MODELLING THE EFFECTS OF EU SUGAR MARKET LIBERALIZATION ON AREA ALLOCATION, PRODUCTION AND TRADE

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Abstract: *This paper presents a partial equilibrium simulation analysis of EU sugar market reforms with a version of the European Simulation Model (ESIM) addressing three issues: preferential EU imports are a function of the price differential between world market and EU price, EU supply functions are estimated based on FADN data, and the production of bioethanol in the EU and the rest of the world is taken into account as an important component in sugar beet and sugar cane demand. It is found that the current sugar market reform including the restructuring process until the end of 2007 is sufficient to allow the EU to comply with its WTO commitments only very narrowly. EU sugar supply is simulated to decrease from roughly 19 million tons in the base period to 15.5 million tons by 2015 and the EU price remains at a level of about 450 €/t and thus significantly above the reference price. In case of full liberalization production in the EU is projected to decrease to 7.5 million tonnes by 2015.*

Key words: Sugar, Common Agricultural Policy, Sugar Market Reform, Partial Equilibrium Modelling, Everything But Arms

1. Introduction

The 2006 Reform of the European Union's (EU) sugar policies marked a first step in bringing this sector in line with the EU commitments in the World Trade Organization (WTO) and the preferences granted under the Everything But Arms (EBA) initiative. So far, however, the reform has fallen short compared to expectations with respect to reducing sugar quotas as part of the restructuring process. Therefore, the European Commission has applied linear ad hoc quota cuts for all Member States in the first two years of the implementation of the reform. In addition, the restructuring scheme has been reformed in order to provide stronger incentives for sugar producers to return production quotas. Still, it is an open question whether the policy changes agreed upon so far will be sufficient to reach the target of a balanced EU market. It is, therefore, possible that the EU sugar policy will be further reformed. What would be the effect of further sugar market reforms in the EU?

Simulation modelling of such changes is a challenge in several regards. First, the EU market balance is heavily impacted by future preferential imports under various preferential trade agreements such as the EBA initiative and the Economic Partnership Agreements (EPA) to be closed with African, Caribbean and Pacific (ACP) countries. These imports are responsive to the EU price as well as prices which can be received in other markets and are difficult to model. Secondly, the empirical foundation of EU supply functions is difficult, as price changes under the current reform as well as under a potential complete liberalization are without historical precedent in the EU Member States over the last 50 years. Third, EU production of bioethanol has increased strongly in recent years. This establishes a non-traditional demand component for sugar beets which affects the EU sugar market balance.

This paper presents a partial equilibrium simulation analysis of EU sugar market reform with a version of the European Simulation Model (ESIM) which addresses these three issues: preferential EU imports are a function of the price differential between world market and EU price, EU supply functions are estimated based on Farm Accountancy Data Network (FADN) data and the production of bioethanol in the EU and the rest of the world is taken into account as an important component in sugar beet and sugar cane demand. Chapter 2 presents an overview of recent EU sugar market reforms and an outlook

on potential future reforms. Chapter 3 explains the model used for this analysis and Chapter 4 presents the two policy scenarios and results. Chapter 5 finalizes with some conclusions.

2. The Reform Process of the EU Sugar Market

In November 2005 the council of EU farm ministers agreed upon a reform of the EU's sugar sector (Council Regulation (EC) 2006/318) which entered into force with the crop year 2006/07. The final decision followed upon an almost three year long process of internal discussion of various reform options. The sugar sector had so far been spared from major changes in the preceding rounds of reforms of agricultural policies which the EU embarked upon over the last two decades. Various external pressures, however, rendered a reform finally inevitable.

The major steps of the reform of the Common Market Organization (CMO) were the replacement of the intervention by a reference price system and a reduction of the reference price by 36% to € 404.40/t as well as the reduction of the minimum price for sugar beets to be paid to farmers by 39.7% to € 26.29/t. These price cuts are phased in over a period of four years. A further important element of the reform is the merger of A and B quotas and the limited options for the use of out-of-quota sugar, formerly C-sugar. Basically, out-of-quota sugar may only be used as industrial sugar or carried forward. The reform of the CMO was accompanied by the introduction of a decoupled payment to farmers amounting to 64.2% of the reference price cut, and a restructuring scheme for the sugar sector, in order to achieve a reduction of the overall quota, which is necessary to balance the EU sugar market by 2010. A restructuring fund was established from a levy collected on each ton of quota from the sugar producing enterprises. This fund pays companies willing to sell quota a premium, which reduces from € 730/t in 2006/07 to € 520 in 2009/10 (European Union, 2005).

The success of the restructuring scheme had, however, been unsatisfying till mid 2007. Merely 2.2 million t of quota had been renounced in the first to years. Furthermore, the new CMO offered former C-sugar producers the opportunity to buy additional quota subject to a plafond at Member State level which resulted in purchases of roughly one million tons. In March 2007 as well as in the year before, as a result of the slow progress, the European Commission temporarily withdrew about two million tons or 13.5% of quota from the market to avoid an oversupply (European Union, 2007a). In September 2007 the Council decided upon a reform of the restructuring scheme, granting additional incentives for quota renouncement (European Union, 2007b). There are no numbers available yet on final quota sales to the restructuring fund for the following crop year. It seems, however, to be the case that the new regulation will result in a sizeable quota renouncement by virtually all companies and Member States, also those which are relatively efficient. This is due to provisions of the new restructuring scheme which favour quota sales up to the level of the quota withdrawal mentioned above over sales beyond that level (Nolte and Grethe, 2008). Should the EU market not be balanced by 2010, the quota will be cut without any compensation. These cuts will be based on how much quota will have been renounced by then by every Member State (European Union, 2007a).

3. The Representation of Sugar Markets and Policies in ESIM

ESIM is a comparative static partial equilibrium net-trade multi-country model of agricultural production, consumption of agricultural products, and some first-stage processing activities. ESIM is a partial model as only a part of the economy, the agricultural sector, is modeled, i.e. macroeconomic variables (like income or exchange rates) are exogenous. As a world model it includes all countries, though in greatly varying degrees of disaggregation. All EU Member States as well as accession candidate Turkey plus the US are modeled as individual countries; all others are combined in one aggregate (the so-called rest of the world (ROW)). ESIM is a price and policy-driven model with rich cross-commodity relations; it depicts price and trade policy instruments as well as direct payments. As ESIM is mainly designed to simulate the development of agricultural markets in the EU and accession candidates, policies are only modeled for these countries (i.e. for the USA and the ROW, production and consumption take place at world market prices). Area allocation, yield and demand functions are isoelastic. An isoelastic area allocation curve with a price elasticity below Unity has a shape such as the lower curve shown in Figure 1.

For the area allocation of sugar a different functional form (1) is implemented, which is also shown in the figure. This function, unlike an isoelastic one, allows the model to let production in a country be ceased at a positive price.[1] To achieve this, an additive (negative) parameter α is introduced in a generic isoelastic function.

$$Area_i = MAX\left\{0, \left(\alpha + \beta * P_i^{\gamma}\right)\right\} \quad \textbf{(1)}$$

It is not evident a priori to which price/area combination this function should be calibrated for each Member State. Due to the quota, the price for sugar in the EU does not reflect marginal production costs, and the production quantity, especially the production of C-sugar (Gohin and Bureau, 2006), cannot solely be explained with profit maximization behaviour. To address this problem, Member State-specific supply functions in ESIM are calibrated in the following two steps.

- The course of the curve is derived from FADN data. All cost positions in FADN data e.g. for fertilizer are merely available on farm group level. This does not allow attributing costs to single production activities. It is, however, possible to rank all farm groups in the sample according to their overall cost efficiency, if all costs including opportunity costs for farm-owned factors are divided by total receipts. The sugar producing farms in the sample are ranked accordingly and graphed with the cost/receipts ratio on the vertical axis and the cumulative production area on the horizontal axis resulting in a curve shaped like the non-isoelastic one in Figure 1. With Ordinary Least Square regression, this data is used to estimate the parameters of equation (1) with $Area_i$ substituted for the cumulative area of beets and P_i substituted for the cost/receipts ratio.
- The curve is scaled such as to meet the Member State-specific shadow price/area combination. As a shadow price for sugar (the model does not explicitly depict beet production, but merely white sugar production), estimates by the European Commission (2005) are taken as a benchmark. As area, the entire sugar area in the base period of the model is chosen, including the area used for C-sugar.[2]

[1] For details, refer to Nolte and Grethe (2007).

[2] This results in a slight overestimation of the price responsiveness of sugar supply.

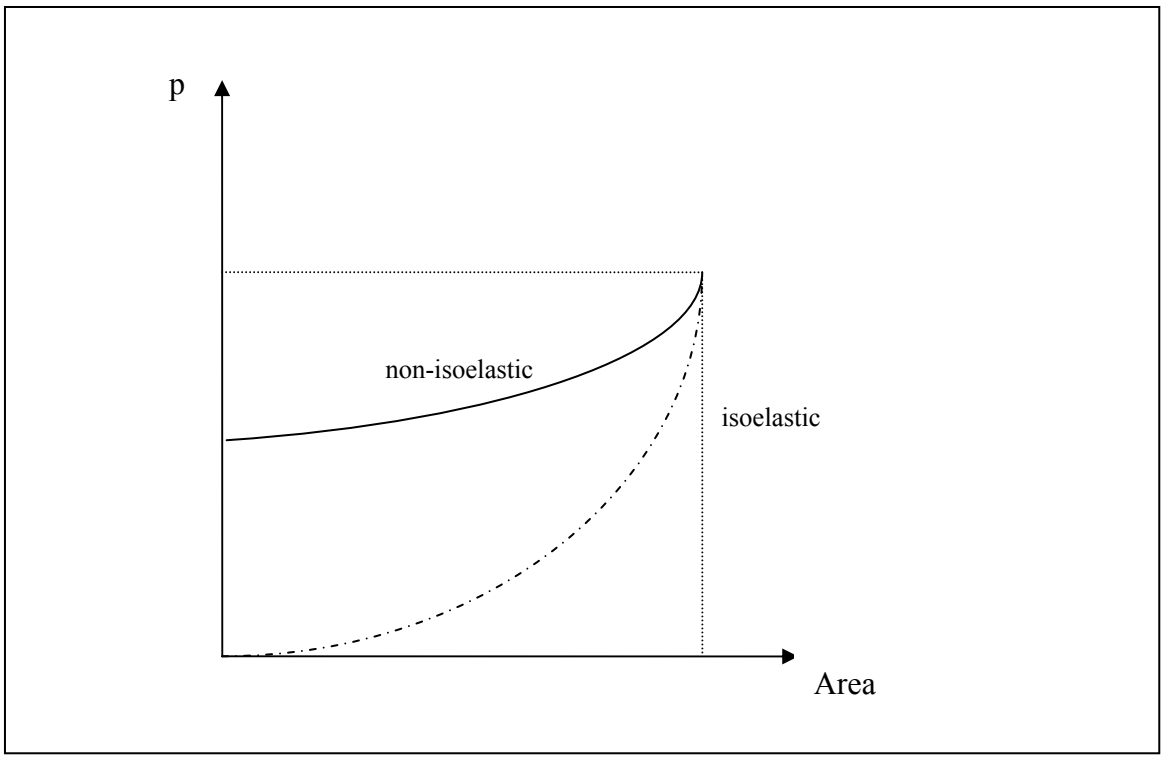

Figure 1: Functional Form of Beet Area Allocation in the Model Compared to an Isoelastic Function. Source: own graph.

Despite being a net-trade model, ESIM also contains a price responsive export supply function to represent preferential EU imports under various schemes. In a former version of the model, these where modelled as a fixed quantity entering the EU market each year. Under the new CMO with decreasing prices this is not appropriate anymore. The preferential export supply function for sugar is a function of the price difference between the internal price in the EU and the world market price plus a specific amount accounting for a possible freight cost differential, transaction costs, and costs of "swapping". If this difference approaches zero, preferential exports fall to zero as well. For each country an export supply function is specified for every year as a function of this price differential. These functions are calibrated on shadow prices from the literature and export supply elasticities and technical progress coefficients are chosen based on plausibility considerations. Individual countries' exports are restricted by the tariff rate quota (TRQ) prevailing in the respective year.[3] These individual export supply functions are finally added up to an aggregate export supply function for every year of the projection horizon.

ESIM also depicts the use of oilseeds for biodiesel production and cereals and sugar crops for bioethanol production. The production of bioethanol and biodiesel each depend on the bioethanol/biodiesel price and the weighted prices of energy crops/oils. The shares of feedstocks in bioethanol production/oils in biodiesel production are determined by a CES function based on energy crop prices (minus prices of related feed outputs). EU production of biofuels and biofuel inputs competes with imports from other countries.

[3] This relates mainly to the implementation of EBA und the subsequent abolishment of SPS imports. The provisions of the Economic Partnership Agreements (EPA) granting duty and quota free access to ACP member states in 2015/16 are not yet accounted for. Also the increase of preferential imports due to quotas which had to be opened for Brazil after the Accession of Romania and Bulgaria in 2007 are not accounted for.

4. Scenario Description and Results

4.1. Scenario Description

Two scenarios are formulated for 2015. For the baseline, several assumptions are made with respect to variables which are exogenous to this analysis such as demographic developments, macro-economic growth, consumer preferences and agri-technology. Most assumptions are based on the Scenar 2020 project (Nowicki et al., 2007). Furthermore, many assumptions are made for the baseline with respect to the development of the CAP; these are depicted in Table 1.

Table 1: Assumptions on Agricultural Policy Development in the Baseline

Topic	**Assumption**
Market Policies	
Intervention	• Current system of intervention prices • Exclusion of maize from intervention in 2009 • Adjustment of intervention prices to balance markets where necessary in order to comply with WTO restrictions on export subsidies: • Intervention price for butter decreases by 15% from 2012 onwards

Regulations for quota products (milk, sugar)	• Reform of the 2006 sugar MO including the first steps of the restructuring process:
	  • For all Member States quotas are reduced by 15% from 2006 on
	  • Reductions to zero for Ireland from 2006 and Slovenia and Latvia from 2007 on
	  • Reduction for Italy, Portugal and Finland by 50%, 70% and 40%, respectively, from 2007 on
	• Maintenance of quotas

Changes in biofuel policies	• Human demand shifters set to reach a biofuel share of 5.2% in total EU transport fuel consumption by 2015
Trade Policies	
Tariffs	• EU offer, no consideration of sensitive products, implementation period 2009-2013
Export subsidies	• EU offer, implementation period 2009-2013
TRQs	• Constant level of current TRQs, no new TRQs • But full phase in of unrestricted sugar market access for LDCs in 2009/10
Direct Payments	
Development of direct payments	• SAPS and SFP per ha payments constant in nominal terms (deflated by EU inflation rate)
Modulation rate	• 20%
Decoupling of direct payments	• Full decoupling from 2011 onwards
Application of the Single Farm Payment in the EU-10	• Prolongation of the SAPS system until 2011 as recently decided by the Council
Obligatory set-aside rates	• Removal of mandatory set-aside in 2011

The liberalisation scenario contains an abolishment of all tariffs, TRQs and production quotas for sugar implemented between 2009 and 2013. Voluntary quota reductions being part of the baseline are assumed to be irreversible: sugar production remains restricted not to exceed the 2007 quota level in these cases.

4.2. Scenario Results

As a first impression of the baseline Figure 2 displays the development of world market prices in real terms. The overall trend of world market prices under the baseline is based on projections published by FAPRI for 2015 (FAPRI, 2006). Technical progress and demand shifters in the rest of the world are programmed in order to approximate FAPRI projections. An exception is price projections for biofuels, plant oils and oilseeds, for which the implementation of human demand shifters for biofuels in the EU – in order to meet the projections of the European Commission (2007a) – leads to significantly higher prices which apply in the baseline.

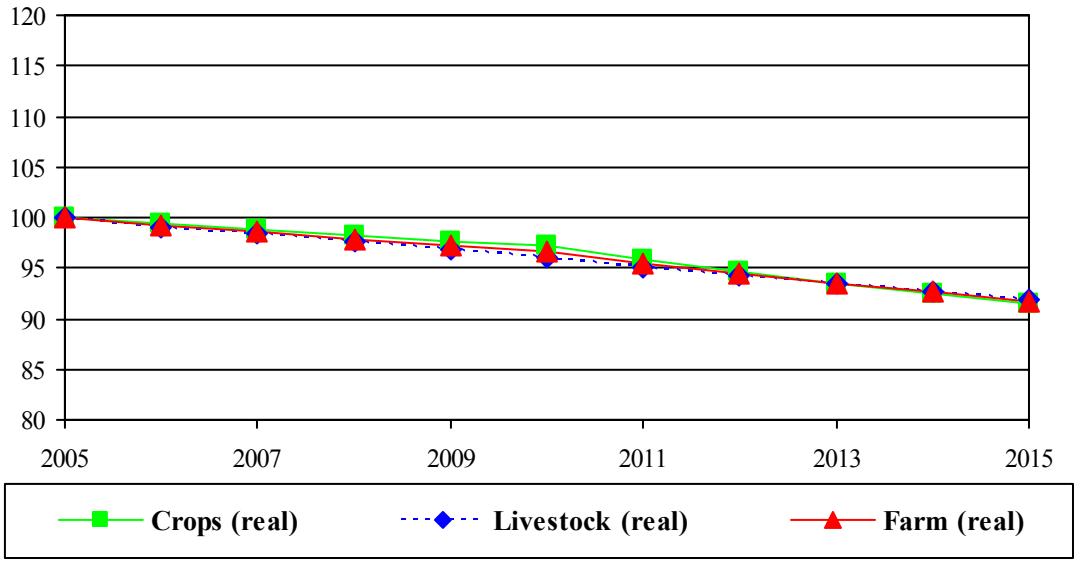

Figure 2: Real World Market Price Indices for Agricultural Products 2005-2015

Source: Own calculations.

World market prices are projected to fall by about 8% in real terms for crops and animal products until 2015. EU prices can be expressed relative to the world market price, reflecting the degree of political protection. Figure 3 displays the development of weighted (with fixed supply quantities in the base period) EU prices for agricultural products expressed in relative terms compared to the world market price.

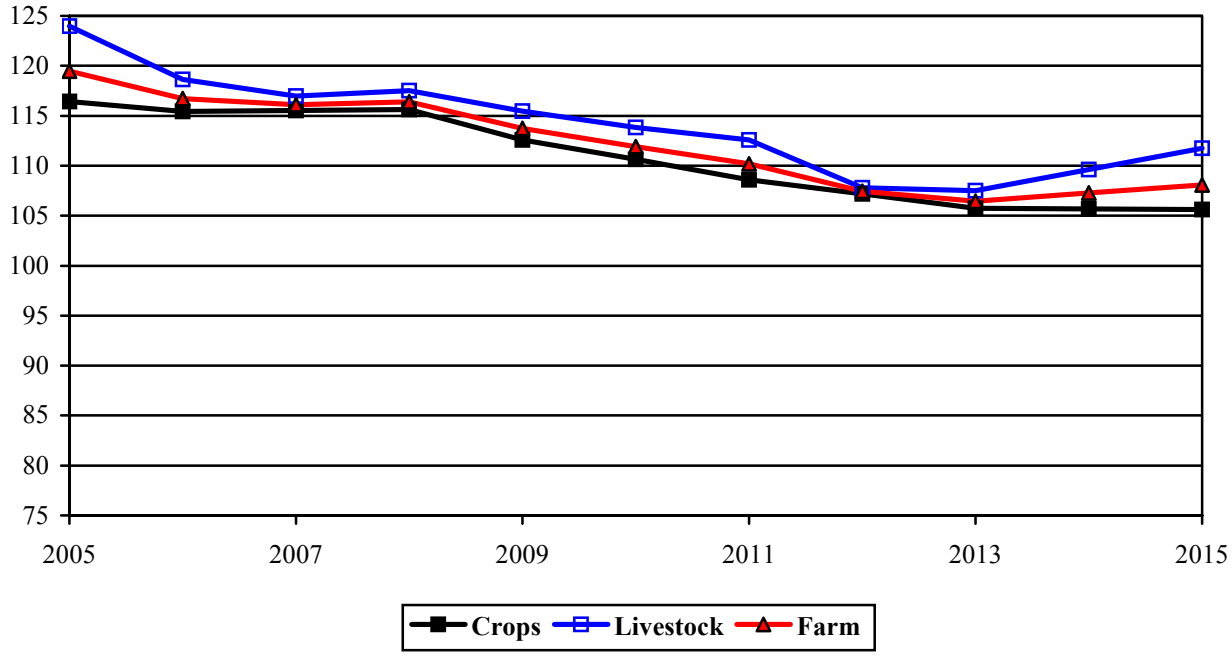

Figure 3: Development of EU Price Relative to World Market Price Indices for Agricultural Products 2005-2015 (production value-weighted)

Note: Under a situation with no distortion between EU prices and prices on world markets, all numbers in Figure 2 would be exactly 100. Numbers above 100 indicate higher prices on EU markets compared to prices on world markets, while numbers below 100 describe an EU price level below international prices. Source: Own calculations.

For agricultural products, the EU price declines on average from almost 120% compared to the world market price in 2005 to about 113% in 2013. Most of this decline is due to the implementation of the tariff reductions that are part of the EU offer in the Doha Round, which is included in the baseline. From 2013 onwards, EU crop prices remain fairly constant relative to the world market level. This reflects the fact that the EU is at the world market price level for most crop products over this period, and no other policy changes are implemented except a deflation of remaining institutional prices and specific duties. For animal products, EU prices start rising from 2013 on. This is caused by declining net exports of all animal products, which tends to result in higher prices: domestic prices are increasingly influenced by the relevant import price, which is the world market price plus a tariff that is higher for all animal products than the relevant export price, which is the maximum of the world market price and the institutional price (if any). Sugar specific results for the EU are depicted in Table 2.

Table 2: Simulation Results for the EU Sugar Market in Baseline and under Full EU Sugar Liberalization

		Base (2005)	Baseline (2015)		EU Liberalization (2015)	
				Change relative to base		Change relative to baseline
World	**Price (€/t)**	259	263	1.5%	270	1.9%
EU-27	**Price (€/t)**	712	451	-36.7%	332	-27.0%
	Sugar production (mill. t)	19.4	15.5	-20.0%	7.5	-52.0%
	Sugar beet area (mill. Ha)	2.2	1.5	-31.6%	0.7	-54.1%
	Sugar demand (mill. t)	16.2	18.5	14.7%	19.2	3.8%
	Sugar net-exports (mill. t)	3.1	-3.2		-11.9	
	Sugar pref. imports (mill. t)	1.9	1.81	-4.9%	1.09	-39.8%
	Ethanol production (mill. T)	0.66	0.53	-19.5%	0.51	-4.5%
	Sugar use in ethanol (mill. t)	0.2	0.16	-17.6%	0.15	-7.9%
	Ethanol net-imports (mill. t)	0.06	5.61		5.52	

Source: Own simulations.

Under the baseline, the domestic price decreases by 37% in real terms until 2015. The world market price increases slightly by 1.5% during the same period. EU sugar supply decreases from roughly 19 million tons in the base period to 15.5 million tons by 2015 and sugar beet area declines by 32%. Preferential imports decrease slightly by 100 thousand tonnes in spite of the full implementation of the EBA initiative. This is because of the declining EU price which establishes a declining incentive for preferential imports. But substantial Most Favoured Nation (MFN) imports occur and the EU turns into a strong net-importer of sugar at a level of about 3.2 m tons. Ethanol demand increases strongly in the EU, but most of it is covered by imports. This is because of the strong reduction in the EU ethanol price which results from the tariff reduction as part of the Doha Agreement envisaged under the baseline.

In the liberalization scenario, the domestic price in the EU falls to world market level. EU imports amount to 12 million tons and sugar production in the EU-27 decreases to roughly 7.5 million tonnes by 2015. The world market price increases slightly by 2% compared to the baseline. It amounts to 270 real 2005 € (Caribbean, fob) and to 332 € (Europe, cif landed), respectively.

Table 3 displays sugar production per Member State. The production decreases in single Member States under the baseline scenario reflect the quota sales to the restructuring fund, which are implemented exogenously. As mentioned above these are in some cases higher than the 15% of quota cuts which are implemented in the baseline. The picture changes under the liberalization scenario. No Member State except for Sweden is under the open market conditions able to fill its quota anymore. There are differences in decreases between Member States. The southern Member States, Greece, Italy, Portugal, Spain and Bulgaria end production almost completely. Only in Bulgaria, the scenario results in a minor quantity being produced, for which it is, however, questionable, whether a sugar factory can be operated profitably. Also in Poland sugar production ceases. The remainder of the new Member States is relatively strongly affected by the liberalization of the EU sugar market. Production decreases are in all cases by more than 50% compared to the baseline, with the strongest decline in Hungary, where almost 70% of the production is abandoned. The remainder of the EU-15 countries reduces sugar production compared to the baseline by lower percentages. In most cases reduction rates are at or somewhat below 40%. In the UK, the production decreases by merely 13%. The two

exemptions within the northern EU-15 countries are Denmark and Finland, where production decreases by 91% and 65%, respectively.

Table 3: EU Sugar Production per Member State (1000 tons)

Member State	Base (2004/2005)	Baseline (2015)		EU Liberalization (2015)	
			Change relative to base		Change relative to baseline
Germany	3,940	3,318	-16%	2,012	-39%
Austria	449	382	-15%	242	-37%
Belgium/Luxembourg	985	834	-15%	480	-42%
Denmark	453	385	-15%	34	-91%
Finland	155	93	-40%	33	-65%
France	4,331	3,669	-15%	2,346	-36%
Greece	255	154	-40%	0	-100%
Ireland	203	0	-100%	0	
Italy	1,458	722	-50%	0	-100%
Netherlands	918	770	-16%	508	-34%
Portugal	80	24	-70%	0	-100%
Spain	1,011	844	-17%	0	-100%
Sweden	385	319	-17%	329	3%
United Kingdom	1,313	1,112	-15%	969	-13%
Latvia	68	0	-100%	0	
Romania	42	45	7%	18	-60%
Slovenia	36	0	-100%	0	
Lithuania	119	101	-15%	39	-61%
Bulgaria	3	3	0%	1	-67%
Poland	2,014	1,712	-15%	0	-100%
Hungary	494	421	-15%	132	-69%
Czech Republic	518	441	-15%	215	-51%
Slovak Republic	229	195	-15%	88	-55%

Source: Own simulations.

5. Conclusions

One of the core results of this analysis is that the sugar market reform including the restructuring process until the end of 2007 is sufficient to allow the EU to comply with its WTO commitments only very narrowly. The EU is projected to import about 1.4 m tons of sugar at MFN conditions in 2015. But our analysis does not yet account for non LDC imports resulting under potential EPA from 2015/16 on and the preferential TRQ which had to be opened for Brazil after the accession of Romania and Bulgaria in 2007.

A second conclusion is that a MFN tariff reduction for sugar at the size which can be expected in the Doha Round affects the EU market price, as the EU price is simulated substantially above the reference price level.

Third, compared to full liberalization, the current reform only reaches about two third with respect to the price reduction which would result under full liberalization: The EU price falls by 37%, whereas it would fall by about 53% in case of full liberalization. At the same time, the simulated sugar production quantity reduction in the baseline is only about one third (from 19 m tons to 15.4 m tons)

of what would result from full liberalization (reduction to 7.5 m tons). These results must be interpreted critically, however, as ESIM underestimates the positive world market price effect of EU liberalization significantly. This is because policies of other than EU countries are not depicted. Models which explicitly depict world wide sugar policies project higher world market price effects which would dampen the effect of EU liberalization on EU prices and production (Nolte, 2008, Elobeid and Beghin, 2006). In the long run, however, a strong effect of sugar policies on world sugar prices may be questioned: the higher the prices for fossil energy, the stronger the development of bioethanol refineries in countries such as Brazil and the more the pressure on the development of substitution technology such as flex fuel motors. As a result, the international sugar price may be determined by energy prices in the future rather than by agricultural policies.

To conclude, critical parameters for the determination of the future EU market balance are the level of shadow prices in the model base period, the competitiveness of preferential suppliers, assumptions on ethanol driven sugar beet demand in the EU and international energy prices.

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