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## **The CAP Reform Impact on the Italian Durum Wheat Production: an Application of the AG-MEMOD Model**

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# The CAP Reform Impact on the Italian Durum Wheat Production: an Application of the AG-MEMOD Model

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## *Abstract*

This paper presents the results emerging from the application of alternative Common Agricultural Policy (CAP) scenarios into the Italian econometric country model, developed as part of the AG-MEMOD research project. Major attention is paid on the effect of the 2003 CAP reform on the Italian durum wheat production and a key role in shaping this impact is attributed to national choices. These concern the full or partial decoupling regime for the durum wheat supplementary payment, the introduction of the “quality premium” ex article 69 of the reform and the respective selective application. The implementation of these alternative CAP scenarios within the Italian AG-MEMOD model eventually confirms how critical national choices may be in determining the final outcome of the reform itself.

**Keywords:** Commodity Market Models, Common Agricultural Policy, Durum Wheat Market

**EconLit Classification:** Q110, Q180

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### 1. Introduction: the Italian AG-MEMOD model

This paper aims to present some of the major results emerging from simulating the impact of the 2003 CAP reform (the so-called Fischler Reform or Luxembourg Agreement, LA) within the Italian AG-MEMOD model<sup>1</sup>. The Italian AG-MEMOD model is an econometric, recursive, multi-product, partial equilibrium model including the main commodities of the Italian agriculture (Esposti and Lobianco, 2004). This model is a part of the EU AG-MEMOD composite model that consists of a combination of all EU Member States' models functioning together (Chantreuil et al., 2005). The AG-MEMOD model aims to represent all the cross-commodity and cross-country effects induced by an external change and, in particular, by changes in the CAP support. Its structure allows replicating the complex direct and indirect implications of the recent CAP reform.

The paper shows how the model generates impacts when alternative policy scenarios are specified. Two basic policy scenarios are here compared: the CAP according to Agenda 2000 (also called the *baseline scenario*) and the CAP as reformed by the Luxembourg Agreement in June 2003 (also called the *alternative* or *LA scenario*). In addition, several alternative specifications of the LA scenario are adopted, especially to take into account the set of national options implied by the new regime. The effect of this reform is then displayed by comparing results emerging from these scenarios, the rest of exogenous variables remaining the same.

As a major evidence of the reform application in the Italian case, the durum wheat sector is dealt with in detail, mainly to emphasize how the reform may specifically affect the Mediterranean agriculture, and how strongly the actual implementation of the regime change in durum wheat support may affect its impact. In this respect, the durum wheat case is of major interest since several national choices may eventually make the difference. On the one hand, any producing country has to decide whether to partially or fully decouple the declining durum wheat supplementary payment. On the other hand, new kinds of coupled support, as "quality premiums", are introduced one of them, as established by article 69 of the reform, is left to the voluntary adoption within any country.

The paper is organised as follows. The second section shortly presents the general structure and some major characteristics of the Italian AG-MEMOD model. The third section analyses the relevance of the durum wheat production within the national agriculture, also emphasizing the role played so far by the specific CAP measure, i.e. the durum wheat supplementary payment. The fourth section describes the adopted CAP scenarios; for the LA scenario, alternative specifications about the durum wheat supplementary payment and "quality premiums" are introduced. The fifth section presents and comments the 2003-2010 projections generated by the model under these alternative CAP scenarios. The final section

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<sup>1</sup> More information about the EU-funded AG-MEMOD research project ("Agricultural sector in the Member State and EU: econometric modelling for projection and analysis of EU policies on agriculture, forestry and the environment") can be found at the project web-site: <http://www.tnet.teagasc.ie/agmemod>.

provides a short comparison of these AG-MEMOD model results with other evidence concerning the impact of the CAP reform on Italian crop production.

## *2. The AG-MEMOD modelling approach*

This work concerns a specific policy-based application of the Italian AG-MEMOD model. Therefore, an extensive description of the model is beyond the scope of this paper. More details on the general AG-MEMOD model structure can be found in Chantreuil et al. (2005), whereas Esposti and Lobianco (2004; 2005) provide an extensive specific description of the Italian country model, as well as all the information about model estimation. For the sake of clarity, however, and with respect only to the crop sectors, the list of estimated equations and the detailed structure of the commodity sub-models are reported in the annex.

Nonetheless, it is still useful to shortly introduce the general AG-MEMOD modelling strategy, as depicted in figure 1. The EU aggregate model is built by combining the EU country models, which are, in turn, obtained by merging single commodity sub-models. The rest of the world variables (mainly world market prices) are entered exogenously, together with macrovariables and policy measures, whereas aggregate components of the Economic Accounts for Agriculture (EAA) for any country are directly derived by the respective commodity models. Therefore, to achieve the complete EU AG-MEMOD model, the first stage is the estimation of the commodity country models in parallel across the EU countries. Commodity models across countries are based on a common template and are estimated on historical data using the same variables definition and data sources. Once estimated, all the country commodity models are translated into GAMS format and solved, that is for any commodity the “supply and use” identity is imposed by computing the closing variable. Then, all solved country models can be combined into one aggregate EU GAMS model which is in turn solved by imposing the supply and use identity in any market through the net EU export variable.

Commodity market models are recursive for the presence of lagged variables among regressors. Therefore, any country model, as well the combined EU model, can generate projections of the model endogenous variables, by feeding the estimated model with projections of the exogenous variables, imposing the markets closure for any projected year, and solving the estimated model in a recursive way; that is, the equilibrium in a period is the starting point to solve the next equilibrium. Since policy (CAP) measures belong to the vector of exogenous variables, these projections are generated over a set of alternative values of these measures, in other words over a set of alternative policy scenarios. The comparison of the projected endogenous variables across these alternative scenarios provides evidence on the impact of policy reform.

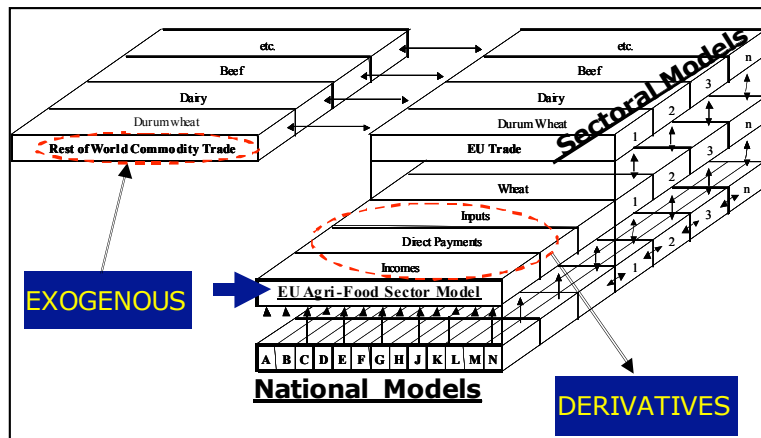
For any commodity, a country model is explicitly linked to the other countries through a price transmission relationship, where a EU key-price drives price formation in any country. The EU key-price is usually set as the price observed in the most important national market for that commodity; thus, for any commodity a key-market is identified. In the case of durum

wheat, the Italian price is selected as the key-price. Eventually, this modelling strategy aims to emphasize at the maximum possible extent the cross-country and cross-commodities effects of any external change, policy variables included, in such a way to have a more realistic and complex representation on how markets react to CAP reforms.

The Italian AG-MEMOD model describes the equilibrium formation on the following commodity markets, also modelled at the aggregate EU level; these are also named GOLD commodities:

- Grains (Cereals): soft and durum wheat, barley and maize;
- Oilseeds: rapeseed, soybeans and sunflower seed (seed, oil and meal use);
- Livestock: cattle-beef, pig, broiler, other poultry and sheep
- Dairy-milk products: cheese, butter, whole milk powder and skim milk powder

Results here presented refer to this multi-output specification, though the focus is specifically on crop production and, mainly, on durum wheat.



Source: AG-MEMOD Project

Figure 1. AG-MEMOD general strategy in modelling the EU agri-food sector

### *3. The Italian durum wheat production: some general remarks*

Italy is traditionally considered the second agricultural producer country in the EU, following France. In particular, looking at the sectoral value added, Italian agriculture accounts for more than 15% of the EU value added, more or less as Germany and a little more than Spain. Nevertheless, the Italian agri-food sector shows some quite specific character in terms of output composition. In particular, in the formation of the value of agricultural output the role of specific Mediterranean crops (mainly, durum wheat, wine grapes, olives, citrus, other fruits, etc.) is high. This specificity of the Italian agri-food sector may be appreciated by looking at the Italian share within EU for the different agricultural commodities. Italy accounts for just 12% of the value of animal productions within the EU, and for 18% for the value of crops. However, within these general categories, we can observe great variations. Italy covers about 55% of durum wheat production, 25% of all fruits and, among these, more than 30% of both wine grapes and olives.

The output composition of the Italian agriculture has major relevance in policy analysis, also because it affects the full amount of payments received by the industry from the CAP measures. Table 1 reports the distribution of the EU CAP expenditure by recipient country in the last three years (2001-2003) before the reform. It emerges that Italy receives less payments than what could be expected on the base of its share on the EU agricultural value added. In fact, Germany and Spain receive more money than Italy, though their sectoral value added is lower or equal to the Italian one. Moreover, the gap between France and Italy (payments in France are almost double in 2003) is much larger than the difference in terms of output value. This distortion is mainly caused by the specific composition of output, since in Italy a relevant part of the agricultural output is generated by non-supported, or less supported, products. In general terms, this reinforces the idea that the overall impact of the CAP reform in the Italian case might take different directions and intensity, compared to other EU countries, also because it is strongly concentrated and biased towards some crops, of which durum wheat is one of the most relevant cases.

Table 2 shows that in the last decade, since the 1992 McSharry Reform, the soft wheat cultivated area has dramatically decreased by about 42%, while it remained almost constant for fruits and vegetables. On the contrary, it increased for durum wheat (about +10%), which is by large the main cereal crop in Italy, also because its support remained higher than other crops due to the supplementary per ha payments. Actually, durum wheat is the commodity on which the higher shock is expected upon the introduction of the LA CAP Reform, as its cultivated area remained artificially high with respect to the declining tendency observed in other cereals.

Figures 2 and 3 display in detail the production, consumption and net export patterns since 1980 of soft and durum wheat. These figures suggest how the CAP, together with many other external changes, strongly affected land allocation and production decisions in the last two decades. The quite rapid and intense reduction of soft wheat cultivated area determined a strong decline in production (-40%) while consumption remained almost constant over time. It also implied a negative effect on the soft wheat trade balance; it was already significantly

negative in early eighties and became three times larger in late nineties. On the contrary, in durum wheat production a relevant increase was observed until mid-nineties with a consequent increase of the positive trade balance, which was after that counterbalanced by a reduction in production growth rate and a more intense consumption growth.

In this general context, the focus on the durum wheat case is easily explained. Firstly, it is the major, if not the only, Mediterranean character within the EU-15 AG-MEMOD model. Secondly, durum wheat is a key-crop in Italy and one of the most specific production in the Mediterranean regions. Not only Italy accounts for more than 50% of durum wheat cultivated area in the EU-15; durum wheat also covers almost 50% of cereal cultivated area in Italy, and it is highly concentrated (about 75% of area) in the Southern regions. Thirdly, durum wheat has been largely supported by the CAP until the 2003. Thus, the full decoupling of the durum wheat supplementary payment (still 313€/ha in 2004) raised several objections about the future of this production, particularly in Southern Italy (AgriSole, 2004), as respective yields and prices often make it not competitive with other crops (for instance, soft wheat). This made the perspectives of the durum wheat sector the most relevant and debated issue upon the application of the new CAP regime in Italy (AgriSole, 2004)

**Table 1.** EU-policies agricultural spending by country recipient, 2001-2003

COUNTRY	2001		2002		2003	
	millions €	%	millions €	%	millions €	%
France	9230	22.2%	9782	22.5%	10464	23.6%
Germany	5862	14.1%	6813	15.7%	5877	13.2%
Italy	5344	12.9%	5695	13.1%	5393	12.2%
Spain	6185	14.9%	5960	13.7%	6485	14.6%
Other EU countries	14912	35.9%	15270	35.0%	16159	36.4%
EU-15	41533	100%	43520	100%	44378	100%

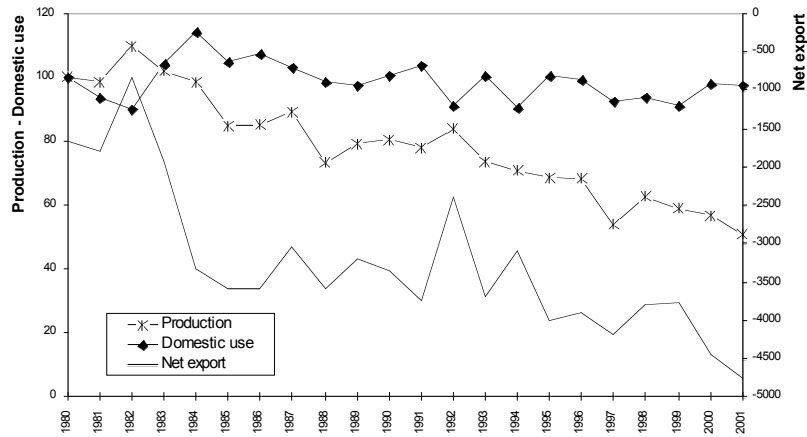
Source: European Commission; Data includes rural development payments from EAGGF, Guarantee Section

**Table 2.** Cultivated area of main crops in Italian agriculture, 1992-2003 (thousands of Ha)

	1992	1995	1998	2001	2003	2004
Cereals (incl. rice)	4225	4225	4068	4113	4127	4282
<i>Soft Wheat</i>	988	859	698	625	577	581
<i>Durum Wheat</i>	1530	1623	1629	1664	1689	1772
Vegetables	501	408	364	459	457	NA
Fruits						
(incl. olives+wine)	2871	2738	2697	2720	2661	NA

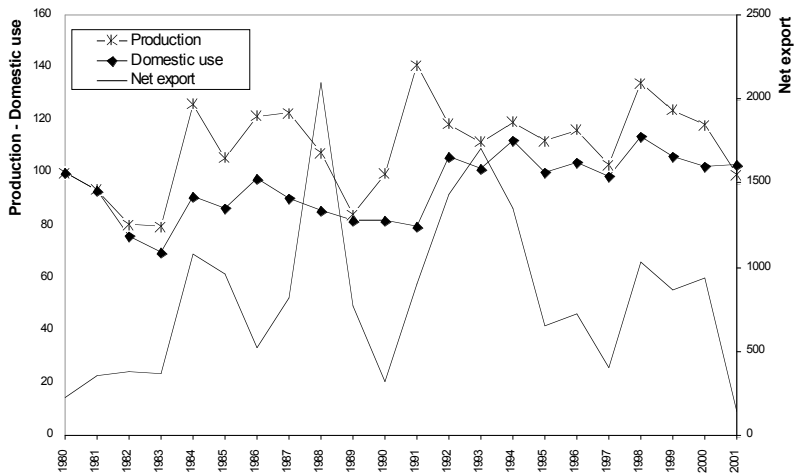
Source: ISTATND





Source: EUROSTAT and PSD database

Figure 2. Soft wheat in Italy: production and consumption (domestic use) index (1980 = 100) and net export (in thousands of tonnes), 1980-2001



Source: EUROSTAT and PSD database

Figure 3. Durum wheat in Italy: production and consumption (domestic use) index (1980 = 100) and net export (in thousands of tonnes), 1980-2001

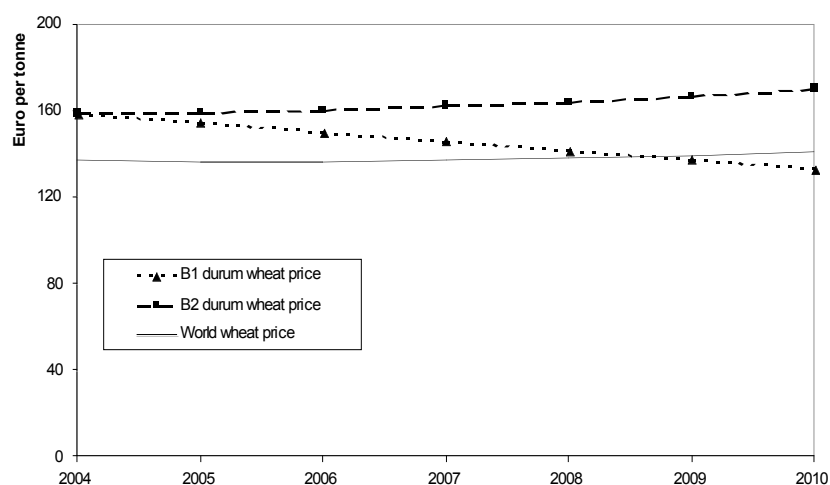
#### *4. CAP scenarios and the case of durum wheat*

##### *4.1. Baseline scenario*

This section describes the exogenous variables' projections under the baseline scenario. A relevant part of these projections are indeed common to the baseline and the alternative (LA) scenarios. In fact, the projections of the underlying macroeconomic variables and of the world market prices are the same across the two scenarios. Moreover, both scenarios do not make assumptions about the outcome of the WTO Doha Development Round, thus the existing Uruguay Round Agreement on Agriculture (URAA) is assumed to prevail in both cases for the whole projection period. Nor do they incorporate the accession of new members on the 1st of May 2004. Therefore, the only difference between the scenarios concerns the projections of CAP measures. The baseline scenario incorporates the Agenda 2000 reform of the CAP and assumes a no-change regime until 2010; these assumptions about the CAP as agreed under 'Agenda 2000' are outlined in Binfield et al. (2003a, 2003b and 2003c).

As mentioned, world market prices are exogenous in the AG-MEMOD model for all commodities; their projections come from FAPRI 2003 World Situation and Outlook 2003 (FAPRI, 2003), which includes a review of the background to these projections. In contrast, projections of prices on the EU key-markets under both baseline and LA scenarios are endogenously generated by solving the EU combined model.

In this respect, a critical aspect in generating the simulation results under the AG-MEMOD framework is related to the role of these commodity key-prices, since they are the driving-forces behind this multi-commodity and multi-country equilibrium modelling. Here, we try two alternative specifications of the only Italian key-price (that is, durum wheat price), to be interpreted as "limit cases" of all possible intermediate specifications of price formation (see the Annex for details on the equation alternative specifications). In both cases, price is driven by the world market price, assumed fully exogenous. However, in one case (Vers. 1 or Baseline 1/B1), the EU net export of durum wheat does not affect price formation which is also affected by a slightly negative time trend. In the other case (Vers. 2 or Baseline 2/B2), the negative time trend is excluded while the lagged EU net export (approximating the EU self-sufficiency rate) is included among regressors of the durum wheat price formation equation, thus shifting price upwards. Figure 4 displays the projections of the world market price together with the two mentioned durum wheat price baselines showing a significant different pattern over the projection period.



Source: Our elaboration on Italian AG-MEMOD model

**Figure 4.** Wheat price projections: alternative baseline durum wheat price projections (B1 vs. B2) and wheat world market price

#### 4.2. *Alternative scenarios: national choices on durum wheat measures*

The policy reform introduced under the alternative scenarios are those CAP measures contained in the Final Presidency Compromise Document of the Council of the European Union, on 26 June 2003, also called Luxembourg Agreement (thus, LA) (Council of the European Union, 2003). Under the Luxembourg Agreement and the negotiations that followed, a very wide range of possible implementation scenarios can be envisaged. What is examined here, however, is the maximum decoupling scenario allowed under the Luxembourg Agreement, i.e. all direct payments (with the exclusion of the supplementary payment for durum wheat) under Agenda 2000 are fully decoupled at the earliest possible date. Member State choices vis-à-vis the implementation of the Luxembourg Agreement may actually deviate significantly from this maximum decoupling scenario. In fact, an analysis of the impact of the Luxembourg Agreement according to the actual implementation choices made by any Member

State is possible with the AG-MEMOD model, at least whenever such choices are formally defined. This possibility is exploited here for the durum wheat production in Italy<sup>2</sup>.

The LA essentially modifies the CAP as it applies to cereals, oilseeds, livestock and dairy sub-sectors. From January 2005, cereals and oilseeds arable aid payments are decoupled from production. It follows that for any commodity the impact of the LA will be observed starting from year 2005, and the model results will be here displayed accordingly. Due to their intrinsic complexity, in the present analysis no attempt is made to incorporate cross-compliance, modulation or other specific elements of the Luxembourg Agreement. Moreover, since the focus is on crop production, and durum wheat in particular, the adopted LA policy scenarios will not differ in terms of those relevant changes occurred in the livestock (mainly beef) and dairy sectors.

To enter the LA in the country commodity models, the Single Farm Payment (SFP) is applied in all countries from 2005 with the maximum amount of decoupling agreed at the Luxembourg Council. Unlike previous policy instruments, the Single Farm Payment is not driven by levels of various farming activities, though the land should be maintained in 'good agricultural condition'. Thus, the LA affects the commodity models by changing the expected gross returns, through reduction in intervention price, when it applies, and, mainly, through reduction of direct payments or premiums. However, the analysis of the farmer response has shown that these payments are still likely to be somewhat supportive of farming activity (Dewebre et al., 2001; Westhoff and Binfield, 2003; Binfield et al., 2003b); in other words, they may still have a residual supply inducing effect. So, although decoupling is assumed to be full, we consider two different kinds of scenarios with respect to this inducing effect. In one case, we assume that farmers still associate part of the decoupled payment to the original production; as residual supply inducing effect we thus consider that 30% of the SFP actually remains associate to the original commodity, as it were a direct payment (see Westhoff and Binfield, 2003, and Binfield et al., 2003b, for more details on the theoretical motivation of this assumption). Alternatively, we maintain the hypothesis that decoupling is full and no portion of the SFP remains associated to the commodity. The comparison between a 30% and 0% residual effect shows how it plays, as wanted, a sort of incentive to maintain higher production levels.

As mentioned, it is a major interest here to perform a more detailed analysis of the durum wheat case with respect to the CAP reform implementation. This interest is due either to the mentioned central role played by this commodity in Mediterranean agricultural and to the decisions any country has to take about the reform application in this sector. In fact, the CAP reform pays specific attention and reserves specific measures to this commodity. We can distinguish three different specific measures.

Firstly, the durum wheat supplementary payment is gradually reduced by about 15% from 2004/05 to 2006/07 and, in addition, it may be fully or partially (60%) decoupled, according to the national choice. Secondly, to avoid a rapid abandonment of this production by a significant

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<sup>2</sup> A fully detailed description of the CAP revision under the LA, as well as of all possible implementation options, is reported in Binfield et al. (2003c). The official document concerning the CAP reform is COM(EU) No 1782/2003, especially concerning full decoupling and single farm payments, whose detailed rules for the implementation are described in COM(EC) No 795/2004.

part of the EU and Italian Southern regions, a coupled durum wheat “quality premium” (40€/ha) for traditional production areas is introduced (article 72-74 of COM(EU) No 1782/2003). This measure actually does not leave space to any specific national implementation, though the definition of the eligible traditional areas is indeed carried out by any producing country. Thirdly, any country can voluntarily reserve part of its SFP budget to introduce year-by-year specific-quality premium ex article 69, thus adding a further coupled payment to the selected commodities. National choices in this respect do not only concern the adoption of article 69 but also its selective application. If we limit our attention to the crop commodities<sup>3</sup>, any country has to decide which maximum budget hold back from the SFPs towards the article 69 premiums; moreover, this budget must be then attributed selectively to some eligible activities.

In 2004, Italy decided to adopt full decoupling for the durum wheat supplementary payment and to apply the article 69 measures by reserving 8% of the crops budget ceiling; that is, the total budget available for article 69 amounts to 142 millions of Euros. As attention is on the role this measure can have on durum wheat production, here we assume two extreme cases regarding the use of this budget. On the one hand, we assume that only durum wheat is eligible for article 69 “quality premiums”. Alternatively, we consider that all cereals (rice excluded) will receive the same amount of per ha premium. By taking the 2004 values of cultivated area, we thus allocate this total amount of money firstly to the 1,77 millions of ha cultivated with durum wheat, then to the 4,05 millions of ha cultivated with cereals (rice excluded). Consequently, the article 69 premium ranges from 80€/ha only for durum wheat (still lower than the maximum admitted per ha premium of 180€) to 35€/ha for all cereals. The actual Italian choice for 2005 is in the middle between these two limit cases; in fact, some first estimates indicate a 50€/ha actual premium ex article 69 for 2005 (Agrisole, 2004).

It must be also reminded that country choices about article 69 are made on a yearly base; so, at this stage, it is not possible to know if and how Italy will adopt article 69 premiums after 2005, that is in the next projection years 2006-2010. In principle, the amount of per ha premium could be made endogenous, since it depends on the total budget and the amount of eligible land. However, due to the lack of information about the national choices after 2005, we maintain the assumption that the per ha premium for 2006-2010 will be equal to the premium assumed for 2005 under the two mentioned hypotheses.

Eventually, with specific reference to durum wheat and to the Italian application of the reform, the LA scenarios are thus distinguished in four groups. Scenario 1 assumes that the durum wheat supplementary payment is fully decoupled and that “quality premiums” ex article 69 are not selective, thus spread over the whole cereal production. As the special durum wheat premium ex article 72-74 is also admitted, under this scenario durum wheat production achieves a 40€/ha+35€/ha coupled payment, while other cereals (excluded rice) receive a 35€/ha coupled payment. This scenario is, roughly speaking, the closest to the actual Italian implementation in 2005. Scenario 2 admits the same kind of payment regime under article 69, but assumes a less radical national choice in terms of decoupling of the durum wheat supplementary payment, since the 40% coupled payment option (i.e. the maximum admitted

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<sup>3</sup> Actually, “quality premiums” ex article 69 also apply to livestock production.

by the reform, corresponding to 156,4€/ha in 2005 and 154€/ha from 2006 onward) is adopted. Scenario 3 assumes full decoupling of the supplementary payment but also considers a more selective national choice for the use of the article 69 budget; under this scenario, no “quality premium” is attributed to other cereals and all the budget is allocated to durum wheat, thus receiving a total amount of 40€/ha+80€/ha coupled payment. This same selective choice is assumed in Scenario 4 where, however, the supplementary payment is maintained coupled at the maximum allowed extent, that is 40%. Therefore, Scenario 4 admits the highest coupled support to durum wheat while, on the opposite side, Scenario 1 implies the minimum amount of coupled payment. Moving among these scenarios, we want thus to depict the different degrees of preference the country wants to maintain in favour of durum wheat production with respect to other cereals and crops. For any of these four scenarios, we also have further four sub-scenarios generated by the alternative specifications of the durum wheat price formation according to the mentioned hypotheses (Vers. 1 and 2, where Vers. 2 is more favourable for the durum wheat producers), and by assuming alternatively 30% or 0% residual supply inducing effect of the decoupled payment. In this respect, for durum wheat, scenario S4\_2\_a represents the best case (higher price and maximum coupled support), whereas scenario S1\_1\_b corresponds to the worst case (lower price and minimum coupled support). Table 3 summarizes this set of adopted scenarios.

**Table 3.** Description of the whole set of adopted CAP scenarios (DW = durum wheat)

	Decoupling of arable aid payments	Residual supply inducing effect	Decoupling of DW supp. payment	DW price	DW “quality premium” (art. 72-74) (40€/ha)	“quality premium” (art. 69): only DW (80€/ha)	“quality premium” (art. 69): all cereals (35€/ha)
<b>BASELINE</b>							
B1	NO	NO	NO	Vers. 1	NO	NO	NO
B2	NO	NO	NO	Vers. 2	NO	NO	NO
<b>LA SCENARIO 1</b>							
S1_1_a	Full	30%	100%	Vers. 1	YES	NO	YES
S1_1_b	Full	0%	100%	Vers. 1	YES	NO	YES
S1_2_a	Full	30%	100%	Vers. 2	YES	NO	YES
S1_2_b	Full	0%	100%	Vers. 2	YES	NO	YES
<b>LA SCENARIO 2</b>							
S2_1_a	Full	30%	60%	Vers. 1	YES	NO	YES
S2_1_b	Full	0%	60%	Vers. 1	YES	NO	YES
S2_2_a	Full	30%	60%	Vers. 2	YES	NO	YES
S2_2_b	Full	0%	60%	Vers. 2	YES	NO	YES

<b>LA SCENARIO 3</b>							
S3_1_a	Full	30%	100%	Vers. 1	YES	YES	NO
S3_1_b	Full	0%	100%	Vers. 1	YES	YES	NO
S3_2_a	Full	30%	100%	Vers. 2	YES	YES	NO
S3_2_b	Full	0%	100%	Vers. 2	YES	YES	NO
<b>LA SCENARIO 4</b>							
S4_1_a	Full	30%	60%	Vers. 1	YES	YES	NO
S4_1_b	Full	0%	60%	Vers. 1	YES	YES	NO
S4_2_a	Full	30%	60%	Vers. 2	YES	YES	NO
S4_2_b	Full	0%	60%	Vers. 2	YES	YES	NO

## 5. Results

A selection of the main findings about the impact of the LA scenarios is provided in this section. Since most variables are updated to 2002, projections generally refer to the 2003-2010 period, albeit policy impacts are displayed by comparing only the last year of projection, that is 2010, among scenarios. However, complete projections are reported in Esposti and Lobianco (2004) and are available upon request. Due to space limit, the model results here discussed only refer to the crop sector with major emphasis on durum wheat, also because the rest of the model (particularly, livestock and dairy models) is just partially affected by the reform, at least in Italy (Esposti and Lobianco, 2004).

### 5.1. Crop sector

Table 4 reports the main results emerging from simulating the impact of mentioned CAP scenarios on very aggregate variables concerning the crop commodities under study, that is cereals (grains) and oilseeds. Major interest is on the supply side, that is on land allocation and yields and, consequently, on overall production. This latter effect may eventually generate significant changes in the sectoral trade balance, that is net export.

However, before analysing the main effects on the supply side, it is also interesting to assess how prices behave, since only they transmit the impacts of the reform on the demand side. As mentioned, prices in the AG-MEMOD model are driven by the EU key-prices, which are in turn somehow linked to world market prices. So, the interest is on understanding the behaviour of the only Italian key-price, that is durum wheat price. In this respect, a clear evidence emerges by comparing the two alternative specifications of the baseline scenario (B1 vs. B2); they differ only by how price formation is modelled, the CAP measures being fixed at the Agenda 2000 regime in both cases. B2 derives the durum wheat price not only from the

exogenous world market value but also from a proxy of the EU self-sufficiency rate. Since both baseline projections indicate for durum wheat an higher growth of EU demand than of supply, the durum wheat price in B2 is significantly higher than in B1 (see figure 4). Due to higher price, B2 shows a significantly higher cereal harvested area (+20%) and production (+15%) with respect to B1, and this also strongly reflects on net export, which is higher in B2 by about 42%. The impact of this different durum wheat price between B2 and B1 is, on the contrary, null on oilseeds production. These effects of price are fully confirmed in sign, as expected, in any comparison between analogous alternative scenarios where price formation is the only difference (that is comparison between S\*\_1\_\* and S\*\_2\_\* scenarios). However, in magnitude we observe quite small differences in the CAP Reform impact between the baselines, with a lower reduction of cultivated area and production by about 3-4% when the higher durum wheat price is assumed. In other words, although price formation specification strongly matters in how the baseline behaves, the CAP impact is quite similar across the baselines.

Beyond these price effects, the variation observed either between the alternative scenarios and the respective baselines and among alternative scenarios, can be fully attributed to the CAP reform and its implementation. As expected, the reform causes a significant reduction of cereal harvested area ranging between 13% and 26% (so, in any case, higher than 10%), with a corresponding decline of production (between 10% and 22%) and, more intensely, of net export (between 28% and 76%). On the contrary, the impact on oilseeds is remarkably much smaller: the reduction in harvested area does not vary much across scenarios and amounts to about 0,5%, as well as the corresponding reduction in production, while the net export decline is limited to 2%-3%.

It is interesting to compare the S\*\_\*\_a with the S\*\_\*\_b counterparts, given that the differences between them depend on whether a supply residual inducing effect of full decoupling is assumed. The observed differences go in the expected direction: a null residual effect implies a greater reduction in harvested area (thus, also in production and net export) in both cereals and oilseeds. However, again, the difference is much larger for cereals, since it amounts to about 4-5% in both harvested area and production with respect to the baseline, while it is just 0,20% and 0,15%, respectively, in oilseeds.

Further differences among alternative scenarios are, as mentioned, only due to the different implementation of the reform with respect to the specific durum wheat measures (S1\_\*\_\* with respect to S2\_\*\_\*, S3\_\*\_\* and S4\_\*\_\* counterparts). In aggregate terms, these differences are actually null in the case of oilseeds, while become particularly important for cereals, thus confirming how much durum wheat matters in the Italian cereal sector. Comparing the full coupling (S2\_\*\_\* and S4\_\*\_\*) with the partial decoupling (S1\_\*\_\* and S3\_\*\_\*) options about the durum wheat supplementary payment, the difference (with respect to the baseline) in terms of cereal harvested area and production ranges between 3% and 5%. This confirms that the implementation of the durum wheat specific measures may actually be, in the Italian case, one of the most crucial issue in the application of the reform, as the negative effect of full decoupling on this crop is only partially counterbalanced by better performances of the other cereals.



**Table 4.** The impact of the CAP reform in Italy: 2010 % variation with respect to the corresponding baseline scenario (B1 or B2) in the crops sectors

	Harvested cereals	areaHarvested oilseeds	areaProduction cereals	Production oilseeds	Net export cereals	Net export oilseeds
BASELINE						
B2 wrt B1	20.26	0.00	15.27	0.00	41.56	0.00
LA SCENARIO 1						
S1_1_a	-21.12	-0.37	-17.88	-0.31	-37.61	-1.87
S1_1_b	-25.90	-0.58	-22.14	-0.47	-46.57	-2.88
S1_2_a	-17.56	-0.37	-13.68	-0.31	-61.22	-1.87
S1_2_b	-21.54	-0.58	-16.98	-0.47	-75.92	-2.88
LA SCENARIO 2						
S2_1_a	-16.54	-0.37	-13.78	-0.31	-29.48	-1.87
S2_1_b	-21.33	-0.58	-17.94	-0.47	-38.36	-2.88
S2_2_a	-13.76	-0.37	-10.53	-0.31	-48.04	-1.87
S2_2_b	-17.73	-0.58	-13.74	-0.47	-62.60	-2.88
LA SCENARIO 3						
S3_1_a	-20.16	-0.47	-16.95	-0.38	-36.08	-2.35
S3_1_b	-24.94	-0.67	-21.19	-0.55	-45.02	-3.36
S3_2_a	-16.77	-0.47	-12.98	-0.38	-58.82	-2.35
S3_2_b	-20.74	-0.67	-16.25	-0.55	-73.47	-3.36
LA SCENARIO 4						
S4_1_a	-15.59	-0.47	-12.88	-0.38	-27.98	-2.35
S4_1_b	-20.37	-0.67	-17.01	-0.55	-36.83	-3.36
S4_2_a	-12.96	-0.47	-9.85	-0.38	-45.68	-2.35
S4_2_b	-16.94	-0.67	-13.04	-0.55	-60.19	-3.36

Source: Our elaboration on Italian AG-MEMOD model

### 5.2. Evidence on durum wheat

Table 5 reports in detail the impact of the reform on the durum wheat sector. It firstly makes explicit how strongly the different specification of the price formation between the baselines (B1 and B2) affects the results, as price is much higher when the EU self-sufficiency is

included and trend is excluded in price formation mechanism. This generates several expected effects. On the one hand, demand decreases significantly (by 16%) passing from B1 to B2, while production increases, though this effect is much less relevant. In fact, higher price induces more harvested area (24%), which, however, implies a reduction of yields (by 12%), thus partially offsetting the former effect. The combination of lower demand and higher supply eventually generates a reduction in import (3%) and a significant increase of export (32%), thus a strong increase in durum wheat net export.

Again, however, our major interest is on the effect of the CAP reform on durum wheat production in Italy, regardless the significantly different possible behaviour of the respective price. First of all, since all the alternative scenarios are compared in table 5 (as in table 4) with the respective baseline (that is, under the same specification of the price formation), and since the durum wheat price (as any key-price) is only driven by exogenous variables, for no scenario there is any variation in demand with respect to the baseline and all the effects of the CAP reform are observed exclusively on the supply side.

Secondly, on the supply side, the effect of the reform is normally a little larger for durum wheat with respect to the other cereals. Harvested area reduction ranges between 13% and 27%; this strong effect is only partially compensated by yields increase, ranging between 10% and 17%, thus letting the production decline at a still significant level. Since demand is not affected by decoupling, this reduction on the supply side can be fully observed in trade balance: a slight increase in import (less than 2%) but, above all, a significant decline in export (between 4% and 23%), whose large variations are mainly determined, as expected, by the different specifications of the price formation equation.

These wide variations of the CAP reform impact on the durum wheat production can be attributed to the specific measures concerning this crop. Actually, disentangling these different contributions is one of the major purposes of this study. These effects may be reciprocally compensating or reinforcing, and can be detected by comparing scenarios and sub-scenarios pairwise, in terms of variations with respect to the baseline. First of all, one important aspect is to understand the role of the degree of decoupling with respect to the durum wheat supplementary payment. By comparing scenarios S1\_\*\* with S2\_\*\*, as well as S3\_\*\* with S4\_\*\*, it clearly emerges that partial decoupling implies a lower reduction of harvested area by about 5%. Similarly, if we admit a 30% residual supply inducing effect, we obtain a decreasing impact by about 4-5%, as evident from the comparison between S\*\_a and S\*\_b scenarios. Overall, by comparing the S1\*\_b and S2\*\_a (as well as the S3\*\_b and S4\*\_a) scenarios, it comes out that the actual degree of decoupling, as expressed by both full vs. partial decoupling and by the presence of a residual inducing effect, may change the impact on durum wheat cultivated area by about 8-10%.

Secondly, the other major force driving the overall impact is the national application of the specific “quality premiums”, in particular according to article 69, given that all scenarios include the same premium under article 72-74. In this respect, the comparison of the S1\_\*\* and S2\_\*\* scenarios with the S3\_\*\* and S4\_\*\* cases is informative about the role of these coupled specific payments. The former scenarios allocate the article 69 payments to all cereals, while the latter cases concentrate them only on durum wheat. Consequently, in the first group of scenarios we expect a greater (more negative) impact on durum wheat, while the overall

effect on cereals should be quite limited, given that the differences among the scenarios just involve a different allocation of the same amount of coupled support within these crops.

**Table 5.** The impact of the CAP reform in Italy: 2010 % variation with respect to the corresponding baseline scenario (B1 or B2) in durum wheat (DW)

	DW Harvested area	DW Yield	DW Price	DW demand	DW Import	DW export
<b>BASELINE</b>						
B2 wrt B1	23.60	-12.16	81.05	-15.84	-3.09	32.07
<b>LA SCENARIO 1</b>						
S1_1_a	-23.05	13.33	0.00	0.00	1.75	-18.19
S1_1_b	-27.78	16.53	0.00	0.00	2.17	-22.54
S1_2_a	-18.64	15.18	0.00	0.00	0.97	-7.36
S1_2_b	-22.47	18.81	0.00	0.00	1.21	-9.22
<b>LA SCENARIO 2</b>						
S2_1_a	-17.72	10.57	0.00	0.00	1.24	-12.83
S2_1_b	-22.45	13.76	0.00	0.00	1.61	-16.75
S2_2_a	-14.33	12.03	0.00	0.00	0.62	-4.71
S2_2_b	-18.16	15.67	0.00	0.00	0.82	-6.25
<b>LA SCENARIO 3</b>						
S3_1_a	-21.54	12.90	0.00	0.00	1.56	-16.24
S3_1_b	-26.27	16.09	0.00	0.00	1.97	-20.49
S3_2_a	-17.42	14.68	0.00	0.00	0.81	-6.20
S3_2_b	-21.25	18.32	0.00	0.00	1.05	-7.98
<b>LA SCENARIO 4</b>						
S4_1_a	-16.21	10.13	0.00	0.00	1.06	-10.98
S4_1_b	-20.94	13.33	0.00	0.00	1.43	-14.80
S4_2_a	-13.11	11.54	0.00	0.00	0.47	-3.61
S4_2_b	-16.94	15.18	0.00	0.00	0.67	-5.07

Source: Our elaboration on Italian AG-MEMOD model

Tables 4 and 5 actually confirm that the impact of the two alternative applications of article 69 is, as obvious, larger for durum wheat than for the whole cereals group. A more selective

application only in favour of durum wheat reduces the impact of about 1,5-2% with respect to the baseline in either harvested area and export. However, it is also confirmed how strongly durum wheat is relevant in conditioning the overall performance of the cereal sector. The distribution of the article 69 payment to all cereals actually generates a reduction of about 1% of harvested area and production, and 1,5% of export, with respect to the application restricted to durum wheat. In any case, the impact of these alternative applications of the article 69 payments seems to be relatively less important than the degree of decoupling of the durum wheat supplementary payment.

Nonetheless, the set of national choices regarding durum wheat specific measures (decoupling of supplementary payment and introduction of “quality premiums”) confirms how much any country may attenuate the impact that the CAP reform generates on its own durum wheat supply. The comparison of the two extreme cases in this respect (S1\_1\_b and S4\_2\_a) indicates a difference of 15% in harvested area and 19% in export, with respect to the baseline. In other words, in terms of area reduction the national choices may attenuate the CAP reform impact by more than an half.

### *6. Some final remarks: a comparison with other projections*

It can be useful to compare our most important results with the evidence emerging from other studies and approaches about the impact of the CAP reform on Italian agriculture. In October 2004 the AIS (Italian Association of Seed Producers) estimated a reduction of the durum wheat production ranging between 20% and 30% (AgriSole, 2004), which is not far from results here presented. Moreover, using a Positive Mathematic Programming (PMP) approach, Arfini (2004) has recently calculated the possible impact of the reform on Italian land allocation. His results are not so different to what obtained in our AG-MEMOD projections. According to different decoupling devices (partial vs. full decoupling), he obtains a reduction of cereals cultivated area ranging between 9% and 13%. Also for oilseeds the results are not particularly different. Though his results suggest a +1% increase in oilseeds harvested area, both approaches essentially signal that the CAP reform is not expected to affect oilseeds land allocation very much.

It must be also noticed that these projections about Italian cereal and durum wheat production, after the reform, can be now also compared to the current data concerning the first campaign under the new CAP regime, that is 2004/2005. Though data are still provisional and only refer to cultivated area, not yet to production and trade, it may be interesting to see if they confirm the direction and magnitude of change suggested by the present model. First data provided by ISTAT would indicate a decline of durum wheat cultivated area of about 20%, which is just in middle of the extreme values indicated by the AG-MEMOD projections. However, one major difference concern soft wheat for which the first evidence suggest a significant increase of cultivated area (+8%), at odds with the AG-MEMOD results, and this eventually explains a decline of the cereal area lower than the minimum expected decline according to our projections.

Finally, one missing key-issue remains also in the country-specific AG-MEMOD projections and concerns the different impact of the reform across Italian regions. This is of particular relevance since durum wheat is actually limited to the Southern and Central part of the country. Using a specific EU regional modelling approach (CAPRI), Britz (2004) emphasized that the reduction of durum wheat cultivated area for some Southern Italian region may be larger than 30%. Other regional studies confirm how the geographical bias of the CAP reform may be critical in Italy (IReR, 2004), although according to other projections (ESPON, 2004) this should not generate significant effects on agricultural income at the Italian regional level.

In any case, results here obtained do confirm that, in Italy, the CAP reform impact on cereals and durum wheat is expected to be strong, and this makes particularly crucial the way the specific measures for durum wheat are implemented. The strong specialisation on durum wheat of several Italian regions may thus justify all the concerns emerged about the biased territorial effects of the reform. This latter critical aspect, however, can not fully tackled within the approach presented in this paper, and should deserve further attention in future research.

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*Annex**Structure of the Italian AG-MEMOD model (cereals and oilseeds)*

Table A.1. List of behavioural equations of crop sub-models

Equations	Total Grains Total oilseeds	Soft wheat Durum wheat Barley Maize	Rapeseed Sunflower seed Soybean	Rape oil Sun oil Soy oil	Rape meal Sun meal Soy meal
Area harvested	X	X (only durum wheat)			
Share on total area		X (soft+durum wheat)	X		
Yield		X	X		
Production				X	X
Food per capita demand		X			
Food per capita demand (share)				X	
Feed demand		X			X
Crush demand			X		
Stocks		X	X	X	X
Imports		X (only durum wheat)			
Exports		X (excl. durum wheat)	X	X	X
Price formation		X	X		

The general (implicit) form of these equations is described as follows:

*Supply side*

We assume that land allocation is a three-steps decision process. Producers first determine the total land allocated to cereals or grains (g) and to oilseeds (o). Secondly, this total area is allocated to any of the n,m crops belonging to the two groups respectively, where wheat is a single aggregate. Thirdly, total wheat area is allocated between soft and durum wheat.

In the first decision step, the total harvested area at year t for grains (ah<sub>g,t</sub>) and oilseeds (ah<sub>o,t</sub>) is determined as follows:

$$ah_{g,t} = f(er_{g,t}, er_{o,t}, ah_{o,t}, v_t) \quad (1a)$$

$$ah_{o,t} = f(er_{g,t}, er_{o,t}, ah_{g,t}, v_t) \quad (1b)$$

where  $er_{g,t}$  and  $er_{o,t}$  are the expected *per ha* returns for cereals and oilseeds, respectively, and  $v_t$  is a vector of exogenous variables which can have an impact on the harvested area (namely, the set aside rate and a linear trend). The expected returns for the two commodity groups are calculated as weighted sum of the expected returns  $er_{i,t}$  of any of the i-th crop belonging to the group plus the *per ha* compensation or payment ( $C_{g,t}$  or  $C_{o,t}$ ):

$$er_{g,t} \equiv \sum_i \alpha_i \cdot er_{i,t} + C_{g,t}, \quad \text{where } \sum_i \alpha_i = 1, \quad \forall i = 1, \dots, n \quad (2a)$$

$$er_{o,t} \equiv \sum_i \alpha_i \cdot er_{i,t} + C_{o,t}, \quad \text{where } \sum_i \alpha_i = 1, \quad \forall i = 1, \dots, m \quad (2b)$$

where  $\alpha_i$  is the lagged share on total group area. The expected return  $er_{i,t}$  is the three-years weighted sum of the trend return (that is, the product of the trend yield  $ty_{i,t}$  by the market price  $p_{i,t}$  where the trend yield is estimated by regressing the observed yield on a deterministic trend):

$$er_{i,t} \equiv \sum_{L=2}^0 \beta_{t-L} \cdot ty_{i,t-L} \cdot p_{i,t-L}, \quad \text{where } \sum_L \beta_{t-L} = 1 \quad (3)$$

where  $\beta_{t-L}$  is 0.5, 0.3 and 0.2 for  $L = 0, 1$  and  $2$  respectively.

The second decision step involves the allocation of land among the  $n, m$  crops of the grains-oilseeds group, respectively. This allocation is modelled as share equation as follows:

$$sh_{i,t} = f(er_{g,t}/er_{i,t}, v_t) \quad \text{or} \quad f(er_{o,t}/er_{i,t}, v_t) \quad (4)$$

where  $sh_{i,t}$  is the  $i$ -th crop share on total group area, and  $v_t$  again includes the set aside rate and a linear trend. It follows that land allocated to any  $i$ -th crop is derived as an identity:

$$ah_{i,t} \equiv sh_{i,t} \cdot ah_{g,t} \quad \text{or} \quad ah_{i,t} \equiv sh_{i,t} \cdot ah_{o,t} \quad (5)$$

In equations (4) and (5) wheat is considered as a single aggregate. Therefore, a durum wheat (DW) area equation is estimated:

$$ah_{DW,t} = f(er_{DW,t}, er_{g,t}, er_{o,t}, v_t) \quad (6a)$$

to allow for the calculation of the consequent soft wheat (SF) area as:

$$ah_{SW,t} \equiv ah_{wheat,t} - ah_{DW,t} \quad (6b)$$

The supply side of the model is completed by the yield equation, which is written, for any  $i$ -th cereals crop, as follows:

$$y_{i,t} = f(ty_{i,t}, ah_{i,t}, p_{i,t-1}, (ah_{g,t} + ah_{o,t})) \quad (7)$$

whereas for any oilseeds crop is:

$$y_{i,t} = f(ty_{i,t}, ah_{i,t}) \quad (8)$$



Therefore, the *per hectare* yield  $y_{it}$  depends on the calculated trend yield, the harvested area and, for cereals, on lagged own price and on the total area allocated to grains and oilseeds. Total production ( $qp$ ) for any  $i$ -th crop can be derived by multiplying estimated yield and area.

#### *Demand side*

On the demand side, *per capita* food (non-feed), crush and feed demand is modelled using the following general functional forms:

- Food (non-feed) use (cereals)

$$qd_{nfeed,i,t} = f(p_{i,t}, v_t) \quad (9)$$

where  $qd_{nfeed,i,t}$  and  $p_{i,t}$  are the *per capita* food demand and price for  $i$ -th commodity, respectively, and  $v_t$  is a vector of other variables (*per capita* GDP, lagged feed demand, other prices)

- Feed demand (grains and oilseeds meals)

$$qd_{feed,i,t} = f(p_{i,t}, p_{m,t}, \gamma_{i,t}) \quad (10)$$

where  $qd_{feed,i,t}$  is the *per capita* feed demand for  $i$ -th commodity,  $p_{i,t}$  and  $p_{m,t}$  are the own and other feed prices, and  $\gamma_{i,t}$  is a feed demand index.

- Crush demand (oilseeds)

$$cr_{i,t} = f(cm_{i,t}, cr_{i,t-1}) \quad (11)$$

The *per capita* crush demand of  $i$ -th oilseed depends on a crushing margin  $cm_{i,t}$  relating the own (oils and meals) price with the price of the original seeds.

- Oils demand (seeds oils)

$$qd_{tot,i,t} = f(p_{i,t}, p_{m,t}, gdp_t) \quad (12)$$

Seeds oil demand is calculated as *share* of the total *per capita* oils-fats expenditure in a demand system that includes the three vegetable oils and butter;  $gdp_t$  indicates the *per capita* GDP,  $p_{i,t}$  and  $p_{m,t}$  are the own and other oil prices. Multiplying the estimated share by the expenditure we obtains the respective oil demand.

Finally, total demand (food+feed) can be derived for any commodity multiplying by population and summing the above components.

*Trade, stocks and price formation*

In any commodity model, for modelling imports, exports and stock level equations we use the following general functional forms:

$$im_{i,t} = f(qp_{i,t}, qd_{tot,i,t}, st_{i,t}, st_{i,t-1}, v_t) \quad (13)$$

$$ex_{i,t} = f(qp_{i,t}, qd_{tot,i,t}, im_{i,t}, st_{i,t}, st_{i,t-1}, p_{i,t}) \quad (14)$$

$$st_{i,t} = f(qp_{i,t}, st_{i,t-1}, p_{i,t}, pol_{i,t}) \quad (15)$$

where  $im_{i,t}$ ,  $ex_{i,t}$  and  $st_{i,t}$  are imports, exports and ending stocks respectively for the  $i$ -th commodity, while  $p_{i,t}$ ,  $qp_{i,t}$  and  $qd_{tot,i,t}$  are price, production and the total demand, respectively;  $Pol_{i,t}$  is a vector of possibly relevant policy variables (mainly, intervention prices), while  $v_t$  may include other variables as time trend, dummy and production losses. It must be also reminded that for any commodity, one the three equations above is not estimated but calculated from the domestic supply and demand identity, thus playing as the model closing (market clearing) variable.

When the Italian market is not the EU key-market, the  $i$ -th commodity price  $p_{i,t}$  in Italy is estimated through the price linkage equation:

$$p_{i,t} = f(p_{key,i,t}, v_{i,t}) \quad (16)$$

where  $p_{key,i,t}$  is the EU key-price and  $v_{i,t}$  is a vector of variables which could have an impact on the Italian price (mainly, the Italian self sufficiency rate and the key-market self sufficiency rate). For oilseeds the world price is directly used in the price formation equation since no EU key-price exists for these products.

For durum wheat, the Italian price is considered the key-price. In this case, the equation describing the price formation is written as:

$$p_{DW,t} \equiv p_{key,DW,t} = f(p_{world,DW,t}, v_{DW,t}) \quad (17)$$

where  $p_{world,DW,t}$  is the durum wheat world price, and  $v_{DW,t}$  is a vector of variables which could affect the durum wheat Italian price. In particular, as further explanatory variables we admit the durum wheat price at time  $(t-1)$ , the EU durum wheat net export at time  $(t-1)$ , as a proxy of the EU self-sufficiency rate, and a time trend. In fact, as mentioned, two different alternative specifications of equation (17) are used in running the model: with the lagged price and time trend and without the EU durum wheat net export as regressors (Vers. 1), or without the lagged price and time trend and with the EU net export (Vers. 2).