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Trends and support models in public expenditure on agriculture: An italian perspective

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Abstract

This paper identifies, quantifies, and qualifies the streams and models of public expenditure in the agricultural sector for the 2010-2020 period, and attempts to respond to the main preliminary needs of interventions that benefit the agricultural sector.

The specific methodology of the CREA has been used to classify public expenditure on agriculture at the national and regional levels, thus allowing for a homogeneous classification of all direct and indirect support for the sector, which has been obtained from the accounting records of the disbursing agencies.

This is accompanied by the use of cluster analysis to identify the support models for the sector that have been adopted by the Italian regions.

Through the analysis of FAO data on the Agriculture Orientation Index (AOI), national trends in spending are identified and compared with the European and global contexts, which also allows tracking of the evolution of the national agricultural policy independently of support from the Community Agricultural Policy (CAP).

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Introduction

Agriculture is undoubtedly the key sector of any world economy (Svatoš & *et al.*, 2009), as well as being a strategic sector, since it satisfies one of the population's most important needs: food (Horská, 2011).

Its performance and development are influenced both by market dynamics (supply and demand for products and services) and support policies, which make the agricultural market one of the least liberalised worldwide (Bartolini & Viaggi, 2013; De Castro *et al.*, 2012; Horská & Hambálková, 2008; Svatoš, 2008).

Public support is an important source of funding for the development of the sector (Pokrivcak *et al.*, 2003) and, in the EU, Common Agricultural Policy (CAP) subsidies represent a significant income supplement for individual agricultural entrepreneurs (Bašek & Kraus, 2011; Střeleček *et al.*, 2009).

It is well known and widely recognised by both scholars and decision-makers that, in the absence of public intervention, most EU agricultural enterprises would not be able to remain in the market (Bielik *et al.*, 2008; Ciliberti & Frascarelli, 2018). Indeed, the literature is in agreement in identifying financial barriers as the main constraint to which agricultural enterprises are subjected (David *et al.*, 2000b). Therefore, most interventions are based on direct financial support measures, in the form of aid, or indirect measures (tax and social security incentives).

The EU CAP, from its inception, was one of the main agricultural support policies for supporting farmers' incomes. Subsequently, it also targeted improvement of socio-economic conditions in rural areas. It has evolved over time to respond to the economic, environmental, and local challenges that the European Union has encountered, both in the field of agriculture and within a broader context (Ciliberti & Frascarelli, 2018; European Commission. Directorate General for Agriculture and Rural Development *et al.*, 2021; Lillemets *et al.*, 2022).

These structural changes were also necessary due to the strict budgetary constraints deriving from international agreements within the framework of the WTO trade negotiations and the various phases of enlargement of the

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European Union that have occurred since the early 2000s (Galluzzo, 2022). Added to this are the new challenges of supporting resilience and sustainable development of agriculture, taken on by recent support policy guidelines, and implemented through the CAP 2023-2027, the NRRP, and national policy interventions (Buitenhuis *et al*., 2022; Pilvere *et al*., 2022).

In Italy, public support for agriculture as a topic of study developed significantly in the 1980s and 90s (Anania, 1996; Antonelli *et al*., 1989, 1989; Antonelli & Mellano, 1980; Colombo, 1990; Orlando, 1984). In the following decades, interest in the topic within the scientific community waned. Nevertheless, the CREA Research Centre for Agricultural Policies and Bioeconomy has, since the 1990s, analysed and quantified public intervention in agriculture through the analysis of spending on the sector, in an effort to contribute to the awareness and dissemination of knowledge on the matter (Briamonte & Vaccari, 2021; Iacovone, 2014; Reviglio, 2007).

The CREA methodology, which was also designed to respond to preliminary scientific needs, has produced analyses that have been used primarily for the benefit of the "key stakeholders", represented by public decision makers and sector operators involved in the various phases of implementing public interventions in agriculture (Briamonte & D'Oronzio, 2004; Cesaro, 2006; Ievoli & Rubertucci, 2014; Marino, 2005; Pergamo, 2008).

Given the context described above and the available data, the present paper addresses the following questions:

- Is it possible to define models of public support for Italian agriculture?
- How does the analysis fit into an international context?

Compared to the traditional use of data on public expenditure on agriculture and given the research questions above, this paper identifies the main regional patterns of public support in agriculture, based on the incidence of different expenditure components in relation to total transfers (Section 3.1). The efficiency of said expenditures is then evaluated over time and at the regional level (Section 3.2).

Finally, the analysis is framed in an international context using the Agriculture Orientation Index (AOI), from the FAO (Section 3.3).

1. Theoretical framework and research objectives

Large budgetary deficits and the increased national debt in many countries, arising from the international financial crisis in recent years, have highlighted the importance of reliable and timely statistics on administrations and public sectors. Public finance statistics play a fundamental role in the development

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and monitoring of fiscal programmes and in the surveillance of economic policies (International Monetary Fund, 2014).

Adopting an approach that allows for international comparability of data is crucial for impact assessment, immediate identification of critical issues in implemented interventions, and timely adoption of corrective measures (Mogues & Anson, 2018).

A review of the literature on this issue finds heterogeneous methodological approaches and the use of different statistical sources (Allen & Qaim, 2012; Bašek & Kraus, 2011; Bielik *et al*., 2008; Coleman & Grant, 1998; Govereh *et al*., 2011; Martini & Sisti, 2009; Olomola *et al*., 2014). For instance, a line of study concerns the composition of public expenditure and the level of support which are often related to economic growth (Agénor & Neanidis, 2011; Alegre, 2010; Devarajan *et al*., 1996; Ormaechea & Morozumi, 2013; Sanz & Velázquez, 2001; Weber & Singh, 1997; Yu *et al*., 2015).

Instead, a relatively recent approach in the study of support policies for different sectors, such as education, social protection, and welfare, concerns the identification of patterns characterising the structure of public expenditure in different countries (Abu Sharkh & Gough, 2010; Angelov, 2019; Besana, 2018; David *et al*., 2000; Halásková, 2015; Provazníková & Chlebounová, 2018).

More specifically, with reference to the agricultural sector, several studies analyse government spending in order to assess its economic impact (Pietriková & Radomíra Hornyák, 2022; Shucksmith *et al*., 2005; Wielechowski, 2019; Wielechowski & Grzęda, 2019; World Bank Group, 2015; Zeszyty, n.d.). Many of these relate to developing countries and the effect of support on growth and poverty reduction (Ahuja & Pandit, 2020; Maïga *et al*., 2021; Olawumi & OYEWOLE, 2018; Olomola *et al*., 2014; Pernechele *et al*., 2021; Singh *et al*., 2021), other studies use AOI for cross-country comparative analysis (Chiaka *et al*., 2022; Dastagiri & Vajrala, 2018; FAO, 2017, 2022; Kaya, 2021; Wielechowski, 2019).

The literature review highlights that a shared system for classifying interventions is rarely provided and that the results of analyses are not always sufficient to assess the efficiency of public resources in producing net effects, i.e. effects that would not have occurred in the absence of public support. Indeed, sharing methodologies and findings would allow for analyses that overcome geographic and temporal barriers and would prepare the ground for a convergence of ideas and experiences to improve standards for measuring public expenditure (Govereh *et al*., 2011).

To address the need for a comprehensive source of homogeneous and comparable information for the Italian agricultural sector, the CREA methodology (Briamonte & D'Oronzio, 2004; Sotte, 2000) provides a

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framework to interpret the empirical results of the application of agricultural policy interventions in Italy, both at the national and the regional level (Briamonte & D'Oronzio, 2004; Cesaro, 2006; Ievoli & Rubertucci, 2014; Marino, 2005; Pergamo, 2008).

In light of the above, this paper provides indications regarding the extent of total support and its related incidence on the growth of the agricultural sector.

In particular, the CREA has gathered data on combined total agricultural expenditure, the main institutional players, the methods of disbursement, and the extent of financial resources. This data can be used to geographically and temporally describe the characteristics and evolution of agricultural expenditure by classifying the financial flows in the financial statements of the administrations that directly or indirectly supply resources to the sector (Briamonte & Vaccari, 2021).

The primary objective of the present research is to identify regional models of public support for agriculture, defined according to different components of expenditure (objective 1, analysed in paragraph 3.1), through the use of the CREA methodology to analyse expenditure combined with cluster analysis.

Close examination of the data set shows that the predominant form of public support comes from EU policies and, for the most part, it is constant for the entire period considered. Therefore, the impact of regional support from EU sources and from the other aforementioned types of support (Pillars I and II) on total transfers was examined, and subsequently the efficiency of EU transfers was evaluated, based on the ratio of public resources used and results achieved in terms of added value (objective 2, analysed in paragraph 3.2).

Finally, FAO's Agriculture Orientation Index (AOI) index has made it possible to frame the analysis within an international context (objective 3, analysed in paragraph 3.3).

2. Materials and methods

The quantification of public resources for agriculture and their qualitative analysis makes it possible to create an overview of the Italian agricultural policy implemented through direct and indirect interventions that, on the basis of the decisions of the public authorities, aim to achieve the planned sectoral targets.

In this paper, "total public support" (TPS) for agriculture is defined as all the aid provided by the different decision-making levels (European Union, National government, Regions and Autonomous Provinces) intended to boost

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the economic growth of the sector. Such support can take place directly, through the provision of actual payments referred to as "transfers" (T), or indirectly, in the form of tax and social security contributions "reliefs" (R), which are advantageous for farmers who, notwithstanding the rules for determining and applying taxes, pay smaller sums to the Treasury than those due in relation to ordinary tax rates (Briamonte *et al.*, 2012; Briamonte & Vaccari, 2021; Fiore *et al.*, 2012).

The amount of total support is equal to the sum of the two components indicated, attributable to the total number of transfers disbursed to farmers by EU, national, and regional public authorities and to the estimation of tax and social security contribution reliefs determined at the national government level. The resulting aggregate quantifies the total monetary value of public aid to the primary sector and corresponds to the advantage received by operators (Finuola, 2006, 2010). The amount of support is therefore expressed by the following formula:

[1] TPS = T+R

where:
TPS = Total public support
T = Total direct transfers to the sector expressed as tEU + tN + tR, where
tEU = EU transfers
tN = National government transfers
tR = regional transfers
R = Total reliefs, expressed as tr + sscr, where
tr = tax reliefs
sscr = social security contribution reliefs

Depending on the disbursing agency, the transfers come from the following sources: the EU, disbursed through AGEA (Italian agricultural payments agency), OOPPRR (regional paying agencies), SAISA (autonomous service for interventions in the agricultural sector) and ENR (national rice authority); the national government, disbursed by ministries and national bodies, such as Sviluppo Italia, Invitalia and ISMEA (Institute of services for the agricultural food market); or regional origins (Regions and public administrations). Reliefs are determined at a national level by the competent ministries (Figure 1).

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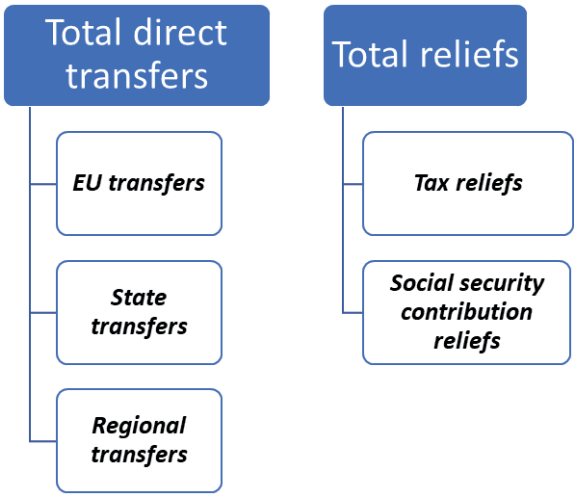
Figure 1 - Composition of combined total transfers and reliefs for agriculture



Source: CREA-Research Centre for Agricultural Policies and Bioeconomy (CREA-PB).

Figure 2 shows a diagram of the support for the agricultural sector and its components, where decision makers and disbursing agencies act as a link to the multilevel system of Italian public intervention in agriculture.

Some of the transfers that come from the European Union (1) – in particular, those disbursed by Pillar I and EU programmes – are characterised by the rather limited role played by the Italian State and Regions in the decision-making process, compared to what, by contrast, takes place with reference to other streams of EU support. This is the case, for example, with Pillar II, where the role of the Italian State and Regions is considerable, during both the planning and management phases (2).

Alongside European support, interventions implemented on a national level should be considered. Some of these, similar to those previously mentioned, are characterised as expenditure streams (3), others – tax and social security contribution reliefs – equate to a reduction in national government levies (4). Lastly, the expenditure streams determined independently by the Regions (5) on the basis of their budgetary resources, complete the overview of support for agriculture.

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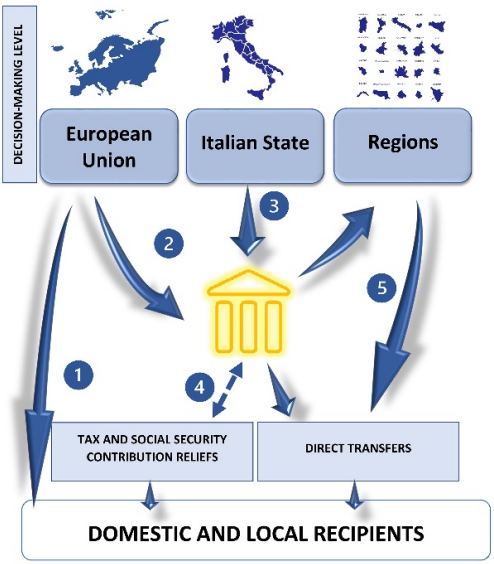
Figure 2 - Diagram of public support for the agricultural sector



Decision-making level	Component of expenditure	Type of expenditure
European Union	CAP, Pillar I	Direct payments (DP) and agricultural market measures
	CAP, Pillar II	Rural development measures
	EU Programmes	Directly managed EU programmes that financially support projects aimed at achieving EU objectives
Italian State	State transfers	Direct aid from state sources (Ministries and other bodies)
	Tax reliefs	Reductions in the tax base or in the estimated taxes for particular individuals or sectors
	Social security contribution reliefs	Reductions in the contribution rate for particular tax subjects or sectors
Regions	Regional transfers	Direct aid from regional sources

Source: CREA-Research Centre for Agricultural Policies and Bioeconomy (CREA-PB).

The original analysis methodology (Briamonte & D'Oronzio, 2004; Sotte, 2000), produced by the CREA, is applied to examine the expenditure flows related to public support policies for the agricultural sector in a standardized accounting information framework and to identify economic aims and the extent of financial resources, supply methods, disbursing agencies and beneficiaries.

This methodology is used for the collection, processing, analysis, and dissemination of data, which is managed by a special working group. This is, therefore, a tool that provides a homogeneous framework of rules for reclassification and re-aggregation of public spending on agriculture, applied to financial data derived from official accounting sources. It allows for assessments of the dynamics of expenditure over time, the economic effects of financial interventions and their effectiveness in relation to the stated objectives of agricultural policy.

The resulting database is a unique instrument that maps the last thirty years of public expenditure on agriculture and is intended to be used as a reference for operators and analysts in the sector. It also allows calculation of the total support for the sector and total expenditure by source (the EU, the National government or regional origin), as well as how the national government and the individual regions spend, and how much is allocated

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to direct income support and to tax and social security contribution reliefs. More specifically, this database allows national and regional administrations to identify the changes that have affected policies in the sector and, consequently, to improve the management and monitoring of agricultural policy interventions (Aa.Vv., 2021b, 2021a; Vieri *et al.*, 2006).

The data analysed were collected via a direct survey and processed through the application of the CREA methodology for classifying the budgetary chapters (the base unit of measurement) of the bodies providing support to the sector, thus providing a homogeneous picture of expenditure, from a territorial (regional detail) and temporal perspective[1].

With regard to regional expenditure alone, the classification is aimed both at analysing the results of regional policies in terms of efficiency and effectiveness and at evaluating the quality of the policies adopted. More specifically, it is divided into ten thematic frameworks, each of which is aimed at understanding a particular aspect of the policy implemented (Figure 3), and deals with the main financial aggregates present in the estimated budgets and final financial statements (Figure 4).

In order to respond to research objective 1 of analysing regional support models, the statistical technique of cluster analysis was used (Cattell, 1943; Zubin, 1938), through the application of the k-means algorithm (Hartigan & Wong, 1979; Lloyd, 1982; Macqueen, 1967; Steinley & Brusco, 2007) to identify the potential existence of groups of regions that may be distinguished by a certain homogeneity in the mode of support employed.

The choice of variables to be adopted for the analysis was made on an empirical basis in view of the fact that the different support models are determined solely by the incidence of the various components of expenditure in relation to the amount of total support at a regional level (the region, therefore, corresponds to the unit of observation). In order to normalise the measurements (mathematical normalisation), i.e. to take into account the aspects related to scale and thus to "neutralise" the dimensional effect, the percentage of each support method (Pillar I, Pillar II, National government, Region and Reliefs), with respect to total regional support was compared to the corresponding percentage at the national level. Therefore, for each region,

1. ISTAT's National Statistical Plan, which classifies statistical work, defines the Survey of Public Expenditure on Agriculture conducted by CREA as a statistic derived from administrative sources and new data sources, i.e. statistical information produced through a transformation of non-statistical sources. Information is drawn from administrative sources, or sources responding to other purposes owned by public or private entities, as well as new data sources such as Big data. The information transformation process entails the stages of acquisition, processing (checking and correction, possible integration with other data sources), analysis, and dissemination.

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Figure 3 - CREA methodology: classification of agricultural expenditure

Thematic frameworks	*Purpose of expenditure*
Economic - functional	Type of agricultural policy intervention
Support expenditure	Type of support disbursed to the agricultural sector
Final beneficiaries	Recipients of agricultural policy intervention
Expenditure management	How funds are distributed to the final beneficiary
Decision-making function	Level of delegation in relation to Region
Financial means	Origin of the resources disbursed that are used to finance expenditure
Production sectors	Production sector that the intervention is exclusively or predominantly aimed towards
Environmental protection	Environmental protection interventions
Natural disasters	Mutually beneficial nature of the intervention
Essential performance levels for agriculture (LEPA*)	A guarantee of essential levels of agricultural performance and development objectives

* The concept of essential levels of performance for agriculture was developed by Briamonte and Ievoli in "*Spesa agricola regionale e federalismo fiscale: Problemi di determinazione dei fabbisogni finanziari*", 2010, INEA.

Source: CREA-Research Centre for Agricultural Policies and Bioeconomy (CREA-PB).

five different parameters were calculated, indicated as location quotients (LQ), one for each component of expenditure (Pillar I LQ, Pillar II LQ, National government LQ, Region LQ, Reliefs LQ), according to the following formulas:

$$[2]\ LQ - Pillar\ I = \frac{\frac{{}^{1}P_R}{T_R}}{\frac{{}^{1}P_N}{T_N}}$$

$$[3]\ LQ - Pillar\ II = \frac{\frac{{}^{2}P_R}{T_R}}{\frac{{}^{2}P_N}{T_N}}$$

$$[4]\ LQ - National\ govt = \frac{\frac{S_R}{T_R}}{\frac{S_N}{T_N}}$$

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$$[5]\ LQ - Region = \frac{\frac{R_R}{T_R}}{\frac{R_N}{T_N}}$$

$$[6]\ LQ - Reliefs = \frac{\frac{Rel_R}{T_R}}{\frac{Rel_N}{T_N}}$$

where *1P* indicates Pillar I expenditure, *2P* indicates Pillar II expenditure, *S* is national expenditure, *R* is regional expenditure, *Rel* is reliefs and *T* indicates total public expenditure. The subscript *R* and *N* denote geographical area, specifically regional and national, under whose jurisdiction each of the above-mentioned components fall.

Figure 4 - CREA methodology: classification of financial data

Financial Code	***Code Description***
	Final Financial Statements
C1	Final accrual-based appropriations
C2	Commitments
C3	Accrual payments
C4	Residuals from previous years
C5	Residual payments
C6	Confirmed residuals (C4-C5) + (C2-C3)
C7	Final cash appropriations
	Provisional Budget
P1	Estimated residuals on 31/12 of each year
P2	Estimated accrual-based appropriations
P3	Estimated cash appropriations

Source: CREA-Research Centre for Agricultural Policies and Bioeconomy (CREA-PB).

Values of LQ that are greater than 1, which correspond to an incidence of the specific mode considered (e.g. Pillar I) being higher than the Italian average, indicate a region with a prevalence of this mode of support. Conversely, an LQ value less than 1 indicates a lower weight of support than what is found on a nationwide level.

The five parameters calculated in this way were used to identify the clusters.

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In order to frame the analysis carried out with the data collected by the survey on public expenditure on agriculture in an international context, data from FAO's Agriculture Orientation Index (AOI) were analysed (FAO, 2017, 2022; Wielechowski, 2019).

The AOI is an indicator determined through the following formula:

$$[7]\ \text{AOI} = \frac{\text{ASGE}}{\text{AVASG}}$$

$$[8]\ \text{ASGE} = \frac{\text{CGEA}}{\text{TCGE}}$$

$$[9]\ \text{AVASG} = \frac{\text{AVA}}{\text{GDP}}$$

where:
ASGE = Agriculture Share of Government Expenditure;
AVASG = Agriculture Value Added Share of GDP;
CGEA = Central Government Expenditure on Agriculture;
TCGE = Total Central Government Expenditure;
AVA = Agriculture Value Added;
GDP = Gross Domestic Product.

The AOI is a currency-free index since it is calculated as the ratio of two shares. It indicates the level of orientation of national economies towards agriculture: index values greater than 1 denote high shares of national government expenditure allocated to agriculture compared to the contribution in terms of value added contributed by the sector to GDP; by contrast, values lower than one indicate that greater importance as regards support is given to non-agricultural sectors.

3. Results

This paper analyses the trend in the value and structure of public expenditure on agriculture in Italy for the 2010-2020 time period.

During this period, the agricultural sector changed its position in the national economy and, towards the end of the decade considered, its performance was affected by the Covid-19 health crisis (Cesaro *et al.*, 2020).

The Italian agricultural system, although affected by the measures that were put in place to control the spread of the epidemic, nevertheless ensured food supply and food safety for the entire population, thanks to the efforts of operators and the intervention of institutions[2]. In fact, the heath crisis

2. In order to contain the spread of Covid-19, the Italian government planned a series of interventions. In particular, 90 million euros were disbursed by the MIPAAF (Ministry

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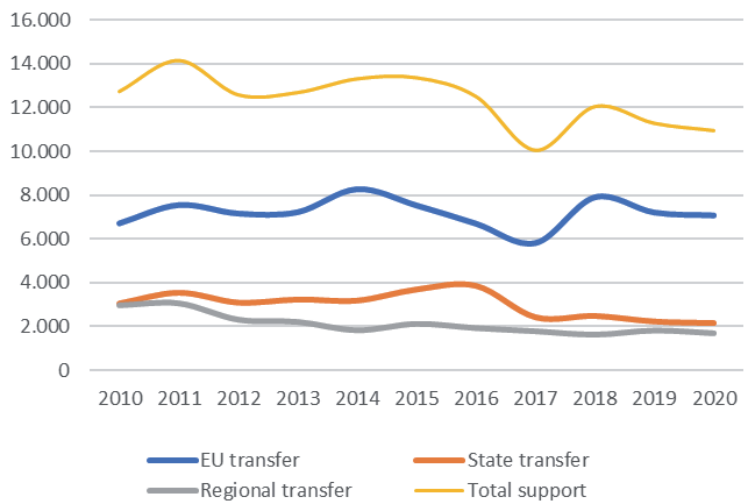
enhanced the essential and strategic function of the agricultural sector, highlighting the tenacious resilience of the system and refocusing the debate on this topic with some comprehensive observations on how to mitigate its vulnerabilities and weaknesses (Aa.Vv., 2021a, 2021b; Carè & Varia, 2020).

The data currently available do not allow us to quantify the impact of the pandemic on the sector and on public support. That will be the focus of a subsequent study based on updated data.

3.1. *Regional models of public support for agriculture*

An informative overview of the combined support for the agricultural sector is shown in Figure 5 for the 2010-2020 period, in terms of total volume and contributions offered by the individual decision-making components of expenditure.

Figure 5 - Public support for Italian agriculture by source of origin (in millions of euro, 2010-2020)



Source: Authors' processing of data from the "Agricultural expenditure of Italian Regions" database, CREA-Research Centre for Agricultural Policies and Bioeconomy (CREA-PB).

of Agricultural, Food and Forestry Policies) emergency fund (budgetary chapter 2303). In addition, the regional rural development programmes (RDPs) planned a specific measure (M21 "Extraordinary temporary support due to the Covid-19 crisis") through which approximately 107 million euros were disbursed.

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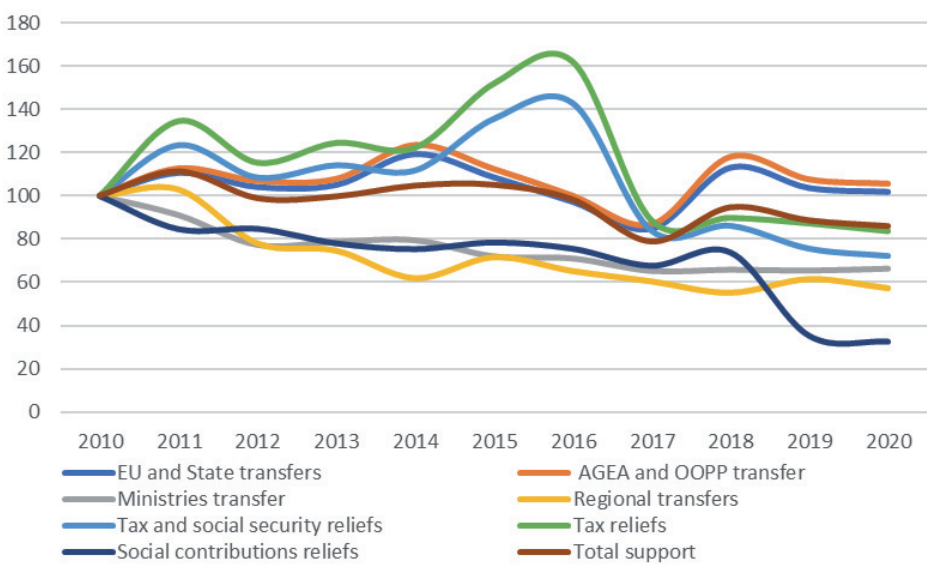
In 2020, public support for the sector amounted to 10.9 billion euros (adjusted for inflation at the date of writing). About two-thirds (64.6%) is attributable to European agricultural policy measures; 19.9% originates from national government policies in the form of transfers and reliefs, and 15.5% derives from regional policies.

The figures for the last available year differ from the average figures for the decade 2010-2020: total support was higher at roughly 12.3 billion euros, and the distribution by spending origin also varied, with 58.5% from the EU, 24.3% from national and 17.2% from regional sources.

During the period under examination, the series of fixed-base index numbers with 2010 as the reference year shows a reduction in the combined resources dedicated to the sector, estimated to be 14.0% at the end of the period, corresponding to a reduction in expenditure of about 1.8 billion euros (adjusted for inflation at the time of writing) (Figure 6). In particular, it can be observed that between 2010 and 2020, the decline in support is mainly attributable to the progressive reduction both in the support provided by the Regions through their budgets (–42.4%) and the national government in terms of transfers (–33.6%) and reliefs (–27.6%). The latter type of national support

Figure 6 - Fixed base index numbers for public support by source of origin (2010=100)



Source: Authors' processing of data from the "Agricultural expenditure of Italian Regions" database, CREA-Research Centre for Agricultural Policies and Bioeconomy (CREA-PB).

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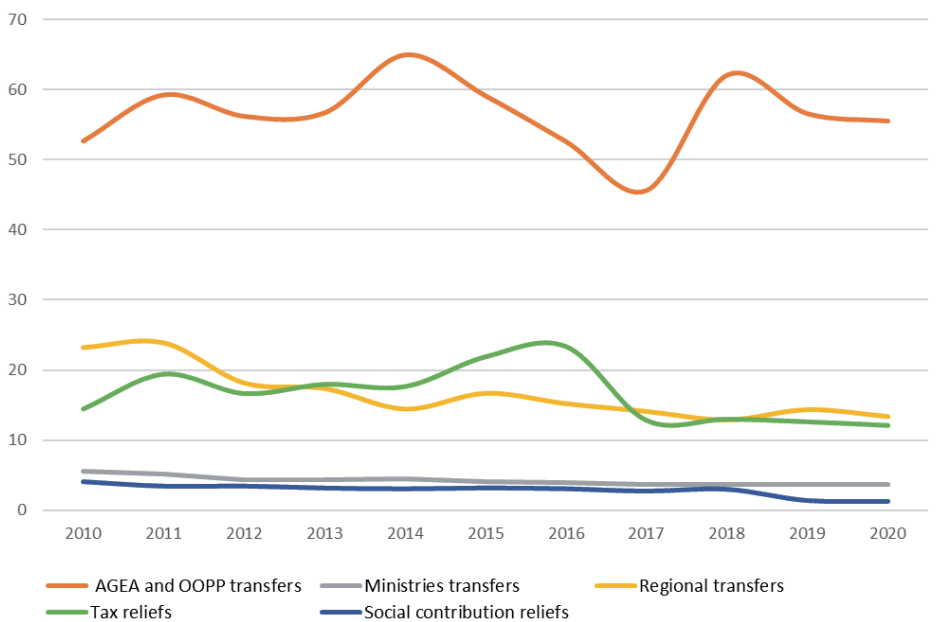
saw a significant reduction in social security contribution reliefs (–67.5%), while the decrease in tax reliefs is less significant (–16.3%), which had a significant upward trend until the year 2016 and then experienced a sharp decline in 2017. For EU transfers, a stable trend emerges over time, with a deviation of +5.4% between the beginning and the end of the period.

The incidence of the various combined components on total expenditure (Figure 7) demonstrates an upward trend for transfers made by AGEA and other Paying Agencies which, starting from a 53% share in 2010 and after reaching a peak of 66% in 2018, amounted to 56% of the total support in 2020. Therefore, for the entire period considered, this component is the most significant, accounting for more than half of the support given to the sector. By contrast, regional transfers experience a steady decline throughout the period examined, from 23% in 2010 to 13% in 2020. Starting in the 2007-2013 planning period, and unlike what had occurred previously, the national government and EU co-financing shares have been managed directly by AGEA and the other Paying Agencies and, as a result, they no longer pass through regional budgets. Hence, the decrease in regional transfers has, at

Figure 7 - Trend in the incidence of each component on overall total support (%, 2010-2020)



Source: Authors' processing of data from the "Agricultural expenditure of Italian Regions" database, CREA-Research Centre for Agricultural Policies and Bioeconomy (CREA-PB).

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least in part, resulted in the aforementioned increase in transfers by AGEA and other Paying Agencies. Moreover, added to this is the effect of the curbing of public expenditure at the national government level and the resulting repercussions on regional budgets. Tax reliefs remained steady at an average level of 17% but showed considerable growth in the central years of the period, especially in 2016, when the national stability act provided for the abolition of the IMU (municipal property tax) on agricultural land, the IRAP (regional income tax) exemption for individuals who engage in agricultural work and the exemption for IRPEF (personal income tax) purposes for rental income and agricultural income relating to farmland declared by farmers and professional agricultural entrepreneurs who are registered with the agricultural social security scheme. Although these measures were also extended to the years following 2016, the incidence of tax reliefs gradually returned to previous levels, which was also due to the introduction of the regulation that provides for the revaluation of rental and agricultural income from farmland ownership. The weight of transfers made by ministries and by social security contribution reliefs, which in 2020 account for 4% and 1% of total support, respectively, is much lower, and has decreased in the last decade.

The composition of support on a regional scale has been examined using cluster analysis, applying LQ values referring to the entire period examined (2010-2020 average). The cluster analysis results revealed differing support models across the Italian regions, depending on their production and political-administrative specificities. Six clusters have been identified, as illustrated in Figure 8, according to their level of similarity in terms of the composition of expenditure.

Among the regions that base their support model on EU sources, a first group can be defined by the prevalence of EU interventions under CAP Pillars I and II, named "EU Prevalence" (light blue), which includes Piedmont, Veneto, Umbria and Molise. Alongside this, a second group emerges, consisting of Lombardy, Marche and Apulia (green), which mainly relies on Pillar I support.

Many regions, by contrast, have adopted a model that focuses on non-EU sources. Among these, a group has been identified in which the greatest weight of national and regional reliefs and transfers ("non-EU support") is found, which includes the majority of regions (grey), specifically Friuli-Venezia Giulia, Lazio, Abruzzo, Campania, Basilicata and Sicily. Other regions, on the other hand, show the prevalence of a single non-EU source: this is the case with Valle d'Aosta, Trentino-Alto Adige, Sardinia and Calabria (dark orange), which are characterised by a greater incidence of regional support, and Liguria (light orange), which is a group in its own right due to the predominance of national government spending. Lastly, Emilia-

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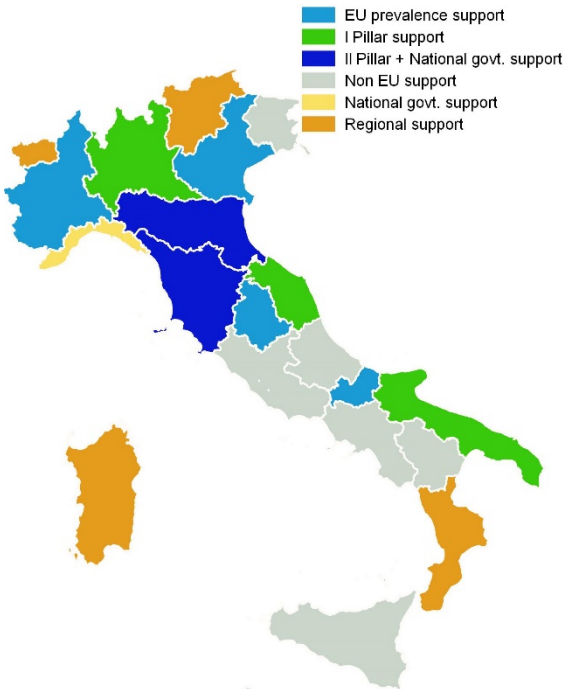
Figure 8 - Regional clusters according to support models (LQ on 2010-20 average, k-means method)



Source: Authors' processing of data from the "Agricultural expenditure of Italian Regions" database, CREA-Research Centre for Agricultural Policies and Bioeconomy (CREA-PB).

Romagna and Tuscany (dark blue) are characterised by a mix of support streams related to Pillar II and national government interventions (including reliefs).

In order to analyse the dynamics of the different regional support models during the period considered (Figure 9), LQ values calculated using a simple three-year moving average were used. Considering that the planning and subsequent implementation of public support interventions take place on a multi-year basis, an analysis of annual data would produce "noisy results". Conversely, the adoption of three-year moving averages makes it possible to minimize the fluctuations caused by the discontinuity of the procedural steps.

During the period under review, it was observed that only Liguria, Marche and Apulia kept their support model unchanged, while Valle d'Aosta, Trentino-Alto Adige, Emilia-Romagna, Tuscany and Campania only occasionally moved away from the model that distinguished each region for the entire period. By contrast, many of the regions used between two and

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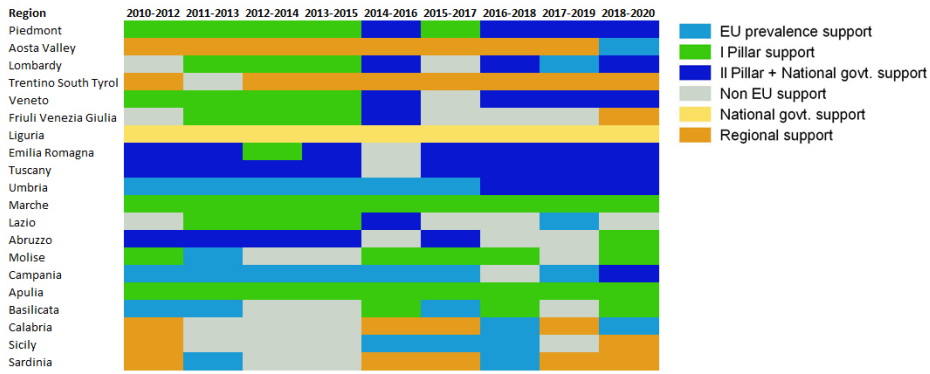
four different support models. However, even in these regions, there are several cases in which it is possible to identify a certain continuity in the use of a particular model, for periods of varying length (Piedmont, Veneto, Friuli-Venezia Giulia, Umbria, Abruzzo, Lazio, Molise, Sicily). On the other hand, Basilicata, Calabria and Sardinia are characterised by the fact that they have changed more frequently between three support models.

Figure 9 - Trend in regional clusters according to support models (LQ on simple three-year moving averages, k-means method)



Source: Authors' processing of data from the "Agricultural expenditure of Italian Regions" database, CREA-Research Centre for Agricultural Policies and Bioeconomy (CREA-PB).

3.2. *Incidence and efficiency of support items on overall transfers*

Delving further into the analysis of the main source of support for the agricultural sector, it should be noted that transfers related to the CAP considered as a whole (Pillar I and Pillar II) on a national level account for an average of more than half (58.5%) of the total resources transferred to the regions in the 2010-2020 period (Figure 10). The analysis on a regional level, however, demonstrates highly diverse situations: only three regions, Valle d'Aosta, Liguria and Trentino-Alto Adige, show significantly lower percentages than the national average (36.7%, 38.2% and 38.9%, respectively). On the contrary, for a rather large group of regions, in particular, Abruzzo, Calabria, Campania, Friuli-Venezia Giulia, Lazio, Lombardy, Sardinia, Sicily and Tuscany, the weight of these transfers is close to the national average, with an incidence ranging from 50.1% for Friuli-Venezia Giulia to 59.5% for Tuscany. The fact that regions from the north, centre and south of Italy all belong to this group highlights that there is no correlation between the

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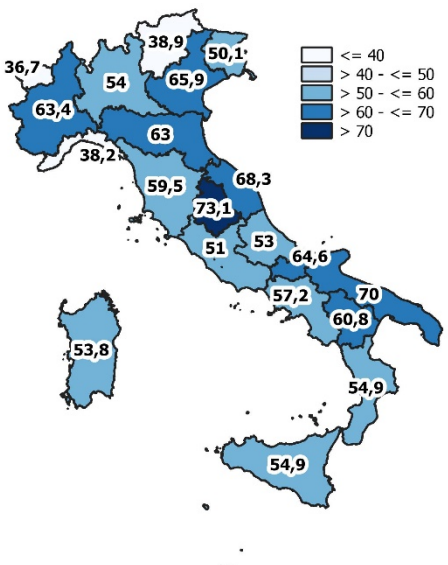
incidence of CAP transfers and the geographic district to which the region belongs. This is also confirmed by considering the regions in which the incidence of CAP transfers on total resources is greater than 60% (Basilicata, Emilia-Romagna, Marche, Molise, Piedmont, Apulia, Umbria, Veneto). Within this group, only for the Umbria region are CAP transfers particularly significant, exceeding 70% of the total.

Figure 10 - Weight of CAP transfers on total transfers for 2010-2020 period (values in %)



Source: Authors' processing of data from the "Agricultural expenditure of Italian Regions" database, CREA-Research Centre for Agricultural Policies and Bioeconomy (CREA-PB).

With reference to the analysis of the individual components of expenditure, the national average of the incidence of Pillar I in total regional transfers is 37.2%, while Pillar II is 21.3%. With reference to Pillar I, if we focus on the macro-areas, the regions in central Italy have a higher average incidence (39.3%), followed by the southern regions (35.7%) and, lastly, the northern regions (31.1%).

As can be seen in figure 11, the incidence of transfers related to Pillar I compared to overall support is higher than the Italian average in Emilia-Romagna, Marche, Molise, Piedmont, Apulia and Veneto. The regions of Abruzzo, Basilicata, Friuli-Venezia Giulia, Lazio, Lombardy, Tuscany and

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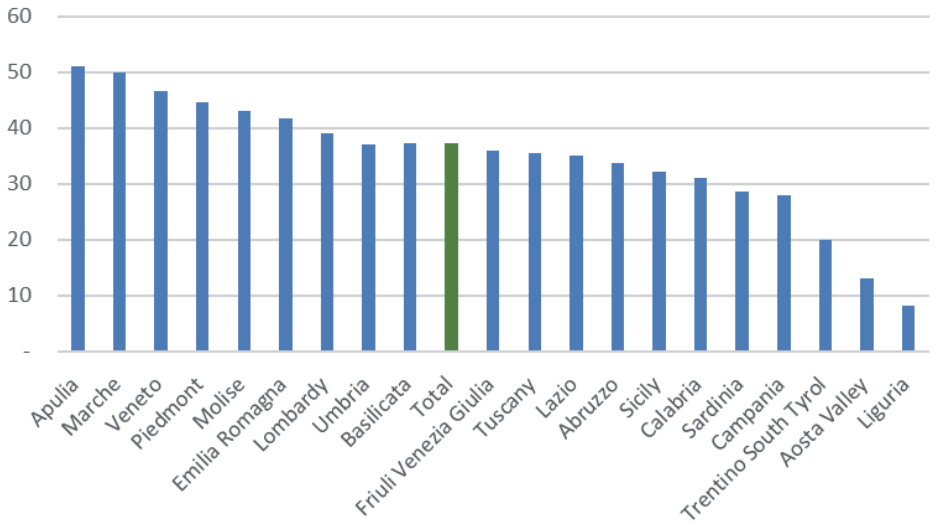
Umbria are in line with the national average, while in the remaining regions, the incidence is lower than the national average.

Figure 11 - Pillar I share of total transfers (%)



Source: Authors' processing of data from the "Agricultural expenditure of Italian Regions" database, CREA-Research Centre for Agricultural Policies and Bioeconomy (CREA-PB).

With regard to Pillar I, the districts of central and southern Italy show similar values compared to the national average, 23.7% and 22.9%, respectively. Once again, for this component of EU policy, values in the north of Italy are slightly lower than the national average (20%).

On a regional level, the incidence of transfers related to Pillar II in overall support is higher than the Italian average in Campania, Sardinia and Umbria. The values recorded for Basilicata, Calabria, Emilia-Romagna, Molise, Sicily, Sardinia, Tuscany, Trentino Alto-Adige, Valle d'Aosta and Veneto are mostly in line with the national average while in the remaining regions, the incidence is lower than the national average (Figure 12).

The indicator obtained from the ratio between CAP transfers and value added in the agricultural sector is one way of measuring the impact of EU agricultural expenditure on the sector.

On average, during the 2010-2020 period, the incidence of CAP (Pillar I and II) with respect to value added was 23.9%. At the level of geographic macro-areas, we can observe that the centre of Italy has a higher average

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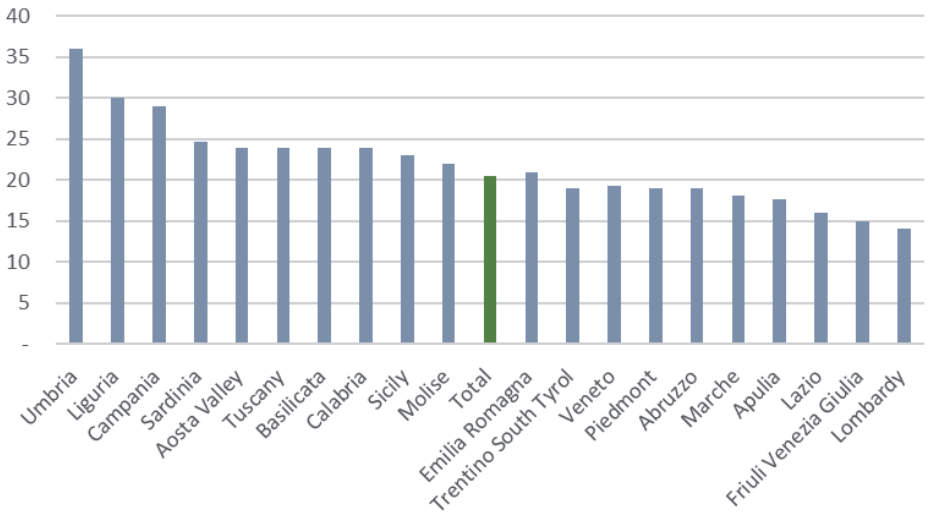
Figure 12 - Pillar II share of total transfers (values in %)



Source: Authors' processing of data from the "Agricultural expenditure of Italian Regions" database, CREA-Research Centre for Agricultural Policies and Bioeconomy (CREA-PB).

incidence than the national average (28.1%), followed by the south (27.3%) and finally, the north (23.7%).

Leading the group in the central regions are Umbria and Marche – with an average incidence of 41.4% and 36.2%, respectively – followed by Lazio (17.7%) and Tuscany (17.1%). As far as the southern regions are concerned, Calabria (35.1%), Basilicata (34.6%), Apulia (32.5%), Molise (29.5%) and Sardinia (28.8%) have a higher average incidence than the national average, while values in Sicily and Campania are below the national average (22.3% and 17.3%, respectively). Among the northern regions, only Valle d'Aosta (44.3%), Piedmont (29.3%) and Veneto (26.4%) have values higher than the national average (Figure 13).

A more complete picture of agricultural expenditure at the regional level is obtained through the analysis of total support in relation to the value added of agriculture shown in Figure 14. The bubble chart presents three dimensions of data: total agricultural support (horizontal axis) and agricultural value added (vertical axis) are the coordinates of the bubbles that represent the twenty Italian regions; the relationship between the two previous dimensions defines the size of the bubbles and represents the level of support for the sector with respect to its importance in the regional economy. Large bubbles indicate a high value of this ratio: in the case of Valle d'Aosta, for example, total support is quite high compared to the low value added of

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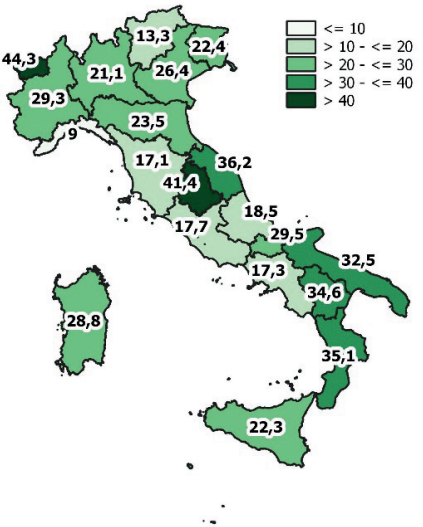
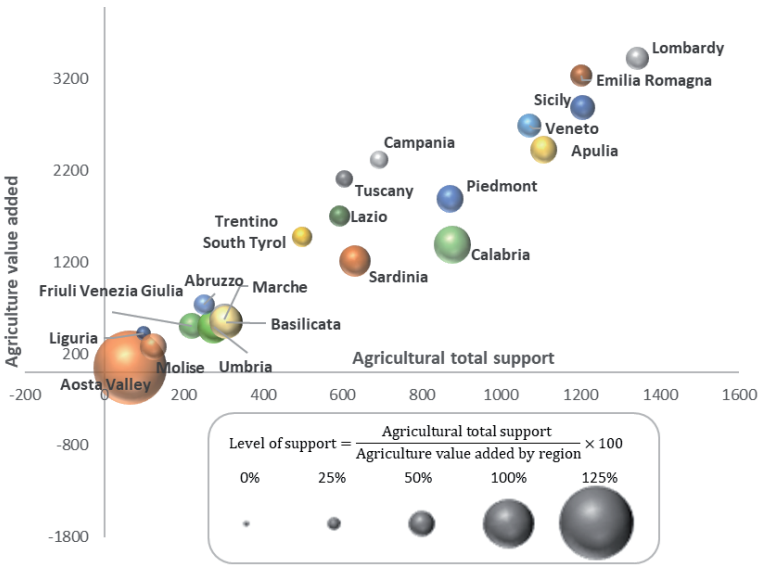
Figure 13 - Weight of CAP transfers on Value added (%, mean 2010-2020)



Source: Authors' processing of data from the "Agricultural expenditure of Italian Regions" database, CREA-Research Centre for Agricultural Policies and Bioeconomy (CREA-PB).

Figure 14 - Total agricultural support and Agricultural value added by region – Italy (euro, 2010-2020 average)



Source: Authors' processing of data from the "Agricultural expenditure of Italian Regions" database, CREA-Research Centre for Agricultural Policies and Bioeconomy (CREA-PB).

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agriculture. At the opposite extreme, Lombardy and Emilia-Romagna are represented by two small bubbles since the total support is lower than the value added of agriculture, which reaches its highest amount here.

3.3. *Agriculture Orientation Index: data analysis in an international context*

The AOI data refer only to the expenditure of the central governments of the countries included and, therefore, for EU member states, they do not consider CAP support for agriculture. This index provides useful information to help us understand the extent to which the principle of additionality is actually applied in the EU countries, according to which contributions disbursed through EU funds should not replace the public expenditure of a member state and, therefore, should not lead to a reduction in national investments but should be additional.

In general, on a global scale, index values are below 1 and, therefore, show support for the sector that is not commensurate with its economic importance (Figure 15). The highest index values, even if below 1, are found in Asia, which grew during the period considered. Conversely, the lowest values are found in Africa.

Analysis of the index on a European scale shows a level of support that is lower than the world average. Specifically, Italy is at a lower level than most European countries and shows a downward trend until 2017 and a slight recovery starting in 2018 (Figure 16). Among the main European countries, Germany stands out with a higher average index and with a rising trend over the period considered but with a reduction in the last two years. The most striking case, however, concerns Switzerland and Luxembourg (not represented in figure 16), which have an index greater than 3, which is equivalent to a level of investment in agriculture that is three times greater than the sector's contribution to GDP. While in the case of Luxembourg, which is considered the richest country in the world, this can be traced back to the high availability of national resources that are added to EU resources, for Switzerland, a non-EU country, the figure should be interpreted without taking CAP aid into consideration when examining national support for agriculture. Even for other countries in the European area, albeit with a lower intensity than what was observed for Switzerland, there are similar situations (the average value of the AOI index for European countries that are not part of the EU is 0.8, double that of the European average). The cross-reading of the data illustrated above, therefore, suggests a common tendency by EU members states to delegate the more general trends for planning investments in agriculture to EU policy guidelines, while keeping certain interventions of a more specific nature within the framework of

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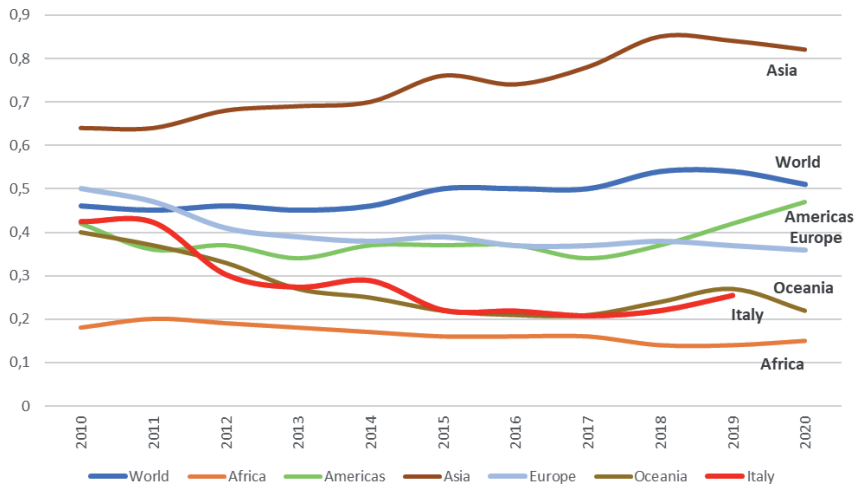
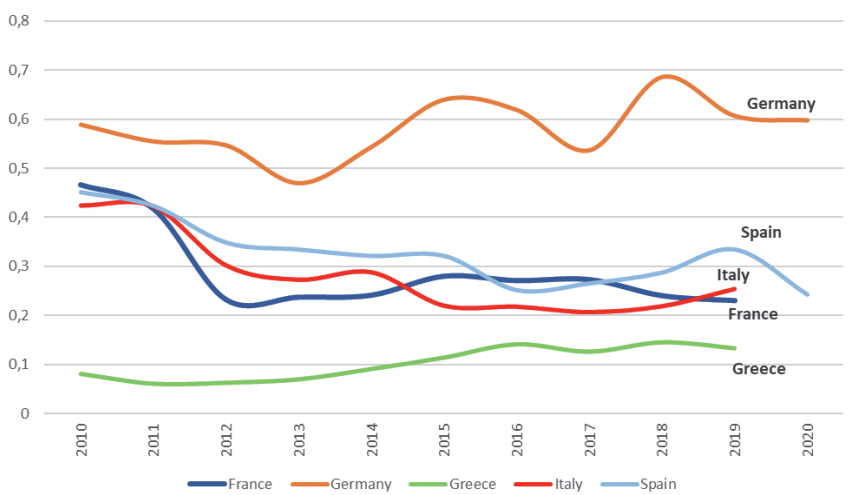
national political decisions, such as is the case in Italy, for example, with tax and social security reliefs for the sector.

Figure 15 - Agriculture Orientation Index by geographic region - World



Source: *Authors' processing of data based on* data from the Food and Agriculture Organization of the United Nations (FAO) (2022).

Figure 16 - Agriculture Orientation Index by Country – Europe



Source: *Authors' processing of data based on* data from the Food and Agriculture Organization of the United Nations (FAO) (2022).

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Conclusions

In view of the present research objectives and the need for data comparability, this paper highlights the usefulness of having a comprehensive source of homogeneous and comparable information, the use of which allows for some considerations with reference to public support for the agricultural sector.

The analysis carried out demonstrates that in Italy, for the 2010-2020 period, public expenditure on agriculture has decreased, due both to lower support from the national and regional levels and to a reduction in tax and social security contribution reliefs. The resources disbursed by the EU increased slightly, but there is no correlation between their impact on overall support and the geographical location of the regions. Through in-depth analysis of the available data and the use of an empirical approach, we can hypothesize the existence of a relationship between the growth of the agricultural sector and public support for the sector. Moreover, we can highlight how various factors, such as the heterogeneity of agricultural systems, different policy objectives and the expenditure management capacity of regional administrations, affect the use of public resources, thus determining different allocations and uses. These differences affect the ability of each region to attract resources, which is reflected in the predominance of certain support streams, and have made it possible to distinguish six different models of support for the sector (Regional clusters according to support models). Among the possible objectives for future analytical study, thanks to the updating of the information contained in the CREA database, priority should be given to an analysis of the implications of the Covid-19 epidemic and to the new guidelines related to the 2023-2027 CAP planning, especially given the importance of EU sources of support within the support mechanisms for the Italian agricultural sector.

In addition, further study may be beneficial to deepen our understanding both as regards the quantification of the sector in terms of growth ascribable to the amount of support, and the identification and quantification of the economic variables that affect the choice of the support model on a local geographical level.

One question that remains is whether public support has generated additionality, that is, if public expenditure is complementary and, therefore, "additional" to private expenditure or if it replaces and tends to "displace" private expenditure (David *et al*., 2000a).

There are mixed answers to this question. For example, Jaffe (Jaffe, 2002) claims that assessing the beneficial effects of public interventions (especially if oriented towards supporting the choices of policy makers) should always be based on the responses that come from the application of various approaches.

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The issue of additivity reflects the fundamental problem of evaluating whether the final objective of a programme has long-term effects; something which, in real terms, is inherently very difficult to measure and attribute to specific programmes and interventions. For the agricultural sector, this problem is likely to be mitigated by joint planning by different levels of government of programmes for the sector and this may be the subject of further study.

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