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ON-FARM AND REGIONAL FACTORS AFFECTING THE PARTICIPATION OF FARMERS TO ALTERNATIVE FOOD NETWORKS

1. INTRODUCTION. — The study of alternative food networks (AFNs) gained growing attention and nowadays some scholars argue (Goodman, 2003; Sonnino, Marsden, 2006; Tregear, 2011) that it is appropriate to reflect critically on the results of these body of literature and consider what is needed for the focus and directions of future research.

A first problematic feature in AFN research is a tendency to bifurcate agri-food systems into two antagonistic type, namely "alternative" and "conventional" food systems. The latter are characterised by strong economies of scale reliant on industrialised methods of food production and processing, large distribution and consumption networks, while the former can rely on AFNs such as farmers' markets, community supported agriculture, on-farm direct sale, informal groups of consumers, community gardens, vegetable box scheme, etc. There are a few case studies (Murdoch, Miele, 1999; Straete, Marsden, 2006; Jarosz, 2008) demonstrating that clear boundaries between them do not exist and therefore "in the context of the evolutionary dynamics of alternative food networks, the conventional dichotomy between standardized and localized food does not thoroughly reflect the present reality of the food sector" (Sonnino, Marsden, 2006, p. 184).

The AFNs can be considered as innovation systems (Randelli, Rocchi, 2017) offering an additional market option to farmers, which can operate on both alternative and conventional networks (Mastronardi *et al.*, 2015). Furthermore, both alternative and conventional networks have a role to play in the sustainable transformation of agriculture. In isolation, none of these two agri-food systems would necessarily lead to sustainable transformation of mainstream markets because AFNs tend to be stuck in their high quality, low-market penetration niches, while conventional food systems have a tendency to react to cost pressures by lowering the quality standards of their products (Sonnino, Marsden, 2006; Hockerts, Wüstenhagen, 2010).

The present study goes beyond the dichotomy between conventional and alternative which are patterns of the same agri-food system: dominant and incumbent the first, innovative and emerging the latter. Furthermore, it argues that the sustainable transformation of agriculture is not going to be brought about by alternative or conventional food networks stand alone, but instead that their interaction and co-evolution is essential (Hockerts, Wüstenhagen, 2010). The challenge posed by the co-evolution between conventional and alternative food systems goes beyond a more intense integration of studies and it requires a stronger understanding of the competitive space in which both are embedded. This would allow to uncover the evolution at the niche level of competitive (network of) farmers and their ability in creating new spatial organizational structure which compete with the more standardised productionist systems. In this sense we propose to study the agri-food system as a competitive rural space where conventional and alternative food system coexist, although with different set of quality, embeddedness and commercial networks.

A second problematic feature of AFNs research is an unclear theoretical perspective and a large focus on specific case studies of AFNs. The shift from a de-localized conventional food system to a re-localized alternative food system is not a linear process, as it involves experimentation, learning processes, new spaces, new capabilities, new policies, adjustment and reconfigurations. In addition, the geographical dimension of the transition changes the background of every process and the transition shapes differently in every region (Coenen, Truffer, 2012). In order to reveal the dynamics and mechanisms that move towards a ri-localization of food systems, this paper suggests to draw the analysis upon recent evolutionary economic geography (EEG) literature (Boschma, Martin, 2010).

In this paper, we study the on-farm and regional factors affecting the farmer's choice to partecipate to AFNs in Italy. Differently to previous studies (Aguglia *et al.*, 2011) we use data on the entire Italian farms' population, available from the Census of Agriculture carried out by ISTAT (Istituto Nazionale di Statistica) in 2010 (about 1,653,000 farms). The Census Questionnaire asks the respondents to quantify the share of different marketing channels, including on-farm and off-farm direct selling to consumers. We use this information as a proxy of farmer's participation to AFNs. As we use the micro data, we know every single farm in Italy selling, the entirety or a part of their products, on AFNs.

Despite the focus on the new geographies of food has increased in the literature (Gatrell *et al.*, 2011), the lack of a spatial perspective on AFNs has endured (Dansero, Puttilli, 2014). While they all shared a common focus on the way food supply chains are subject to increasingly pervasive changes in the organisation of their social, economic, environmental, cultural and spatial set-up, it is not clear which typology of geographical context fosters the development of AFNs. In this paper we explore a third level of explanation of the farmers' participation to AFNs, taking into account the farms' location and a set of variables on the geographic context.

The empirical setting of the analysis reflects the three different levels of explanation of farmers' choice (farm and farmers characteristics and geographic context). We estimate a linear probability model using a multi-level approach that allows us to capture, beside the impact of individual characteristics (such as farmers' age and education or farm endowment of production factors), also the influence of regional peculiarity of the municipality, province and regions where each farm operates. Moreover, we pay a great attention on the spatial determinants of the outcomes including in the regressions also spatially lagged variables describing the geographical, social and economic aspects of neighbouring area and the characteristics of other (neighbouring) firms (see Drukker *et al.*, 2013).

The research questions that this paper follows to answer are then: among the whole universe of Italian farms, which are those, operating on AFNs? Which farm and/or farmer characteristics' increase the probability to operate on AFNs? Which regional context do positively affect the spread among farmers of a direct marketing with consumers?

This paper is structured as it follows: section two introduces the theoretical framework and the hypothesis to be tested in the model; section three presents the methodology; section four introduces the dataset and the descriptive statistics; section five reports the results of the econometric analysis; section six presents some conclusions and insights for future research and policies.

2. THEORETICAL FRAMEWORK. — In recent years, EEG has attracted increasing attention (Frenken, 2007; Boschma, Martin, 2010) and its conceptual framework has been applied to explain the path creation process in many different economic sectors. As Boschma and Martin (2007) put it, EEG deals with the process of spatial diffusion of economic novelties such as innovations, new product, new firms, new networks. The emphasis is on the micro-behaviours of economic agents (individuals, firms, organisations) and the analysis focus on the locational behaviour of firms and how firms compete and learn based on their routines in time and space. Due to their tacit and cumulative nature, routines do not change easily and they are difficult to be imitated (Boschma, Frenken, 2006).

The development of AFNs is a novelty that requires a deep renovation of farmers' routines. In the early stage of a new path such as the re-localisation of agri-food system, the key mechanisms is the imitation of successful routines. The literature has focused on agglomeration externalities as a mechanism that allows firms to acquire successfully routines from other firms. In particular, co-location creates possibilities for knowledge spillover and the exchange of ideas through face-to-face contacts (Storper, Venables, 2004). Broadly speaking, there is a general claim in the literature that location matters in the sense the more proximity between actors, the more interaction, the more interactive learning, and more innovation.

Also in the case of AFNs, the transfer of knowledge may happen face-to-face and the spaces for such an interaction are at the core of the innovation process (Randelli, Rocchi, 2017). Such networks also function as social production systems in which trust and knowing each other play an important role (Graziano, Forno, 2012). These localized networks are important for yet another reason: it is through these networks that farmers gain reputation and recognition within their field. Although reputation and credibility are important for all firms, they are even more crucial for firms producing food. The partnership-based characteristic and the high value of face-to-face contacts in AFNs makes it important for farmers to be geographically closed to these networks (Brunori *et al.*, 2012) which have a double effect: to reinforce the alliance between consumers and farmers and to increase the demand for local food. These emerging networks are farmers' market (Randelli, 2015). It follows that farmers located in a geographical context dense of farmers' markets might be fostered in the decision to explore different marketing strategies. Broadly speaking, the role of farmers' market goes further the phase of "market formation" (Randelli, Rocchi, 2017) and they function as incubator spaces as they support the process of research and experimentation in an early phase of a path creation (Boschma, Martin, 2010).

Hypo n. 1: Closer to farmer' markets, higher the probability to succeed in the transition towards AFNs.

Few scholars took a rather critical stand (Nooteboom, 2000; Boschma, 2005) and argued that proximity means more than just geography as it includes also non-spatial dimensions such as cognitive, organizational, institutional and social aspects. Therefore, the geographical proximity is important but it is not sufficient to have access to new routines (Boschma, 2005). It follows that other individual characteristics may also foster the process of innovation and not all farmers will have equal access to knowledge. In a competitive rural space, farmers with an absorptive capacity, which is to say with a specific background and skills, will have a higher probability to access the specific knowledge related with AFNs.

Hypo n. 2: To be competitive in a re-localised agri-food system the farmers need some selected capabilities (namely the use of ICTs) and a high educational degree. The youngest farmers have more probability to step into AFNs.
Hypo n. 3: The small and organic farms are more interested in the participation of AFNs.
Hypo n. 4: The local presence of tourists can support the growth of direct sale.

Many scholars (Jarosz, 2008; Aguglia *et al.*, 2011) have proposed proximity to urban areas as a factor affecting the choice of direct selling, due to the availability of better infrastructure and services supporting the growing interest of urban consumers to the so – called "relocalization" of food. As a proxy of urban area we will test in the model the effect of population density on AFNs. Furthermore, in order to reach and to be reached by consumers, we assume as relevant the accessibility of farms. As a proxy of accessibility we will test the effects of road infrastructure per km^2.

Hypo n. 5: Higher the population density and the GDP per capita in the surroundings of the farm, higher the probability to operate in the AFNs.
Hypo n. 6: Better the accessibility (km of roads), higher the probability to sell directly to consumers.

The selection environment also includes institutions, "whose effects become especially visible when a major institutional change occurs and the 'playing field' on which firms compete changes dramatically" (Boschma, Martin, 2010, p. 12). Thus, understanding the transition of agri-food systems from long to short networks requires an analysis of institutions and policies, as relevant enabling and constraining contexts. Any institutions (municipality, region and country) may influence the emergence of new paths at the micro level of the firm, although today the Common Agricultural Policy (CAP) affects rural development widely and more deeply than national and regional policies do. On the other hand, regions and countries can change policies, and they can use European funding in many alternative ways.

In conclusion, we will explain agri-food transitions as a shift from a predominant historical conventional system to a new ri-localized organic food system through the interplay of processes at three different levels: micro (local), meso (regional) and macro (European). The important point of such evolutionary approach is that the further success of AFNs within rural area is not only governed by processes within the micro-level (Hypo 1-7), but also by developments at the meso and macro level. It is the alignment of developments (successful processes within the micro level reinforced by changes at meso and at the macro level) which determine whether a rural shift towards a re-localisation of agri-food systems will occur.

Hypo n. 7: Higher the total amount of CAP funds in the region, higher the probability to find AFNs.

3. ECONOMETRIC ANALYSIS. — Our analysis bases on the spatial dimension of Census data focusing on three kinds of determinants: a) the characteristics of the farm and the farmers, b) the characteristics of the area where the farm is located (the context variables) and c) the characteristics of the neighbouring areas (context variables weighted for the distance from the farm).

As mentioned above, a very important piece of our analysis is the explicit consideration of the spatial dimension. This means that we are taking into account that each observation (each farm) is located in a specific municipality, which is included in a province, which in turn belongs to a given region: at best then, we have three different levels to identify the location of each observation. From a theoretical point of view the spatial dimension can be represented considering that each different level has a level-specific stochastic component that captures erratic component shared among all farms in that level. Such a structure can be used in a multilevel regression: in our, the estimation we are dealing with three different spatial levels (whose lower one is made of 8,092 Italian municipalities) plus a fourth one representing the farm.

A further spatial dimension that can be included in the model is represented by spatially lagged variables, that is, variables representing the characteristics of more distant municipalities weighted for the distance from the farm. Including spatially lagged variables is equivalent to assume that not only the characteristics of the area in the immediate proximity of a farm (the municipality in our case) affect its decisions but also the characteristics of more distant (even though close enough) areas. A spatial lag of a variable is defined as a weighted average of values of the variable over neighbouring units, where the weighted average are obtained using a spatial-weighting matrix. The spatial-weighting matrices allow us to take into account Tobler's first law of geography – "everything is related to everything else, but near things are more related than distant things" (Tobler, 1970). In our specific case, we compute an inverse-distance spatial-weighting matrix that is composed of weights that are inversely related to the distances between the units: this is done computing the inverse of the Euclean distance obtained from the coordinates of the area where the farm is located.

All this said, we estimated the following equation:

$$V_{i,\,m,\,p,\,r} = \alpha + \beta_1 x_i + \beta_2\, x_m + \beta_3 x_{m\,sl} + \varepsilon_i + \varepsilon_m + \theta_p + \omega_r$$

where, i identifies the individual farm, m the municipality, p the province and r the region; α is the constant term; x_i are the individual characteristics of the farm, x_m are the context variables in the municipality where the farm is located, $x_{m\,sl}$ are context variables spatially lagged with respect to the municipality where the farm is located. The terms ε_i, ε_m, θ_p, and ω_r are the normally distributed error terms at the different levels. Finally $V_{i,\,m,\,p,\,r}$ represents the dependent value which tells whether the firm i, located in municipality m, province p and region r is directly selling its product: this variable is one in case of direct selling and zero otherwise.

TAB. I – MULTILEVEL LINEAR PROBABILITY MODEL FOR DIRECT SALE

	Dependent variable: Direct sale
Farm and farmer characteristics	
Age	-0.000459 (0.000513)
Age squared	-2.01e-06 (3.07e-06)
Female	-0.00726*** (0.00170)
Lower secondary education	-0.00512* (0.00227)
Intermediate secondary education in agriculture studies	0.0247* (0.00972)
Intermediate secondary education	-0.000994 (0.00285)
Higher secondary education in agriculture studies	0.0319*** (0.00533)
Higher secondary education	-0.00224 (0.00296)
Tertiary education in agriculture studies	0.0303*** (0.00509)
Tertiary education	-0.0144** (0.00483)
Farm has employees	-0.00915 (0.00752)
Farm employs family members	-0.0252 (0.0130)
Farm produces organic products	0.118*** (0.0125)
Farm has Internet access	0.106*** (0.0143)
Farm has a web page	0.236*** (0.0225)
Farm uses IT devices	0.0463*** (0.00808)
SAU	1.57e-07 (2.54e-07)
Total sales	-1.95e-08*** (2.73e-09)
Context variables	
First pillar PAC expenditure per total SAU	-9.52e-05 (8.82e-05)
Second pillar PAC expenditure per total SAU	-0.000146 (0.000629)
Hill	0.0793*** (0.0195)
Mountain	0.0945*** (0.0230)
Population density	1.03e-05* (4.14e-06)
Higher secondary education, % of population	-0.0171 (0.126)
Tertiary education, % of population	-0.0575 (0.0962)
Average income per capita	4.57e-06 (3.17e-06)
Total square km of roads	0.0433 (0.0563)
Number of tourist visitors per capital	-0.000711 (0.000874)
Farmer markets per km	0.117 (0.169)
Farmer markets per km squared	-0.359* (0.175)
Spatially lagged context variables	
Farmer markets per km	91.88* (43.07)
Farmer markets per km squared	680.2** (240.0)
First pillar PAC expenditure per total "SAU"	-0.186 (0.189)
Second pillar PAC expenditure per total "SAU"	1.493 (0.898)
Population density	0.00357 (0.00199)
Higher secondary education, % of population	-11.97 (23.77)
Tertiary education, % of population	-42.99 (98.50)
Average income per capita	-0.00130 (0.0297)
Total square km of roads	781.3 (757.8)
Number of tourist visitors per capita	-20.21 (22.34)
Constant	0.115 (0.115)
Observations	1,620,884

Robust standard errors in parentheses: ***$p<0.001$, **$p<0.01$, *$p<0.05$.

The estimation was performed using a multilevel (with 4 levels) linear probability model. The estimation is computational problematic: the huge number of observations (about 1.5 millions), 4 levels of the erratic components two of which are extremely large (the farm level and the municipality level with about 8 thousands municipalities) complicate things. Combining these difficulties with the known problems with logit and probit regressions (see Wooldridge, 2010) we choose to use the linear probability model, which is known to do a very good job in estimating the partial effects of the explanatory variables (*ibidem*).

In the estimation we also focused on the difference that can be present between farms that differs on their type of production (the survey distinguish 9 different types). Therefore we estimates some coefficients to be farm-type specific: the actual variables with farm-type specific coefficients were selected after several trials.

In Table I are provided the results of our estimation.

4. RESULTS AND FINAL REMARKS. — The results show some key determinants of the direct sale. First of all, IT related variables all appear to have a positive effect on direct sale. The degree of education of the farmer also matters and more educated ones, surprisingly, are less likely to choose the direct channel of sale. However, when education is based on agriculture studies, then the probability increase. Also age matters, and younger farmers are more likely to sell directly; females, on the contrary are less likely to do it. So hypothesis 2 and 3 are partially confirmed.

Different from other studies, farm size in terms of hectares of Utilized Agricultural Area does not significantly affect the choice of direct selling, although higher the total sales, lower the probability to have a direct sale.

The systematic inclusion of the spatial component of available information probably is the main reason of this result: net of the regional differentiation of farm structures (captured by fixed effects at the regional level), the physical size of the farms becomes less relevant in explaining the participation to short food supply chains.

Furthermore, whereas the characteristics of the area in the immediate proximity of farms do not matter too much, also the spatially lagged context variables are not more often significant. As expected (Hypo 1), only the number of farmers' markets has a positive effect. These localised network may function both as a placed for face-to-face meeting with other farmers and as places to meet consumers.

Both first and second pillar PAC expenditure have not a significant effect when considered at the level of the municipality where the farm operates. It follow that agricultural policies do not affect the spread of the innovation in the marketing.

If we look to the context in the neighbouring areas of farms we find that, unexpectedly, population density (Hypo 5) has no significant effect on the probability to join with short forms of food supply chain, nor when considered at the municipality level neither when considered as a spatially lagged variable. The education attainment of population shows any impact. Square kilometres of roads and number tourists don't show any positive effect and then hypothesis 4 and 6 are not confirmed. Finally also the per-capita income of population doesn't affects the probability to adopt direct forms of marketing.

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RIASSUNTO: In questo articolo si analizzano i fattori aziendali e regionali che influenzano la scelta dell’agricoltore di partecipare alla filiera corta in Italia. Utilizziamo le informazioni disponibili nel Censimento dell’Agricoltura del 2010. Il questionario sul censimento chiedeva agli intervistati di quantificare la quota dei diversi canali di commercializzazione, tra cui la vendita diretta ai consumatori in azienda e fuori dell’azienda. Abbiamo usato queste informazioni come proxy della partecipazione dell’agricoltore alla filiera corta del cibo. Per calcolare la probabilità che le imprese scelgano canali di marketing diretto ai consumatori abbiamo adottato un modello di probabilità lineare utilizzando un approccio multilivello che ci consente di catturare, oltre all’impatto delle caratteristiche individuali (come l’età degli agricoltori e istruzione o dotazione aziendale di fattori di produzione), anche l’influenza delle peculiarità regionali del comune, della provincia e delle regioni in cui ogni impresa opera. Inoltre, abbiamo prestato grande attenzione alle determinanti spaziali dei risultati, includendo nelle regressioni anche variabili spazialmente ritardate (*lagged*) che descrivono gli aspetti geografici, sociali ed economici dell’area vicina e le caratteristiche di altre imprese (vicine). Il modello è stimato utilizzando l’intera serie di osservazioni sulle singole aziende agricole in Italia.

SUMMARY: In this paper we study the on-farm and regional factors affecting the farmer’s choice to participate to short food supply chains in Italy. We use information available from the Census of Agriculture carried out by ISTAT in 2010. The Census Questionnaire asks the respondents to quantify the share of different marketing channels, including on-farm and off-farm direct selling to consumers. We use this information as a proxy of the participation of the farmer to short food supply chain and use it to define also an index of intensity of such a participation. To model the choice of firms in terms of marketing channels (direct versus non-direct forms) we adopt a linear probability model using a multi-level approach that allows us to capture, beside the impact of individual characteristics (such as farmers’ age and education or farm endowment of production factors), also the influence of regional peculiarity of the municipality, province and regions where each firm operates. Moreover, we pay a great attention on the spatial determinants of the outcomes including in the regressions also spatially lagged variables describing the geographical, social and economic aspects of neighbouring area and the characteristics of other (neighbouring) firms. The model is estimated using the whole set of observations on individual farms in Italy.

Parole chiave: filiera corta, Censimento dell'Agricoltura, analisi spaziale
Keywords: short food supply chain, census of agriculture, multilevel linear probability models, spatially lagged variables