



## The future of agriculture. Prospective scenarios and modelling approaches for policy analysis

Sergio Gomez y Paloma<sup>a</sup>, Pavel Ciaian<sup>a,\*</sup>, Adriana Cristoiu<sup>b</sup>, Frank Sammeth<sup>a</sup>

<sup>a</sup> European Commission, Joint Research Centre, Institute for Prospective Technological Studies, C/ Inca Garcilaso 3, 41092 Seville, Spain

<sup>b</sup> European Research Council Executive Agency, Place Charles Rogier 16, BE-1210 Brussels, Belgium

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### ABSTRACT

The objective of this paper is (i) to compare and discuss literature related to global and European outlooks in relation to the farming sector and rural areas and (ii) to provide an overview of policy modelling methodologies, especially but not only those used in assessing the impact of the Common Agricultural Policy (CAP). There is significant variation in terms of both the policies and external drivers that are taken into account in global and European outlooks, driven predominantly by the heterogeneity in focus of studies, the approach applied and/or external pressures. An increasing number of studies take on board the new CAP challenges. However, an area where improvements are needed is in the understanding of the sensitivity of policy effects to assumptions on external drivers. Two key modelling approaches applied for policy impact analysis include structural models and econometric models, with the former dominating the latter mainly due to its better adaptability to the needs of policy makers. However, with the CAP evolving towards ever more complex instruments, the relevance and predictive accuracy of structural models will possibly improve only as long as methodological and data issues are addressed.

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### Introduction and objectives

The Common Agricultural Policy (CAP) is an important player in rural areas in the EU and has a profound impact on agricultural and rural markets spanning from output and factor markets to income and environment. The changing focus of the CAP generated different pressures on the rural economy over time. The emphasis of the early CAP was on encouraging agricultural productivity, ensuring a stable supply of affordable food to consumers and ensuring a viable agricultural sector. The support to farmers was implemented predominantly through market price support. Market and environmental pressures of the early CAP led to a substantial overhaul of the policy instruments in the 1990s. The 1992 MacSharry reform and the Agenda 2000 reduced the importance of price support and introduced coupled direct payments. At the same time, the rural development issue was strengthened and environmental concerns were integrated into the CAP. The 2003 CAP reform decoupled most direct payments and made environmental aspects of agriculture a compulsory requirement (i.e. cross-compliance requirements) for receiving support. The recent

European Commission proposals on the future CAP (for the CAP post-2013) aim to further strengthen and enhance these environmental objectives by improving the targeting of direct payments (European Commission, 2010, 2011).

In recent years important structural developments have taken place in the global markets. Of particular importance for the agricultural sector are the energy price rise and the expansion in bioenergy production, greater commodity price volatility, the shift in consumption patterns in developing countries and climatic changes. All these factors have important implications for the agricultural sector because they may lead to structural changes in production and farming systems thus creating pressures on rural markets, the environment and sustainability of food production. These global developments are also important from a policy perspective because they likely affect policy needs besides policy effects and thus may induce future adjustments of the CAP.

The purpose of this paper is twofold: firstly it reviews some of the major recent studies addressing the medium to long-run projections of agriculture and rural areas at world and EU levels with the aim of identifying prospective scenarios and main external drivers, and secondly it assesses the main methodologies used to analyse the ex ante and ex post impacts of agricultural and rural policies on the farming sector and rural areas.

Prospective global and EU level scenarios and national level survey results concerning the future development of the CAP and external drivers are presented and discussed. They are derived from the non-exhaustive literature review. External drivers identified to

\* Corresponding author. Tel.: +34 95 448 8429; fax: +34 95 448 8274.

E-mail addresses: [sergio.gomez-y-paloma@ec.europa.eu](mailto:sergio.gomez-y-paloma@ec.europa.eu) (S.G.y. Paloma), [pavel.ciaian@ec.europa.eu](mailto:pavel.ciaian@ec.europa.eu), [ciaian@yahoo.com](mailto:ciaian@yahoo.com) (P. Ciaian), [adriana.cristoiu@ec.europa.eu](mailto:adriana.cristoiu@ec.europa.eu) (A. Cristoiu), [frank.sammeth@ec.europa.eu](mailto:frank.sammeth@ec.europa.eu) (F. Sammeth).

be the most important factors affecting the future evolution of agriculture and rural areas at world and EU levels are also presented in greater detail. They include demography, climate change, economic growth, energy prices and agricultural world markets.

Concerning methodologies, an attempt is made to identify the key challenges of modelling agricultural policies. The focus is mainly on the CAP but for illustration purposes a global overview is, in some cases, also provided. The aim here is not to provide an exhaustive list of models applied for policy impact analyses. The main objective is to identify the main practical and theoretical challenges to model policies in the framework of the CAP.

The paper is structured as follows. Drivers, trends and prospective scenarios are presented in the next section, including “Drivers and prospective scenarios” section and “Trends and projections”. Section “Modelling Approaches for policy analysis” outlines the key challenges of modelling agricultural policies. It includes a first subsection on the “Classification of policy modelling approaches”, and a second one on “Modelling first versus second pillar CAP policies”. The last section concludes.

## Drivers, trends and prospective scenarios

### *Drivers and prospective scenarios*

Focusing on the most recent studies addressing the evolution of world and EU agriculture, this section summarises the key underlying assumptions on prospective scenarios, drivers and projections in the medium- to long-term. The results of a recent survey among EU Member States on the opinion at national level concerning the future of the CAP are also included.

The studies consulted belong to two broad groups. The first group includes projections on the most likely evolution of the agricultural sector (either at global or regional level, e.g. OECD Members) subject to a set of drivers identified by the studies as being essential for the development of agriculture (FAO, 2006; OECD-FAO, 2011; USDA, 2009). These studies do not include scenarios on alternative future developments. They provide projections for macro-indicators and development of agricultural markets. In FAO (2006), projections for world agriculture for the 2030/2050 time horizon are conducted with four key drivers considered to be the most instrumental: demography, energy markets, food consumption and world commodity markets. The OECD-FAO (2011) and the USDA (2009) studies provide projections for shorter time horizons; for 2020 and 2018, respectively. However, both studies include similar drivers and assumptions, together with a more explicit representation of agricultural policies and agricultural market developments (Table 1). The projections of these studies (particularly macro-indicators) form the basis of the underlying macro assumptions on which most other studies build their future-orientated scenario exercises usually conducted at country level or for a group of countries (e.g. the EU).

The second group of studies focuses on the European agricultural sector and its key drivers. Additionally from proposing a baseline scenario considered to be the most likely development, these studies also propose alternative scenarios about the evolution of the sector and the CAP, including some on rural economies (e.g. SCENAR2020, EURURALIS, SENSOR, MEASCOPE, etc.). The alternative scenarios are justified by the focus these studies take (e.g. EU agricultural sector and rural areas in SCENAR2020, land use in SENSOR, etc.). The additional scenarios are used to explore the potential implications for the evolution of the topic of interest under an alternative assumption of drivers and/or policies (Table 1).

SCENAR2020 (SCENAR2020 – Scenario study on agriculture and the rural world) takes an in-depth approach to identify future trends and drivers of change in European agriculture and rural areas

in the 2020 time horizon (SCENAR2020, 2006). Drivers are grouped into two broad categories based on whether they are influenced by policy intervention: (i) exogenous to the EU policymaking or (ii) endogenous to the EU–policymaking system. The exogenous drivers include demography, macro-economic growth, agri-technology and world agricultural markets, whereas the endogenous drivers include trade and agricultural policies, environmental policies, enlargement and international agreements. SCENAR2020 (2006) simulates future effects of three scenarios. The baseline (reference) scenario assumes the observed developments in exogenous macro drivers to continue into the future and unchanged policy environment. The other two scenarios consider an alteration of EU policies: (i) the regionalisation scenario assumes sustained policy preference to promote regional economic strength and social welfare, as well as considering the maximum degree of agricultural support allowed under the WTO framework; and (ii) the liberalisation scenario assumes the reduction of policy intervention to a socially acceptable minimum.

Five macro-drivers are considered in the SENSOR<sup>1</sup> project (Kuhlman et al., 2006; Bakker and Verburg, 2009): oil prices, world GDP excluding the EU-25, population, labour force and R&D expenditure (all sectors). Quantitative assumptions are made about their evolution under three scenarios (Baseline, High-growth and Low-growth scenarios) using information from various international statistical sources (e.g. under Baseline population and R&D expenditure projections are from Eurostat, World GDP projections are based on PROMETHEUS, a stochastic model of the world energy system, etc.). The primary objective of the SENSOR project is to assess the impact of CAP policies on land use in the EU. For this purpose the bio-diversity scenario (extension of area protected under Natura 2000) and CAP reform scenario (gradual abolition of CAP) are simulated.

EURURALIS (2008) includes a wider set of drivers to develop scenarios about EU rural areas at the 2030 time horizon. EURURALIS is an integrated impact assessment tool for exploring the future development of rural areas in the EU within a global context. Four contrasting world visions (scenarios) are developed along two dimensions: the first dimension representing a range from a global to a more regional integration, and the second one representing a range from market orientation to a higher level of governmental intervention to ensure specific social, economic and environmental objectives. The macro-drivers' set includes demographic developments, consumer preferences, macro-economic growth, agro-technology, border support, income support, Less Favourable Areas (LFA), nature, spatial, erosion and energy policies. Further assumptions are made in EURURALIS about the CAP settings under each of the four scenarios. For example, the Global Economy scenario assumes full liberalisation and phasing out of income support (with CAP market support still maintained in 2010 but its total abolition after 2020, all CAP income support abolished after 2010, no support to biofuels combined with 0% blending obligations, no taxes or subsidies and from 2010 no special LFA policy and no designated Natura2000 areas). On the other hand, the Continental Markets scenario assumes no change in border support and domestic support. The other two scenarios are intermediary cases where the Global Co-operation scenario considers more trade integration and removal of trade protection, whereas the Regional Communities scenario assumes more environmental support.

The same four-quadrant-model approach to building scenarios used in EURURALIS is also used in MEASCOPE (Micro-economic instruments for impact assessment of multifunctional agriculture to implement the Model of European Agriculture) (MEASCOPE,

<sup>1</sup> SENSOR stands for “Sustainable Impact Assessment: Tools for Environmental, Social and Economic Effects of Multifunctional Land Use in European Regions.”

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