Effects of Cap Reform on Regional Employment in the EU.

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EFFECTS OF CAP REFORM ON REGIONAL EMPLOYMENT IN THE EU.

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Abstract- **CAP reform affects employment in the agricultural sector as well as in other sectors of the regional economy through changes in regional and sectoral competitiveness and resulting re-allocation of fixed resources. However, analysis of the relationship between CAP reform and total regional employment for the EU as a whole are scarce. In this paper a rather ad-hoc method is proposed to fill this gap. Both the CAPRI model and the LEITAP model is used. Both models are linked through an econometrically estimated and scenario specific relationship between agricultural income and employment in LEITAP. LEITAP is also used to analyse the employment changes at regional level in the rest of the economy. LEITAP results are regionalized using sectoral employment shares per region in 2020 in the reference scenario. This paper presents and discusses the strengths and the weaknesses of the proposed ad-hoc downscaling approach.**

Key words- **CAP, employment, model linking.**

I. INTRODUCTION

The purpose of the Scenar 2020 study is to identify the future trends and driving forces that will be the framework for the European agricultural and rural economy on the horizon of 2020 [1]. Three scenarios have been retained, identified by the terms *baseline (or moderate liberalization)*, *regionalisation* and *liberalisation*. The *Moderate liberalisation* scenario is based on the continuation of the trends in exogenous drivers, and assumes the development of agricultural and rural policy according to current policy objectives, including the successful outcome of the Doha Round negotiations. Regionalisation is a policy framework which refers to the possibility that, in the absence of a successful conclusion of the Doha Round, then not only will further bilateral and multi-lateral negotiations continue but also more encouragement will be given at the same time to promoting the production of commodities in the internal market. *Liberalisation* – also a policy framework – implies that the current context of moving towards more open markets at the international level will be strengthened. In this scenario, all forms of market and trade policies and income support – that are related to agricultural commodity production – will be abolished in the EU and the rest of the world.

The purpose of this paper is to analyse the sectoral employment developments at the regional level in the EU25 due to CAP reforms in 2020. In doing so, different types of models are used.

	Agricultural	Rest of economy
Global	LEITAP	
NUTS2	CAPRI	downscaling/model linking

[1] TSA: Time series analysis

Figure 1: Schematic overview of the models: geographical and sectoral coverage.

Figure 1 gives an overview of some of the models that are used in the Scenar 2020 project. The global economy-wide dimension is covered by the economic LEITAP model (Figure 1). CAPRI is providing more agricultural detail for the EU-25 countries and it is also distributing this impact to the regional (NUTS2) level. The gap in our (and the EU research community) modelling framework is what happens with the other sectors (i.e. rest of the economy) at the regional level. This is important for rural development because an agricultural decline in a region is especially a problem when there is no absorption capacity of the redundant agricultural labour in the other sectors of the regional economy. In this paper a rather ad-hoc methodology is proposed to fill this gap. The method is based on CAPRI and GTAP behaviour, sectoral shares in total regional employment and an econometrically estimated relationship between agricultural income and agricultural employment derived from GTAP applications. This relationship is applied to income changes from CAPRI.

The paper is organised as follows. The next section discusses the methodological approach in more detail. In section three some important data are discussed. Section four describes the scenarios in more detail. In section five we present the results focusing on regional employment in 2020 in different CAP reform scenarios as compared to a 2020 reference. Finally in section six strengths and weaknesses of the approach are discussed.

II. METHODOLOGICAL APPROACH

A. Model descriptions

LEITAP is a global computable general equilibrium model that covers the whole economy including factor markets and is often used in WTO analyses [2] and CAP analyses [3]. More specifically, LEITAP is a modified version of the global general equilibrium Global Trade Analysis Project (GTAP) model. Agricultural policies are treated explicitly (e.g. production quotas, intervention prices, tariff rate quotas, (de)coupled payments). Information is used from the OECD's Policy Evaluation Model (PEM) to improve the production structure [4] and a new land allocation method, that takes into account the variation of substitutability between different types of land [5], as well as a new land supply curve are introduced [6,7].

Another important assumption affecting results presented in this paper has to do with the treatment of labour and capital markets. If labour were perfectly mobile across domestic sectors, we would observe equalized wages throughout the economy for workers with comparable endowments. This is clearly not supported by evidence. Wage differentials between agriculture and non-agriculture can be sustained in many countries (especially developing countries) through limited off-farm labour migration [8]. Returns of assets invested in agriculture also tend to diverge from returns of investment in other activities. To capture these stylized facts, we incorporate segmented factor markets for labour and capital by specifying a CET structure that transforms agricultural labour (and capital) into non-agricultural labour (and capital). This specification has the advantage that it can be calibrated to available estimates of agricultural

labour supply response. In order to have separate market clearing conditions for agriculture and non-agriculture, we need to segment these factor markets, with a finite elasticity of transformation. We also have separate market prices for each of these sets of endowments. The economy-wide endowment of labour (and capital) remains fixed, so that, for example, any increase in supply of labour to manufacturing has to be withdrawn from agriculture, and the economy-wide resources constraint remains satisfied. (Similarly for capital). The elasticities of transformation can be calibrated to fit estimates of the elasticity of labour supply from OECD [9].

CAPRI consists of a supply model and a market model that are iteratively linked to each other [10]. The supply model features detailed descriptions of agricultural supply in about 205 regions in Europe. In the supply model, agricultural production in European regions is determined by a mathematical programming model, which maximizes gross value added of a representative regional farm subject to technological constraints and a behavioural quadratic cost term. The quadratic cost term is derived from Positive Mathematical Programming (PMP) [11], but the methodology has been improved in several respects [12]. The market model features detailed descriptions of different demand components of about 40 primary and processed agricultural products, covering about 40 countries or country blocks in 18 trading blocks. Model results include the activity levels per region and income indicators as variable costs, revenues, gross margins, etc., both for individual production activities and for regions, according to the methodology of the EAA.

B. Downscaling and 'model linking'

Both CAPRI and GTAP can not analyse the effect of CAP reform scenarios on total *regional* employment in 2020. A downscaling method and a model linking method are proposed, below, to solve this problem.

Downscaling

The LEITAP model gives economy wide employment effects at national level, while a regional breakdown is lacking. This problem is overcome by assuming that each sector within a region within the Member State has the same employment change as the national change in employment per sector. Next total change in regional employment is based on the change per sector and the employment share per sector per region. Sectors included in LEITAP are agriculture, industry and services. The change in total regional employment in region r in scenario i in 2020 can be written as:

$$\%total\_change_{r,i} = \sum_n \%change\_ag_{n,i} * share\_ag_{r,n} + \sum_n \%change\_ind_{n,i} * share\_ind_{r,n} + \sum_n \%change\_serv_{n,i} * share\_serv_{r,n} \quad (1)$$

Where indices i (1 (moderate liberalization), 2 (regionalization) and 3 (liberalization)), r and n refer to scenarios, regions and countries respectively. Where $\%change\_ag_{n,i}$ is percentage change in agricultural employment in country n and scenario i, $\%change\_ind_{n,i}$ and $\%change\_serv_{n,i}$ are percentage changes in employment in industry and services in country n and scenario i respectively. Variables $share\_ag_{r,n}$, $share\_ind_{r,n}$ and $share\_serv_{r,n}$ are employment shares in total employment in region r and country n for agriculture, industry and services respectively in the reference scenario in 2020. In this paper the regionalization scenario is used as the reference in 2020.

'Model linking'

The regional agricultural employment effects are derived from CAPRI. The major motivation to use CAPRI is that the CAPRI model has more functionality in representing specific agricultural policies such as premiums or quotas and has a considerably more disaggregated representation of the agricultural sector regarding product and regional differentiation. Consequently, the CAPRI

model is generally more suitable to simulate impacts of changes in agricultural policies on the agricultural sector [13].

A shortcoming of CAPRI is that labour markets are lacking. Hence, employment effects are not calculated directly. To solve this problem we make use of the GTAP scenario-specific relationship between agricultural income and agricultural employment. The GTAP results of the moderate liberalisation, regionalisation and liberalisation scenario are used to estimate econometrically a log-linear equation between agricultural income and agricultural employment. This is done at country level. The log-linear relationship between agricultural income and agricultural employment at national level looks as:

$$\ln W_{i,n} = \alpha_n + \varepsilon_n \ln(I_n) \qquad (2)$$

Where α_n and ε_n are parameters to be estimated. $W_{i,n}$ is the agricultural employment per scenario i (i=1 (moderate liberalization),2 (regionalization),3(liberalization)) in country n and $I_{i,n}$ represents agricultural income per scenario i and country n. It is assumed that this equation at the country or national level can also be applied at the regional (r) level. Next, this equation is used to calculate regional employment effects for the agricultural sector, using regional agricultural income from CAPRI as the independent variable. From this the percentage change in agricultural employment in 2020 in comparison to a reference in 2020 can be calculated. Finally, it is proposed to simply replace GTAP results at national level for the CAPRI results at regional level. This would change equation (1) as follows:

$$\begin{aligned} \%\text{total\_change}_{r,i} = & \sum_n \%\text{change\_ag}_{r,n,i} * \text{share\_ag}_{r,n} \\ & + \sum_n \%\text{change\_ind}_{n,i} * \text{share\_ind}_{r,n} \\ & + \sum_n \%\text{change\_serv}_{n,i} * \text{share\_serv}_{r,n} \end{aligned} \qquad (3)$$

Where $\%\text{change\_ag}_{r,n,i}$ is percentage change in employment in agriculture in region r in country n in scenario i.

III. DATA

This section discusses some key variables. Firstly, the development of the regional employment shares per sector (agriculture, industry and services) until 2020 (see equation (1) and (3)). Secondly, the elasticity between employment and income is discussed as resulting from the econometric estimation. (see equation (2)).

A. Sectoral employment shares per region

The basic data on regional employment, used in this paper, are mainly taken from the NewCRONOS database of Eurostat. Because data where needed on a regional level (NUTS 2 and NUTS 3) most data are obtained from the REGIO domain in the NewCRONOS database.

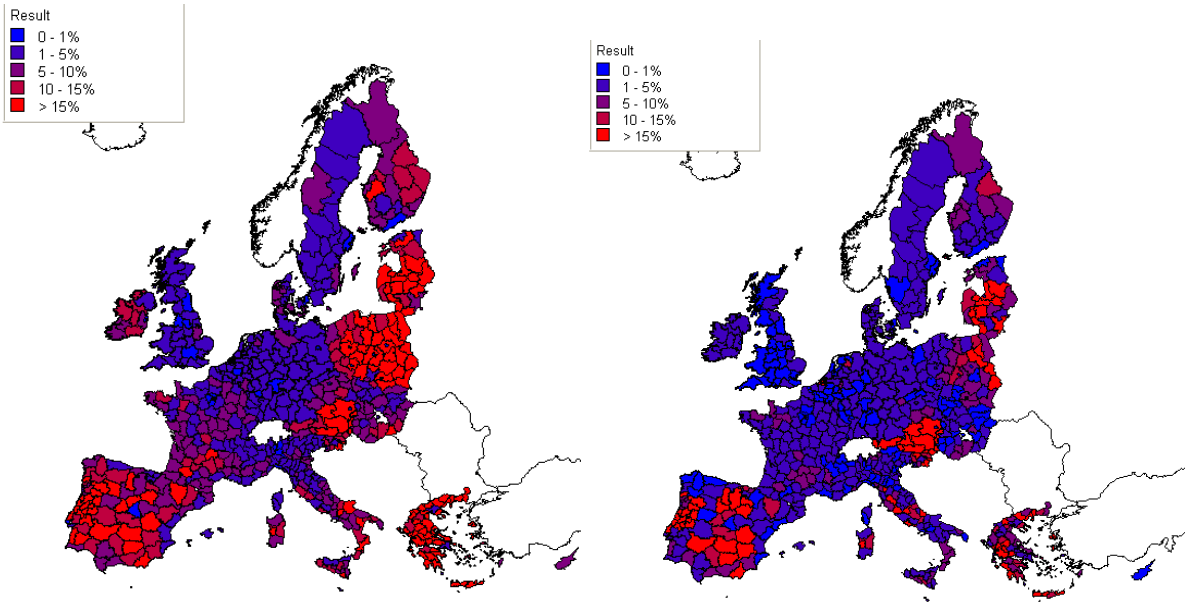
To process the basic data originating from Eurostat and the model results for the different scenarios we first transformed all the available information to HARM regions[1]. Secondly we determined for each region and for each sector (agriculture, industry and services) the growth rate for employment on the basis of the development between 1998 and 2002. This is a rather short estimation period. However, if trends were calculated from say 1990 onwards, in many cases this would provoke dramatic decreases in agricultural employment if these trends were extrapolated until 2020. So, using the period 1998-2002 this trend is dampened

[1] These HARM regions are created by the Dutch Agricultural Economics Research Institute (LEI). The regional division of the HARM regions is constructed in such a way that they can capture (a) the regional division used by Eurostat in their REGIO domain (NUTS regions) (b) the regional division used by DG-AGRI in their Farm Accountancy Data Network (FADN regions) and (c) the regional division of the Farm Structure Survey (FSS regions and districts).

somewhat. Moreover, long term time trends are not available for the EU10. We still have the problem of changes in the definition of 'workers' and 'agriculture' over time, such as, for example, including forestry or certain types of horticulture in agriculture or not[2].

The resulting regional shares of employment in agriculture in 2004 and in 2020 are presented in Map 1. Map 1 shows a decrease in the share of agriculture in total regional employment going from 2004 to 2020. This decrease is relatively big in regions in Ireland, Spain and Portugal and in Eastern Europe.

[2] As an example, in regions in Austria an increase in the share of agricultural employment in 2020 was found as compared to 2004. This is the result of the extrapolation of the increase in employment in the statistics in the period 1998 – 2002. The latter probably results from changes in definition. This could not be resolved before submitting the paper.



Map 1.: Share of agriculture in total regional employment in 2004 (left hand side) and in 2020 (right hand side).

B. Relationship between agricultural income and employment in GTAP: results of the econometric estimation

Parameter ε_n in equation (2) equals the country specific point elasticity between agricultural employment and agricultural income estimated from the LEITAP applications. Results are presented in table 1. The elasticity shows the effect of a 1% income change on percentage change in employment. In general these elasticities are rather low. There are several explanations for this:

- employment in GTAP is related to the wage rate and very indirectly to income;
- segmentation of land, capital and labour markets between agriculture and non-agriculture;
- differences in input cost shares (land, capital, labour and intermediates) in total costs per country.

Income is the sum of the revenues to the fixed resources. In general the major impact of the CAP reform scenario is on the land rent [1]. This lowers income but within the framework of a CGE, it makes the production factor land also competitive compared to other production factors and it keeps production levels up. The higher the share of land in total input costs, the bigger this effect probably is. High elasticities are found for the Netherlands and Belgium/Luxembourg. Low elasticities are found for Greece, Austria, Portugal, Cypris/Malta and the Baltic States.

Table 1 Elasticity between Agricultural employment and Agricultural income per country estimated from GTAP applications.

Belgium; Luxembourg.	0.81
Denmark	0.42
Germany	0.44
Greece	0.07
Spain	0.26
France	0.36
Ireland	0.43
Italy	0.39
The Netherlands	1.22
Austria	0.11
Portugal	0.11
Finland	0.26
Sweden	0.24
United Kingdom	0.56
Cyprus; Malta	0.17
Czech Republic	0.32
Estonia; Latvia; Lithuania	0.04
Hungary	0.54
Poland	0.50
Slovenia	0.22
Slovakia	0.30
Bulgaria; Romania	0.19

IV. SCENARIO DESCRIPTION

An assumption that has guided the preparation of the Scenar 2020 scenario study is that there are two levels of drivers that will influence scenario building (Nowicki et al. 2006). The first level is a set of *exogenous* drivers; these are drivers that are not directly influenced by policies, or at least not in the time horizon of the Scenar 2020 study (that is, up to 2020). As presented in Table 1, exogenous drivers are population growth, macro-economic growth, consumer preferences, agri-technology, environmental conditions and world markets[3]. The second level is a set of *policy-related* drivers, and these will certainly have a discernable effect within the Scenar 2020 time horizon. They are EU agricultural policies, enlargement decisions and implementation, WTO and other international agreements and environmental policy.

Several choices have been made for the development and analysis of scenarios. The first is to have a baseline scenario that is based on the exogenous drivers. The second is that the policy-related drivers are then coupled to the baseline scenario in three iterations. The first iteration is the *moderate liberalization scenario*, with modifications over time of current policies that are reasonably certain to happen according to the current political situation. Within the scenario this means a rather high degree of market liberalization. The second iteration is a *regionalisation scenario*, in which there is a sustained policy preference to promote regional economic strength and social welfare; to some extent this is also an emphasis on the maximum degree of support for agricultural supply that is possible under the current, and likely, WTO framework. The third iteration is a *liberalisation scenario*, in which policy intervention in the economy – and in social welfare, including environmental protection – is reduced to the minimum that would be socially acceptable.

Contrary to the Scenar 2020 study, the regionalization scenario is considered as the reference scenario. This is done because the regionalization scenario more closely extrapolates current policies into the future[4].

[3] World markets are partly endogenous in this study as we use a global economy-wide model in which world markets are dependent on macro-economic and population developments, preferences shifts, technological change and policy changes.

[4] Reinforcement of environmental legislation in the regionalization scenario is maybe an exemption. However, the impact of changes in environmental policies on agricultural production is in fact neglected, both in CAPRI as well as in GTAP.

(a) Based on the exogenous drivers

Assumptions	Demographics	Macro-economic growth	Consumer preferences	Agri-technology	World Markets
Baseline	Major population trends as observed in the past	Moderate growth as seen in the trends; Increasing trend for labour market liberalisation	More demand for value added and increasing absolute spending per capita; Consumption of organic and regional food as observed in the past	Continuous trends in cost saving technical progress; Biotechnology; GMO	Outcome depends on other exogenous drivers. Trends in agri-markets, generally, as observed in OECD/FAPRI studies. Change from these trends due to different assumptions on exogenous and policy-related drivers.

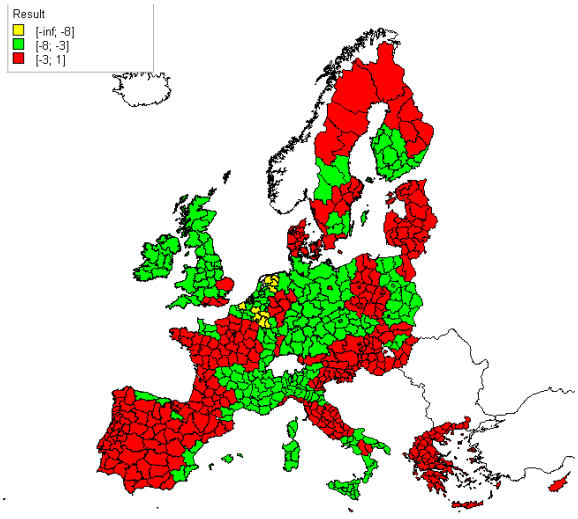
(b) Based on the policy-related drivers

Assumptions	CAP			Biofuels	Enlargement	WTO and other international agreements	Environmental policies impact on agriculture
	Market policies	Direct payments	Rural development policy				
Baseline	Balanced markets, i.e., keeping public intervention stocks at 1 to 2% of domestic consumption; if stocks are too high support prices will be decreased	Financial discipline and 25% modulation	Taking into account the new financial perspective	Continuation of EU Biofuels Strategy	EU-25 plus the accession of Bulgaria, Romania, Turkey and the Western Balkans	EU offer	Continuation of existing environmental legislation
Regionalisation	Existing CAP	Financial discipline and 5% modulation	Significant increase in funding of rural development through all EAFRD axes	Higher policy support to produce biofuels	Baseline	No WTO agreement / bilateral approach	Reinforcement of environmental legislation
Liberalisation	No internal support policies	Removing direct agricultural payments	Rural development is funded according to EAFRD provisions: decrease in funding of all EAFRD axes	No per hectare subsidies for biofuels	Baseline	Removing import tariffs	Partial withdrawal of environmental legislation

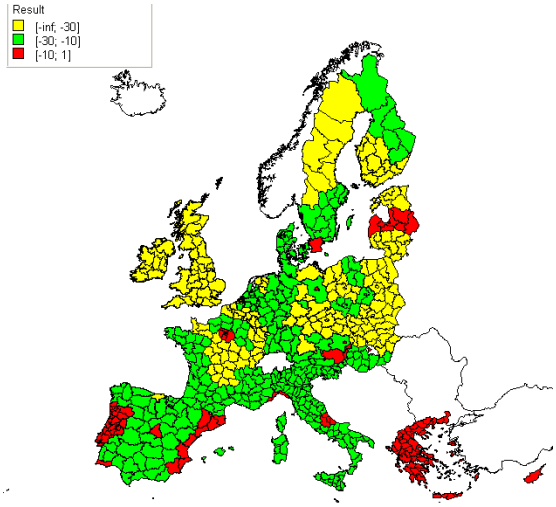
Fig. 2 Scenario assumptions

V. RESULTS

Maps 2a and 2b show the impact of the moderate liberalisation scenario and the full liberalisation scenario respectively on agricultural employment at regional level. Effects on regional agricultural employment depend on the scenario, the composition of the regional agricultural sector and the elasticity between agricultural employment and income (Table 1). In Sweden and in the Baltic states this elasticity is rather small. This means that labour stays in agriculture despite the change in income forecasted by CAPRI. From the other hand in the Netherlands and in Belgium this elasticity is relatively large. Combined with high shares of crops and animals heavily involved into the CAP reform scenarios, this gives relatively large changes in employment. This is especially the case in the Northern part of the Netherlands (sugar beets, starch potatoes, dairy) and in the Belgian Ardennes/Luxemburg (beef cattle). In Southern European countries the share of vegetables and permanent crops in total production value and income is relatively high. Income in this sector is relatively less affected by the moderate liberalization and liberalization scenario.



Map 2a Changes in regional agricultural employment in the moderate liberalization scenario compared to regionalisation scenario



Map 2b Changes in regional agricultural employment in the liberalisation scenario as compared to the regionalisation scenario

Moreover, in Spain and Greece the elasticity between employment and income is also relatively small.

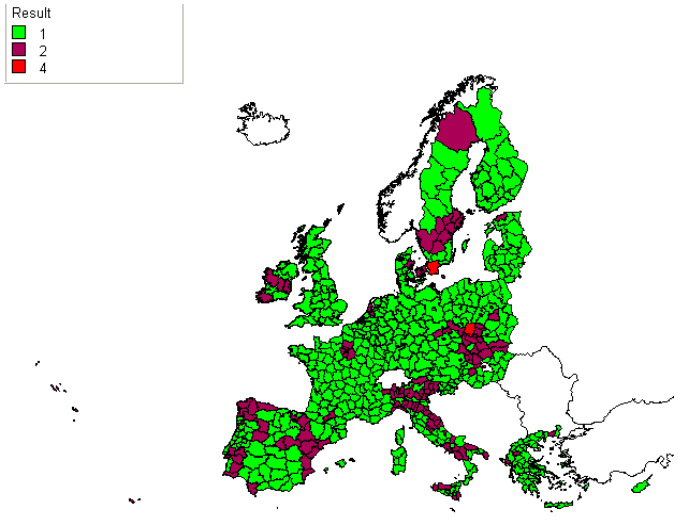
In the full liberalisation scenario the effect on agricultural employment is strengthened (Map 2b).

Table 3 shows the sectoral and weighted total employment effect of the moderate liberalisation scenario as compared to the regionalization scenario in 2020 at the national level. In general the employment effects in the industry and services sector are small. The effects can be positive or negative. This shows the diversity of the sectors and the countries. In a limited number of countries the decrease in the agricultural employment is offset by an increase in employment in the other sectors. This is the case for Denmark, Ireland, Italy, Cyprus, Malta, Austria, Slovakia and Sweden. The largest decrease in total employment is found for Portugal, Slovenia, Belgium and Germany. The explanation for Portugal and Slovenia is especially the relative high share of agriculture in total employment.

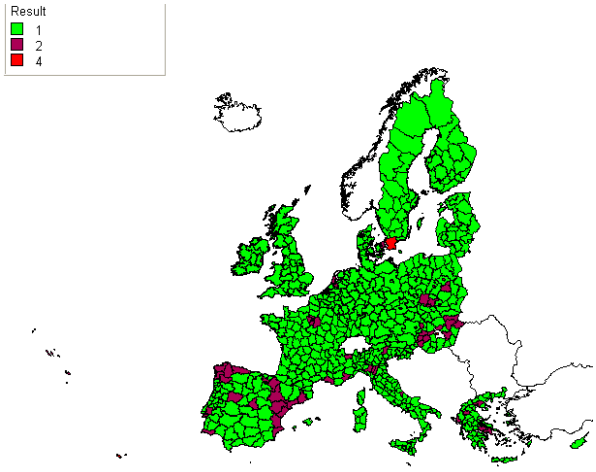
Table 3 Percentage change in employment in 2020 in the moderate liberalisation scenario as compared to the reference (= regionalisation scenario)

	agriculture employment (CAPRI)	industry employment (GTAP)	services employment (GTAP)	Total employment
Belgium	-9.42	0.22	-0.09	-0.11
Czech Republic	-3.81	-0.08	0.10	-0.01
Denmark	-2.26	-0.39	0.15	0.03
Germany (including ex-GDR from 1991)	-4.04	0.17	-0.09	-0.10
Estonia	-0.74	-0.22	0.06	-0.02
Greece	-0.51	0.16	-0.05	-0.05
Spain	-2.36	0.20	-0.04	0.00
France	-2.91	0.09	0.00	-0.03
Ireland	-4.72	0.32	0.08	0.04
Italy	-3.05	0.33	0.00	0.01
Cyprus	-0.82	0.00	0.05	0.04
Latvia	-0.36	-0.22	0.06	-0.05
Lithuania	-0.52	-0.22	0.06	-0.07
Luxembourg (Grand-Duché)	-9.42	0.22	-0.09	-0.07
Hungary	-1.93	0.01	0.00	-0.03
Malta	-0.65	0.00	0.05	0.02
Netherlands	-7.15	-0.14	0.05	-0.09
Austria	-1.09	-0.09	0.09	0.02
Poland	-2.79	-0.07	0.05	-0.05
Portugal	-1.26	0.14	0.00	-0.19
Slovenia	-1.27	-0.16	0.06	-0.14
Slovakia	-1.90	-0.14	0.14	0.06
Finland	-2.63	-0.01	0.01	-0.06
Sweden	-2.69	0.04	0.05	0.01
United Kingdom	-3.78	0.21	-0.04	-0.03

Further analyses of the results of the full liberalization scenario reveals that only Spain, Cyprus and Malta experience an increase in total employment as compared to the regionalization scenario. Map 3a and Map3b summarize the results and give insights into changes in total employment at the regional level in the moderate liberalization and full liberalization scenario.



Map 3a: Changes in total regional employment in the moderate liberalization scenario compared to regionalisation scenario. Legend: 1 = decrease in total employment, 2 = increase in total employment



Map 3b Changes in total regional employment in the full liberalization scenario compared to the regionalisation scenario in 2020. Legend: 1 = decrease in total employment, 2 = increase in total employment.

Maps 3a and 3b basically show that in most regions regional employment in 2020 will be lower in the moderate liberalisation and the liberalisation scenario as compared to the regionalisation scenario. This is especially the case in the liberalisation scenario.

VI. DISCUSSION AND CONCLUSIONS

GTAP results can be quite different from CAPRI results [1]. Differences in results are explained by differences in endogenous and exogenous variables, structural and behavioural relationships and underlying data. In this paper it is proposed to simply replace agricultural employment figures from GTAP by results derived from CAPRI, without a formal link between the two models. So the CAPRI results do not affect the GTAP results and there is no feed back from changes in the agricultural sector to changes in employment in other sectors of the economy. It could be argued that the interaction between agriculture and the rest of the economy is limited. Hence, results would not change dramatically if a formal link was reached. Off course a formal link is preferred. Currently a research project is going on to establish a more formal link between CAPRI and GTAP. This is done within in the SEAMLESS framework (http://www.seamless-ip.org).

In this paper we do not take into account the heterogeneity of the non-agricultural sectors at the regional level. More qualified quantitative models are required to address this. This analysis could be based on regional input/output models or on regional CGE models which explicitly cover non-agricultural sectors.

This paper focuses on effects on regional employment, not on income. Nevertheless, we should mention that income disparity increases in our analyses. Wage differentials between agriculture and non-agriculture can be sustained in many countries (especially developing countries) through limited off-farm labour migration. This is, *inter alia*, dependent on the human capital of the farmers and the growth of the other sectors. The higher the mobility of agricultural workers to other sectors the closer the wage rate will be to the wage rate of other sectors.

From our analysis we would like to draw some conclusions:

- Agricultural employment in Europe decreases due to further liberalization;
- Taking into account autonomous developments, the composition of the agricultural sector and the working of the local labour markets, it is very unlikely that a decrease in agricultural employment in the full liberalisation scenario is compensated by an increase in the employment in the non-agricultural sectors.
- Compared to the regionalization scenario, income disparity increases in all scenarios in almost all regions;
- Further integration of CAPRI and GTAP will be helpful to model economy-wide effects of agricultural and trade policies
- Regional CGE models are necessary to decrease aggregation bias at regional level.

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