IMPACT OF THE CAP REFORM ON THE SPANISH AGRICULTURAL SECTOR

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Rete di informazione della Commissione Europea

Paper prepared for the 109th EAAE Seminar " THE CAP AFTER THE FISCHLER REFORM: NATIONAL IMPLEMENTATIONS, IMPACT ASSESSMENT AND THE AGENDA FOR FUTURE REFORMS".

Viterbo, Italy, November 20-21st, 2008.

Abstract

This paper analyses the impact of the 2003 CAP reform on Spanish agricultural sector in the context of the recent CAP Health Check and high food prices, using PROMAPA, a positive mathematical programming model for representative farms.

The analysis compares the model results for base year 2002 to the findings for a scenario with the CAP reform measures in place, taking into account recent modifications. The effect of adopting a full decoupling scheme instead of the present partial decoupling is also studied.

Brief descriptions are given of the PROMAPA model, the representative farm considered and the assumptions about both price variations and the policy measures simulated.

The findings showed that the farming area for cereals grew substantially after abolition of the compulsory set-aside and that the impact of transition to full decoupling was scant, except in the sheep and rearing cattle sub-sectors, where it considerably steepened the already sizeable decline in livestock numbers induced by the partial decoupling scheme.

Keywords: CAP reform, CAP Health Check, Decoupling, Spanish agricultural sector.

JEL: Q10, Q12, Q18,

Introduction

The purpose of the CAP health check conducted by the EU Commission, among others, is to assess the 2003 CAP reform and propose modifications to enhance CAP effectiveness, (see Commission Staff Working Document SEC (2008) 1885). These tasks have been undertaken in a scenario of substantial rises in food prices due to the expansion of agro-energy crops and the increase in the world-wide demand for cereals.

In that context, this paper aims to evaluate the impact of the decoupling measures adopted in 2006 by Spain taking into account recent measures proposed or studied for possible future proposals. More specifically, the modifications studied are: abolition of the 10% set-aside requisite to qualify for compensatory payments for COP crops, the increase in the milk quota and recent provisions for the cotton and sugar beet sub-sectors.

The farm types defined in the Spanish Farm Accountancy Data Network (FADN) are used to perform a static comparative analysis between the results of the positive mathematical programming (PMP) model PROMAPA1 for the base year 2002 and the findings for a simulated year in which a new price scenario is established and the decoupling scheme measures are assumed to be in effect.

The paper is structured as follows: section 2 discusses the interest aroused by and recent developments in positive mathematical programming for the analysis of agricultural policy, section 3 contains a brief description of PROMAPA and sections 4, 5 and 6 respectively describe the farm types, prices and agricultural policy scenarios considered. Finally, section 7 analyses the results obtained.

Positive mathematical programming and agricultural policy

Mathematical programming and in particular linear programming has been and continues to be a widely used technique in the context of agricultural economics.

Despite this extensive use, however, considerable criticism has been levelled against linear programming. Specifically, to obtain solutions that accurately reflect reality, it is felt that certain – usually arbitrary – constraints must be included.

One way of avoiding this problem is to use PMP, as devised by Howit (1995). Briefly, by estimating the coefficients of the target function for a non-linear programming model, this technique can calibrate the model so that it reproduces the situation existing in a base year for the unit modelled (farm or region). The calibration method proposed by Howit was subsequently enhanced by including entropy maximization in the procedure (Paris and Howit, 1998).

[1] ***PRO****gramación* ***M****atemática para el* ***A****nálisis de* ***P****olíticas* ***A****grarias*

The suitability of PMP for formulating and evaluating the Common Agricultural Policy (CAP) has driven further development of this technique, as can be seen in the recent revisions by Heckelei and Britz (2005) and Henry de Frahan et al.(2007).

Variations designed to correct some of the shortcomings of the Howit and Paris calibration procedure have also been proposed. Such variations have been published, among others, by Judez et al. (1998, 2001), who propose to perform calibration without running the first stage of PMP, Gohin and Chantreuil (1999) introduce a procedure for processing marginal activities, Helming et al. (2001) include supply elasticities obtained exogenously to calibrate the target function coefficients, Röhm and Dabber (2003) propose a method for linking different variants of the same crop, and more recently Severini and Cortignani (2008) and Júdez et al (2008) suggest procedures for including activities in PMP that are not present in the base year. In addition to these proposals in which calibration is achieved for each unit modelled with the data for a single year, in Heckelei and Wolf (2003) and in Buysse et al. (2007) calibration is replaced with econometric estimation procedures using datasets.

In parallel with the theoretical developments around calibration, PMP has been applied in a fair number of cases lately to analyse the effects of agricultural policy (essentially Common Agricultural Policy measures) on agricultural sector. In addition to the above papers, in which the authors illustrate their calibration proposals with applications, others have been published by Arfini and Paris (1995), Heckelei and Britz (1999), Barkaoui and Butault (1999, 2003), Röm and Dabbert (1999), CAPRI (2000), Paris et al. (2000), Osterburg et al. (2001), Arriaza and Gómez-Limón (2003), Júdez et al. (2003), Buysse et al. (2004), Buysse and Van Huylenbroeck (2005), Offermann et al. (2005), Blanco and Iglesias (2005), Adenauer et al. (2006) and Kuepker and Klainhauss (2006).

Finally, for several years now a number of European teams have been developing PMP models at the farm level, using national and European FADN. Some of these models, which are often used by national and/or Community officials as a tool for analysing the impact of agricultural policy are: FARMIS (FAL- Germany), SEPALE (Ghent University, CAE Brussels, Catholic University of Louvain - Belgium) and CAPRI (Bonn University - Germany)[2]. The PROMAPA model pursues the same line of research as the foregoing studies.

[2] The AROPAJ model developed in France applying linear programming, which also uses information from the farm accountancy data networks, is used to analyse agricultural and agro-environmental policies (see Jayet et al., 2000)

Brief description of the PROMAPA model

PROMAPA is a PMP representative farm model, designed to study the impact of change in agricultural policies on the Spanish agricultural sector[3]. Model calibration can be performed with several procedures. Exogenous supply elasticities are used in this study.

The activities covered by the model included some fifteen non-irrigated and around twenty five irrigated crops, as well as dairy cattle, rearing cattle, and dairy and non-dairy sheep. Livestock feeding is endogenous, whether produced on the farm or purchased to meet the energy and protein needs of different livestock categories; intake capacity was taken into account as well. The activities associated with the agricultural policy tools implemented in the model included the mandatory set-aside in irrigated and non-irrigated land requisite to receiving direct payments for COP crops, several premiums for livestock (dairy and rearing cattle and sheep), several types of (coupled and decoupled) direct payments for crops in the context of the Single Payment System, modulation and crop and livestock quotas.

The primary source of the data to feed the model was the Spanish FADN, although information provided by experts was likewise used, especially to determine unit costs for crops and different categories of livestock and to establish livestock feeding needs.

Farm types

The farm types considered were the mean types listed in the Spanish FADN in 2002 by autonomous community for each of the farm sizes in the TFs most affected by the CAP reform. A total of 140 farm types, covering 188,310 farms nation-wide, were included.

Price scenario

The prices of 2007 were adopted to reflect the price increase with respect to the base year. The variation in prices from 2002 to 2007 according to data published by the Spanish Ministry of the Natural, Rural and Maritime Environments are shown in Table 1.

[3] The model is being developed by the Departamento de Estadística y Métodos de Gestión en Agricultura, ETSIA (UPM) and the Instituto de Economía, Geografía y Demografía, CCHS (CSIC).

Table 1 : Price variations, 2002-2007

Rice	-1.34	Maize	49.27
Sugar beet (*)	-47.87	Sunflower	50.84
Cotton	44.69	Veal (7-18 days)	-17.00
Potato.	49.88	Veal (6 months)	-11.85
Chick pea	-9.63	Cow's milk	23.42
Vetch	31.34	Sheep's milk	0.21
Common wheat	56.82	Lamb	15.58
Durum wheat	150.85	Dehydrated alfalfa	10.40
Barley	55.33	Concentrated feed, dairy cow	10.46
Rye	45.58	Concentrated feed, rearing cattle	7.43
Oats	25.36	Concentrated feed, sheep	17.29

(*): Variation between the minimum base year price and the minimum price in place under sub-sector reform.

Agricultural policy scenarios

The base year measures considered were the Agenda 2000 arrangements in effect in 2002, while in the main scenario simulated, partial decoupling measures adopted in Spain in 2006 were included, with the following modifications:

i) For sugar beet, according to the new proposal for the sub-sector, a coupled payment of €8.78/t and a decoupled payment of €12.83/t were assumed. The sugar quota was reduced by 50%.

ii) For cotton, the new measures entailed a coupled payment of €1551/ha, while the decoupled payment was the same as in the base year €1351/ha. The maximum farming area eligible for guaranteed coupled payments was lowered from 70,000 to 48,000 ha.

iii)The compulsory 10% land set-aside was eliminated.

iv)The dairy quota was increased by 2%.

Furthermore, for the full decoupling scheme simulation, the decoupled measures were defined to be the sum of the coupled and decoupled measures in the main partial decoupling scenario.

Results

The following assumptions were made to obtain the results: i) the reduction,due to modulation, for direct payments totalling over €5,000 was set at 5%; ii) the decoupled aid for each farm type was established on the basis of farming area and livestock numbers in the base year. That is, the base year replaced the reference period (mean for calendar years 2000, 2001 and 2002); and iii) as a result, the land set aside in 2006 was the same as in the base year.

The results for the 140 farm types were obtained with GAMS. The analyses in the following sections concerns the weighted sum of the results for each farm type. The weighting coefficient was the number of farms represented by each type nation-wide.

Impact of price variations and of the new agricultural policy measures

The effect of prices and the new agricultural policy measures on crop distribution and on gross margin and payments are given in Table 2 as variations with respect to the base year.

In scenario 1, the agricultural policy measures were the ones in effect in 2006. The variations in the results for this scenario with respect to those of the base year 2002 scenario (Agenda 2000) were due to the agricultural policy adopted in 2006 and the increase in prices between 2002 and 2007.

Scenario 2 differed from scenario 1 only in the elimination of the compulsory 10% set-aside. That is, the land set aside under both the 2002 and the 2006 measures was available for farming in scenario 2.

In the main scenario, the primary object of the present analysis, the new measures referred to above for cotton, beet and the dairy sector were included, and the mandatory set-aide was eliminated.

Table 2: Variation (in %) in the results for simulated scenarios compared to the base year

	SCENARIO 1 2006 measures Compulsory set-aside: 10%	SCENARIO 2 2006 measures Compulsory set-aside: 0%	MAIN SCENARIO 2006 + new measures Compulsory set-aside: 0%
Cereals (except rice) (ha)	2.31	12.22	12.71
Rice (ha)	-0.35	-0.34	-0.34
Oilseed (ha)	-19.12	-2.12	-1.62
Grain legumes (ha)	-40.02	-26.64	-26.64
Sugar beet (ha)	-3.66	-1.55	-50
Cotton (ha)	-19	-19	-34.28
Gross margin (€, real terms)	2.22	5.39	4.41
Payments (€, nom.terms)	9.99	10.08	15.83

The following may be deduced from the analyse of the variations shown in the table.

Cereals. Despite the partial decoupling of the compensatory payments for cereals, the steep rise in prices led to a 2.5% increase in the farming area, even with the mandatory set-aside in effect (scenario 1). When it was not (scenario 2), the area increased by approximately 12%. The rest of the new measures studied had no significant effect on this rise.

Rice. The slight price decline between 2002 and 2007 barely impacted the farming area for this crop, despite the competition from other crops with steep price rises. This was due to the substantial rise in payments for rice between the base year and 2006.

Oilseed. The partial decoupling of oilseed payments and their price made them much less profitable than the cereals that competed with them for farming area. Nonetheless, the amount of area yielded to the latter was much smaller when the set-aside, still mandatory in 2006, was recovered for farming. Moreover, with the introduction of the new cotton and beet policies (main scenario), oilseed occupied part of the farming area formerly devoted to those crops.

Grain legumes. The Spanish decision to fully decouple payments for grain legumes, in conjunction with their price, which was lower in 2007 than the price paid for the cereals with

which they compete, led to a substantial reduction in the farming area used to grow these crops. This decline was smaller, although nonetheless significant, when the 10% set-aside was released for farming. The new cotton and beet policies had no impact on the grain legume farming area, because in the farm types studied, grain legumes are non-irrigated, whereas cotton and beet are irrigated crops.

Sugar Beet. Despite partial decoupling, the substantial price rise in the cereals studied made them more profitable under the 2006 measures than sugar beet on the farms where the two types of crops competed. While this led to a decline in sugar beet farming area, approximately half of the loss was recovered when the 10% set-aside was released for farming. The 50% reduction in sugar beet farming area in the main scenario was due to the lower sugar quotas established in the new proposal for the sub-sector. Be it said in this regard that without this constraint the simulations showed that the sugar beet area would be about 30% of its area in the base year.

Cotton. Under the 2006 measures, the farming area for this crop came to approximately the total eligible (70,000 ha) for coupled aid, regardless of whether a 10% or a 0% mandatory set-aside was used. When the recently proposed measures were assumed to be in effect, the area devoted to cotton declined to 56,758 ha (65,72% of the base year figure), which is more than would be eligible for coupled payments (48,000 ha), despite the penalization per hectare applied for exceeding that ceiling.

Gross margin. In scenario 1 the gross margin rose by approximately 2% compared to base year 2002. This increase was essentially due to the steep rise in prices (a simulation with the 2006 partial decoupling measures and base year prices showed a 2.8% decline in gross margin).

The recovery of set-aside land for farming (scenario 2) led to a three percentage point increase in gross margin. When all the new measures considered in this study, i.e., a 2% increase in the dairy quota and new cotton and sugar beet policies, in conjunction with the cultivation of mandatory set-aside land, were implemented, the gross margin was just slightly over two points higher than in scenario 1. The reason for this dip compared to scenario 2 is that the new measures for cotton and beet partially offset the increase in gross margin induced by the growth in farming area and the dairy quota.

Payments. The 2006 measures led to higher payments than in the base year due to the increase in certain types of aid (for rice for instance) and the institution of new measures (such as for cotton and dairy products). The enlargement of the farming area with the elimination of the mandatory set-aside (scenario 2) did not, logically, lead to higher payments: on the one hand, the penalisations per ha applied to coupled payments for exceeding the eligible farming area kept the total sum unchanged despite increases in the amount of farming area that would initially qualify for payments. On the other hand, the

decoupled payments could not grow either, for they were limited to the amounts payable for the area eligible for such aid in the base year.

Payments were higher under the new measures as a result of the new provisions for beet and the higher dairy quota.

Livestock. The variations with respect to the base year were similar in the three scenarios. Table 3 gives the results for the main scenario.

Table 3: Variations in livestock numbers with respect to the base year, in %

	All farm holdings	Farm holdings in northern Spain	Proportion of total farm holdings located in northern Spain
Suckler cows	-7.53	-0.66	40.08
Dairy cows	0.61	0.45	79.28
Dairy sheep	-16.13	-1.9	6.25
Non-dairy sheep	-23.82	-14.66	4.19

Suckler cows. The decline in the selling price of livestock and the increase in purchased feed prices were the chief reasons for the 7.5% decline in the number of suckler cows. This type of cattle was also adversely affected, albeit to a lesser degree, by the 7% decrease in payments in Spain, further to Article 69.

Dairy cows. Despite the decline in the selling price of weaned animals and the rise in the price of purchased feed, the upward trend in milk prices, the coupled payments for dairy farmers and the possibility of increasing the milk quota led to growth in dairy livestock numbers, although the increase was smaller than allowed under the 2% rise in the quota.

Sheep. A sizeable proportion of the sheep-raising farm types considered in this paper are heavily dependent on purchased feed. The rising price of such feed and the high payment decoupling rate for this type of livestock (nearly 50% of the total) led to a considerable decline in the herd size, which was less steep in the case of dairy sheep.

***Regional variations*.** Substantial regional variations were observed for suckler cows and sheep in the 140 farm types studied. These differences are illustrated in Table 3, which shows that the number of suckler cows varied very little in northern Spain, which accounted for approximately 40% of the total number of cows in all the farm types studied. Similarly, the variation observed for dairy sheep in northern Spain was less than 2%, while the figure for non-dairy sheep was nearly 50% lower than for the farms considered as a whole. This smaller decline in livestock numbers in what is known as humid Spain was due to the fact that the abundant pasture land in that region makes the activity less dependent on purchased feed.

Effects of a possible adoption of the full decoupling scheme

Table 4 shows how the change from the present partial to possible full decoupling would affect the main crop groups and certain economic indicators.

As the table shows, full decoupling only affected rice, sugar beet and cotton. In all three cases, this was due to the fact that the prices considered did not make these crops more profitable than others with which they compete when crop-coupled payments were decoupled. In the case of sugar beet, the farming area dipped to below the required minimum 50% of the base year area. Cotton farming area came to around 55,000 ha, higher than the 48,000 ha for which coupled payments are guaranteed under the partial decoupling scheme.

Table 4: Variations (in %) in farming area and economic indicators stemming from the change from partial to full decoupling

Cereals (except rice) (ha)	0.04
Rice (ha)	-4.46
Oilseed (ha)	0.14
Grain legumes (ha)	0.00
Sugar beet (1)	-10.17
Cotton (ha)	-2.72
Potato (ha)	-0.50
Gross margin (€)	0.13
Payments (€)	2.62

The change from partial to full decoupling went hand-in-hand with a decline in farming activity, translating into a larger number of non-farmed hectares and a substantial downturn in the numbers of cattle and sheep. This decline did not affect all the regions of Spain to the same degree, however, for as Table 5 shows, hypothetical full decoupling had little impact on livestock in northern Spain.

Table 5: Variations (in %) in livestock numbers stemming from the change from partial to full decoupling.

	All farms	Farms in northern Spain
Suckler cows	-19.65	-0.75
Dairy cows	-0.21	-0.23
Dairy sheep	-8.16	0.36
Non-dairy sheep	-18.34	-1.26
Total L.U.	-9.44	-0.35

Note, finally, that despite full decoupling, payments would be higher. This is because activity was lower in certain sub-sectors (suckler cows, sheep and cotton) under partial decoupling than in the base year. As a result, when payments were wholly decoupled, they were associated with a higher level of activity than when only partially decoupled. Thanks in part to this increase in direct payments, the total gross margin for all the farms as a whole was similar under the two decoupling schemes.

Conclusions

The following conclusions can be drawn from the results obtained for the scenario in which new measures for cotton, sugar beet and dairy products were incorporated and the mandatory set-aside was eliminated:

- Even with a guaranteed minimum price, the optimum sugar beet farming area would be less than allowed under the present quota, although higher than 50% of that quota, as provided in the new reform for this crop.

- Despite the penalization applied to coup

- led payments for exceeding the 48,000-ha ceiling, the high price for cotton assumed in the simulated scenario would lead to a farming area for this crop 15% above that limit.

- Under the price conditions simulated, dairy farms would not exhaust the 2% rise in the quota, for the assumed increase in milk prices over the base year would be partially offset by the decline of nearly 20% envisaged in the selling price of weaned animals.

- The recovery of the 10% mandatory set-aside for farming and the substantial rise in cereal prices would raise the amount of farming area devoted to these crops, which would occupy a sizeable portion of the recovered area. The magnitude of the rise shown in the model may

possibly be greater than the increase that would be obtained if farms not represented in the Spanish FADN were included.

- The change from the present partial to full decoupling would not prompt any substantial variations in farming area for the chief crops or in the results for farms taken as a whole. Sheep and rearing cattle would be affected, however, with substantial declines (in addition to the downturn recorded under the partial decoupling scheme). Nonetheless, not all regions would be affected to the same extent. Before any possible full decoupling scheme is adopted, a detailed study should be conducted of its effects on sheep and rearing cattle sub-sectors in the various autonomous communities.

References

Adenáuer M., Britz W., Gocht A., Gömann H., Cristoiu A., Ratinger T. (2006): Modelling impacts of decoupled premiums: building-up a farm type layer within the EU-wide regionalised CAPRI model. Selected paper presented at the 93rd EAAE Seminar. Prague, 22-23 September 2006.

Arfini F., Paris Q., (1995) : A positive mathematical programming model for regional analysis of agricultural policies. In: Sotte, E. (Hg.): The Regional Dimension in Agricultural Economics and Policies, EAAE, Proceedings of the 40 th Seminar, 26-28 June 1995, Ancona, S., 17-35.

Arriaza M., Gómez-Limón J.A. (2003): Comparative performance of selected mathematical programming models.In Agricultural Systems. 77, 155-171.

Barkaoui A., Butault J.P. (1999): Positive Mathematical Programming and Cereals and Oilseeds Supply within EU under Agenda 2000. Paper presented at the 9th European Congress of Agricultural Economics, Warsaw, August 1999.

Barkaoui A., Butault J.P. (2003): Révision à mi-parcours de la PAC : simulations de l´effect du découplage sur l´offre dans les régions françaises. Document de travail. INRA-ESR Nancy.

Blanco A., Iglesias E. (2005*):* Modelling New EU Agricultural Policies: Global Guidelines, Local Strategies. Selected paper presented at the 89th EAAE Seminar .3-5 February. Parma.

Buysse J., Fernagut B., Harmignie O., Henry De Frahan B. ,Lauwers L. , Polomé P., Van Huylenbroeck G., Van Meensel J. (*2004*): Modelling the impact of sugar reform on Belgian Agriculture . *S*elected paper presented at the International Conference on Policy Modelling. Paris, 30 June- 2 July, 2004.

Buysse J., Van Huylenbroeck G. (2005): Impact of alternative implementations of the Agenda 2000 Mid Term Review. Selected Paper presented at the 11 th Congress of the EAAE. Copenhagen, Denmark, August 24-27, 2005.

Buysse J., Van Huylenbroeck G., Lauwers, L. (2007): Normative, positive and econometric mathematical programming as tools for incorporation of multifunctionality in agricultural policy modelling. Agriculture, Ecosystems & Environment, 120, 70-8.

Commission of the EU: Commission Staff Working Document SEC (2008) 1885.

CAPRI (2000): Common Agricultural Policy Regional Impact (Fair3-CT96-1849). Final Consolidated Report. Institute for Agricultural Policy, University of Bonn, Department of Economics, University College Galway, Institut Agronomique Meditérranéen de Montpellier, Departamento di Economia, Sociologia y Politica Agraria, Universidad Politécnica de Valencia, Università degli Studi di Bologna, Dipartamento di Protezione e Valorizzazione Agro-Alimentare (DIPROVAL), Sezione Economía.

Gohin A., Chantreuil F. (1999) : La programmation mathématique positive dans les modèles d´exploitation agricole : principes et importance du calibrage. In Cahiers d´Économie et Sociologie Rurales. 52 , 59-78.

Heckelei T. , Britz W., (1999): Maximum entropy specification of PMP .In CAPRI. CAPRI Working Paper 08199.

Heckelei T. , Wolff H. (2003): Estimation of Constrained Optimisation Models for Agricultural Supply Analysis Based on Generalised Maximum Entropy in European Review of Agricultural Economics, 30(1), 27-50.

Heckelei T., Britz W. (2005): Models Based on Positive Mathematical Programming: State of the Art and Futher Extensions. Plenary paper presented at the 89 th EAAE Seminar, 3-5 February. Parma, 48-73.

Helming J.F.M., Peeters L., Veendendaal P.J.J. (2001): Assessing the Consequences of Environmental Policy Scenarios in Flemish Agriculture. In Heckelei, T.; Witzke, H.P. and Henrichsmeyer, W. (eds.). Agricultural Sector Modelling and Policy Information Systems, Vank Verlag, Kiel.

Henry de Frahan, B., Buysse, J., Polomé, P., Fernagut, B., Harmignie, O., Lauwers, L., Van Huylenbroeck, G., Van Meensel, J. (2007): Positive mathematical programming for agricultural and environmental policy analysis : review and practice. In : Weintraub, A., Bjorndal T., Epstein R., Romero, C. (Eds), Management of Natural Resources: A Hanbook of Operations Research Models, Algorithms and Implementations Springer, International Series in Operations Research and Management Science (Series Editor: Hillier, F.S., Stanford University)

Howitt R.E. (1995a): Positive Mathematical Programming in American Journal of Agricultural Economics. 77(2), 329-342.

Jayet P.A., Marzochi E., Hofstetter A., Donati M. (2000): Modular approach of agricultural supply modelling through linear programming. EUROTOOLS, Working Paper, Series n.26.

Júdez L., Martínez S., Fuentes-Pila J. (1998): Positive Mathematical Programming Revisited. Trabajo presentado al meeting de Madrid, 16-17 Octubre sobre EUROTOOLS (Proyecto FAIR 5-CT97-3403).

Júdez L., Chaya C., Martínez S., González A.A. (2001): Effects of the Measures Envisaged in "Agenda 2000" on Arable Crop Producers and Beef and Veal Producers: An Application of Positive Mathematical Programming to Representative Farms of a Spanish Region in Agricultural Systems. 67, 121-138.

Júdez L., de Miguel J.M., Piniés M., Legorburu I.G., Miguel J.L.(2003): Effects of Mid-Term review measures on some representative Spanish farm: an application of the PROMAPA model. Selected paper presented 80 th EAAE Seminar, Ghent, 24-26 September 2004.

Júdez L., de Andrés R., Ibáñez M., Urzainqui E. (2008):A method for including in PMP models activities non –existent in the baseline situation. Selected poster presented at the XII th Congress EAAE, Ghent, Belgium, 26-29 August .

Kuepker B., Kleinhanss W. (2006): Comparative Assessment of National and Alternative Decoupling Schemes in EU Member States. Selected paper presented at the 93 rd EAAE Seminar. Prague 22-23 September 2006.

Offermann F., Kleinhanss W., Huettel S., Kuepker B. (2005): Assessing the 2003 CAP reform impacts on German Agriculture using the farm group model FARMIS in Arfini F. (ed.) : Modelling agricultural policies : state of the art and new challenges. Proceedings of the 89 th EAAE Seminar , Parma

Osterburg B., Offermann F., Kleinhanss W. (2001): A sector consistent farm group model for German agriculture in: Heckelei, T., Witzke, H.P. and Henrichsmeyer, W. (eds.) Agricultural Sector Modelling and Policy Information Systems. Kiel, Wissenschaftsverlag, Vauk 2001.

Paris Q., Howitt R.E. (1998): An Analysis of Ill-posed Production Problems Using Maximum Entropy. American Journal of Agricultural Economics. 80(1), 124-138.

Paris Q., Montresor E., Arfini F., Mazzocchi M. (2000): An Integrated Multi-Phase Model for Evaluating Agricultural Policies Through Positive Information in: Heckelei, T.; Witzke, H.P. and Henrichsmeyer, W. (eds.) Agricultural Sector Modelling and Policy Information Systems.Proceedings of the 65 th EAAE Seminar, March 29-31, 2000 at Bonn University, Vauk Verlag Kiel:100-110.

Röhm O., Dabbert S. (1999): Modelling regional production and Income Effects in Huylenbroeck G., Witby M. (Eds.) (1999): Countryside Stewardship :Farmers, Policies and Markets. Pergamon, Amsterdam.

Röhm O., Dabbert S. (2003): Integrating Agri-Environmental Programs into Regional Production Models: An Extension of Positive Mathematical Programming in American Journal of Agricultural Economics. 85(1), 254-265.

Severini S., Cortignani, R. (2008): Introducing deficit irrigation crop techniques derived by crop growth models into a Positive Mathematical Programming model. Selected paper presented at the XII th Congress EAAE, Ghent, Belgium, 26-29 August .