Effects of WTO export subsidy abolition and tariff rate reduction on agriculture on global and national level

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Abstract

Commitments by the EU in multilateral trade negotiations have diverse effects on the member countries and especially their prospects in agricultural production. Each of the details in the current agricultural negotiations within the WTO have an impact on country level production possibilities and this raises a real interest for single farmers and their representatives to get information on the transmittance of global commitments to national decision making, either in production possibilities or support programmes.

GTAP framework is a well-known approach in the analysis of global trade liberalisation. Changes in world market prices have repercussions on national production and consumption decisions thus producing a new equilibrium with altered production and consumption patterns. Considering agriculture and use of agricultural land, the consequences of changing trade flows and product prices, as well as consequences of possibly changing support levels for agriculture, are important to be analysed also at national and regional level.

The DREMFIA sector model (Lehtonen 2001) is utilised to investigate the medium-term impacts of the policy changes in production, input use, incomes, and structure of Finnish agricultural sector. The model is disaggregated in 4 main regions and 18 smaller regions which facilitate a very detailed representation of agricultural policy and use of region specific information of agricultural production. Relevant EU level price changes, which are exogenous in the DREMFIA model, are derived from the GTAP model.

In this paper some of the scenarios in the WTO negotiations are taken as examples of international commitments whose effects are studied on the national level. We rely mostly on the commitment in December 2005 Ministerial meeting where the WTO members engaged in removing agricultural export subsidies by 2013. This scenario has bee also analysed in isolation from other negotiation chapters in our previous paper (Kerkelä, Lehtonen and Niemi 2005). Apart from that we shortly include one of the tariff reduction scenarios into the analysis.

Both the tariff cuts as well as export subsidy abolition show decreasing prices and production for the EU members in agricultural production. Giving these price decreases as shocks to Dremfia model give negative output responses exceeding those of coming from the GTAP model. Still, the drastic output decline is dampened when short run and long run price effects are taken separately to the Dremfia model.

1. Introduction

Commitments by the EU in multilateral trade negotiations have diverse effects on the member countries and especially their prospects in agricultural production. Each of the details in the current agricultural negotiations within the WTO have an impact on country level production possibilities and this raises a real interest for single farmers and their representatives to get information on the transmittance of global commitments to national decision making, either in production possibilities or support programmes.

In quantitative modelling of international policies, the situation poses an interesting challenge to combine the results from global models with national models, especially in agriculture, that traditionally have been utilised in quantifying domestic policy changes. The approach is both pracmatic as well as methodologically interesting as several open questions can be raised when combining different types of models. This paper is a preliminary work in such a project.[1]

GTAP framework is a well-known approach in the analysis of global trade liberalisation. Changes in world market prices have repercussions on national production and consumption decisions thus producing a new equilibrium with an altered production and consumption patterns. From a single country perspective, the model is still very aggregate both in commodity details as well as technology assumptions. So theres is a genuine need to combine GTAP results with more detailed analysis in country level.

In poverty research and labor market studies this kind of work in combining and jointly analysing the model results is already well-known and spread in some extent. Macro-micro models often combine the CGE-model results with microsimulation models to englighten the poverty impacts of trade liberalisation scenarios (see e.g. Bussolo et al. 2005, Robilliard et. al. 2001). There is also work on combining and linking GTAP model with national CGE-models (see Horridge et al.2003 , Adams et. al. 1998). As Horridge et al. put it, there are several theoretical and empirical questions arising from this kind of work, even when both of the models used are of type general equilibrium. For instance, which endogenous variable results are used as inputs in the other model. On the other hand, if we use price information as an exogenous input in the other model, are the production responses in GTAP and the other model consistent with each other.

These questions can be even more severe when combining the results from GTAP model with a national dynamic partial equilibrium model, as we are doing in this paper. [2] Considering agriculture and use of agricultural land, the consequences of changing trade flows and product prices, as well as consequences of possibly changing support levels for agriculture are important to be analysed also at national and regional level. The DREMFIA sector model (Lehtonen 2001) is utilised to investigate the medium-term impacts of the policy changes in production, input use, incomes, and structure of Finnish agricultural sector. The model is disaggregated in 4 main regions and 18 smaller regions which facilitate a very detailed representation of agricultural policy and use of region specific information of agricultural production. Relevant EU level price changes, which are exogenous in the DREMFIA model, are derived from the GTAP model.

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[2] Any comments on this kind of work are welcome.

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The world market price development through these commitments is also an area which often is neglected in the national scene.

Changes in EU prices at the short and medium run can be taken into account in Dremfia model where domestic and imported products are also imperfect substitutes. Since Dremfia is a recursive dynamic model and includes investments, the short run and long run price changes drive structural and technical change in the model. Hence in Dremfia model the price dynamics plays a role as well, not only prices and production at short run or long run economic equilibrium. Hence the coupling of GTAP and Dremfia model through prices from the GTAP-model facilitate a dynamic-recursive production and structural change analysis at national and regional level, consistent to the EU level markets and price changes.

This paper proceeds as follows. First, the GTAP and DREMFIA models and how they are integrated in this study is described in section 2. In section 3 we present the two scenarios performed in this study and the main results from GTAP simulations: export subsidy elimination, and the export subsidy elimination combined with tariff rate reduction. The model results concerning global and EU level effects are reported only briefly, whereas we concentrate in reporting how the policy changes and global economy drives agricultural production and prices in different parts of the EU and, finally, in Finland. In section 4 we present the Dremfia results and reflect them to the GTAP results. Finally we explain some main mechanisms which drive the results and make some conclusions to be taken into account in further research.

2. Framework for quantitative analysis

2.1. Applying GTAP in deriving global economy wide effects of trade policies

The quantitative results of this study are derived by using the multiregional numerical general equilibrium model of the Global Trade Analysis Project (GTAP). The GTAP model and database are standard tools for analysis in the changing world of commodity markets.[3] The standard model assumes a competitive environment where consumers and firms take prices of goods and factors of production as given. It is assumed that the outcome of the model is one of optimizing behaviour by firms and consumers restricted by their resources (land, labour, capital, natural resources), restraints (taxes etc.) and their objective functions. Based on utility and profit maximization objectives, the new outcome in the model as a response to policy changes can be derived by behavioural equations that depend a lot on the elasticities used.

Different trade policies as well as domestic policies are implemented to the model and database as price wedges between different prices, e.g. the domestic and world market price. Exogenous changes such as trade liberalisation affect the relative prices between regions and commodities and the behaviour of consumers and producers within economies to produce a new equilibrium to the economy. Different regions in the model are combined by bilateral trade flows and the demand

[3] Applications and references to the model structure can be found at the GTAP project webpage; http://www.agecon.purdue.edu/gtap. Hertel and Tsigas (1997) describe the model. Dimaranan and McDougall (2005) describe the GTAP Database.

structure in foreign trade differentiates between commodities imported from different sources. This enables the equilibrium to remain in non-specialized pattern of trade where substitution possibilities play a central role.

The GTAP database version 6.0 is a cross-section of data from year 2001 collecting balanced values for bilateral trade flows in sectors and description of the economies. The GTAP database distinguishes between 87 regions, 57 sectors and five primary factors. In this analysis, the database is aggregated into a 11-region and 14-commodity aggregation 8 of which are in primary agriculture (Table 1).

Table 1. Model regional and commodity aggregation (GTAP Version 6)

Regions	Abbreviations	Sectors	Abbreviations
EU – 15	EU	Wheat	WHEAT
Rest of ACCEU, Croatia	REU	Other grains	GRO
Switzerland, Norway, Iceland	EFT	Vegetables, fruits, nuts	V_F
USA	USA	Other crops	OCR
Mercosur (excl. Paraguay)	MERCOSU	Raw milk, cattle	MILCT
Australia and NZL	AUSNZ	Animal products, nec	OTAG
Russia	RUSSIA	Bovine meat	CATTMEAT
China and Honkong	CHINA	Other meat products	OTMEAT
India	INDIA	Dairy products	DAIRY
LDSs in Africa	LDCs	Sugar	SUGAR
ROW	ROW	Other food	OTFOOD
		Resources	RESOUR
		Manufacturing	MANUFAC
		Services	SVCES
Further disaggregations	EU		
Finland	EU		
France	EU		
Germany and Austria	EU		
Northern EU	EU		
Southern EU	EU		
Poland	REU		
Rest of ACCEU	REU		

Source: GTAP Data Base 6.0

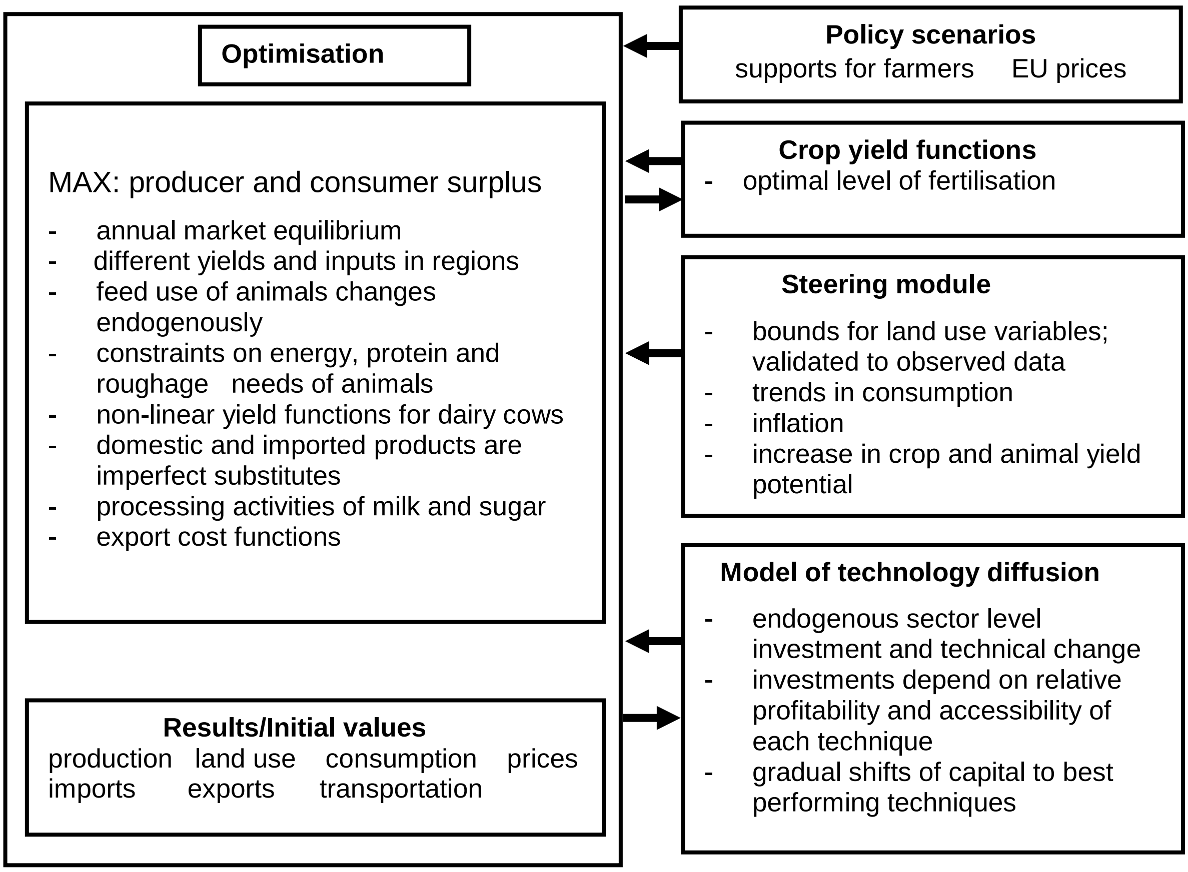
The regional aggregation includes the major agricultural exporting and importing regions (the EU, the United States, China, India). Mercosur and Australia/New Zealand are considered largest exporters in agricultural products, whereas Russia is an example of a single large country importing subsidised products from the EU market. The EFTA countries comprise of Iceland, Norway and Switzerland. For further analysis within the EU, we have disaggregated the EU into six regions (see table above). Also Poland is disaggregated from other Eastern European countries.

The export subsidies are part of the database implemented as a price wedge between the value of exports f.o.b. and world market price. This is a measure of the export subsidy rate reported in the Appendix 3. The data for export subsidies are collected from the 2000/2001 notifications to the WTO and compared to the f.o.b value of exports for 2000/2001 using UNCTAD trade data. Few assumptions on dividing the subsidies among the EU countries have bee made. First, the trade within Europe has been neglected in evaluating the export subsidy rates. It has also been assumed that the subsidy is not dependent on the destination country. The notifications have been divided to all of the trade in each sector, i.e. all products in dairy sector are assumed to enjoy a similar rate of subsidy.

2.2. National and regional level model of agricultural sector in Finland

Dynamic Regional Sector Model of Finnish agriculture (DREMFIA) is a dynamic recursive model for simulating agricultural production and markets from 1995 up to 2020. The model consists of two main parts (Fig. 1): (1) a technology diffusion model which determines sector level investments in different production technologies; (2) an optimisation routine simulating annual production decisions (within the limits of fixed factors) and price changes, *i.e.* supply and demand reactions, by maximising producer and consumer surplus subject to regional product balance and resource (land and capital) constraints. Production activities include number of different animals, hectares under different crops and set-aside, feed diet composition, chemical and manure fertilizer use and the resulting crop yield level.

Figure 1. Basic structure of the DREMFIA model.



Products and intermediate products may be transported between the regions at certain transportation costs. The optimisation model is a typical spatial price equilibrium model (see *e.g.* Cox & Chavas 2001), except that no explicit supply functions are specified, *i.e.* supply is a primal specification. This means that supply changes are not in fixed proportion to product price changes but are results of an explicit optimisation problem which takes into account all factors, not only product prices, affecting relative profitability between products. Furthermore, foreign trade activities are included in DREMFIA. The Armington assumption (Armington 1969) is used. In other words, imported and domestic products are imperfect substitutes, *i.e.*, endogenous prices of domestic and imported products are dependent. For example, the prices of domestic and imported beef may be different since consumers do not see the two products homogenous but are somewhat (depending on the specific substitution elasticity parameter used in model validation) reluctant to switch from domestic to imported beef. There are 18 different processed milk products and their regional processing activities in the model. In total, there are 17 different production regions. This allows a regionally disaggregated description of policy measures and production technology.

Technical change and investments, which imply evolution of farm size distribution and production capital in regions, are modelled as a process of technology diffusion described by Soete & Turner (1984). Two crucial aspects about diffusion and adaptation behaviour are included: first, the profitability of a new technique, and second, the risk and uncertainty involved in adopting a new technique. The information about and likelihood of adoption of a new technique will increase as its use becomes widespread. To cover the first aspect, the likelihood of adoption of a new technique ($f_{\beta\alpha}$) is made proportional to the fractional rate of profit increase in moving from the previously used technique α to a new technique β. The second aspect is modelled by letting $f_{\beta\alpha}$ be proportional to the ratio K_β/K, where K_β is the capital stock in technique β and K is the total capital stock in a certain agricultural production line. The total investments in each technique are further influenced by the savings rate (σ) (proportion of economic surplus re-invested in agriculture) and farmers' propensity to invest in alternative techniques (η) which are left as calibration parameters. For example, three dairy techniques have been included in the DREMFIA model: farms with 1-19 cows (labour intensive production), farms with 20-49 cows (semi-labour intensive production), and farms with 50 cows or more (capital intensive production). A unique set of parameters (σ,η) calibrates the farm size distribution to the observed farm size structure in 2002.

If a technique is highly profitable, it will tend to attract investments and, conversely, if it is relatively less profitable, investments and eventually the total capital stock in a technique will decline. To summarise, the investment function is an attempt to model the behaviour of farmers whose motivation to invest is greater profitability but who, nevertheless, will not adopt the most profitable technique immediately because of uncertainty and other retardation factors. The investments are strongly dependent on capital already invested in each technique. This is consistent with the conclusions of Rantamäki-Lahtinen *et al.* (2002) and Heikkilä *et al.* (2004), *i.e.* farm investments are strongly correlated with earlier investments, but poorly correlated with many other factors, such as liquidity or financial costs.

Use of variable inputs, such as fertilisers and feed stuffs, is dependent on agricultural product prices and fertiliser prices through production functions. The nutrients from animal manure are explicitly taken into account in the economic model. Feeding of animals may change provided that nutrition requirements, such as energy, protein, phosphorous and roughage needs, are fulfilled. In the feasible range of inputs per animal, production functions can be used to model the dependency between the average milk yield of dairy cows and the amount of concentrates and other grain based feed stuffs. Since in historical farm level data there are relatively less low or high levels of concentrates, the dataset is enriched by experimental data. A number of research trials have been made by agro-biological research on the yield response effects of significant changes in animal feeding and crop fertilisation (Sairanen *et al*. 1999, 2003; Bäckman *et al*. 1997). In the case of dairy cows and field crops, the uniform pattern of the results of many similar trials facilitates the inclusion of the data material in the estimation of the production functions. Hence, the production functions in the model include not only the observed historical variation in the use of inputs but also responses to large changes in the use of inputs rarely observed in actual farms (Pro Agria 2005).

Milk quotas, which constrain milk production at farm and country level, are traded within three separate areas in the model. Within each quota trade area, the sum of quotas purchased must equal the sum of quotas sold. The price of the quota is the weighted sum of the shadow values of an explicit quota constraint in each sub-region. Milk quota trade has an important role in facilitating improvements in production efficiency. The observed milk quota prices have served a valuable reference point in the model validation.

The overall model replicates very closely the *ex post* production development in 1995-2003. Official agricultural production and price statistics (http://matilda.mmm.fi) have been used as the basis in validation. Calibrating the unobserved parameters of the investment model (discussed above) is a significant part of the overall validation of the model. Price changes in 1995-2003 have been validated through calibrating the unobserved parameters in the Armington system and in export cost specification (see Lehtonen 2001 for details). The total value of each single input, calculated from input specifications of many production activities in the model, has been checked and validated using cross sectional statistical data (Statistics Finland 1995, 2003). Furthermore, also total *quantities* of inputs, not only the total *values* of inputs and outputs, are validated to observed aggregate levels. Hence, the validation of the model is consistent also in terms of the physical flows of inputs, such as fertilisers and feed stuffs.

The long- and medium-term changes in aggregate amounts and regional location of production are consistent in economic sense since the model is built to reach a steady-state equilibrium in a 10-15 year period given no further policy changes. There is a gradual adjustment built-in in the model as fixed production factors and animal biology make immediate adjustments costly. Non-linear production functions in the model are concave, *i.e.* the marginal productivity is decreasing with output. The steady-state equilibria found at the whole country level are also due to limited domestic consumption of food stuffs and expensive exports because of low EU price level compared to the production and transportation costs. Another reason for steady states in 10-15 year period is the Armington assumption and the assumption that consumers have some preference as to domestic products, *i.e.* scarcity of domestic food stuffs slightly increase producer prices, even though this increase is relatively low (only 1-10% on producer price level) in the model, when validated to observed price development.

A detailed presentation of the model and its parameters can be found in Lehtonen (2001, 2004). A comprehensive description on use of the DREMFIA model in analysing economic, ecological and social implications of different policies is reported in Lehtonen *et al.* (2004, 2005, 2006).

2.3. Integrating global economy wide insights from GTAP to national level modelling

In addition to the impacts of export subsidy abolition on the world and EU level we also analyse the impacts on prices and production in Finland, and compare them to the impacts in other parts of the EU because price changes in Finland are highly dependent on price changes in the main production countries in the EU and in neighbouring northern parts of the EU. Furthermore the results suggest that there are obvious differences in short and long run impacts at the EU level and especially in Finland.

Combined use of macro-economic models with national sector level models of agriculture is considered necessary and relevant in some countries (see, for example, Kaergård 2000). The sector models include a rich detail of agriculture and linkages between its different sub-sectors, but they typically rely on exogenous estimates of input prices. This makes sector level models sensitive to assumed input prices. For example, price of labour, which typically has a large impact on production costs in agriculture, can be estimated from national and international macro-models. On the other hand, prices of energy and steel, which have a large impact on production costs in agriculture, can be reasonably estimated from outcomes of global or multi-country macro models.

When national level sector models of agriculture are concerned also export and import prices of agricultural products need exogenous estimates. For example, even if Armington-specification is used in DREMFIA, and the model outcome responds smoothly to changes in import and export prices, the EU price level has impact on the production volume in the mode. Hence the model should be used preferably in combination with international macro-model which could provide estimates on both input and product prices. Hence the GTAP model, where also agriculture has been disaggregated in some extent, provides a relevant basis for product and input price estimates in short and long run.

Price dynamics influence structural adjustments of agriculture which have been emphasized in many studies and economic analyses of Finnish agriculture. Production volume per farm is clearly smaller in Finland compared to most competitive production countries in the EU which utilize significant economies of scale in production. For example, the farm size distribution of dairy farms is concentrated close to the average farm size (appr. 20 cows/farm in 2005) in Finland. This also means that the number of large and efficient farms, which may be able to make profits even at low milk prices, is relatively low in Finland compared to many other EU countries. Hence the effects of price reductions on farm investments and growth of farms are likely to be significant in Finland.

This study provides an analysis which is made on two different cases:

(1) Assume capital is rigid in all sectors
(2) Assume capital is mobile across sectors

Capital rigidity means short run analysis and capital mobility long run analysis. Considering typical durations of agricultural investments, 10-15 years in the case of machinery and equipment, and 20-50 years in the case of buildings, short run means time period of 0-2 years and long run over 10 years. In a period of less than 2 years relatively little capital mobility between agriculture and other sectors can be observed. However in a period of ten years very significant changes in capital may take place in agriculture. For example, the number of dairy, beef and pig farms decreased by appr. 50% in 1995-2004 (Lehtonen & Pyykkönen 2005). Since there was little change in milk production volume, for example, in this period one can conclude that there were not only capital movement out of agriculture but also capital movement in agriculture. Small farms typically sell or rent out their land (and possibly some part of their usable machinery and equipment) when they exit production. A significant part of the remaining farms have enlarged their production and invested in new production facilities. For example, a lot of capital has been invested in pig farms since production volume has increased from 170 million kg up to 200 million kg in period 1995-2004. One can conclude that very significant capital movement can take place already in ten years even if it is often technically possible to use the machinery and other equipment up to 15-20 years and buildings up to 30-50 years. However fully flexible capital cannot be assumed in a period of ten years. In the GTAP-model, fully flexible capital is not assumed since capital, as well as other production factors adjust according to price relations and defined substitution elasticities. It should be also noted that total capital (sum of capital over all sectors) is fixed in the model. Exact number of years related to the short and long runs cannot be accurately defined, however.

Changes in EU prices of agricultural products in the short and medium run in the GTAP model can be directly taken into account in the Dremfia model Since Dremfia is a recursive dynamic model and includes investments in the short run and long run, price changes drive structural and technical changes in the model. Hence the price dynamics play a role as well; not prices and production at short run or long run economic equilibrium alone. Since labour is still an important production factor in Finnish agriculture the changes in prices of labour in the GTAP model as an outcome of trade policy changes may have some impact on structural change and production as well. Hence the coupling of GTAP and Dremfia model through prices from the GTAP-model facilitate a dynamic-recursive production and structural change analysis at national and regional level, consistent to EU level markets and price changes.

3. Results of trade policy changes in short and long run – GTAP Simulation results

In December 2005 Ministerial meeting the WTO members engaged in removing agricultural export subsidies by 2013. Under pressure from virtually every other participant in the WTO negotiations, the European Union (EU) took the historic step of agreeing to abandon export subsidies over time. The EU agreed to this after extracting more binding language in the final text to ensure that the export subsidy elements within the USs export credit and food aid programmes, and within `single desk export selling bodies such as the Canadian Wheat Board (CWB), are similarly disciplined - a significant concession by Canada.

Even though the final decision on the commitments to tariff cuts in DDA are still open, different scenarios have been under discussion. Here we rely on the scenarios described in Sebastien, Laborde and Martin (2006) and take one of the scenarios as an example to be analysed in connection with export subsidy removal in both of the models. The role of cutting domestic support is abstracted in this phase of the study.

The first scenario applied here assumes that all the countries utilizing export subsidies wil give them up. The results suggest that removal of export subsidies alone, keeping in place other policies, lowers domestic prices for subsidizing countries and raises world prices. World prices increase for dairy (4.2%), coarse grains and sugar (1.2%), and to a lesser extent bovine meat (1.0%) and other meats (0.5%). World markets for dairy are more affected by export subsidies because the EU – the world largest agricultural market and the largest subsidizer – has high subsidy rate for dairy (30 %) and has substantial export market shares for these products. Global agricultural trade declines with the largest decrease in trade volume in bovine meat (-2.7%) and dairy products (-2.0%). EU exports drop significantly, particularly for sugar, grain, dairy and bovine meats. For other exporters, such as Australia, the United States (US), and the MERCOSUR countries, higher world prices increase the value, and sometimes the volume of exports.

In the EU, removing export subsidies lowers domestic prices and lowers output as productive resources are re-allocated from agricultural sectors like sugar, dairy, grains and meat into other sectors. For countries such as Australia, the US, and the MERCOSUR group, higher world prices stimulate domestic agricultural production, partly offsetting the EU output decline. The extent and scope of output expansion varies among countries. For Australia and the MERCOSUR countries, there is a modest increase (1-2 %) for most commodities, notably dairy and sugar. For other exporters, output expansion in agriculture requires pulling resources away from other sectors.

Welfare change under the removal of agricultural export subsidies scenario is positive for exporters but not for net food importers. The largest welfare gains accrue to the EU, which eliminates the bulk of the multilateral export subsidies. These gains are mainly driven from the allocative effects that are born from the better use of resources. Exporting countries such as Australia-NZ, and the

MERCOSUR group also show a net welfare gain. Much of the welfare gains by the major exporters are due to improved terms of trade. However, net food importers such as Russia, China, and the group of least developed countries show a welfare loss due to both worsening terms of trade and allocative efficiency loss. These welfare results are also reported in Kerkelä et. al. (2005).

The tariff cutting scenarios are based on those constructed by CEPII from the MacMap-HS6 tariff database (CEPII/ITC) and from bound tariffs from the WTO´s Conlidated Tariff Schedules (CTS). These tariffs are contributed to the GTAP 6 87-region level. The scenarios implemented here include the baseline scenario (S0) that encompasses the EU Enlargement + WTO Commitments) which then is used as a baseline for the actual tariff cut scenario. The tariff cut scenario used here is the one labelled S1 : AGRI Harmonizing Formula and more thoroughly described in Sebastien et al.

The results of the tariff cutting scenario suggest that the world price increases due to export subsidy abolition are dampened by the tariff cutting. The joint impact will result in lower price increases than only export subsidy abolition because the tariff cutting has an effect of decreasing the world market prices. Suggested tariff cuts are still not that large that they would exceed the price increase resulting from the export subsidy abolition. [4]

The output responses are more varying depending on the export subsidy cut or the tariff reduction. Still, in principle, the tariff reductions also decrease the production in line with export subsidy cuts. In many studies on Doha Development Round the role of export subsidies are expected to be rather small compared to other elements and when all the components are included in the package. Still, we claim that for a single country the effects of export subsidies are more significant.

Table 2. Changes in production of agricultural products (%-change) in the short run (rigid capital) in scenario 1 (ese; export subsidy elimination) and 2 (export subsidy elimination + tariff rate reduction; trr)

		Wheat	Other grains	Milk	Dairy products	Beef	Other meat
Finland	exp.s.el.	+0.1	-11.0	-4.1	-5.2	-0.9	-0.7
	exp.s.el.+trr	0	-12.3	-5.5	-5.9	-3.1	-0.3
Northern EU	exp.s.el.	-1.8	-5.4	-2.5	-4.7	-2.1	-1.3
	exp.s.el.+trr	-1.2	-7.3	-4.0	-4.8	-12.5	-1.0
Germany and Austria	exp.s.el.	-3.6	-6.3	-1.9	-1.8	-5.1	-0.4
	exp.s.el.+trr	-4.6	-8.4	-1.8	-2.4	-11.1	-2.0
France	exp.s.el.	-3.5	-3.9	-1.7	-4.1	-1.2	-0.7
	exp.s.el.+trr	-4.4	-4.6	-3.0	-4.6	-4.3	-1.6
Southern EU	exp.s.el.	-1.6	-1.3	-1.8	-2.6	-1.8	-0.5
	exp.s.el.+trr	-1.8	-2.0	-2.6	-2.8	-6.2	-1.2
Poland	exp.s.el.	+0.5	+1.2	+0.7	+3.8	+1.3	+0.4
	exp.s.el.+trr	+0.6	+1.2	+1.5	+4.8	-14.6	0
Rest of the EU	exp.s.el.	+0.1	+2.1	+0.2	+1.9	+2.0	+0.2
	exp.s.el.+trr	+1.3	+1.0	-1.1	-3.2	+4.0	-0.5
EFTA	exp.s.el.	+1.2	+1.7	-1.9	-4.8	+3.2	+0.1
	exp.s.el.+trr	-8.4	+1.6	-1.7	-2.5	-0.3	-8.9
USA	exp.s.el.	+0.3	+0.5	0.3	+0.3	+0.5	+0.5
	exp.s.el.+trr	+1.9	+0.3	+0.2	+0.3	+2.0	+1.3
Russia	exp.s.el.	+0.3	+0.9	1.3	+3.9	+11.3	+0.8
	exp.s.el.+trr	-1.8	-0.8	+0.4	+2.4	+9.5	-4.1

[4] This conclusion is derived from analysing the subtotals of the joint simulation on export subsidy abolition and tariff reduction, not by comparing the actual simulation results.

Table 3. Changes in production of agricultural products (%-change) in the long run (mobile capital) in scenario 1 (export subsidy elimination) and 2 (export subsidy elimination + tariff rate elimination)

		Wheat	Other grains	Milk	Dairy products	Beef	Other meat
Finland	exp.s.el.	+0.6	-13.8	-5.4	-6.6	-1.2	-1.1
	exp.s.el.+trr	0	-14.9	-7.7	-8.2	-4.2	-0.6
Northern EU	exp.s.el.	-3.2	-7.9	-2.5	-6.3	-2.9	-2.1
	exp.s.el.+trr	-1.1	-10.7	-6.6	-7.7	-18.9	-1.6
Germany and Austria	exp.s.el.	-5.7	-7.0	-2.6	-2.4	-6.2	-0.5
	exp.s.el.+trr	-7.1	-9.6	-3.0	-3.7	-14.9	-2.6
France	exp.s.el.	-8.4	-5.0	-2.3	-5.1	-1.7	-1.0
	exp.s.el.+trr	-10.2	-6.2	-4.4	-6.4	-5.9	-2.3
Southern EU	exp.s.el.	-2.7	-1.4	-2.2	-2.7	-2.1	-0.6
	exp.s.el.+trr	-2.7	-2.6	-3.1	-3.2	-9.0	-1.5
Poland	exp.s.el.	+0.7	+1.4	+0.8	+3.7	+1.3	+0.5
	exp.s.el.+trr	+0.8	+1.4	+2.6	+7.8	-25.9	0
Rest of the EU	exp.s.el.	+0.3	+2.8	+0.4	+2.2	+2.4	+0.6
	exp.s.el.+trr	+2.8	+1.4	-1.9	-5.5	+5.3	+1.6
EFTA	exp.s.el.	+3.5	+2.9	-3.0	-5.9	-2.1	+0.1
	exp.s.el.+trr	-30.6	+2.5	-2.7	-3.5	-1.6	-11.0
USA	exp.s.el.	+1.2	+0.8	+0.3	+0.3	+0.5	+0.5
	exp.s.el.+trr	+10.7	+0.4	+0.1	+0.2	+4.0	+4.8
Russia	exp.s.el.	+0.5	+1.2	1.9	+4.8	+16.3	+1.1
	exp.s.el.+trr	-1.9	-0.8	+0.2	+2.5	+14.8	-6.1

Table 4. Changes in prices of agricultural products (%-change) and inputs in the short run (rigid capital) in scenario 1 (export subsidy elimination) and 2 (export subsidy elimination + tariff rate elimination)

		Wheat	Other grains	Milk	Dairy products	Beef	Other meat	Land	Unskilled labour	Capital
Finland	exp.s.el.	-2.4	-5.8	-6.2	-3.0	-1.4	-0.9	-27.8	-0.2	-0.3
	exp.s.el.+trr	-3.3	-6.8	-8.2	-4.2	-2.2	-1.6	-32.5	-0.6	-0.7
Northern EU	exp.s.el.	-2.4	-5.4	-2.6	-2.1	-1.1	-0.8	-12.5	-0.2	-0.3
	exp.s.el.+trr	-2.9	-7.1	-4.7	-3.4	-4.1	-2.4	-19.4	-0.5	-0.7
Germany and Austria	exp.s.el.	-2.5	-3.3	-2.5	-1.9	-1.5	-0.6	-15.4	-0.1	-0.2
	exp.s.el.+trr	-3.8	-4.8	-3.6	-2.8	-3.9	-1.7	-22.7	-0.5	-0.6
France	exp.s.el.	-2.8	-3.4	-1.9	-1.8	-1.3	-0.7	-11.5	-0.2	-0.3
	exp.s.el.+trr	-4.0	-4.6	-3.5	-2.8	-3.3	-1.7	-16.5	-0.6	-0.7
Southern EU	exp.s.el.	-1.7	-1.4	-1.5	-1.2	-1.0	-0.5	-4.5	-0.1	-0.2
	exp.s.el.+trr	-2.6	-2.6	-2.8	-2.0	-3.4	-1.4	-9.8	-0.6	-0.7
Poland	exp.s.el.	+0.8	+0.9	+0.7	+0.9	+0.5	+0.4	+1.6	+0.2	+0.1
	exp.s.el.+trr	+1.1	-0.7	-0.8	0	-4.2	-1.1	-3.2	-1.1	-0.9
Rest of the EU	exp.s.el.	+0.4	+1.7	+0.5	+1.0	+0.8	+0.4	+1.5	+0.1	+0.1
	exp.s.el.+trr	-0.5	-0.6	-1.4	-1.5	+0.4	-1.0	-4.2	-0.5	-0.5
EFTA	exp.s.el.	+0.9	+2.0	-4.6	-2.3	-0.8	+0.1	-5.6	+0.1	+0.1
	exp.s.el.+trr	-16.5	-3.5	-9.4	-3.6	-4.8	-7.5	-19.6	-0.5	-0.8
USA	exp.s.el.	+0.9	+1.1	+0.6	+0.4	+0.3	+0.3	+1.5	0	+0.1
	exp.s.el.+trr	+5.5	+2.0	+1.3	+0.5	+1.4	+1.1	+7.2	0	+0.1
Russia	exp.s.el.	+0.6	+1.0	+0.6	+1.8	+4.2	+0.6	+1.6	+0.2	+0.1
	exp.s.el.+trr	-0.6	-0.2	+1.0	+2.0	+4.3	-0.6	-4.8	+0.8	+4.2

Table 5. Changes in prices of agricultural products (%-change) and inputs in the long run (mobile capital) in scenario 1 (export subsidy elimination) and 2 (export subsidy elimination + tariff rate elimination)

		Wheat	Other grains	Milk	Dairy products	Beef	Other meat	Land	Unskilled labour	Capital
Finland	exp.s.el.	-1.9	-1.6	-2.5	-0.9	-0.5	-0.4	-28.1	-0.1	-0.1
	exp.s.el.+trr	-3.3	-6.8	-8.2	-4.2	-2.2	-1.6	-32.5	-0.5	-0.4
Northern EU	exp.s.el.	-1.1	-1.2	-1.1	-0.4	-0.4	-0.3	-14.0	-0.2	-0.3
	exp.s.el.+trr	-1.9	-2.3	-2.2	-1.4	-1.4	-1.1	-22.3	-0.5	-0.5
Germany and Austria	exp.s.el.	-1.1	-1.2	-1.3	-0.5	-0.4	-0.4	-15.8	-0.1	-0.2
	exp.s.el.+trr	-3.8	-4.8	-3.6	-2.8	-3.9	-1.7	-23.8	-0.4	-0.4
France	exp.s.el.	-1.2	-1.2	-1.0	-0.3	-0.5	-0.3	-15.9	-0.2	-0.3
	exp.s.el.+trr	-4.0	-4.6	-3.5	-2.8	-3.3	-1.7	-21.9	-0.6	-0.5
Southern EU	exp.s.el.	-0.5	-0.4	-0.4	-0.2	-0.2	-0.2	-5.2	-0.1	-0.2
	exp.s.el.+trr	-2.6	-2.6	-2.8	-2.0	-3.4	-1.4	-11.2	-0.5	-0.4
Poland	exp.s.el.	+0.5	+0.5	+0.5	+0.3	+0.2	+0.3	+1.7	+0.2	+0.1
	exp.s.el.+trr	+1.1	-0.7	-0.8	0	-4.2	-1.1	-2.7	-1.1	-0.7
Rest of the EU	exp.s.el.	+0.5	+1.1	+0.5	+0.3	+0.2	+0.3	+2.1	+0.1	+0.1
	exp.s.el.+trr	-0.5	-0.6	-1.4	-1.5	+0.4	-1.0	-3.1	-0.4	-0.4
EFTA	exp.s.el.	-0.2	-0.2	-1.2	-0.3	+0.1	+0.2	-4.6	+0.1	+0.1
	exp.s.el.+trr	-16.5	-3.5	-9.4	-3.6	-4.8	-7.5	-25.4	-0.5	-0.5
USA	exp.s.el.	+0.5	+0.4	+0.2	+0.1	+0.1	+0.1	+1.7	0	+0.1
	exp.s.el.+trr	+5.5	+2.0	+1.3	+0.5	+1.4	+1.1	+13.6	-0.1	-0.1
Russia	exp.s.el.	+0.5	+0.7	+0.4	+0.3	+0.8	+0.3	+2.3	+0.2	+0.1
	exp.s.el.+trr	-0.6	-0.2	+1.0	+2.0	+4.3	-0.6	-5.8	+0.2	+1.1

3.3. Adjusting to changing global and EU level markets in Finnish agriculture

The most important trade partners to Finnish agriculture are countries in northern EU, such as Sweden, Estonia and Denmark. For this reason the product prices in northern EU derived by the GTAP model are considered the most relevant ones to be fed in the DREMFIA model. Changes in prices of unskilled labour and capital seem to be seem rather small and of the same magnitude in northern EU and Finland. However the decrease in land prices in Finland is much larger than in northern EU. The prices of capital, land and unskilled labour derived for Finland by the GTAP model were used in the analysis.

The short run prices of inputs and products were used in DREMFIA in years 2010-2012. It was assumed that EU is obliged to decrease the use of export subsidies considerably already up to 2010 before full abolishment of export subsidies in 2013. Consequently the short run price changes are assumed to take place up to 2010. This is justified because agricultural markets, like any other economically rational product markets, typically take into account future policy changes as soon as they are known. It is also assumed that until 2010 markets already know the substantial reduction import tariffs and hence the short-term changes in input and output prices, derived by the GTAP model, are also used in DREMFIA in 2010-2012. At 2013 and after long run price changes derived by the GTAP are assumed for agricultural products and inputs.

Impacts of the two trade policy scenarios (export subsidy elimination “ese” and export subsidy elimination + reduction of import tariffs “ese+trr”) on Finnish agricultural production were studied assuming the following two distinct set of exogenous EU product prices and input prices:

1) Partial equilibrium assumptions: No changes in prices of primary inputs (land, labour and capital) will take place while the short run (2010-2012) price changes in product prices in northern EU will prevail until 2020;
2) General equilibrium assumptions: Short run and also long run price changes for both inputs and outputs, derived by the GTAP to take place in northern EU (for products) and Finland (inputs), are taken into account

Under these assumptions, development of milk production in Finland was calculated using DREMFIA model and the outcome is presented in Figure 2. One can see that under PE assumptions export subsidy elimination ("ese") will result in significantly lower milk production compared to no trade policy change –situation. One should note that production decreases significantly in no trade policy –scenario where CAP reform is already decreasing production through a significant milk powder and butter price reductions (15% and 25%, respectively) and full de-coupling of milk payments compensating the price reductions (see Lehtonen 2004 for details of the CAP reform impact). This effectively diminishes investments in larger dairy farms (Figure A1 in Annex). On the top of the CAP reform the export subsidy elimination produces relatively modest changes in total milk production volume. However under GE assumptions the export subsidy elimination will result only in temporary reduction in milk production volume in Finland (Figure 3).

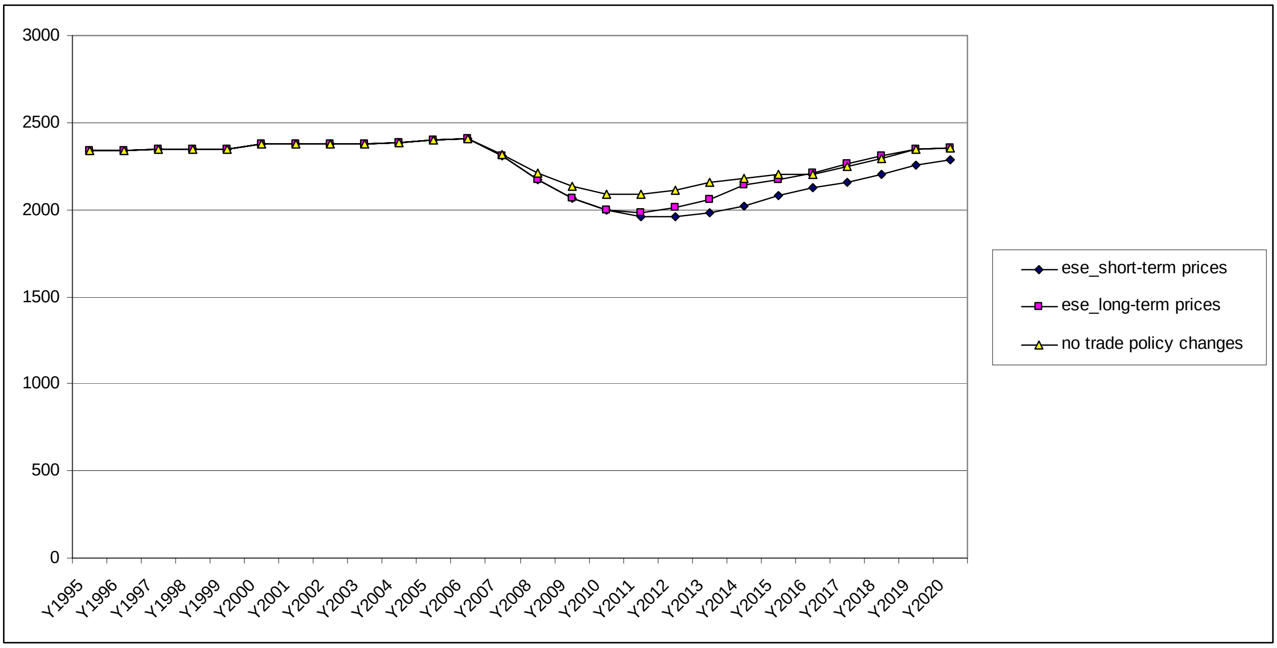


Figure 2. Development of milk production volume (mill. litres) in Finland assuming no trade policy change, and export subsidy elimination in cases considering short run price changes ("ese+trr_short-term_prices") and both short and long run price changes ("ese+trr_long-term_prices").

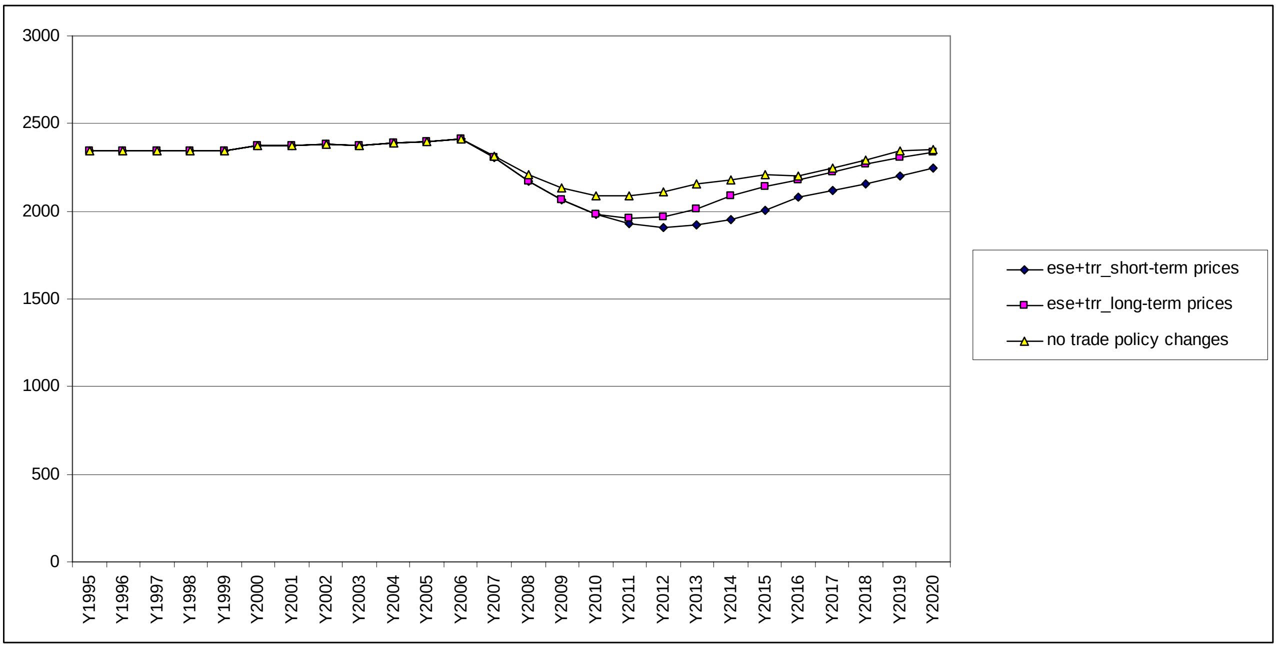


Figure 3. Development of milk production volume (mill. litres) in Finland assuming no trade policy change, and export subsidy elimination + tariff rate reduction considering short run price changes ("ese+trr_short-term_prices") and both short and long run price changes ("ese+trr_long-term_prices").

The short run price changes represent a situation typical for partial equilibrium modelling; impacts of a policy shock are calculated assuming that no capital will move out from the agricultural sector while only variable production factors adjust. Such assumptions lead to significant, up to 10%, reduction national level milk production, in addition to CAP reform impact. Figure 3 shows that taking into account consistent global and European level changes in production and prices the impacts of trade policies are much smaller, and in this example the trade policy scenarios result in the same volume of production at the national in a 5-7 year period than in the case of no trade reform. However this result is subject to the formulation of the trade policy scenarios and implementation in GTAP. In this study the GTAP shows rather small price impacts of even very significant trade reforms. As reported in Tables 2-4 the agricultural production, notably beef and dairy as well coarse grains, decrease considerably in northern part of the EU as well as in France and Germany. Such large reductions in agricultural output in major trading partners in Finland result in relatively small price changes despite significant trade policy reforms such as significant reduction of import tariffs in addition to elimination of export subsidies.

Figure 4 presents grass area in Finland. It shows that grass area expands as a result of significant decrease of land prices (and partly because of small reduction is labour and capital prices) in the second trade scenario. Despite the land price changes could be taken into account in DREMFIA only partly (it was assumed that low land prices will also result in lower investment costs on land, such as drainage costs, bridges etc) the lower land costs implied more extensive (less intensive) grass cultivation practices. Intensive silage cultivation was partly replaced by pasture and other green fodder cultivation. Grass area increases particularly in northern and eastern Finland where grain is relatively less competitive, especially after decreased grain prices. This comparative advantage of grass cultivation in some parts of Finland, in turn, provided some stimulus for beef production. Surprisingly, according to the DREMFIA results, beef production is very little affected by the trade policies in Finland (Figure 5). This result is opposite to prior expectations and also to the results of the GTAP model. In addition to the relative competitiveness of grass cultivation in traditional milk and beef production areas the rather low substitution elasticity between domestic and imported beef, as well as some national support paid for bulls (assumed unchanged from 2006 level in this study) contribute to the very small effect of trade policy scenarios. Concentration of production in most favourable regions inside Finland also explains the recovery of beef production

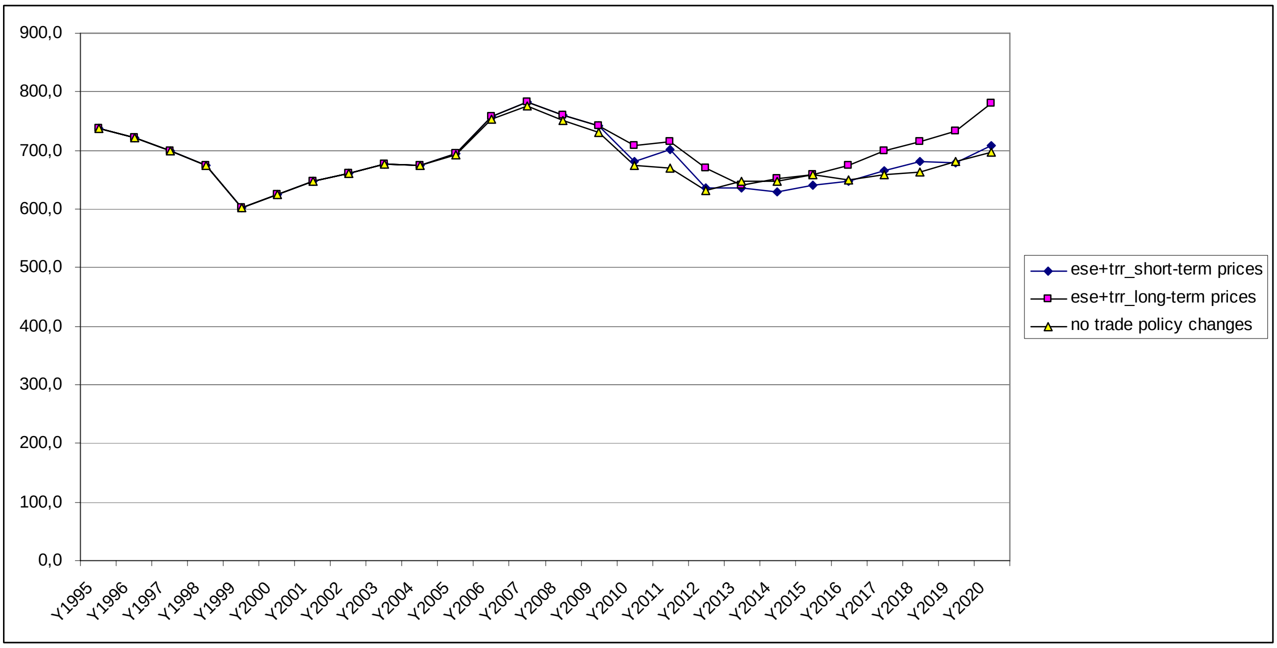


Figure 4. Grass area (1000 ha) in Finland assuming no trade policy change and export subsidy elimination + tariff rate reduction considering short run price changes (“ese+trr_short-term_prices”) and both short and long run price changes (“ese+trr_long-term_prices”).

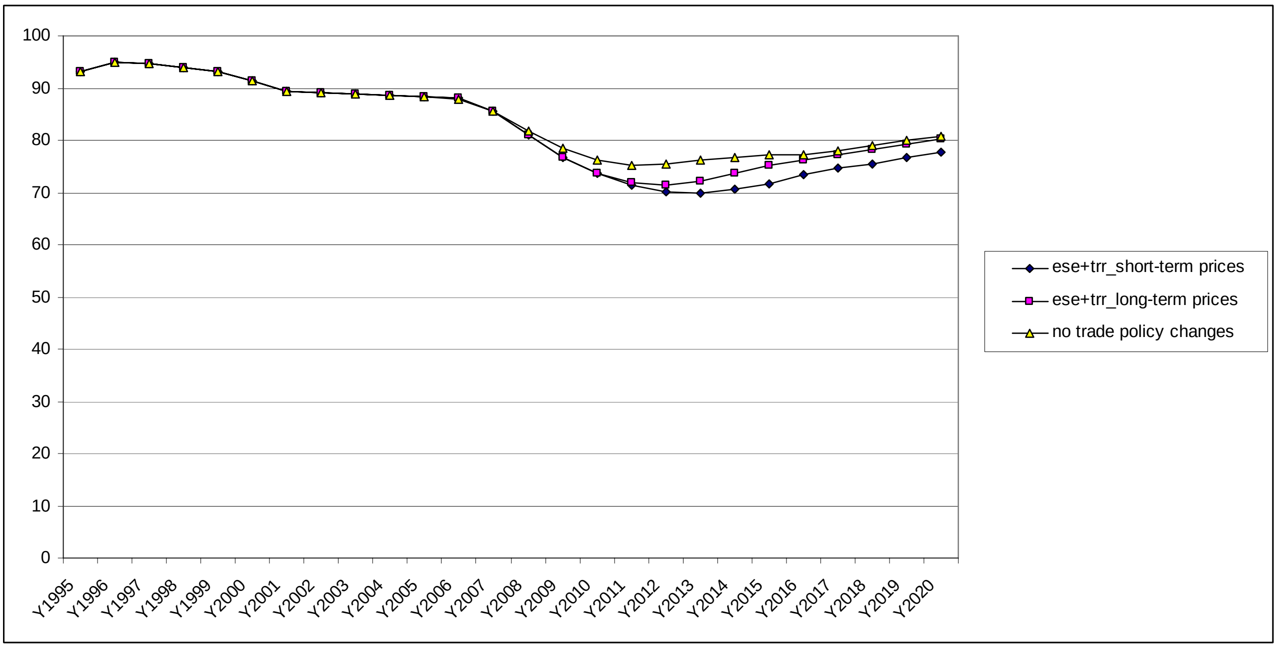


Figure 5. Beef production (mill. kg) in Finland assuming no trade policy change, and export subsidy elimination + tariff rate reduction considering short run price changes (“ese+trr_short-term_prices”) and both short and long run price changes (“ese+trr_long-term_prices”).

4. Conclusions

Export subsidy elimination and tariff rate reduction result in significant grain and milk price reductions in the short run in Northern Europe. In the long run the product prices recover when production and use of inputs in agriculture, including land, labour and capital, decrease significantly in the EU and adjust to equilibrium levels. Hence the product price effects of export subsidy elimination and tariff rate reduction are relatively small in the long run, and there is little difference in product prices in these scenarios.

Price dynamics, i.e. price changes in the short and long runs, at the EU and Northern European level influence adjustment of Finnish agriculture to the trade policy shocks. The long run implications of the two trade policy scenarios are surprisingly similar in terms of production quantities: significant tariff rate reduction on the top of export subsidy elimination produces little change on production. Prices of primary inputs of agriculture, such as labour and capital, change only little as a result of both trade policy shocks, but they, in addition to decreasing feed grain prices, help animal sector to recover from tariff rate reduction. Changes in both product and input prices contribute to the recovery and stabilisation of production in Finland. This result is somewhat different from the partial equilibrium or sector level reasoning where input prices do not adjust and where EU level product prices in the two trade policy scenarios do not come any closer to each other in the equilibrium. Hence the GTAP contribution to the national level analysis is that recovering (not fixed) product prices and slightly decreasing input prices at the EU level helps Finnish agriculture in recovering from the trade policy change better than forecasted by partial equilibrium (PE) framework. Thus the global general equilibrium view provides a more optimistic picture of trade policy impacts in Finland than PE frameworks. Both frameworks however are necessary since global GE models typically lack national level detail and dynamics needed for national and regional level evaluation.

High costs of Finnish agricultural production and the relatively small farm size, i.e. economies of scale not yet materialised, imply that steep price reductions in the short run due to trade policy shocks result in cease of investments for 1-2 years. In the later years the investment activity and hence production recover due to slightly higher product and input prices. This study shows that linking price dynamics from global and European level has significance in national level modelling of trade policy shocks. Taking into account the price dynamics deepens the national level view of the consequences of trade policy shocks. Large changes in investment activity in different time periods may be considered harmful for the development for agriculture at the national level: In the short run one may loose the technical change and learning related to investments, and in a later period of active investments prices of investment goods and milk quotas, for example, may go up and harm investing farms. In both time periods there is a risk that competitiveness of agriculture is retarded. Linking of national level models to global economy wide model output opens insights how balanced agricultural development can be fostered and implications of trade policy shocks could be made less severe in less favoured and competitive agricultural areas such as Finland.

However this preliminary model linking exercise showed that there are also some caveats in taking output from GTAP to national level sector models. First, the level of aggregation is somewhat different both in products and inputs. There are more products and inputs in national level model than in GTAP, and the meaning of price of “unskilled labour” or “skilled labour” may fit exactly the actual labour used in agriculture. On the other hand the national level is not linked back to gtap which however is not fatal in this case Finland is a marginal producer at the EU or even at the Northern European level. It is also not very clear what is exactly the meaning of “short” and “long” runs in the GTAP model and they should be interpreted in national level model which operates at annual basis. Also the ultimate assumption is the models in this study are different: in GTAP a full and immediate equilibrium is assumed while in DREMFIA the existence of equilibrium is not ensured: in the case of drastic price changes it may happen that production does not converge since input prices are fixed, even if agriculture itself includes many adjustment mechanisms in DREMFIA. There are less such agriculture specific mechanisms in GTAP which implies that large changes are derived for land changes which is rather agriculture specific input in GTAP but not however applicable as an input to DREMFIA where land is free resource for which only shadow values can be obtained. Hence the models do not actually speak the same language. This study however shows that it is useful to apply GTAP results in national level model and differing assumptions also opens up some points of view that need to be integrated in analysing changing trade and agricultural policies.

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Annex.

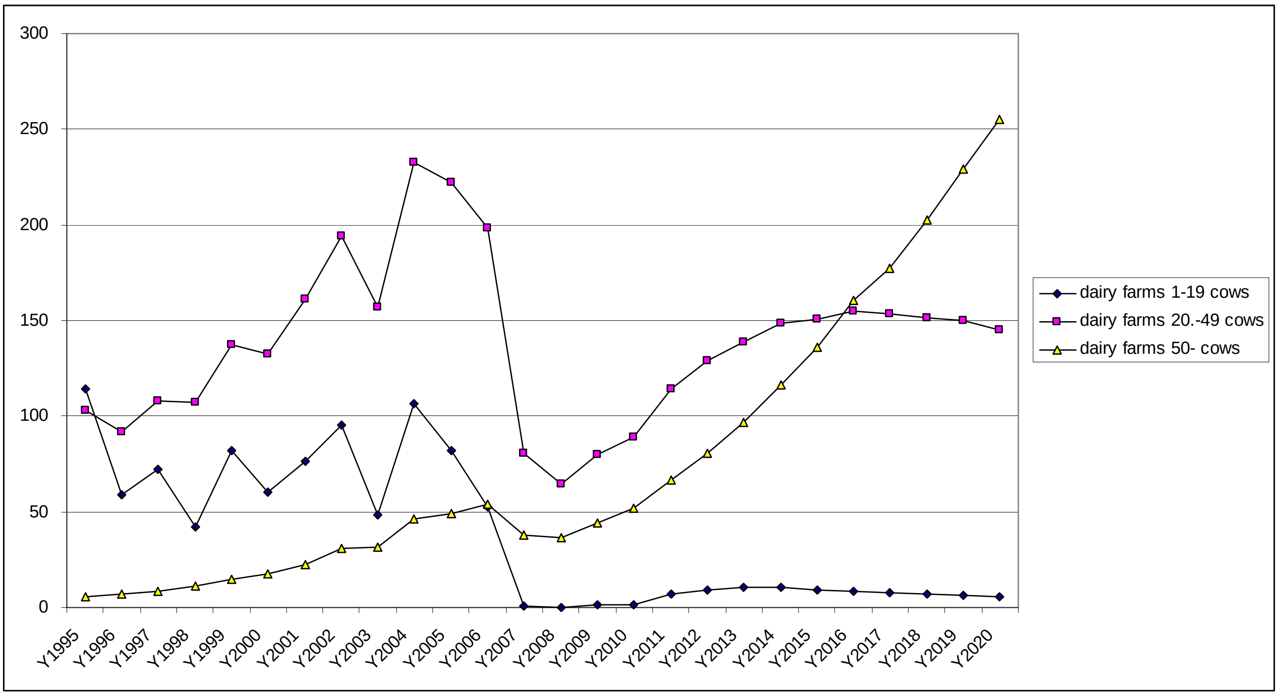

Figure A1. Investments (million euros) in dairy farms of different size in Finland under CAP reform.