An Assessment of the Luxembourg Agreement on the Spanish Agricultural Sector: an Econometric Model

José María Casado[1] and Azucena Gracia[1]

[1] Unidad de Economía Agraria Centro de Investigación y Tecnología Agroalimentaria – Gobierno de Aragón

Contribution appeared in Arfini, F. (Ed.) (2005) "Modelling Agricultural Policies: State of the Art and New Challenges", proceedings of the 89th EAAE Seminar, pp. 496 - 511

February 2-5, 2005

Parma, Italy

An Assessment of the Luxembourg Agreement on the Spanish Agricultural Sector: an Econometric Model

José María Casado and Azucena Gracia

Unidad de Economía Agraria
Centro de Investigación y Tecnología Agroalimentaria – Gobierno de Aragón*

Abstract

The main aim of this paper is to build and validate an econometric model for the Spanish agri-food sector that allows for projection and policy simulation under alternative scenarios. We developed an econometric, dynamic, multi-product partial equilibrium commodity model where policy instruments were explicitly introduced in order to allow quantitative analysis of CAP reform scenarios. The Spanish Econometric Simulation of Agricultural Policies (SESAP) model results indicate that the new decoupling measure introduced by the Luxembourg Agreement have mainly impact on the sectors more linked to the new instrument, cereals, oil-seed, cattle and beef meat and, sheep and lamb meat. Moreover, only changes in area harvested, number of animals and production for those products have been found.

Keywords: Partial equilibrium model, simulation, CAP reform.

1. Introduction

The Common Agricultural Policy (CAP) has played an important role in the Spanish Agriculture due to the substantial body of legislation and case law and its undeniable impact on the social, economic and land use field. Although there are significant differences according to type, size, kind of holding and geographical location thereof, direct grants to producers have had a favourable impact on the income of Spanish farmers, representing on average a quarter of their earning in the last few years. Spain is the second ranking recipient of these Community funds (with 14.88%). Grants by area indicate that herbaceous crop are the first recipient of grants with the 32% of total transfers, in particular, cereals with the 23.3%, followed by the

* Avda Montañana 930, 50059 Zaragoza, Spain. E-mail: jmcasado@aragon.es; agracia@aragon.es.

olive oil sector 15.8%. Moreover, the 81% of these payments were allocated to direct grants to producers. In this context, any change in the CAP will have an important impact on Spanish Agriculture.

Then, to quantitative assess the impact of the different agricultural policies on agriculture would be an important contribution mainly for policy makers. At European and international level, several modelling efforts have been made (CAPMAT, CAPRI, AGLINK, ESIM; FAPRI-GOLD, MISS, SWOPSIM, among others[1]) in order to provide satisfactory and validated models that allow to measure the effect of agricultural policy changes on the sector. However, in Spain, models have been mainly built for some specific agricultural sectors. The only whole agricultural sector model that was undertaken to analyse the impact of the 1992 CAP Reform in Spain is the MESTA (Ibánez and Perez Hugalde (1993); Ibañez and Perez Hugalde (1996) and Ibañez and Perez Hugalde (1999)). Therefore, the main aim of this paper is to build and validate an econometric model for the Spanish agri-food sector that allows for projection and policy simulation under alternative assumed conditions.

The model, called in Spanish SEPA-Simulación Econométrica de Políticas Agrarias (Econometric Simulation of Agricultural Policies-SESAP), allows to generate projection for the main agricultural commodities and includes policy instruments explicit that will permit to quantitative assess the impact on the Spanish agriculture of the different CAP policy changes. The SESAP is an econometric, dynamic, multi-product, partial equilibrium commodity model. The most important commodities in terms of area harvested and number of animals and the most influence by the CAP are included.

In Spain, cereals are the most important crop representing the 43.2% of the total area harvested followed by fruits and vegetables (11.8%) and industrial plants (10.4%). However, cereals represents only the 10% of the final agricultural production (FAP) while fruits and vegetables, with only 9.9% and 1.9% of the total area harvested respectively, account for 33.4% of total FAP. Moreover, looking to the European subsides to the agricultural sectors, Spain is the second ranking recipient of these Community funds (with 14.8%) and herbaceous crops are the first recipient of grants with the 32% of total transfers, in particular, cereals with the 23.3%. Among animal production, the pork sector is the most important in terms of number of heads and FAP participation while, the poultry sector is the less (only accounts for 2.9% of FAP). Moreover, the significant increase in cattle population in the last years has located the cattle sector in the second position of the animal production (6.2% of FAP). On the other hand, lamb and goat, although represents only about 5% of FAP, accounts for 45% of heads. Finally, other animal products such as milk and dairy and eggs are less importance. Then, the SESAP model contains sub-models for grains, oilseeds and roots. Further, it includes models for the livestock products cattle, pig, sheep and poultry. For all commodities, behavioral equations have been specified and estimated in terms of prices, demand and supply.

In this paper, the SESAP model provides results for two different scenarios. First, the baseline scenario, incorporating the Agenda 2000 reforms of the CAP, is introduced. The baseline scenario is use as a reference for evaluation the effects of any policy changes. Second, the

[1] A revision of those models can be seen in Tongeren et al. (1999); Conforti (2001); Conforti and Londero (2001) and De Muro and Salvatici (2001).

Luxembourg scenario, that provides the projection for the Luxembourg Agreement measures, is compared to the baseline scenario.

The paper is structured as follows. Section two describes the general structure of the model. Section three presents the baseline scenario and the simulations results of the impact of the Luxembourg Agreement in the Spanish agri-food sector. Finally, last section shows main conclusions, limitations and extension of the model and alternative scenarios.

2. The structure of the Spanish Econometric Simulation of Agricultural Policies Model

This section outlines the general structure of the Spanish Econometric Simulation of Agricultural Policies Model (SESAP Model). First, the main characteristics of the model are presented. Then, the specification and estimation of the behavioural equations are described. Finally, the model closure is defined.

2.1. Overview of the model

The SESAP model is an econometric, dynamic, multi-product and partial equilibrium commodity model. The aim of the SESAP model is to provide a tool for projection and policy simulation under alternative assumed conditions. Then, policy instruments were explicitly introduced in order to allow quantitative analysis of CAP reform scenarios. The model consists of two different sub-models, the crop and the livestock model. Some links between both sub-models exist. The products covered in each of the sub-models are the following:

- grains: soft and durum wheat, barley and maize;
- oilseeds: soybeans and sunflower seed;
- root crops: sugar beet, sugar and potatoes;
- livestock: cattle and beef, pig, poultry, and sheep;
- milk

A partial equilibrium model consists 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 (area harvested, 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 Spanish agricultural sector together with expert judgement.

2.2. Specification of behavioural equations

Crop sub-model. The crop model consists of three sub-models: the grains sub-model (soft wheat, durum wheat, barley and maize), the oilseeds sub-model (sunflower and soybean[2]) and the root sub-model (sugar beet and potatoes).

In the crop sub-model, it is assumed that land allocation is made in a two step process driven by prices and yields. Producers first determine the total land allocated to grains, oilseeds and root crops. Then, in a second stage, total grains, total oilseeds and total root crops areas are allocated to each crop within these main groupings. The supply side of these crop sub-models will depend on real price in the previous year and direct payments rather than receipts per hectare.

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

$$ah_{i,t} = f\left(p_{i,t-1}^{j}, Pol_{i,t}^{j}, V_i^{j}\right) \tag{1}$$

i: represent the main crop groups (grain, oilseeds and roots)
j: represents the different crops within the main group (soft wheat, durum wheat, barley, maize, sunflower, soybean, sugar beet and potatoes)

where $ah_{i,t}$ is the area harvested for crop i in year *t*, $p_{i,t-1}^{j}$ [3] real price or price ratio and specific crop j within the crop group i for year $t-1$. $Pol_{i,t}^{j}$ consists of the set of policy variables that might affect directly area harvested decision, (i.e. set aside, compensatory payment,…). Finally, V_i^{j} are the other exogenous variables that might determine area harvested for the analysed commodity (i.e., other crops area harvested, trend, lags, etc).

Then, area harvested for each of the sub-crops *j* is determined calculating the area share for each sub-crop *j* within crop *i* for year *t* as follows:

$$sh_{i,t}^{j} = f\left(p_{i,t-1}^{j}, Pol_{i,t}^{j}, V_i^{j}\right) \tag{2}$$

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

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

[2] In Spain no rape production neither consumption and trade exists.
[3] Instead of including receipts per hectares and in order to differentiated the effect of prices and policy variables, the last ones have been included.

$$sh_{i,t}^{n} = 1 - \sum_{j=1}^{n-1} sh_{i,t}^{j} \tag{3}$$

$$\sum_{j=1}^{n} sh_{i,t}^{j} = 1 \qquad 0 \le sh_{i,t}^{j} \le 1 \qquad \forall i$$

Multiplying (1) and (2), the area harvested for each of the sub-crops *j* within crop *i* is obtained:

$$ah_{i,t}^{j} = ah_{i,t} * sh_{i,t}^{j} \tag{4}$$

The yield per hectare equation for each crop *j* within group *i* r^{j} is determined by prices of the crop and substituted crops and, other exogenous variables V_{i}^{j} (i.e. technological change, weather indicators such as raining level, …),

$$r_{i,t}^{j} = f\left(p_{i,t-1}^{j}, V_{i}^{j}\right) \tag{5}$$

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

$$PR_{i,t}^{j} = ah_{i,t}^{j} * r_{i,t}^{j} \tag{6}$$

Total domestic use for each crop *j* within group *i* $DU_{i,t}^{j}$ consists of three different uses: feed use $Fu_{i,t}^{j}$, non-feed use (human) $NFu_{i,t}^{j}$ and, industry use demand $CR_{i,t}^{j}$ as follows,

$$DU_{i,t}^{j} = Fu_{i,t}^{j} + NFu_{i,t}^{j} + CR_{i,t}^{j} \tag{7}$$

Feed demand equation for each crop *j* within group *i* depends on prices and livestock crops as follows:

$$Fu_{i,t}^{j} = f(p_{i,t-1}^{j}, ac_{k,t-1}) \tag{8}$$

where, $p_{i,t-1}^{j}$ is price or price ratio for different grains or oilseeds used to feed animals and $ac_{k,t-1}$ represents the number of animals that were born during the year for each type of animal k (beef cattle, pork, sheep and poultry).

Non-feed demand equation for each crop *j* within group i (human demand) depends on traditional demand theory, it means, prices $p_{i,t-1}^{j}$, and per capita income GDP_{t} (real per capita GDP as a proxy) and a set of other exogenous variables V_{i}^{j} that might affect human demand of the product,

$$NFu_{i,t}^{j} = f(p_{i,t-1}^{j}, GDP_t, V_i^{j}) \tag{9}$$

Finally, in the case of oilseeds, there is a crushing use to get either oil or meal. The crushing use depends on oilseeds prices as well as output prices (oil or meal) and other exogenous variables affecting crushing use:

$$CR_{i,t}^{j} = f(p_{i,t-1}^{j}, p_{i,t-1}^{d}, V_i^{j}) \tag{10}$$

where, $p_{i,t-1}^{d}$ is the price for the oil and/or meal obtained from the oil seeds and V_i^{j} are other exogenous variables affecting the crushing demand.

Finally, trade and stocks change equations complete the supply and demand specification. These equations depend on production, domestic use and price (11)-(13),

$$St_{i,t}^{j} = f(PR_{i,t}^{j}, DU_{i,t}^{j}, p_{i,t-1}^{j}) \tag{11}$$

$$Ex_{i,t}^{j} = f(PR_{i,t}^{j}, DU_{i,t}^{j}, p_{i,t-1}^{j}) \tag{12}$$

$$\mathrm{Im}_{i,t}^{j} = f(PR_{i,t}^{j}, DU_{i,t}^{j}, p_{i,t-1}^{j}) \tag{13}$$

where $St_{i,t}^{j}$, $Ex_{i,t}^{j}$ y $\mathrm{Im}_{i,t}^{j}$ are stock change, exports and imports for each crop *j* within group *i* in year t respectively, and $PR_{i,t}^{j}$, $DU_{i,t}^{j}$ and $p_{i,t-1}^{j}$ are production, domestic use and prices for each crop *j* within group *i*.

Livestock sub-model. The livestock sub-model consists of four sub-models: cattle and beef meat, pig and pig meat, sheep and lamb meat and poultry meat. The first three sub-models have similar structure. However, the poultry model, due to the nature of the production process (industrial behaviour) and the limited extent of the EU policy in the sector, is considerably less complicate than the others livestock sub-models.

The key supply-side variable in the livestock models is the stock of female breeding animals (cows, sows and ewes). Female ending stocks are determined by the beginning stocks, output prices, input costs, and policy variables (direct payments per animal, quotas, etc.) as follows.

$$BN_{k,t} = f(BN_{k,t-1}, p_{cattle,t}, Pol_{k,t}, V_{k,t}) \tag{14}$$

k: represents the specific livestock group (cattle, pig or sheep).

where, $BN_{k,t}$ is the number of female ending stocks, $BN_{k,t-1}$ is the number of female beginning stocks, $p_{cattle,t}$ is the real price of cattle for year *t* $Pol_{k,t}$ policy variables that might affect

herd size (i.e. compensatory payments, quotas, etc), and $V_{k,t}$, other exogenous variables that might affect the herd size.

These stocks determine the number of young animals available for fattening and slaughter:

$$ac_{k,t} = BN_{k,t} * r_{k,t} \tag{15}$$

where, $ac_{k,t}$ is the number of born animals in year t, and $r_{k,t}$ the number of per capita animal born per female, determined exogenously.

Slaughtering decisions are mainly based on ending animal stocks, number of new animals added to the herd in the current year, and slaughter in the previous year. There are three different types of slaughters depending on the type of animal: young animals, female adult animal and other animals. This distinction is important because the slaughter not only provides the base for the meat production estimation but also determine the herd size.

The young, adult female and other slaughter equations are:

$$ysl_{k,t} = f(ES_{k,t}, ac_{k,t}, ysl_{k,t-1}, V_{k,t}) \tag{16}$$

$$bsl_{k,t} = f(ES_{k,t}, ac_{k,t}, bsl_{k,t-1}, V_{k,t}) \tag{17}$$

$$osl_{k,t} = f(ES_{k,t}, ac_{k,t}, osl_{k,t-1}, V_{k,t}) \tag{18}$$

$$Tsl_{k,t} = ysl_{k,t} + bsl_{k,t} + osl_{k,t} \tag{19}$$

where $ysl_{k,t}$, $bsl_{k,t}$ y $osl_{k,t}$ are the number of young, adult female and other animals slaughter in year *t*, respectively. Slaughter depends on ending animal stocks $ES_{k,t}$, number of animal born in year t $ac_{k,t}$, slaughter in previous years ($ysl_{k,t-1}, bsl_{k,t-1}$ y $osl_{k,t-1}$, respectively), and other exogenous variables $V_{k,t}$ (i.e. trends).

The model is complete with the trade equations for live animals (20) and (21),

$$Ex_{k,t} = f(ac_{k,t}, Tsl_{k,t}, p_{k,t-1}) \tag{20}$$

$$\mathrm{Im}_{k,t} = f(ac_{k,t}, Tsl_{k,t}, p_{k,t-1}) \tag{21}$$

Meat production is calculated multiplying the number of total slaughter animals and the slaughtering weight estimated as follows:

$$slw_{k,t} = f(p_{k,t-1}, ic_{k,t}, V_{k,t}) \tag{22}$$

where $p_{k,t-1}$ is the price of animal *k*, $ic_{k,t}$ the input cost of animal *k* and, $V_{k,t}$ other exogenous variables.

Meat production for the different animals z (beef meat, sheep meat and pig meat) $PR_{z,t}$ is calculated by the following identity[4],:

$$PR_{z,t} = Tsl_{k,t} * slw_{k,t} \tag{23}$$

The demand side is modelled as a function of the income, the real own price and the price of the rest of meats assuming that they might be gross and net substitutes in consumption[5] as follows:

$$NFu_{z,t} = f(p_{z,t-1}, GDP_t, V_i^j) \tag{24}$$

$$DU_{z,t} = NFu_{z,t} * pop_t \tag{25}$$

where $NFu_{z,t}$ is human per capita consumption for the different meats z and the domestic use is calculated taking into account the population, pop_t.

Finally, trade and stocks change equations for meat complete the supply and demand specification.

These equations depend on production, domestic use and price (26)-(28),

$$St_{z,t} = f(PR_{z,t}, DU_{z,t}, p_{z,t-1}) \tag{26}$$

$$Ex_{z,t} = f(PR_{z,t}, DU_{z,t}, p_{z,t-1}) \tag{27}$$

$$\mathrm{Im}_{z,t} = f(PR_{z,t}, DU_{z,t}, p_{z,t-1}) \tag{28}$$

where $St_{z,t}$, $Ex_{z,t}$ y $\mathrm{Im}_{z,t}$ are stock change, exports and imports for each meat z in year t respectively, and $PR_{z,t}$, $DU_{z,t}$ and $p_{z,t-1}$ are production, domestic use and prices for each meat z.

2.3. Estimation and validation of behavioural equations

All previous equations have been estimated using annual data from the period 1973-2000. 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 behav-

[4] For poultry, production is estimated because there are not animal stocks.
[5] In this case, human consumption is the only one.

ioural equations was done with the software Eviews. The specific variables finally included in each of the estimated equations together with estimated parameters and validation tests are available in Casado and Gracia (2003).

2.4. Price transmission and market closure

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 will include 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. The previous year's price in Spain is in the linkage equation too. For most commodities the French market has been used as the leader. The estimation of the price transmissions equations are in Casado and Gracia (2003).

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 but, in Spain not ending stocks information is available, then, for many commodities, the stock change has been the closure variable.

Finally, the SESAP model is 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 from 2001 to 2010 using the GAMS software.

3. Scenario and simulation results

This section provides the results of the potential effects of the Luxembourg Agreement on the Spanish agriculture sector over the period 2001-2010. The starting point for the analysis is the baseline scenario to be used as a reference for evaluating the effects of any policy changes. Once the baseline projections are set, they are used as a comparison point for the policy scenario under the Luxembourg agreement.

3.1. Baseline scenario

To generate the baseline projection over the period 2001-2010, a specific set of assumptions about exogenous variables (macroeconomic assumptions and prices) must be defined. The macroeconomic assumptions in the baseline come from external sources. Population projections are from EUROSTAT, projections of most macro economy variables are from the econometrics unit in DG Economics and Finance. Other sources include macroeconomic from the Spanish Central Bank. World market prices projections are not endogenous to the SESAP model. Then, world market prices projections comes 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 incorporates the Agenda 2000 reforms of the CAP. The baseline does not make assumptions concerning the outcome of the WTO Doha Development Round thus, the existing Uruguay Round Agreement on Agriculture (URAA) is assumed to prevail for the whole projection period.

Main results for the baseline projections (2001-2010) are summarised in table 1 (some of the results can be seen in table 2, 3 and 4).

Table 1. Baseline projection (2001-2010): main results

Crop results
Crop area harvested is expected to decrease of 2, 41 y 50 percent for cereals, oilseeds and roots, respectively
Soft and durum wheat area harvested are expected to decrease of 25 and 2 percent, respectively. However, barley area harvested is expected to increase of 6 percent while maize will maintain stable
Soft wheat and durum wheat production will decrease of 18 percent and 11 percent
Durum wheat domestic use might increase of 25 percent, respectively, then Spanish production could not be enough to satisfy future domestic demand
Barley production is expected to increase of 17 percent while barley domestic demand will drop in 2001, increasing of 12% since then until 2010
Maize production is expected to increase steadily reaching 5 thousand tonnes in 2010
Sunflower area harvested and production are expected to decrease of 40 percent, while domestic use is expected to rise 21 percent, then Spanish sunflower production will not satisfy demand
Potatoes and sugar production are expected to decrease of 50 and 20 percent
Livestock results
The number of cattle animals is expected to decrease of 14 percent
The number of pigs and sheep will increase of 24 and 36 percent
Pig, poultry and lamb meat is expected to increase of 37, 12 y 6 percent

Source: SESAP model results

3.2. Policy reform scenario

The policy reforms examined are those contained in the Presidency compromise document (Council of the European Union, 2003). Under the Luxembourg Agreement and the negotia-

tions that have followed, a very wide range of possible implementation scenarios can be envisaged. In this paper is examined the most extreme implementation scenario allowed under the Luxembourg Agreement, i.e. all direct payments under the Agenda 2000 Common Agricultural Policy (CAP) are fully decoupled at the earliest possible date. The Luxembourg Agreement changes the CAP as it applies to livestock, cereals and oilseeds. From January 2005 all direct payments are decoupled from production. In the beef sector the suckler cow, special beef, and slaughter premium are all decoupled from production. In the sheep sector the ewe premium is fully decoupled. In the cereals and oilseeds regime arable aid payments are decoupled from production. In this analysis no attempt has been made to incorporate the cross-compliance or modulation elements of the Luxembourg Agreement.

Main results indicate that only considerable changes from the baseline scenario have been found for sectors affected by the new policy instruments, cereals, oilseeds, cattle and beef meat and, sheep and lamb meat. Moreover, only changes in area harvested, number of animals as well as production for those products have been detected. It means, the new policy instruments considered in the policy scenario only influence the supply side having found only some small changes in imports and exports for those products and, insignificant or null changes in the domestic use. Therefore, only results for those commodities and for area harvested, number of animals and production are presented.

Crop sub-sector results. Under the projection results for the Luxembourg scenario, crop area harvested in Spain is expected to decrease of 2, 64 y 49 percent for cereals, oilseeds and roots, respectively (Table 2).

Table 2. Area harvested for grains, oilseeds and roots under the baseline and Luxembourg scenario from 2001 to 2010 (thousand hectares)

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	%
Grains											
Baseline	5,967	5,944	5,934	5,914	5,897	5,880	5,867	5,855	5,844	5,834	-2.2
Luxembourg	5,967	5,944	5,934	5,914	5,897	5,881	5,868	5,855	5,844	5,834	-2.2
Soft wheat											
Baseline	1,352	1,333	1,289	1,262	1,225	1,185	1,140	1,100	1,058	1,016	-24,9
Luxembourg	1,352	1,333	1,289	1,262	1,225	1,180	1,134	1,093	1,050	1,009	-25,4
Durum wheat											
Baseline	729	724	723	720	718	716	715	713	712	710	-2.6
Luxembourg	729	724	723	720	718	716	715	713	711	710	-2.6
Barley											
Baseline	3,408	3,405	3,439	3,448	3,470	3,497	3,531	3,560	3,594	3,628	6.5
Luxembourg	3,408	3,405	3,439	3,448	3,498	3,547	3,593	3,629	3,666	3,702	8.6
Maize											

Baseline	480	482	484	483	483	482	481	480	480	480	0.0
Luxembourg	480	482	484	483	455	437	427	420	415	412	-14.2
Oilseeds											
Baseline	941	825	758	721	686	654	625	599	575	553	-41.2
Luxembourg	941	825	758	721	538	454	408	379	357	338	-64.1
Roots											
Baseline	263	248	234	219	205	190	176	161	147	132	-49.8
Luxembourg	263	248	234	219	205	190	176	161	147	132	-49.8

Source: SESAP model results

Then, the percentage change in the area harvested for the Luxemburg scenario compare to the baseline is negative for sunflower seeds and almost zero for cereals and roots. These results must be considered with precaution because we cannot conclude that the Luxembourg Agreement implementation will not induce any change in projection form the baseline scenario for cereals and roots. It must take into account two things in order to put these results in context. First, only the decoupling measure has been implemented in the Luxembourg scenario. Second, in the specification and estimation of area harvested has been found that direct payments have not been statistically significant on either cereals or roots area harvested equations. Then, not differences between results from the baseline and policy scenario have been found. In the case of roots, potatoes and sugar beet area harvested have continuously decreased apart from the policy measures. Then, the insignificance of the direct payment on area harvested is justified. However, in the case of cereals, the insignificance of direct payment might be due to the aggregate nature of the cereals analysis. In other words, in Spain, cereals production is obtained from both, irrigated and non-irrigated land. This distinction has not been taken into account yet in the model. Therefore, the direct payment had not influence the area harvested decision at aggregated level while it is expected to find some influence on area harvested once it will be disaggregated into irrigated and non-irrigated land. This is the main shortcoming of the current version of the SESAP model. This limitation will be overcome once information on both, irrigated and non-irrigated will be collected and the model will be modified to incorporate this distinction.

Although no differences have been found for total cereals between the baseline and policy scenario, some small differences can be observed for soft wheat and barley. Under the Luxembourg scenario, wheat production is expected to decrease of 17% under the Luxembourg scenario (almost the same than under the baseline scenario 16%) (table 3). Barley production will increase of 19% under the Luxembourg scenario although it would have increase of 17% under the baseline one. These differences are due to the link that exist between these two cereals and the livestock sector through the feed use equation.

Table 3. Production for grains and oilseeds under the baseline and Luxembourg scenario from 2001-2010 (thousand tonnes)

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	%
Soft wheat											
Baseline	3,524	3,538	3,340	3,283	3,215	3,186	3,096	3,039	2,965	2,898	-17.8
Luxembourg	3,524	3,538	3,340	3,283	3,262	3,238	3,147	3,087	3,013	2,940	-16.5
Durum wheat											
Baseline	1,336	1,327	1,306	1,284	1,265	1,246	1,230	1,214	1,199	1,185	-11.3
Luxembourg	1,336	1,327	1,306	1,284	1,265	1,246	1,230	1,214	1,199	1,185	-11,3
Barley											
Baseline	8,694	8,784	8,970	9,092	9,251	9,421	9,614	9,796	9,991	10,190	17.2
Luxembourg	8,694	8,784	8,970	9,092	9,325	9,555	9,782	9,986	10,193	10,399	19.6
Maize											
Baseline	4,623	4,711	4,872	4,956	5,028	5,084	5,168	5,244	5,323	5,402	16.8
Luxembourg	4,623	4,711	4,872	4,956	4,717	4,586	4,549	4,548	4,575	4,617	-0.1
Sunflower seed											
Baseline	888	760	732	697	666	631	609	583	560	539	39.3
Luxembourg	888	760	732	697	522	437	398	369	347	330	-62.8

Source: SESAP model results

Oilseeds area harvested was the most affected by the Luxembourg new policy instrument (Table 2). Moreover, this reduction in oilseed area harvested will not be partially compensated by higher productivity per hectare (not impact has been found). Then, in table 3 can be observed that sunflower seed production will decrease of 38 percent from 2001 to 2010 in relation to the baseline scenario. Finally, the decoupling of direct payment from production would lead to lower receipts from grain production, this would tend to reduce areas harvested and output, particularly for oilseeds where these payments have been crucial. The reduction in area harvested would tend to be partially compensated by higher productivity per hectare. However, results indicates that yields has not been affected by the reform policy.

Livestock sub-sector results. Results indicate that the Luxembourg reform scenario has effects on cattle and sheep ending stocks and therefore, in the beef and veal and lamb meat (Table 4). Pig ending stocks, pig meat and poultry meat is expected to change as in the baseline scenario.

Table 4. Animal ending stocks and meat production under the baseline and Luxembourg scenario from 2001-2010 (thousand heads and thousand tonnes)

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	%
Beef cattle											
Baseline	6,628	6,689	6,715	6,695	6,631	6,525	6,378	6,192	5,965	5,699	-14
Luxembourg	6,628	6,689	6,715	6,695	6,475	6,128	5,772	5,393	4,986	4,546	-31.4
Sheep											
Baseline	29,234	30,286	31,372	32,492	33,635	34,801	35,990	37,201	38,433	39,684	35.7
Luxembourg	29,234	30,286	31,372	32,492	33,623	34,726	35,822	36,921	38,031	39,157	33.9
Pigs											
Baseline	22,441	23,111	23,763	24,398	25,017	25,619	26,024	26,772	27,324	27,861	24.2
Luxembourg	22,441	23,111	23,763	24,398	25,017	25,619	26,204	26,772	27,325	27,861	24.2
Beef meat											
Baseline	647	667	687	705	723	741	757	771	783	794	22.7
Luxembourg	647	667	687	705	723	731	743	758	773	787	21.6
Lamb meat											
Baseline	230	228	231	233	235	237	238	240	241	243	5.7
Luxembourg	230	228	231	233	234	229	226	226	226	227	-1.3
Pork meat											
Baseline	2,959	3,026	3,130	3,261	3,391	3,509	3,624	3,747	3,891	4,045	36.7
Luxembourg	2,959	3,026	3,130	3,261	3,391	3,509	3,624	3,747	3,891	4,045	36.7
Poultry meat											
Baseline	1,052	1,064	1,077	1,091	1,107	1,121	1,136	1,149	1,164	1,178	12.0
Luxembourg	1,052	1,064	1,077	1,091	1,107	1,121	1,136	1,149	1,164	1,178	12.0

Source: SESAP model results

Under the baseline, cattle ending stock was expected to decreased of 15% while, the expected decrease under the Luxembourg scenario is around 32%. Then, cattle ending stock is expected to decline in the Luxembourg scenario compared to the baseline 20% (table 4). However, beef and veal production is expected to increase under the baseline (23%) but also under the Luxembourg agreement (22). Beef and veal meat production is expected to decline in the Luxembourg scenario compare to the baseline 1%. The different expected trend for the cattle herd size and the beef meat production, negative and positive, respectively, can be explained by the different decreasing rate of the total cattle ending stock and the sucker cow ending stock. While total cattle is expected to decrease by 14% under the baseline, the sucker cows are expected to decrease at a lower rate (9%). Then, the number of born animals will be the same and to reduce the beef cattle ending stocks higher number of animals will be slaughter. Then, beef meat production will increase.

Under the baseline, sheep ending stock in Spain was expected to increase of 36% while, the expected increase under the Luxembourg scenario is lower, accounting for 34%. However, it is expected that lamb meat production will increase under the baseline (6%) but, it will even slightly decrease under the Luxembourg agreement (1%). Then, lamb meat production is expected to decline in the Luxembourg scenario compare to the baseline 7%.

4. Conclusions

The main contribution of the paper is to provide an econometric model of the Spanish agricultural sector, called SESAP model, that allows to generate projections and simulation for alternative policy scenarios. Moreover, it presents baseline projections as a starting point for evaluating policy changes. First results for the decoupling measure introduced by the mid term review and the Luxembourg Agreement are also important contributions of the paper.

Main conclusions from policy scenario are outlined.

First, the new Luxembourg policy instruments have mainly impact on those sectors more linked to the new policy instruments, cereals, oilseed, cattle and beef meat and, sheep and lamb meat. Moreover only changes in area harvested, number of animals and production for those products have been found. It means that, the new policy instruments only influence on the supply side having found only small changes in imports and exports for those products and, insignificant changes in the domestic use.

Second, the expected evolution under the baseline (Agenda 2000) will continue the same trend under the Luxembourg Agreement although the magnitude of the changes will be different. For crops, it was expected a decline in the area harvested and production for wheat (soft and durum), oilseeds and roots under the baseline assumptions (Agenda 2000). However, barley and maize production is anticipated to increase. Those trends will continue under the Luxembourg Agreement scenario and, in many cases, the percentage changes from 2001-2010 for both scenarios (baseline and Luxembourg Agreement) are very similar. Only, the decreasing trend of oilseeds production and the increasing trend of barley production for the Luxembourg agreement are higher than in the baseline.

For animals, it was expected that the number of total beef cattle animals will decrease under the baseline scenario and this decline is expected to be higher after the Luxembourg Agreement. However, it was anticipated in the baseline that beef and veal meat production will increase and similar increase is expected under the Luxembourg Agreement. Sheep and pigs ending stocks will be much higher in the medium-term and both predictions (baseline and Luxembourg Agreement) are quite similar. Although the number of sheep animals was expected to increase in an important rate, lamb meat is expected to increase slightly under the baseline but, also, decrease under the Luxembourg Agreement.

Finally, we must to point out that the current version of the SESAP model is still a working progress version and it must be extended in different ways. One of them will be to distinguish between irrigated and non-irrigated land. In addition, further work should be done in or-

der to analyse other alternative policy scenarios. For instance, the impact of specific measures as, the decrease in durum wheat supplementary payment, on the Spanish agricultural sector.

References

Casado J.M. and Gracia A. (2003): *Spanish AG-MEMOD documentation Manual.*

Conforti P. (2001), *The Common Agricultural Policy in main partial Equilibrium models*, INEA Working Paper, Rome.

Conforti P., Londero P. (2001): *AGLINK. The OCDE partial equilibrium model*, INEA Working Paper, Rome.

Council of the European Union (2003): *CAP – Reform – Presidency Compromise (in agreement with the Commission)*, Brussels June 30.

De Muro P., Salvatici L. (2001): *The Common Agricultural Policy in multi-sectorial models*, INEA Working Paper, Rome.

FAPRI-Ireland (2003): *Outlook 2003*, http//tnet.teagas.ie/fapri.

Ibañez J., Perez Hugalde C. (1993): "Un modelo econométrico multiecuacional de asignación de superficies de cultivos. Aplicación a los subsectores cerealistas de Navarra y de toda España", *Investigación Agraria. Economía*, 9 (1): 127-137.

Ibáñez J., Perez Hugalde C. (1996): "Efectos de una reducción del precio de los cereales sobre el subsector cárnico en España", *Investigación Agraria. Economía*, 12 (1, 2, 3): 203-214.

Ibáñez J., Perez Hugalde C. (1999): "Impactos de la reforma de la PAC de 1992 sobre el subsector agrícola español", *Estudios Agrosociales y Pesqueros*, 185: 9-30.

Tongeren van F., Van Meijl H. (1999): "Review of applied models of international trade in agriculture and related resource and environment modeling", Agricultural Economics Research Institute (LEI) Report, 5.99.11, The Hague.