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The Resilience of Bergamot Farmers in the Reggio Calabria Province of Southern Italy

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Abstract

Bergamot is a citrus fruit with more than 90% of the global production coming from the Reggio Calabria province. It is used almost exclusively as an essential, high-quality fragrance ingredient. A study was carried out to examine the impact of the stability that has occurred in the bergamot sector after the reform of the bergamot value chain in 2007. The objectives of this paper are (i) to measure the resilience of bergamot producers, (ii) to highlight the structure of their resilience building strategy, (iii) to assess the relevance of the bergamot production and the reform of the bergamot value chain. Interviews with representatives of 326 households who produce bergamot and are registered at the Consortium of Bergamot of Reggio Calabria were carried out in three interview centres across the province in March and April 2014, using a CAPI-adapted technique. The measurement of bergamot producers' resilience was based on the application of multivariate analysis techniques and on the existing body of knowledge regarding social and ecological resilience. The study demonstrated that almost 70% of interviewees have seen their income increase by between 32% and 35% in the seven years to 2014. Bergamot was identified as both being more profitable than other crops and contributing to farmers' resilience by increasing their access to networks. Using a simulation scenario approach, analyses showed that if the cultivation of bergamot were no longer carried out it would induce a decrease in producers' resilience by 21%.

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1. Introduction

Agriculture plays a significant role in Calabria's economy. During the 1950's, the Italian land reform took place as a ten-year plan which focused on irrigation, land transformation, mountain conservation and afforestation, agrarian reform, road construction and the provision of public water supply (Dickinson, 1954). It resulted in changing the dynamics and visual appearance of the region as the former large landed estates, 'latifundia', were broken up and new small holdings were created. In addition, the government invested in promoting the growing of commercial crops such as citrus fruits, figs and chestnuts to supplement the traditional agricultural activities of the region which were focused on growing cereals and olives and on the raising of sheep and goats. Calabria is one of the poorest regions in Italy.

Nowadays, Calabria is characterised by small agricultural units with an average farm size of 3.2 hectares, compared, for example, to France or Germany where the average farm sizes are 55 and 56 hectares, respectively. These data indicate that the region has many small and medium agricultural enterprises which produce crops mainly for direct family consumption (Arzeni & Sotte, 2013). However, recently there has been an increase on a regional level regarding the average farm size (from 3.2 hectares in 2000 to 4.0 hectares in 2010). The workers in a farm are mostly relatives of the farm owner (72%), with foreign agricultural workers representing less than 14% of the farm labour workforce.

This study focuses on the Reggio Calabria province, where bergamot production takes place, near the Ionian coast, between the towns of Villa San Giovanni and Gioiosa Jonica (Consorzio di Bergamotto)[1].

The province is characterised both by a good agro-ecological potential but also by a substantial fragility due to very substantial recent and historic deforestation and to a climate that alternates between long droughts and rain storms (Ciancio et al., 1995). Vines and olives are produced along with bergamot, clementines and other citrus fruits. A large part of this province is taken up by the Aspromonte National Park which contains thousands of hectares of pine forests on the Tyrrhenian side and beach on the Ionian side. The olive production is the most significant both in terms of surface area (41.6%) and number of farms (83.2%) involved, while citrus is at number three with 12.4% of the land and 28.5% of farms (ISTAT, n.d.).

[1] Available online: http://www.consorziodituteladelbergamotto.it/inglese.html

Bergamot is a citrus fruit (*Citrus Bergamia Risso*) which is yellow when ripe. It blossoms in April and the fruit is harvested between November and March. More than 90% of the global production is coming from the Reggio Calabria province in southern Italy. It is used almost exclusively as a fragrance ingredient. However, a small portion of the production is used as a flavouring and in the pharmaceutical and cosmetics industries. Approximately 1,200 hectares is under bergamot production with an average crop of some 100,000 kg of the essential oil. To obtain 1 kg of oil, approximately 200 kg of fruit are required. It is estimated that 6,000 people are employed in the bergamot cultivation and the essential oil production (Consorzio di Bergamotto, 2012).

Bergamot is a significant ingredient for the perfume industry where it is used in more than 65% of women's perfumes and almost half of men's fragrances. Its sourcing steps are the following:

- The bergamot crop is delivered from the farmer's property to the processing plants.
- Bergamot fruits are washed and any that are unsuitable are discarded.
- Using a variety of physical processes, the surface of the fruit which contains the oil is abraded into a water medium.
- The oil is then separated from the water.
- It is then purified using high-vacuum distillation.
- The remains of bergamot fruit are mainly used as fertilizer but a small amount is used in food and pharmaceutical production.

The Consortium for Bergamot oil of Reggio Calabria Tutelace is a regulatory body which was reformed in 2007 and ensures that the bergamot essential oil produced in the region meets the criteria set out by the European Union. In 2001, the European Union created a Controlled Mark of Origin for essential oil from Reggio Calabria bergamot. This covers all key aspects, including bergamot cultivation, extraction of the essential oil and marketing. It also foresees the establishment of the Consortium to monitor Reggio Calabria bergamot in all these stages. Unionberg is a consortium of bergamot producers closely linked to the Consortium for Bergamot oil of Reggio Calabria Tutelace. Unionberg has created agreements with the main bergamot transformation industries to stabilise prices and relationships between demand and supply.

The *"Commission Decision of 5 July 2005 on the aid scheme which Italy plans to implement for the protection of bergamots and bergamot derivatives in Calabria (Notified under document number C (2005) 1814)"* is the key piece of legislation.

Calabria receives funding from the EU through the European Regional Development Fund (ERDF) in support of its programmes on regional development, economic change, and enhanced competitiveness. Funding priorities include research, innovation, environmental protection and risk prevention. Infrastructure investment retains an important role (EC Regulation, 2006).

The aim of the study is two-fold. Firstly, to survey those involved with bergamot production to understand the impact of the changes (the initiative of the Consortium to stabilise the price of bergamot and restore a voluntary stockpile system for the Consortium members) that have occurred in recent years and which has induced an overall stability for the sector. Secondly, to measure the livelihood resilience of bergamot farmers in the Reggio Calabria province. The objective is thus to identify the structure of farmers' resilience-building strategies and assess the role of bergamot production in these resilience-building processes. This paper therefore sets out to examine if techniques utilised in developing countries can be applied in this region and, to what extent, this 'new situation' has impacted the resilience of those households involved. The bergamot sector in Reggio Calabria depicts a stable and sophisticated environment where an increasing number of producers is both interested in increasing the quantity and improving the quality of the bergamot that they produce. There are farmers in the area who have expanded their bergamot production or have the intention to do so by purchasing more land, or by expanding their bergamot cultivation, or both. This exemplifies the general attitude towards bergamot, which is seen as a serious, long-term investment which could bring in a substantial income to the household. Therefore, the study sets out to identify the impact of long-term price stability of bergamot, a major fragrance and flavouring ingredient, on households in Calabria, an economically depressed region in Italy.

2. Resilience of Social-Ecological Systems

Resilience – derives from the Latin '*resalire'* meaning to spring back – has become a widely used term in many disciplines ranging from psychology to ecology (Community and Regional Resilience Institute, 2013). The concept of resilience is already well-established in the ecological literature, but is comparatively new to socio-economic

systems (Alinovi et al., 2009 and 2010). In broad terms, resilience is a measure of a system's ability to withstand stresses and shocks, that is, its ability to persist in an uncertain environment.

A key dimension of resilience is the 'social-ecological system' (SES). Natural resource management relates not just to ecological or social issues, but to having multiple integrated elements. Social-ecological systems have, *inter alia,* cultural, political, social, economic, ecological, and technological components that interact together, emphasising the 'humans in nature' perspective in which ecosystems are integrated with human society (Resilience Alliance, 2010).

From the social sciences' perspective, the link between social and ecological resilience is the dependence of communities, and their economic activities, on ecosystems, showing that the two systems have synergistic and co-evolutionary relationships. It is evident that the resilience of a social system is related to the resilience of the ecological system on which the former depends. This is more evident for social systems that are dependent on a single ecosystem or a single resource. In addition, analysis of the resilience of 'institutions', including habitualised behaviour, the rules and norms that govern society as well as the more usual notion of formal institutions with memberships, constituencies and stakeholders, which govern the use of natural resources and create incentives for sustainable or unsustainable use within social systems, is a central component linking social and ecological resilience (Adger, 2000).

This study adapted the resilience concept (Alinovi et al., 2009 and 2010) developed within the environmental context to the livelihood strategies and agricultural production of households in a rural setting in southern Italy.

3. Data & Methods

Two bespoke questionnaires were developed for both household and community levels that enabled the resilience of target group to be evaluated.

The 'household' questionnaire consisted of 150 items and its administration lasted approximately 45 minutes. The interviewees were all bergamot producers of the province of Reggio Calabria, members of the Bergamot Consortium (Unionberg Association). The sample for interview was drawn from a list of approximately 350 farmers who are currently members of the Consortium (Unionberg Association). This list was provided by the President of the Consortium of Bergamot. These farmers were the target group for interviews, irrespective of the location and the size of farm. Part

of the items of the questionnaire were retrospective: since the reform of the Bergamot Consortium took place in 2008, a seven-year interval was used in order to capture the possible differences that might have occurred due to the stabilisation of the bergamot prices.

During this phase 326 farmers were interviewed using the bespoke questionnaire. The interviews were carried out in three centres established in the villages of San Gregorio, Bianco and Condofuri. The farmers, who were interviewed in each centre, were mostly from the nearby area (Table 1).

Table 1 – Geographical Distribution of Interviews

Centre	Frequency	%
Bianco	136	41.72%
Condofuri	58	17.79%
San Gregorio	132	40.49%
Total	**326**	**100.00%**

Source: Authors' elaborations

The 'community' questionnaire was an adaptation of the 'household' questionnaire retaining the items which were relevant to be asked at a community level. The 'community' questionnaire consisted of 100 items and was administered over approximately 30 minutes. 'Community' interviews were conducted in two villages where bergamot is produced and also in two 'matching' villages where bergamot is not produced, in order to have a well-defined idea of the context.

In addition, reports on Calabria were obtained from the Italian National Institute of Statistics (ISTAT). This public research organisation provides high-quality statistical information, analyses and forecasts on national and regional level.[2] The combination of the 'community' questionnaire along with the research from ISTAT, provided valuable insights on the socio-economic status of the Calabria population and helped create a more complete image of the setting for the study.

As the concept of resilience is being more widely used in the field of social science, the effort to find more pragmatic methodologies to measure it has led to different approaches (Carter et al., 2006; Keil, 2008; Alinovi et al., 2009 and 2010). The approach developed by Alinovi and colleagues (2009 and 2010) has been adopted by the FAO in order to identify and measure the household resilience to food insecurity and, on a larger scale, the resilience of food systems. This approach, with some

[2] Available online: http://www.istat.it/en

modifications (Ciani, 2012) has been used in this study. This is based on the concept that resilience, while not being directly observable, can be conceptualised as a latent variable and thus estimated through a factor analysis procedure. Factor analysis was initially used in psychometric studies aimed at the measurement of human intelligence (Bartholomew et al., 2008). Factor analysis starts by examining how a set of observed variables co-vary and seeks to extract a set of factors that explain why the observed variables co-vary in a given way. The objective is to model the covariates with the minimum number of factors. The better the explanatory power of the first *n* factors is, the more the *n* factor model can be considered satisfactory. The relationship between the observed variables and each factor can then be interpreted to explain the factor itself. In this case, the framework is further complicated by the two stages structure of the model because resilience is not estimated directly from a set of observed variables but from a set of latent resilience components which are, in turn, derived from a set of observed variables. In this case, both in the first and in the second stage, the objective is to have a set of one-factor, factorial models where the only factor retained represents a resilience latent component (in the case of first stage models) or the resilience index (in the case of the second stage factorial model).

In the case of bergamot and of southern Calabria, a further challenge for the study was readapting this approach to address the context of a high-income country and reflect a more general definition of resilience to economic insecurity/shock. The analysis implemented in this project focuses on the household unit because it is at this level that most risk management practices and coping strategies are implemented. Moreover, decisions concerning the household agricultural business are usually taken at the household level and the consequences of these decisions usually impact the entire household.

The general resilience model is an approach that derives an index (latent variable, i.e., it cannot be observed directly), from combining, using mathematic techniques, the resilience components (in the study of Alinovi and colleagues (2010), which was the basis for our study, there were eight resilience parameters): **Income & Food Access (IFA), Access to Basic Services (ABS) Social Safety Nets (SSN), Agricultural Assets (AA), Agricultural Practice & Technologies (APT), Non Agricultural Assets (NAA), Stability (S), and Adaptive Capacity (AC)**. These eight components are also not directly observable but are developed by combining observable variables. For example, the resilience component Income & Food Access is

derived from per capita income (INC), per capita expenditure (EXP), etc. Within each observed variable, there is a set of questions (items) which measures this variable.

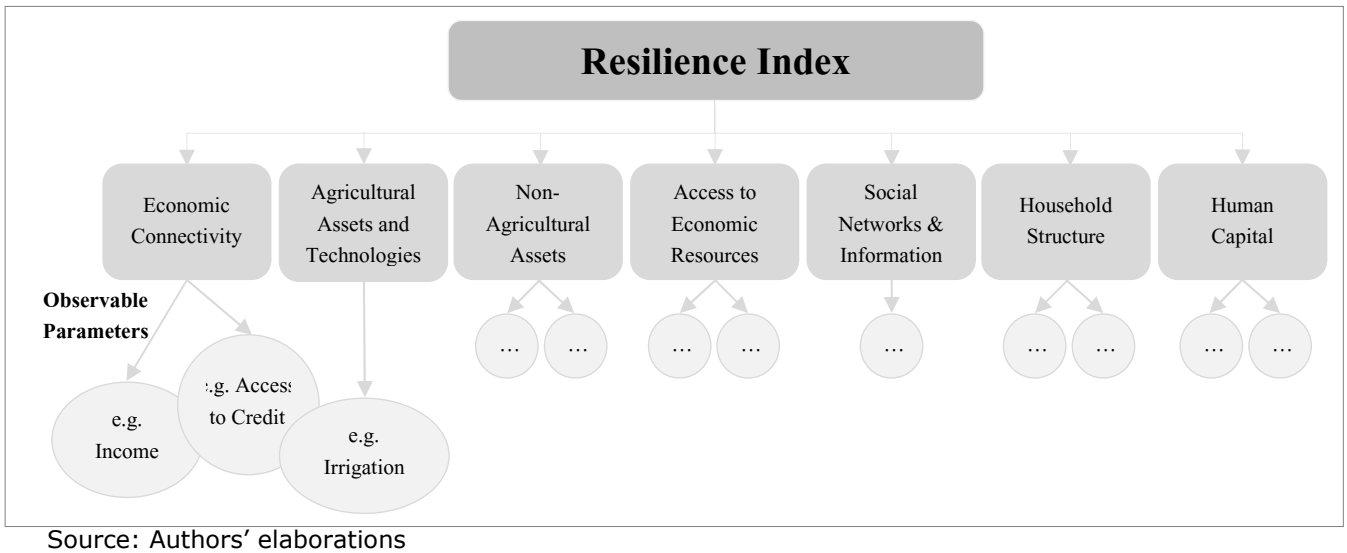
The first resilience component in the study – Economic Connectivity (EC) derives from the Income and Food Access (IFA) resilience parameter which was used in previous studies in Kenya (Alinovi et al., 2010) and Palestine (Alinovi et al., 2009). However, since this study was conducted in a high income country which does not face the challenge of food shortage as is the case in the previous two contexts, it was decided to adjust this parameter and focus only on income.

In order to measure resilience, observable variables consistent with the methodological approach were developed for addressing via the questionnaire. It was critically important that each variable was only included once in the model. Thus, careful attention was paid to assigning any variables that were relevant for more than one component. While drafting the overall structure of the research, the study by Alinovi and colleagues (2010) was used as starting point to develop a new questionnaire targeted on the context under analysis and on the topic of this research (i.e. livelihood resilience). This meant both reviewing literature and research relevant to Calabria and consulting with key stakeholders.

Using this approach, ultimately, seven resilience components were developed: **Economic Connectivity (EC), Agricultural Assets and Technologies (AAT), Non Agricultural Assets (NAA), Access to Economic Resources (AER), Social Networks and Information (SNI), Household Structure (HS), Human Capital (HC)** (Figure 1).

In addition, the questionnaire was designed in such a way to minimise the risk of incomplete or inaccurate information. For example, as there were questions of sensitive nature concerning income, it was decided to include additional questions related to household assets that are useful to impute missing value and to check the reliability of responses to direct questions related to income.

Figure 1 – Bergamot Resilience Index Conceptual Framework



Source: Authors' elaborations

4. Results

Almost all of the producers interviewed are owners of the farm they cultivate (322 out of 326). In addition, 96% of the interviewees reported their farms being run exclusively by their household. These findings reinforce existing data which show that the agricultural land is mostly inherited from one generation to the other and that agricultural production remains a strictly family business.

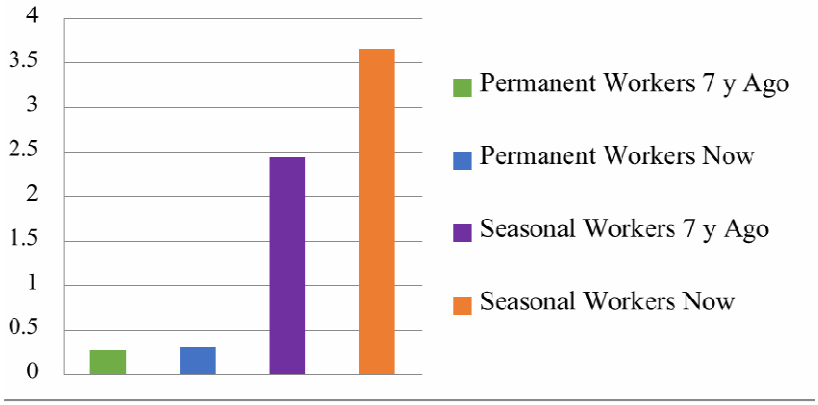
Despite the bulk of the agricultural enterprises covered by the survey being household-managed, the production is heavily market oriented. Currently, the survey showed that for 88.85% farms more than 90% of production is sold on the market. This percentage increased slightly over last seven years (in 2007 it was 85.08%).

As expected, the majority of labour force in the farms in this survey consists of household members. In the 81% of farms there are no permanent workers with only 2.73 of farms reporting more than 1 permanent worker. This picture does not change substantially if we compare the current situation to that of seven years ago: only 4.6% of farms (15 farms) experienced a variation in the number of permanent workers (positive in 12 cases and negative in 3).

The situation is substantially different if we take into consideration seasonal workers. The use of seasonal work is widespread in the study sample. It is interesting to note that the use of seasonal workers increased in more than half of the cases (53.99%). This point is extremely relevant if one considers the extremely negative employment situation in Calabria during this period. This underlines both the potential and actual

role of agriculture in general, and of bergamot cultivation in particular, as a means to create job opportunities in the region. As expected, the use of non-household labour is directly proportional to farm size both for permanent and seasonal workers. Figure 2 shows the evolution of the number of permanent and seasonal workers comparing the current situation and that of seven years ago.

Figure 2 – Average Number of Permanent and Seasonal Workers

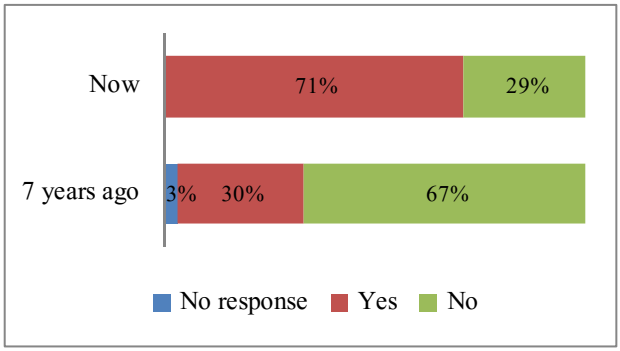


Source: Authors' elaborations

Agricultural activities are slowly becoming a steady source of income. When asked whether they think that it would be possible for them to live exclusively from their agricultural activities, 26% of interviewees answered 'yes' while 71% responded 'no'. For the same question, with reference to seven years ago and before the bergamot stabilisation of prices, the results were 15% and 79% respectively. In both cases a small percentage did not express an opinion.

Moreover, 71% of respondents replied that their farming activities are profitable compared to seven years ago that only 30% of them thought the same (Figure 3).

Figure 3 – Do you Believe your Farming is Profitable?



Source: Authors' elaborations

This significant upward trend explains why 84% of farmers are planning investments in their agricultural activities in the next three years. These investments vary and the

most commonly cited were: planting new bergamot trees, purchase of new equipment, purchase of land and improvement of the irrigation system. It should be noted however that in the last seven years only a small percentage (27%) of farmers has obtained funding from public grants. In addition, as 75% of farmers report having sufficient information regarding possible ways of funding for their agricultural holdings, the causes for such low funding rates among them would appear to derive elsewhere e.g., long bureaucratic procedures, difficulty to obtain grants, inadequate funding which discourages farmers from applying, etc. However, farmers continue to believe that their agricultural enterprise will grow as 73% of participants answered that they have a positive or very positive view for their future in agriculture.

Table 2 shows what is the primary occupation of the participants and the members of their household. This helps form a clear picture of the demographic, occupational and social distribution of the sample under study. It is worth noting that the percentage of persons who list farming, as a primary occupation, is quite low. This seems to suggest that for these households agriculture is a supplementary source of income.

Table 2 – Primary Occupation

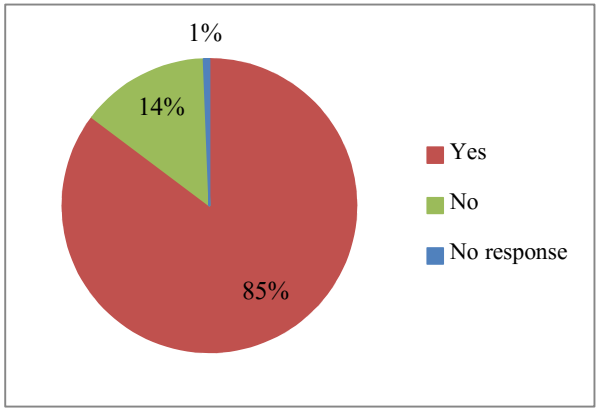
Sector	% (Members 15-75)
Public Sector	19.18%
Commerce	4.68%
Private Sector: Employees	1.80%
Private Sector: Entrepreneurs/Freelance Professionals	12.23%
Agriculture	14.39%
Students	10.91%
Pensioners	22.78%
Unemployed	7.43%
Other	1.08%

Source: Authors' elaborations

It is worth noting that apart from the primary and secondary occupation of the members of the household, the questionnaire also considered other fixed sources of income such as pensions, savings, rent from property or from other types of investment. However the results obtained showed that these additional sources of income are quite limited in those sampled. Pensions were the most common steady source of income and about one-third (33.4%) were in receipt of these.

Bergamot has become a stable and secure source of income and this is shown by the intention of the participants to expand their bergamot production in the next three years (Figure 4).

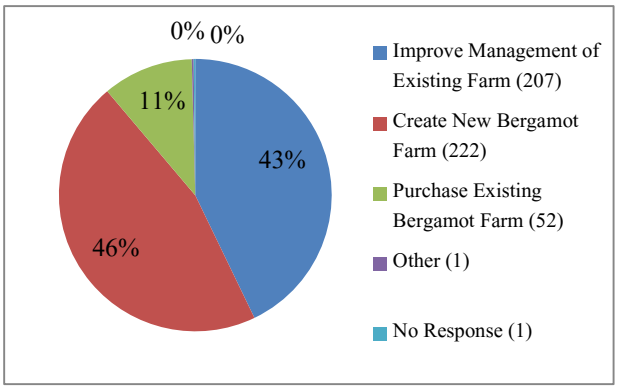
Figure 4 – Intention to Expand Bergamot Production



Source: Authors' elaborations

These planned investments would include improving the management of the existing farm, creating a new bergamot farm or purchasing an already existing bergamot farm (Figure 5).

Figure 5 – Types of Future Investments in Bergamot Production



Source: Authors' elaborations

In 9.8% of farms, the area cultivated with bergamot has expanded over the last seven years. The production of bergamot has grown in 69.94% of farms while it has decreased in only 8.9% of cases. The profit resulting from bergamot production has also increased in 84.97% of farms. It is interesting to notice that the increase in profit is maintained if profit per ha (increased in 87.73% of cases) is considered rather than just total profit. Bergamot profit margin (i.e. the ratio between profit and total production value) increased in 69% of farms (while it has decreased only in 14% of cases). It seems reasonable to hypothesize that these widespread and positive changes can be associated with the reform of the bergamot value chain.

Besides its impact on prices and profits, the effect of the bergamot value chain reform is clear if we take into consideration how the use of marketing channels has changed in the years following the reform (Table 3). In 2014 the bulk of bergamot production

(87.42%) was sold through the consortium while in 2007 this share was below 20%. On the contrary, the direct selling to transformation industries (identified as one of the main causes of price instability and quality uncertainty) has been significantly reduced (from 61.96% to 10.12%).

Table 3 – Where Do Producers Sell Bergamot?

Prevailing Marketing Channel	2014	2007
Bergamot Consortium	87.42	18.71
Transformation Industries	10.12	61.96
Final Consumer	-	0.31
Middle Men	0.61	10.43
Local Market	0.61	2.15
Other	0.61	5.52
Uncultivated field	0.61	0.92

Source: Authors' elaborations

This overall positive picture is confirmed if the level of household income and its evolution is analysed. When questioned regarding their income, 69.94% of bergamot producers reported that their earnings have increased over the last 7 years, 22.70% didn't report any variation, while only 7.36% experienced an income loss. For those households who experienced an income growth (69.94%), the average increase was around 33% with no significant changes among the different income groups. This is against a real income decrease for all of Italy of 13% between 2007 and 2013 as reported by the International Monetary Fund (IMF, 2013). On average, incomes in Calabria, one of the most depressed regions in Italy, are only 50% of those in the North. Table 4 reports the average increase for each income distribution quartile (only for those households which saw their income increase over the last seven years).

Table 4 – Increase in Household Income

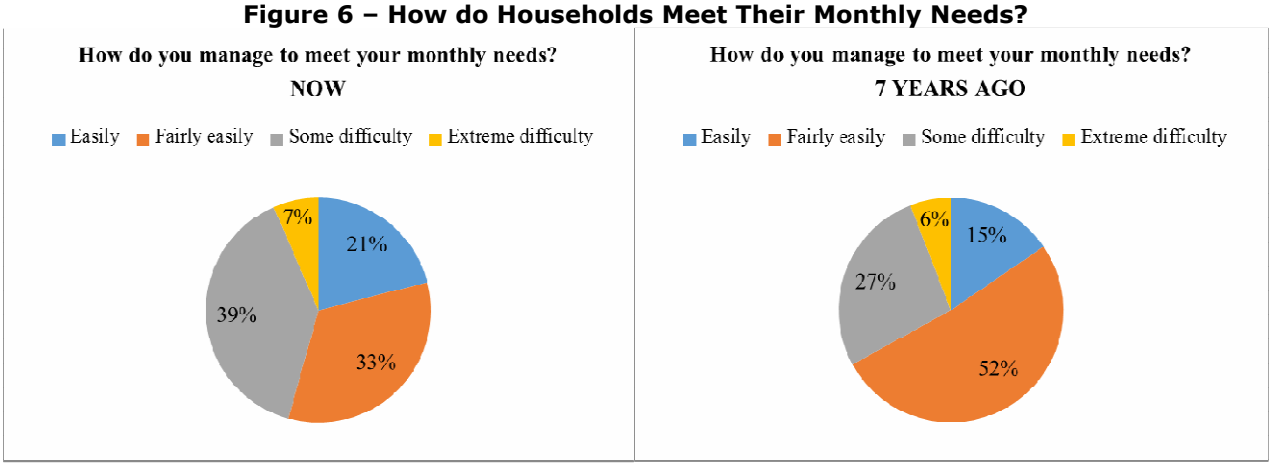
Groups (Farmers with Income Increase)	Increase (%)
Total Sample	33.43%
1st Quartile of Income Distribution	34.76%
2nd Quartile of Income Distribution	32.29%
3rd Quartile of Income Distribution	33.49%
4th Quartile of Income Distribution	33.79%

Source: Authors' elaborations

With regard to the level of financial stability perceived by the interviewed households, it is possible to note that only 6.48% of households find it extremely difficult to manage monthly family needs while more than 20.99% of households do not perceive any difficulty at all. About one third of interviewed households perceived a change in their economic condition over the last seven years. A critical finding, if one takes into

consideration the economic crisis, is that the percentage of farmers who cope with their monthly needs easily has increased in the last seven years by more than 6% (from 15.43% to 20.99%). Figure 6 shows farmers' perception regarding their ability to cope with monthly needs now and seven years ago. The figure seems to suggest that there is a sort of polarisation process with a substantial decrease of the share of households managing fairly easily (from 52% to 33%), while both the share of households experiencing some difficulty and of those managing very easily increased over the years. This depicts that "the middle class" could be vulnerable and this may need to be addressed.

Figure 6 – How do Households Meet Their Monthly Needs?



Source: Authors' elaborations

Overall, the agricultural enterprises participating in the survey report being dynamic to a certain degree (increasing value of production, increasing profitability, increasing labour demand). This finding is quite significant when considered in the context of a very depressed economic environment. The effect of the bergamot value chain reform on producers is evident. The production of bergamot as well as the profitability of the sector has increased steadily. The impact on the marketing channels is clear: the renewed central role the Consortium is a crucial asset for the whole value chain. These achievements have an impact on the general attitude of producers relative to their farming activity: producers' widespread optimism and pro-active approach towards the future is maybe the most important result of the reform of the sector.

4.1. Resilience-Based Approach

Using the raw data from the interview study, we applied the concept of resilience in order to explore further implications that the bergamot production might have on farmers' livelihood strategies. As already noted, household resilience is not directly

observable and, as such, is considered a latent variable. In accordance with the model employed, resilience is based on different components that are also latent variables which, in turn, are derived from a set of observed variables. Seven possible latent resilience components have been identified. This section will first explain, in detail, the composition of each subsidiary latent variable and then how these components have been combined to compute an overall resilience index.

The seven components are:

- Economic Connectivity (EC)
- Agricultural Assets and Technologies (AAT)
- Non-Agricultural Assets (NAA)
- Access to Economic Resources (AER)
- Social Networks and Information (SNI)
- Household Structure (HS)
- Human Capital (HC)

Each component has been estimated through a standard factor analysis where the value of the component is the factorial score (loading) of the first factor extracted by the analysis. The first stage factorial analysis has been calibrated so that (i) the signs of the loadings are coherent with the theoretical framework and (ii) the first factor can be considered valid if it meets at least two of the three criteria (i.e. scree plot curve, explained variance higher than 70% and Eigen value greater than 1). The factor loadings have been computed through the Bartlett method (Bartlett, 1937). The following sub-sections examine each of these components/factors in turn. In the following sub-section, the results of the estimations will be reported and briefly commented. In particular the signs of the coefficients will be discussed. Moreover, the results tables will report also the variable mean and the standard deviation. The variable mean is a measure of the position of the variables and the standard deviation is a measure of the dispersion of a set of data from its mean. The wider the spread of the data, the higher the deviation.

Economic Connectivity

The Economic Connectivity of a household is its ability to be connected to several markets and income generating opportunities. The model considers that the higher the household economic connectivity, the higher its ability to withstand shocks (Ciani, 2012). In the case of bergamot producers, the observable variables used to compute the latent resilience component are:

- Ownership of non-agricultural firms: a binary variable equal to 1 if at least one household member owns a non-agricultural firm.
- Income from financial assets: a binary variable equal to 1 if the household receives returns from financial assets.
- Income from real estate assets: a binary variable equal to 1 if the household receives a rent from property assets.
- Number of sectors in which the household members are active: a count variable.
- Access to credit market: a binary variable equal to 1 if the household has actual or potential access to credit.

Table 5 reports the descriptive statistics and the coefficients used to compute the factorial scores.

The type of variable is also specified in the last column. The reported statistics are variable mean and standard error. The score coefficients indicate how observable variables are linked to this latent resilience component. This means that, given a certain value of a variable, a higher absolute value of the coefficient is linked to a higher (positive or negative, according to the coefficient sign) value of this resilience component (i.e. the latent variable). The sign of the coefficient indicates whether the relationship between the observed variable and the latent resilience component is direct or inverse. Clearly, it is important to carry out a plausibility check on the sign of the coefficient. This insures, in this case, for example, that more sources of income do not lead to lower economic connectivity. For this latent variable, the number of sectors where the household is active has a relatively low coefficient, while the others are both higher and more homogenous. This difference in coefficient size is due to the characteristics of the variables. All the variables, except for the number of sectors in which the household members are active, are binary. It means that the impact of these variables on the scores can be 0 or 1 times the coefficient (i.e. the value of the coefficient). The number of sectors on the contrary is a count variable ranging from 1 to 4 in the dataset. This means that the impact of this variable on the factors scores ranges from 0.088 to 4 times 0.088=0.352. The coefficient signs in the table are consistent with expectations.

Table 5 – Economic Connectivity (EC)

Variable	Score Coefficient	Mean	Standard Deviation	Type of Variable
Non Agricultural Firm	0.254	0.119	0.325	binary
Financial Rent	0.584	0.074	0.262	binary
Real Estate Rent	0.334	0.236	0.425	binary
Number of Sectors	0.088	1.727	0.749	count
Credit	0.169	0.709	0.455	binary

Source: Authors' elaborations

Agricultural Assets and Technologies (AAT)

Agricultural Assets and Technologies are represented by: (i) a set of variables concerning the amount of assets owned by the household and used directly and indirectly into agricultural production and (ii) other variables related to the manner in which agricultural production is carried out. Also, these assets can be potentially used both to accumulate value and as productive capital. The variables are:

- Extension of the household farm: a continuous variable of the self-reported number of hectares that is cultivated by the entire household, measured in hectares.
- Number of permanent workers: a count variable of the number of workers that are permanently hired by the household, excluding household members.
- Number of seasonal workers: a count variable of the number of workers that are hired only during certain periods of the agricultural year.
- Variety of crops within the farm: a count variable of the number of crops in the farm, without taking into consideration the harvested area.
- Irrigation: a binary variable equal to 1 when the farm possesses some form of irrigation system.
- Amount of productive equipment: a count variable of the number of productive assets owned by the household starting from an exhaustive list.

Table 6 presents the coefficients of the factorial model and other descriptive statistics. The coefficients are characterised by a fair degree of homogeneity which means that the latent variable is influenced by all the observed variables to a similar degree. All the coefficient signs in the table are consistent with expectations: basically this resilience component is a measure of the degree of complexity/sophistication of the farm as it is positively linked to the size, to the use of external labour, and to the complexity of used technologies (ex. irrigation, productive assets).

Table 6 – Agricultural Assets and Technologies (ATT)

Variable	Score Coefficient	Mean	Standard Deviation	Type of variable
Farm Size	0.206	7.017	15.777	continuous
Permanent Workers	0.146	0.309	0.822	count
Seasonal Workers	0.282	3.666	3.299	count
Crops Variety	0.183	1.785	1.021	count
Irrigation	0.343	0.966	0.181	binary
Productive Assets	0.253	3.933	1.497	count

Source: Authors' elaborations

Non-Agricultural Assets (NAA)

Non-Agricultural Assets are other assets owned by the household that can increase or decrease in value but which represent household wealth. They also reflect past flows of resources in and out of the household. The selected variables are:

- Value of the house owned by the household: a continuous variable of the self-reported value in euros, in case the household owns the house where they are living.
- Number of cars owned by the household: a count variable.
- Household ability to accumulate savings over the last three years: household members were asked to indicate whether during the last three years they were able to save money, were compelled to spend previously accumulated money, or spent all money earned. This was modelled as a binary variable as households will never consistently balance their budgets so overall they are either over- or under-spending.

Table 7 reports the main results of the factorial analysis. Note that the mean of the house value has a different scale if compared to the other values. It is due to the magnitude of the variable. This factor does not affect the estimation as all the values are standardised[3]. The coefficients are characterised by a fair degree of homogeneity which means that the latent variable is influenced by all the observed variables to a similar degree. All the coefficient signs in the table are consistent with expectations.

[3] In other words, the factor is extracted directly from the correlation matrix and not from the covariance matrix (where the magnitude and the unit of measure matter).

Table 7 – Non-Agricultural Assets (NAA)

Variable	Score Coefficient	Mean	Standard Deviation	Type of Variable
House Value	0.655	176625.802	133595.935	continuous
Number of Cars	0.520	1.589	0.794	count
Ability to Save	0.281	0.123	0.329	binary

Source: Authors' elaborations

Access to Economic Resources (AER)

Access to Economic Resources is one of the basic dimensions of the resilience building process as both the level and the variability of income flows are key factors.

These variables are:

- Profit from agricultural activities: a continuous variable for the self-reported amount of money in euros that the household obtains from its agricultural activities, remaining after paying for inputs, wages, etc.[4]
- Monthly income: a continuous variable of the self-reported amount of money in euros available monthly to cover household needs.
- Gap income-needs: a continuous variable of the difference between monthly income and the amount of money identified as 'sufficient to live without problems' by the respondent. The variable can be higher, lower or equal to zero according to the degree of satisfaction of households' needs. The gap is measured in euros and has a positive value when the actual income is less than the desired income.

The score coefficients and other descriptive statistics are reported in Table 8. The coefficients are characterised by a fair degree of homogeneity which means that the latent variable is influenced by all the observed variables to a similar degree. All the coefficient signs in the table are consistent with expectations.

Table 8 – Access to Economic Resources (AER)

Variable	Score Coefficient	Mean	Standard Deviation	Type of Variable
Agricultural Profit	0.235	13102.084	28443.667	continuous
Monthly Income	0.627	2338.389	1137.563	continuous
Gap Income-Needs	0.455	321.045	1025.187	continuous

Source: Authors' elaborations

[4] It should be noted that for the scope of this report the term 'profit' includes both land rent and the implicit wage that the household pays to the household members involved in the production.

Social Networks and Information (SNI)

Access to Social Networks and Information can increase the range of opportunities for the household, particularly in case of shocks and perturbations. In this case the variables selected to represent this phenomenon are:

- Share (percentage) of household members belonging to farmers' organisations, trade unions etc. (apart from the Bergamot Consortium) – a continuous variable.
- Responsible position in NGO: a binary variable equal to 1 when at least one member of the household holds a responsible position within an organisation.
- Sufficient access to support for what concerns farm-related issues: a binary variable equal to 1 if the respondent claims to receive sufficient support when applying to receive subsidies, grants etc.
- Access to information: a binary variable equal to 1 if the respondent claims to be sufficiently informed about the opportunities of receiving support from public institutions on farm-related issues.

The score coefficients and other descriptive statistics are reported in Table 9. While the coefficients are characterised by a fair degree of homogeneity which means that the latent variable is influenced by all the observed variables to a similar degree, the quality of participation is significant, as the variable 'responsible position in NGO' is the one characterised by the highest coefficient.

All the coefficient signs in the table are consistent with expectations.

Table 9 – Social Networks and Information (SNI)

Variable	Score Coefficient	Mean	Standard Deviation	Type of Variable
Share of Household Members who are Part of an NGO	0.107	0.320	0.339	continuous (limited 0/1)
Responsible in NGO	0.590	0.071	0.256	binary
Sufficient Support	0.352	0.752	0.433	binary
Sufficient Information	0.446	0.816	0.388	binary

Source: Authors' elaborations

Household Structure (HS)

The Household Structure dimension is related to the demographic composition of the household. The argument advanced is that the demographic structure of the household may be related to the household's ability to react to a shock (e.g. a household with a higher prevalence of people aged 18-65 has a larger labour force related to its size). The variables used to approximate this dimension are:

- Household demographic dependency ratio: it is the ratio between the number of household members who can be defined as dependents (i.e. people younger than 15 and older than 64) to the number of household members aged 15-64. A continuous variable.
- Number of first degree relatives (i.e. father, mother, husband, wife, brothers, sisters, sons or daughters of the interviewed person) who are not living in Calabria anymore. A count variable.

Table 10 reports the score coefficients and descriptive statistics about the variable. It is worth underlining that this is the only negative factor which is positively correlated with demographic dependency and emigration. In other words, this factor is expected to be negatively correlated with household resilience.

Table 10 – Household Structure (HS)

Variable	Score Coefficient	Mean	Standard Deviation	Type of Variable
Demographic Dependency Ratio	0.706	0.058	2.253	continuous
Emigration from the Household	0.590	1.331	2.435	count

Source: Authors' elaborations

Human Capital (HC)

Human capital is a pivotal component of a household's resilience. The higher the human capital of a household, the higher its flexibility and its ability to seize opportunities and change behaviours. The variables used to estimate this dimension are:

- The maximum degree of education achieved within the family: it is the highest degree of education (elementary, junior high school, senior high school, university or more) reached by one of the members of the household. An ordinal variable.
- The degree of education (elementary, junior high school, senior high school, university or more) achieved by the household head. An ordinal variable.
- The percentage of English speaking members of the household. A continuous variable.
- The percentage of household members who can use a computer. A continuous variable.
- The percentage of household members who can use the Internet. A continuous variable.

Table 11 – Human Capital (HC)

Variable	Score Coefficient	Mean	Standard Deviation	Type of Variable
Max Education among Household Members	0.194	3.429	0.748	ordinal
Household Head Level of Education	0.193	3.015	0.946	ordinal
Percentage of English Speaking Members of the Household	0.151	0.474	0.401	continuous (limited 0/1)
Share of Computer Users among the Household Members	0.315	0.726	0.343	continuous (limited 0/1)
Share of Internet Users among the Household Members	0.306	0.715	0.344	continuous (limited 0/1)

Source: Authors' elaborations

Table 11 shows the main results of the factorial analysis and some descriptive statistics. The coefficients are characterised by a fair degree of homogeneity which means that the latent variable is influenced by all the observed variables to a similar degree.

Following the methodology used by Alinovi and colleagues (2008 and 2010) and modified by Ciani (2012), the factorial scores have been used to compute the overall resilience index. The Household Structure component was not included in the model for three main reasons. Firstly, it substantially decreased the share of variance explained by the first factor extracted (i.e. the resilience index). Secondly, the coefficient relative to this component would be very low. Thirdly, the sign is not expected as it is positively related to the resilience index while the expected sign was negative. Previous experience with the model suggests that this occurs when the component is not an appropriate one or is inconsistent with the model. As will be shown later, the consequences of the exclusion of the Household Structure component from the resilience index have been checked. The exclusion of this dimension from the index does not affect the validity of the index itself for several reasons. Firstly, the resilience definition is inherently context based. As a consequence, it is quite expected that a component that is relevant for resilience-building in a specific context is not in another one. Secondly, the low value of the Household Structure dimension coefficient might arise as a consequence of two opposite effects cancelling out each other. On one hand, having more elderly persons within a household tends to reduce resilience (weaker labour force, usually lower endowment of human capital etc.); on the other, it tends to increase the number of persons receiving an income from pension (i.e. a stable and reliable income).

Table 12 reports the scoring coefficients of the six resilience indices and other descriptive statistics, excluding the Household Structure component. All coefficients' signs are positive. As would be expected, a higher level of resilience is linked to higher economic connectivity, to the complexity of the agricultural firm, to a higher value of households' assets, to a more effective access to income and income generating opportunities, to a more intensive level of participation and involvement in social networks and to having greater human capital.

It is valuable to use the resilience index to develop different resilience profiles[5]. This can be done by stratifying the population according to some variable of interest: in other words, we observe the average value of the resilience index and of the resilience components in each strata and identify meaningful differences. In this case, the values of the resilience index have been stratified according to the size of the farms. The population has been classified in five categories according to the size of their farms.

Table 12 – Resilience Index and Its Components

Variable	Score Coefficient	Mean	Standard Deviation
Resilience Index (RI)	-	0.348	0.282
Economic Connectivity (EC)	0.313	0.425	0.298
Agricultural Assets and Technologies (ATT)	0.268	0.418	0.406
Non Agricultural Assets (NAA)	0.318	0.116	0.875
Access to Economic Resources (AER)	0.238	0.404	0.672
Social Networks and Information (SNI)	0.176	0.842	0.384
Human Capital (HC)	0.301	0.176	0.498

Source: Authors' elaborations

Table 13 reports the frequency of the sizes of the farms into five categories.

Table 13 – Farm Size

Farm Size (ha)	Frequency	%	% cum
0-1	86	26.38	26.38
1-2	54	16.56	42.94
2-5	86	26.38	69.33
5-10	56	17.18	86.50
10+	44	13.50	100.00
Total	**326**	**100.00**	**-**

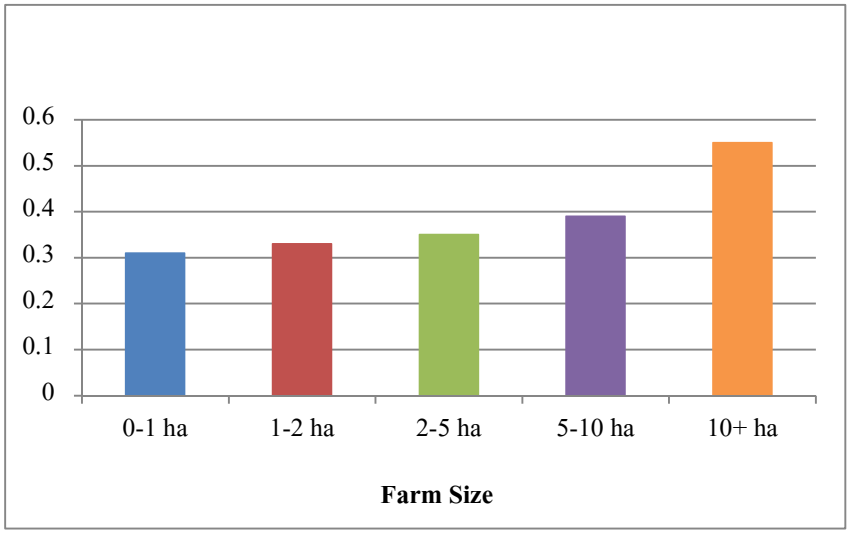
Source: Authors' elaborations

As you can see in Figure 7, as expected, household resilience is directly proportional to the farm size, even if it is quite clear that the relation is not proportional, while the

[5] It is worth to underline that we have one single resilience index. We are simply going to observe how its values vary in different population groups identified by the distribution of a relevant variable.

difference between the fifth group and the fourth one is much more significant than, for example, the difference between the fourth and the third. This trend continues. Additional insights can be obtained on the resilience strategies adopted by the households analysed by examining the average value of the components of the resilience index in the total population and in each single farm size class.

Figure 7 – Household Resilience and Farm Size

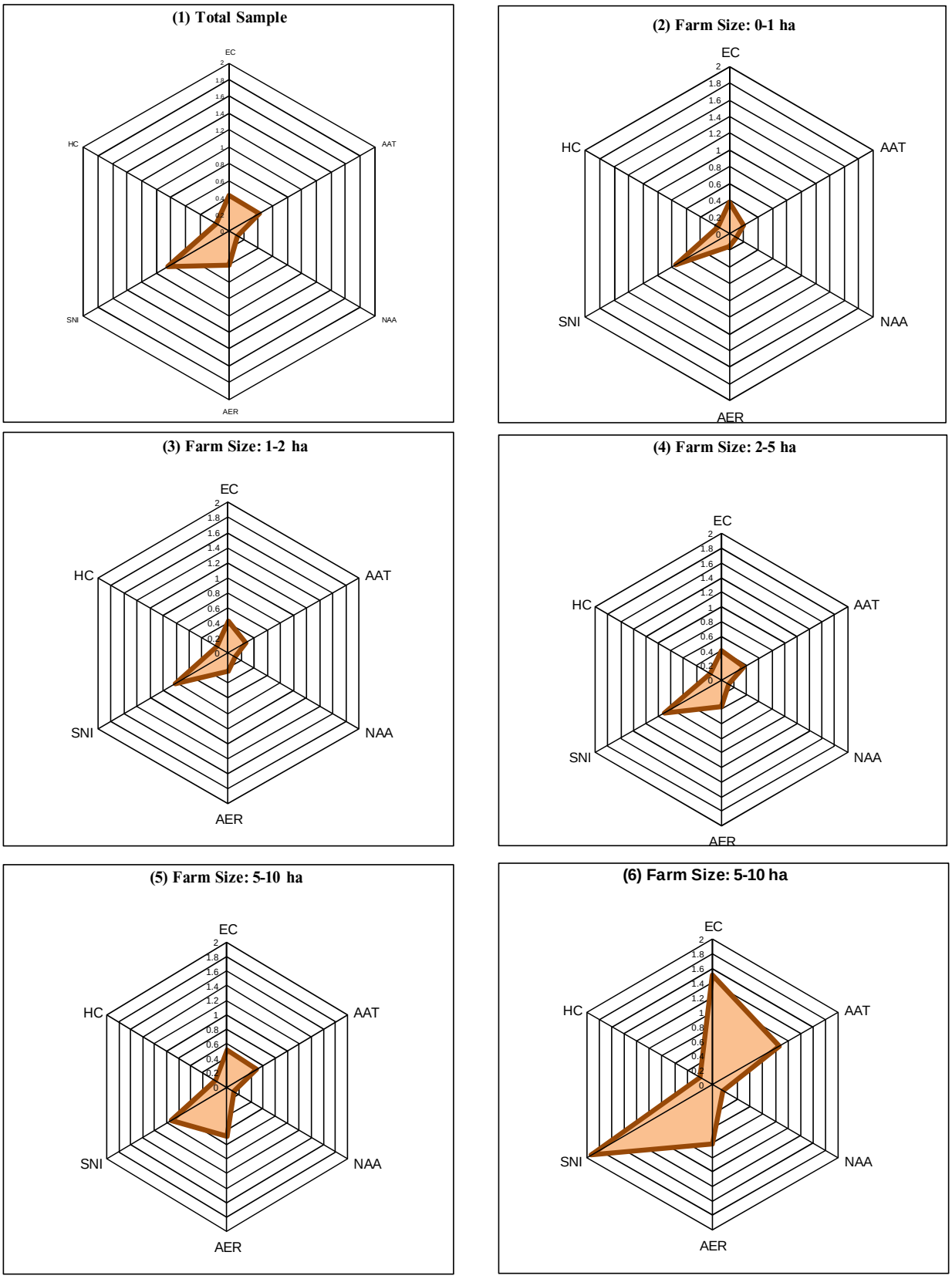


Source: Authors' elaborations

Figure 8 presents the 'average shape' of the resilience strategy in the population. The figure highlights the very important role played by the access to social networks and information. This result may be explained by the involvement of farmers' organisations and in particular to their ability to assist farmers in obtaining support from local institutions e.g. from the regional government[6].

[6]It is worth to remember that the distribution of EU funds for agriculture, rural development and economically depressed areas is usually managed by the regional government.

Figure 8 – Household Resilience Strategy Shape and Farm Size



Source: Authors' elaborations

The stratified analysis allows for a further interesting observation – the shape of the resilience strategy is not radically different across farm size classes. This supports the approach taken in this study of focusing on the impacted (bergamot producers) group rather than initially running a cluster analysis to identify a number of different livelihood strategies, as was carried out by other investigators (Alinovi et al., 2010; Ciani, 2012). It should be pointed out that these previous investigators were constrained to work with existing data sets as opposed to this study which had the ability to generate its own data from the bespoke questionnaire.

Also, the identification of different livelihood strategies is required when the observed population is composed of different groups (e.g. pastoralists, subsistence farmers, market oriented farmers etc., Alinovi et al., 2010). In this case, the five farm size groups differ in their levels of resilience rather than in the fundamental 'shape' of their resilience strategy (Figure 8).

This can be explained by the relative homogeneity of the livelihood profile of the households. Differences in resilience strategies across the farm size classes are seen in income (Economic Connectivity) and relations (Social Networks and Information) as they are the dimensions that vary more sharply across the five groups. Other dimensions such as Human Capital and Non-Agricultural Assets do not show substantial variations between groups. Of course, this does not mean that human capital and non-agricultural assets are not relevant for resilience-building, but that they are not as significant in explaining why resilience varies across household farm size classes. This can be explained by the role played by agricultural activities within the overall household livelihood strategy.

Agricultural activities are usually complementary to other activities. As a consequence, the same farm size may be complementary to activities of two very different households (e.g. one with a very high and one with a very low human capital endowment). It also demonstrates that Reggio Calabria, despite the severe economic problems that it faces, is part of a high-income country in which social welfare, services and formal networks exist. These results, which are to be expected, confirm that the area is quite homogeneous and also conforms the validity of the approach and methodology, which is innovative in being applied in a European/high-income country context. Previous resilience research has focused on low-income countries or areas struck by war, conflicts and natural disasters.

An alternative analysis would be to classify the study population by combining the farm size and the proportion of farm land used for bergamot cultivation. The population has been divided in three farm size classes (from 0 to 2 ha, from 2 to 5 ha, more than 5 ha)[7] and three bergamot intensity classes (up to 33% of total harvested area, from 33% to 66% of total harvested area, more than 66% of total harvested area). Nine potential categories are obtained by cross tabulating the farm size and the bergamot use groups.

Table 14 reports the frequencies of the resulting nine categories. Notably, the category of small size farms with medium intensity of bergamot cultivation is empty. In general, the high bergamot intensity group is mainly small farmers.

Table 14 – Farm Size & Bergamot Cultivation

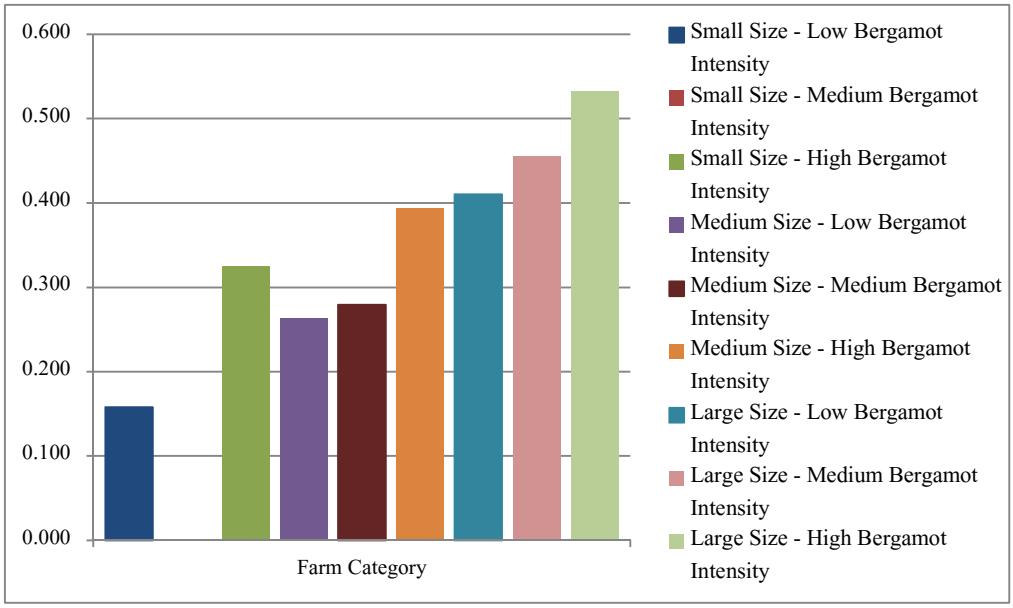
Category	Frequency	%	% cum
Small Size - Low Bergamot Intensity	7	2.2	2.2
Small Size - Medium Bergamot Intensity	-	-	-
Small Size - High Bergamot Intensity	79	24.2	26.4
Medium Size - Low Bergamot Intensity	16	4.9	31.3
Medium Size - Medium Bergamot Intensity	27	8.3	39.6
Medium Size - High Bergamot Intensity	77	23.6	63.2
Large Size - Low Bergamot Intensity	62	19.0	82.2
Large Size - Medium Bergamot Intensity	30	9.2	91.4
Large Size - High Bergamot Intensity	28	8.6	100.0

Source: Authors' elaborations

It is interesting to observe the average value of the resilience index for the above categories. First of all, as clearly shown by Figure 9, in each farm size class, the average value of the resilience index is higher for farmers using larger proportions of their farm to cultivate bergamot. These results also show that households with small-size farms and with high bergamot cultivation intensity have a level of resilience higher than medium-size farm owners with low and medium bergamot cultivation intensity.

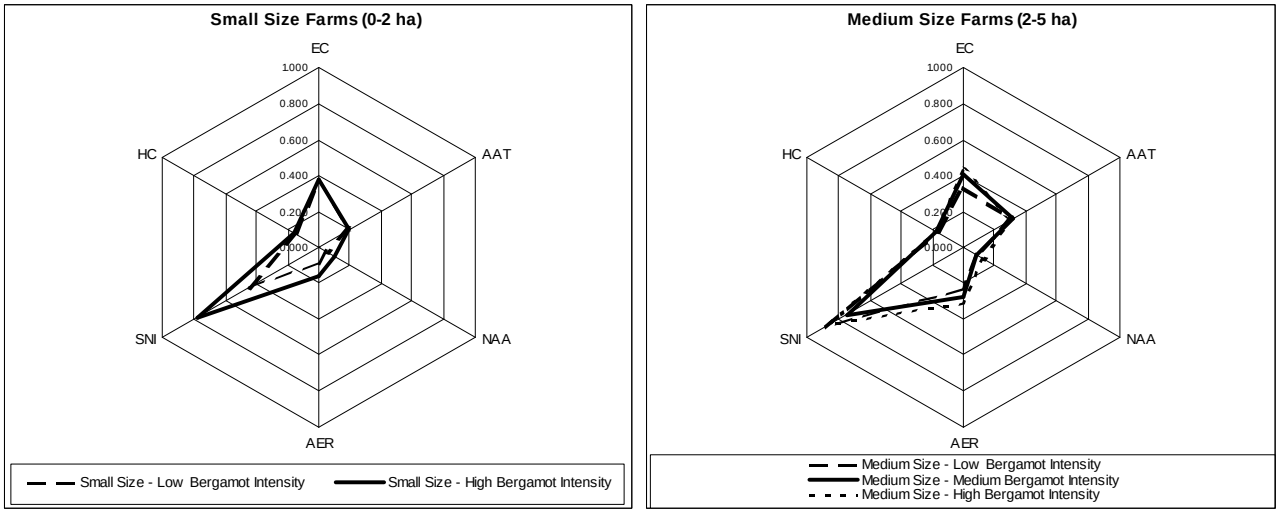
[7] The number of farm size categories has been reduced to three (from five in the previous analysis) to facilitate calculation and presentation of results.

Figure 9 – Farm Size, Bergamot Cultivation and Resilience



Source: Authors' elaborations

Figure 10 – Household Resilience Strategy Shape, Farm Size and Bergamot Cultivation



Source: Authors' elaborations

This data suggests a positive association between resilience and bergamot cultivation when controlling only for farm size but would be confirmed by controlling for several variables.

As was presented for farm size classes, it is interesting to examine the average value of the resilience components for each group in order to have a snapshot of the various resilience strategies. Figure 10 reports the values for the eight categories from Table 14 grouped according to the size of the farm. For small size farms it is interesting to note that the variation in the values of the access to social networks and information are the main driver of the difference between the average resilience of the two groups. In the case of households with medium-size farms, there appears to be no major differences among the three groups with regard to the shape of the resilience strategy. For large farmers, the figure shows considerable differences, particularly for the values of Access to Economic Resources and Agricultural Assets and Technologies.

According to the definition adopted by this report resilience is 'a measure of the persistence of systems and of their ability to absorb change and disturbance and still maintain the same relationships between populations or state variables' (Holling, 1973, p. 14). This paper considers resilience as a latent variable and determines it through a composite resilience index in order to address the complexity of resilience-building. Because this was a bespoke questionnaire, it was possible to place a question that would provide a good proxy for resilience. In this case, the proxy can be used to attempt to validate if that index is effectively measuring resilience. The simultaneous use of the composite index and of the proxy allows for having a robust resilience index. Clearly, relying exclusively on a resilience proxy would not allow the investigation of the components of the resilience-building processes and providing insights as to the variables that are relevant from the policy-maker's perspective.

In the questionnaire, the interviewed farmers were asked to indicate the maximum shock, expressed as monetary loss that their household can endure without reporting a permanent loss of wellbeing. This can be used as a proxy for resilience but has a number of weaknesses. Firstly, it is based on the respondent's perceptions, preferences, etc. Secondly, it reduces the measurement of the consequence of a shock to a monetary measure, even if the reality is much more complex. Nevertheless, it is worthwhile to check whether there is any correlation between the measured resilience index and this proxy, whose distribution is reported in Table 15.

Table 15 – Maximum Shock that Can Be Absorbed by the Household

Max Shock Entity	%
500-999	3.07
1000-4999	8.28
5000-9999	14.11
10000-24999	18.1
25000-49999	45.09
500000+	11.35

Source: Authors' elaborations

The relation between calculated resilience index and this resilience proxy has been analysed through the estimation of an ordered logit model (Greene, 2003) where the classes identified in Table 15 are the categories of the dependent variable of the model[8]. Basically, the model is used to predict the probability of a household to present a modality of the dependent variable given a set of characteristics (including resilience). Beyond the resilience index, other variables have been included in the model. Two alternative variations of the model have been estimated. In the first, the resilience index is included as a continuous variable (Table 16). In the second, the resilience index has been transformed into a categorical variable by computing the quartiles of its distribution (Table 17). The resilience index elaborated in this section is a good predictor of the maximum shock that can be absorbed by the households, irrespective of the form used to include it in the model.

To obtain additional insights concerning the functioning of the resilience index it is beneficial to re-examine the elements of the index and to analyse the relationship between the resilience components and households' ability to absorb shocks.

The model presented in Table 18 highlights the resilience dimension that underlies the households' ability to absorb shocks. The components of Human Capital, Access to Economic Resources and Social Networks and Information are positively and significantly related to absorption capacity. Economic Connectivity and Non-Agricultural Assets appear not to play a significant role. The demographic structure of the household (Household Structure) has been re-included in this model to check whether its exclusion was relevant or not. The lack of significance of its coefficient lends support to its exclusion from the resilience index. The role and the sign of the Agricultural Assets and Technologies dimension is unexpected as it is significantly but negatively related with absorption capacity.

[8] Ordered logit models are models in which the dependent variable is a categorical variable; modalities are ordered in a scale and are attributed on this scale in a meaningful way that is relevant and can be explained by the independent variables.

Given these somewhat unexpected results, a further model has been used to increase the level of detail of the analysis. Starting from the observed variables used to compute the various resilience components, a restricted set of variables has been selected to specify the relation between these variables and households' ability to absorb shocks.

Table 16 –

Model 1: Resilience Index and Resilience Proxy

Variable		Coefficient	Standard Error	
Household Characteristics				
Farm Main Source of Income?				
	Yes	0.511	0.283	*
	No	-	-	
Share Agriculture on Total Income		0.018	0.006	***
At Least 1 Household Member is Farmer				
	Yes	-0.232	0.347	
	No	-	-	
Household Head Gender				
	Female	0.722	0.519	
	Male	-	-	
Interview Centre				
	Bianco	0.022	0.227	
	San Giorgio	0.843	0.298	***
	Condofuri	-	-	
Resilience				
Resilience Index		0.000025	0.000	***
Prob>Chi2= 0.00000				

Source: Authors' elaborations

The two step process of aggregation used in the resilience index calculation approach provides clear aggregated components but is a trade-off with lower complexity. It may be that one of the components (e.g. Household Structure) of the resilience index is not significantly associated with absorption capacity but some of the observed variables used to compute the component do play a significant role. Regarding Economic Connectivity, the results show that both the access to property rent and to credit are positively and significantly related to the absorption capacity. In a similar way, the value of the house and the ability to save have a positive and significant

role. Human Capital, Social Networks and Information and Access to Economic Resources retain their importance even if analysed through primary variables and not through the aggregated index. The farm size, which was the variable selected in the agricultural asset dimension, retains its unexpected sign. This can be explained by the low demand in the land market as resources invested in land are not easy to liquidate and the ownership of larger land areas appears to be perceived more as a constraint rather than an opportunity.

Table 17 –

Model 2: Resilience Index and Resilience Proxy

Variable		Coefficient	Standard Error
Household Characteristics			
Farm Main Source of Income?			
	Yes	0.491	0.281 *
	No	-	-
Share Agriculture on Total Income		0.016	0.006
At Least 1 Household Member is Farmer			
	Yes	-0.155	0.347
	No	-	-
Household Head Gender			
	Female	0.626	0.506
	Male	-	-
Interview Centre			
	Bianco	-0.093	0.225
	San Giorgio	0.704	0.307 **
	Condofuri	-	-
Resilience			
Household Belongs to 1th Resilience Quartile		-1.584	0.299 ***
Household Belongs to 2nd Resilience Quartile		-0.321	0.151 ***
Household Belongs to 3rd Resilience Quartile		-0.165	0.098 ***
Household Belongs to 4th Resilience Quartile		-	-
Prob>Chi2= 0.00000			

Source: Authors' elaborations

Table 18 –

Model 3: Resilience Index and Resilience Proxy

Variable		Coefficient	Standard Error	
Household Characteristics				
Farm Main Source of Income?				
	Yes	0.387	0.312	
	No	-	-	
Share Agriculture on Total Income		0.000	0.006	
At Least 1 Household Member is Farmer				
	Yes	-0.294	0.375	
	No	-	-	
Household Head Gender				
	Female	0.606	0.549	
	Male	-	-	
Interview Centre				
	Bianco	-0.120	0.257	
	San Giorgio	0.259	0.330	
	Condofuri	-	-	
Resilience				
Economic Connectivity		0.618	0.440	
Agricultural Assets		-0.153	0.034	***
Non Agricultural Assets		0.000002	0.000	
Income		0.00028	0.000	***
Access to Networks		1.163	0.326	***
Demographic Structure		-0.066	0.046	
Human Capital		0.924	0.248	***
Prob>Chi2= 0.00000				

Source: Authors' elaborations

Table 19 –

Model 4: Resilience Index and Resilience Proxy

Variable	Coefficient	Standard Error	
Household Characteristics			
Farm Main Source of Income?			
Yes	0.811	0.314	**
No	-	-	
Share Agriculture on Total Income	0.007	0.006	
At Least 1 Household Member is Farmer			
Yes	0.034	0.374	
No	-	-	
Household Head Gender			
Female	-0.208	0.570	
Male	-	-	
Interview Centre			
Bianco	-0.498	0.265	*
San Giorgio	0.277	0.337	
Condofuri	-	-	
Resilience			
Economic Connectivity			
Investment income: yes	-0.379	0.458	
Investment income: no	-	-	
Property income: yes	0.588	0.290	**
Property income: no	-	-	
Access to credit: yes	0.456	0.255	*
Access to credit: no	-	-	
Agricultural Assets			
Farm size	-0.034	0.008	***
Non Agricultural Assets			
House value	0.000002	0.000	**
Income			
Income	0.01206	0.000	***
Ability to save (last 3 years): yes	0.89348	0.353	**
Ability to save (last 3 years): no	-	-	
Access to Networks			
Share of household member in association	1.784	0.413	***
Access to support: yes	1.485	0.350	***
Access to support: no	-	-	
Demographic Structure			
Demographic dependence index	-0.013	0.051	
Human Capital			
Household head education: university	1.064	0.479	**
Household head education: junior high school	0.833	0.426	**
Household head education: senior high school	-0.239	0.426	
Household head education: elementary school	-	-	
Prob>Chi2= 0.00000			

Source: Authors' elaborations

5. Resilience and Bergamot Production

In order to understand the role of bergamot production in resilience-building strategies, it is first necessary to describe the role of agriculture and agricultural activities overall. In general, agriculture is the main source of income and the main economic activity for only a minority of households in the study. Only 26.07% of those interviewed believe that their farm could potentially be the main source of income for the household. However, this number has increased substantially compared to seven years ago (15.34%), before the reforms of the Bergamot Consortium. This is reflected in the portion of household income coming from agriculture-related activities. For 70% of those interviewed, agriculture accounts for less than 30% of total income, but has become more important than seven years ago where for more than 83% of the households it was below 30%. While in only 11.6% of households at least one member is defined as a 'farmer' or farm worker, on average, 67% of family members of working age are involved in the daily management of the farm. In the case of 39% of the interviewed households, all of those of working age are reported as being involved in the daily management of the farm. This suggests that agriculture provides an opportunity to diversify income sources and to get additional family income for the whole family rather than for an individual family member.

It can be concluded that the main, direct short-term impact of bergamot production on resilience may be through increased income and economic connectivity and diversification. Therefore, it would be worthwhile to examine whether bergamot production is more advantageous than other agricultural production. According to our data, the profit from bergamot production has increased in 85% of farms in the past seven years. Those interviewed report that this occurred mainly as a result of increased income from the sale of bergamot rather than by an expansion of the area under bergamot, which occurred in just 9.2% of farms. Information provided by interviewees indicates that bergamot production is currently significantly more profitable than other crops on a hectare basis.

Another dimension where bergamot production can contribute to producers' resilience is the access to networks. The structure of the bergamot sector, after the reform implemented in 2008, is based on the association Unionberg of the producers of bergamot. This increased capacity of collective action is likely to have increased farmers' access to information and to public support with the possible positive impact on other crops. Access to credit has likely been improved by the stabilisation of the

market and the creation of long-term agreements between farmers and buyers that can be used as collateral.

Other dimensions of resilience are likely to be less sensitive to bergamot production. Non-Agricultural Assets, demographic structure, even if this dimension is not included in the resilience index and Human Capital accumulation are likely to be sensitive to more complex factors (e.g. culture policies, etc.). Usually changes in these dimensions, in particular in a high-income country, are slow. As a consequence, the size of the impact of bergamot production on these dimensions is less predictable. The potential impact of Agricultural Assets and Technologies is ambiguous. The higher profitability of bergamot is likely to encourage the enlargement of the area cultivated with bergamot. However, during the last seven years the total bergamot area has increased only by 7.55% (i.e. 58 ha in total). Moreover, a large part of this increase is due to the reallocation of land use and not to the enlargement of farms. In fact, only 7.1% of farms experienced an expansion of total harvested area with an average expansion of 3.78 ha. It should be noted that this kind of investment is likely to be influenced by long-term support policies as the time horizon for an investment in a new bergamot plantation is at least five years.

Simulating the impact of a change of some aspect of the production environment/system (e.g. prices, taxes, incentives) on a variable, or on a set of variables, of interest (e.g. household livelihood resilience) is challenging. In fact, the amount of interactions occurring in the real world is likely to hamper the calculation of the impact of such a change. In simple terms, other factors, not measured, or possibly not measurable, in this study will have changed in the period since the stabilisation of the bergamot market. To address this challenge, a simulation scenario, characterised by a set of hypothesis that allow the complexity of this issue to be managed and coherent results to be obtained, has been developed.

The objective is to consider two scenarios where bergamot production has respectively disappeared or been totally marginalised. In the first, the area previously harvested with bergamot is left uncultivated. In the second, the area cultivated with bergamot is considered to give a return per hectare equal to the average of non-bergamot cultivations in the farm. While the first scenario (i.e. the disappearance of the bergamot sector) may appear extreme, it was seen as realistic prospect immediately prior to the reform of the Bergamot Consortium (Spanti, 2013).

In these two scenarios the disappearance of bergamot is supposed to have an impact on the following variables:

(i) Crops variety (i.e. the ATT resilience component);

(ii) Agricultural profit, monthly income, gap between income and needs (i.e. the AER resilience component).

It is also possible to hypothesise an impact on other dimensions, such as Access to Networks and Information. However, the study dataset does not allow the modelling of the impact on this component. As a consequence, the impact of the simulated changes on the resilience index is likely to be underestimated.

Other additional hypotheses of this simulation are:

(i) There is no direct impact on household consumption. Bergamot has no significant use in the households.

(ii) There is no impact on the prices of other products and thus on the average profitability of non-bergamot production. It is reasonable to hypothesise that conversion of the total area under bergamot to other crops is unlikely to influence the market price of other crops.

The new variable values arising from the simulation are used to compute the simulated values of the resilience components and then of the resilience index by using the factor loadings (and the coefficients) of the previous factor analysis as described above.

Table 20 shows the impact of bergamot cultivation on resilience. The impact on resilience is evident: the disappearance of bergamot cultivation would induce a decrease in producers' resilience by 21.10% in scenario 1 and by 15.73% in scenario 2. The cross tabulation of impact, farm size and bergamot farm intensity shows that the impact is directly proportional to bergamot intensity and to farm size e.g., large producers with a high share of land used for bergamot production being the ones impacted the most.

The dimension Access to Economic Resources (AER) would be the most impacted by the disappearance of bergamot production with an average negative impact around 26% in scenario 1 and around 12% in scenario 2. The impact on Access to Networks

and Information (ANI) would be around 26% in both scenarios while the impact on agricultural technology would be lower (about 15%) and mainly due to the decrease of diversification in the case of disappearance of the bergamot cultivation.

In conclusion, it is possible to note that, despite agriculture not often being the primary source of income for the interviewed households and although bergamot cultivation represents only a modest share of total agricultural activities, the contribution of bergamot to farmers' resilience building in Southern Calabria is significant.

Table 20 – Simulation Results

Impact on…	Group	Scenario 1	Scenario 2
Overall Resilience Index	Total Sample	-21.10%	-15.73%
	Small Size - Low Bergamot Intensity	-16.40%	-15.68%
	Small Size - Medium Bergamot Intensity	-	-
	Small Size - High Bergamot Intensity	-22.14%	-13.38%
	Medium Size - Low Bergamot Intensity	-17.29%	-16.66%
	Medium Size - Medium Bergamot Intensity	-19.74%	-18.39%
	Medium Size - High Bergamot Intensity	-23.94%	-15.01%
	Large Size - Low Bergamot Intensity	-15.31%	-15.03%
	Large Size - Medium Bergamot Intensity	-21.11%	-19.97%
	Large Size - High Bergamot Intensity	-26.34%	-17.80%
Access to Economic Resources	Total Sample	-26.25%	-12.82%
	Small Size - Low Bergamot Intensity	-13.02%	-11.33%
	Small Size - Medium Bergamot Intensity	-	-
	Small Size - High Bergamot Intensity	-26.71%	-4.94%
	Medium Size - Low Bergamot Intensity	-15.75%	-14.14%
	Medium Size - Medium Bergamot Intensity	-21.59%	-18.13%
	Medium Size - High Bergamot Intensity	-33.98%	-11.26%
	Large Size - Low Bergamot Intensity	-13.82%	-13.22%
	Large Size - Medium Bergamot Intensity	-28.89%	-25.89%
	Large Size - High Bergamot Intensity	-39.52%	-18.78%
Access to Networks and Information	Total Sample	-26.92%	-26.92%
	Small Size - Low Bergamot Intensity	-20.28%	-20.28%
	Small Size - Medium Bergamot Intensity	-	-
	Small Size - High Bergamot Intensity	-31.41%	-31.41%
	Medium Size - Low Bergamot Intensity	-20.29%	-20.29%
	Medium Size - Medium Bergamot Intensity	-38.84%	-38.84%
	Medium Size - High Bergamot Intensity	-19.54%	-19.54%
	Large Size - Low Bergamot Intensity	-28.23%	-28.23%
	Large Size - Medium Bergamot Intensity	-31.73%	-31.73%
	Large Size - High Bergamot Intensity	-27.51%	-27.51%
Agricultural Assets and Technologies	Total Sample	-15.01%	-15.01%
	Small Size - Low Bergamot Intensity	-10.04%	-10.04%
	Small Size - Medium Bergamot Intensity	-	-
	Small Size - High Bergamot Intensity	-22.31%	-22.31%
	Medium Size - Low Bergamot Intensity	-19.86%	-19.86%
	Medium Size - Medium Bergamot Intensity	-9.66%	-9.66%
	Medium Size - High Bergamot Intensity	-11.54%	-11.54%
	Large Size - Low Bergamot Intensity	-6.09%	-6.09%
	Large Size - Medium Bergamot Intensity	-6.85%	-6.85%
	Large Size - High Bergamot Intensity	-7.48%	-7.48%

Source: Authors' elaborations

6. Conclusions

This study is an attempt to apply a quantitative approach to the measurement of social-ecological resilience in the context of a high-income country. This pioneering use will be hopefully adopted and advanced by other researchers in the future. This approach can be used to identify groups at risk and what action could be taken to improve their coping strategies. In addition, the approach can be used to determine the impact on the resilience of various groups of a wide range of interventions including social/health services, safety nets, infrastructure investment, new agricultural techniques and new crops or varieties. Resilience now is an internationally recognised metric which not only yields data on current status but also on what has been achieved to date and how future interventions might be optimised.

In addition, this is the one of the first interview study conducted with bergamot producers in the Reggio Calabria province. Our research focused on a topic which is rather unexplored despite the fact that bergamot is a high value crop and in practical terms, only grown in this region. In addition, the success of our study is based on the high participation rate of interviewees, as 326 bergamot farmers were interviewed with a total farming size of approximately 826 hectares. If we take into consideration that the total bergamot production in the province of Reggio Calabria is 1,200 hectares, then we have more than 65% of the bergamot properties represented in our research.

A possible limitation of the study could be that certain data was collected concerning the current situation and that of seven years ago. It is possible that this may have introduced some confounding in the form of recall bias. This was considered and not believed to impact the results significantly because the resilience index was only calculated for the current situation. In the survey results, it may have been a factor but the risk was not judged to outweigh the benefits of obtaining insights concerning the situation prior to the reform of the Bergamot Consortium and the consequent stabilisation of the bergamot price.

As briefly described above, Calabria is a region characterised by high unemployment (particularly among young people) low income, and high internal migration rates. This scenario has worsened over the last years because of the economic crisis and the decrease of transfers from the central government due to budget constraints. As a

consequence, job opportunities and creation of sources of income in Calabria is an urgent need.

Bergamot cultivation is an activity that has several unique characteristics that support the potential of the sector. Firstly, high-quality bergamot production is a natural monopoly of southern Calabria given the unique agro-ecological conditions of the region. It is not possible to cultivate bergamot on a large scale and of sufficient quality to meet the demands of the fragrance industry in other areas. Secondly, the demand of the sector requires specific policy measures.

To conclude, the study shows that bergamot production increases producers' resilience (i) by providing additional and stable income, (ii) by increasing the opportunities of income diversification and (iii) by stimulating collective action.

The potential of the bergamot sector is well recognised and seen as an overall positive trend. For instance, 85% of interviewed farmers plan to expand their bergamot production in the next three years. However, over the last seven years, only 28% of farmers have had access to incentives to invest in their farms and only 5.62% of farmers made use of these incentives to expand bergamot production. Therefore, while bergamot is making a contribution to improving the resilience of those involved in its production, the potential advantages have not been fully exploited.

In a broader sense, promoting and safeguarding the bergamot production is part of a different vision of southern Calabria's development. It will allow it to be transformed into an area that will be competitive and open to opportunities from an economic, social and cultural point of view through the valorisation of its endogenous resources.

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