Studying the effects of domestic support provisions on global agricultural trade: WTO and OECD policy indicators in the CAPRI model

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Abstract

This paper illustrates the potential benefits of implementing policy indicators on domestic support provisions to agriculture in the large-scale agricultural sector model CAPRI (Common Agricultural Policy Regional Analysis) designed for European agriculture and global trade. With the reduction of trade barriers and opening up of market access, domestic support plays a potentially increasing role as a means to provide support to agriculture. Domestic support provisions are captured in the WTO and OECD support classification systems. We use the two databases to develop indicators that mirror domestic support as measured by the WTO through a member's notifications and measured by the OECD through monitoring policies in the PSE-database. By comparing the two databases we find, that some green box measures are regarded by the OECD as requiring production and as such potentially in conflict with green box rules. We develop a scenario in which green box measures are abolished to investigate this claim. Our model results indicate only small effects in production and trade even if the green box of the EU is completely abolished.

Keywords: Modeling, agricultural policies, domestic support, Green box, trade liberalization, WTO

JEL-codes: F13, Q11, Q17, Q18

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1 Introduction

The modeling of domestic support, or agricultural policy instruments in general, has always been at the heart of agricultural policy models. However, many models have so far not made use of the richness and recent improvements of the two main international datasets for support measures: The Producer Support Estimate (PSE) database of the Organisation for Economic Co-operation and Development (OECD) and the notifications to the World Trade Organisation (WTO) to monitor a member's compliance with the Uruguay Round Agreement on Agriculture. The structure of the PSE-database focuses on the implementation of a policy instrument, and makes it very attractive and readily available as input for applied policy models. The WTO-notifications, however, receive most attention by policy makers and other users of model results as they contain both actual support and commitment levels.

There is an on-going debate if policy indicators such as the WTO boxes are appropriate instruments to capture trade distorting and other effects of policy support instruments to agriculture. That question is especially relevant in cases as the EU which by now declares the overwhelming part of its support under the green box while budgetary spending for agricultural support remains considerable. The Single Farm Payment (SFP) alone amounts to about 40 bio € per year and pay out in average close to 300 € per ha of land used by agriculture in the EU to farmers. Can such expensive support measures really be "minimally trade distorting"? How do they interact with other policy instruments such as border protection?

There are two interlinked approaches to answer the question. One consists in using economic theory to describe and analyze qualitatively effects of support instruments. It has highlighted possible pathways how fully decoupled payments which are not linked to the current production program might impact allocation decisions by e.g. affecting risk attitude, reduce cost to finance investments or by expectations of future updates of entitlements to support (e.g. Dewbre et al., 2001). The second way consists in estimating econometrically or simulating in economic models the impacts of these instruments (e.g. Boulanger et al., 2010; Brockmeier et al., 2008).

In this paper, we use the latter approach, applying the detailed, large-scale economic model CAPRI to simulate impacts of the instruments classified by the EU under the green box. We use the WTO-notification and the PSE database to develop indicators that reflect the domestic support provided in the EU. A comparison of the two databases allows highlighting potentially conflicting rules between the two classification systems. Afterwards, we implement a scenario in the modelling system in which green box measures are abolished. This enables us to analyse the potential trade impact of the green box measures.

The paper proceeds as follows: In the next section, an exposition of the CAPRI model is given followed in section 3 by an overview on the scenario implementation. Section 4 contains the modelling results and the last section discusses the results and concludes the paper.

2 CAPRI model

2.1 Overview

The CAPRI model (Britz and Witzke, 2011) is a global comparative-static partial equilibrium model with a strong focus on Europe, consisting of a supply and a market module. CAPRI has been intensively used for assessment of the different CAP reforms (see e.g. Britz et al. 2012, Morredu 2011), but also to trade policy questions (e.g. Piketty et al. 2009). The supply module, covering only the EU, Norway, Turkey and Western Balkans, comprises independent aggregate non-linear programming models representing approximately 50 crop and animal activities of all farmers at either regional (NUTS II) or farm type level. The farm type level (Gocht and Britz, 2010) provides for the whole EU a consistent dis-aggregation from the regional level to about 1850 farm type models differentiated by farm specialization and economic size. Each programming model maximises regional or farm type agricultural income with explicit consideration of the CAP instruments of support at given prices, subject to technical constraints for feeding, young animal trade, fertilization, set-aside, a land supply curve and production quotas.

Prices for agricultural outputs are rendered endogenous based on sequential calibration (Britz 2008) between the supply models and a market model. The latter is a global spatial multi-commodity model covering 77 countries or country aggregates in 40 trade blocks and about 50 products. The Armington approach (Armington, 1969), assuming that the products are differentiated by origin, allows simulating bilateral trade flows and related bilateral as well as multilateral trade instruments, including tariff-rate quotas.

2.2 Modelling land supply and total agricultural land use

The CAPRI model comprises land supply and transformation functions at the regional and farm type level which allow for the endogenous supply of arable land and grassland in response to changed marginal land rents, replacing the former fixed endowment constraints. The behavioural functions for land supply were parameterised based on the results of van Meijl et al. (2006) and Golub et al. (2006), but they were adapted to the regional resolution of CAPRI based on GIS analyses and simulation experiments using the Dyna-CLUE model (Verburg et al., 2010). The core of the model reactions when overall CAP support is reduced roots in the interaction between the land supply function and subsidies to land (the single farm premium and the support to Less Favored Area under Pillar 2) which together account by far for the largest share of CAP spending.

To obtain the full farm premium, a farmer must not only possess one ha of land in good agricultural and environmental condition but also a (tradable) payment right (the following description is cited from Britz *et al.*, 2012). The above graphic depicts the impact on land rent, and it helps illustrate the reactions to changes in the SFP. For simplicity, we did not graphically capture changes in other premium schemes. At the starting point t_0 and without a premium, the amount of land under agricultural cultivation is determined by the intersection of the marginal returns in agriculture to land (*mr)* and the land supply from other sectors. The SFP, as a subsidy to land use in agriculture, shifts the *mr* curve upward according to the size of the subsidy. Without further restrictions, agricultural land use would be expanded to a new intersection between the two curves. However, because of the introduction of the entitlements, such an expansion does not occur, as the old and the new *mr* curves are identical beyond the entitlement point, where the subsidy cannot be claimed. Accordingly, immediately after its introduction, the subsidy is capitalised into the premium rights. However, urbanisation and other factors shift the land supply curve over time to the left. Depending on the slope of the

land supply curve and the speed and size of the shift, the economic rent on the entitlements will be eroded over time until the new intersection between the *mr* and the land supply curves is to the left of the original entitlements. At that point (t_1), the subsidy will be fully capitalised in the land rent. Because the land supply curves are rather steep in many countries, according to our parameterisation, and a continuous decline in agricultural land cover can be observed in almost any EU member state, as we assume in our 2020 baseline (i.e., more than fifteen years after the introduction of the MTR), capitalisation only occurs on land and not on payment rights. This interpretation is also supported by the actual legislative text, which states that entitlements that are not claimed for two consecutive years will be withdrawn.

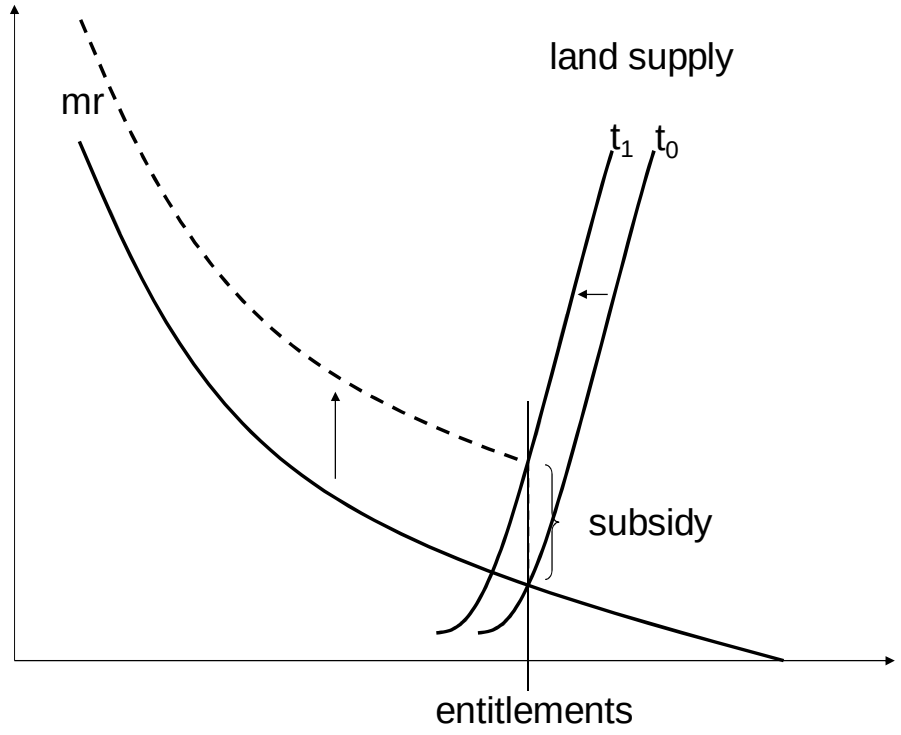

Figure 1. Effects of SFP on land markets (Britz et al., 2012)

2.3 Policy instruments

For the European Union, the programming models cover in rich detail the different coupled and de-coupled subsidies of the so-called first Pillar 1 of the CAP, as well as major ones from Pillar 2 (Less Favoured Area support, agri-environmental measures, Natura 2000 support). The interaction between premium entitlements and eligible hectares for the SFP of the CAP is explicitly considered, as are the different national SFP implementations, possibly remaining coupled payments for suckler cows and sheep & goat, and national "specific support programs" under article 68 of Council Regulation (EC) No. 73/2009.

Decoupled payments – as with other premium schemes of the CAP from the present and past – are simulated in CAPRI relatively closely to their definition in existing legislation. The rather high dis-aggregation of the model template regarding production activities and the resolution by farm types inside of NUTS 2 regions clearly eases that task. Currently, more than 30 coupled premium schemes are differentiated, in addition to decoupled income support (SFP). The schemes cover almost all payments within the first pillar of the CAP, such as premiums to arable land ("Grandes Cultures"), durum wheat premiums in traditional regions,

durum wheat premiums in established regions, rice premiums, premiums to pulses, premiums to energy crops, silage premiums in Sweden and Finland, suckler cow premiums, direct premiums to dairy cows, extensification premiums to bulls, steers and suckler cows, payments to sheep and goats, and supplementary payments to sheep and goats, to olives, to fruits and vegetables, to the wine sector, to tobacco, to cotton, to starch potatoes; different type of Nordic aid premiums in Northern Sweden and Finland as well as complementary national premiums in the new Member States during the transition period. Important payments of the second pillar of the CAP (Less Favourite Area support, agri-environmental schemes, Natura 2000 support) are covered. Work is ongoing to include also the rest of pillar II via regional CGEs as well as national payments. Each premium scheme is defined by four attributes: (1) the groups of production activities covered, (2) payment rates for each group of activities, (3) the way the premium is implemented (per ha, per head, per slaughtered head or per main output coefficient), and (4) possible ceilings in values and/or physical limits, such as the maximum number of hectares or heads eligible. The numerical attributes of the premiums can be differentiated in a hierarchical manner from EU over Member States, and sub-regional EU differentiation (NUTS 1, NUTS 2), and finally to farm types in NUTS 2 regions, and are typically stored as time series. During models runs, premiums are endogenously updated to ensure that they do not violate ceilings. Whereas the model is generally of a deterministic nature, the behaviour of sugar beet producers under the A(B)-C regime of the EU sugar market comprises a risk component.

Further on, the market model endogenously captures market interventions and subsidized exports as a function of market and administrative prices as well as support to consumers resp. processors. Border protection is based on specific and ad-valorem tariffs which can be defined bi-laterally. Equally, tariffs resp. per unit quota rents under bi-lateral and multi-lateral TRQs are explicitly modelled, tariffs can further rendered endogenously dependent on minimum import price regimes. Care is given to capture the different trade preferences granted by the EU.

2.4 Policy indicators

The WTO classification system organizes domestic support into three categories according to the trade distortive effect of the measure: Aggregate measurement of support (AMS or *amber* box), *blue* box and *green box*. The OECD classification system also distinguishes between three main categories, however according to the direction of the transfer. PSE covers transfers from consumers or taxpayers to individual producers, broken down in sub-categories according to the method of implementation in order to reflect impacts on allocation decisions. The General Services and Support Estimate (GSSE) measure transfers from consumers or taxpayers from which producers benefit collectively. Finally, the Consumer Support Estimate (CSE) contains transfers from producers or taxpayers to consumers. Mittenzwei and Josling (2012) show the complementary of the two classification systems by establishing a mapping between single policy instruments in the WTO and OECD data sets. As far as direct payments are concerned, the two systems basically coincide although there may be differences in annual support values and in coverage of what measure to include. Market price support is also present, but calculated quite differently in the two datasets (Orden et al., 2011). While the WTO defines market price support only for products eligible to an administrative price, and uses the difference between a fixed historic reference price and that administered price, the OECD calculates market price support for all commodities and uses actual representative world market prices and domestic prices.

Figure 1 shows the development of domestic support for the EU according to the WTO and OECD classification system for the 1995 to 2008 period. The left bars for each year

indicate the different 'boxes' in WTO parlance. Market price support (MPS) and non-exempt direct payments (Non-ex DP) make up trade-distorting support subject to reduction commitments (Aggregate Measurement of Support, AMS). The blue box contains trade-distorting support exempt from reduction commitments as the targeted activities are subject to supply control, while the green box collects measures classified as non or minimal trade-distorting support. Further on, amber box support measures for a specific sector below 5% of the production value are classified as de-minimis and not included in the AMS.

The EU has continuously reduced its trade-distorting domestic support as measured by the WTO (figure 1). Total support has also declined and most of support is now mainly channelled through the green box. The development of domestic support as measured by the OECD (the right bars for each year in figure 1) basically follows the WTO classification. Total support is typically higher when measured by the OECD. Interestingly, support for which production is not required (the green part of the right bars), is lower than WTO green box support. In fact, Mittenzwei and Josling (2012) estimated the share of green box measures that are considered requiring production by the OECD to be 25 % in 2007. That category includes e.g. agri-environmental measures. The green box share in total support of the EU will continue to raise over the next years as most remaining coupled support regime are integrated in the so-called Single Farm Payments. At the same time, EU countries gain some flexibility to introduce national coupled payment programs financed under the CAP. However, these programs are restricted and could fall at least partially under de-minimis. The only blue box payments currently planned to be maintained EU wide are suckler cow and sheep & goat payments.

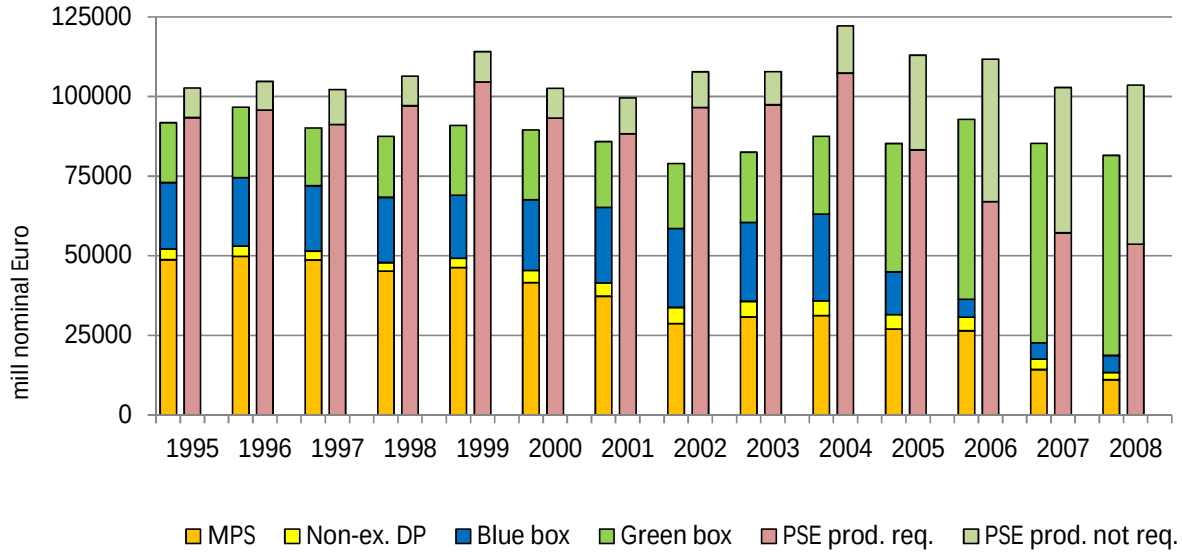

Figure 2. WTO and OECD domestic support classification for the EU (1995-2008) (Based on Mittenzwei and Josling, 2012)

Although the model's overall base year is '2004' defined as the weighted average of the years 2003-2005, policy measures refer to the year 2004, reflecting the fact that certain instruments such as production quotas or TRQs cannot be easily averaged. According to the OECD database, the sum for the PSE-categories A2 to G for the EU amounts to 53 564 mill € (table 1). These categories account for the major categories for support measures specific to farmers. A comparison between the OECD calculations and the CAPRI reveals that about

70% of the support is covered by CAPRI in the base year. What is missing is mainly input payments (PSE-category B) which are on the one hand national programs not covered in CAPRI (e.g. ca. 3 bill € fuel tax rebate and 0.5 bill € insurance subsidies) as well as support for fixed capital formation, both from national sources and from Pillar 2 of the CAP. There is also a larger differences in output payments (PSE-category A2), relating to support to dairy cows which is in CAPRI only granted from 2005 onwards (according to article 16 of EC No 1255/1999), whereas is reported in the PSEs already in 2004. There are further smaller differences which can possibly be attributed to differences in the allocation of payments to specific calendar years. No data on pillar 2 are currently available in the base year. The reader is reminded that integration of support categories in CAPRI requires that each policy measure is allocated to regions/farm types and activities. Both the WTO and the OECD only report EU totals which clearly eases the task.

The coverage of the PSE categories in CAPRI is certainly higher in the current medium-term reference run (2020) where CAPRI fully (1) integrates the national budget envelops for the decoupled and coupled support granted under Pillar 1 and (2) major elements from the second pillar (rural development) of the CAP.

Regarding the EU's domestic support notifications to the WTO, CAPRI contains information regarding administrative prices and 1986-88 reference prices to calculate market price support which is one component of the Aggregate Measurement of Support (AMS or amber box) consisting of distorting support policies. The other component is non-exempt direct payments such as output payments. CAPRI endogenously calculates whether some of product-specific AMS falls within the de-minimis-rule. If this is the case, that AMS is taken out of current total AMS. Besides AMS, CAPRI calculates blue box and green box support. In addition, overall trade-distorting support (OTDS) consisting of AMS, de-minimis support and blue box support is calculated.

Table 1. Coverage of CAP premiums in CAPRI for 2004 (mill €)

PSE category	PSE	Covered by CAPRI	Remarks
A2. Payments based on output	6 336	3 916	Mainly support for dairy cows, in CAPRI covered from 2005 onwards
B. Payments based on input use	9 759	-	Pillar 2 data not available in CAPRI expost, national subsidies missing
C. Payments based on current A/An/R/I, production required	37 720	36 745	Disaster payments missing
D. Payments based on non-current A/An/R/I, production required	15	-	Semi-subsistence farms EU expenditures missing
E. Payments based on non-current A/An/R/I, production not required	1 455	1 449	
F. Payments based on non-commodity criteria	1 184	108	Afforestation expenditures, permanent abandonment measures, landscape payments missing
G. Miscellaneous payments	-271	254	Clearance of previous year's account missing
Total	56 198	42 472	
Covered by CAPRI (%)		75.58	

Source: OECD, own calculations

No ex-post results for the WTO boxes exist. Based on a comparison of policies included in CAPRI and notified to the WTO, we expect the CAPRI mirrors all blue box payments and

about one half of total green box payments in the current base year 2004. The other half consists of very specific payments such as natural disaster payments and more general payments like general services, public stockholding and structural adjustment. We also expect CAPRI to correctly reflect the market price support component of AMS, and de-minimis support. Regarding non-exempt direct payments, the EU notifies a series of payments related to the fruit and vegetable sector (market withdrawal, processing aid), interest concessions, insurance subsidies and (temporary) output payments to various sectors. CAPRI does not cover most of those payments. The share of green box payments covered in the 2020 baseline is much higher as the national budgetary envelops which encompass the Single Farm Payment, the remaining coupled payments and national support under Art. 68 are integrated. Equally, in opposite to the expost-data base, the ex-ante data base covers major part of Pillar 2 spending (agri-environmental schemes, Less Favourite Area Supports, Natura 2000 payments).

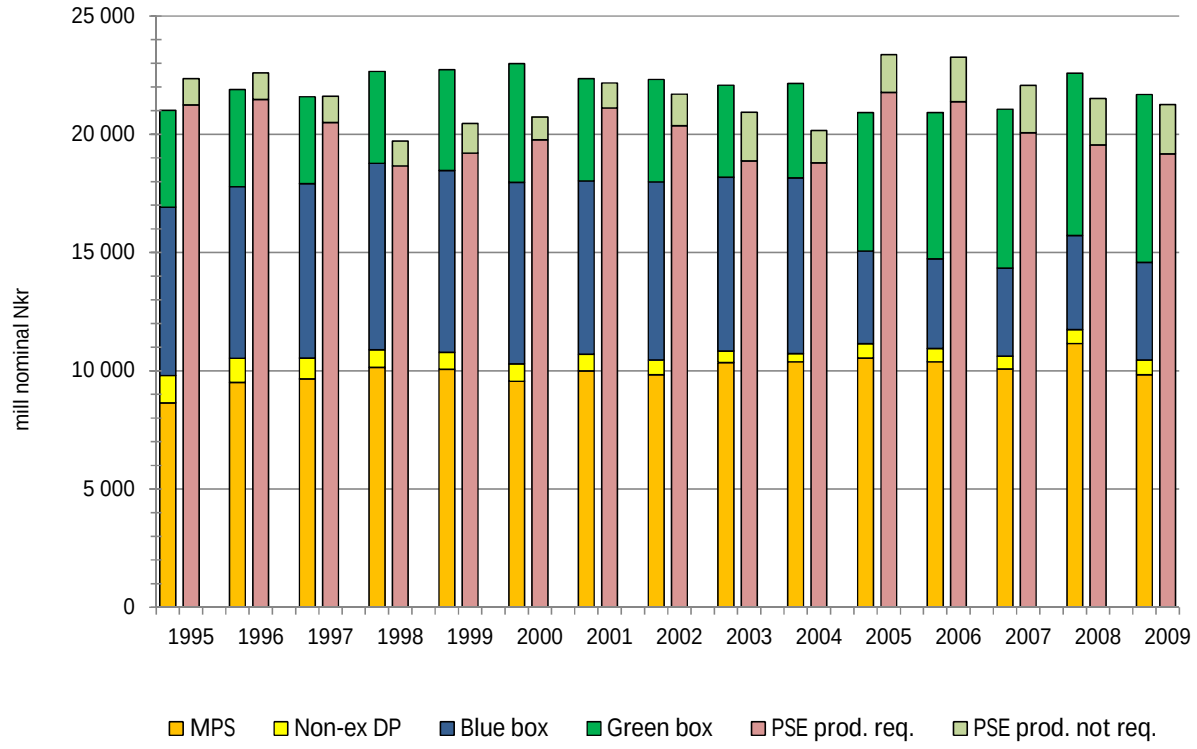

Figure 3. WTO and OECD domestic support classification for Norway (1995-2008) (based on Mittenzwei and Josling, 2012)

For Norway, support schemes are equally depicted in detail in the CAPRI model. Norway uses a wide range of policy instrument such as output payments, input payments and payments based on acreage and animal numbers. Most payments require production. The payments rates for many instruments differ between regions and with regard to farm size. The rationale behind agricultural policy design in Norway is to use support in order to compensate for natural disadvantages and economies of scale. That is, per unit payment rates are highest for small farms in the Northern part of the country and lowest for large farms in the Southern part. Figure 2 depicts the WTO and OECD domestic support classification for Norway for the period 1995 to 2008. Support measured by the two classification schemes pretty much follows each other. However, the comparison hints that many of Norway's green box measures seem

to be regarded as requiring production by the OECD. Mittenzwei and Josling (2012) estimated that share to be 80 % in 2009.

Norwegian domestic support almost completely enters CAPRI as those measures not implemented specifically enter the model as a residual direct payment for acreage and animals.

3 Baseline and counterfactual scenario

In order to illustrate the relevance of our approach, we analyse the potential production and trade impacts of green box support measures. The introduction of the SFP in the EU and its notification into the WTO green box has highlighted this issue which has been an important topic in the academic debate (e.g. Swinbank 2008). Moreover, developing countries have sometimes accused developed countries for "box-shifting" meaning that domestic support has been moved from trade-distorting boxes (amber, blue) into the non trade-distorting green box without really changing the farmers' production incentives (Josling, 2008).

The scenario is compared to a reference run or baseline for the year 2020. For the current study, the baseline captures developments in exogenous variables such as policy changes foreseen in current legislation, population growth, GDP growth and agricultural market development for the year 2020. It relies on a combination of three information sources (for a detailed description, see Britz and Witzke, 2011): (1) most importantly, the Aglink-COSIMO baseline, (2) analysis of historical trends and (3) expert information (Blanco Fonseca et al., 2010).

4 Model results

This section presents the main results of the counterfactual simulation. The main finding from the simulated changes in production and net trade if the green box is abolished is the perhaps astonishing overall coherence between the classification of the green box measures (especially for the SFP) as minimal trade distorting and the behaviour of CAPRI.

Table 2. Market balance for the EU (in 1000 tons, percentage change in italic)

	Reference scenario			Elimination of green box		
	Net production	Imports without intra trade	Exports without intra trade	Net production	Imports without intra trade	Exports without intra trade
Cereals	306662	10912	30602	301539	12987	26274
				-1,7	*19,0*	*-14,1*
Wheat	145098	2488	24886	142406	3220	21231
				-1,9	*29,4*	*-14,7*
Grain maize	67094	1801	61	66583	2408	53
				-0,8	*33,7*	*-12,4*
Oilseeds	32364	18562	1073	31359	19352	966
				-3,1	*4,3*	*-10,0*
Vegetables and Permanent crops	122115	19865	7387	121080	20188	7244
				-0,8	*1,6*	*-1,9*
Meat	44903	690	2696	44134	757	2262
				-1,7	*9,8*	*-16,1*
Beef	7772	217	411	7709	219	372
				-0,8	*1,0*	*-9,5*
Pork meat	23420	20	1801	23018	26	1528
				-1,7	*28,9*	*-15,2*
Sheep and goat meat	873	235	51	849	239	38
				-2,8	*1,8*	*-26,3*
Poultry meat	12837	218	432	12558	273	324
				-2,2	*25,2*	*-25,0*
Raw milk	149724	0	0	148573	0	0
				-0,8		
Eggs	7187	15	299	7075	21	242
				-1,5	*40,8*	*-19,1*
Dairy products	70985	243	2892	70547	249	2827
				-0,6	*2,6*	*-2,3*
Butter	1991	85	98	1966	86	93
				-1,3	*0,7*	*-4,3*
Skimmed milk powder	865	5	76	853	5	73
				-1,3	*12,3*	*-2,9*
Cheese	10278	30	565	10188	31	553
				-1	3	-2
Oils	18542	5341	6743	18333	5390	6604
				-1,1	*0,9*	*-2,1*
Oil cakes	30100	22978	3371	30002	23228	3365
				-0,3	*1,1*	*-0,2*
Sugar	15548	6387	1373	15504	6482	1348
				0	1	-2

Source: CAPRI Modelling System

The removal of the SFP in CAPRI leads to a 5 per cent reduction of land use of agriculture (see figure 4). Consequently, agricultural output and net exports drop (see table 2). Regarding the regional distribution of land use reduction, there seems to be a tendency that regions at the boundaries of the EU (Finland, Baltic countries, Greece, Italy, Spain, Portugal, Ireland and UK) more affected than central regions (Denmark, Germany, Benelux, France). Two factors probably impact mainly these results: (1) the relative importance of the SFP and further green box payments such as LFA support for agricultural land demand, and (2) land

supply to agriculture. In the central regions, more favourite conditions for agriculture lead to a higher share of market based income while at the same land availability is lower by more urbanised area and less forest cover.

The effect is even smaller for Norway. There are minimal effects on land use from the policy shock. The most obvious reason is the fact that Norwegian green box measures accounted for only about 18 per cent of total support to agriculture as measured by the OECD in 2004.

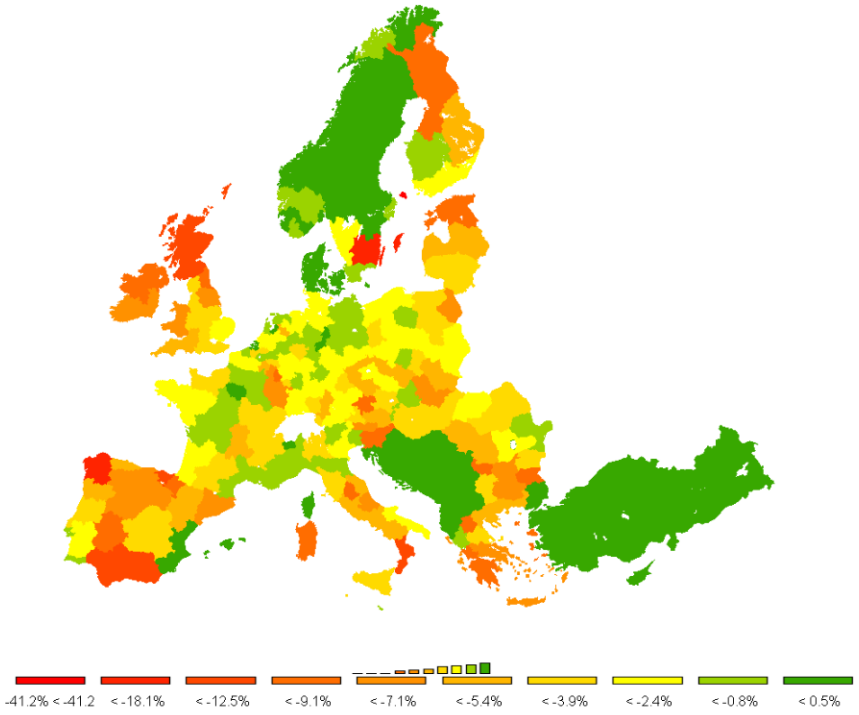

Figure 1. Percentage change in utilized agricultural area (Elimination of green box / reference scenario) (CAPRI Modelling System)

So there are clearly some trade distortion effects linked to the green box subsidies of the EU and Norway, but at least according their implementation in CAPRI, changes are relatively limited. Part of that might be due to the fact that the border protection of the EU for major products is still rather high and tainted by instruments which prevent a rapid reaction of imports to changes in EU prices such as TRQs and flexible levies linked to minimum border prices. Classical policy indicators such as the PSE market price support capture only a part of the effect as they measure only the difference between world market and EU prices which in many sectors is not longer very large. Still, it does not necessarily indicate a high price transmission.

The limited reaction on the import side allows for increases in EU domestic prices (see table 3) which buffer the output reduction (see table 4).

Table 3 Price developments (Euro/ton)

	Reference scenario		Elimination of green box	
	Consumer Price	Producer Price	Consumer Price	Producer Price
Cereals	2523	135	2529	140
			0,2	*3,3*
Soft wheat	2523	136	2529	141
			0,3	*3,2*
Durum wheat	2548	169	2553	171
			0,2	*1,4*
Grain maize	2608	139	2614	144
			0,2	*3,7*
Oilseeds	2401	290	2417	305
			0,6	*5,1*
Vegetables and Permanent crops	1972,48	667,08	1985,06	679,67
Meat	5440	1758	5518	1822
			1,4	*3,6*
Beef	7975	3029	8057	3106
			1,0	*2,6*
Pork meat	5388	1418	5446	1472
			1,1	*3,9*
Sheep and goat meat	9911	5374	10093	5562
			1,8	*3,5*
Poultry meat	3636	1361	3724	1418
			2,4	*4,1*
Cow and buffalo milk	0	270	0	286
				5,6
Sheep and goat milk	0	662	0	709
				7,1
Eggs	2949	672	2996	710
			1,6	*5,7*
Dairy products	1683	0	1712	0
			1,7	
Butter	3617	2512	3751	2640
			3,7	*5,1*
Skimmed milk powder	2014	1974	2092	2031
			3,9	*2,9*
Cheese	4823	3354	4906	3435
			1,7	*2,4*
Oils	3004	1237	3031	1263
			0,9	*2,1*
Oil cakes	2432	219	2436	223
			0,2	*2,1*

Source: CAPRI Modelling System

If the green box is removed, EU market prices increase and trigger intensification with yield increases. Equally, the removal of agri-environmental payments contributes to a certain extent to higher yields as it wipes out incentive for extensive production system. Additionally, there is a weighting effect: more marginal area and production activities (e.g. coarse grains with the exemption of corn) are more affected from the green box removal, letting the average yields at EU level increase.

Table 4. WTO policy indicators for the EU in simulation year 2020 (in million Euro)

	Reference scenario						
	Overall trade distorting support (OTDS)	Current total AMS	Market Price support	Other non-exempt measures	Blue Box	Green Box	De Minimis
All products	12751.25	9344.43	8591.66	752.77	2721.62	47213.47	685.20
All primary agricultural output	7889.30	4496.55	4478.92	17.64	2721.62	47213.47	671.13
Cereals	5001.31	4496.55	4478.92	17.64	31.98	15318.79	472.78
Other arable field crops	38.37	0	0	0	29.52	959.44	31260
Vegetables and Permanent crops	248.32	0	0	0	65.78	3989.30	182.54
All other crops	36192	0	0	0	36192	2039.89	0
Fodder	958.21	0	0	0	958.21	20336.35	0
Meat	61.36	0	0	0	61.36	0	0
Other Animal products	682.40	0	0	0	675.44	1116.56	35217
Young animals	891.88	0	0	0	891.88	450.34	0
Dairy products	1374.78	1374.78	838.33	536.45	0	0	0
Secondary products	3487.17	3473.10	3274.41	198.69	0	0	41104
	Elimination of green box						
	Overall trade distorting support (OTDS)	Current total AMS	Market Price support	Other non-exempt measures	Blue Box	Green Box	De Minimis
All products	12413.01	9236.02	8493.48	742.55	2500.94	0	676.05
All primary agricultural output	7581.10	4418.11	4400.77	17.34	2500.94	0	662.05
Cereals	4918.69	4418.11	4400.77	17.34	31.77	0	468.81
Other arable field crops	37.48	0	0	0	28.65	0	30529
Vegetables and Permanent crops	244.49	0	0	0	66.33	0	178.16
All other crops	41124	0	0	0	41124	0	0
Fodder	955.79	0	0	0	955.79	0	0
Meat	0	0	0	0	0	0	0
Other Animal products	404.06	0	0	0	397.80	0	45809
Young animals	949.79	0	0	0	949.79	0	0
Dairy products	1353.46	1353.46	827.64	525.82	0	0	0
Secondary products	3478.45	3464.46	3265.08	199.38	0	0	13.99

Source: CAPRI Modelling System

The model results underline that the major part of the ODTS and the current total AMS of the EU in its current definition are rather detached from the price and quantity developments in EU agriculture. As administrative prices remain unchanged, only quantity changes for those products for which AMS is calculated, may potentially trigger changes in AMS and ODTS. A bigger part of the blue box payments is tied to land use in EU agriculture. Eliminating the SFP thus has the effect of reducing blue box payments, however, the production activities still benefitting from coupled support show lower decreases or even slight increases compared to those not directly supported. Equally, some non-exempt

measures such as processing aid are in on our implementation reduced if EU market prices increase.

The PSE categories show more or less the same picture (see table 5). In the reference scenario, the sum of other non-exempt direct payments, blue box and green box is 546 mill Euro higher than the sum of the payments covered by the PSE (table 5). There is a similar inconsistency between table 4 and table for the elimination scenario. It appears that only blue box payments are covered by the PSE, while non-exempt direct payments are not.

Table 5 PSE indicators for the EU in simulation year 2020 (in million Euro)

	Reference Scenario					Elimination of green box				
	Current output	Current area/animal number	Not current, production required	Not current, production not required, fixed	Non commodity output	Current output	Current area/animal number	Not current, production required	Not current, production not required, fixed	Non commodity output
Sum	0	11012.41	0	38979.77	140.47	0	2500.94	0	0	0
Sum of pillar I payments	0	2721.61	0	38782.20	0	0	2500.94	0	0	0
Single farm payments	*0*	*0*	*0*	*38782.20*	*0*	*0*	*0*	*0*	*0*	*0*
Sum of pillar II payments	0	8093.23	0	0	140.47	0	0	0	0	0
Sum of agri-environmental payments	*0*	*5172.40*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
National payments	0	197.57	0	197.57	0	0	0	0	0	0

Source: CAPRI Modelling System

5 Discussion and conclusion

The mapping of already existing policy instruments in the CAPRI model to the two main support classification schemes greatly improves policy transparency and allows analyzing the impact of policies not only with respect to market and price impacts, but also with respect to WTO conformity of existing and new agricultural policies. CAPRI is able to produce PSE-data and WTO notifications for future years and counterfactual runs for these regions. This improves the monitoring and evaluation of agricultural policy reforms in a field that has not yet received much attention from policy makers (and academics). Ongoing international negotiations on agricultural support as well as a possible conclusion of the Doha-round with tighter disciplines on domestic support or an increase in dispute settlement procedures over agricultural subsidies may well trigger the need for policy makers to look deeper into this issue.

The main finding is that the CAPRI simulation results indicate that the EU support under the green box is to a large extent only minimally trade distorting. Thus, from an economic point of view, it seems to fit with the WTO classification of the EU support instruments as being green box compatible. That does not preclude, of course, that green box measures may be incompatible for legal reasons. The literature does not report examples from model simulations involving the complete dismantling of the EU green box measures, probably because that scenario is politically unlikely. However, such a scenario may provide a useful supplement to theoretical studies on the production effect of the SFP and empirical studies focusing on single farms. Exercises with other large-scale models would be of potential interest. In general, our results support the part of the literature that finds the production effect of SFP payments to be limited (Schokai and Moro, 2009; Rude, 2008; Gohin, 2008).

We judge that our finding does not root in a naive interpretation of the instruments in CAPRI. Rather, we link it firstly to the fact that the still rather high level of EU border protection and its specific implementation (TRQs, minimal border prices) insulate EU markets to some extent on the import side from world markets. Removing subsidies hence let EU market prices increase, which partly offsets the drop in output. The limited trade effects thus stems mainly from the fact that output is somewhat reduced and EU exports decrease with increasing EU market prices. Secondly, the land supply functions are in most regions inelastic, so that a land subsidy reduction impacts mostly land rents and thus the income of the land owners, but has a smaller effect on allocative decisions. We however remind the reader that in our deterministic model without investment decisions, possible wealth and risk effects of the green box are not covered, albeit these are generally assumed be small in case of programs such as the SFP (e.g. Bhaskar and Beghin 2009; Hennessy, 1998).

From a trade policy point of view, our study addresses the question on how to judge the potential production and trade distortionary effect of agricultural policies in the context of WTO dispute settlement procedures. Should they be assessed in the presence of other policy instruments, or should they be assessed in comparison to a hypothetical non-policy intervention scenario? Our model results underline the intuitive finding that less border protection would give rise to a larger effect on production and trade of a complete elimination of green box measures. They thus support a well-known result in economic theory that the distortionary effect of a measure is influenced by other existing measures. This is, of course, exactly the idea of the blue box which links supply boosting support instruments with supply control measures to reduce their distorting effects. To the best of our knowledge, the few WTO disputes that have addressed the distortionary effects of agricultural policies so far, have not utilized large-scale sector models. In this respect, our study indicates that the results from detailed agricultural sector models like CAPRI may well be useful as an input for those disputes.

References

Armington, P.S. (1969). A Theory of Demand for Products Distinguished by Place of Production. *Staff Papers - International Monetary Fund* 16(1): 159-178.

Bhaskar, A. And J.C. Beghin (2009). How Coupled Are Decoupled Farm Payments? A Review of the Evidence. *Journal of Agricultural and Resource Economics* 34 (1): 130–153.

Blanco Fonseca, M., A. Burrell, H. Gay, M. Henseler, A. Kavallari, R. M'Barek, I. Pérez Domínguez, and A. Tonini (2010). Impacts of the EU Biofuel Target on Agricultural Markets and Land Use: A Comparative Modelling Assessment. JRC Scientific and Technical Report EUR 24449 EN.

Boulanger, P., Jomini, P., Zhang, X., Costa, C., and Osborne, M. (2010). An Economic Assessment of Removing the Most Distortive Instruments of the Common Agricultural Policy (CAP). Paper presented at 12. Annual ETSG Conference, Lausanne.

Britz W. (2008). Automated model linkages: the example of CAPRI. *German Journal of Agricultural Economics* 57 (8): 363-367.

Britz W. and Witzke P. (2011). CAPRI model documentation 2011. University of Bonn, http://www.capri-model.org/docs/capri_documentation.pdf.

Britz, W., Gocht, A., Pèrez Dominguez, I., Jansson, T., Grosche, S. and Zhao, N. (2012). EU-Wide (Regional and Farm Level) Effects of Premium Decoupling and Harmonisation Following the Health Check Reform, *German Journal of Agricultural Economics* (61): 44-56.

Brockmeier, M., Pelikan, J. and Klepper, R. (2008). The WTO negotiations and the CAP. *German Journal of Agricultural Economics*, vol. 57 (8), p. 165-177.

Dewbre, J. , Antón, J., Thompson, W. (2001). The Transfer Efficiency and Trade Effects of Direct Payments. *American Journal of Agricultural Economics* 83(5): 1204-1214.

Gocht A. and Britz, W. (2011). EU-wide farm types supply in CAPRI - How to consistently disaggregate sector models into farm type models, *Journal of Policy Modelling*, 33(1): 146-167.

Gohin, A. (2006). Assessing CAP Reform: Sensitivity of Modelling Decoupled Policies. *Journal of Agricultural Economics* 57(3): 415-440.

Golub, A., T.W. Hertel, H.-L. Lee and N. Ramankutty (2006). Modeling Land Supply and Demand in the Long Run. GTAP Resource #2111. Purdue University.

Hennessy, D.A. (1998).The Production Effects of Agricultural Income Support Policies under Uncertainty. *American Journal of Agricultural Economics* 80 (1): 46–57.

Jansson, T. and Heckelei, T. (2011). Estimating a Primal Model of Regional Crop Supply in the European Union. *Journal of Agricultural Economics* 62: 137–152.

Josling, T. (2008). *After Cancún: what next for agricultural subsidies?* EuroChoices 2:12-17.

Marie-Gabrielle Piketty, Lucie Weissleder, Hildo Meirelles de Souza Filho, Mario Otávio Batalha, Marcel Adenäuer and Arno Becker (2009). Assessing agricultural trade policies options with European Union: A Brazilian perspective. *Agricultural Economics*, Band 40, S. 447-457.

Mittenzwei, K. and Josling. T. (2012). Comparative analysis of data frameworks for agricultural policy analysis: the WTO-notifications and the OECD's PSE database. NILF-discussion paper 2012-4. Norwegian Agricultural Economics Research Institute. Oslo.

Morredu, C. (2011) (main author and editor) with contributions by Martini, R., Kimura S., Britz, W., Gocht, A., Perez, I., Hart, K. and Baldock, D.: *Evaluation of Agricultural Policy Reforms in the European Union*. OECD, Paris.

Orden, D., D. Blandford and T. Josling (2011). *WTO Disciplines on Agricultural Support: Seeking a Fair Basis for Trade*. Cambridge, Cambridge University Press.

OECD (2011). Producer support estimate. Organization for Economic Cooperation and Development. Paris.

Rude, J. (2008). Production effects of the European Union's Single Farm Payment. *Canadian Journal of Agricultural Economics* 56: 457-471.

Schokai, P. and D. Moro (2009). Modelling the impact of the CAP Single Farm Payment on farm investment and output, *European Review of Agricultural Economics* 36: 395-423.

Swinbank, A. (2008). Potential WTO Challenges to the CAP. *Canadian Journal of Agricultural Economics* 56: 445–456.

WTO (var.). *Domestic support notifications*. World Trade Organization. Geneva. (http://wto.org/english/tratop_e/agric_e/transparency_toolkit_e.htm)

Van Meijl, H., T. van Rheenen, A. Tabeau and B. Eickhout (2006). The impact of different policy environments on agricultural land use in Europe. *Agriculture, Ecosystems & Environment* 114: 21-38.

Verburg, P., D.B. van Berkel, A.M. van Doorn, M. van Eupen and H.A. van den Heiligenberg (2010). Trajectories of land use change in Europe: A model-based exploration of rural futures. *Landscape Ecology* 24: 217-232.