

A Multi-Criteria Approach to Assessing PDOs/PGIs: An Italian Pilot Study

Francesca Galli¹, Anna Carbone¹, Julie A. Caswell², and Alessandro Sorrentino¹

¹University of Tuscia, Italy

²University of Massachusetts Amherst, MA, USA

francescagalli@gmail.com; acarbone@unitus.it; caswell@isenberg.umass.edu; sorrenti@unitus.it

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ABSTRACT

The paper contribute to the assessment of PDO/PGI schemes by building an approach to measuring the actual performance of the PDO/PGI products in relation to the objectives of the European Regulation 510/2006. This is done through a multi-criteria ex-post analysis that compares the performance of different PDO/PGI products with respect to multiple criteria. The research presented, based on a small sample of Pdo cheese products in Italy, can be considered a pilot study that develops a comparative evaluation of the performance of PDO cheeses: i) relative to the different objectives of the schemes, ii) by using a set of suitable and informative indicators that can help to evaluate the effectiveness of a wide number of PDOs/PGIs with respect to the regulation's objectives, and iii) by considering that different actors involved in PDO/PGI schemes may have different priorities with regard to the importance of different objectives in evaluating the performance of schemes.

Keywords: Protected Designations of Origin (PDO), Protected Geographical Indications (PGI), Multi-Criteria Decision Analysis, Cheese

1 Introduction

Geographical Indications of origin (GIs) are increasingly being adopted as public policy in the European Union for the identification of typical food products in the form of Protected Designations of Origin (PDOs) and Protected Geographical Indications (PGIs). In recent years substantial interest has emerged in improving this policy in order to encourage the adoption of PDO/PGI schemes as well as to increase their effectiveness (EU Commission 2008a, EU Commission 2008b). Sound assessments of the actual benefits and costs of the policy are important to its ongoing revision. Significant study has been done exploring the different features of the policy by testing, from a theoretical point of view, the rationales on which it is grounded and evaluating expected welfare impacts on different actors in society (Moschini *et al.* 2008, Langinier *et al.* 2008, Lence *et al.* 2007, Zago *et al.* 2004). Fewer studies provide empirical assessments of the policy in terms of its multiple impacts. Empirical contributions draw their conclusions on the basis of single cases (Belletti *et al.* 2007, De Roest 2000, Arfini 2000, Carbone 1997) and supported by anecdotal evidence. A comprehensive and replicable approach for the assessment of the impacts of PDO/PGI schemes in terms of achievement of their objectives is missing (Marescotti 2010).

Here we begin to fill this gap by developing a multi-criteria framework for assessing the performance of PDO/PGI schemes from an ex-post perspective. The PDO/PGI performance is here defined according to

* European Union Reg. 2081/1992 introduced Protected Designations of Origin and Geographical Indications and was revised through Reg. 510/2006. From the Fischler Reform in 2003 onward, in line with policy to strengthen rural development, quality schemes have been fostered through public incentives including the possibility of financial aid to producers committed to quality improvement.

the objectives stated by the European Union in the Regulations that rules the use of these quality schemes (QS). In other words, the performance of these QS is evaluated assuming the perspective of the European policy maker. Legislative documents issued by European Union institutions show that there are several performance objectives for PDOs/PGIs. Hence, a performance analysis should be multidimensional. Multi-criteria analysis (MCA) allows ranking PDOs/PGIs according to the different objectives stated by the EU regulations. It also gives a unique ranking and allows analysis of the role of each objective in the overall ranking. Furthermore, it shows the extent to which trade-offs arise among these different targets of the QS allowing insights into the general coherence and a priori feasibility of the scheme.

The second section provides an overview of recent contributions to the literature analyzing the performance of PDO/PGI products and insights into critical issues encountered in these evaluations. The third section presents the multi-criteria framework and its application for the evaluation of PDO/PGI schemes. It also presents and discusses the choice of criteria for the performance assessment. The fourth section provides a pilot application of the framework to a selection of PDO cheeses in Italy.

2 Literature Review

We turn to the literature on the assessment of PDO/PGI schemes to obtain insights into the criteria selected for the evaluation, to understand what evidence supports the increasing interest in the use of PDO/PGI schemes, to assess whether the existing empirical work succeeds in evaluating the results of the policy, and to evaluate the extent to which all relevant objectives and the impacts on different actors have been considered. Due to space limits, we offer a synthetic comparison between four contributions to the literature. The objective, approach used, criteria considered, and main results are discussed for each contribution.

Barjolle et al. (2009) performed a meta analysis of research on PDOs/PGIs suggesting that there is no unique established evaluation method due to the deeply differentiated markets for these products and the lack of detailed information on the economic results, especially for the smallest ones. They define impacts as “effects deriving from the implementation of a geographical indication system on the dimensions of sustainable rural development (economic, social and environmental factors)” (p. 3). The different methods of evaluation they review are distinguished as objective or subjective methods. Objective methods provide a picture of the differential impact between two states, other conditions being equal, either by looking at the situation of a GI product before and after its registration (i.e., diachronic evaluation) or by comparing two similar products, one with and the other without a GI (i.e., synchronic evaluation). Analysis is usually based on statistical data, accounts data, and field observation, and is then integrated with qualitative data. Subjective methods are based on the comparison of preferences in terms of incentives, perceived expected outcomes (costs and benefits), and opinions of the actors involved. These methods are generally based on interviews of operators, experts, and different decision makers.

Barjolle et al. present a conceptual framework for the harmonized assessment of a set of 14 previously performed case studies. The assessment is subjective and based on expected effects relative to a set of economic indicators (market stabilization/increase, price premiums, and value added in the region), social indicators (local employment, levels of empowerment of producers, and cultural value/tradition related to the product), and environmental indicators (local breed/variety, the use of extensive farming, and natural resources). Criteria were graded subjectively for each case study (on a scale from zero to six) after discussion with the experts who carried out each study. The authors cluster the GIs and characterize them in terms of the prevalence of different types of expected impacts. It appears that the expected impacts of geographical indication systems are mainly economic, and may be - as the authors observe - to the detriment of social and environmental impacts.

Barjolle and Sylvander (2000) focus on the specific conditions and institutional requirements for the development of PDO and PGI products[†]. The ultimate objective of their work is to identify conditions that are critical for the success of PDO/PGI products. Mere registration as a PDO/PGI does not guarantee the market success of the product but a number of other conditions need to be fulfilled by a supply chain if it is to be successful (Barjolle and Sylvander, 2000, p.46). They assume that value creation on a collective basis is an essential factor that must be backed by public policy (i.e., the protection of the schemes), where the producers are networks of small firms with limited resources and visibility. The role of the policy is considered essential in supporting the collective process of value creation. From this view, performance should be evaluated based on value creation and the success of supply-chains in the market.

[†] For further details see the FAIR project 1 - CT 95 – 0306, “PDO and PGI products: market, supply chains and institutions”, Final Report.

Barjolle and Sylvander select a set of criteria relevant to the assessment of each PDO/PGI supply chain: i) product specificity and differentiation; ii) relevance on the market[‡]; and iii) internal organization and coordination. The authors subjectively assign a success score with respect to these three criteria to the products analyzed[§] using a benchmarking approach. This success score is named “calculated success”. In the following step, the measures of calculated success are correlated with “observed success”, derived with respect to five measures of actual market performance: i) turnover; ii) growth rate with respect to the reference market; iii) notoriety of the product; iv) premium price with respect to the a generic product; and v) rural employment. They interpret the degree of correlation between calculated and observed success, as an indication of the goodness of the criteria of calculated success initially chosen. In this rather circular approach, if calculated success is consistent with observed success, then the criteria behind calculated success are good indicators of PDO/PGI supply chain success. No single factor by itself can guarantee the success of the supply chain. The criteria of success considered by Barjolle and Sylvander are complex and broad; they require a great amount of detailed data that can only be collected on a case-study basis.

A wider evaluation of PDO/PGI schemes is provided by the European Commission (2008b)**, which carried out a detailed description of the implementation and usage of the schemes over the period 1992-2006. It evaluated the effectiveness of PDO/PGI schemes in relation to their objectives^{††}. Effectiveness is evaluated for 18 case studies using a wide set of subjective methods, largely based on the responses of producers to a series of questionnaires and expert evaluations. The responses indicate the perceptions of operators with respect to the functioning of the scheme. However, potential subjective bias and personal judgment make it unclear how well this approach assesses the actual performance of products.

A recent contribution from Arfini and Capelli (2009) considers PDO/PGI schemes as means of providing better economic returns to producers. They make comparisons across 98 Italian PDO/PGIs using a cluster analysis based on a series of variables. The variables identified rely on data available from official sources. The authors emphasize that “an important condition for the success of the PDO/PGI schemes is the capacity of companies to develop an action of governance with the power to help them obtain remunerative prices on the relevant market” (p.1). The cluster methodology implies a certain degree of objectiveness (as the observed data provide the basis of the analysis) and also subjectiveness (as the clusters are interpreted by the researcher). The key factors identified for differentiating clusters are the product’s quality profile, the commercial strategy, and the governance structure. They find a clear distinction between typical products produced in large volumes with industrial methods and those that may be considered niche products. This diversity is linked to different economic and commercial objectives set by players and to technological and production restrictions that characterize the production phase. The increase in value added is made possible through the development of a collective commercial strategy that enhances the bargaining power of the enterprises that turn to large scale distribution and traditional retailing with higher quantities.

Although the reported studies address different aspects of the performance of PDO/PGI schemes, they converge on the idea that a successful PDO/PGI policy is a consequence of: i) the actual product differentiation, ii) an effective marketing strategy, and iii) a strong coordination among the actors involved. The studies agree that PDO/PGI policy has its effects through the functioning of the market. Therefore the assessment of the performance of a scheme, at least at a preliminary stage, should be carried out indirectly by focusing on impacts on the components of agri-food supply chains that produce and commercialize PDO/PGI products, along with the impacts on consumers who should benefit from a reduction in information asymmetry.

[‡] This is not always defined by the nature of the actual product or its common use but is evaluated by looking at, for example, the customer appeal of the product’s specific characteristics, willingness to pay, and choice of distribution channel.

[§] The authors base their results on field surveys on twenty-one supply chains whose final product is registered as a PDO/PGI.

** Carried out by London Economics with the involvement of other universities throughout Europe.

†† The objectives considered are: i) ensuring the quality and diversity of products; ii) increasing the market shares of PDO/PGI products in domestic and export markets; iii) increasing the returns along the supply chain; iv) insuring diversification of products; vi) increasing economic activity in rural areas; and vii) establishing cultural value in rural areas.

3 A Multi-Criteria Approach for the Assessment of the Performance of PDO/PGI Schemes

We contribute to the assessment of PDO/PGI schemes by building an approach to measuring the actual performance of PDO/PGI products in relation to the objectives of the European Regulation 510/2006. We use a multi-criteria, ex-post analysis that measures the performance of different products with respect to multiple criteria in order to move forward the common acquis reached so far. This framework allows: i) an overall evaluation of the coherence and feasibility of the multiple objectives assigned to PDOs/PGIs, ii) a ranking of the performance of PDO/PGI products overall on different objectives and, at the same time, analysis of the role of each dimension, iii) definition of a set of suitable and informative indicators that can help to evaluate the effectiveness of a wide range of PDOs/PGIs with respect to the regulation's objectives, and iv) testing of an approach that can account for the views of different actors involved in PDO/PGI schemes who may have different priorities (or weights) with regard to the importance of different objectives in evaluating performance^{‡‡}. The framework provides operational advice and insights for policy makers and chain stakeholders.

Multi-criteria techniques have been developed in the field of decision theory to aid problem-solving and are applicable to cases where multiple objectives and criteria enter the evaluation of an alternative among different options. The multicriteria outcome is not the absolute best solution since none of the options available can optimize all the criteria at the same time and a compromise solution must be selected (Munda, 2005). Such solutions depend on two elements: the basic data available and the characteristics of the decision maker (i.e., preferences on the criteria involved in the problem) (Brans and Mareschal, 2005). In the evaluation field, multi-criteria analysis is more often an ex ante evaluation tool for the examination of alternative projects or strategic solutions (OECD, 2008). The present work is focused on an ex post assessment of PDO/PGI schemes as policy tools based on their performance.

The performance of each PDO/PGI product is defined as the degree of achievement of the policy objectives, where the assessment of the performance on the different objectives relies on the definition of a set of indicators. In general terms, an indicator is a measure derived from a series of observed facts that can reveal the relative position of a product in a given context (OECD, 2008). They can be expressed in quantitative or qualitative terms and hence are measured using different types of scales (continuous measures, binary terms, discrete variables, and ordinal scales). An information card for each PDO/PGI product is constructed and data are collected. Once suitable indicators for each objective are identified, the cards represent the basic building blocks of the analysis as they contain detailed information on the main characteristics and the indicators for each PDO/PGI product.

Once the information cards are completed, a subset of the data and indicators for each objective is selected for the *performance matrix*. The basis of the selection for the pilot study is discussed in the next section. The definition of the performance matrix is the first key output of the multi-criteria analysis and is the basis for comparing products. The performance matrix consists of rows that refer to each PDO/PGI product and columns representing indicators for each objective. The intersections between rows and columns indicate the performance of the particular product on a specific indicator.

There are numerous multi-criteria decision methods. For assessing the performance of PDO/PGI schemes we chose an outranking method based on multi-criteria analysis using pair-wise comparisons and dominance relationships. Given what is known about the decision-maker's preferences over the objectives and related indicators, outranking is based on a binary relation S defined on the set of potential actions A such that $a S b$, if there are enough arguments to decide that a is at least as good as b whereas there is no essential argument to refute that statement (Roy, 1974). Outranking methods are suitable for this analysis because they do not force the translation of different scales and units of measurement for different criteria into a single common measure for purposes of comparison but rather compare products within each criterion (Henson et al. 2007). Moreover under this approach two options can be classified as not comparable when information on a particular indicator is missing.

There are various types of models that can be used in the outranking decision process. There is no best model in principle: all have some strong and weak points (Bouyssou et al, 2000). We adopt a particular version of outranking methods named Preference Ranking Organization Method for Enrichment Evaluations (PROMETHEE) (Brans et al. 1985). We choose this approach for several reasons. The PROMETHEE approach allows us to consider the multiple dimensions of PDO/PGI schemes through the simultaneous comparison on several indicators. Moreover it allows the grouping of subsets of indicators and treats them as common categories (i.e. objectives). Outranking approaches allow us to adapt weights

^{‡‡} This last aspect is not widely explored in the present work but represents an interesting extension, made possible by the functioning of the framework adopted, and is currently being developed by the authors.

to alternative sets of preferences, thus simulating the perspectives of different stakeholders. This would not be possible if we used a compensatory technique, (such as a Multi Attribute Utility approach). In fact, outranking non compensatory approaches, such as the PROMETHEE I and II methods, interpret weights as “importance coefficients” (i.e., the greatest weight is placed on the most important dimension, according to the priorities of the stakeholders). Varying numerical weights can be assigned to each objective in different scenarios to reflect different hypotheses on the importance placed on them by stakeholders (including the decision maker). Finally, the visualization of the decision problem is possible by using the Graphical Analysis for Interactive Assistance (GAIA plane), which is a powerful tool to provide a global view of the characteristics of the results and to identify conflicts between criteria. The GAIA application is a feature included in *Decision Lab* software used in this analysis. *Decision Lab* is a popular software in the field of decision support systems, developed to help in the selection of the best compromise alternatives (Brans and Mareschal, 2000).

There are an increasing number of researchers and practitioners interested in the development and application of the PROMETHEE method, as shown in the comprehensive literature review presented by Behzadian et al. (2010). The authors review contributions focused on description of methods, mathematical features and software development (22 out of 217 papers reviewed). They also review a very large number of applications (195 out of 217 papers). The most popular application areas are environmental management, including waste management; Life Cycle Assessment; environmental impact assessment; and land use planning. Other relevant fields of empirical research that recur using PROMETHEE methods are hydrology and water management, business and finance, chemistry, logistics and transportation, energy management, and social applications. Not included in the review, is a more recent and interesting application of PROMETHEE methods to prioritize food borne pathogen risks that considers public health impact as well as market impact, consumer risk acceptance and perception, and social sensitivity (Ruzante et al. 2010). This framework provides an instrument to support policymakers in complex risk prioritization decision making when different stakeholder groups are involved and multiple pathogen-food combinations are compared.

The following information is required to apply PROMETHEE methods. First, information on relations between the criteria is needed including understanding the relative importance of the criteria. Varying numerical weights can be assigned to objectives in different scenarios to reflect the different importance placed on them by stakeholders (including the decision maker). Confronting the different rankings that result from using different sets of weights can be useful in assessing how specific structural conditions and industrial strategies perform with respect to different objectives. Moreover, in an ex post analysis different rankings according to different weights might provide useful insights into the model of governance and the strategic choices implemented in the supply chain of the different PDO/PGI products. Assessment of the weights policy makers would apply would require the elicitation of their priorities and perceptions. In the present preliminary work, we limit the definition of the weights on the objectives perspectives to hypothetical sets of weights in order to carry out simulations to show the ranges of outcomes that result.

Also required for PROMETHEE methods is information within each criterion related to the degree of preference associated with the deviation between the evaluations of two alternatives on a particular criterion. A function of such deviations represents the preference on one alternative with respect to another relative to a certain criterion. The preference function takes values between 0 and 1 and equals zero when the deviations are negative. The preference function assigns a smaller or null preference degree when deviations are small or negligible and larger preference degree when deviations are larger. Six types of functional forms have been proposed by the Vincke e Brans (1985) in order to reflect the different degrees of preference associated with the different criteria. For this analysis, we adopted a “usual preference function” for all the indicators used. This function does not depend on any parameter and does not discriminate among the differences between indicator values. In each pair wise comparison, a value of zero is associated with the worst alternative and a value of one with the best alternative.

Based on the scores obtained in the pair wise comparisons, PROMETHEE yields positive and negative preference flows for each product analyzed. A positive flow represents the degree to which, on average, one product outperforms the other products in the pair-wise comparison of the indicators. The larger the positive flow the higher the ranking of the product. A negative flow represents the degree to which, on average, the other products outperform the product considered in the pair wise comparisons. The smaller the negative flow the higher the ranking of the product. The net flow of a product, and consequently its ranking, is the result of a balance between the corresponding positive and negative flows. Rankings can be partial (PROMETHEE 1 gives an incomplete ranking when options are conflicting) or complete (PROMETHEE 2 is based on the balance of the two preference flows). Rankings are influenced by the weights allocated to the criteria. Further insights into performance can be gained by looking at the GAIA plane. GAIA makes use of the multivariate data method of Principal Component Analysis (PCA) applied to

the net preference flows computed separately for each criterion. For example, the positioning of the PDO cheeses on the GAIA plane presented later in this article provides a clear representation of performance and allows the identification of clusters of products according to their performance.

Rankings are influenced by the weights allocated to the criteria. The sensitivity of the ranking to the weights assigned to the indicators gives an idea of the stability of the ranking of the performance of the different products^{§§}. This feature is also included as a function in the software, which allows the weights placed on objectives to be modified in order to observe the resulting effect on performance rankings.

There are caveats with the use of the PROMETHEE multi criteria approach in regard to the expected results and thus limitations on the performance analysis. The outcome of the evaluation is a relative ranking of units within the sample analyzed. It is important to underline that the method does not provide any absolute assessment of performance. Such an assessment would require defining a benchmark that could provide an absolute measure of performance for PDOs/PGIs. Analyzing the factors that influence the performance of each single PDO/PGI is also not part of this work, although it could be considered as an important extension of the research.

Our approach uses PROMETHEE II. In it, the partial ranking of PROMETHEE I, which may show incomparability between options due to non-coherent positive and negative flows, is "forced" into a complete ranking, based on the net flow, which is a balance of positive and negative flows (Macharis 2004). This may lead to a loss of information.

The PROMETHEE requirement of associating a preference function with each of the criteria implies the ability to structure preferences in detail. This, especially in ex post analysis, may not be trivial or even necessary. PROMETHEE does not provide any guiding principle for determining the weights but assumes that the decision-maker is able to weight the criteria correctly. The assessment of the performance is essentially static except for any indicators of variation that are included in the analysis. The monitoring of the performance of PDO/PGI products should be continued over a period of time, by including new registered products and new criteria if appropriate. Finally, all units of analysis are judged based on common criteria so PDO/PGI products cannot be evaluated using different criteria.

4 Relevant Objectives and Indicators of Performance for PDO/PGI Schemes

The identification of the objectives and the choice of the corresponding indicators is a crucial step of the multi-criteria analysis because they are the reference points for the performance evaluation. For this analysis, the identification of the objectives used for the evaluation of PDO/PGI schemes is grounded in regulations and other official documents (EU Reg. 510/2006, EU Reg. 2081/1992, Green Paper and Communication on agricultural product quality policy). We identify five objectives and discuss the degree to which they overlap

1. Enhancing producers' bargaining power. The premise for this objective is that producers of high quality, typical products, especially at the farm level, quite often face different constraints that limit their bargaining capacity. Among these constraints may be the small dimension of the productive units and strict controls on the production process due to territorial boundaries that must be fulfilled to gain certification as typical product. These constraints, negatively affect producers' bargaining power and their opportunities to choose market strategies targeted at improving and communicating product quality. Thus, the PDO/PGI scheme aims to give them a tool to build a collective reputation, increase market power, and increase the share of value added they receive.
2. Promoting differentiation of production. The objective is based on the idea that consumer demand is increasingly oriented towards quality and variety. Thus promoting differentiation and quality can contribute to a better market equilibrium between supply and demand that helps European producers be competitive and results in better remunerating for input suppliers. This objective may overlap with the objective of enhancing producers' bargaining power. However, it differs in its focus on a supply that matches the articulated and differentiated preferences of final consumers.

^{§§} The software shows the stability interval within which the weights applied to each criterion could vary without changing the complete ranking for a set of alternatives.

3. Providing reliable and relevant information to consumers on product origin. Markets for differentiated products need sufficient information but this is not always at hand and not always reliable, especially for an attributes like product origin, which is a credence attribute.
4. Enhancing market performance. This objective includes the previous ones to some extent but goes further as it refers to market performance of typical products, their market size, and their capacity to gain a price premium.
5. Promoting local development. Here the focus is even wider. PDO/PGIs are seen as an indirect lever to foster rural society, to preserve cultural identity, and to preserve traditions linked to typical products (Hingley et al., 2010).

Among this wide set of objectives associated with the EU official documents, some are more directly targeted to agricultural producers (i.e., bargaining power and local development), some to consumers (i.e., reliable information and product differentiation), and others are wider and concern the entire food chain (i.e., market performance).

The next step in the operationalization of the framework is to select measurable indicators of the performance objectives. We chose a set of indicators for each objective for two reasons. First, the objectives are, by their nature, complex and multidimensional. Second, and more practically, data availability posed serious limitations so that to better represent each dimension it was necessary to use more than one indicator. The choice is the result of a compromise between the explanatory value of the indicators and the availability of information on PDO/PGI schemes. Once objectives and corresponding indicators are identified, the information card for each product can be constructed.

The information card presents each objective and the corresponding indicators. In addition, the information card provides background information on the productive structure of the PDO/PGI that is relevant to the understanding of its setting and functioning. This background information includes the age of the PDO/PGI, actions taken by a consortium to monitor and promote the PDO/PGI as a whole, the number of firms associated with the consortium, the number of agricultural farms and processing firms in the supply chain, the number of certified firms in each year from 2004-2008, the percentage of sales among different channels of distribution and market segments (local, regional and other areas), and the dimension of the production base (e.g., arable land or number of head of cattle).

The central section of the information card lists the indicators representing each objective. The pilot application here is to the PDO cheese sector in Italy. The complete set of indicators for this sector is:

1. *Enhancing producers' bargaining power.*
 - 1.1. Ratio of estimated turnover at producer price over estimated turnover at consumer price within the PDO/PGI. Other things being equal, the bigger this share the bigger the role of producers and the higher their influence in the transactions and in the decision process along the chain.
 - 1.2. Share of firms associated with the PDO/PGI Consortium over total number of firms in the PDO/PGI chain. The more the Consortium is representative of the production base, the more it may be legitimate to undertake collective actions aimed at enhancing producers bargaining power.
 - 1.3. Average certified quantities per firm. The larger the firms, the higher may be their bargaining power.
 - 1.4. Share of farms that also transform raw material over total number of firms in the PDO/PGI chain. The higher the share of farms engaged in transforming raw materials, the more influence they can exert along the chain and in the final market.
 - 1.5. Share of production sold through direct sales. The higher the share of farms engaged in direct selling, the more influence they may be able to exert along the chain and in the final market, for example by avoiding stronger counterparts such as retailers.
2. *Promoting diversification of production.*
 - 2.1. Certified quantity over total cheese sector production. The smaller this quantity the higher the differentiation level.

- 2.2. Dimension of the production area relative to the overall cheese PDO/PGI area in Italy. Similar to the above but in terms of production areas.
- 2.3. Use of highly distinctive and deeply rooted traditional raw material and/or techniques (qualitative, dummy variable).
3. *Providing reliable information for consumers on the origin and other quality attributes of typical products.*
 - 3.1. Reliability of the information included in the name with respect to the area of origin. This is a qualitative, dummy variable that measures the match between the name and the area of production. . For example, for some PDOs/PGIs the actual production area lies, at least partly, outside the area named by the PDO/PGI.
 - 3.2. Precision of the name with respect to the actual origin. This is a qualitative, dummy variable that measures the accuracy of the information on product origin carried by the PDO/PGI names. For example, some PDOs/PGIs are linked with production areas that are so vast and heterogeneous that the quality indications suggested by the name are not accurate.
4. *Enhancing market performance of PDO products.*
 - 4.1. Quota of actual over potential production in the area. The assumption here is that the use of the PDO/PGI is costly and brings many constraints to the producers so that it is worthwhile if it improves opportunities to market certified production compared to non certified production.
 - 4.2. Trend in the turnover of the PDO over the turnover of cheese production in Italy. The same as above but as a trend in the market share of certified product over substitutes.
 - 4.3. Share of certified production exported. The choice of this variable assumes the orientation towards exports of the Italian Agri-food system and the usefulness of the Qs in conveying information on quality especially in the distant markets, where other forms of communications are less effective.
 - 4.4. Price premium, in percent, of the PDO. The same as for variable 4.1, but in terms of price increase.
5. *Promoting rural development.*
 - 5.1. Number of firms in the PDO chain out of 100Km².
 - 5.2. Average certified quantities per firm. The same as for 1.3.
 - 5.3. Use of highly distinctive and deeply rooted traditional raw material and/or techniques (qualitative, dummy variable). The more the production is linked to the local productive system the less it may suffer from competition by substitute product (the variable used here is the same of 1.3, but its role here is different).
 - 5.4. Share of production sold on the local and regional market. The idea here is that product sold locally can activate a larger share of the local economy and more directly promote the territory. Nevertheless, the variable can be partly ambiguous in its meaning and relevance.
 - 5.5. Local events for the promotion of the PDO. This is a qualitative, dummy variable is directly linked to the promotion of the territory that may go together with the promotion of the product.

5 Evaluation of the Performance of PDO Cheeses in Italy: A Pilot Study

We conducted a pilot study applying the multi-criteria analysis to the evaluation of a subset of PDO cheeses in Italy. The Italian agri-food system has the highest number of food products with PDO/PGI recognitions, accounting for 193 out of 873 across all food sectors in the European Union at the end of 2009 (ISMEA 2010). A closer look at the economic importance of PDO/PGI products across sectors in Italy indicates a strong concentration in terms of value creation: 94% of total turnover (estimated at the producer price) is generated by the first 20 PDOs/PGIs products. Consequently 173 denominations together represent only 6% of the total turnover. The concentration is the result of two different factors. First, there is a large number of very small PDO/PGI, in terms of production area, producers involved, potential production, and, hence, turnover. These are mainly targeted at niche markets, whether local or

distant. Second, and not less frequent, there are PDOs/PGIs that exist only on paper, where a product that is in principle is entitled to be certified and sold as PDO/PGI is not. This represents a kind of failure of the scheme and it is one of the empirical facts that motivated this research focused on creating a frame to assess which PDOs/PGIs are aimed at and to what extent they actually reach these targets.

These data show marked differences in terms of types of products, firms, marketing characteristics, and actual functioning across the Italian designations system. The highest share of sales is linked to denominations in the cheese sector, together with processed meats. In 2008, approximately 61% of the total turnover was produced by the famous cheese and ham PDOs/PGIs (Parmigiano Reggiano, Grana Padano, Prosciutto di Parma, and Prosciutto San Daniele). This pilot study concentrates on a single sector, cheese, in order to treat as exogenous the events and dynamics specific to the Italian dairy sector that are common to all the products included.

Out of the 34 PDO cheeses in Italy in 2008, we selected 11 for the pilot study. These cheeses were chosen to span the range of cheese PDOs in terms of turnover, quantities produced and certified, and geographical extent of the territory as defined in the specification of production (see Table 1). We also selected the sample to reflect the geographical dispersion of PDOs across Italy. There are many more cheese PDOs in northern Italy than in the south. Finally, the types of cheeses chosen are differentiated in terms of typology (hard, semi-hard, and fresh; more or less aged).

The analysis is based on data available through official sources (ISTAT, ISMEA, Qualivita) integrated with information obtained from internet websites of PDO Consortia, the Italian National Ministry of Agriculture, and the European Commission. Table 2 shows the performance matrix for the 11 PDO cheeses analyzed with the five objectives of PDO/PGI policy and related quantitative and qualitative indicators. We specify whether each indicator is to be maximized or minimized to meet the corresponding objective. The analysis of the performance matrix was done using PROMETHEE 2, the outranking method discussed earlier based on the principle of pair-wise comparison that gives a complete ranking.

Table 1.
Sample of Italian PDO Cheeses in Pilot Study

CHEESE PDOs	dimension of area of production (km ²)	turnover (mln euro)	average quantities (ton 2008)
Casciotta d'Urbino	2,892	1.7	229.0
Fontina	3,263	30.3	4,322.1
Gorgonzola	35,371	223.3	35,566.7
Montasio	18,614	47.8	7,348.8
Murazzano	617	0.2	21.5
Pecorino Romano	45,802	172.9	10,097.6
Pecorino Siciliano	25,703	0.3	10.5
Pecorino Toscano	23,534	19.0	2,174.5
Raschera	6,903	4.3	780.5
Robiola di Roccaverano	301	1.1	84.2
Taleggio	19,330	49.1	7,924.3
<i>Mean</i>	16,576	50.0	6,232.7
<i>Standard deviation</i>	15,259	76.3	10,394.8
<i>CV</i>	0.9	1.5	1.7

Source: elaboration on ISTAT, ISMEA (2008)

The first step in the analysis is the construction of a baseline scenario in which the ranking among the products is based on equal weights of 20% assigned to each of the five objectives. Thus it assumes that the five objectives of the regulation are equally important. Official documents themselves do not offer a basis for weighting objectives thus the hypothesis that European legislators attribute equal importance (weights) to the multiple aims of the PDO/PGI schemes. Within each objective, the weight assigned is equally shared between the indicators for that objective. For example, the bargaining power objective has 5 indicators so each indicator has a 4%

Table 2.
Performance Matrix for Five Objectives for Pilot Study of Italian PDO Cheeses

CHEESE PDOs	bargaining power					differentiation			info to		market performance				rural development				
	avg % turnover to producers (2004-2008)	% firms in Consortia and prod. ass. (2008)	Quantity certified per firm (ton_2008)	% direct sale (2004-2008)	% farms that process and sell (2008)	% avg quantity certified vs. tot. PDO cheeses (2004-2008)	% area of production vs tot PDO cheese area (km ²)	traditional breeds and varieties	reliability	precision	% actual use vs potential (2008)	% Δ market share (2004-2008)	avg % export PDO vs tot certified (2004-2008)	avg % price PDO vs generic (2004-2008)	# of PDO firms 100 km2 of the area (2008)	traditional breeds and varieties	% of sales in the local/regional area (2008)	Quantity certified per firm (ton_2008)	presence of local events related to the PDO product
	max	max	max	max	max	min	min	max	max	max	max	max	max	max	max	max	max	min	max
Casciotta d'Urbino	72.3%	33.3%	4.5	5%	nd	0.05%	0.60%	0	2	1	100%	-6.9%	0.0%	19.39%	1.76	0	80%	4.5	0
Fontina	95.0%	15.4%	25.4	0%	nd	0.81%	0.68%	1	2	1	94%	-24.0%	10.5%	87.9%	35.85	1	20%	25.4	1
Gorgonzola	41.6%	1.3%	468.0	5%	0.7%	7.25%	7.35%	0	0	0	nd	3.1%	28.5%	8.7%	8.69	0	nd	468.0	0
Montasio	70.0%	3.5%	126.7	10%	nd	1.69%	3.87%	1	1	1	33%	-13.6%	4.0%	9.31%	8.91	1	65%	126.7	1
Murazzano	62.5%	85.7%	1.8	61%	2.2%	0.01%	0.13%	1	2	1	36%	-17.0%	0.0%	132.9%	2.27	1	100%	1.8	1
Pecorino Romano	56.4%	0.5%	183.6	8%	0.3%	2.48%	9.52%	0	0	0	nd	5.9%	83.3%	-36.7%	22.77	0	nd	183.6	0
Pecorino Siciliano	56.0%	25.6%	0.4	40%	nd	0.00%	5.34%	0	2	0	12%	0.0%	55.5%	0.28%	0.32	0	35%	0.4	1
Pecorino Toscano	43.2%	1.8%	120.8	10%	nd	0.45%	4.89%	1	1	0	79%	-3.8%	9.1%	-1.9%	4.19	1	30%	120.8	1
Raschera	70.1%	9.9%	23.0	7%	2.2%	0.17%	1.43%	1	2	1	100%	0.2%	2.5%	23.50%	5.00	1	80%	23.0	1
Robiola di Roccaverano	63.0%	100.0%	4.2	29%	55.6%	0.02%	0.06%	1	2	1	99%	28.3%	8.8%	176.8%	6.64	1	90%	4.2	1
Taleggio	46.8%	6.9%	132.1	5%	0.3%	1.91%	4.02%	0	1	1	100%	-12.5%	10.0%	7.51%	4.52	0	80%	132.1	1

Source: our elaboration on ISTAT, ISMEA, Qualivita, European Commission, and Consortia.

weight in the baseline scenario. This means that the weight of a single indicator toward the achievement of each objective is inversely proportional to the number of indicators assigned to that objective.

Table 3 shows the baseline ranking of the 11 cheese PDOs and the net flows on each of the five objectives on which these rankings are based. As discussed above, the net flow of a product, and consequently its ranking, is the result of a balance between the corresponding positive and negative flows.*. Figure 1 shows a graphical presentation of the product ranking and the performance of each product with respect to each objective.

The products at the top of the baseline scenario ranking (Robiola, Murazzano, Raschera) are small PDOs from the Piedmont region in the north of Italy where there is a strong tradition of high quality cheese manufacturing. These products perform well with respect to all objectives. The exception is Murazzano, which has lower market performance. However this weakness is counterbalanced by good performance on the other objectives, particularly on differentiation. The group of top ranked PDOs also includes Fontina cheese, which performs just below the top three PDOs. It originates from Valle d'Aosta, a small region close to the Piedmont with the same strong tradition of high quality, typical cheeses.

The products positioned at the bottom of the ranking (Pecorino Romano and Gorgonzola) show a low performance on bargaining power, differentiation, information, and rural development, despite some good market performance due to levels of export and increasing market shares. Taleggio and Pecorino Toscano have similar low rankings. The lower ranked PDOs are far less homogeneous with respect to production areas, including quite famous and well established PDOs from northern Italy as well as PDOs from central and southern Italy. Their overall net flows scores are around zero.

Table 3.
Overall Ranking of Cheese PDOs and Performance on Individual Objectives

CHEESE PDOs	scenario 1 (baseline) ranking	net flows	net flows on objectives				
			bargaining power	differentiation	information	market performance	rural development
Robiola di Roccaverano	1	0.49	0.34	0.7	0.45	0.5	0.44
Murazzano	2	0.27	0.24	0.7	0.45	-0.37	0.36
Raschera	3	0.25	0.08	0.3	0.45	0.2	0.24
Fontina	4	0.18	0.04	0.23	0.45	0	0.2
Casciotta d'Urbino	5	0.05	0.08	0.13	0.45	-0.07	-0.32
Montasio	6	-0.02	0.14	0.03	0	-0.44	0.16
Pecorino Siciliano	7	-0.07	-0.04	-0.07	-0.1	0	-0.14
Taleggio	8	-0.18	-0.24	-0.47	0	0	-0.18
Pecorino Toscano	9	-0.21	-0.18	0.03	-0.55	-0.25	-0.08
Pecorino Romano	10	-0.37	-0.16	-0.8	-0.8	0.19	-0.28
Gorgonzola	11	-0.41	-0.3	-0.8	-0.8	0.24	-0.4

Source: our elaboration (software: Decision Lab)

* For simplicity of exposition, we do not report the values of the positive and negative flows (available from the authors upon request). For further details see Brans and Mareschal (2001) and Brans and Vincke (1985).

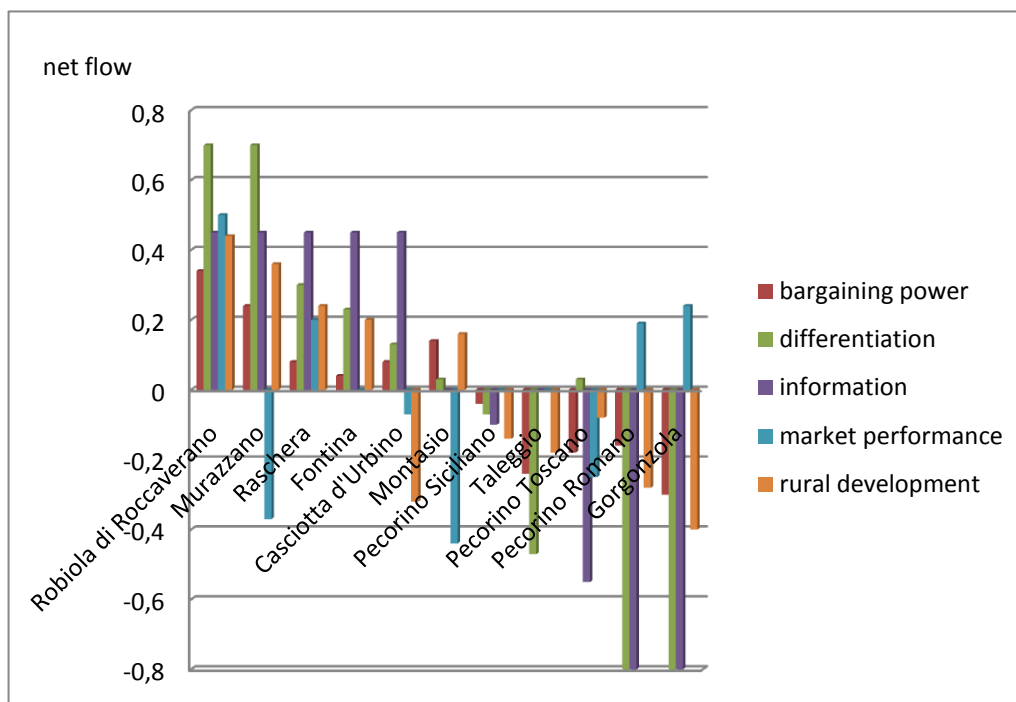


Figure 1. Performance of PDO Cheeses Relative to Five Objectives
 Source: our elaboration (software: Decision Lab)

A closer look at the results reveals that there is a negative correlation between the economic size of the PDO/PGI product and its ranking with respect to performance on the objectives. To a certain extent this result is a consequence of the way the indicators have been measured and it is consistent with the rationale of the European Regulation that is mainly targeted to the smallest traditional production chains. However, it should be noted that the sample here is too limited to be able to draw general conclusions in this regard.

We carried out a sensitivity analysis of the baseline ranking with respect to different weight distributions to test for robustness. Table 4 shows the weight stability intervals that represent the limits within which the weight of an objective can be modified without changing the ranking. The width of the intervals is a starting point for the identification and analysis of further scenarios. The results show substantial stability with quite wide intervals for three objectives: providing reliable information, enhancing bargaining power, and fostering rural development. Product differentiation and market performance are far less stable.

Table 4.
 Weight Stability Intervals for the Baseline Scenario Ranking for PDO Cheeses

objectives	weight %	%interval		size
		min	max	
differentiation	20	15.57	24.24	8.67
market performance	20	9.91	22.82	12.91
bargaining power	20	7.91	45.45	37.54
information	20	15.71	61.54	45.83
rural development	20	5.51	31.06	25.55

Source: our elaboration (software: Decision Lab)

Further insights into performance can be gained by looking at a visual representation provided by the Graphical Analysis for Interactive Assistance (GAIA) plane. GAIA makes use of the multivariate data method of Principal Component Analysis (PCA). PCA is applied to the net preference flows computed separately for each criterion. The axes of the plane correspond to the two first principal components,

which ensures that a maximum quantity of information is represented on the plane[†]. This visual support provides a global view of the characteristics of the results.

Figure 2 shows the GAIA analysis for the baseline ranking scenario. The colored axes represent the objectives and the triangles represent the PDO cheeses, positioned accordingly to their performance with respect to the objectives. The orientation of an axis and its length give meaningful information on the relationships between the objectives. These directions provide insight into tradeoffs between the achievement of multiple objectives. Based on the graph, there are no total trade-offs among the different objectives. In particular, three objectives (differentiation, bargaining power and local development) are pointing approximately in the same direction showing a quite clear complementarity in their achievement. This is consistent with the relationship between differentiation and the bargaining power as discussed above. Both objectives, as long as they strengthen the economy of agricultural producers, promote local development. The GAIA plane also suggests that local development, despite its general nature, is not as closely related with the objectives of information and market performance. The information axis points in an intermediate direction, while the market performance axis points in a quite different although not opposite direction. The length of the axes indicates objectives for which more important deviations are observed. A very short axis on the GAIA plane corresponds to low deviation between products on performance for that objective. Objectives with shorter axes will have a smaller impacts in the PROMETHEE 2 ranking and vice versa. For the baseline scenario, Figure 3 shows the market performance objective will have relatively more impact on product rankings.

The red axis labeled P_i represents the weights of the criteria. Its orientation emphasizes which criteria are predominant and shows a compromise or tradeoff solution between the objectives as proposed by PROMETHEE. As shown in Figure 3, for the baseline its orientation is approximately halfway between the objectives.

The positioning of the PDO cheeses on the GAIA plane provides a clear representation of performance and allows the identification of clusters of products according to their performance. A first cluster includes the Robiola, Murazzano, Raschera, Fontina, and Casciotta PDOs. These PDOs are grouped closely to four of the objectives but quite apart from the market performance axis, with the exception of Robiola, which is ranked in first place on this objective. A second group includes Montasio, Pecorino Siciliano, Taleggio, and Pecorino Toscano. These PDOs occupy an intermediate position and show a non-homogeneous achievement of the objectives. A third cluster includes Pecorino Romano and Gorgonzola. These products are most apart from all objectives, except from the market performance axis, which however is not able to offset the lower performance on the other objectives.

[†] The “delta value” measures the amount of information preserved in the GAIA plane. In practice, delta values higher than 70% correspond to reliable GAIA planes. In the present case, the value of 89.7% and can be considered reliable.

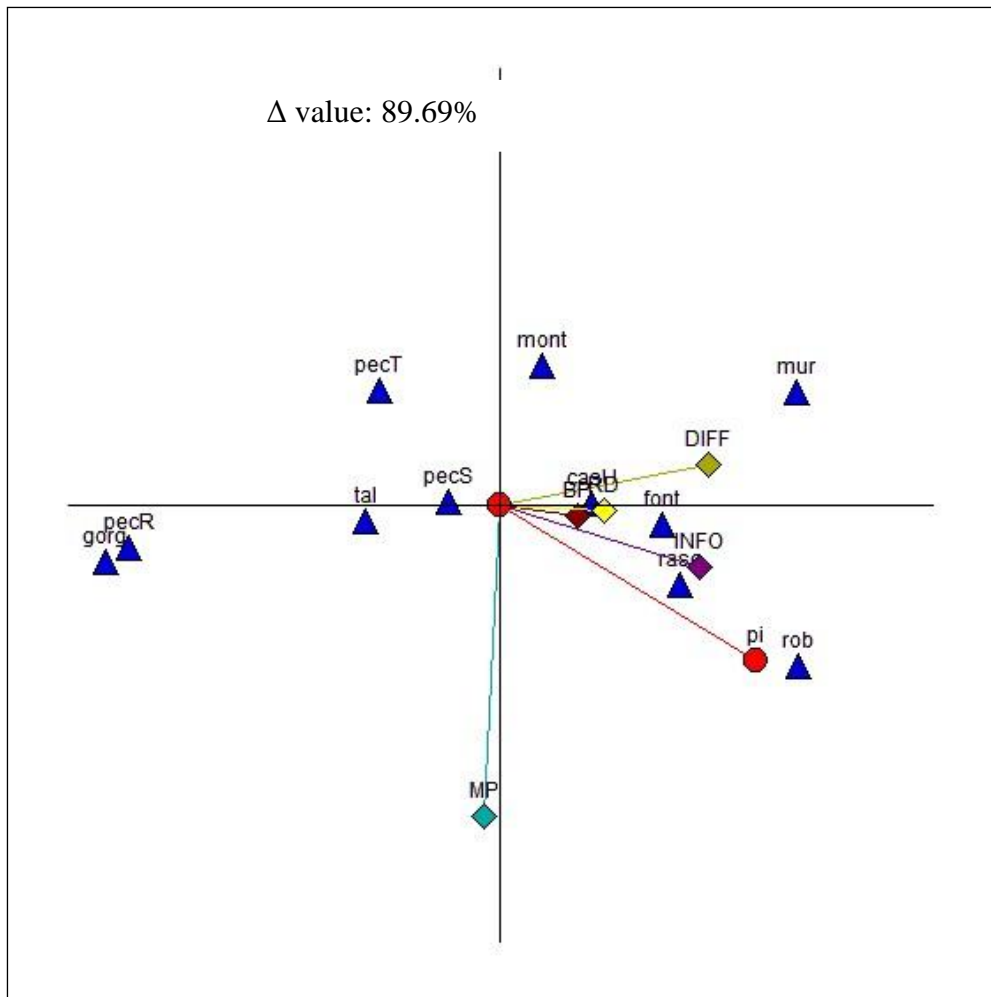


Figure 2. The GAIA Plane for the Baseline Scenario Ranking of PDO Cheeses

Source: our elaboration (software: Decision Lab)

Multi-criteria analysis is designed to explore how the ranking of alternatives changes under different perspectives, i.e. under different sets of weights attributed to different stakeholders or policy makers. In this preliminary study, we hypothesize two further weighting schemes for the baseline scenario of equal weighting of the objectives. These are intended as simulations and are not based on stakeholder surveys. They do, however, represent plausible alternative weightings. The second scenario is characterized by a heavy, triple weight being assigned to the market performance objective (60%), while the other four objectives each have a smaller 10% weight. In contrast, the third scenario assigns a 0% weight to the market performance objective and a 25% weight to each of the remaining four objectives. The aim of the scenario analysis is to gain a deeper insight into the role played by the market performance objective that emerged as an important determinant of the ranking of the PDOs in the baseline scenario. The alternative scenarios also allow an exploration of the impact of different preferences for objectives on the rankings.

Table 5 shows the rankings of the PDOs in the baseline and alternative scenarios. Robiola is ranked first across all three scenarios reflecting its strong performance on all five objectives. The much heavier weighting of market performance in Scenario 2 yields a different ranking than under the baseline Scenario 1 except for the top ranked PDO. On the other hand, scenario 3, which places no weight on market performance, yields virtually the same ranking as Scenario 1, which gives it a 20% weighting. Overall, the change in weightings of all objectives between Scenarios 1 and 3 are not sufficient to cause a change in rankings. Figure 3 shows the net flow of each PDO under the three scenarios. As noted, Scenarios 1 and 3 are almost overlapping. In contrast, differences in ranking are clearly evident in Scenario 2 with Murazzano and Montasio being ranked lower, while Pecorino Romano and Gorgonzola are ranked higher.

Table 5.
Rankings of Cheese PDOs in Three Scenarios with Different Weighting of Objectives

CHEESE PDOs	scenario 1 ^a		scenario 2 ^b		scenario 3 ^c	
	ranking	net flow	ranking	net flow	ranking	net flow
Robiola di Roccaverano	1	0.49	1	0.49	1	0.48
Murazzano	2	0.27	6	-0.05	2	0.44
Raschera	3	0.25	2	0.23	3	0.27
Fontina	4	0.18	3	0.09	4	0.23
Casciotta d'Urbino	5	0.05	4	-0.01	5	0.09
Montasio	6	-0.02	11	-0.24	6	0.08
Pecorino Siciliano	7	-0.07	5	-0.03	7	-0.09
Taleggio	8	-0.18	9	-0.09	9	-0.22
Pecorino Toscano	9	-0.21	10	-0.23	8	-0.19
Pecorino Romano	10	-0.37	7	-0.08	10	-0.51
Gorgonzola	11	-0.41	8	-0.08	11	-0.57

a All four objectives weighted equally at 20%

b Market Performance weighted at 60%, other four objectives weighted at 10% each

c Market performance weighted at 0%, other four objectives weighted at 25% each

Source: our elaboration (software: Decision Lab)

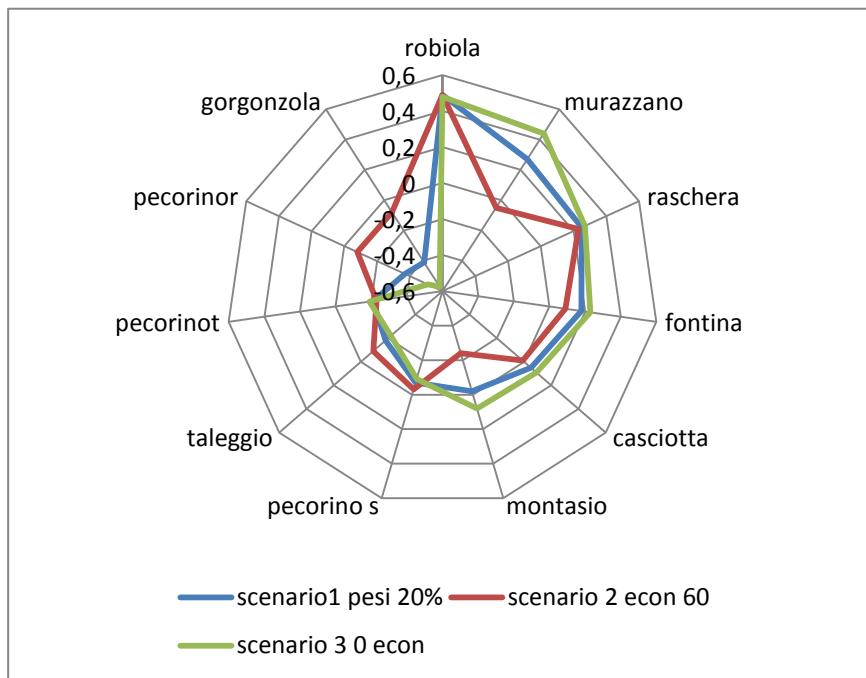


Figure 3. Cobweb Diagram of Net Flows for Cheese PDOs Under Three Weighting Scenarios

Source: our elaboration (software: Decision Lab)

The results of the scenario comparison are consistent with the indications obtained from the visual analysis of the GAIA plane in Figure 2 that showed a trade-off between the market performance objective and the other four objectives that were aligned together. The difference in the weighting of the market performance objective between Scenario 3 (0% weighting) and Scenario 1 (20%) did not change the rankings. However the increase in the weighing of market performance from 20% in Scenario 1 to 60% in Scenario 2, along with the reduction of the weightings on the other objectives, did change the rankings. However, it is important to note that for the majority of the PDOs included in the analysis that the different scenarios generate similar rankings.

6 Concluding Remarks

We developed a multi-criteria framework for the assessment of the performance of the PDOs/PGIs. This performance is defined with respect to five objectives set out in EU Regulation 510/2006 and other related official documents. Performance on these objectives is measured with several indicators. We applied the framework with a small pilot study of eleven Italian PDOs in the cheese sector. The analysis presented here is preliminary but offers insights for further analysis. First, it shows no strong trade-off among the different objectives. The ranking of PDOs/PGIs obtained in this baseline scenario proved to be significantly stable. The results of the small sample of cheese indicates that among this group smaller PDOs/PGIs tend to perform better than larger ones and those located in the North better than those in the South. Drawing broader conclusion requires further analysis using a larger sample of PDOs/PGIs.

Multi-criteria analysis is a promising approach to evaluating the performance of PDOs/PGIs. It offers a means to systematically explore the effect of multiple objectives and weightings of those objectives on the evaluation of the performance of individual PDOs/PGIs. The rankings obtained in the pilot study with three alternative weighting scenarios indicate that different PDOs are performing in a differentiated way, both in overall terms and also with respect to single objectives. The values of net flows in the multi-criteria analysis in the pilot study suggest the existence of three differentiated levels of performance with the top group of PDOs well above the others on the majority of the objectives.

The market performance objective is the most influential for the ranking obtained in the baseline scenario for the cheese PDOs studied based on the partial net flows and the GAIA plane. Rural development and bargaining power are the least influential. In addition, the analysis suggests that for the PDOs studied market performance is less closely aligned with the other four objectives, which are themselves quite closely aligned. Should this be confirmed by further analysis, it will have significant implications for how policy makers and producers evaluate PDO policy and PDOs. These results of the baseline scenario suggested weights for two alternative scenarios. Scenario 2 assigned a triple weight to the market performance objective. This generated a different ranking, with some of the lower ranked PDOs in Scenario 1 ranking higher and some of the higher ranking lower. Scenario 3 excluded the economic performance objective by assigning it a zero weight and choosing equal weights for the remaining four objectives. This scenario did not produce rankings different from the baseline Scenario 1.

The results, while promising, cannot be extended to make conclusions about other PDOs because of the small number of PDOs considered, refinements that are needed in the definition of some of the indicators used to measure the objectives, and the need for further research to define the weights that represent the different points of view (or interests) of different stakeholders within PDO chains. Further work is on-going to collect data to include as many PDOs as possible in the analysis and to refine the indicators (especially those measuring information and differentiation). Our research agenda includes the further definition of a set of different weights consistent with the preferences of different stakeholders. In addition, future work will focus on defining a benchmark that can provide an absolute measure of the performance of PDOs/PGIs and on analyzing factors that influence performance.

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