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**System for Environmental and Agricultural Modelling;  
Linking European Science and Society**

**A typical application of SEAMLESS-IF at macro  
level: a trade liberalization scenario applied to the EU**

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## General information

Task(s) and Activity code(s): T6.3 – A6.3.4, A6.3.5

Input from (Task and Activity codes): T6.1 - A6.1.1; T6.2 – A 6.2.3

Output to (Task and Activity codes): all WPs

Related milestones: M6.2.3, M6.3.4.1

## Executive summary

This deliverable describes a typical macro level application of SEAMLESS-IF. This application serves two main purposes within the SEAMLESS project. First of all it served as Test Case 1 (TC1) to test the various prototypes delivered by the SEAMLESS project and guide the development of the framework by indentifying the requirements for a real-world application of the framework for ex-ante policy analysis. The second purpose of this application and main focus of this deliverable is to illustrate the potential use of SEAMLESS-IF to address macro-level policy questions across domains and scales.

This deliverable builds on deliverables prepared throughout the SEAMLESS project, compiling and updating the essence of each of these individual deliverables to a final application with SEAMLESS-IF.

The deliverable highlights the potential of SEAMLESS-IF to analyze macro level policies. For this purpose three scenarios have been defined, featuring different degrees of trade liberalization. It the first scenario we analyse the effects of an abolition of EU's export subsidies for agricultural commodities. In the remaining two scenarios this subsidy abolition is combined with two proposals for tariff reductions. We analyze the effect of the different scenarios on the welfare of the different actors in the agricultural sector of the EU as well as on some environmental and social issues. Regarding the total welfare of the agricultural sector, we show that it increases throughout all scenarios for the EU mainly due consumers gaining from lower prices which compensate the income losses of farmers.

We find that welfare effects are not equally distributed among EU Member States. Especially agricultural income changes vary across the different regions of the EU, where regions with a higher share in animal production suffer more than those specialized on crop production. This is due to the animal sector being affected the most in the trade liberalization scenario since for example the beef sector is still heavily protected in the EU.

When analyzing the income effects on farm type level, we also observe differences across types and regions, due to different specialization and production structure as well as biophysical conditions. This is also true for nitrate leaching, which is chosen as an indicator to asses environmental effects. While we observe reduced nitrate leaching across all NUTS2 regions of the EU, some farm types show increasing nitrate leaching when switching from less nitrate intensive crops to more intensive ones.

Finally an assessment of total labour use in agriculture shows the social dimension of integrated assessment with SEAMLESS-IF. We find that trade liberalization negatively impacts the labour demand in agriculture which may place additional stress on the viability of rural communities.



Pulling all results together we find a diverse impact of trade liberalization both across scales as across domains. At EU level we find a positive impact on welfare and nitrate leaching, but a negative impact on employment which may affect the viability of rural communities. The aggregate impacts, however, mask a wide variety of impacts. Consumers for example benefit while agricultural producers lose. Furthermore countries and regions within the EU are differently affected in three domains. For some farm types, for example, we find an increase in nitrate leaching which may cause local environmental concerns despite an average positive impact.

The analysis illustrates that expanding the scope of the analysis across scales and domains results in a rich and diverse picture of impacts. Such a broader view inhibits simple recommendations in terms of trade liberalization being either a good or a bad since the conclusion depends on the perspective taken. Apart from resulting in a nuanced view on the policy assessed, the results also beckon further explorations of additional (regional) policies with SEAMLESS-IF which could modify the impacts of trade liberalization for example on labour use.

All in all the application illustrates the potential of SEAMLESS-IF for integrated assessment across scales and suggests that analyses may not be one-off assessments of a policy but instead develop in several rounds searching for a combination of policies at different levels and in different domains to achieve different policy objectives in the economic, environmental and social domain.

# 1 Introduction

This deliverable describes a macro-level application of SEAMLESS-IF to analyse the impact of trade liberalization on the EU. The application illustrates the potential of SEAMLESS-IF by analyzing effects at different scales (from global to farm level) and across different domains (economic, biophysical and social).

The application focusing on trade liberalization illustrates a typical question of EU policymakers dealing with a macro-level policy since EU trade policy is determined in Brussels by the EU commission. This policy has ramifications that may differ for EU member states and regions within member states which affect the political feasibility of the agreement. Furthermore the economic policy may have environmental and social impacts which could conflict or support other policies (at EU, national or regional level). These multi-scale and cross-domain concerns warrant the use of SEAMLESS-IF.

Apart from representing a realistic macro-level policy question, the application also provides an elaborate test of SEAMLESS-IF. This application requires use of all backbone-chain models thus providing an elaborate test of the full system. Furthermore, although the policy being assessed is an economic one, the assessment of environmental and social indicators will provide a test of the capacity of SEAMLESS-IF for integrated assessments across different domains.

## 1.1 Background on the trade-liberalization policy

The trade liberalisation scenario focuses on the evaluation of a possible outcome of the World Trade Organization (WTO) negotiations (Doha Development Round) that aim at reducing international barriers to trade. The example aims at assessing the impact of changes in border protection on European agriculture, consumers of agricultural goods and the income from agricultural tariffs. The analysis is based on the “G20 proposal on market access”<sup>1</sup> which provides a certain formula for the reduction in border protection depending on the initial level of protection and the developing status of a nation. The G20 is a group of developing countries emphasizing special and differential treatment for developing countries constitutes an integral part of all elements of the negotiations. In terms of ambition their proposal lies in between the proposals made by the EU and other (importing) countries protecting agriculture, and the proposals made by exporting countries like the US that aim at a strong reduction of agricultural trade barriers.

The G20-proposal dates from December 2005 and has been outdated by recent developments in the WTO negotiations. Especially during the last ministerial meeting in July 2008 and the planned (but cancelled) follow-up meeting in December 2008 there have been significant strides towards a final agreement which included changes in the G20 tariff reductions. In the application we will analyze both the G20 proposal as well as the tariff reductions agreed to in December 2008 when the WTO negotiations broke down again. Analyzing both tariff reduction scenarios provide a sensitivity analysis of the results to changes in the tariff reductions. Such a sensitivity analysis is essential in the case of trade analyses where reduction percentages tend to change with every WTO meeting. Understanding the general

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<sup>1</sup> [http://www.g-20.mre.gov.br/conteudo/proposals\\_marketaccess.pdf](http://www.g-20.mre.gov.br/conteudo/proposals_marketaccess.pdf)

direction of effects and their size in relation to the tariff cuts thus provides useful information for negotiators.

A second reason for analyzing both proposals is the development within the EU on the WTO negotiations. Negotiations are done by the EU commission representing all member states. During the July 2008 ministerial the negotiating position of the EU commission became weakened by explicit opposition of several EU member states led by France and with Ireland and Poland as other vocal members. These strongly pro-farm member states considered that the EU commission gave away too much in terms of protection of EU agriculture. Although the trade liberalization analyzed here is limited to agriculture and therefore does not provide a complete assessment of a potential WTO agreement that would cover manufacturing and services as well, it does give an insight if the current trade liberalisation proposal is indeed much worse for EU agriculture as some member states claim. Analyzing the outdated G20 tariff reduction proposal therefore also makes sense in terms of policy support.

## 1.2 A short outline of policy-analysis with SEAMLESS-IF

SEAMLESS-IF provide a computerised tool for ex-ante quantitative policy analysis. In order to be able to use the quantitative tool the policy question of interest needs to be defined in parameters such that an implementation in the computer system is possible. This is done by defining a scenario, defined within SEAMLESS as “a consistent framework of exogenous assumption and endogenous-related variables describing the possible future of systems”. Within SEAMLESS considerable effort has been spend on arriving at a common and unambiguous definition of scenarios that can be used to analyze policy issues with SEAMLESS-IF. This has resulted in a guideline for describing a project in SEAMLESS-IF that is consistent with the SEAMLESS framework of analysis. For more information of the project definition see Janssen et al. (2007). For an elaborate discussion of the definition of scenario in SEAMLESS and several illustrations with different types of applications see Belhouchette (2007).

The approach to policy analysis in SEAMLESS-IF is summarized in figure 1.1. There are three phases in the analysis, which will also be used in this deliverable to facilitate the link with the modelling system. In the first step, *pre-modelling*, the problem identified in consultation with policymakers or other stakeholders is translated into a scenario which can be analysed with SEAMLESS-IF and indicators are selected to measure the relevant impact of the policy under consideration. This pre-modelling phase is essential since in most policy questions do not translate one-on-one to a scenario in SEAMLESS-IF. Often only part of the policy can be addressed with the available tools and this limitation needs to be communicated well. Especially in the case of ex-ante policy analysis all necessary details on the implementation may not need yet be available and assumptions made can affect the conclusion of the analysis.

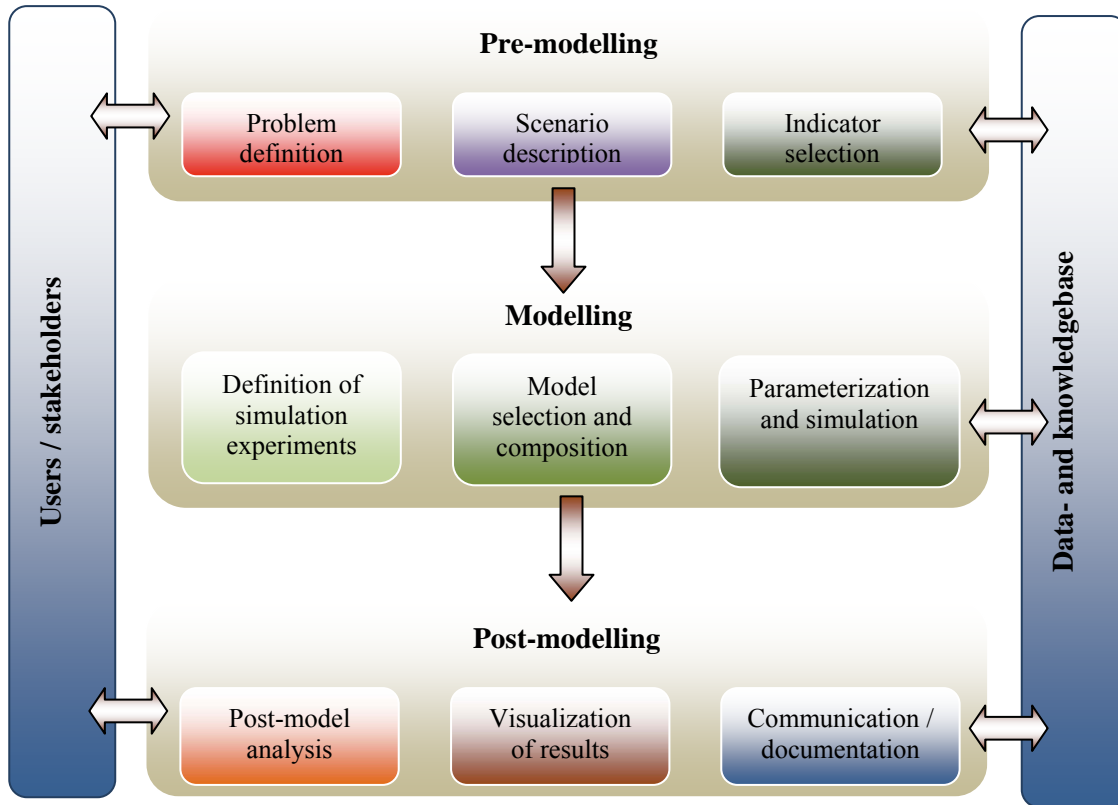
The *modelling* phase involves the definition of experiments aimed at providing the necessary detail and variation to address the policy question at hand. The definition of experiments leads to a selection of models that can perform the necessary simulations. The last step is to parameterize (i.e. define the experiments in terms of the appropriate parameters for each model) and run the models. The definition of experiments also includes the specification of experiments for sensitivity testing, i.e. variations in some parameters to test the robustness of the results.

The third step is *post-modelling* and consists of the analysis of the model results, creating visual displays of key findings and communicating the results to policymakers and other stakeholders through presentations and documentation in reports. The full model results can

be made available through a user interface that allows viewing of the project but does not allow running new experiments.

In this deliverable we describe the application of SEAMLESS-IF in line with these three steps to analyse the impact of a trade policy at EU level.

*Figure 1.1: Integrated assessment procedure with SEAMLESS-IF*





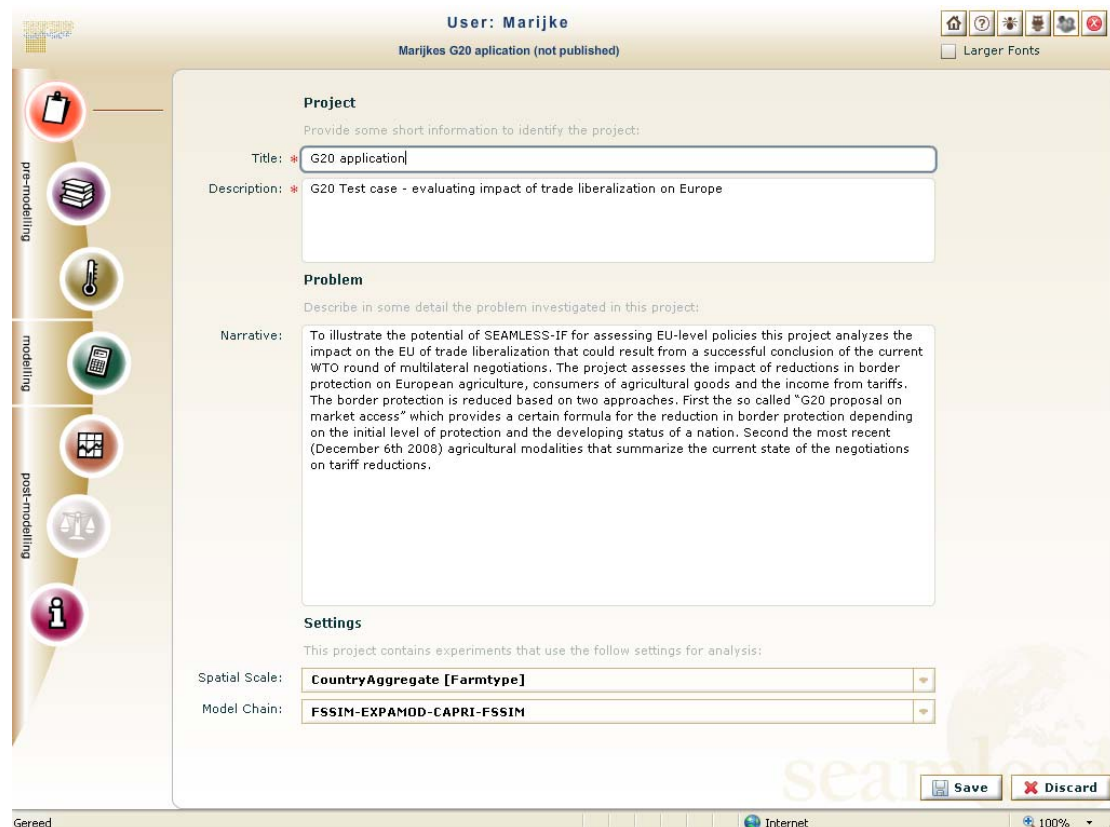
## 2 Pre-modelling – defining the scenario

The pre-modelling phase consists of defining the problem or research question to be analyzed, translate this problem in a scenario that can be analyzed with SEAMLESS-IF and define the indicators that will be used to measure the impact. The pre-modelling phase sets the context of the policy analysis, providing the justification for the choice of parameters. Since there is no need to access the models during this phase the data recorded in SEAMLESS-IF may also be entered after one or several meetings with stakeholders to record the agreements made.

### 2.1 Problem definition and choice of model chain

The application aims at providing policymakers in the EU with an evaluation of the impact on the EU of a potential WTO trade agreement negotiated in the current Doha Development Round (see figure 2.1 for the a description of the problem analyzed in the G20 application).

Figure 2.1. Screenshot of the problem definition in SEAMLESS-IF



User: Marijke  
Marijkes G20 application (not published)

**Project**  
Provide some short information to identify the project:

Title: \* G20 application  
Description: \* G20 Test case - evaluating impact of trade liberalization on Europe

**Problem**  
Describe in some detail the problem investigated in this project:

Narrative: To illustrate the potential of SEAMLESS-IF for assessing EU-level policies this project analyzes the impact on the EU of trade liberalization that could result from a successful conclusion of the current WTO round of multilateral negotiations. The project assesses the impact of reductions in border protection on European agriculture, consumers of agricultural goods and the income from tariffs. The border protection is reduced based on two approaches. First the so called "G20 proposal on market access" which provides a certain formula for the reduction in border protection depending on the initial level of protection and the developing status of a nation. Second the most recent (December 6th 2008) agricultural modalities that summarize the current state of the negotiations on tariff reductions.

**Settings**  
This project contains experiments that use the follow settings for analysis:

Spatial Scale: CountryAggregate [Farmtype]  
Model Chain: FSSIM-EXPAMOD-CAPRI-FSSIM

Save Discard

Key concerns are to assess the impact of a reduction in border protection on European agriculture, consumers of agricultural goods and the income from tariffs. The analysis focuses on two proposals the "G20 proposal on market access" of December 2005 and the most recent agricultural modalities of December 6<sup>th</sup> 2008 that summarize the current state of play in the negotiations. Both proposals provide a formula for reducing border protection depending on the initial level of protection and the developing status of a nation. Given that

market access proposals tend to change with every meeting there is a need for a sensitivity analysis to assess the robustness of the results to changes in the reduction percentages. This will prepare trade negotiators with a basis to judge developments in market access proposals occurring during negotiations.

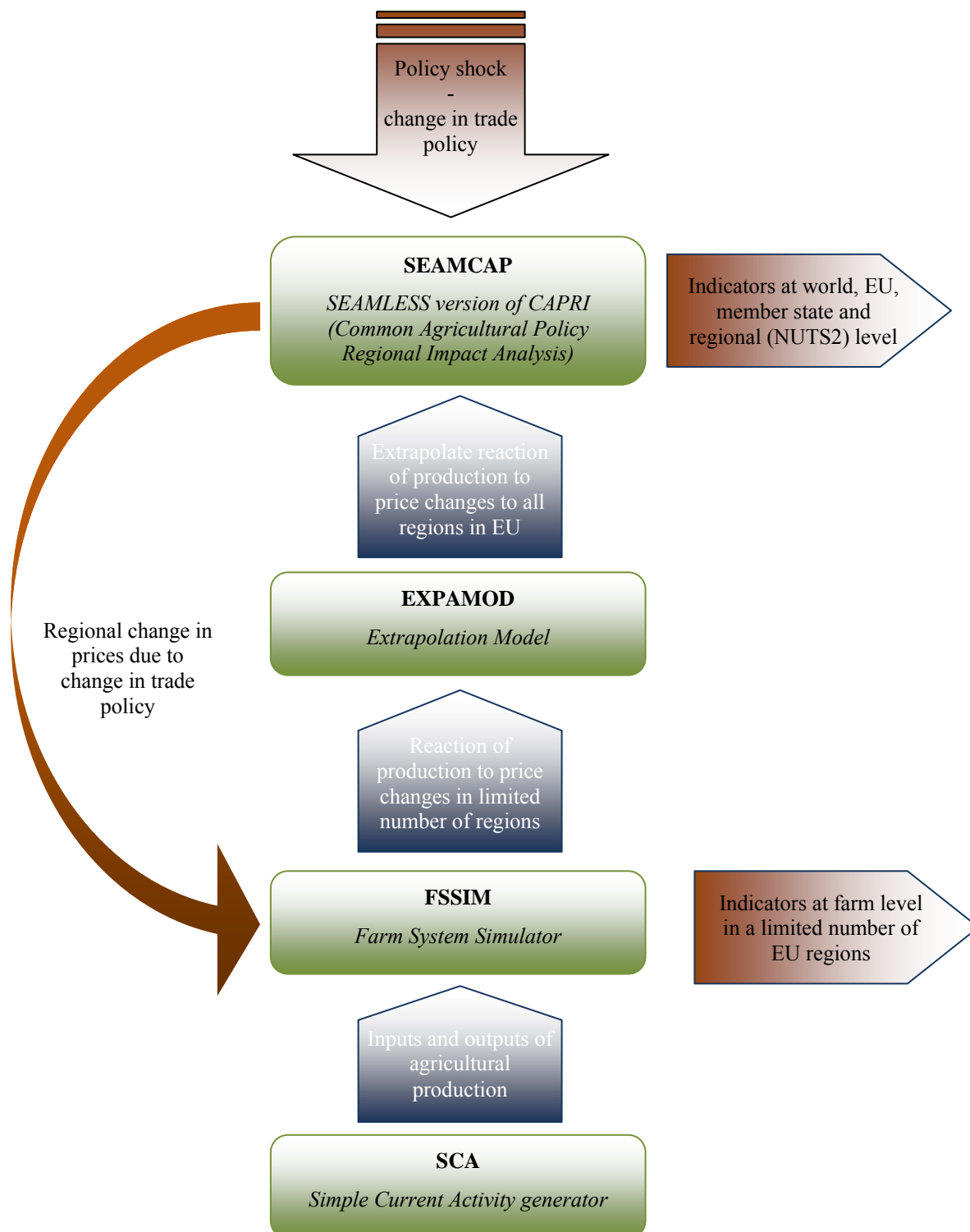
To fully exploit the potential of SEAMLESS-IF this study uses the complete backbone modelling chain reaching from field to global level (FSSIM – EXPAMOD – SEAMCAP – FSSIM). This allows an analysis across scales and domains setting this study apart from existing analyses of the Doha Round. Figure 2.2 presents the models used in the analysis, their purpose in the current case study and the way in which the trade liberalization scenario is implemented.

By using the full model chain we first of all aim for consistency between the description of agricultural production at an aggregate level in SEAMCAP (the market level model in SEAMLESS-IF) and the more detailed farm level descriptions in FSSIM (the farm level model in SEAMLESS-IF). This consistency is achieved by calibrating the agricultural supply elasticities (describing how production responds to price changes) in SEAMCAP to the observed responses of the FSSIM model to price changes. Due to extensive data demands, especially for modeling the technical details of agricultural production (done by the SCA model in SEAMLESS-IF), we only have calibrated FSSIM models for a limited number of regions in the EU (13 regions with a total of 58 farm models varying from 10 to 1 farm model by region). By choosing these regions such that they are representative of the variation in the EU we aim at deriving a representative supply response for the EU as a whole from this limited number of models. This is up-scaling from the limited number of calibrated FSSIM models to the EU level is done by the EXPAMOD model (Adenäuer, 2009). In figure 2.2 this consistent calibration of the models is described by the blue arrows building the calibrated chain from the field (SCA) to market level (SEAMCAP).

The trade liberalization policy analyzed in this case study is implemented at the (global) market level, i.e. there is a change in policy parameters in SEAMCAP. This results first of all in adjustments in SEAMCAP reflected by indicators at global, EU, member state and regional level. Farm level implications of the changes in regional prices (available for the 58 calibrated farm models) are then assessed by transferring these changes from SEAMCAP to FSSIM (as indicated by the arrow from SEAMCAP to FSSIM). This provides indicators at farm level which may also be aggregated to regional level (for the 13 regions with calibrated farm models) to complement regional level indicators of SEAMCAP for these regions.

By choosing the full model chain we are thus able to analyze the impact of global trade liberalization on the EU from a variety of angles both in terms of spatial scale as well as in terms of economic as well as biophysical impacts. Before being able to start the model analysis we first need to be explicit about the number and type of scenarios that we want to analyze, as well as choosing relevant indicators for measuring the impact of the trade policy liberalization.

Figure 2.2. Model chain used in the trade liberalization analysis





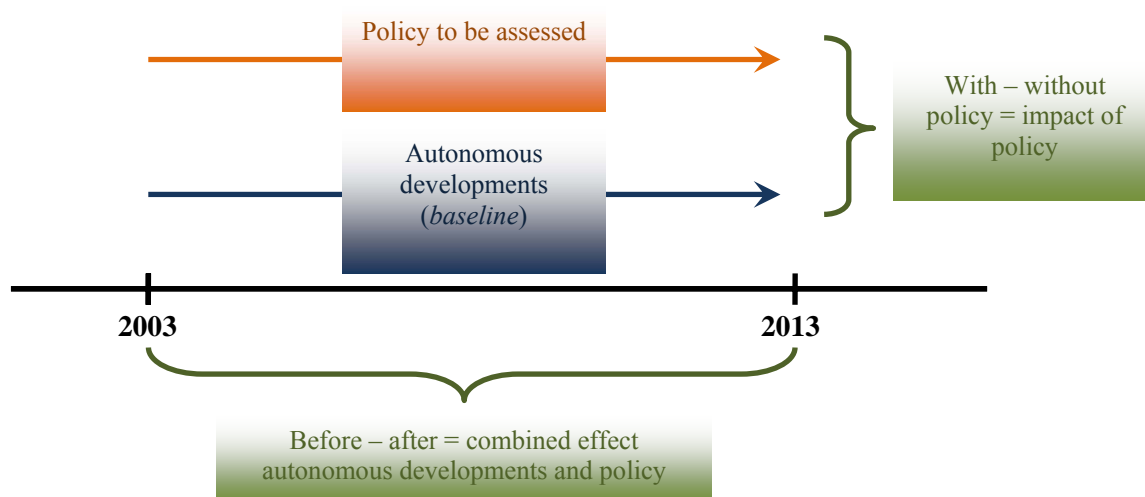
## 2.2 Scenario definition

There are two main scenarios<sup>2</sup> that we want to contrast, the G20-proposal for tariff reductions and the December 6<sup>th</sup> 2008 modalities. In order to be able to analyze these two scenarios quantitatively we need to be more specific in terms of what aspects of the policy we are going to analyze as well as the context in which we assess the scenarios.

### 2.2.1 Using a baseline as a reference point

In SEAMLESS-IF analyses use a baseline as reference scenario. SEAMLESS-IF is developed for ex-ante policy analysis, i.e. to analyze the future impacts of a policy currently considered by policy makers. This implies that we need to assess the impacts at some point in the future. In the case of the trade liberalization we assess the impacts in 2013 since this year has been mentioned as the year in which the EU would have to eliminate its export subsidies (one part of the trade policy being considered). Apart from the change in trade policy other policies and autonomous developments will also affect the EU economy in 2013 and these may affect the impact of the trade policy. We thus need to isolate the effects of the trade policy from other developments until 2013 (see figure 2.3).

Figure 2.3. Ex-ante policy analysis based on a baseline scenario.



The other developments that are deemed of relevance are described in the baseline. In intuitive terms the baseline can be thought of as describing the situation in 2013 based on the situation in 2003 (the year for which we have all necessary data for running the models) given the developments known or expected to occur between 2003 and 2013. The known or expected developments consist of really autonomous developments like population growth, but may also include policies that are being implemented between 2003 and 2013. As illustrated by figure 2.3 comparing the situation in 2013 with the situation in 2003 gives the compound effect of the policy to be assessed as well as autonomous developments. Comparing the situation in 2013 with and without the policy in place provides the actual impact of the policy isolated from other developments affecting the situation in 2013.

<sup>2</sup> The expression “experiment” is used synonymous with the expression “scenario” inside SEAMLESS-IF

In SEAMLESS-IF two standard baselines are provided, one for 2013 and one for 2020. For the current case study we use the 2013 baseline as our references point. The main exogenous drivers considered in the Baseline construction are listed in table 2.1.

*Table 2.1: Exogenous drivers considered for the baseline construction*

<b>Exogenous drivers</b>	<b>Value</b>
Inflation	1.9 % per annum
Growth of GDP per capita	2.0 % nominal per annum for the EU10, 5 % for India, 1.5 % for USA, 4 % for Russia, 1.5 % for Least Developed countries and ACPs, and 1 % for the rest.
Demographic changes	EUROSTAT projections for Europe and UN projections for the rest of countries in the world
Technical progress	0.5% input savings per annum (affecting exogenous yield trends), with the exemption of N, P, K needs for crops where technical progress is trend forecasted
Domestic Policy	National decisions on coupling options and premium models, with their expected implementation date for the EU25 MSs (25 different premium schemes, compilation by Massot Marti, 2005)
Common Market Organisations	Supply and demand shifted according to the expert forecasts (Commission of the European Communities, 2005)
Trade policy	Final implementation of the 1994 Uruguay round plus some further elements as NAFTA.
World markets	Supply and demand forecasts (FAO, 2003).

### 2.2.2 Choice of context and outlook

In SEAMLESS-IF scenarios are defined in terms of context, outlook and policy options. *Context* describes the biophysical and agro-management system used in the analysis. This context is defined in terms of choice of regions and farm types and management options for water and nutrients. In the current case we focus on the impact of a change in trade policy while keeping all else the same. We thus use the standard baseline context which includes all available farm models and available activities and limits the technological options to the currently used technologies.

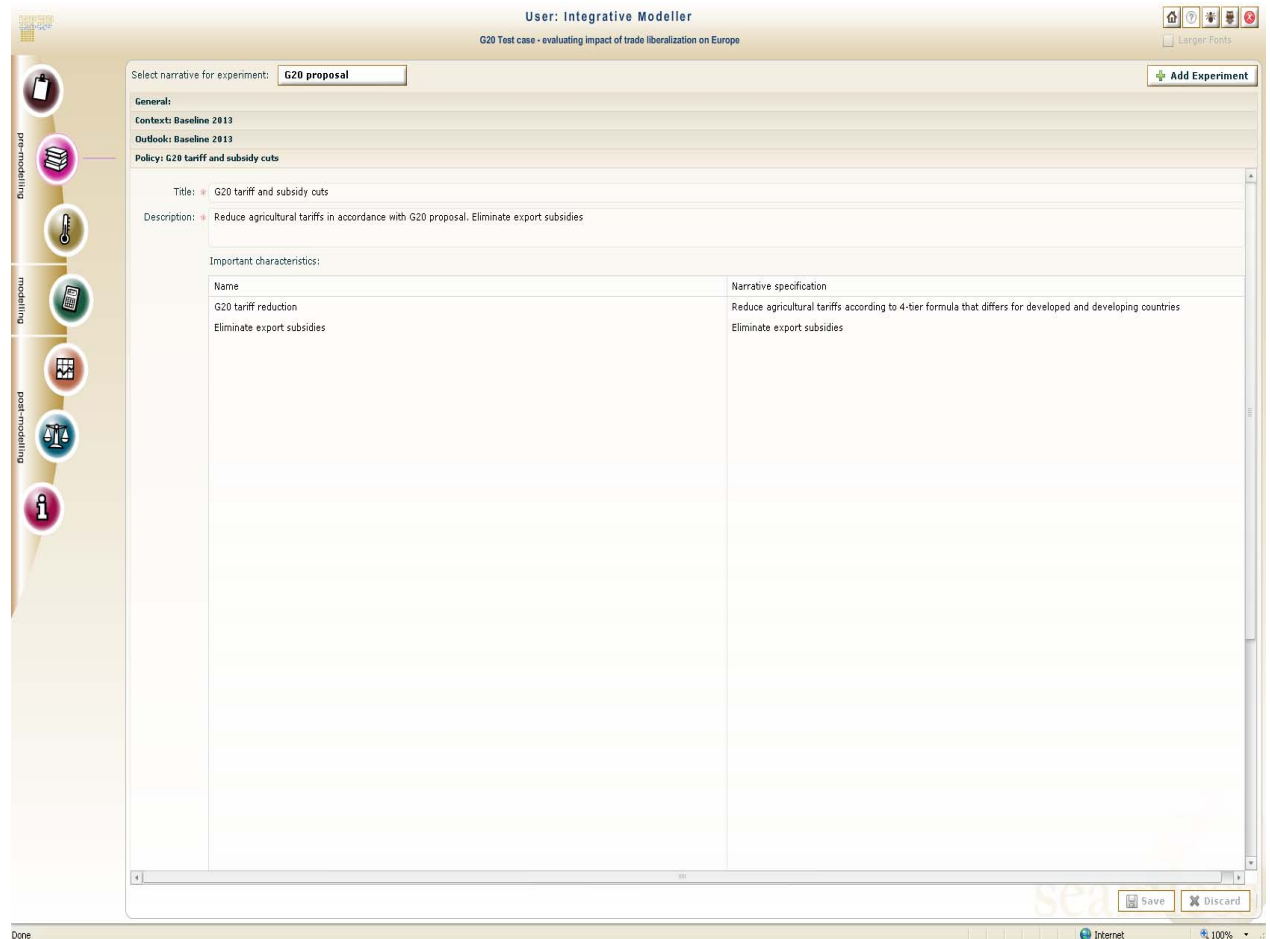
*Outlook* describes key trends (or deviations from trends) that may affect the outcome of a policy. In SEAMLESS-IF a variety of trends may be altered relative to the trends used in the baseline: relative exchange rates, shifts in consumer demand for agricultural products (for example related to expected population growth), demand for agricultural products from the biofuel industry, yearly inflation rate, energy prices (energy is an important input cost in agriculture), growth of agricultural yields between base and simulation year and modulation (percentage of first pillar payments moved to the second pillar in the CAP reform). In the current test case we use the outlook from the standard 2013 baseline, described above.

### 2.2.3 Policy options

So far we have replicated the 2013 baseline in terms of context and outlook. If we would choose the same policy options as in the 2013 baseline we would have a full replica of the

baseline results. We are however interested in how a change in trade policy affects the EU in 2013 and therefore change the trade policy parameters.

Figure 2.4. Screenshot of scenario description in SEAMLESS-IF.



Our analysis captures two key features of the G20 proposal and the more recent agricultural modalities of 2008: a reduction in import tariffs and an elimination of export subsidies by the EU (see figure 2.4). Similar to the disentanglement of the autonomous developments and policy effects depicted in figure 2.3 we also like to separate the effects of the elimination of the export subsidies from the effects of the change in tariffs. Such a separation of effects may aid the negotiators in determining the trade-off between these two components when devising a negotiation strategy (for example, if elimination of export subsidies has only a minor impact compared to a reduction in tariffs offering an earlier implementation of the elimination of subsidies in exchange for lower tariff cuts).

Table 2.2 presents the experiments that will be run to analyze the impact of trade liberalization on the EU. Table 2.3 presents the experiments plan summarizing which information is derived from various comparisons between scenarios. As can be seen from table 2.3 the chosen experiments provide the information needed to assess the impact of the G20 proposal and December 6th 2008 modalities on the EU, determine the separate contributions of export subsidy elimination and tariff reductions, as well as the impact of changing the formula for tariff reductions from the G20 to the December 6th 2008 modalities.

Table 2.2: Description of experiments for the trade liberalization application

Experiment name	Baseline 2013	Subsidies	G20 proposal	WTO proposal
<b>Context</b>				
Baseline 2013 context	X	X	X	X
<b>Outlook</b>				
Baseline 2013 outlook	X	X	X	X
<b>Policy</b>				
Export subsidies	No change	Eliminated	Eliminated	Eliminated
Tariff reductions	No reductions	No reductions	Tariffs reduced according to G20 proposal	Tariffs reduced according to December 6 <sup>th</sup> 2008 modalities
All other policies	Baseline 2013	Baseline 2013	Baseline 2013	Baseline 2013

Table 2.3: Description of experiment plan for the trade liberalization application

	Baseline 2013	Subsidies	G20 proposal	WTO proposal
<b>Subsidies</b>	Effect of eliminating subsidies			
<b>G20 proposal</b>	Effect of elimination subsidies and reducing tariffs according to G20 proposal	Effect of reducing tariffs according to G20 proposal		
<b>WTO proposal</b>	Effect of elimination subsidies and reducing tariffs according to December 6 <sup>th</sup> 2008 modalities	Effect of reducing tariffs according to December 6 <sup>th</sup> 2008 modalities	Effect of change in tariff reduction formula from G20 to December 6 <sup>th</sup> 2008 modalities	

Note: the experiment plan indicates the information provided by comparisons between experiments. For example, comparing results of the subsidies experiment to the baseline provides the impact of the elimination of subsidies in 2013.

#### 2.2.4 Limitations to the policy scenario

A crucial step in any quantitative policy assessment is to translate complex and detailed policies into scenarios that can be analyzed with the available tools. Inevitably this means that part of the richness and complexity of policies is lost in the analysis, which needs to be kept in mind when interpreting the results. We therefore outline the major limitations of the scenarios used in the trade liberalization application.

The agricultural modalities of December 6<sup>th</sup> 2008 consist of three main parts: domestic support, market access and export competition. Our scenario only addresses the latter two parts. Although impressive cuts on domestic support are proposed in the modalities (with reductions up to 85 percent) these cuts are expected not to affect EU policy due to the use of a historic reference point (1995 - 2000) combined with a string of CAP reforms since then

(Jean et al., 2008). The omission of reductions in domestic support will therefore hardly affect the results of our analysis for the EU. However, there will be indirect effects if the domestic support in countries outside the EU is changed, since this will create a feedback on international markets. Due to its economic size and extent of support ignoring the reduction in domestic support for the United States may affect our results. In contrast to the EU proposed reductions will affect United States policies. A significant impact is also suggested by specific provisions for the United States in the agricultural modalities (Blandford, 2008). Since a reduction in support for agricultural producers in the United States will increase competitiveness for producers from other countries, ignoring domestic support will underestimate the benefits for the EU.

The reductions in agricultural tariffs in our scenario are derived from the market access part of the modalities. Our modelling of the reduction in tariffs is however a simplification of the actual proposal. We apply the tariff reductions to applied tariffs whereas the WTO negotiations are based on bound tariffs (the maximum tariffs a WTO member is allowed to levy on imports from other WTO members). Especially in the case of developing countries there is a generally a large gap between bound and applied tariffs implying that a reduction in the bound tariff does not affect the tariffs actually applied on imports. In addition the December 6<sup>th</sup> modalities describe a large set of exceptions for specific products (sensitive products, special products, tropical products, tariff escalation provisions) or specific regions (least developed, recently acceded WTO members, small and vulnerable economies). Exceptions are defined at very detailed level (tariff line level for most product exceptions which are very detailed descriptions of specific products) whereas in our modelling exercise we model most countries as regional aggregates and we do not distinguish products at tariff line level.

In terms of our modelling exercise we are focusing on the impacts of trade liberalization on the EU agricultural sector. For the EU applied and bound rates are about the same apart from the effect of preferential trade agreements whereby tariffs on imports from specific trade are lower than the standard rate but this is reflected explicitly in the trade module of SEAMCAP. The key limitation of our modelling of lowering EU tariffs is the omission of the sensitive products in our analysis. At this point it is not clear which products will be denoted sensitive by the EU and the way in which the compensatory measure of expanding or creating quotas is going to be implemented. Our analysis of the impact of the tariff reductions may provide clues to which sectors will be negatively affected and therefore likely candidates for the category of sensitive products. At the same time we are also exaggerating the increased market access of EU in other countries by ignoring the exceptions other countries will invoke to limit the reduction in their barriers to trade. If we find large increases in a trade flow from the EU to specific country or region we need to keep in mind that this country or region may use the exceptions available in the modalities to curb such an increase. Again our analysis may suggest for which products and regions the exceptions are likely to be used to reduce the impact of the tariff reductions.

The third component of the modalities (export competition) consists of eliminating export subsidies, subsidized export credit, food aid used to dispose of surplus production and privileged treatment of parastatal export. For the EU elimination of export subsidies is the relevant part of the export competition modalities and we include this full elimination in 2013 in our scenario. We do not account for the impact of the other components that relevant for other countries since these are hard to quantify and are not accounted for in our modelling framework.

A final limitation of our analysis stems from the partial nature of the backbone modelling chain which is limited to modelling the agricultural sector. The WTO negotiations by design encompass manufacturing and services as well, aiming at a 'single-undertaking' that allows countries to balance losses in for example agriculture by gains in manufacturing to facilitate

an agreement where all countries gain. Although our partial analysis underestimates the total gains for the EU from a WTO agreement which in large part arise from increased access to markets for manufactured products in large emerging economies like Brazil and India, it will have limited impact on our assessment of the effects on the agricultural sector. First analyses of the impact of the modalities for non-agricultural products with a combination of CAPRI and GTAP (a global economy-wide model covering all sectors in the economy) indicate limited effects on the agricultural sector in the EU (Jansson et al., 2009).

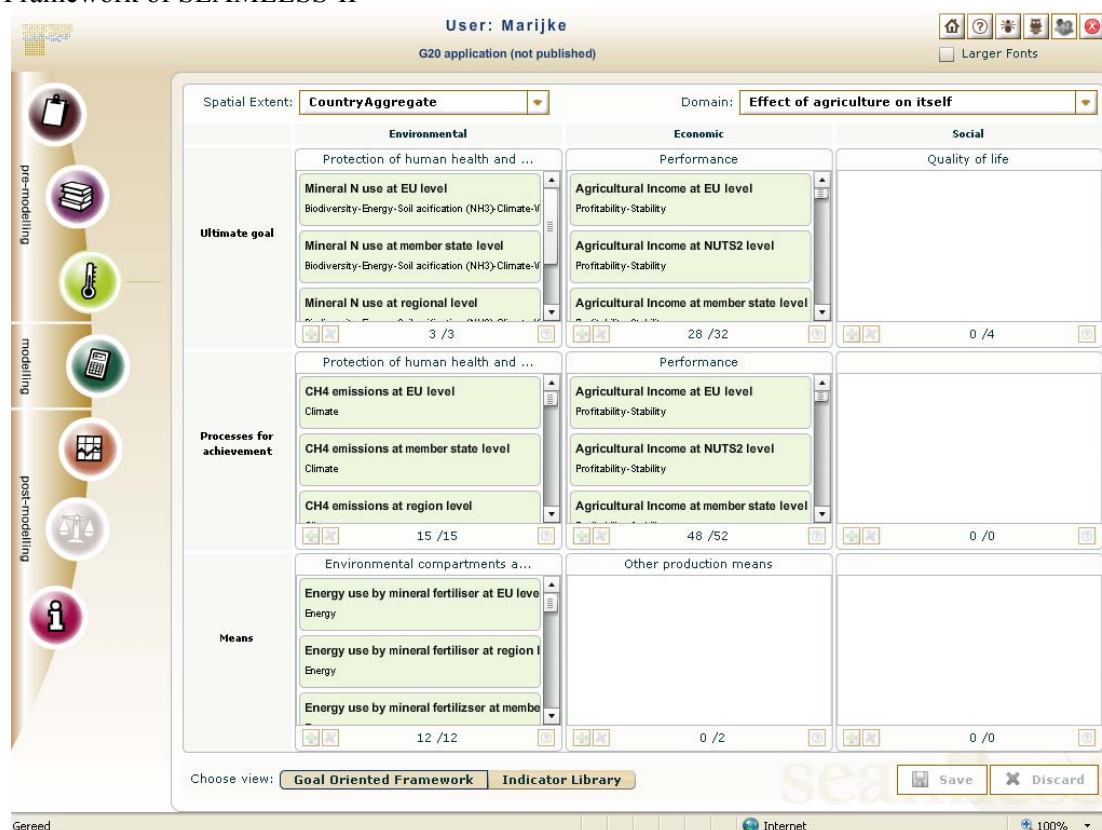
### 2.3 Indicator selection

So far we have defined the policy that needs to be assessed, the experiments needed to address this question as well as the limitations of our experiments in terms of the complexities of the actual policy. The last step in the pre-modelling phase is to select the indicators that will be used to measure the impact of the policy.

SEAMLESS-IF contains a library of indicators organized in the Goal Oriented Framework (GOF) which groups indicators to their *spatial scale* (country, region, farm type, agro-ecological zone), *general domain* (effect of agriculture on itself or effect of agriculture on the rest of the world), *domain* (environmental, economic and social) and *type of measure* (an ultimate goal, process for achieving goals, or means spend to achieve goals) (Alkan Olsson et al., 2007). The availability of indicators is obviously related to the choice of model-chain. Since we employ models from the farm to global level we can also select indicators at all these levels.



Figure 2.5. Screenshot with part of the available indicators in the Goal Oriented Framework of SEAMLESS-IF



The main challenge is to select from the rather extensive list the indicators that are most relevant for the question at hand. Key concerns with trade liberalization is the impact of on *agricultural income*. Apart from the aggregate impact at EU level differences between EU member states and differences between regions within EU member states will be important to assess distributional impacts which are important for the political support of a possible WTO agreement. Changes in agricultural income result from changes in *agricultural production* due to changes in *prices* of inputs and outputs. Part of these price changes are induced by changes in *imports* following the reduction in tariffs. Although these measures may not be of direct concern to policymakers they are crucial for understanding the mechanisms whereby (regional) changes in agricultural income come about.

The change in trade policy does not only affect income earned from agriculture but also affects government finance by reducing *tariff revenues*. While agricultural income and tariff revenues are expected to decline consumers are expected to benefit from lower prices of agricultural products that they consume. This is measured by the *money metric* a special measure of consumer surplus. A monetary measure summarizing the total impact of the change in trade policy on the agricultural sector is provided by the change in *total welfare*. These summary indicators are available for the EU as a whole as well as at member state level again allowing an assessment of the distributional impacts of the policies.

The indicators discussed so far are standard measures used in economic analysis of policy changes. Use of SEAMLESS-IF however allows us a more comprehensive assessment by including environmental and (to a very limited extent) social indicators. The availability of environmental indicators is determined by the availability of detailed agro-management data. These data are not available from existing European databases and have been collected within

the SEAMLESS project. Given the limited available resources a limited amount of data is available for the so-called simple sample regions (i.e. regions where a simple version of the survey has been run). More detailed data have been collected for a smaller set of regions (detailed regions) allowing a more elaborate assessment of environmental impacts. The full backbone model chain employed in the current study relies on the simple regions and has therefore a limited number of operational environmental indicators in the current version (more indicators may be added in later versions if the more detailed data can be extrapolated to other EU regions). The second test case illustrating the use of SEAMLESS-IF employs the more detailed agro-management data for a limited set of regions and offers a broader range of environmental indicators (for more details see PD 6.3.5.2).

In the current version of SEAMLESS-IF two environmental indicators are available: crop diversity and nitrate leaching. *Crop diversity* measures the effect of agriculture on its environment and is computed from the surface area occupied by each crop. The indicator is based on a reciprocal Simpson's index which assures that the indicators is equal to the number of crops when each crop has the same share of the total farm area. Higher values of the indicator signal higher crop diversity which would contribute to soil and water conservation, reduce pesticide and insecticide utilisation through reducing presence of pests, diseases and weeds and may relate to landscape features (plot size and ecological infrastructure) (C. Bockstaller, 2009a).

*Nitrate leaching* is also a measure of the impact of agriculture on its environment. It is defined as the 'amount of nitrate leached by farm type under the root zone of crops and grassland due to fertilisation and nitrogen management after harvest (crop residues, catch crops, etc.), (expressed in kg nitrogen in nitrate form per ha and year)'. Nitrate leaching is of concern due to its detrimental effects on water quality and is considered as a threat to public health. Nitrate leaching is part of the FSSIM model output at farm level. The underlying calculations are based on a simulation of the nitrogen cycle in at a daily basis from which yearly totals are computed (C. Bockstaller, 2009b).

Finally we include *labour use* as a social indicator of the availability of agricultural employment. A decrease in agricultural employment is a matter of concern since this may contribute to an already declining viability of rural communities. As with the environmental indicators labour use measures the impact of agriculture on its environment.





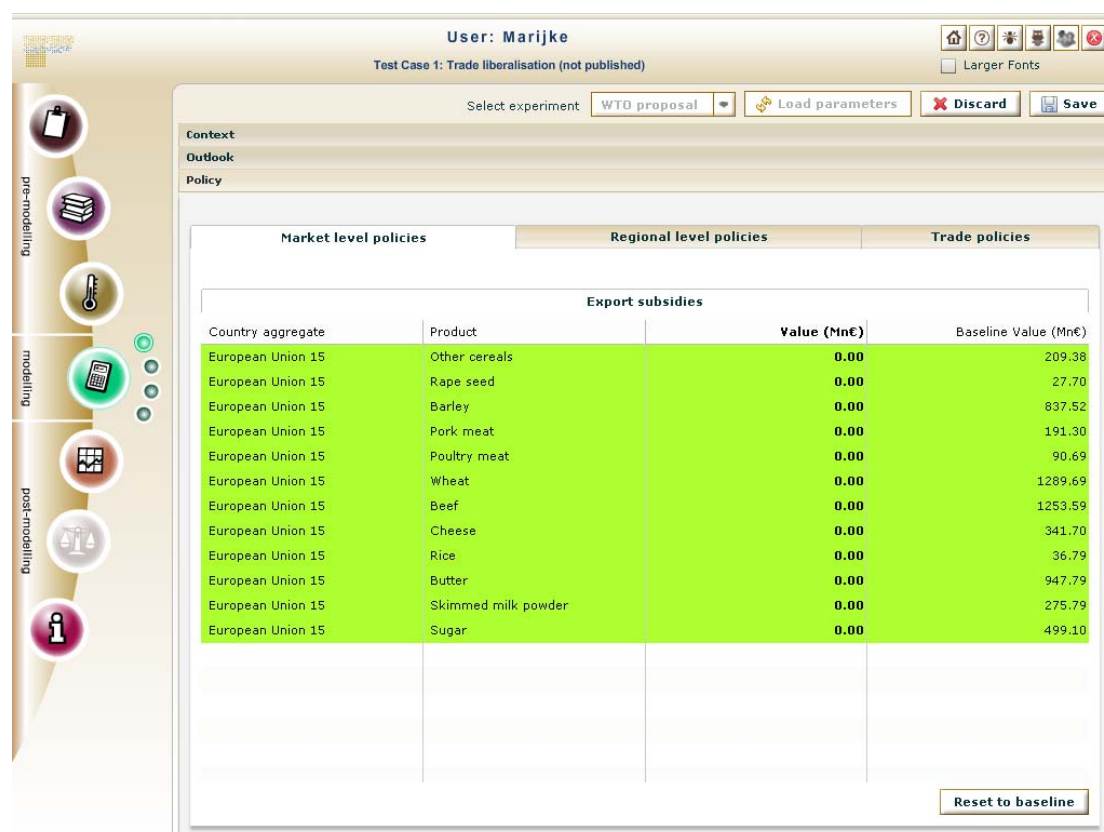
### 3 Modelling – specifying and running experiments

The main activity of the modelling phase is translating the description of the experiments from the pre-modelling phase into specific model runs to be executed in SEAMLESS-IF. The selection of the model chain has already occurred in the definition of the project at the start of the application. This also determined the indicators that are available for assessing the results of the models. These two topics therefore do not require further attention in the modelling phase.

#### 3.1 Parameterisation of experiments

As is immediately obvious from the experiment plan in table 2.3 all experiments in this application use the 2013 baseline outlook and technological context. These are already pre-defined in SEAMLESS-IF and do not require further attention. With the baseline results already residing in the system, we can focus on defining the parameters of the three experiments: subsidies, G20 proposal and WTO proposal. For these three experiments we can leave most policy settings as they are in the baseline for 2013 and we only need to change the policies related to export subsidies (in all three experiments) and tariff reductions (in the G20 and WTO proposals).

Figure 3.1 Screenshot of the implementing the removal of subsidies in SEAMLESS-IF (green indicates the changes made are feasible in SEAMCAP).



Export subsidies			
Country aggregate	Product	Value (Mn€)	Baseline Value (Mn€)
European Union 15	Other cereals	0.00	209.38
European Union 15	Rape seed	0.00	27.70
European Union 15	Barley	0.00	837.52
European Union 15	Pork meat	0.00	191.30
European Union 15	Poultry meat	0.00	90.69
European Union 15	Wheat	0.00	1289.69
European Union 15	Beef	0.00	1253.59
European Union 15	Cheese	0.00	341.70
European Union 15	Rice	0.00	36.79
European Union 15	Butter	0.00	947.79
European Union 15	Skimmed milk powder	0.00	275.79
European Union 15	Sugar	0.00	499.10

Export subsidies are part of the market level policies in SEAMCAP (see figure 3.1). Removing the subsidies entails a straightforward replacing of all product-specific baseline

levels by zeros. The green marking indicates that the chosen values are within the range of parameters for which SEAMCAP can solve.

The tariff reductions in the G20 and WTO proposal are based on tiered formulas with four bands. This means that the tariffs are placed in four groups based on their initial size and each of these groups has a different reduction percentage. The main idea is that tariffs that are high will be cut more than tariffs that are low and thus not very trade distorting. The WTO formula's work with tariffs expressed in ad valorem equivalents (AVEs) expressed in percentages. In case of ad valorem tariffs (tariffs expressed as a percentage of the price of the product) the AVE is equal to the ad valorem tariff. Non-ad valorem tariffs, like for example a tariff stipulating that a 100 euro is levied on each ton of imported product, are converted to AVEs using a formula negotiated among the WTO members.

Having established all AVEs the application of the tariff reduction is a straightforward reduction of the AVEs with the level of the cut depending on the initial level of tariff. Table 3.2 presents the cuts for each tier for both the G20 and WTO proposal. Note that different threshold for the four tiers apply for developed (rich OECD countries) and developing countries (the rest of the world). This is typical for WTO agreements and referred to as special and differential treatment.

Also note that the thresholds for each of the tiers is the same in the G20 and WTO proposal, the only differences are the size of the cuts per tier (generally higher in the WTO proposal) and the absence of a tariff cap in the WTO proposal. In the WTO proposal there is a requirement on the minimal average cut which may become effective if all exceptions to the standard cuts depicted in table 3.1 would be accounted for. We do however not account for these exceptions nor do we have information on which tariff lines would receive an additional cut to satisfy this requirement if it would be violated.

*Table 3.1: Tariff reductions for the G20 and WTO proposal*

Reductions for developed countries (in %)			Reductions for developing countries (in %)		
<i>Thresholds for tariffs<sup>1)</sup></i>	G20	WTO	<i>Thresholds for tariffs<sup>1)</sup></i>	G20	WTO
$0 \leq 20$	45	50	$0 \leq 30$	25	33.33
$20 \leq 50$	55	57	$30 \leq 80$	30	38.00
$50 \leq 75$	65	64	$80 \leq 130$	35	42.67
$> 75$	75	70	$> 130$	40	46.67
<i>Cap<sup>2)</sup></i>	100	n.a. <sup>3)</sup>	<i>Cap<sup>2)</sup></i>	150	n.a. <sup>3)</sup>

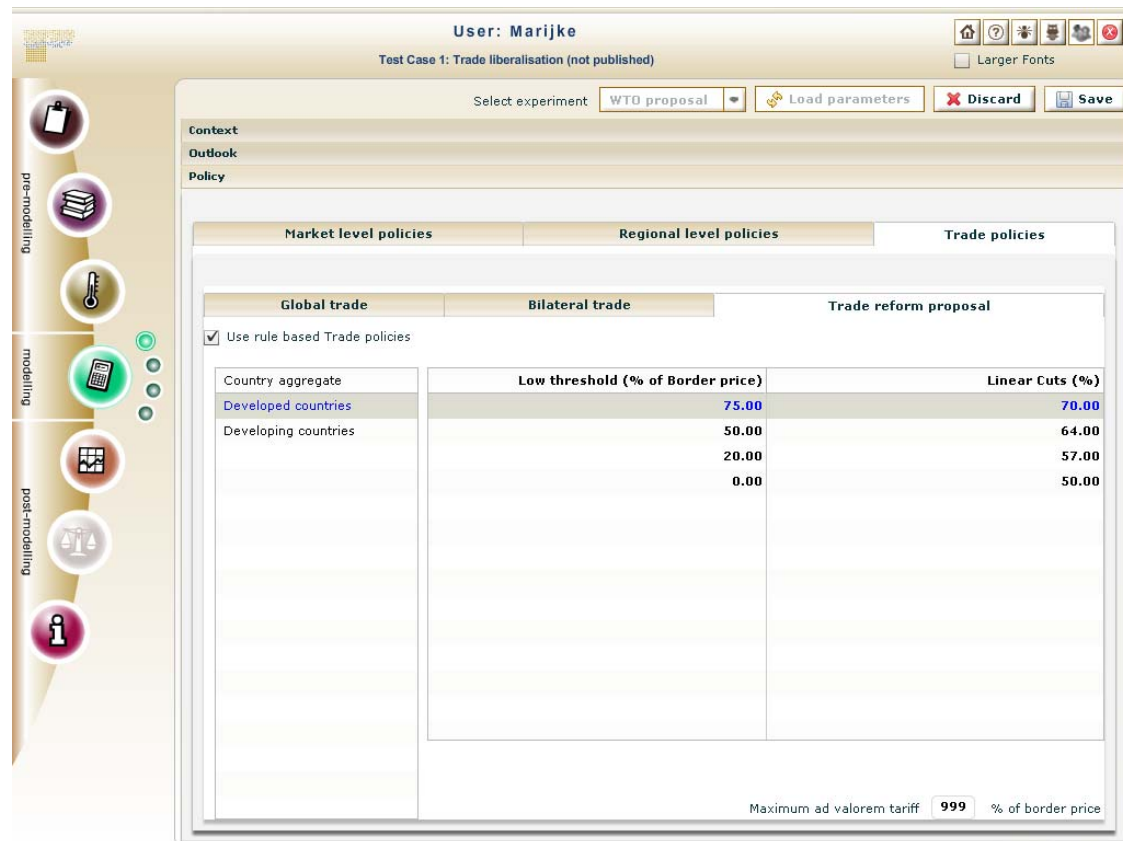
<sup>1)</sup> Tariffs are translated to Ad Valorem Equivalents (AVEs) to determine which reduction percentage applies.

<sup>2)</sup> The cap is imposed after reduction: if tariffs exceed this number after implementing the reduction formula they are reduced to maximum 100% for developed and 150% for developing countries.

<sup>3)</sup> N.a. means not applicable (the current WTO proposal does not longer include a tariff cap)

The numbers in table 3.1 provide enough information to parameterize the two experiments involving tariff cuts (see figure 3.2). SEAMLESS-IF offers different ways of changing tariffs. It is possible to compute the impact of the cuts for each trade flow in the SEAMCAP model and then reduce the tariffs in accordance. This is however a rather cumbersome approach and therefore we make use of the possibility to directly specific the tariff reduction formulas of table 3.1 after which the appropriate changes in tariffs are computed by SEAMCAP.

Figure 3.2 Screenshot of the implementing the removal of subsidies in SEAMLESS-IF.



After specifying the appropriate tariff cuts in the G20 and WTO experiments on top of the removal of the export subsidies we have fully specified the experiments and they can be run in SEAMLESS-IF.

### 3.2 Visualization of the model chain

It is possible to check whether the appropriate indicators have been selected before running the actual experiments. This may be essential since indicators that have not been selected in the pre-modelling phase will not be available for analysis after the model runs have been completed. To this end there is a visual representation of which part of the model chain will provide the indicators that are selected. The lighter colour of SEAMCAP, for example, indicates that agricultural income per ha at EU level comes from SEAMCAP (see figure 3.3).

Figure 3.3 Screenshot of the visualisation of the model chain in SEAMLESS-IF.

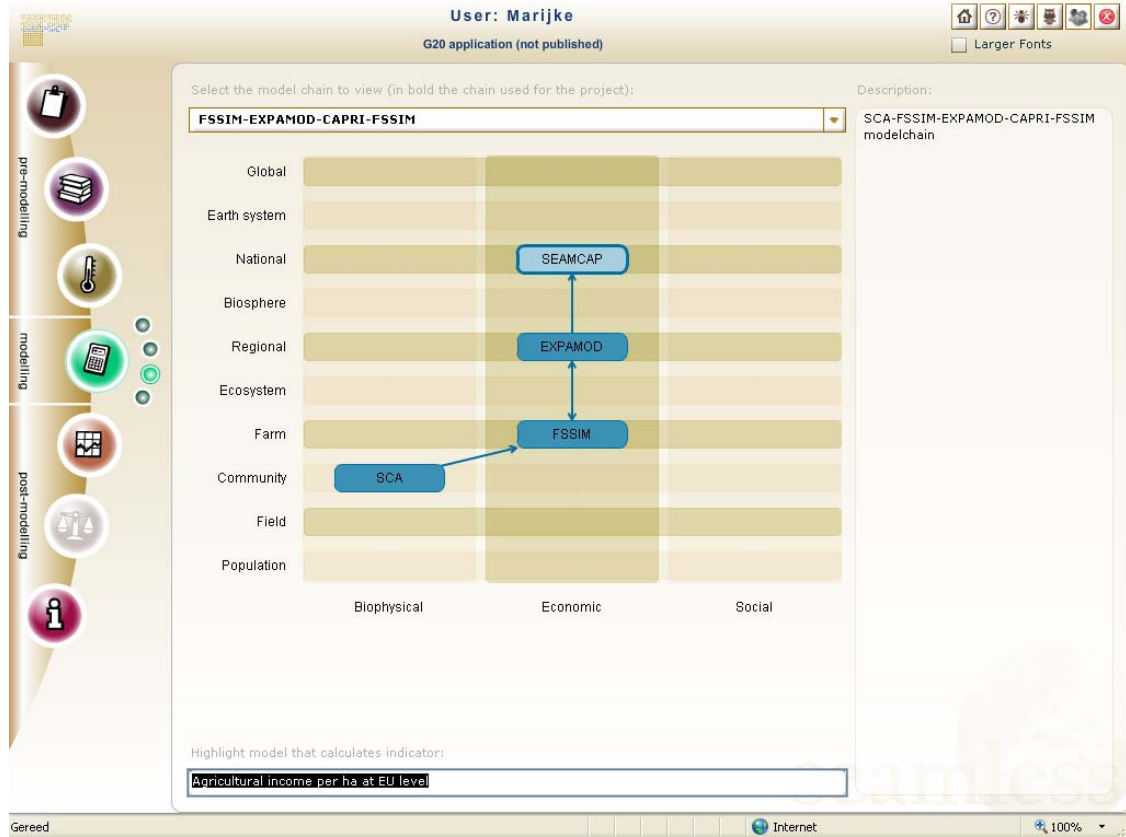
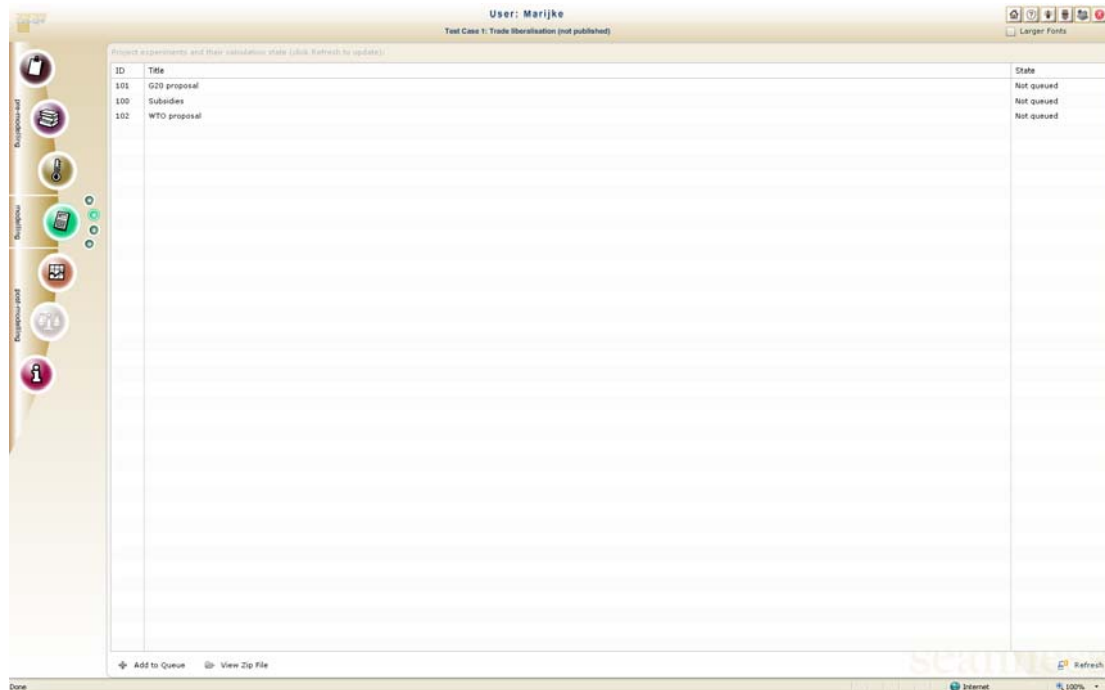


Figure 3.4 Screenshot of the processing centre of SEAMLESS-IF.



### **3.3 Running the model chain**

The experiments are run by adding them to the queue in the processing centre of the SEAMLESS server (see figure 3.4). Depending on the complexity of the model-chain and the presence of experiments from other users on the server the model runs can take 5 to 10 hours. Hereby each instance of FSSIM takes about 2 hours. EXPAMOD generally solves quite fast within half an hour and SEAMCAP used between 1 and 3 hours. These numbers are only estimates, because currently there is only limited experience with executing the whole model chain on the server. Total run time depends on the complexity of the analysed scenario as well as on the computing power of the server.



## 4 Post-modelling – analyzing and presenting results

In the post-modelling phase the model results are analyzed and presented to stakeholders through reports, presentations etc. In order to arrive at an integrated assessment across domains and scales the results for indicators first need to be understood in isolation, i.e. for each indicator at a time, and then the results for various indicators can be contrasted and their implication for sustainable development assessed.

In the remainder of this chapter we first analyze the results at global and EU level in economic terms, employing indicators derived from the market level modelling in SEAMCAP. Points of interests are the implications of trade liberalisation for EU's position in global market and effects on the EU as a whole.

The next part then looks in more detail at the member state level impact. A key point of interest is the distribution of effects over different member states since this will be relevant for the political feasibility of a WTO agreement. Using indicators derived from SEAMCAP results we can assess both.

We then move to a more detailed assessment for the 13 regions within the EU where we can evaluate both regional and farm level impacts using indicators derived from FSSIM. This gives an indication of the distribution of impacts within regions and allows a more detailed assessment of the potential environmental impacts of a trade agreement, which is not normally included in this type of analyses. At this level we will also assess the potential trade-off between indicators from different domains.

The concluding chapter draws the main findings of individual indicators together to arrive at an integrated assessment of the effect of trade liberalization on the EU. Trade-offs as well as win-win situations are identified, which can be in terms of gains and losses at different scales or in different domains.

### 4.1 Results at global and EU level

Table 4.1 gives an overview of different components of total welfare changes at EU25 level. These different components can be loosely thought of as representing the impact on the welfare of consumers (money metric), agricultural producers (agricultural income) and the government (tariff revenues). Together these capture the impact on the main economic actors.<sup>3</sup>

*Table 4.1: Welfare positions at EU25 level (absolute changes to baseline, Mn. €.)*

<i>EU25</i>	<i>Subsidies</i>	<i>G20</i>	<i>WTO</i>
Money metric	1036	19344	17682
Agricultural income	-792	-9304	-8354
Tariff revenues	-210	-5101	-4692
<i>Total</i>	1100	6808	6487

<sup>3</sup> Note that the position total welfare does include further positions (profits of the processing industry and the EU budget expenditures on the first pillar) not reported here explicitly and may therefore differ from the sum of the reported positions.



The first notable result is that in all scenarios we find a welfare increase. Although in the subsidies scenario consumer gains almost equal the sum of losses of agricultural producers and reduced tariff income, the welfare of the agricultural sector increases. This is due to EU budget outlays not shown in table 4.1. Of course, eliminating export subsidies will reduce budget cost and thus have a positive welfare impact.

Since both the G20 and WTO scenario include the subsidy elimination, consumers' welfare increases due to tariff reductions are considerably higher and more than compensate the welfare losses of agricultural producers and loss of tariff revenues. The loss in agricultural income is consistent with other studies of the impact of WTO liberalisation and follows from the current levels of protection sheltering the farmers from global competition. It should be kept in mind that the actual WTO agreement is a 'single-undertaking' not confined to agriculture but reducing trade barriers in agricultural, manufacturing and services simultaneously. Given its economic structure (with a rather limited contribution of agriculture) the largest gains for the EU are expected from manufacturing and services trade, which results in a net positive expected impact of a WTO agreement on the EU economy as a whole.

The G20 and WTO scenario differ only in terms of the extent to which tariffs are reduced (see table 3.1). For the developed countries the most significant difference is the five percent point lower cut on the tariffs exceed 75% under the WTO scenario, whereas for developing countries all reductions are higher under the WTO scenario. For the EU the latter implies improved market access to third markets. Lower cuts on the most protected products and improved market access to third markets explains the more limited decline in agricultural income in the WTO scenario, since EU producers may face stiffer competition in their domestic markets for the most protected products but also gain better access to third country markets for all products. Since there are no major differences between the G20 and WTO proposal we focus the remainder of the analysis on the WTO scenario which represents most closely resembles the outcome of the negotiations.

The main mechanism through which the lowering of tariffs affects EU agriculture is through changes in EU market prices. Lower EU tariffs implies that imports from foreign competitors become less expensive potentially lowering EU market prices, while at the same time improved market access for EU exporters to third countries may reduce their supply on the internal market potentially increasing EU market prices. The net effects are depicted in figure 4.1, showing the average change in market prices for the whole world (including the EU) and the changes in EU market prices.

Prices in the EU decline more than in the rest of the world with meat experiencing the most notable drop. Within the average for meat the strongest decline (-12 %) is observed for beef. The major price decreases for meat are however may not materialize due to the use of sensitive products by the EU. Denominating meat tariff lines as sensitive would greatly limit the tariff reductions although a quota would need to be opened to compensate third countries for their limited increase in market access. The net impact of declaring products as sensitive is difficult to determine. Not all technical details have yet crystallized in the current modalities, but the spirit of the discussions on sensitive products is to limit the impact of trade liberalization.

Figure 4.1 Average change in market prices of product groups with the WTO proposal (% change to baseline). Source: SEAMCAP.

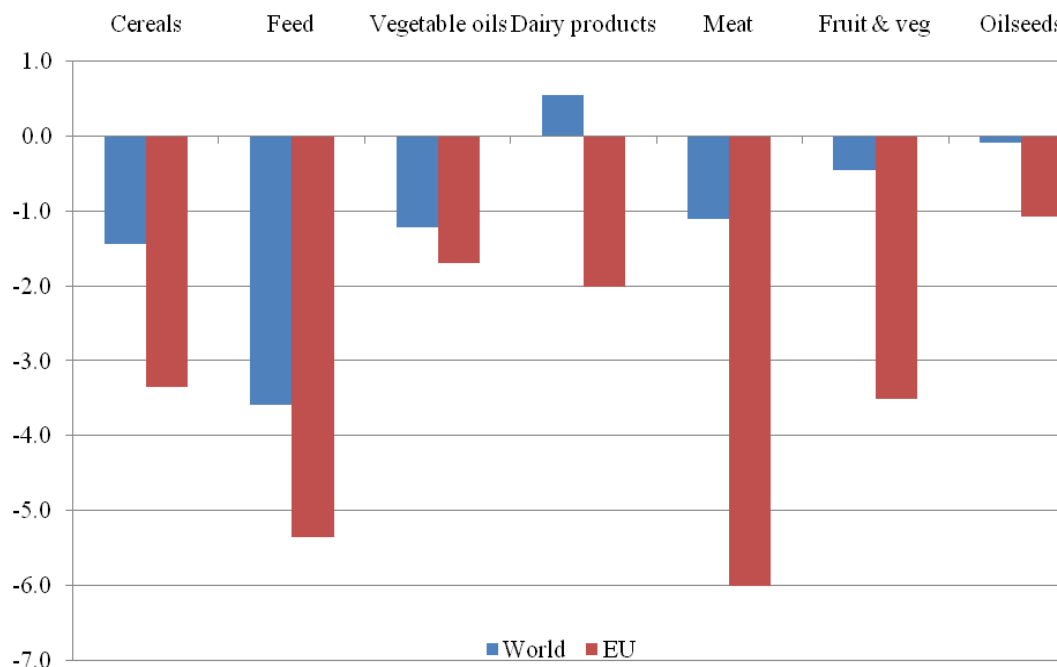


Figure 4.2 Change in production on trade flows for selected products with the WTO proposal (% change to baseline). Source: SEAMCAP.

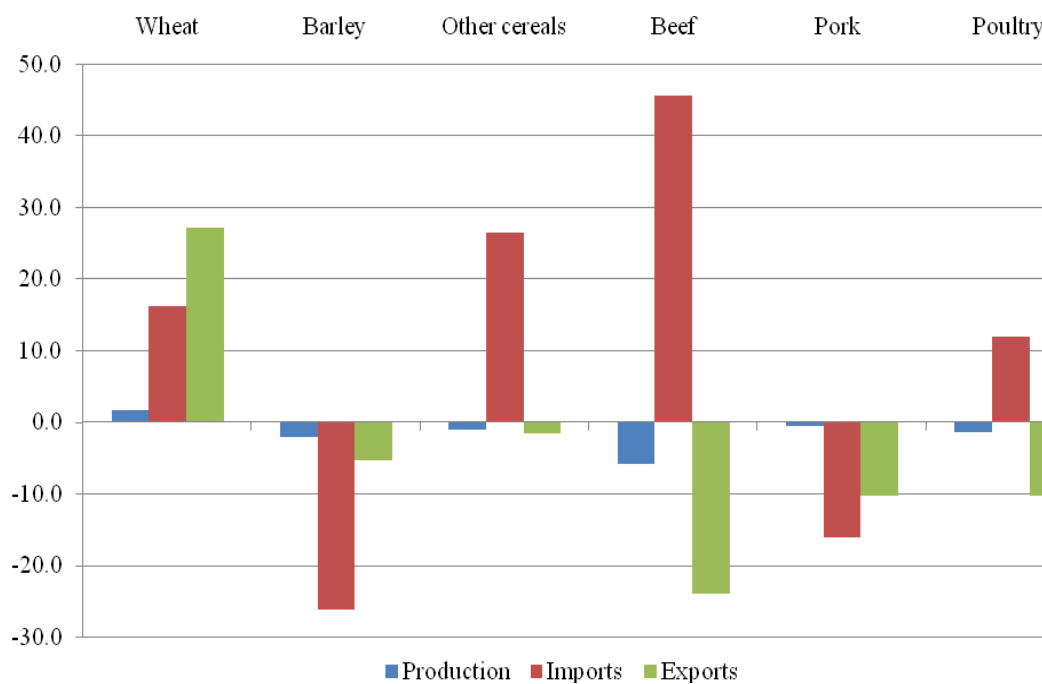


Figure 4.2 explores for cereals and meat the changes in production, import and export relative to the baseline. Changes in production are much less pronounced than those in trade flows reflecting that a major part of EU agricultural production is destined for domestic consumption. Changes in absolute terms are comparable to those for imports and exports but relative to the total production in the EU the impact on production does not exceed 5.8 percent (for beef, the product with the largest price decrease). Since the EU is already a net importer of beef in the baseline, the increase in imports and decline in exports does not change this net trade position. Of the products included in figure 4.2 only for poultry meat a change in trade position occurs with the EU becoming a net importer while being a net exporter in the baseline. As with beef it remains questionable whether this would occur in reality, poultry is also often mentioned as a potential sensitive product for the EU.

## 4.2 Results at member state level

Apart from the total impact on the EU25 the distribution of benefits and costs over EU member states is important from a political point of view. We explore the distribution of impacts on consumers and producers for the WTO proposal (figure 4.3). To facilitate the comparison we marked the average impact on the EU25 using the blue (agricultural income) and red (money metric) boxes. The first thing to note is that in percentage terms the negative impact on agricultural producers exceeds the positive impact on consumers, which contrasts with results in absolute terms of table 4.1 on a first glance, but is a direct result of the small number of agricultural producers relative to the number of consumers in the EU25.

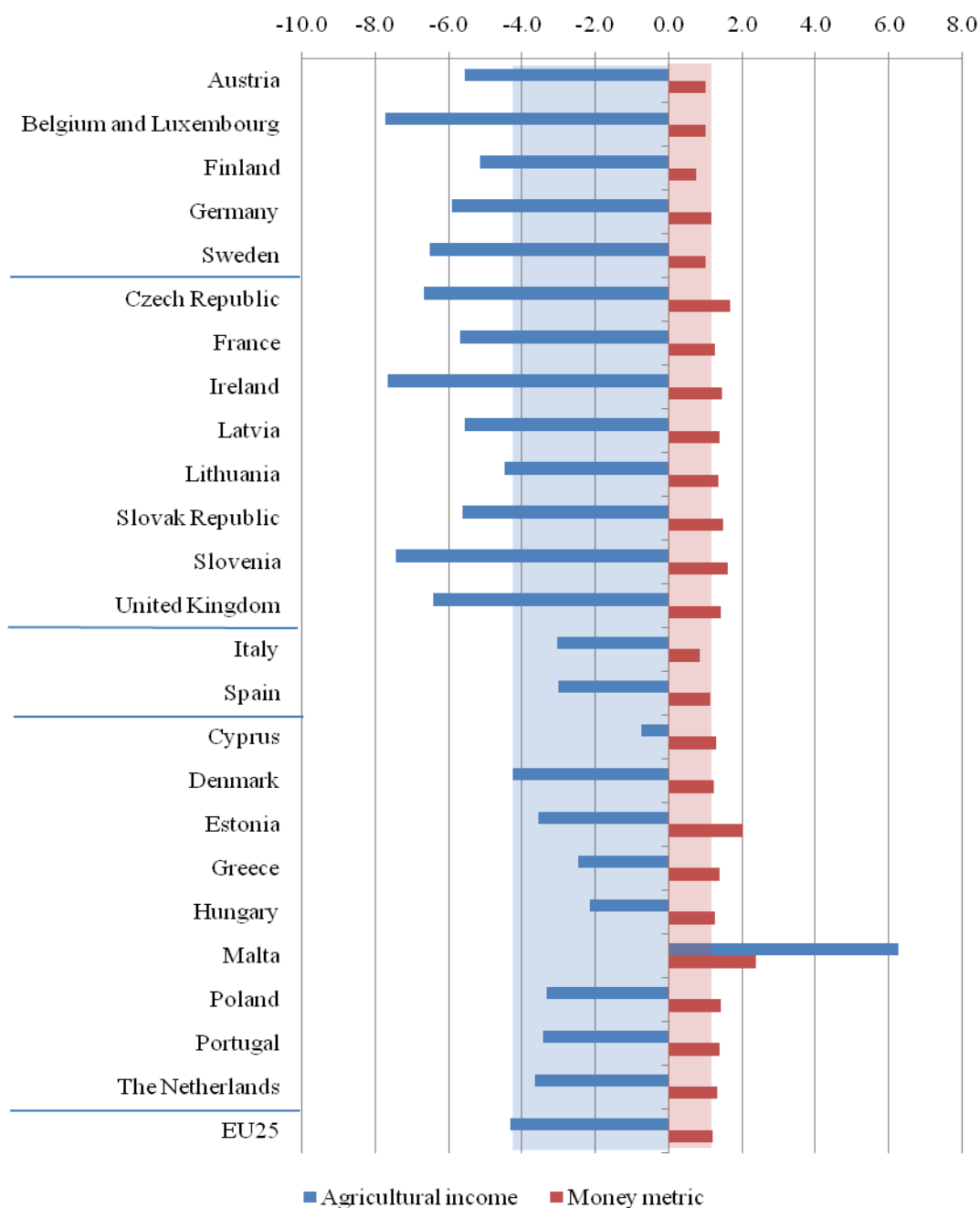
Apart from Malta in all EU member states agricultural income declines and more so than the percentage increase for consumers. To get a grip on the distribution of impacts across member states the countries have been sorted in four groups. The first group experiences a greater decline in agricultural income than the EU average while their consumers gain less than the EU average (Austria, Belgium and Luxembourg, Finland, Germany and Sweden). This group thus benefits least from the agricultural part of the WTO proposal within the EU and for these countries it would be most relevant to assess the impact of manufacturing and services liberalization to assess whether these would provide above average benefits.

The second group of countries also experiences a greater than average decline in agricultural income, but now the consumers gain more than average (Czech Republic, France, Ireland, Latvia, Lithuania, Slovak Republic, Slovenia, United Kingdom). Note that this group includes France, which is the most vocal opponent of agricultural trade liberalization. The third group experiences the opposite with agricultural incomes declining less than average while consumers gain less than average (Italy, Spain). For these two groups of country the WTO proposal thus has a mixed impact compared to the average EU impact.

The final group of countries contains the relative winners within the EU with agricultural income declining less than average while consumers gain (slightly) more than average (Cyprus, Denmark, Estonia, Greece, Hungary, Malta, Poland, Portugal, The Netherlands).

Looking at the most vocal opponents of agricultural trade liberalization in the EU (France, Ireland and Poland) we find that in all three countries consumers gain more than the average EU gain. For France and especially Ireland we find above average declines in farmer income, while Poland experiences lower than average losses in farmer income are found. This indicates that there is no direct relation between relative losses of liberalization and position on agricultural trade liberalization.

Figure 4.3 Distribution of impact WTO proposal on agricultural income and money metric measure of consumer welfare by member state (% change to baseline). Source: SEAMCAP.



The distribution of impacts across EU member states is directly related to activity specializations. A region specializes in products experiencing a large decline like meat will experience stronger declines in agricultural income. Figure 4.4 depicts the regional changes in agricultural income in EU created with SEAMpress.

Figure 4.4 Regional change in agricultural income with the WTO proposal (% change to baseline).  
Source: SEAMCAP

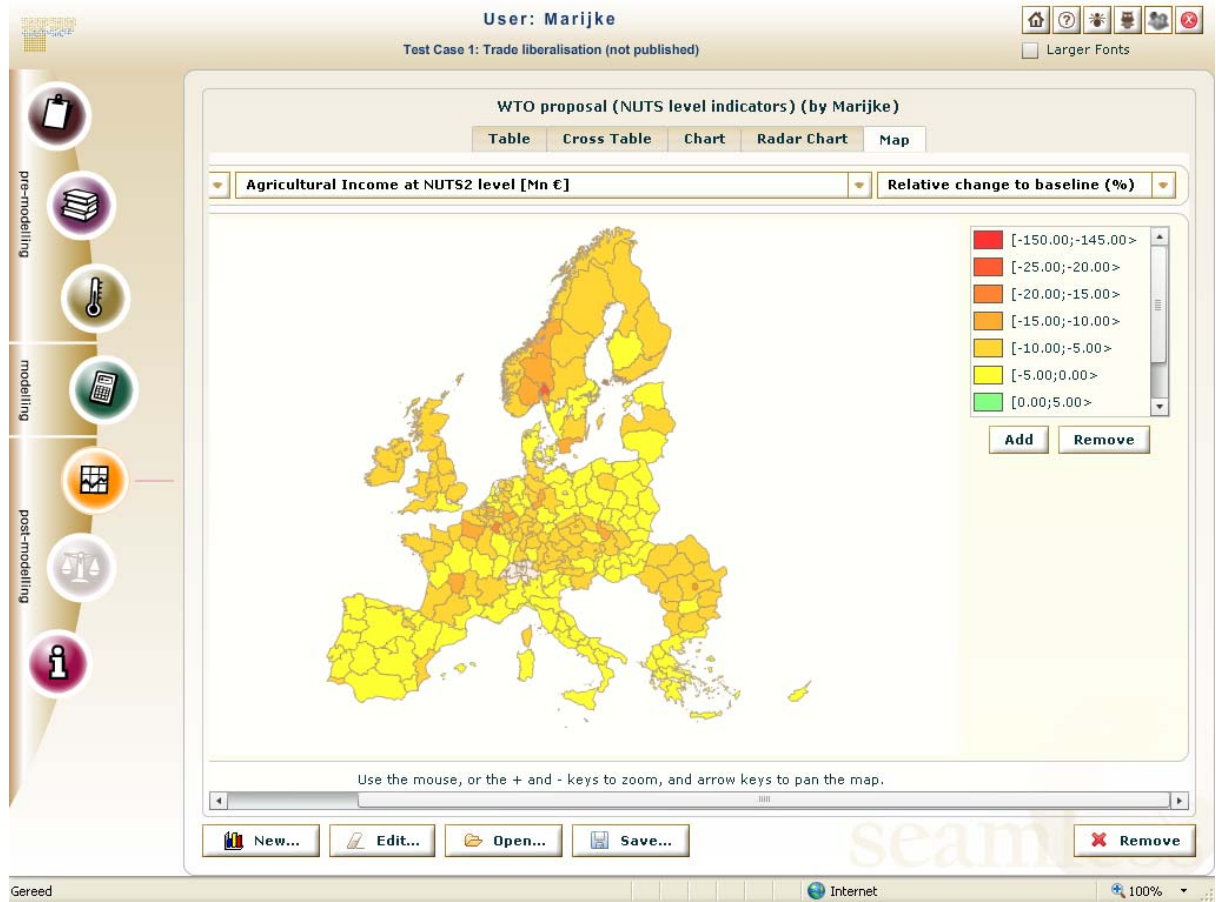
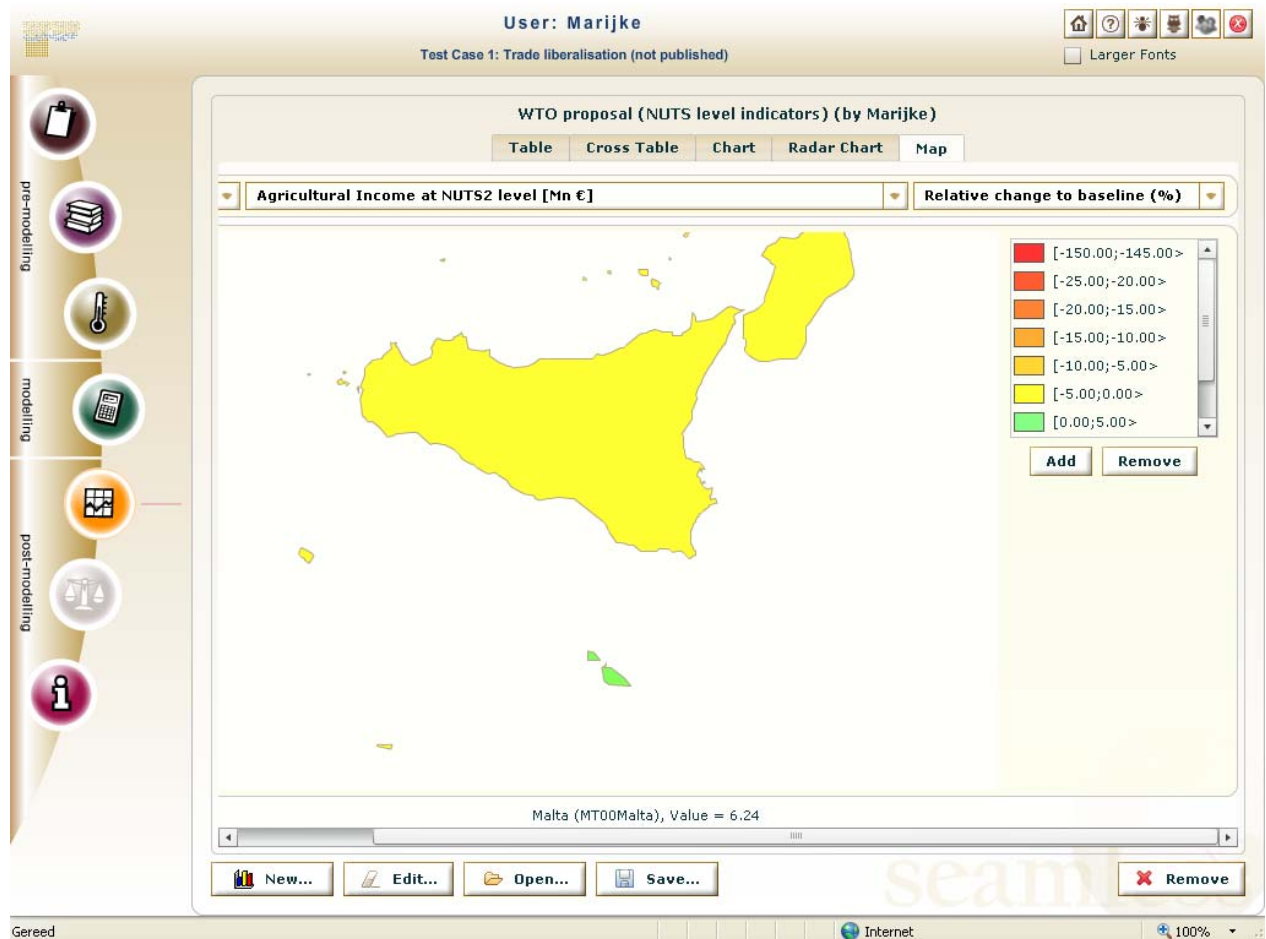


Figure 4.5 Regional change in agricultural income with the WTO proposal zooming in on Malta (% change to baseline). Source: SEAMCAP



Although not directly visible on the map, the legend indicates that in some regions there is an extreme drop in agricultural income. This drop of 147% occurs in Aaland (a region of the coast of Finland consisting of an archipelago of small islands). The expression of the change in agricultural income in percentage terms is also a bit deceptive since the actual level of agricultural income is low 0.34 mln. euro in the baseline and dropping to -0.16 mln. euro in the WTO scenario. In absolute terms the impact is thus limited, although it may still be significant for the region depending on development of other sources of income like tourism not considered in our analysis.

From the map we can also not directly see which region experiences an increase in agricultural income. From figure 4.3 we can however see that Malta is the only region with a positive impact on the agricultural income. Zooming in confirms this (figure 4.5).

The colouring in figure 4.4 indicates that there are also differences between regions in a country, in addition to the differences between member states already discussed. These are partly due to differences in areas of countries with larger countries having more potential for variability in activities. There is no perfect correlation with size however, as is illustrated by the variability between regions in the Netherlands.

Figure 4.6 Farm level change in agricultural income with the subsidy and WTO scenario (% change to baseline). Source: FSSIM



### 4.3 Economic results at regional level

Employing the full backbone model chain of SEAMLESS-IF allows us to not only assess impacts at regional level but assess changes between farm types for the 13 regions where farm level models are available. Since the income of agricultural producers is a key concern in the discussion on the agricultural trade liberalization in the context of the WTO we focus on this indicator at farm level. Figure 4.6 presents a screenshot of the percentage change in agricultural income at farm level for the subsidy and WTO scenario. Although the graph signals a wide variation, the number of farms is too large for a more detailed assessment.

To get a better grip on the variability in response we compute the average change in income by region (figure 4.7 for the subsidies scenario and figure 4.8 for the WTO proposal). We used a simple average without accounting for the number or area covered by the farm types since we are not after an average that represents the aggregated regional response but focusing on the variation in response between farm types. Apart from the average change in farm income for each region also the minimum and maximum change income are displayed to get an understanding of the variation between farm types within a region.

For most regions the variation among farm types within a region is in the range of variation among regions. Exceptions vary by scenario. Andalusia and Brandenburg show a high spread in farm income with the subsidy scenario, while under the WTO scenario the variation among farm types is not very large. Since the subsidy elimination is part of the WTO proposal this indicates that the reduction in tariffs has an opposite effect on the subsidy removal resulting in the dampening of the reaction when only subsidies are removed.



The opposite pattern is observed for the Mazowsze-Podlasie and Pomorze-Mazury. The subsidy removal has a limited (positive) effect on farm incomes but once tariff reductions are added in the WTO proposal there is a strong reduction from some farm types while others are only affected to a lesser extent.

There is one region where there is a wide spread among farm types. For Castilla y Leon we have the largest number of farm types in single region (10) and we also observe the strongest positive and negative reactions in both scenarios. Castilla y Leon thus seems to illustrate the range of farm income changes possible with a change in trade scenario.

Just as the regional variations observed earlier within EU member states are due to differences in dominant activities, such specialization will also affect the impact at farm level. To explore this link we regrouped the farms to look at the average change in farm income by type of farm instead of by region. Note that we ignore the third dimension used in the SEAMLESS farm typology (intensity) and only distinguish scale and activity specialization to keep a manageable number of groups.

Figure 4.9 displays the average changes in farm income for the subsidy scenario jointly with the variation within each group of farms. There are two farm types that benefit much more from the subsidy removal, the medium and small scale arable/fallow farm types. The effect on the large scale arable/fallow farms is much less pronounced which is probably due to a difference in relative importance of activities. If we then turn to the WTO scenario (figure 4.10) we find another type of farm responding most strongly (and negatively), the arable/cereal farms. Again there is a relationship with scale with a limited response of the large scale farms. These findings suggest that the farms benefiting from the subsidy removal and those suffering from the tariff reduction are not the same suggesting a strong difference in farm income effects among farms.



Figure 4.7 Average farm income changes by region with the subsidy scenario (% change to baseline, in brackets number of farm type models per region). Source: FSSIM

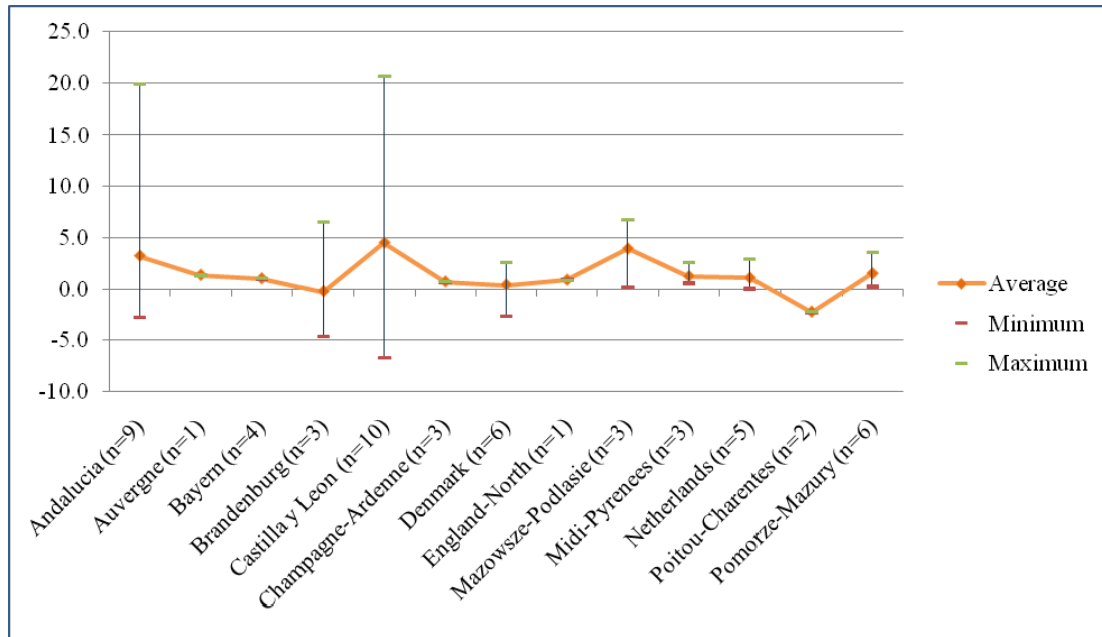


Figure 4.8 Average farm income changes by region with the WTO scenario (% change to baseline, in brackets number of farm type models per region). Source: FSSIM

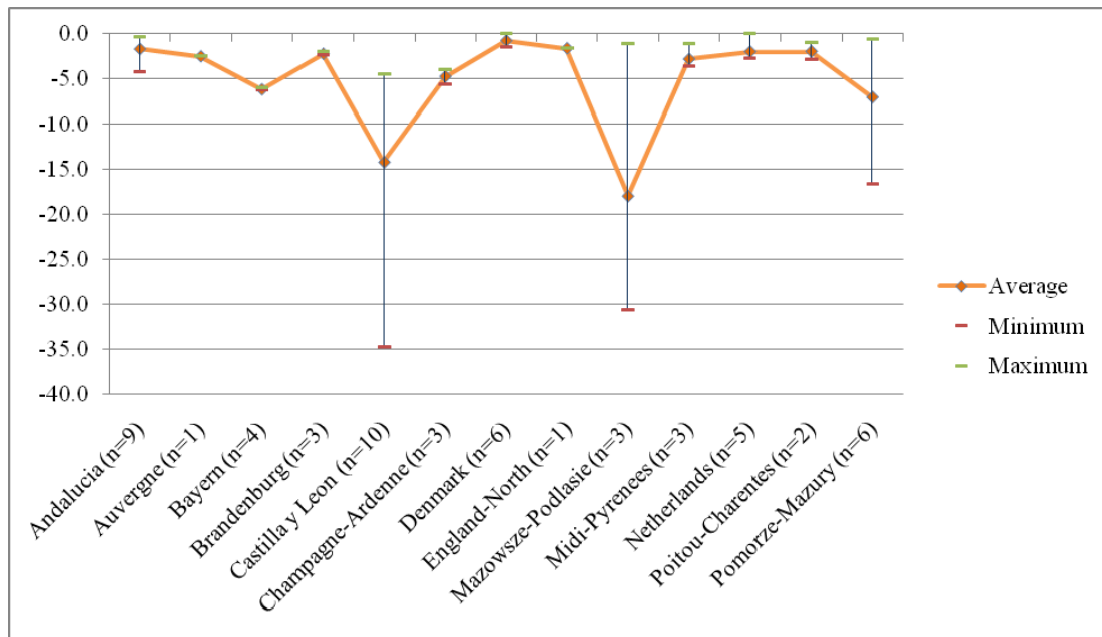


Figure 4.9 Average farm income changes by farm type with the subsidy scenario (% change to baseline, in brackets number of farm type models per group). Source: FSSIM

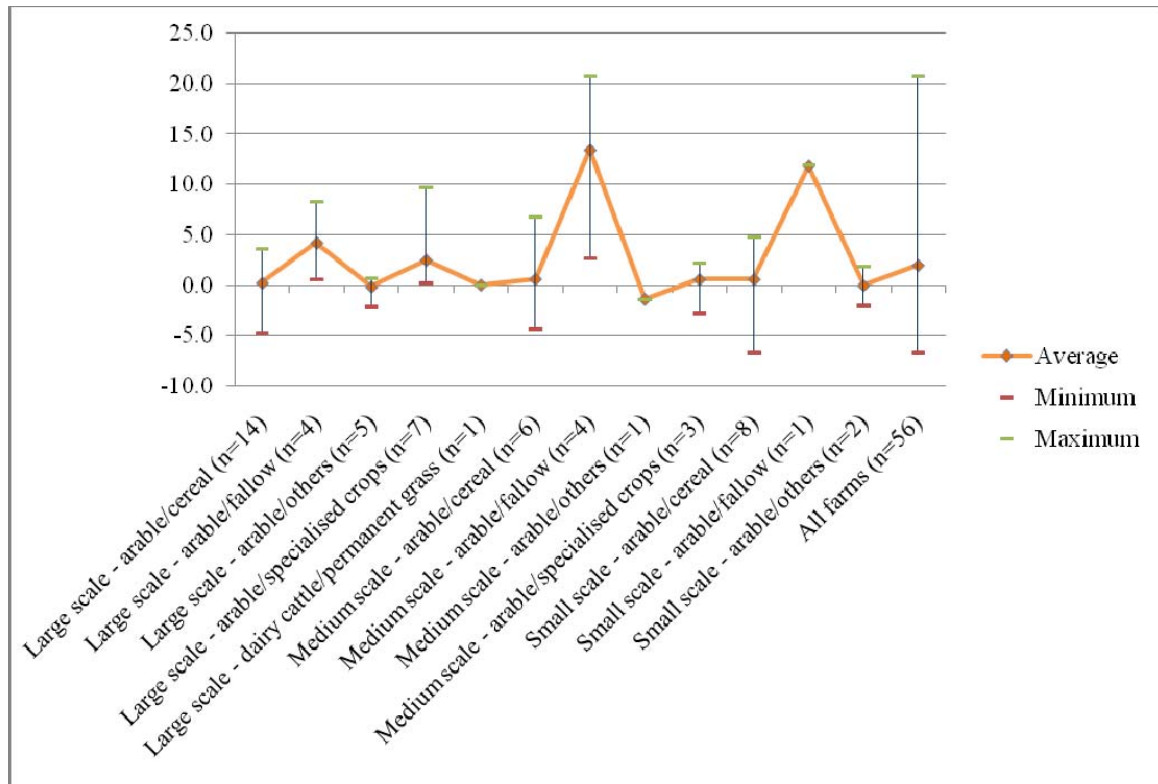
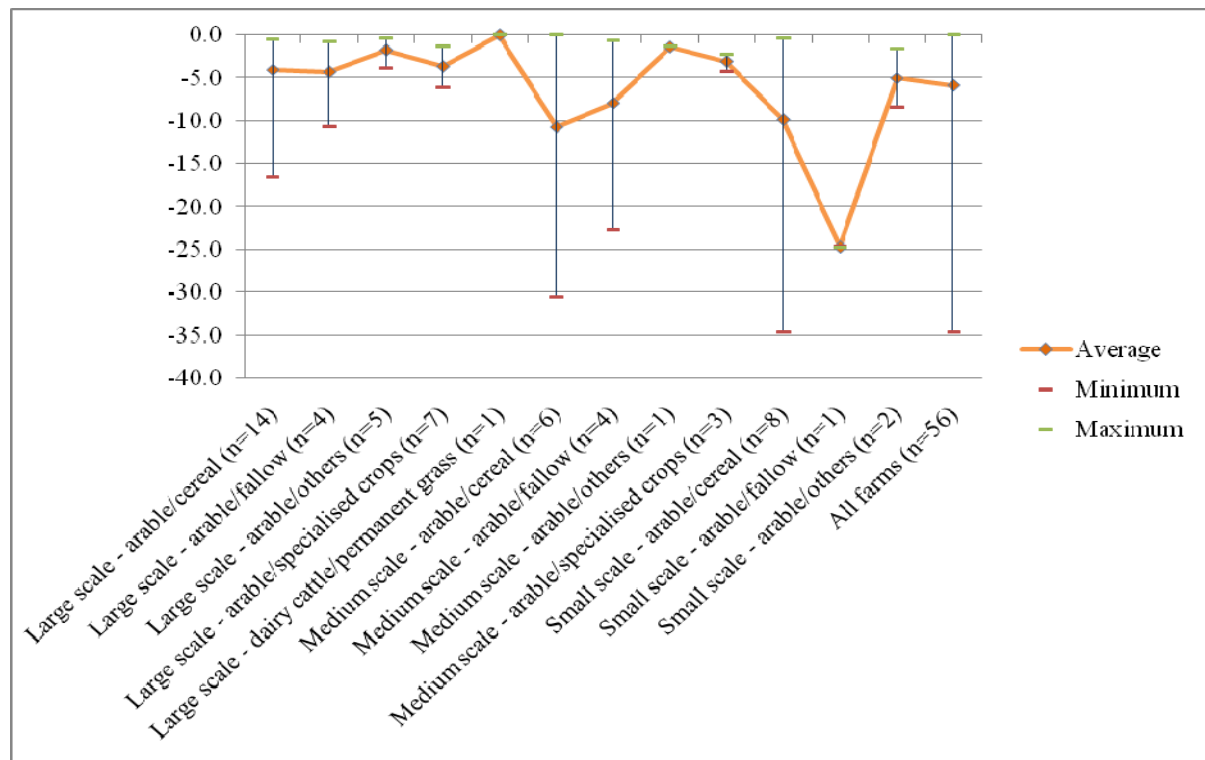
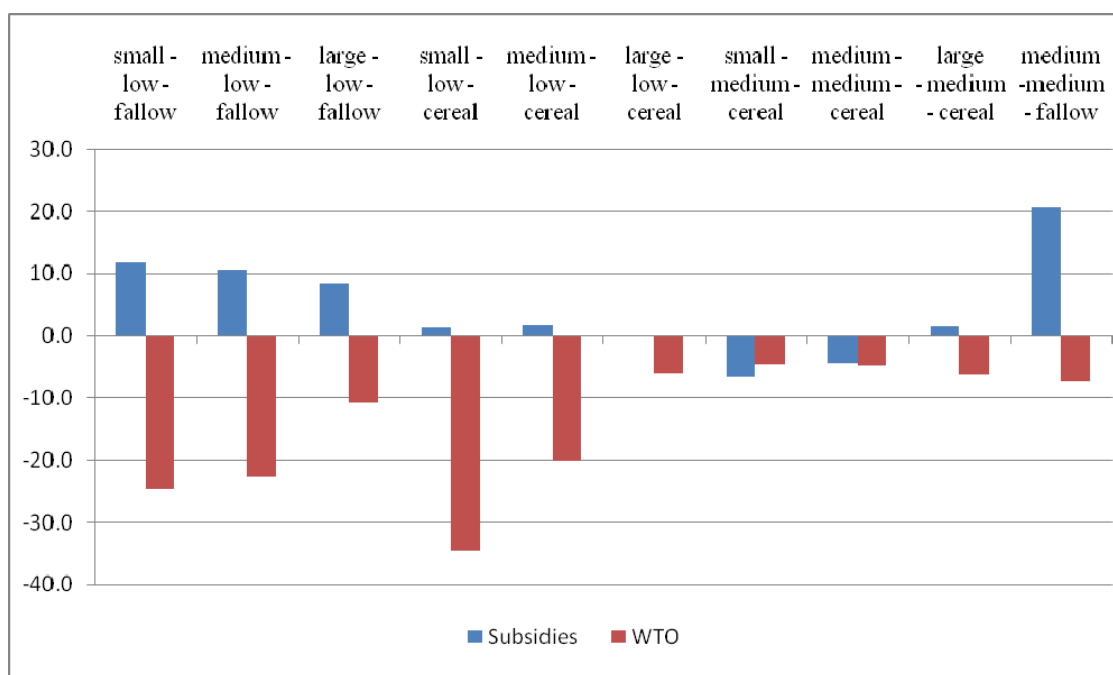


Figure 4.10 Average farm income changes by farm type with the WTO scenario (% change to baseline, in brackets number of farm type models per group). Source: FSSIM



In order to look at individual farm types in a manageable fashion we need to restrict the geographical scope. Since Castilla y Leon showed the largest spread in reactions in both the subsidy and WTO scenario we take a closer look at the changes in farm income in this region. Figure 4.11 presents the change in farm income for all ten farm types in Castilla y Leon for both the subsidy and the WTO scenario. Farm types are distinguished in terms of scale (small, medium, large), intensity of production (low and medium, high does not occur in this region) and the main production activities (arable/fallow and arable/cereal are only occurring in this region).

Figure 4.11 Farm income changes in Castilla y Leon with the subsidy and WTO scenario (% change to baseline). For a description of farm types see text. Source: FSSIM



The limitation of activities to arable/fallow and arable/cereal provides the clue to the strong response observed for Castilla y Leon. These were the two types of farms reacting most strongly positive to the subsidy removal (arable/fallow) and most strongly negative to the WTO proposal (arable/cereal).

From figure 4.11 it is also clear that the cereal farms experience only a small positive, zero or even negative effect in farm income from subsidy removal. The arable/fallow farm types on the other hand experience a strong positive income effect from the subsidy removal. This helps to balance the negative impact of the tariff reductions, which is comparable to the negative impact observed for the small and medium medium intensity cereal farms. The main difference in terms of impact on farm income thus lies not with the reduction in tariffs, which has a considerable impact on most farm types, but with a different response to the removal of subsidies.

The general effect of increasing farm income in the subsidies scenario can be explained through the fact that some prices for agricultural commodities do increase, others decrease. If we look for example at the different types of cereals, we observe increasing prices for rye barley and oats, while those for wheat corn and other cereals are decreasing. Therefore the effect on farm income is strongly connected to the specialization for single crops. This explains the income increase for the arable/fallow farmtype – dominated by sunflower

production is the dominating crop for which we observe increasing prices, while the arable/cereal type – dominated by soft wheat which suffers from decreasing prices, shows a decrease in income.

Apart from product specialization the scale and intensity of the farm types also matters. In figure 4.11 we find the strongest negative impacts for small scale - low intensity farms, irrespective of their cropping orientation. This negative impact fits with the push toward large scale more intensive production when competition increases, as is occurring with trade liberalization.

Although the most severe negative price effects in all scenarios are found for livestock products we cannot assess their impact at farm level due to the lack of livestock farms in the current version of SEAMLESS-IF.

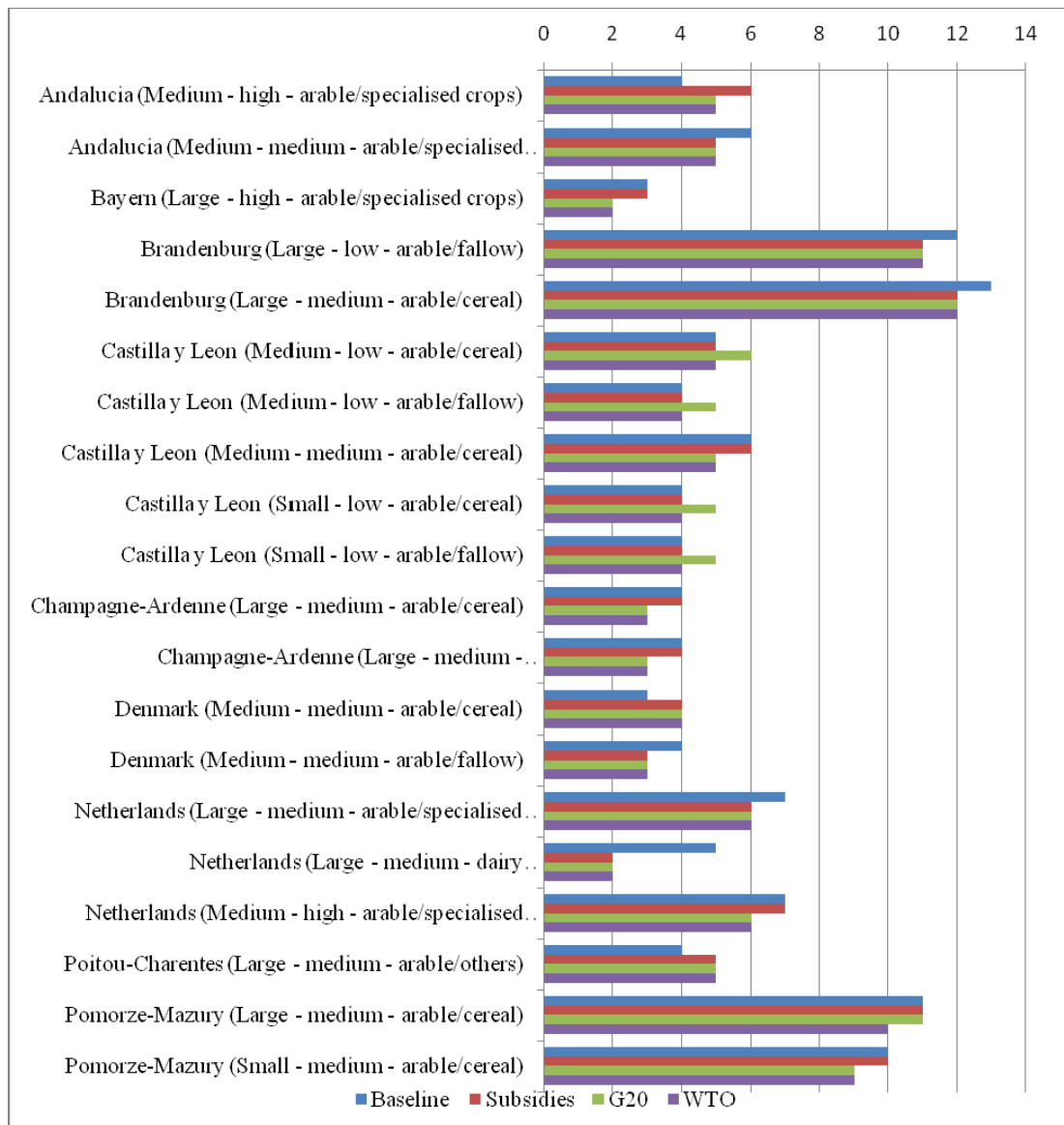
#### **4.4 Environmental results at regional level**

In the pre-modelling phase we selected two environmental indicators to assess the impact of trade liberalisation on environmental issues: crop diversity and nitrate leaching. We find *crop diversity* hardly changes between scenarios. Figure 4.12 presents the value of the crop diversity indicator for 20 farm types where in any of the scenarios a change for this indicator was observed. For the sake of readability we again shortened the farm type descriptions by eliminating the scale reference (first item in shortened farm type description) and intensity reference (second item in shortened farm type description). Recall that a higher number signifies an increase in crop diversity.

First of all we can observe that for the majority of farm types there is no change in the crop diversity indicator. This suggests that either the changes in farm income observed involve limited changes in crop areas (which is unlikely given the variety in price changes observed) or that the indicator is not very sensitive (i.e. does not respond quickly to changes in cropping pattern).

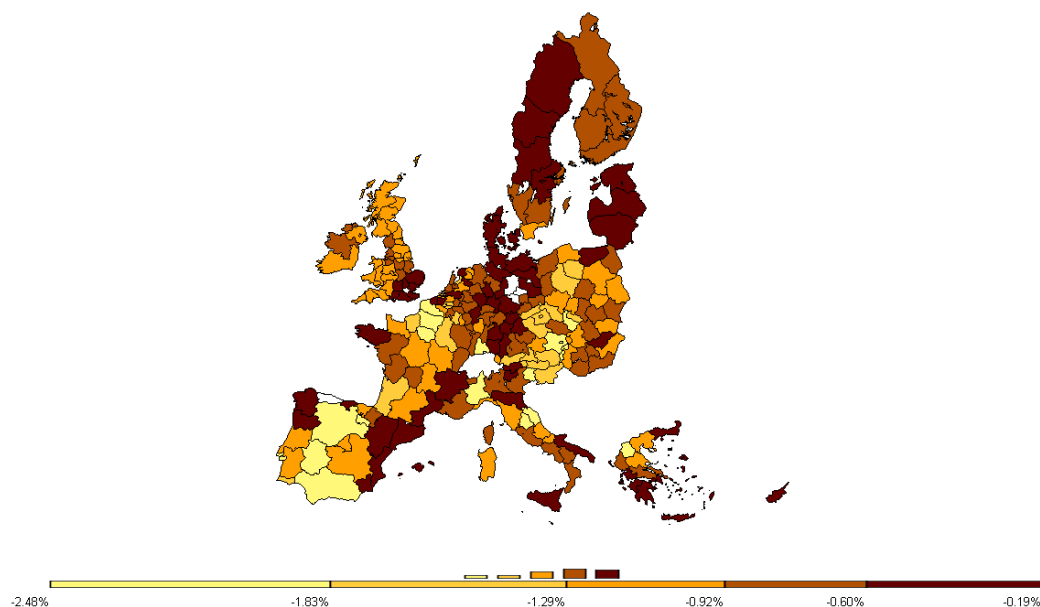
For the farm types where changes in crop diversity are observed figure 4.12 does not indicate a clear pattern, crop diversity both increases and decreases with trade liberalization. In terms of overall patterns there appears to be a different effect of the WTO proposal. Where the subsidies and G20 scenarios have twice as many cases with a reduction in crop diversity as cases with an increase in crop diversity, for the WTO scenario we find only three cases of an increase in crop diversity against 13 cases of a decrease. This may be due to a specialization in specific crops to exploit the comparative advantages of European agriculture when trade liberalization increases competitive pressure. The number of cases with a decrease in crop diversity with the G20 proposal is comparable to the WTO proposal (12), however there are also seven cases of an increase in crop diversity under the G20 proposal. All in all the crop diversity indicator clearly hints at a strong local variation in farm responses to trade liberalization.

Figure 4.12 Farm types with changes in crop diversity indicator. For a description of farm types see text. Source: FSSIM



*Nitrate leaching* is the second environmental indicator that we selected. We start by analyzing the impact of the WTO scenario on nitrate leaching displayed at regional level (figure 4.13). The WTO reform has generally a positive impact on the NUTS regions of the EU25. At least slight reductions of more than 0.19% occur in the dark shaded regions, while nitrate leaching is reduced up to 2.5% in the bright shaded ones. This goes along with the observation that the main affected sector of this scenario is the cattle sector, where reduced prices may lead to less intensive production and thus to reduced manure application which is one of the most important sources for nitrate leaching.

Figure 4.13 Changes of nitrate leaching in the WTO scenario relative to the baseline (%)



While this result is plausible on regional level, there might be differences across farm types, because for those farm types not producing animal products this argumentation does not hold. If we zoom into the three available farm types in the region Midi Pyrénées in France, where the regional result predict a reduction of nitrate leaching of around -1.2%, we see that those behave differently (table 4.2). While the arable farmtype specialised in cereal production reduces nitrate leaching by 2% the other two types show increasing nitrate leaching.

Table 4.2: Change of nitrate leaching and crop pattern for the three farm types in Midi Pyrénées

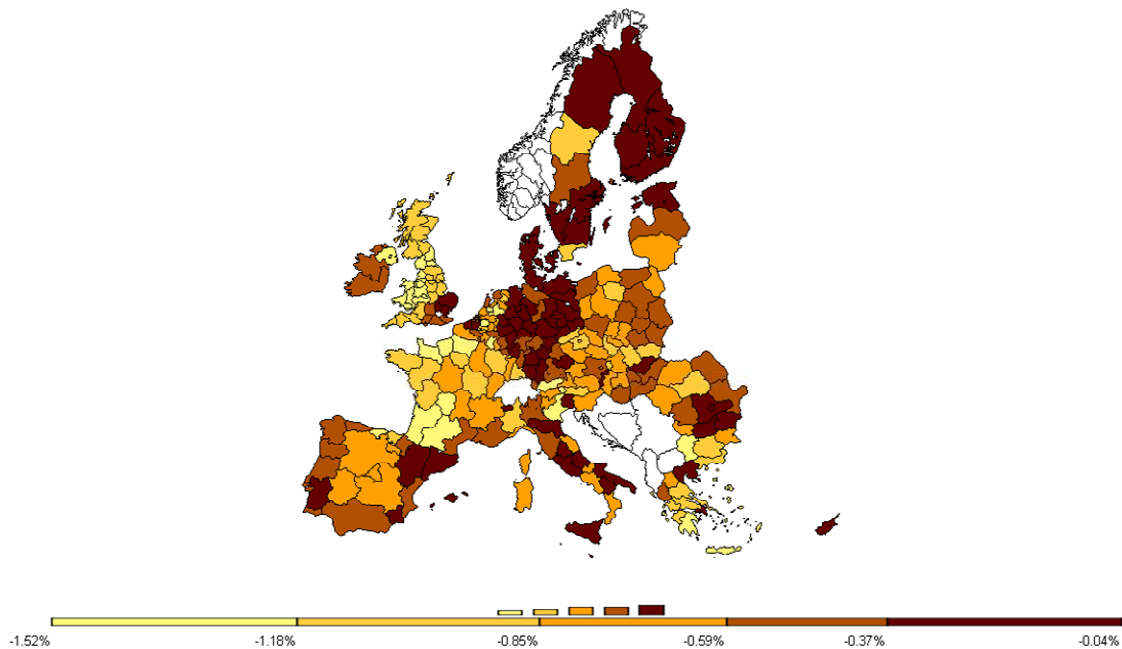
		arable/cereal		arable/fallow		arable/other	
		Baseline	WTO	Baseline	WTO	Baseline	WTO
Nitrate leaching	(kg/ha)	37.02	-2%	41.47	3%	22.14	6%
Fallow land	(ha)	13.66	0%	12.28	0%	17.31	0%
Fodder Maize	(ha)	1.05	-3%	1.09	0%	1.45	-9%
Maize	(ha)	30.75	-4%	16.84	-10%	2.66	88%
Peas	(ha)	2.96	-5%	2.98	-29%	3.81	-35%
Rape	(ha)	2.87	-16%	2.03	1%	2.28	8%
Soya	(ha)	6.35	18%	8.56	0%	16.36	10%
Sunflower	(ha)	22.24	2%	20.18	-6%	48.4	-7%
Winter barley	(ha)	3.73	-5%	1.22	10%	2.03	2%
Winter soft wheat	(ha)	18.11	2%	25.85	14%	16.36	5%

The reason for these differences must be found in the reallocation of crops which have different nitrate leaching potential and also by switching to other, less nitrate saving crop rotations (not shown here). We can see that the arable/cereal farm type increases sunflower acreage, while the other two reduce it considerably. The cropping of sunflowers in turn only has a low nitrate leaching potential compared to maize or soft wheat, which might explain parts of the opposed effects among farm types.

#### 4.5 Socio economic results at regional level

As one of the few available socio economic indicators, we selected total labour use per region. In figure 4.14 it becomes apparent that labour used in agriculture is reduced by in between 0 and 1.5% over the regions of the EU27. We can therefore conclude that the WTO scenario creates some pressure in the agricultural labour market. This effect is explained by reduced prices for most agricultural commodities that create pressure on farms which reduce their production and may switch from more labour intensive cropping activities to less intensive ones.

Figure 4.14 Changes of labour use in agriculture in the WTO scenario relative to the baseline (%)



It should be noted here that the models used in the analysis do not feature a labour market. Labour needs are attached to each production activity, but there is not competition with other sectors. The presented results are therefore only a rough estimate of the impacts on agricultural labour. It may well be that although agricultural labour demands decreases demand for labour in manufacturing and services increases. If a shift from agriculture to manufacturing occurs this may have positive income implications for the people involved since generally wages in the rest of the economy are higher than in agriculture. It would however put additional pressure on the viability of rural communities.



## 5 Conclusions

The aim of this deliverable is to provide an integrated assessment of the impact of trade liberalization using SEAMLESS-IF. Defining three different scenarios (subsidies, G20 and WTO) we explored the impact on three different domains and at three different levels. In Table 5.1 summarizes our key findings.

*Table 5.1: Summary of the impacts of trade liberalization*

	<i>Economic</i>	<i>Environmental</i>	<i>Social</i>
<i>EU</i>	Overall positive effect with consumers gaining and agricultural producers losing; both gains and losses are smaller with WTO than with G20 proposal	Reduction in nitrate leaching in EU	Reduction in labour use in EU
<i>Country</i>	Gains or losses relative to EU average vary by country; countries most vocal in their opposition to liberalization are not the ones losing most	Reduction in nitrate leaching in all countries	Reduction in labour use in all countries
<i>Regional</i>	Impacts at regional level depend on specialization of regions; meat producing regions lose most agricultural income	Reduction in nitrate leaching in all regions	Reduction in labour use in all regions
<i>Farm</i>	All farm types experience losses in income mostly due to the tariff reduction component of the trade liberalization scenarios	Nitrate leaching increases in some farm types despite decreases at regional level  Crop diversity remains stable in most farm types, if it changes it does so both upwards as downwards	

The diversity we found in terms of impact is already apparent from table 5.1. Although the overall economic impact the agricultural sector is positive, the agricultural income declines. And although at regional level nitrate leaching declines, it may still increase locally within some regions. The diversity of impacts prevents a simple conclusion on trade liberalization as being either good or bad, such an assessment depends on the perspective taken. Apart from resulting in a nuanced view on the policy assessed, the results also beckon further explorations of additional (regional) policies with SEAMLESS-IF which could modify the impacts of trade liberalization for example on labour use.

The analysis illustrates that expanding the scope of the analysis across scales and domains results in a rich and diverse picture of impacts. Such a broader view inhibits simple recommendations in terms of trade liberalization being either a good or a bad since the conclusion depends on the perspective taken. Apart from resulting in a nuanced view on the policy assessed, the results also beckon for further explorations of additional (regional)



policies with SEAMLESS-IF which could modify the impacts of trade liberalization for example on labour use or local nitrate leaching.

When interpreting the results various limitations need to be kept in mind. First of all the models employed focus on the agricultural sector whereas the WTO negotiations are on purpose a 'single-undertaking' involving manufacturing and services as well. Due to the economic structure of the EU these latter two components are of more importance in economic terms and liberalization in these will benefit the European economy. Focussing on agriculture only we also do not account for changes in prices of labour or inputs that could result from liberalization in the rest of the economy and may affect agriculture.

Secondly, the current version of SEAMLESS-IF does not cover well the meat production at farm level. This implies that we are unable to explore the farm level impact of the large reductions in meat prices occurring with trade liberalization. Additional farm types describing meat production would greatly add to the analysis.

Thirdly, as in all policy assessments our representation of the policy changes in the models does not cover all complexities and richness of the actual policies. We expect that that our assessment underestimates potential benefits for the EU by ignoring the possibilities for limiting liberalization for sensitive products and ignoring a reduction in domestic support in the United States. We also ignore the difference between bound and applied rates and exceptions to tariff reductions for developing countries which would reduce benefits for the EU, but generally the limited economic size of developing countries also limits their impact on global economic changes.

All in all the application illustrates the potential of SEAMLESS-IF for integrated assessment across scales and suggests that analyses may not be one-off assessments of a policy but instead develop in several rounds searching for a combination of policies at different levels and in different domains to achieve different policy objectives in the economic, environmental and social domain.

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## Glossary

<i>Applied tariffs</i>	Import tariff (generally expressed in ad valorem terms, i.e. as a percent of the price of the product) levied at the border on imports from other countries.
<i>Bound tariffs</i>	Maximum tariff that a WTO member can levy on imports from another WTO member. These tariffs are the ones negotiated on in WTO negotiations but may be considerably higher than actually applied tariffs.
<i>Consumer surplus</i>	The amount consumers are willing to pay for a product depends on consumer preferences and income. These vary widely among consumers resulting in consumers not willing to pay the market price (and therefore not buying the product) as well as consumers willing to pay more than the going market price. The consumer surplus measures this benefit to consumers willing to pay more and is computed as the difference between the amount consumers are willing to pay and the actual market price.
<i>Doha Round</i>	The November 2001 declaration of the Fourth Ministerial Conference in Doha, Qatar, provides the mandate for negotiations on a range of subjects and other work within the WTO.
<i>Modalities</i>	A way to proceed. Modalities set broad outlines — such as formulas or approaches for tariff reductions — for final commitments.
<i>Supply elasticities</i>	The percentage change in the quantity supplied resulting from a 1 percent change in the price.
<i>WTO</i>	World Trade Organization, a multilateral platform where member states negotiate on global reductions in barriers to trade (like tariffs and domestic support).