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THE EFFECT OF THE NEW SINGLE FARM PAYMENT IN IRRIGATED AGRICULTURE: THE CASE OF SPAIN

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Abstract

The aim of the paper is to provide an econometric, dynamic, multi-product and partial equilibrium model for the Spanish agriculture able to analyse the effects of the SFP and subsequent reforms in both the irrigated and non-irrigated cultivation. In the case of the EU Mediterranean countries, irrigated agriculture is very relevant because farmers in irrigated land get higher productivity and returns. However, irrigation is also the source of a number of environmental concerns, such as over-abstraction of water from subterranean aquifers, irrigation driven erosion, soil salinisation, etc.. The new decoupling direct payments from production will reduce many of the incentives to intensive production. The developed model is called Spanish Econometric Simulation of Agricultural Policies (SESAP) and it is estimated using Eurotat data from 1983 to 2004 and solved using the GAMS software for the period 2005 to 2020. Simulation results indicate that irrigated area harvested for arable crops, less environmental friendly, is expected to decrease more than non-irrigated.

Key words: CAP reform, partial equilibrium model, policy modelling, irrigated Agriculture, simulation.

1. Introduction

The Common Agricultural Policy (CAP) has greatly influenced in the Spanish Agriculture due to the substantial amount of EU funds received mainly since the end of transitory adhesion period and after the 1992 CAP reform. This reform focused on the arable crop sector and induced significant changes in the policy incentives to produce. The emphasis on the arable crop sector was due to their importance in land use and the close interaction with the livestock sector via the feed sector. This reform marked a turning point in the EU agricultural policy because it involves a reduction in intervention prices, compensated by direct payments per hectare and a compulsory set-aside requirement, and introduces, for the first time, some specific measures to encourage environmental friendly farming in an attempt to integrate the environmental concerns into the CAP. Then, since the 1992 CAP reform, modeling the new arable crop regime has been a common task of many agricultural economists (Moro and Sckokai, 1999). Most of the studies analyse the effectiveness of the set-aside requirement on land allocation (Rygnestad and Fraser, 1996; Fraser, 1993) or the welfare effect of the new CAP cereals regime (Froud and Roberts, 1993; Nardone and López, 1994). Few studies have estimated the effects of the new CAP measures in the arable crop sector (crop allocation, supplies and yields) (Guyomart *et al.,* 1996; Lansink and Peerlings, 1996; Sckokai and Antón, 2005).

In 1999, a new CAP reform (Agenda 2000) goes further in the changes introduced by the previous reform, cutting intervention prices and integrating the environmental requirements into the CAP mainly through the horizontal and the rural development regulations. After this reform, several modelling studies concerning the Agenda 2000 instruments were carried out. The first one by Cahill (1997) evaluates the rate of decoupling provided by the Agenda 2000. Moro and Sckokai (1999) estimated the impact of the new Agenda 2000 in the Italian arable crop sector. Meijl and van Tongeren

(2002) estimated the effects of Agenda 2000 on agricultural production and trade for different economic world areas in order to examine the compatibility of the Agenda 2000 reform with the GATT-WTO Agreement on agriculture. Other modelling studies assessed the impact of Agenda 2000 on the EU agricultural sector using different models (i.e. FAPRI-UMC, (1999); Gohin and Guyomard, 2000; European Commission, 2000a; Philippidis and Hubbard, 2003).

Not far from the Agenda 2000, a new CAP reform was enacted in 2003 called the Luxembourg Agreement. The 2003 CAP reform involves decoupling of most direct payments from production and gives greater importance to the environmental issues. The 2003 CAP reform creates a Single Farm Payment (SFP) per hectares of land calculated by dividing the total payments received in a base historical period by the hectares in the farm. This new decoupled payment reduces the links between agricultural support and production removing incentives to intensification of production and giving the farmer increasing freedom on planting decisions (although they are obliged to maintain the agricultural land in good agricultural and environmental condition). After this latest reform, a proliferation of studies emerge which aim is to measure the effects of the Luxembourg Agreement Reform on different agricultural sectors in EU Member States countries (FAPRI, 2003; European Commission, 2003a; OECD, 2004; Schmid and Sinabell, 2004; Esposti and Lobianco, 2005; Casado and Gracia, 2005; Chantreuil *et al.,* 2005; Niemi *et al.,* 2005; Tabeau and van Leeuwen, 2005; Gelan and Schwarz, 2006; Gohin and Latruffe, 2006, among others). Moreover, Gohin (2005) provides a review of different studies on the impact of 2003 CAP reform on the EU agricultural sector. He concludes that impact studies anticipated a negative impact of the 2003 CAP reform on the arable crop and beef production. Moreover, these studies show that decoupling effects may be higher on the arable crop sector than in the beef sector.

This paper with a similar aim, to study the effects of the 2003 CAP reform and subsequent reforms on the Spanish arable crop sector, provides a new econometric model that distinguishes between arable crops cultivation in irrigated and non-irrigated land. This new model enables to analyse the expected reduction on the arable crop area harvested induced by the implementation of the SFP but also, to state whether the SFP is useful to disincentive the intensification of production in the arable crop sector through the reduction mainly of irrigated cultivation. This disaggregated model is called Spanish Econometric Simulation of Agricultural Policies (SESAP). We propose this disaggregated model because of the following reasons. First, irrigated agriculture is very relevant in the case of the EU Mediterranean countries for their economic implications to farmers. In Spain, irrigated Final Agricultural Production (FAP) accounts for up to 50% of total FAP while, the harvested irrigated area represents 15% of the total area harvested. Irrigated production has economic implications to farms because one hectare in irrigated land produces six times more than one non-irrigated hectare and gives four times higher returns. Irrigation allows improvement of the crop productivity and reduction of the risks associated with dry periods, and makes it possible to cultivate more profitable crops. However, irrigation is also the source of a number of environmental concerns, such as over-abstraction of water from subterranean aquifers, irrigation driven erosion, soil salinisation, alteration of pre-existing semi-natural habitats; and secondary impacts arising from the intensification of the agricultural production permitted by irrigation (European Commission, 2003b). Then, decoupling direct payments from production will reduce many of the incentives to intensive production, in particular, irrigated production system. In this context it is expected a reduction in the land under irrigated agriculture, mitigating the environmental damages. Second, none of the previous models have taken account this specific characteristic of the Mediterranean agricultures.

The paper is structured as follows. Section two gives a revision of existing agricultural models for policy analysis and describes the general structure of the model. Section three presents the baseline scenario, the projection of the Spanish arable crop sector under the Single Farm Payment. Finally, section 4 shows main conclusions, limitations and extension of the model.

2. The model

2.1. Previous experiences

Several global models have been designed to examine the impacts of agricultural and trade policy on both, the agricultural sector and the whole economy[1]. Most of them provide results for the impact of agricultural and trade policies on large world regions (Europe, Asia, etc.) or some selected countries. On the other hand, many developed countries have also built their own policy analysis models. Among others: i) Denmark: ESMERALDA model (Jensen, 1996; Jensen *et al.,* 2001); ii) Finland: DREMFIA model (Lehtonen, 2001); iii) France: MEGAAF model (Gohin *et al.,* 1998); iv) Great Britain: Manchester model (Burton, 1992); v) The Netherlands: WAGEM model (Komen and Peerlings, 1996); vi) Ireland: TEAGASC model (www.tnet.teagasc.ie/fapri); and vii) USA: The FAPRI model (www.fapri.org). Moreover, some developing countries have also built different models to analyse the impact of policy changes on the rural economy and economic growth (i.e. Yao and Lin, 2000; Stifel and Ranfrianarisoa, 2006; Drogruel *et al.,* 2003). All these models are general or partial market equilibrium models for one country covering a diversity of agricultural products. The main objective of them is to simulate the impact of changes in the agricultural policies on their agricultural sectors.

However, in Spain, there is not a tradition to build such models. We can only cited two models that cover the whole Spanish agricultural sector: *i)* the MESTA model (Modelo Econométrico Sectorial para la Agricultura-Econometric Model for the Agricultural Sector) (Ibáñez and Pérez Hugalde, 1995; Ibáñez and Pérez Hugalde, 1996); and *ii)* the DESPA model (Diagnóstico Económico y Simulación de Politicas Agrarias-Model of Economic Diagnosis and Simulation of Agricultural Policy) (García and Rivera, 1995). Both of them were built to assess the impact of the 1992 CAP reform in the Spanish Agriculture. The MESTA model is a sectorial econometric model consisting of four sub-models (crop production, livestock production, expenditures on inputs and prices). Main agricultural products are considered: arable crops (grains, oilseeds, roots, vegetables and cotton), perennials crops (grapes, olives and fruits) and livestock. The model is used to provide analysis of both, Spanish agriculture as a whole and one selected Spanish region. The DESPA model was also

[1] A revision of those models can be seen in Tongeren *et al.,* (2001)

designed to simulate the impact of changes in the CAP on the Spanish agricultural sector. The DESPA model is a system of sub-models to simulate the effects on area allocation, output, production cost and farmers' income of changes in the exogenous variables (product prices, inputs, direct aids and other subsidies). The DESPA's methodological approach is mixed because it combines the postulates of economic theory, econometrics, agronomic technical knowledge and expert opinion (García and Rivera, 1995). This model is adapted to the analysis of both, Spanish agriculture as a whole and the five regional subsystems into which Spanish agriculture is divided.

Although the three simulation models share the same objective, to analyse the effect of agricultural policy changes on the Spanish agriculture, they have some similarities but also some differences among them. The model provided in this paper shares more similarities with the first one (MESTA model). Both of them are econometric models for the crop and livestock sectors and, they take into account the distinction between cultivation in irrigated and non-irrigated land while the other does not have such as characteristics. However, the three models use historical annual data for the Spanish agriculture and different ex-post and ex-ante assumptions for the simulated scenarios. The other two models were build early 90's to analyse the impact of the 1992 CAP reform, while the current model has been build ten years after to analyse the impact of the Luxembourg Agreement and subsequent reforms.

2.2. Overview of the Model

The SESAP model is an extension of the Spanish AGMEMOD model taking into account the distinction between irrigated and non-irrigated land use for arable crops. The Spanish AGMEMOD model is one of the 14 country models that constitute the EU AGMEMOD composite model (Chantreuil *et al.,* 2005). Each AGMEMOD country models are econometric, dynamic, multi-product and partial equilibrium commodity model. The specification of the models are inspired by the EU GOLD (Grains, Oilseeds, Livestock and Dairy) FAPRI model (Hanrahan, 2001; Binfield *et al.,* 2004; Binfield *et al.,* 2005). The models consist of two different sub-models, the arable crop and the livestock and dairy model. Some links between both sub-models exist, mainly through feed demand equations and input costs. The products covered in each of the sub-models are the following: *i)* cereals (wheat, barley and maize); *ii)* oilseeds (soybeans, rape and sunflower seed); *iii)* root crops (sugar beet and potatoes); *iv)* livestock (cattle, pig, poultry, and sheep); and *v)* dairy products (milk, cheese, butter, milk powder and cream).

The models consist of a set of behavioural equations, a set of equilibrium relations between supply and demand and a set of identities. Equations can be grouped into supply component (harvested area, yield, animal ending stocks, slaughter animal, etc.), demand or utilisation side (domestic use, feed use and food use), trade (import and export), stocks change and price transmission. The specification of the behavioural equations is based on economic theory, particular characteristics of the country agricultural sector together with expert opinion. Microeconomic theory of consumer and producer behaviour stated that the explanatory variable in the demand and production equations are the prices of the considered commodities and their closest substitutes. Moreover, consumption is explained by income levels and, production (breading inventory, slaughter animal, etc) by livestock production levels. Additionally, it is expected a negative own price elasticity for the own demand, positive price elasticities for the demand of competitive commodities and positive income elasticity for demand. To represent rigidity in the adjustment of agricultural production levels and consumption patterns, lagged production or consumption is used. Time trends are seen as a proxy for technological change, while dummy variables represent special policy regulation (i.e. quotas) or extraordinary events like very bad weather (Tabeau and van Leeuwen, 2005).

The aim of these models is to provide a tool for policy simulation under alternative assumed conditions. Then, policy instruments are explicitly introduced in order to allow quantitative analysis of CAP reform scenarios. Then, three types of agricultural policy instruments, production quotas, direct payments and intervention prices, are introduced in the behavioural equations. The production quotas influence production levels through stock equations in the animal sector and harvested area in the crop sector. The direct payments increase the return from production and hence, the production levels. The intervention prices enter the stock level equations. In addition, the cereals set-aside reduces the crop area. Most of behavioural equations are econometrically estimated with historical data from 1983 to 2004. Parameter estimation validation consists of statistical criteria and economic consistency.

In order to complete the building of the model, it is necessary to add an equation describing the equilibrium for each commodity market. This condition requires production plus beginning stocks plus imports to equal domestic use plus ending stocks plus exports. In a closed economy, this supply and use equilibrium condition is sufficient for an endogenous determination. However, this model includes the impact of other economies through price linkage equations to account for the relations between Spain and the European Union and/or the rest of the World. Then, the price in Spain depends on the key market price together with the degree of self-sufficiency of Spain and that in the key market. For most commodities the French market has been used as the leader. There is no guarantee that variables computed with the econometric model satisfy the necessary supply and use equilibrium condition noted above. To solve this problem, a closure variable ensuring that the supply and use identity holds for all markets has been used. In other words, for each market there exists one endogenous variable that closes the model and thus is determined by a supply and use identity. Generally, this closure variable is the export or import variable.

Finally, the models are solved with the estimated parameters in a recursive way for the projection period. It means, the equilibrium for one period is the starting point to solve the next equilibrium. The equilibrium has been solved for a set of assumptions related to policy and macroeconomic variables, and world prices over the period 2005-2020 using the GAMS software.

2.3. The SESAP model

The SESAP model has been mainly developed to provide reliable result of the impact of the Single Farm Payment and subsequent reforms on the Spanish arable crop sector. This sector has been selected for his higher dependency on the Community grants. Grants by area indicate that arable crops are the first recipients of grants with 33% of total transfers, in particular, cereals with 22%. Moreover, cereals are the most important crops in Spain representing 43.2% of the total area harvested followed, by far, by fruits and vegetables (11.8%) and industrial plants (10.4%). The SESAP model, that distinguishes between irrigated and non-irrigated land use, is able to assess the impacts of the Single Farm Payment on the Spanish agriculture and, specifically, on the irrigated and non-irrigated arable crop sector.

Below, we describe the supply side of the arable crop part of the SESAP model in order to point out the innovative aspects of the new model.

The arable crop model consists of three sub-models: the cereals sub-model (wheat, barley and maize), the oilseeds sub-model (sunflower and soybean [2]), and the root sub-model (sugar beet and potatoes). In the arable crop sub-model, it is assumed that land allocation is made in a two-step process driven by prices and yields. First, producers determine the total land allocated to cereals, oilseeds, and root crops. Then, in a second stage, total grains, total oilseeds, and total root crops area are allocated to each crop within these main groupings. The supply side of the irrigated and non-irrigated cultivation will depend on cereal real price and cereal compensatory payments.

Area harvested for crop i in year t is determined by:

$$ah_{i,t} = Iah_{i,t} + Nah_{i,t} \qquad (1)$$

$$Iah_{i,t} = f\left(p^j_{i,t-1}, Pol^j_{i,t}, V^j_i\right) \qquad (2)$$

$$Nah_{i,t} = f\left(p^j_{i,t-1}, Pol^j_{i,t}, V^j_i\right) \qquad (3)$$

i : represent the main crop groups (cereals, oilseeds and roots)

j : represents the different crops within the main group (wheat, barley, maize, sunflower, sugar beet, and potatoes)

where $ah_{i,t}$ is the area harvested for crop i in year $t, Iah_{i,t}$ is the irrigated area harvested for crop i in the year t , $Nah_{i,t}$ is the non-irrigated area harvested for crop i in year t , $p^j_{i,t-1}$ is the real price or price *ratio* for the specific crop j within the crop group i for year $t-1$. $Pol^j_{i,t}$ consists of a set of policy variables that might directly affect area harvested decision, (i.e. set aside, compensatory payment,). Finally, V^j_i are other exogenous variables that might determine area harvested for the analysed commodity (i.e., other crops area harvested, trend, lags, etc).

Area harvested for each of the sub-crops j is determined calculating the irrigated and non-irrigated area share for each sub-crop j within crop i for year t as follows:

[2]In Spain neither rape production nor consumption and trade exist

$$Ish^j_{i,t} = f\left(p^j_{i,t-1}, Pol^j_{i,t}, V^j_i\right) \qquad (4)$$

$$Nsh^j_{i,t} = f\left(p^j_{i,t-1}, Pol^j_{i,t}, V^j_i\right) \qquad (5)$$

where $Pol^j_{i,t}$ is the set of policy variables affecting crop j, (i.e. intervention price).

In order to satisfy the adding-up restriction, irrigated and non-irrigated area share for the most important crop n is dropped for the estimation and is calculated afterwards by adding-up the estimated values for the rest of the crops:

$$Ish^n_{i,t} = 1 - \sum_j Ish^j_{i,t} \forall j \neq n \qquad (6)$$

$$Nsh^n_{i,t} = 1 - \sum_j Nsh^j_{i,t} \forall j \neq n \qquad (7)$$

where

$$\sum_j Ish^j_{i,t} = 1; \sum_j Nsh^j_{i,t} = 1 \quad \text{and} \quad 0 \leq Ish^j_{i,t} < 1, \; 0 \leq Nsh^j_{i,t} < 1 \quad \forall j$$

Multiplying (4),(5),(6) and (7) with (2) and (3), respectively, the area harvested for each of the sub-crops j within crop i is obtained:

$$Iah^j_{i,t} = Iah_{i,t} * Ish^j_{i,t} \qquad (8)$$

$$Nah^j_{i,t} = Nah_{i,t} * Nsh^j_{i,t} \qquad (9)$$

The irrigated and non irrigated yield per hectare equation for each crop j within group i, $Iy^j_{i,t}$ and $Ny^j_{i,t}$ is determined by prices of the crop and substituted crops, and other exogenous variables V^j_i (i.e. technological change, weather indicators such as raining level,),

$$Iy^j_{i,t} = f\left(p^j_{i,t-1}, V^j_i\right) \qquad (10)$$

$$Ny^j_{i,t} = f\left(p^j_{i,t-1}, V^j_i\right) \qquad (11)$$

Given area harvested and yield per harvested hectare, production for each crop j is calculated by the following identity:

$$IPR^j_{i,t} = Iah^j_{i,t} * Iy^j_{i,t} \qquad (12)$$

$$NPR^j_{i,t} = Nah^j_{i,t} * Ny^j_{i,t} \qquad (13)$$

$$PR^j_{i,t} = IPR^j_{i,t} + NPR^j_{i,t} \qquad (14)$$

All specified equations are estimated using annual data from the period 1983-2004. These data were obtained from EUROSTAT's, AGRIS and New-Cronos, FAO and OECD databases, FAPRI projections and from the Spanish Ministry of Agriculture when information was not available in the

European databases. The estimation of the parameters for the behavioural equations was done with the Eviews software.

3. Baseline scenario results

The baseline projections have been made under a given set of assumptions regarding policy variables, macroeconomic variables and key and world prices over the period 2005-2020. The macroeconomic assumptions come from external sources. Population projections are from the Spanish Statistical Office (INE) and the macro economy variables from the Spanish Central Bank and the Klein Institute (http://www.uam.es/otroscentros/klein/). World market prices projections are not endogenous for the SESAP model. Then, world market prices projections come from the FAPRI-Missouri EU GOLD model (FAPRI-Ireland Outlook, 2003). It is assumed that all national and international agreements remain in place over the projection period.

The baseline scenario is this contains in the Presidency compromise document (Council of the European Union, 2003). Under the Luxembourg Agreement and the negotiations that have followed, the biggest change in the Common Agricultural Policy is the introduction of the Single Farm Payment (SFP). This SFP could have been implemented as early as 2005, but no later than 2007. In the case of Spain, the least decoupled option allowed by the reform was chosen in order to have as many payments as possible directly linked to production. Decoupling was delayed until 2006, and afterwards the following percentage of the payments will be still coupled to the production. Twenty-five per cent of the payment will remain coupled for the arable crops, 50% of the ewe premiums, 100% of the suckle cow premiums and 40% of the slaughter premiums. This SFP decoupling scheme has been introduced in the model using the applied general procedure developed under the AGMEMOD combined model (European Commission Directorate General JRC – IPTS, 2007).

Once the baseline projections are set, they will be used as a comparison point for future policy scenarios evaluation. In this paper, a disaggregated baseline scenario for irrigated and non-irrigated arable crop cultivation was simulated using the SESAP model (disaggregated into irrigated and non-irrigated arable crops) to analyse the differences in the evolution of the baseline projections for irrigated and non-irrigated arable crop land.

3.1. Evaluation of the SESAP and Spanish AGMEMOD models

In this section, both models, the SESAP and the Spanish AGMEMOD, are compared. Table I shows the evolution of production for the SESAP model baseline (disaggregated into irrigated and non-irrigated) and the Spanish AGMEMOD model baseline (this distinction was not considered).

The projections of total cereals area harvested baseline are similar for the AGMEMOD and SESAP models and it is expected a decrease of around 10% from 2005 to 2020. However, for oilseeds the baseline projections differs and while it is expected around a 25% decrease in the area harvested by the AGMEMOD model, only a 3% decreasing trend is anticipated by the SESAP model. Among cereals, the greater differences between area harvested projections are found in the case of wheat. While AGMEMOD projections anticipated a decrease of 5% in the area harvested, the SESAP model ones indicate that wheat area harvested will maintain in the projection period. In the case of barley, both models projections anticipated a decrease in area harvested of around 13%. In the case of maize, the AGMEMOD model predicts a decrease in the area harvested of 3% while the SESAP model anticipated a reduction in the area harvested of 11%.

Table 1. Cereals and sunflower production projections for the AGMEMOD and SESAP model from 2005 to 2020.

	2005	**2010**	**2015**	**2020**	**Production 2005/2020**	**Area harvested 2005/2020**
Total cereals production						
AGMEMOD Baseline	18702	18667	18901	19192	2.6	-9.25
SESAP Baseline	18204	19385	19091	18968	4.2	-10.16
Non-irrigated Baseline	11656	12729	12469	12374	6.2	-10.03
Irrigated Baseline	6548	6655	6622	6594	0.7	-11.17
Wheat production						
AGMEMOD Baseline	5937	5889	5895	5948	0.2	-4.59
SESAP Baseline	4900	5629	5253	5071	3.5	0.67
Non-irrigated Baseline	4066	4770	4404	4225	3.9	1.71
Irrigated Baseline	834	859	848	846	1.5	-5.84
Barley production						
AGMEMOD Baseline	7954	7807	7760	7665	-3.6	-13.88
SESAP Baseline	8721	9085	9116	9133	4.7	-13.28
Non-irrigated Baseline	7297	7671	7783	7874	7.9	-13.18
Irrigated Baseline	1424	1414	1333	1259	-11.6	-15.03
Maize production						
AGMEMOD Baseline	4812	4971	5246	5579	15.9	-2.93
SESAP Baseline	4583	4671	4722	4764	4.0	-11.01
Non-irrigated Baseline	293	288	281	275	-6.3	-10.03
Irrigated Baseline	4289	4382	4441	4489	4.7	-11.20
Sunflower seed production						
AGMEMOD Baseline	794	809	729	623	-21.6	-25.71
SESAP Baseline	1110	1035	1011	997	-10.2	-3.91
Non-irrigated Baseline	724	677	666	659	-9.0	-1.60
Irrigated Baseline	386	358	345	338	-12.4	-15.41

Although a reduction in area harvested is expected for all the cereals and sunflower seed (oilseeds is only consisting of sunflower), the evolution of production in some cases is positive due to yield improvements. In particular, total cereals production is expected to increase but, while the AGMEMOD model anticipated a 2% increase, the SESAP model predicts a 4% rise. The contrary is found in the case of sunflower, although some improvement in yields is also expected it is not high enough to compensate the area harvested decrease. Then, while the AGMEMOD model forecast a 21% decrease in production, the SESAP predict a 10%.

3.2. The effect of the Single Farm Payment in the irrigated and non-irrigated arable crop sector

The contribution of the SESAP model is that it provides projections for both the irrigated and non-irrigated arable crop cultivation. Table 1 shows that, based on prior expectations, the decreasing expected trend in area harvested for arable crops is higher in irrigated cultivation. However, except in the case of barley, the higher improvements in yield anticipated for irrigated cultivation will shift this decreasing trend and production will show an increasing trend. This is the case of wheat and maize where irrigated production is expected to increase although irrigated area harvested is anticipated to decrease. For sunflower, although the rate of decreasing of irrigated production is lower than the rate of decreasing of irrigated area harvested, a negative production projection evolution is still expected.

The main differences between irrigated and non-irrigated production of cereals are two. Wheat and barley are mainly produced in non-irrigated land and it is expected that production in non-irrigated land will also increase (around 4% and 8%, respectively) while irrigated production is anticipated to maintain or decrease from 2005 to 2020. However, maize is mainly produced in irrigated land, and irrigated production will increase by 4.7% while, non-irrigated production will decrease by 6% from 2005 to 2020.

4. Summary and conclusion

The arable crop sector in Spain is highly dependent on the Community subsidies and Spain receives grants for arable crops of 33% of total transfers received by the Community. It was expected that the new measure introduced by the Luxembourg Agreement Reform, the Single Farm Payment, would drive important changes on arable crop production in Spain. To provide an econometric model for the Spanish agriculture able to analyse the effects of the SFP and subsequent reforms on the Spanish agricultural sector in both the irrigated and non-irrigated land is the overall objective of this paper. With this aim, a new econometric, dynamic, multi-product and partial equilibrium commodity model has been built. This model is called Spanish Econometric Simulation of Agricultural Policies (SESAP) model. The model is still under construction then, projection results from this paper must be considered preliminary.

The production projections under the SFP differ for the different cereals. We can distinguish between cereals mainly produced in non-irrigated land (wheat and cereals) and cereals produced in irrigated land (maize). The production of total wheat, barley and maize is expected to increase by 3.5%, 4.7% and 4%, respectively from 2005 to 2020. Wheat and barley production in non-irrigated land is expected to increase by 4% and 8%, while irrigated production is expected to maintain or decrease by 11% from 2005 to 2020. Irrigated maize production is expected to increase by 4.7% due to the important improvements in yield while non-irrigated production is expected to decrease by 6%. Those projections reinforce the non-irrigated nature of wheat and barley cultivation in Spain because they are mainly cultivated in non-irrigated land and this situation is accentuated by the implementation of the SFP. In the same way, maize production projections reinforce the irrigated orientation of the Spanish maize cultivation. Moreover, we can expected that the SFP will accentuated the decreasing trend on irrigated area harvested for arable crops although the higher expected yields in irrigated land will more than compensated this reduction driving an increase in production in the case of cereals and a lower decrease in the case of sunflower seed.

Results from our study prove that irrigated area harvested for cereals and sunflower seed is expected to decrease more than the area of non-irrigated cultivation. Then, we can conclude that the new SFP has fulfilled the policy makers expectations because, harvested area of arable crops has decreased but, the decrease of irrigated cultivation, less environmental friendly, is higher. Therefore, both 2003 CAP reform aims, to promote the production of more competitive and market oriented crops and to enhance sustainable agriculture, have been reached. As a consequence, less productive and small farmers of irrigated cereals would have fewer incentives to cultivate those products and, might swift to harvest other high value added products such as vegetables. Then, the main policy implication of the paper is that the new SFP will induce decreases on cereals and oilseed area harvested, mainly on the irrigated agriculture. This is not a problem for Spanish farmers because irrigated areas have higher flexibility and farmers are able to swift their production to other more profitable and value added products such as vegetables in order to make their farms more viable.

Finally, the main limitation of the paper is that it does not provide yet simulation results for any change in policy because the model is still under construction and the current baseline is been validated. Then, results must be taken as preliminary. A future extension of the model would be the inclusion of other important crops for the Spanish Agriculture such as, vegetables, fruit, grapes, and olive oil. In addition, further work must be done in order to analyze alternative policy scenarios.

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