Paper prepared for the 15th Annual Conference on Global Economic Analysis, *"New Challenges for Global Trade and Sustainable Development"*, Centre International de Conférences, Genève, June 2012

Decoupling Agricultural Policies in CGE Models: Theory and Empirics

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Abstract:

The Common Agricultural Policy (CAP) is moving away from8 coupled payments towards an increasing emphasis on decoupled payments. However current CGE models to study effects of decoupled payments remain limited. This paper introduces the application of a CGE model framework for a comparative analysis of possible effects caused by coupled and decoupled support on agricultural and food sectors in an economy. The CGE model used is the STAGE_AGR which is an extension of the STAGE model containing equations that permit modellers to introduce agricultural policy instruments either as coupled or decoupled. We have taken as empirical example the case of Ireland.

We start with the updating of the Irish SAM according to the economic conditions of 2007. The data base is presented with a high degree of disaggregation including 30 raw agricultural sectors and 12 processed food sectors. It contains most of the CAP payments in Ireland for the year 2007. In the simulations we assume cuts in the CAP budget. In one scenario most of the CAP payments (except export refunds and LFA) are treated as decoupled while in the other scenario they are treated as coupled. The results suggest that GDP and welfare would experience positive development under both assumptions despite the drop in returns of all primary factors employed in agricultural and food sectors. Results quantify the higher distortive nature of coupled payments by contrast to decoupled payments.

Keywords: CAP, Decoupling, CGE, Ireland

JEL: C68, Q18

1. Introduction

The development of agricultural policy instruments has a long, and arguably opaque, history. Prior to the latter part of the 19th century agricultural in most countries was to a large extent insulated from changes in world prices by large trade and transport costs. Even so, domestic producers were often protected by trade restrictions; for instance in the UK wheat prices were protected by a system of, effectively, variable import levies under the auspices of the Corn Laws[1]. While the repeal of the Corn Laws in 1848, introduced a period liberalised agricultural trade in the UK it did not immediately cause a fall in domestic agricultural prices. In fact the between the mid and late 19th century European agriculture boomed in a period of strongly growing demand and before transport costs fell very sharply and facilitated a rapid growth of trade and falling world prices. For the vast majority of the 20th century, European agriculture has been extensively insulated from world markets primarily through the use of trade barriers.[2] Such trade policies instruments are transparently coupled payments that are intended to influence directly the prices of agricultural commodities paid by consumers and thereby protect agricultural producers; the economic modelling of coupled policy instruments involves ensuring that the instruments enter into the determination of the prices paid and received by agents and hence into decisions made by agents.

In the European Union (EU), the 1992 and subsequent reforms of the Common Agricultural Policy (CAP) were manifest shifts away from price support towards direct payments. In parallel, rural development policies emerged, bringing together a range of targeted structural and environmental measures. The 2003 reforms initiated the progressive and partial decoupling of direct payments; Single Farm Payments (SFPs), which were (intended) to be unrelated to current market prices and production decisions, were introduced. However, these payments remain intrinsically market distortive if one takes into account the way they have been computed and allocated. This move away from coupled payments towards an increasing emphasis on decoupled payments is intended to continue with the current round, post-2013, of CAP reforms that are driven by the 2014-2020 European budget, the recent European Parliament co-decision on agricultural affairs, and the Doha Round negotiations. As such, EU agricultural policy is intending to replace coupled payments with decoupled payments. Similar shifts in policy

1 In this case the 'corn' refers to wheat, not maize.

2 The UK is an exception in that free agricultural trade remained the policy and the prior to entry into the EU agricultural support was primarily achieved through deficiency payment schemes.

emphasis and instruments are taking place in other OECD countries with highly protected agricultural sectors.

The shift towards decoupled payments represents a substantial challenge to economic modellers. While coupled payment entered directly into the price formation processes for commodities, and thereby influence agents, decoupled payments are intended to avoid influencing current market prices and production decisions, although they may indirectly enter into the determination of prices and production decisions. An important dimension of these policy changes has been that they have altered the decision making processes by farmers. Consider the stylised case of a hill farmer who can only produce lambs and store cattle[3]. Under stylised pre reform policies, where all support is coupled, the farmer received support through price instruments that influenced/raised the (net) prices of lamb and beef and through direct payments based on the numbers of breeding ewes and cows, i.e., the support instruments directly influenced the farmer's decisions about the outputs of lambs and store cattle since the payments were determined directly and indirectly by the farms commodity outputs. In a stylised post-reform environment, where all support is decoupled, through some form of SFP determined by, for instance, the geographic location of the farm, the farmer's decision making processes will be changed. Specifically, the farmer's output decisions should not be directly influenced by the SFP but by the (expected) relatively prices of lambs and store cattle and any conditions imposed on farming systems by the SFP, although the farmer's decision to operate the farm, i.e., employ labour, capital and land, will be influenced.

One response to this change has been the development of Consumer and Producer Subsidy Equivalents (CSE and PSE) whereby efforts are made to convert policy interventions, coupled and decoupled, into measures that are 'equivalent' measures of traditional coupled instruments. This approach, and the data so collected, have many virtues and are especially relevant for partial equilibrium models that seek to identify the supply and demand for commodities at the level of an economy. However, it is contended that the extension of this logic to a general equilibrium framework based on commodity by commodity accounts introduces a discontinuity into the economic logic. Specifically, in the scenario developed above, the SFP is paid on the basis of the location of the farm. If this is converted into an equivalent support for lamb and beef it will impact on the decisions about ALL production of lamb and store cattle, which is not the intended mode of operation, while if it is attached as a subsidy to an undifferentiated factor land it will influence current prices and production decisions directly, i.e., the SFP will be converted into a coupled payment.

3 Weaned calves sold onto other farmers for finishing.

This paper presents a computable general equilibrium (CGE) model framework for the analysis of the coupled and decoupled agricultural and food sectors in an economy. The model is given empirical content using Ireland as an example. The rest of the paper is organised as follows. The next section, 2, provides a brief modelling review of decoupled payments in CGE models and identifies areas of concern. Thus section 3 presents the adaptations made to the STAGE model to address these issues. The policy environment and the model adaptations are the key determinants of the data requirements; the data are recorded in a Social Accounting Matrix (SAM) format together with various satellite accounts. Details about the SAM, the satellite accounts, the compilation process and CAP data in Ireland are reported in section 4. The simulations are defined in section 5 and the results and analyses are reported in section 6. The paper ends with a summary and some suggestions for future developments.

2. The CAP in Economic Modelling: A Focus on CGE Models

2.1. Decoupled Payments in a new CAP

European domestic support is at stake. Breaking the linkage between the budgetary amount of support received by a farm holding and the market-commodity dimension which could result from present (and past) farming activity is far from being complete. Such a rupture remains a key challenge in CAP reforms since the 1992 reform (Mahé and Roe, 1996). Indeed, with a growing open international market, any effect on production has a repercussion on corresponding trade. This distortion transmission is especially significant considering that Europe is a sizeable exporter -and importer- and thus is frequently a world price maker. A new policy cycle started in 1992 initiated the progressive market price de-linking path of the CAP that is still in progress.

In order to adapt an almost exclusive past price support to a more market-oriented and budgetary-monitored agricultural policy, the 1992 reform started to shift the main mechanism from guaranteed price to direct "compensatory" payment. Direct payments towards crop lands have been computed by hectare, considering yields and scheduled price support decrease. Livestock direct premiums by head have been revalorised and/or created. The aim was to compensate the negative effect on farm income and wealth which may result from the decreases in price support.

Decoupling direct payments from production has been the cornerstone of the 2003 reform. In line with the 1992 and 1999 reform[4], it introduced SFP schemes in which direct payments are not

[4] The 1999 reform extended the 1992 reform i.e. decreased further price support, compensated with direct payments to farmers. It classified CAP measures within two pillars, market support and direct payments on the one hand, rural development measures on the other hand.

related to current market prices and production decisions. In 2012, about 75% of payments under first pillar are formally decoupled. Although being less distortive than coupled payments, it is assumed that SFPs distort markets.

The implementation and management of domestic support decoupling provided a unique occasion to redistribute the European domestic support. Two main SFP models have been proposed i.e. historical and regional. The latter model possesses the ability to almost freeze the past distribution of support whereas the former model shuffles it within a determined territory. One may keep in mind that in Ireland, which is the case analysed in this paper, one third of Irish farm holdings captures 72% of all direct payments (Table 1).

Table 1– Distribution of first pillar's direct payments in Ireland, percentage, 2003-2009

	2003	**2005**	**2007**	**2009**
Share of farm holdings	26.37	29.78	33.09	33.04
Share of payments	69.07	70.09	72.65	72.25

Reading assistance: In 2007, 33.09% of Irish farm holdings capture 72.65% of first pillar's direct payments
Source: European Commission

Legitimacy of historical decoupling model – as adopted by Ireland – is declining rapidly. Society is increasingly reluctant to pay subsidies to farm holdings based on increasingly faraway productions and yields. The 2003 CAP reform linked payments to farmers achieving certain environmental, animal welfare and quality standards.[5] These requirements – cross-compliance – aim at addressing social and environmental objectives, while also providing direct support to farmers.[6] Instead of being based on a contract for the rewarding or improvement of good practices, SFP's cross-compliance is "at best a straight jacket" (Mahé, Naudet and Roussillon-Montfort, 2006). One should keep in mind that SFPs amount is based on past market support, thoroughly incoherent with farm-level needs and duties. This raises a whole series of issues relating to the impact of decoupled support on factor mobility and structural adjustment path. In such a context, the provision of multi-functional services through the current SFP regime is doomed to be a delusion.

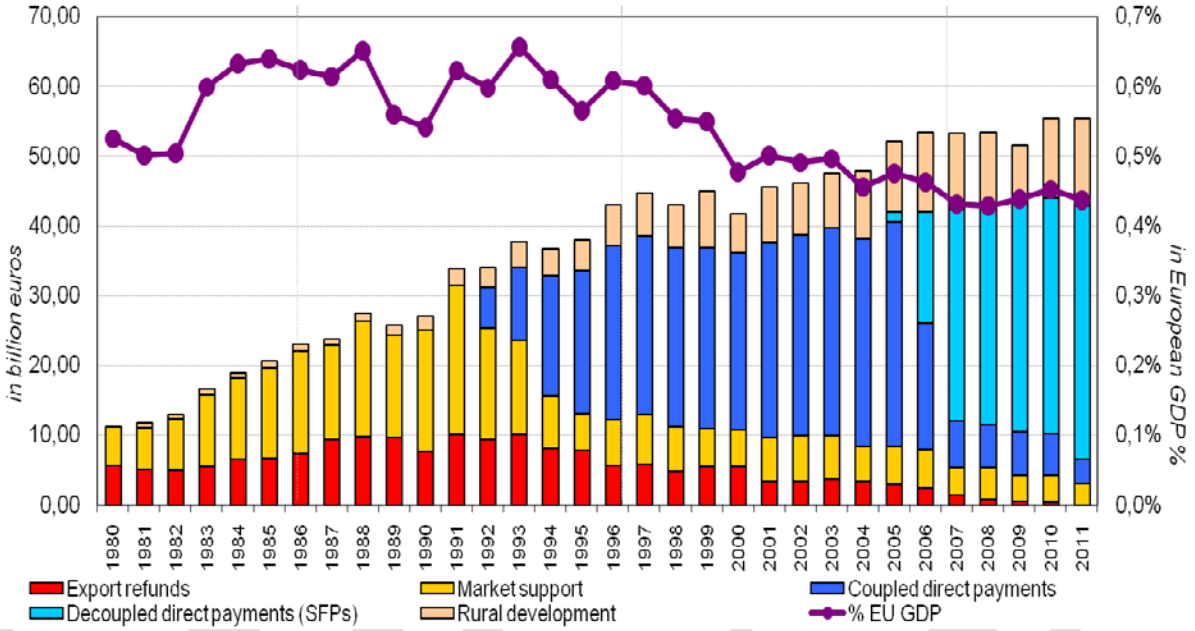
European domestic support is no more pertinent as a sector-based income policy, and is unclear concerning their role in territorial or environmental amenities. The CAP remains a

5 Cross-compliance makes full payment conditional upon (i) land being maintained in good agricultural and environmental condition (GAEC) – according to standards established at national levels and (ii) adherence to the EU statutory management requirements regarding the protection of environment; public, animal and plant health, and animal welfare.

6 This raises a whole series of issues relating to the impact of decoupled support on factor mobility and structural adjustment path. , e.g. do payments programmes induce factors to stay in agric that would otherwise leave

redistributive policy mainly deferred to national discretionary decisions (Boulanger, 2011). For the period 2014-2020, agricultural practices beneficial for the climate and the environment should be better targeted, as well as areas facing specific natural constraints. The willingness of the society to pay for farming externalities exists but suffers from lack of information as regards their localisation and price.

Figure 1. Breakdown of CAP support, EU, billion euros and percentage, 1980-2011.



Source: European Commission

Although several time reformed, the CAP still generates distortions and inefficiencies. Figure 1 illustrates the path undertaken by the European domestic support since the 1992 reform. From compensatory coupled subsidies – based on income losses induced by price support decreases – to single decoupled payments – conditioned to European and national statutory requirements – market price distortion remains the hub of the system.

Therefore, scenarios of CAP budget cut will be useful to test the level of distortion of the current distribution of SFPs, entered in force in 2005-2007.[7]

With the introduction of the SPFs, the European Commission (EC) changed the support to farmers by removing the link between subsidies and any specific production (decoupling). Farmers should in any case maintain their land in good agricultural and environmental condition

7 One may consider the unrealistic feature of these scenarios under the current political negotiation for the 2014-2020 financial period. Results should be interpreted as indicative of the magnitude of the effects.

(GAEC) under the cross-compliance mechanism. The SPS is paid in the form of a single annual payment based on the value of the payment entitlements hold by the farmer. Payment entitlements are allocated to active farmers by the competent national authorities.

2.2. Decoupled Payments in Economic Modelling

According to the Directorate General for Agriculture and Rural Development of the European Commission (DG AGRI), direct payments ensure a safety net for farmers in the form of a basic income support, decoupled from production, stabilising their income. Direct payments also contribute, in combination with cross-compliance, to providing basic public goods delivered through sustainable farming. With a yearly budget of around € 40 billion, direct payments form a significant part of the EU budget. Since the 2003 CAP reform, agricultural economic models have to be adapted to capture the new logic of the SPS policy and adapt the old modelling of coupled CAP to the new policy environment

Balkhasuen et al. (2008) review ways of modelling the decoupling in the EU in the context of the CAP reform. They compare the likely effects of decoupling from six partial equilibrium (PE) models and two CGE models, i.e. GTAP (Hertel, 1997) and GOAL (Gohin, 2006). According to this review there are three key elements to consider when implementing decoupled payments in economic models: (i) inclusion of fodder and pasture in the model database. According to Balkhasuen et al. (2008), models which do not depict these products can underestimate the potential reduction of area allocated to cereals, protein crops and oilseeds; (ii) link between feed and livestock. In order to capture substitution possibilities of livestock producers among different feeds a more flexible production function e.g., Constant Elasticity of Substitution (CES) should be preferred to the usual Leontief specification of intermediate demand; and (iii) depiction of land market and elasticity of land supply. The models which assume constant base area or inelastic land supply are not able to trace possible reductions in total agricultural area, which should be one of the expected results of the CAP decoupling. Related to the issue of land, Gohin (2006) shows that assumptions on degree of capitalisation of direct payments to land can strongly affect model results.

Therefore one major drawback of global CGE models, using the GTAP database, is the lack of fodder crops and of pasture land due to the GTAP sector aggregation. Thus, substitution effects in these models may underestimate the potential reduction of area allocated to cereals, protein crops and oilseeds

Usually, in GE models land market is endogenous, and the rental price for land generally adjust against a fixed total supply. In GTAP the land demand is inelastic and land is modelled

through a Constant Elasticity of Transformation function. In these cases, according to Balkhasuen et al. (2008), effects of decoupling tend to be smaller than in model with elastic land supply.

Although not completely suitable for this kind of analysis, several projects have assessed the economic impacts of the CAP reform using global CGE models, e.g. Novicki et al. (2009). Most of this literature concentrates on the global impacts of the reform as well as on the impacts on the EU as a single region.

In the case of single-country models, whose database can be extended according to modellers needs, integration of decoupling can be better detailed than in global CGE models. For instance, the AgroSAM database employed in this paper, as explained in section 4, takes explicitly into account fodder crops. The production factor land is disaggregated between arable land and pasture, with the possibility of harvesting fodder on both types of land. However, studies evaluating the effects of decoupled payments in a CGE single country framework are rather limited.

Previous studies, with global or single-country models, followed two main ways to integrate decoupled payments. On the one hand, decoupled payments have be modelled as subsidies to agricultural land, which may be used to produce any agricultural commodity or forestry (Frandsen et al., 2003; Dixon and Matthews, 2006; Novicki et al. 2009; Philippidis, 2010). As claimed in Novicki et al. (2009), due to these payments, farm income increases and more production factors stay within the agricultural sector thus land abandonment is lower than predicted by Partial Equilibrium models.

On the other hand, decoupled payments have been modelled as direct lump-sum transfers from the government to households (Gelan and Schwartz, 2008 for Scotland; Miller et al., 2011 for Ireland).

Both methods reveal to contain substantial flaws. In the first case, subsidies enter directly the first order condition of the maximization of production function. This is distorting the allocation of production factors, thus decoupled payments are treated *de facto* as coupled. In the second case, the assumption behind the lump-sum transfer approach is that the SFP is fully decoupled (this result will be shown later in this work) even if the evidence is that farmers do not treat the SFP as fully decoupled. The following section presents our approach to modelling *decoupled* SFP with the aim to overcome the flaws of other methods.

3. STAGE_AGR: a Single Country CGE Model for Agricultural Policies

The single-country STAGE model (see Mc Donald, 2007 and McDonald et al. 2005) has been modified to take into account main agricultural policies instruments. Specific agricultural policy instruments – commodities tax instruments[8], activity tax instruments and a direct payment instrument – as well as one general policy instrument have been added to the original model. The introduction of these instruments allows modelling the SFP either as fully (support directly paid to agricultural households) or partially decoupled payments (subsidies to activities which influence the process that determines employment and output of the activities), and fully coupled payments. Thus the modeller is free to decide how to represent any agricultural policy instrument in terms of decoupling, and compare results of policies under different scenarios

The main novelty of these instruments is represented by the fact that the ad valorem equivalent tax introduced is endogenously determined. This specification allows keeping the total value of the policy intervention exogenously fixed by the policy makers (e.g. CAP budget), while the ad-valorem equivalent varies according to the variation of the output. This mechanism is represented in Equation 1. The ad valorem equivalent instrument (*TASUBEQV*) is defined as the revenue of the activity *a* from a range of policy instruments divided by the value of the respective output ($PX_a * QX_a$).

A set of three policy instruments are identified. The first ($taqsub_a$) is a subsidy rate per unit of output i.e. a coupled support. The second instrument ($decupb_a$) is a fixed decoupled payment made to activities. While this form of decoupled payment is not determined by the value or quantity of output, it does enter into the decision processes that determined consumption of inputs, employment and output by activity. The last instrument ($tlfa_a$) is a subsidy rate for less favoured areas (LFA) that distinguishes both arable and pasture land (where FD_a is the demand for each type of land by agricultural activity *a*). It allows modeller to keep constant the total budget for LFA measures.

$$TASUBEQV_a = \frac{\left(\left(taqsub_a * QX_a \right) + decupb_a + \sum_{a,land} FD_{a,land} * tlfa_{a,land} \right)}{\left(PX_a * QX_a \right)} \qquad (1)$$

8 Policy measures that target consumption (e.g. milk school schemes, marketing programmes) can be modelled through commodity taxes. SATGE_AGR has two agricultural commodity taxes. The first is a standard format ad valorem commodity tax. The second is a standard format quantity commodity tax. No change to these taxes is implemented in this work.

4. A SAM with Disaggregated Agricultural Sectors for Ireland 2007

The agricultural and food industry sector are often represented as one row and one column in the national datasets. This coarse representation is an important reason for the limited application of CGEs for analysis of the CAP. Furthermore, the few existing studies applying a CGE model use as input the GTAP database which distinguishes 12 raw agricultural products and 8 processed food commodities to cover the agri-food market.

A comprehensive study of the agri-food market requires a disaggregated detail of the agri-food sectors. To this end, the Institute for Prospective Technological Studies (IPTS) has developed Social Accounting Matrices for the EU-27 (base year 2000) with a highly disaggregated agricultural sector (AgroSAMs) (Mueller et al., 2009), a database containing 30 raw agricultural sectors and 12 processed food sectors.

First, this section presents the innovative database employed in this study. Second, it scrutinizes the legal implementation of the CAP in Ireland, especially the SFPs. Total subsidies to Irish agriculture amounted about 2 billion euros in 2007, with SFPs representing two third of these payments.

4.1. The 2007 update of the AgroSAMs

AgroSAMs are based on Supply- and Use Tables from EuroStat. The agricultural sector has been comprehensively covered by adopting the database from the agro-economic simulation model CAPRI (Britz and Witzke, 2008). This data has been processed to compile a specific dataset for each Member State covering agricultural and non-agricultural activities and commodities.

This database allows modellers to assess policy impacts of CAP reforms on agricultural and non-agricultural sectors at a member state level in much more detail than former existing databases.

The original Irish AgroSAMs has been further extended by disaggregating the representative household into an agricultural representative household, who receives incomes generated by agricultural sectors, and a non-agricultural representative household. Additionally, the update of the Irish SAM took advantage of latest policy data coming from the European Commission (European Agricultural Guarantee Fund), Irish Department of Agriculture and Food, and Eurostat. This original set of data represents a significant improvement in the representation of CAP measures (see below).

The original 2000 based SAM have been updated to the year 2007. The supply and use table for 2007, available from Eurostat, represents the anchor of the update procedure. Additional institutional data coming from Eurostat (taxation, transfers, and savings) have been used to complete the income part of the matrix. The CAPRI database represents the reference for the update of the agricultural and agri-food sectors in 2007 together with the compendium of Irish agricultural statistics. A main difference compared with the original SAM has to do with the sugar production. Indeed after the sugar reform, Ireland production of sugar beet and of raw sugar disappeared (DG AGRI, 2010). Consequently, we eliminate these domestic activities from the Irish SAM.

The GTAP database, version 8 (Aguiar et al., 2012), is the source to 2007 values of imports and exports and import tariffs of agricultural and agri-food sectors. The national household budget survey (CSO, 2007) has been used to disaggregate the representative household into two households, representing agricultural (households receiving their income from agricultural activities) and non agricultural household.

The final a-priori SAM has been updated with the cross-entropy (CE) methodology (Robinson et al., 2001).

The current Ireland SAM contains 87 commodities and 80 activities. The agricultural sector is subdivided into 24 commodities and 19 activities while the food industry sector is disaggregated into 11 commodities and activities (see Table A 1 for the detailed disaggregation). The rest of economic accounts follow the Eurostat disaggregation of supply and use tables with 59 sectors. The SAM contains eight production factors: agricultural and non-agricultural labour, agricultural and non-agricultural capital and four types of land (arable land, pasture land, arable land located in LFA, pasture land located in LFA). The accounts for land, not available in the original SAM, were disaggregated from the capital account using data from Eurostat (land prices and rents and land use by sector). The taxation instruments contained into the SAM has been collected in order to take into account the specificity of the CAP. The SAM contains two ad-valorem agricultural subsidies on activities to take into account the coupled interventions of the first and second pillar. A third instrument collect information on SFPs accounted in the calibration of the model as decoupled. LFA payments are collected as additional subsidy to agricultural sectors. In addition, another account is ready to model payments as direct transfers to the agricultural household. This account is empty in the calibrated SAM. The household and institutional part of the SAM is rather standard. Accounts for enterprises, government and the rest of the world complete the scene. The updated values for the 2007 Macro SAM for Ireland are presented in Table 2.

Table 2 – Ireland MacroSAM, million euros, 2007

	Com-modity	Margins	Activity	Value added	HH	Enter-prises	Govert.	Capital	World	Totals
Commodity		24,057	233,929		93,118		29,373	51,710	150,318	582,504
Margins	24,057									24,057
Activity	400,083									400,083
Value added			166,403							166,403
Households				107,248		3,336	17,496			128,080
Enterprises				36,826			2,049			38,876
Government	25,379		-249	4,672	18,108	7,781			-361	55,330
Capital					16,854	27,758	6,412		686	51,710
World	132,986			17,657						150,643
Totals	582,504	24,057	400,083	166,403	128,080	38,876	55,330	51,710	150,643	

Source: own elaboration with information from EUROSTAT

Table 3 shows the total value added for primary agriculture and food industry activities. The sum of the value added over an economy's production sectors is one of the ways of measuring its GDP, hence the figure of 'total value added' shown in the table can be interpreted as such. From the analysis of the 2007 SAM, it appears that agriculture represents 2.7% and the food industry 3.86% of the 16 billions value added produced by the Irish economy.

Table 3 – Agri-food value added and share of total, million euros and percentage, 2007

	Agriculture		**Food**		**Agri-Food**		**Total**
	Value	**%**	**Value**	**%**	**Value**	**%**	**Value**
Labour	462.94	0.59%	1,921.39	2.44%	2,384.33	3.03%	78,786.87
Capital	3,612.86	4.14%	4,497.31	5.16%	8,110.17	9.30%	87,228.54
Value Added	4,463.27	2.68%	6,418.70	3.86%	10,881.96	6.54%	166,402.89

Source: own elaboration with information from EUROSTAT

Analysing the domestic supply of commodities, agricultural represents 1.8% of domestic supply while the food industry 3.5%. The structure of agricultural production and the food industry in Ireland is presented in Table 4. In terms of value of domestic production, raw milk from cattle (28% of agricultural production) represents the key activity within agriculture. Within food industry, production of other food (32%), dairy products (26%) and meat of bovine animals (23%), are the three activities with the highest production value.

Table 4 – Share of production value over agriculture or food production, percentage, 2007

Agricultural activity	**%**	**Agricultural activity**	**%**	**Food Industry activity**	**%**
Wheat	2.23	Raw milk	27.63	Processing of rice	0.03
Barley	3.85	Bovine cattle	16.80	Other food	31.95

Other cereals	0.67	Swine	4.94	Vegetable oils and fats	0.08
Rape seed	0.06	Raw milk sheep, goats	2.77	Dairy	25.84
Other oil plants	0.76	Sheep and goats	5.61	Meat of bovine animals	22.90
Other starch	0.04	Eggs	1.10	Meat of swine	3.96
Potatoes	2.61	Poultry,	3.08	Meat of sheep, goats and equines	5.31
Vegetables, fruit	5.80	Other animals	4.03	Meat of poultry	1.51
Other crops	2.58	Agricultural service	1.21	Beverages	4.17
Fodder crops	14.23			Prepared animal feeds	4.24

Source: own elaboration

In terms of exports, the food industry represents 8% of total Irish export, being the bovine meat 2% of Irish exports. Fruits and vegetables is the most export oriented commodity in terms of share of exports over production, more than half of the production is exported. The food industry is in general export oriented as almost 60% of its production is sold in the rest of the world.

Excluding some products which are not harvested in Ireland (e.g. durum wheat, maize, paddy rice, sunflowers, soybeans and grapes), Ireland appears largely self-sufficient in terms of agricultural and food production. In very few cases the share of imports over domestic demand is higher than 50%. The share for imported agriculture commodities over domestic demand is 17% while for food it reaches 40% due to the almost complete reliance on imports for vegetable oils and high dependence on imports for pork and poultry.

4.2. The CAP in Ireland - legal implementation and data

When introducing the SPS, Member States had three main options for calculating the value of payment entitlements, either (i) on the basis of the payments received by the individual farmer during a reference period (*historical model*) resulting in different aid levels per hectare; (ii) taking all payments received in a region and divide them by the number of eligible hectares (*regional model*) resulting in a flat rate, or (iii) a mixture between these two models (*hybrid model*) that can be either *static* or *dynamic* (with the latter approximating both elements towards a flatter rate).

With the 2003 CAP reform, Ireland decided to fully decouple Irish direct payments under an historical model. This latter model possesses the ability to almost freeze the past distribution of support whereas a regional model shuffles it within a determined territory.

This paper assumes that the distribution of decoupled payments – SFPs – received by each farm in 2007 approximates the distribution of coupled payments received in 2004, one year before the implementation of decoupling in 2005. This assumption is required to integrate in our database the bulk of SFP which are the highest share of domestic support in Ireland. Total

subsidies to Irish agriculture amounted about 2 billion euros in 2007, with SFPs representing two third of these payments.

SFPs are calculated as the sum of the eligible payments that were linked to production in 2004 (2005 financial year) with the 2007 financial envelope (2008 financial year). Bovine support gathers previous suckler cow premium, special beef premium, slaughter premium, extensification premium, and cattle head premium. Other domestic support are the payments to cereals (common wheat, barley and other cereals) and to sheep and goats.

The 2003 CAP reform introduced a reduction in the intervention price of milk products, compensated by direct payments. In Ireland, the premiums have been decoupled from 2005; ahead of the scheduled implementation date of 2007. Table 5 shows the methodology used to estimate SFP amount which result from milk premium decoupling. Special attention has been devoted to the changes of support and additional payment as agreed in CAP legislation, and to the modulation rate of 5% applied in 2007.

Table 5 - Estimation SFPs granted to milk production in Ireland, 2007

Calendar year	2004	2007
Rate of support (EC regulation 1782/2003 – article 95) (€/t)	8.15	24.49
Milk premium (FEOGA 2005 FY – 05030110) (M€)	42.3	
SFP extrapolation from milk premium (M€)		127.2
Additional payment (EC regulation 1782/2003 – article 95) (M€)	19.20	57.76
Total milk SFPs (M€)		184.96
Total milk SFPs with modulation rate of 5% (M€)**		175.71

* FEOGA 2005 FY: 19 M€
** Without considering any 5,000 euros franchise
Source: own elaboration, data from EAGF/EAGGF

Interventions in agricultural markets for 2007 gather storage measures, operational funds for producer organisations, promotion measures, school milk support - included within raw milk support – and some coupled payments for protein and energy crops. Their amount is 10.62 million euros.

Export refunds amount to 16.54 million euros. By contrast, SFPs amount for 1,274.3 million euros. As a result, the share of subsidies over production varies significantly according to the activity. Bovine cattle appear as the most supported activity with subsidies representing about 100% of the value of production (Table 6).

Table 6 - Share of subsidies over production in Ireland, percentage, 2007

Wheat	31.30	**Fodder crops**	30.46
Barley	35.06	**Raw milk**	14.98
Other cereals	33.11	**Bovine cattle**	99.72
Rape seed	5.35	**Swine**	6.39

Other oil plants	5.23	**Raw milk sheep, goats**	5.34
Other starch	9.82	**Sheep and goats**	32.32
Potatoes	5.46	**Eggs**	0.09
Vegetables, fruit	6.06	**Poultry,**	0.00
Other crops	13.37	**Other animals**	0.00

Source: own elaboration

On rural development support – i.e. second pillar of the CAP – we use data from Irish Department of Agriculture and Food. National and European subsidies are taken into account. Support to LFAs amounts to 253.83 million euros in 2007. It has been redistributed according to production type within LFAs as provided by Eurostat. Most of this area-based compensatory allowance scheme benefits fodder crops.

Rural Environment Protection Scheme (REPS) amounts to 311.75 million euros in 2007. This amount has been redistributed homogeneously to primary activities according to their production level. This assumption was necessary because of the lack of information on REPS distribution. The same distribution methodology has been used to distribute the installation aid for young farmers which amounts to 5.79 million euros. Last, diseases eradication schemes where taken into account, with bovine cattle receiving 19.52 million euros; sheep and goats receiving 0.58 million euros.

As a whole, our analysis considers a total support of 1,892.93 million euros which corresponds to about 98 % of all CAP payments in Ireland. Table 7 summarizes this breakdown.

Table 7- Breakdown of CAP payments by activity in Ireland, million euros, 2007

	First pillar			**Second pillar**			
	Export refunds	**Coupled support**	**SFPs**	**LFA support**	**Environmental support (REPS)**	**Disease era-diction scheme**	**Installation aid for young farmer**
Other wheat			37.76	1.60	7.78		0.14
Barley			75.03	3.21	13.19		0.23
Other cereals			12.14	0.44	2.31		0.04
Rape seed				0.00	0.20		0.00
Other oil plants				0.00	2.63		0.05
Other starch and protein plants		0.10		0.03	0.15		0.00
Potatoes				0.25	9.11		0.16
Other crops		0.20		0.07	8.98		0.16
Vegetables, fruit, and nuts		2.90			20.33		0.36
Fodder crops		0.10		25.33	45.74		0.80
Raw milk from bovine		5.40	179.13		95.46		1.67
Bovine cattle, slaughtered		0.00	866.98		47.07	19.52	0.82
Swine, slaughtered		0.10			24.73		0.43
Raw milk from sheep and					9.77		0.17

goats							
Sheep, goats, equines, slaughtered			103.25		19.24	0.58	0.34
Eggs							0.07
Poultry, slaughtered							0.28
Dairy products		1.50					
Other food products	7.84						
Vegetable oils and fats							
Dairy products	4.30						
Meat of bovine animals	2.80						
Meat of sheep, goats, and equines	1.60						
TOTAL	**16.54**	**10.62**	**1274.30**	**253.83**	**311.75**	**20.10**	**5.79**

Source: own elaboration, data from EAGF/EAGGF, Irish Department of Agriculture and Food, and Eurostat

5. Scenarios Description

Two scenarios are run, compared with the 2007 reference year. These scenarios aim to capture the different impacts of the CAP measures as once they are treated as decoupled or as coupled.

Following equation (1), in scenario 1 we treat all CAP measures but LFA and export refunds (SFPs, first pillar coupled payments, and other second pillar measures) as decoupled and then we cut the total CAP budget by 30%. In scenario 2, we first recalibrate the model by allocating SFPs and all other measures (but LFA measures and export refunds) as coupled measures and then we cut the total CAP budget by 30%.

Export refunds are paid to commodities and not to activities, so they are kept constant under these simulations.

LFA measures are kept constant as the logic of modelling is different from other measures as LFA payments are allocated to land demanded by activities and not directly to activities. It should beard in mind that, LFA payments are allocated to land through Equation 1 so they are modelled as decoupled payments as they do not enter the first order condition of the production function. On the contrary, this would happen by modelling LFA measures as negative factor tax to land.

An extra scenario has been designed by assigning all CAP measures (again excluding LFA payments and export refunds) as direct transfer to agricultural households and then cutting the CAP budget by 30%. Results for third scenario are not shown. This scenario shows that the reallocation of funds from activities to households produce a significant shock to the structure of the Irish agriculture. Nevertheless, the cut of the total CAP budget generates minimal shock to the agricultural production. This demonstrates that, once the funds are allocated to households,

they behave as fully decoupled payments thus a cut in the budget produces negligible changes to the economic system.

As in all mathematical programming models, a series of so called closure rules is needed to assure that the numbers of equation equals the numbers of variables. However, the economic dimensions of closure rules are more complex as they define fundamental differences in how the economic system behaves. The STAGE model allows for full flexibility in the typical macroeconomic closure rule of a CGE model. The rules adopted in this work try to represent reasonably the reality of the Irish case. Being a single-country model, the world prices are kept fixed together with the current account balance (while the nominal exchange rate is flexible). On the saving-investment side, we opt for an investment drive closure rule by fixing the value share of investment in total final domestic demand and let the savings rate scaling factor (for households and enterprises) free to adjust. Dealing with a fiscal policy such as the CAP, the government closure rule assumes great relevance. Scenarios represent a cut in government expenditure, under the assumption of a fix government's savings. In this case the government expenditure and income need to be free to adjust. The household income tax is the tax rate that varies to satisfy the internal balance condition. The direct taxation in these models is modelled as lump-sum tax to households so it represents the least distortive tax within the system. In the factor market, we assume full factor mobility (agricultural capital and labour has been segmented from non-agricultural in the database) and full employment of all production factors.[9]

6. Simulation Results

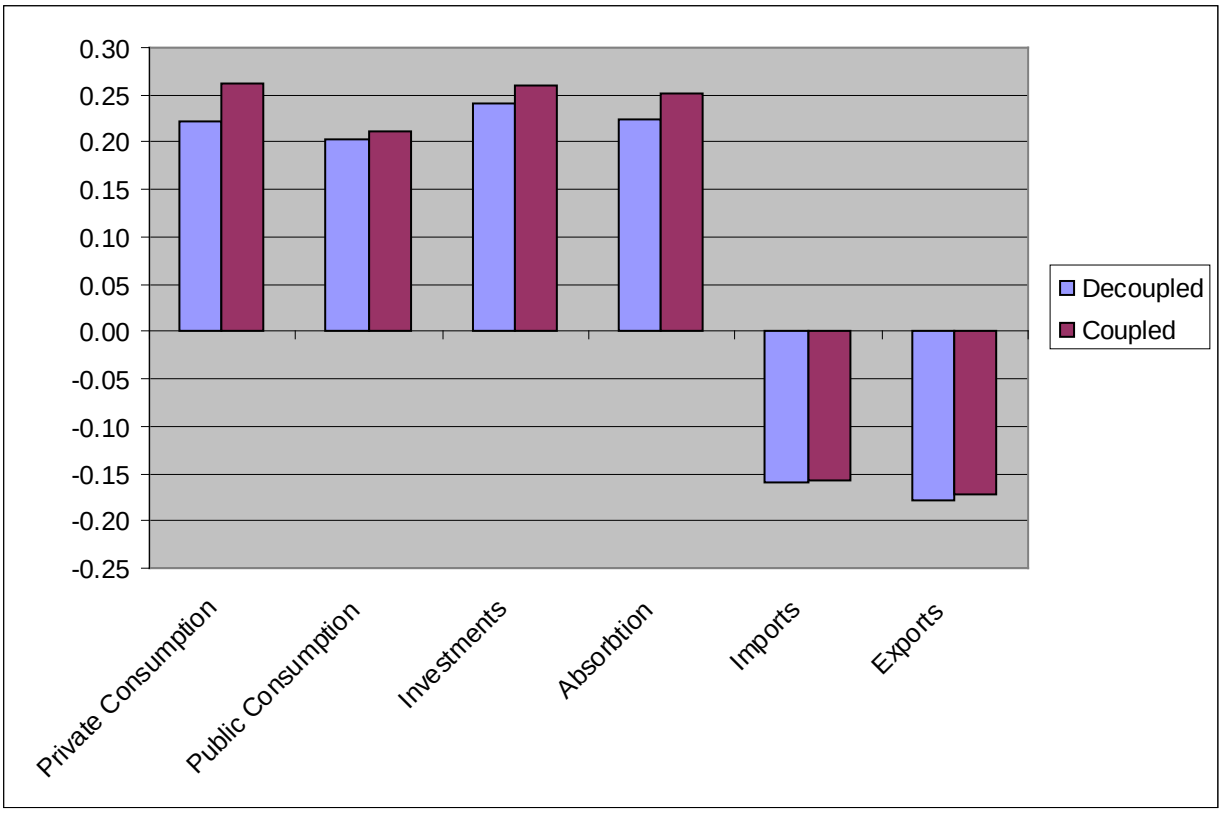
6.1. GDP

The results of the simulations show a slightly increase of GDP under both scenarios. In Scenario 1 with all the payments coupled, a cut by 30% of the total CAP budget causes an increase of the real GDP of 0.18%, equal to around 300 millions euros. In the second scenario, the 30% cut with all the measures coupled, the increase of GDP reaches 0.21%, equal to around 350 millions euros. The additional increase of almost 50 millions euros can be interpreted as the additional efficiency gain due to the reduction of coupled payments. Coupled payments result to be more distorting than decoupled ones, so their reduction gives to the economy an additional increase of efficiency.

9 According to Eurostat, unemployment in Ireland in 2007 was around 4%, thus the full employment hypothesis results reasonable. Nevertheless, the average unemployment rate in the last 30 years is around 12%, so scenarios have been performed with labour unemployment. Core results do not change significantly and for sake of simplicity they are not reported in the paper but are available upon request to the authors.

Analysing the decomposition of the Irish GDP, Figure 2 shows that under the coupled scenario, all the components of GDP experience a larger change than under the decoupled scenario. Particularly relevant is the private consumption component, where cutting coupled support means an additional increase of around 30 million euros. Figure 2 also shows that as consumption and investments increase, imports and exports decrease. This suggests more competitive demand within the Irish market, decreasing both the need of imports and availability of products to be exported.

Figure 2– GDP Structure, percentage change



Source: own elaboration

In the coming sub-sections we go through the changes observed in production structure, commodity prices, and production factors that allow us provide a complete picture of factors contributing to these overall results for GDP, and then income and welfare.

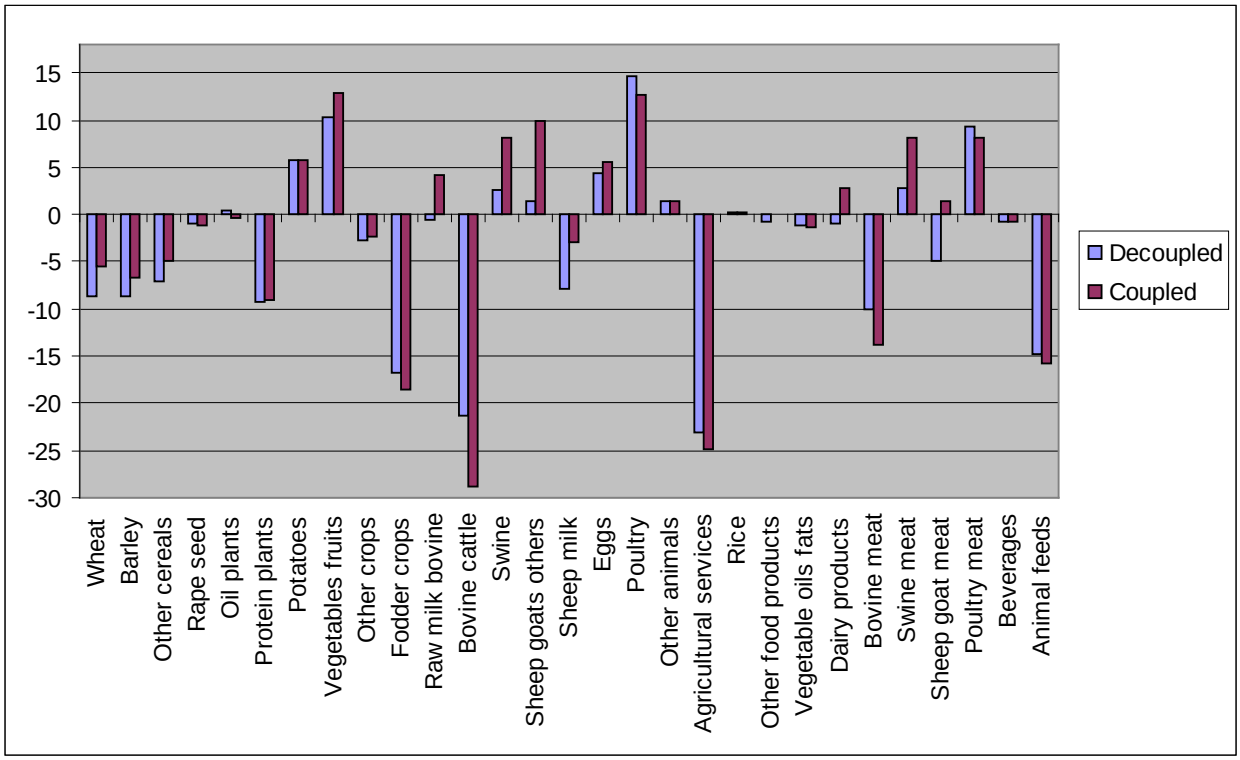
6.2. Production structure

The budget cut causes significant changes in the production structure of Irish agriculture (Figure 3– Domestic production of agricultural and food activities, percentage change). Under the two

scenarios, there is a common pattern under which production of agricultural commodities with a high level of support (cereals, cattle and fodder) in the base year drops while commodities with no or very low level of subsidization increase their domestic production. Vegetable and fruits, potatoes, swine and poultry gain from support reduction as their production increases. For these same products, the increasing production at national level reduces the demand of imports to satisfy domestic demand. As result under the decoupled scenario, imports from vegetable and fruits, potatoes, swine, poultry, decrease (Appendix, Table A2). This trend can be a good indicator that decoupled payments will increase the diversification of production. The increase of both production and variety benefit Irish consumers (non-agricultural households).

The production of food mirrors the changes in the primary agricultural production. The drop in cattle production causes a reduction of beef production while the increase of swine and poultry production provokes the increase of pork and poultry meat domestic production. Given that bovine cattle are the most important livestock activity, the production of animal feeds is negatively affected by the drop in bovine production.

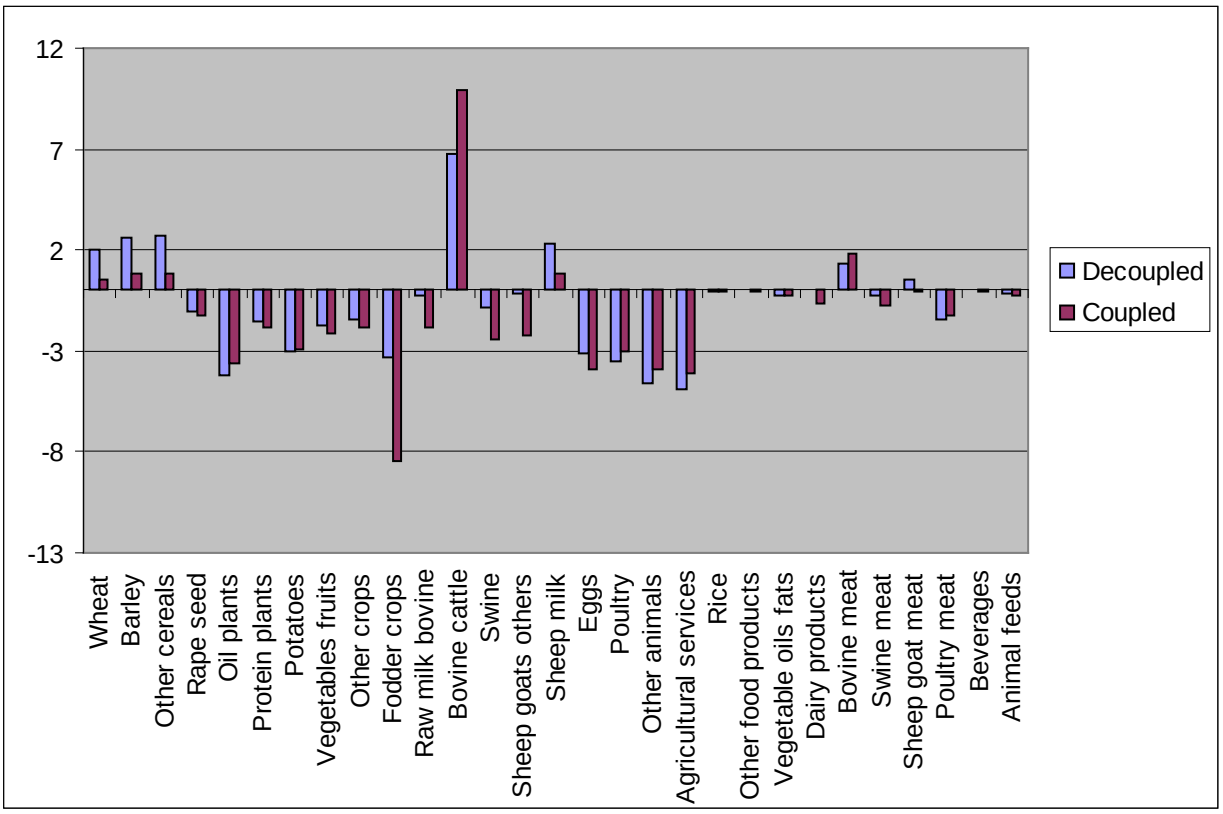
Figure 3– Domestic production of agricultural and food activities, percentage change



Source: own elaboration

At the same time, the reaction of domestic price follows a common pattern across the two scenarios (Figure 4). Again, price of highly subsidized activities (cereals and cattle) increase sharply. In the case of cereals, the increase is between 1 and 2 %, while in the case of bovine the increase can reach almost 10% in the coupled scenario. As a consequence of this steep increase, the price of beef is increasing between 1 and 2%. All other agricultural prices are falling. However, as we have already showed in Section 6.1, private consumption in Ireland experiences an overall positive effect of these changes, which suggests that decreasing prices of current low subsidized commodities outweighs the increase in prices of cereals, bovine and milk.

Figure 4 - Composite price of output of agricultural and food activities, percentage change



Source: own elaboration

6.3. Production factors

The scenarios simulated generate relevant changes in the demand for arable land from agricultural activities. Special attention is given to one of the most affected activities i.e. fodder production, which can take place on both arable and pasture lands. Given that pasture land is

demanded only by fodder crops and under the assumption of fully employment, the shocks do not produce any change for pasture land. Fodder crops activity, due to the reduction of subsidies and the rigidity on the pasture land mobility, will demand less arable land. Given that fodder has highest demand of land and given the reduction in fodder production, return on land drops (Table 8).

Return for all primary factors employed in agricultural production will face negative developments. The drop in production of several agricultural products drops causes a decrease in the demand of production factors. Only non-agricultural labour will experience a positive development.

Given the assumption of full employment, as in the case of land, agricultural wage falls by 9% in the decoupled scenario and by 11% under the coupled scenario, and thus in the income earned by production factors. Again, the coupled scenario generally causes bigger labour movement than the decoupled one.

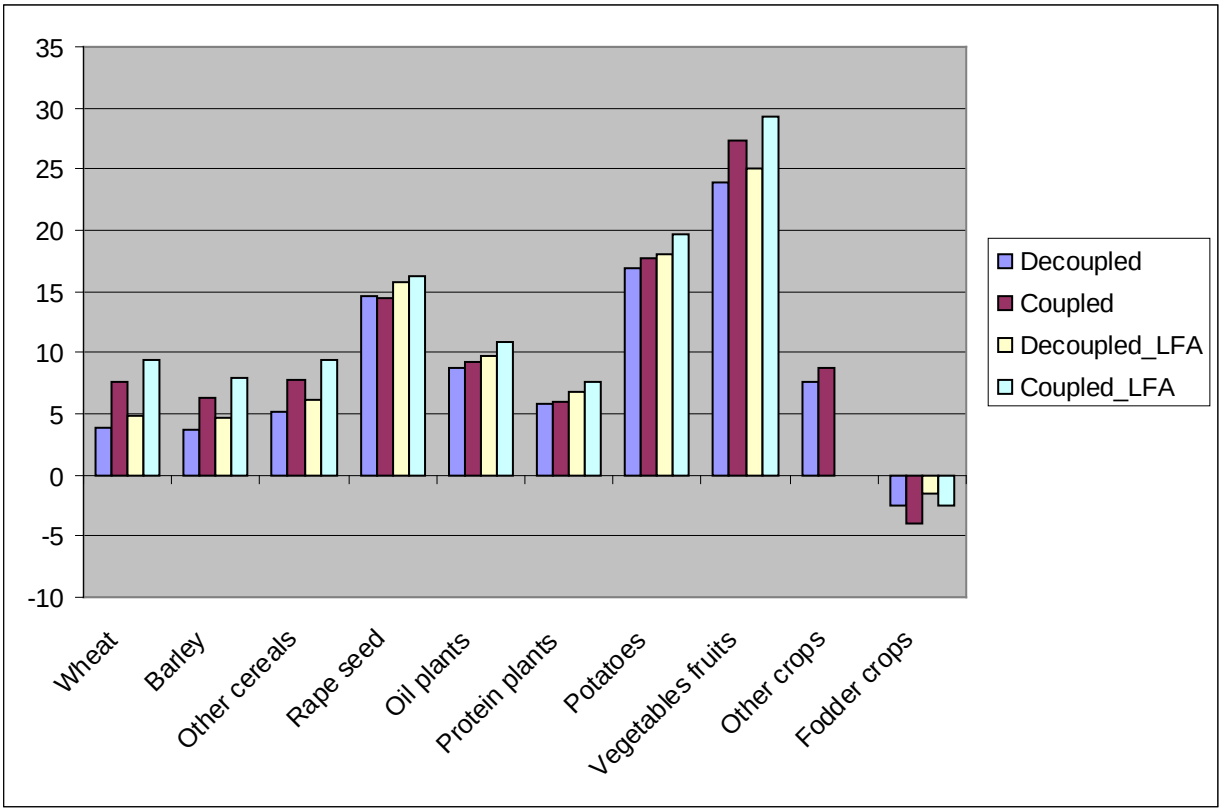
Table 8 – Return on production factors, percentage change

	Decoupled	Coupled
Agricultural Labour	-9.70	-11.46
Non- Agricultural Labour	0.04	0.09
Agricultural Capital	-5.32	-3.94
Non- Agricultural Capital	-0.08	-0.08
Arable Land	-14.39	-14.67
Pasture	-17.03	-18.87
LFA Arable	-15.41	-16.28
LFA Pasture	-17.03	-18.87

Source: own elaboration

The full employment hypothesis assures that all other agricultural activities increase their demand for arable land in both scenarios. In the case of land demand, the higher percentage changes correspond to the smaller initial values such as for fruits and vegetables, potatoes and rapeseed (Figure 5). Comparing the two shocks, the situation of coupled support confirms to be the most distortive scenario. Reallocation of land under the coupled scenario is systematically higher than under the decoupled scenario.

Figure 5- Demand for arable land by agricultural activities, percentage change*

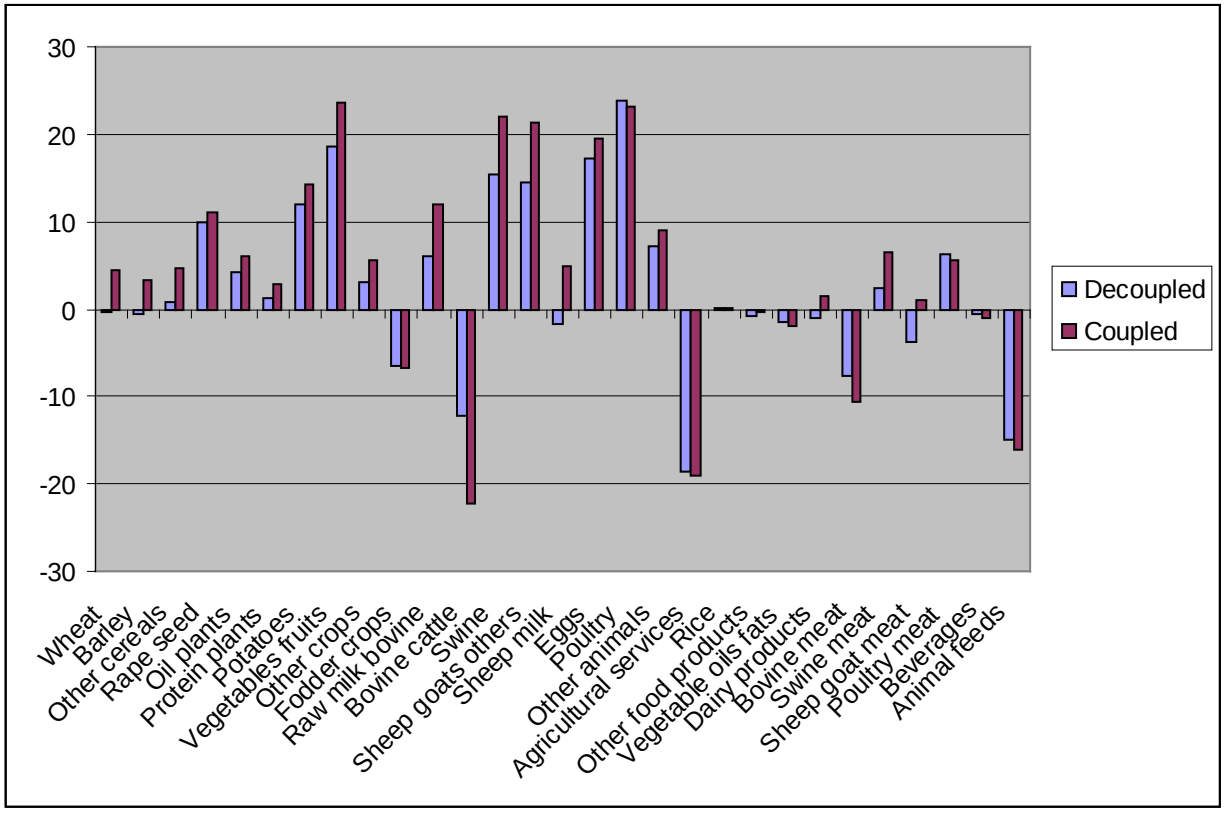


*LFA pasture land and non-LFA pasture land are fully employed and demanded only by the fodder activity, thus there is no change in demand of these types of land.

Source: own elaboration

Labour demand by agricultural and food activities (Figure 6) decreases in those activities which are loosing the most in term of production, whereas it increases in growing sectors. By modelling the agricultural labour as completely segmented from the non agricultural one, we prevent flows from agriculture into other activities. This, short run, assumption once relaxed might provoke the flow of labour leaving agriculture to enter non-agricultural activities (Figure 6). An additional simulation with agricultural labour not fully employed have been performed, the results (available from the authors upon request) do not significantly change.

Figure 6– Demand for labour by agricultural and food activities, percentage change

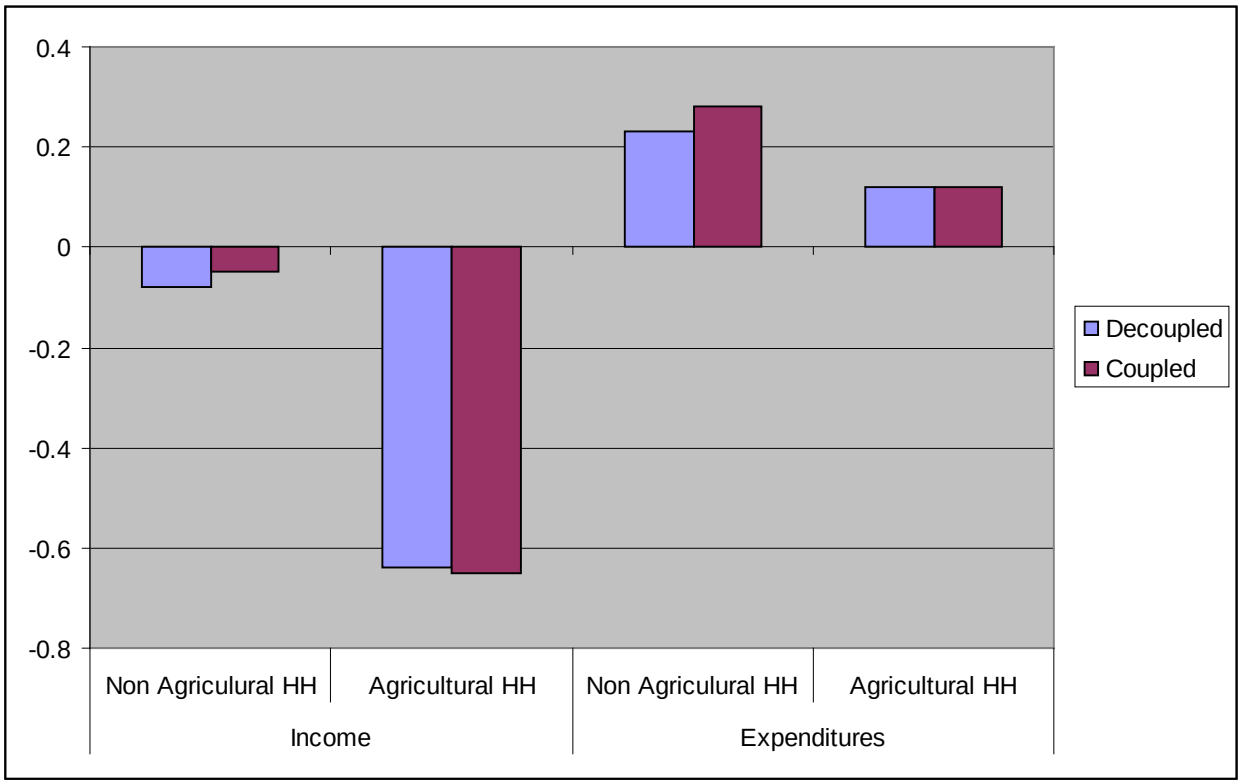


Source: own elaboration

6.4. Income

When focusing on household incomes, changes in production factor have different effects if one splits agricultural and non-agricultural households (Figure 7– Household incomes and expenditures, percentage change. Results suggest that non-agricultural households' income is almost not affected by a CAP budget cut under both scenario, while the drop of income from land, agricultural labour and capital causes a fall of agricultural households' income higher than 0.6%.

Figure 7– Household incomes and expenditures, percentage change



Source: own elaboration

When focusing on household expenditures, both agricultural and non-agricultural households experience an increase in their expenditure levels. One observes that most of the changes under both scenarios are most affecting non-agricultural households, while the expenditures of agricultural households are slighter increasing.

The fall in the households' pre-tax income is accompanied by an increase of their expenditures due to the reduction of direct taxation on households. The 30% cut of the CAP budget, under the hypothesis of fixed government savings, allows the government to reduce direct tax to households of around 3%. This reduction generates the increase in their disposable income and consequently in their expenditures. Again, the expenditure increase under the coupled scenario for agricultural households results higher than under the decoupled one, confirming the more distortive nature of coupled payments.

Last, although both types of households do experience an overall increase in prices, next sub-section shows that the welfare of both groups experiences positive developments

6.5. Welfare

Changes in household welfare are measured in million euros equivalent variation (EV). They follow a similar pattern than the change in GDP. The cut of subsidies under the coupled scenario

gives a further increase of welfare of around 36 million euros to non-agricultural households (Table 9). Thus, these latter are the main winners of the simulated cuts. These households take advantage of the drop in domestic price in most agricultural commodities (Figure 4 - Composite price of output of agricultural and food activities, percentage change).

Agricultural households benefit from cut of subsidies, being coupled or decoupled. There is an analogous positive effect on welfare in both scenarios of about 12.6 and 12.9 million euros respectively. The drop of domestic price is almost entirely compensated by the drop in the return on agricultural production factors. Also we have seen that imports fall while private consumption increases. This suggests an increase in the demand of a range of products which may be reflected as positive effects on welfare of those agricultural households producing the products with increasing demand.

Table 9 – Households welfare, equivalent variation, million euros

	Decoupled payments	Coupled payments
Non agricultural households	191.6	228.3
Agricultural households	12.6	12.9

Source: own elaboration

To obtain a comparative welfare ratio for agricultural and non-agricultural households, we divide the value of the EV by the value of respective household expenditures. From these ratios we observe that non-agricultural households' welfare relative improvements are almost double than those of agricultural households in both scenarios (0.23% vs 0.12% under the decoupled scenario and 0.28% vs 0.12% under the coupled one). It corroborates both that non-agricultural households are the main beneficiary of a flat rate budget cut, and that decoupled payments have less effect on economic aggregates than coupled payments.

7. Conclusive Remarks

The post 2013 CAP has to be adapted to address a range of challenges faced by the European Union and worldwide. One key issue that the CAP reform post 2013 is a new rationale for – and distribution of – decoupled direct payments. Therefore, this paper has evaluated the impact of coupled payments vs. decoupled payments of the European CAP in the agricultural market.

To the best of our knowledge, several studies have covered the effects of coupled vs. decoupled payments but mainly using partial equilibrium models. However, changes undergone in the agricultural sector will have impacts on the macro economy and in non-agricultural sector. We therefore employed a CGE model to assess these effects. With the required modifications of the

STAGE model, we have compared the effects of decoupled and coupled payments as policy instruments in the European agricultural market. In both simulations, cuts in the CAP budget suggest an improvement of welfare for the whole Irish economy (whether they are modeled as coupled or decoupled payments). Results shed some light on product diversification experienced in Ireland, given that farmers would start engaging in the production of agricultural commodities, which in the past were not supported.

Two main further steps are required to complete the research that will go beyond the scope of this paper. Firstly, the policy database has to be extended to be able to model CAP implementation in each European Member State. Secondly, second pillar policies should be better integrated. Given that second pillar measures are mainly focused on investments, a recursive dynamic model will be more suited to take them into consideration.

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APPENDIX

Table A 1– Classification of agricultural and food industry sector in Ireland AgroSAM

	Agricultural Activities		**Food Industry Activities**
A_OWHE	Production of other wheat	A_RICE	Processing of rice, milled or husked
A_BARL	Production of barley	A_OFOD	Production of other food
A_OCER	Production of other cereals	A_VOIL	Production of vegetable oils and fats, crude and refined; oil-cake
A_RAPE	Production of rape seed	A_DAIR	Dairy
A_OOIL	Production of other oil plants	A_BFVL	Production of meat of bovine animals
A_STPR	Production of starch and protein plants	A_PORK	Production of meat of swine
A_POTA	Production of potatoes	A_SGMT	Production of meat of sheep, goats, and equines, fresh, chilled, or frozen
A_FVEG	Production of fresh vegetables, fruit, nuts	A_POUM	Meat and edible offal of poultry
A_OTCR	Other crop production activities	A_BEVR	Production of beverages
A_FODD	Production of fodder crops	A_ANFD	Production of prepared animal feeds
A_COMI	Production of raw milk bovine cattle		
A_LCAT	Production of bovine cattle, live		
A_PIGF	Production of swine, live		
A_SGMI	Production of raw milk sheep goats		
A_LSGE	Production of sheep, goats, horses, asses, mules and hinnies, live		
A_EGGS	Production of eggs		
A_PLTR	Production of poultry, live		
A_OANM	Production of other animals		
A_AGSV	Agricultural service activities		
	Agricultural Commodities		**Food Industry Commodities**
C_OWHE	Other wheat	C_RICE	Processing of rice, milled or husked
C_DWHE	Durum Wheat	C_OFOD	Other food
C_BARL	Barley	C_SUGA	Raw Sugar
C_MAIZ	Maize	C_VOIL	Vegetable oils and fats, crude and refined; oil-cake
C_OCER	Other cereals	C_DAIR	Dairy
C_PARI	Paddy rice	C_BFVL	Meat of bovine animals
C_RAPE	Rapeseed	C_PORK	Meat of swine
C_SUNF	Sunflowers	C_SGMT	Meat of sheep, goats, and equines, fresh, chilled, or frozen
C_SOYA	Soya	C_POUM	Meat and edible offal of poultry
C_OOIL	Other oil plants	C_BEVR	Beverages
C_STPR	Starch and protein plants	C_ANFD	Prepared animal feeds
C_POTA	Potatoes		
C_OTCR	Other crops		
C_GRPS	Grapes		
C_FVEG	Fresh vegetables, fruit, nuts		
C_FODD	Fodder crops		
C_COMI	Raw milk bovine cattle		
C_LCAT	Bovine cattle, live		
C_PIGF	Swine, live		

C_LSGE	Sheep, goats, horses, asses, mules hinnies		
C_EGGS	Eggs		
C_PLTR	Poultry		
C_OANM	Other animals		
C_AGSV	Agricultural services		

Source: own elaboration following the EUROSTAT classification

Table A 2– Imports and exports of agricultural and food commodities (% change)

	Imports		**Exports**	
	Decoupled	**Coupled**	**Decoupled**	**Coupled**
Wheat	-3.58	-4.15	-12.30	-6.52
Durum wheat	-6.23	-6.03		
Barley	-2.67	-4.61	-13.41	-8.20
Maize	-6.37	-5.09		
Other cereals	-0.20	-2.79	-12.06	-6.48
Paddy rice	-4.31	-4.14		
Rape seed	-3.19	-3.76	1.26	1.55
Sunflowers	-0.96	-1.04		
Soybean	-5.65	-5.88		
Oil plants	-12.70	-11.67	9.49	7.35
Protein plants	-12.02	-12.40	-6.43	-5.59
Potatoes	-1.70	-1.55	12.58	12.47
Other crops	-7.05	-7.91	-0.32	1.24
Grapes	0.00	0.13		
Vegetables fruits	-1.89	-2.24	14.22	17.78
Bovine cattle	0.31	0.72	-28.67	-37.83
Swine	0.59	2.00	4.40	13.77
Sheep goats others	-1.88	0.65	-7.48	1.80
Eggs	-3.14	-3.87	11.33	14.79
Poultry	-4.92	-4.00	22.98	19.82
Rice	0.03	0.09	0.24	0.31
Other food products	-0.45	-0.58	-0.70	0.17
Sugar	-3.12	-2.62		
Vegetable oils fats	-10.11	-10.56	8.58	8.37
Dairy products	-1.05	-0.47	-0.89	4.31
Bovine meat	3.84	5.87	-11.66	-15.97
Swine meat	-0.04	0.08	2.81	8.17
Sheep goat meat	2.12	-0.68	-5.81	1.64
Poultry meat	-1.05	-0.84	12.50	10.84
Beverages	-0.64	-0.76	-0.69	-0.31

Source: own elaboration