PDO	*AG*	number of farms producing *PDO*'s products in the municipality	number	ISTAT CA (2010)
MIX	*AG*	number of farms with both vegetable and animal production in the municipality	number	ISTAT CA (2010)
WOM	*AG*	number of female farm manager in a municipality	number	ISTAT CA (2010)
PRO	*Territorial Variables Group* (*TG*)	surface in protected areas (parks) of the municipality	ha	Dusaf (2012)
INC	*TG*	annual income of the municipality /population of the municipality	EUR	OD Lombardy Region (2012)
AGE	*TG*	average age of the municipality population	number	ISTAT CP (2011)

DEN – density population of a municipality; *UAA* – utilized agricultural area of a municipality; *ORG* – organic farms of a municipality; *HOR* – horticultural surface of a municipality; *SMA* – small farms of a municipality; *PDO* – protected designation of origin farms of a municipality; *MIX* – farms with mixed production of a municipality; *WOM* – female farm managers of a municipality; *PRO* – surface in protected area of a municipality; *INC* – population's average income of a municipality; *AGE* – average population's age of a municipality

Source: different sources as indicated in the table

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in which farms work may influence farmers' choices in adopting specific market strategies. Territorial features were therefore introduced into the model as explanatory variables.

The agricultural factors (*Agricultural Variables Group – AG)* include variables related to the area of specialisation of the primary sector, e.g. the number of organic farms. Territorial factors *(Territorial Variables Group – TG)* are variables describing the environmental and socio-economic characteristics of an area, i.e. the average income of the municipality.

The *Agricultural Variables Group* includes: *ORG* (organic farms of a municipality), *HOR* (horticultural surface of a municipality), *SMA* (small farms of a municipality), *PDO* (protected designation of origin farms of a municipality), *MIX* (farms with mixed production of a municipality), *WOM* (female farm managers of a municipality).

ORG is the number of organic farms in an area, and we expect it to encourage a farmer's participation in AFNs because organic farmers are usually more attentive to alternative food chains as a possible market channel of their products. The presence of organic farming in an area could also attract the most environmentally oriented consumers and those interested in health aspects. *HOR* and *SMA* are expected to influence farmers to take part in a farmers' markets or to practice direct sales and, at the same time, could involve consumers in direct purchasing. According to previous work by our research group (Mazzocchi 2015), large areas dedicated to horticultural crops tend to foster the development of direct sales on and off farms. In fact, fruits and vegetables are often sold in local and farmers' markets due to the fact that they are very fresh. In addition, since small farms are often interested in shortening the supply chain in order to reduce costs, a high number of small farms in an area may influence the development of AFNs. In addition, according to Bertoni (2015), farms with both vegetable and animal products (*MIX*) are usually less efficient than the ones that adopt single crop farming and reduce costs by participating in AFNs is a strategy to achieve a sustainable income. Concerning farms that produce protected denomination of origin products (*PDO*), in Italy small specialised companies producing typical and unique products in a very limited geographical area could be very interested in participating in direct sales mechanisms without intermediaries. The percentage of female farm managers (*WOM*) was selected to highlight any connection between gender and the choice of AFN activities (Villamor et al. 2014).

The *Territorial Variables Group* includes: *AGE* (average population's age of a municipality), *PRO* (surface in protected area of a municipality), *INC* (population's average income of a municipality). The landscape structure is expected to influence the emergence of recreational activities (Pfeifer et al. 2009) such as *Agri-tourisms*. Regional parks in Lombardy aim to conserve the former natural vegetation and biodiversity. We hypothesised that *PRO* could positively influence the farmers' participation in AFNs. *AGE* was chosen to test whether a younger population could foster the participation in AFNs. In fact, young people are usually more inclined towards innovation (Rivaroli et al. 2016). A relationship between a higher income in an area and AFN participation is investigated by the *INC* variable. Finally, to test the robustness of the model, some variables were chosen as controls. They are *DEN*, i.e. the population density of the municipality, and *UAA*, i.e. the utilised agricultural area of the municipality.

The dependent variable (*DEP*) is:

$$DEP = EPG + DS + AT + EF + FM \quad (1)$$

where, as in Table 1, *EPG* is the number of ethical purchase groups in a municipality, *DS* is the number of farms that make directs sale in a municipality, *AT* is the number of agri-tourisms, *EF* is the number of educational farms in a municipality, and *FM* is the number of farmers' markets organized in a municipality (within the current year).

Because the analysis was carried out at a municipal scale in which the size of the municipality could influence the presence of AFN activities of the dependent variable, we performed a parameterisation of the dependent variable using the population of the municipality (ISTAT CA 2011). The same parameterisation was performed on the explanatory variables in order to consider the population size of the municipality, except for *AGE* and *DEN* which were already calculated in terms of the population of the municipality. After the parameterisation, all the variables, including the dependent variable, were standardised because of their different units of measurement and a correlation analysis was realised (Table 3). In fact, in regression, centring the variables so that the predictors have mean is recommended. Consequently, the intercept term is interpreted as the expected value of Y_i when the predictor values

Agricultural Economics – Czech, 65, 2019 (6): 259–269

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Table 3. Correlation analysis

	DEP	*DEN*	*INC*	*AGE*	*UAA*	*PRO*	*HOR*	*ORG*	*PDO*	*SMA*	*MIX*	*WOM*
DEP	1		–	–	–	–	–	–	–	–	–	–
DEN	–0.06	1	–	–	–	–	–	–	–	–	–	–
INC	0.01	0.44	1	–	–	–	–	–	–	–	–	–
AGE	0.03	–0.20	–0.24	1	–	–	–	–	–	–	–	–
UAA	0.35	–0.21	–0.14	0.01	1	–	–	–	–	–	–	–
PRO	0.15	–0.08	–0.05	0.07	0.28	1	–	–	–	–	–	–
HOR	0.13	–0.07	–0.06	0.04	0.43	–0.02	1	–	–	–	–	–
ORG	0.26	0.22	0.15	0.05	0.19	0.09	0.05	1	–	–	–	–
PDO	0.52	–0.13	–0.07	0.08	0.4	0.06	0.13	0.13	1	–	–	–
SMA	0.65	–0.13	–0.12	–0.07	0.36	0.24	0.05	0.12	0.24	1	–	–
MIX	0.57	–0.02	0.03	–0.1	0.41	0.04	0.18	0.17	0.44	0.49	1	–
WOM	0.67	–0.17	–0.14	0.07	0.58	0.13	0.31	0.18	0.59	0.59	0.58	1

DEP – dependent variable; *DEN* – density population of a municipality; *INC* – population's average income of a municipality; *AGE* – average population's age of a municipality; *UAA* – utilized agricultural area of a municipality; *PRO* – surface in protected area of a municipality; *HOR* – horticultural surface of a municipality; *ORG* – organic farms of a municipality; *PDO* – protected designation of origin farms of a municipality; *SMA* – small farms of a municipality; *MIX* – farms with mixed production of a municipality; *WOM* – female farm managers of a municipality

Source: our elaboration

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are set to their means. The *z*-score standardisation formula is:

$$z = x - \mu/\sigma \quad (2)$$

where x is the sample mean, μ is the population mean, and σ is the sample standard deviation.

By standardising both the dependent variable and the explanatory terms, we carried out the regression, and the coefficients results were then compared. We estimated an OLS regression model where the dependent variable has continuous values. The OLS regression formula is:

$$Y_i = \beta_1 x_{i1} + \beta_2 x_{i2} + ... + \beta_n x_n + \varepsilon_i \quad (3)$$

where i are the observations, x are the explanatory variables (Table 4), β are the coefficients of the regressions, and ε is the error term. Starting from the control variables, the others were then added one by one to test the effect of each one on the regression. Tests based on the Akaike Information Criterion (AIC) (Akaike 1973) and Bayesian Information Criterion (BIC) (Schwarz 1978) are used to gauge the goodness of fit of the models and to compare the performance of non-nested models. In both cases, a lower value means that a model is considered to be more likely to the true model. As a base model to compare the results against, the outcome is presented with only the control variables. Model A (Table 4), represents the effect of the control variables on the dependent variable. Model B shows the results of the controls plus *AG* independent variables on the dependent variable. Model C shows the results of the controls plus *TG* independent variables on the dependent variable, and Model D is the full model.

Table 4. Descriptive statistics

Variables	Observations	Mean	Std. dev.	Min	Max	Measurement unit
DEP	1 544	9.55	11.40	0	110	number of AFNs' activities /population of the municipality
DEN	1 544	549.08	776.27	0	7 061	inhabitants/surface of the municipality
INC	1 544	22 571.92	3 199.30	11 998	53 589	average income of the population in the municipality (EUR)
AGE	1 541	42.96	3.19	33	60	average age of the population in the municipality
UAA	1 544	639.14	933.64	0	14 544	hectares of *UAA* in the municipality /population of the municipality
PRO	1 544	387.50	1307.35	0	20 969	hectares of protected areas in the municipality /population of the municipality
HOR	1 544	11.33	61.03	0	1 529	hectares of horticultural surfaces in the municipality/population of the municipality
ORG	1 544	1.01	4.15	0	148	number of farms in the municipality /population of the municipality
PDO	1 544	7.11	18.52	0	222	number of farms in the municipality /population of the municipality
SMA	1 544	9.58	11.95	0	132	number of farms in the municipality /population of the municipality
MIX	1 544	1.55	2.39	0	23	number of farms in the municipality /population of the municipality
WOM	1 544	6.97	9.93	0	97	number of female farm's manager /population of the municipality

DEP – dependent variable; *DEN* – density population of a municipality; *INC* – population's average income of a municipality; *AGE* – average population's age of a municipality; *UAA* – utilized agricultural area of a municipality; *PRO* – surface in protected area of a municipality; *HOR* – horticultural surface of a municipality; *ORG* – organic farms of a municipality; *PDO* – protected designation of origin farms of a municipality; *SMA* – small farms of a municipality; *MIX* – farms with mixed production of a municipality; *WOM* – female farm managers of a municipality

Source: our elaboration

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RESULTS

The correlations do not suggest multi-collinearity since correlations among independent and control variables are well below the value of 0.60.

The regression analysis is presented in Table 5. To show the robustness of our findings, we tested alternative model specifications. We used the R^2, the AIC and BIC together to perform goodness of fit test of the models.

Model A was tested including only control variables; Model B with only the *AG* variables; Model C with the *TG* variables, and Model D, including both *AG* and *TG* variables. As we added the explanatory variables of interest, the fit of the Models B, C and D improved significantly compared to Model A.

Table 5. Regressions' results

Variables	Model A (only *CG*)	Model B (only *AG*)	Model C (only *TG*)	Model D (full model)
DEN (*CG*)	–0.172*** (0.024)	–0.010 (0.016)	–0.110*** (0.025)	–0.036* (0.017)
UAA (*CG*)	0.272*** (0.024)	0.062*** (0.019)	0.193*** (0.024)	0.062*** (0.019)
INC (*TG*)	–	–	–0.036 (0.026)	0.091*** (0.017)
AGE (*TG*)	–	–	0.305*** (0.025)	0.101*** (0.017)
PRO (*TG*)	–	–	0.028 (0.024)	–0.011 (0.016)
HOR (*TG*)	–	–0.007 (0.016)	–	0.002 (0.017)
ORG (*TG*)	–	0.056** (0.018)	–	0.048** (0.018)
PDO (*TG*)	–	0.418*** (0.020)	–	0.416*** (0.020)
SMA (*TG*)	–	0.588*** (0.019)	–	0.601*** (0.200)
MIX (*TG*)	–	0.009 (0.016)	–	0.004 (0.015)
WOM (*TG*)	–	0.023 (0.024)	–	–0.001 (0.024)
Observations	1 544	1 544	1 541	1 541
R^2	0.130	0.640	0.220	0.650
AIC (Akaike Information Criterion)	4 179	2 807	4 004	2 748
BIC (Bayesian Information Criterion)	4 195	2 855	4 036	2 812

significance levels are ***, **, * $p < 0.005, 0.05, 0.5$, respectively; *DEN* – density population of a municipality; *UAA* – utilized agricultural area of a municipality; *INC* – population's average income of a municipality; *AGE* – average population's age of a municipality; *PRO* – surface in protected area of a municipality; *HOR* – horticultural surface of a municipality; *ORG* – organic farms of a municipality; *PDO* – protected designation of origin farms of a municipality; *SMA* – small farms of a municipality; *MIX* – farms with mixed production of a municipality; *WOM* – female farm managers of a municipality; *CG – Control Variables Group*; *AG – Agricultural Variables Group*; *TG – Territorial Variables Group*

Source: our elaboration

https://doi.org/10.17221/230/2018-AGRICECON

As shown in Table 5, Model B (*Agricultural Group* variables) improved significantly compared to Model A, with a R^2 = 0.64 and AIC = 2.807, BIC = 2.855. Although Model C (*Territorial Group* variables) showed better results than Model A, it did not perform as well as Model B, resulting in R^2 = 0.22, AIC = 4.004 and BIC = 4.036. This means a higher influence of *AG* variables than *TG* variables on the dependent variable and a better fitting model. Finally, Model D performed similarly to Model B but included more information from the *TG* variables.

Model D was the best fitting model for our study. In Model D, seven of the eleven explanatory variables were significant. Among the *AG* variables, *ORG*, *PDO*, *SMA* were significant and positively related to the dependent. All these variables are related to the structure of the agricultural sector in the study area. Concerning the *TG* variables, including the socio-economic characteristics of the study area, *INC* was significant and positively related to the dependent variable. *DEN* is the population density of an area, and a proxy of the magnitude of the agro-food demand, and was inversely related to the dependent variable; whereas *UAA* was significant and positively related to *DEP*.

DISCUSSION

Agricultural factors are significant in terms of participation in AFNs, and the structural characteristics of the agricultural sector seem to be the most significant. *ORG*, *PDO*, *SMA* could be considered drivers of participation in AFNs. With regard to *ORG*, organic agriculture in Lombardy covers 2% of the regional *UAA*, and from 2010–2015 in some areas, the number of certificated organic farms almost doubled and the organic *UAA* increased by 14.2%, with a greater presence of young farmers than in conventional farms, and with a higher level of education. In fact, young and highly educated farmers are usually more interested in forms of innovation in food chains (Rivaroli et al. 2016). In recent years, many organic farmers, either individually or in groups, have been involved in AFN initiatives. For example, Organic Districts have been created in order to involve farms and consumers in a fiduciary relationship based on the supply of organic products.

On the demand side, AFN consumers are often interested in purchasing organic products (Denver and Jensen 2014). The positive influence of *PDO* on participation in AFNs is mainly explained by the fact that farms producing *PDO* products, especially the small farms, are particularly interested in developed forms of distribution that are alternative to the traditional channel. In fact, those farms involved in "niche" products within a limited geographical area (i.e. following *PDO* regulations), often participate in local food exhibitions, farmers' markets and *EPG* networks.

SMA (i.e. small farms) was a significant driver of participation in AFNs and can be explained as follows. Firstly, in the last twenty years, the food sector has witnessed various outbreaks: "mad cow", "bird flu", and "swine disease". In the same period, repeated crises of agricultural markets have increased the price volatility of agricultural commodities. This has mainly affected a sector where production is based on high investments and long-term decisions, such as livestock. In this context, the participation of small farms in AFNs is a strategic choice in order to increase the farm's income. In Lombardy, many small farmers prefer to participate in *FM* and sell to *EPG*. Lastly, small farms process animal and vegetable products, and sell them in AFNs rather than opt for mainstream marketing channels where retailers dominate, and producers can only get low prices.

Territorial factors that influence the participation level in AFNs are *AGE* and *INC*. The model shows that the higher the income of the local population, the higher the participation in AFNs. *INC* could be interpreted as the potential willingness to pay for AFN products, so local populations with a high average income are more likely to be involved in AFNs. As suggested by Engelseth (2016), the typical buyers of local foods are women, college educated and with above-average incomes.

AGE is the average age of the population in a municipality and is positively related to *DEP*; this means that the higher the age, the higher the participation in AFNs. Although there seems to be a wider interest by younger people in AFNs, this result seems to indicate a higher involvement of the older population in the development of AFNs, or rather a greater presence of AFNs in municipalities where the average size of the population is higher.

The density of the population (*DEN*) may be interpreted as the magnitude of the demand. Surprisingly *DEN* is negatively related to the dependent variable, but it could be explained by the fact that the lower the population density, the lower the number of urbanised areas for residences and industrial settlements and thus the greater the amount of agricultural land and farmers that can take part in AFNs. At the same time, *UAA* was significant and positively related to AFNs,

https://doi.org/10.17221/230/2018-AGRICECON

confirming that the more agricultural area is used, the more likely AFNs will develop in that area.

The characteristic of shortening the distance is related to notions of localness, the small size of networks, transparency, information, and short supply chain. This concept could have multiple meanings: physical distance, value chain distance, reflecting the number of intermediaries in the food supply chain, and informational distance, reflecting the ways in which AFNs increase the availability of information about foods, their production methods, producer and place of production. In this vision of AFNs, territorial characteristics seem to be less important in explaining the phenomenon of consumers' and producers' participation in AFNs, while factors specifically related to the agricultural sector seem to have more importance in terms of being drivers

CONCLUSION

This paper has explored the drivers for the development of AFNs in Lombardy, northern Italy.

AFNs can be considered as innovative forms of markets where specific segments of demand meet the targeted supply, and where both consumers and producers are often driven by ideal and/or ideological backgrounds and share a common vision of the food system and sustainability. Both try to escape the mainstream market channels which supply standardised, undifferentiated and conventional food, whereas members of AFNs have their own alternative ways of producing and purchasing food.

Our main findings show that the features of the local agricultural system can trigger the development of AFNs more than the territorial characteristics included in the *Territorial Group*. In particular, AFNs are more likely to exist where farms are small and oriented to organic farming and typical certified production. At the same time, the number of AFNs increases, when the average income and age are higher.

AFNs are the result of the interaction between farms aimed at quality production and consumers willing to pay for environmental and local friendly products. According to the literature, AFNs help preserve farmland from urbanisation and at the same time spread a healthier and more sustainable life style, but only where consumers are richer and more aware. Only a joint effort and a willingness to share visions by consumers and producers can give rise to AFNs.

The main limitation of this paper is the use of territorial and farm system data as proxies of participation, whereas a direct survey of farmers and consumers about the motives for participation might lead to a greater understanding of the determinants of the success of AFNs.

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