

Agricultural market access: A moving target in the WTO negotiations?

Martina Brockmeier¹, Janine Pelikan^{*}

Federal Agricultural Research Centre, Institute of Market Analysis and Agricultural Trade Policy, Bundesallee 50, 38116 Braunschweig, Germany

Received 12 December 2005; received in revised form 17 October 2007; accepted 22 October 2007

Abstract

This article analyzes the impact of multilateral market access liberalization of the Doha Round agricultural negotiations. At the center are the effects of variations in the magnitudes of tariff cuts, different tariff cutting formulas, the tariff capping as well as different numbers and width of tariff bands. The simulations are conducted with an extended version of the GTAP model and the GTAP database (6.0) including bound and applied rates and a module to cut tariffs at the 6-digit tariff line level. The results reveal that the heights of the tariff cuts and the kind of tiered formula applied are most important for the outcome of the Doha Round, while the width of tariff bands and the tariff capping only have a moderate influence on the countries' trade pattern and welfare. In contrast, the number of tariff bands is not important for the results.

© 2007 Elsevier Ltd. All rights reserved.

Keywords: Market access; WTO negotiations; Bound and applied tariffs; CGE modeling; Agricultural trade policy

Introduction

Agricultural market access is a highly controversial issue in the current WTO policy debate. According to the latest proposals of the EU, the USA, the G-20 and the G-10,² the positions on market access differ strongly, and thus the success of the Doha Round is evidently put at risk. The most contentious issues concerning market access are: Which magnitude should the tariff cuts have? What kind of tiered formula should be implemented? Should tariffs be cut at a maximum level? How should the width of the four tariff bands be determined in developed and developing countries? Should there be flexibility within the tariff bands? How many products should be defined as sensitive? Which degree of Special and Differential Treatment should be imposed? How should Tariff Rate Quotas (TRQs) be handled? The answers to these questions will determine the

magnitude of market access of the prevailing WTO member countries which is accordingly still a moving target in the WTO negotiations.

This paper addresses some of the questions raised above. Based on the analysis we show how much the trade pattern and the welfare of the EU-27 changes, if different tariff cutting options to open market access are applied and whether industrialized countries (ICs), developing countries (DCs), least developed countries (LDCs) or the non-WTO member countries (ROW) are able to take advantage of the enlarged EU market access. Furthermore, we show how the different developments of the countries' trade balance corresponds to their overall welfare. The paper begins by discussing the analyzed variables for market access. Chapter 3 introduces the extended Global Trade Analysis Project (GTAP) model which is used as the methodological instrument for the calculations. Empirical results are discussed in the subsequent chapter. The paper ends with a conclusion.

Variables to enlarge market access

The Doha Work Programme commits the WTO members to enlarging market access on the basis of a tiered

^{*} Corresponding author. Tel.: +49 531 596 5316; fax: +49 531 596 5399.
E-mail addresses: martina.brockmeier@fal.de (M. Brockmeier),
janine.pelikan@fal.de (J. Pelikan).

¹ Tel.: +49 531 596 5301; fax: +49 531 596 5399.

² Compare http://www.ictsd.org/ministerial/hongkong/documents_resources.htm#ictsd.

tariff formula that grants higher cuts for higher tariffs (WTO, 2004). Also, member countries have already decided on the number of bands used to apply tariff cuts, and on a complex concept to convert non-ad valorem tariffs, e.g., specific tariffs to ad valorem equivalents (AVEs). Beyond these points, not very much has been decided yet, so that the list of open questions concerning tariff cuts to open market access is rather long. While some WTO members prefer tariff cuts to be rather small, e.g., the G-10 group, other WTO members, like the US, suggest substantial reductions up to 90%.

The magnitude of these tariff cuts is one of the most contentious issues in the negotiations. Jean et al. (2005) as well as Anderson and Martin (2006), however, find that only large tariff cuts would have a major impact on market access. They identify the difference between bound and applied tariff rates as the main reason for this result.

Although the use of a tiered formula is already decided, some leeway exists to implement this formula. It can be imposed as a linear formula with linear cuts between the bands, comparable with the Harbinson proposal (WTO, 2003). This approach implies the problem of discontinuity which results in a change of the ordering of tariffs. From the political-economy perspective, such discontinuities would create political resistance from firms which are just above the transition points (Anderson and Martin, 2006). Also, developing countries such as the Dominican Republic, which fixed their bound tariffs at one specific level, can be strongly affected by the problem of discontinuities. A possibility for avoiding this problem is the implementation of a progressive tiered formula as proposed by Canada in May 2005.³ Instead of applying a single cut to the entire tariff line, different cuts are applied to different portions of the same tariff. Because of smaller cuts in the lower portions of the tariff, in absolute terms this formula cuts high tariffs by less than a linear tiered formula.

Another open question in the WTO negotiations is the degree of flexibility within each formula. Formulas with high flexibility only demand an average reduction. In that way, these formulas allow governments to shift the burden of the tariff reduction from one sector to another (Bureau and Salvatici, 2004). Abreu (1996) shows with manufactures, that the average tariff cutting rule used in the Uruguay Round (1986–1994) has lead to small cuts in sectors with high tariffs. He identifies the same sectors as the most important ones for LDCs. High flexibility can be reduced by an increasing number of tariff bands in combination with a smaller width of these tariff bands. Also, more tariff bands can reduce the problem of discontinuity.

Another controversial issue in the negotiations is the number of sensitive products. This has already been analyzed by Jean et al. (2005). They find that even allowing two percent of the 6-digit tariff lines in developed countries to be classified as sensitive would dramatically reduce the

effectiveness of tariff reductions. Whether or not to impose a maximum tariff or a tariff cap is another undecided issue. Here, Jales et al. (2005) show that a capping of tariffs does not improve trade if the cut due to the cap is not high enough to decrease the applied tariff below a prohibitive level. Concerning tariff rate quotas, De Groter and Kliuga (2005) find that a reduction of the out-of-quota tariffs increases trade much more than an expansion of tariff rate quotas. Jales et al. (2005) point out that TRQs are only a second best option for liberalization because they are not transparent and no efficient way to increase market access.

Most of the studies mentioned above do not take intersectoral and interregional effects of tariff cutting options into account. Also, comparisons of different options for market access are not well documented in the literature. Particularly different numbers and width of tariff bands or different tiered formulas have not been analyzed in a comparable manner. In the following chapters, we try to partially close this gap in the literature.

Empirical model

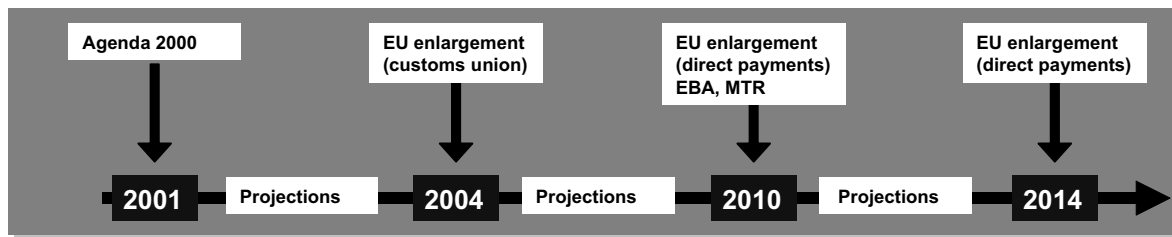
The analyses in this paper are based on the comparative static multi regional general equilibrium GTAP model. This model provides a detailed representation of the economy including the linkages between farming, agribusiness, industrial and service sectors of the economy. The use of the non-homothetic constant difference of elasticity (CDE) functional form to handle private household preferences, the explicit treatment of international trade and transport margins and a global banking sector which links global savings and consumption are innovative in GTAP. Trade is represented by bilateral matrices based on the Armington assumption. Further features of the standard model are perfect competition in all markets as well as a profit and utility maximizing behavior of producers and consumers. All policy interventions are represented by price wedges. The framework of the standard GTAP model is well documented in Hertel (1997) and available on the Internet (www.gtap.agecon.purdue.edu).

Extensions of the model

Agricultural policy instruments are represented via price wedges in the Standard GTAP model. Therefore, the Standard GTAP model is complemented with an explicit modeling of the instruments related to the Mid Term Review (MTR) reform of the EU. Following the approach of Jensen and Frandsen (2003), we introduce an additional land subsidy rate into the model that can be equalized across all sectors entitled to direct payments. Additionally, the EU budget is included in the GTAP model using a Social Accounting Matrix which covers the expenditures and revenues of the European Agricultural Guidance and Guarantee Fund (EAGGF) as well as the net transfer between EU member countries. Here, we followed the approach of Brockmeier et al. (2005).

³ Compare <http://www.tradeobservatory.org/library.cfm?refid=72991>.

Baseline



Policy Scenarios

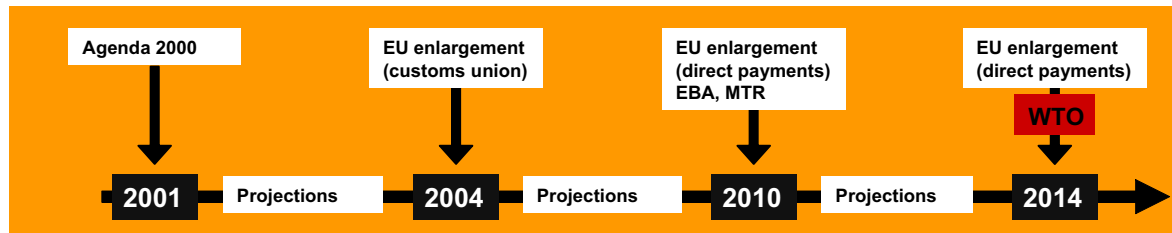


Fig. 1. Baseline and Policy Scenarios.

Besides the political environment of an economy, macroeconomic developments like technical progress are of great importance for the growth of an economy. In order to take these changes into account, corresponding trends are incorporated into the analysis at hand. For this purpose we include exogenous projections based on data from the World Bank for regional GDP and factor endowment into the extended GTAP model. In so doing, we use a separate GTAP module for projections in our simulations. This module adopts the approach of Tongeren et al. (2004) which allows the generation of technical progress by the model and thereby enables us to project growth patterns.

Scenarios

Two sequences of simulations are conducted to quantify the effects of the Doha Round, namely a Baseline and several Policy Scenarios (compare Fig. 1). Each sequence starts in 2001 with the base year of the GTAP database and ends in 2014 where we assume the WTO members will have implemented the by then agreed upon WTO commitments. The Baseline represents an update of the economic and political environment. The economic update is conducted with the extended GTAP model and the GTAP projection module that adapts population, GDP and factor endowment thereby leading to the corresponding shifts in world wide supply and demand.

The political update is carried out with the extended GTAP model and considers only political interventions which have already been decided upon. In 2001, the Agenda 2000 is implemented by reducing the intervention prices for cereals (–15%), beef (–18%) and milk (–15%), while direct payments for cereals, oilseeds and protein plants are unified. Furthermore, the set aside rate is

reduced from 15% to 10%. The enlargement is introduced in 2004 by implementing a customs union between the EU-15 and 12 Central and Eastern European Countries (CEECs).⁴ It was agreed to transfer direct payments of 35% to the new member countries in 2006 and phase them in to 100% by the year 2013. Accordingly, 70% of direct payments are transferred to new EU member countries in the form of a land subsidy in 2010, while the increase of the remaining 30% is transferred in 2014. In 2010, we also introduce the EBA agreement without a transition period through an elimination of EU tariffs for all LDCs. Additionally, we introduce the MTR reform of the CAP in 2010 by equalizing direct payments across all entitled sectors, while budgetary outlays for total direct payments of the EU are held constant.⁵

Parallel to the Baseline, Policy Scenarios are implemented as well. The Policy Scenarios take account of the same projections and policy shocks (Agenda 2000, EU enlargement, EBA agreement and MTR reform of the CAP), but in 2014, it additionally implements different options for the outcome of the WTO negotiations. The results discussed in the subsequent chapter are based on a comparison of the Baseline and the Policy Scenarios and

⁴ The 12 CEECs are Bulgaria, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia, and Slovenia. Thus, we assume that in 2010 Romania and Bulgaria will also have joined the EU.

⁵ We focus our analysis on the EU, because this was our main point of interest. It would be a very time consuming task to take political developments in other parts of the world into account. We particularly did not take the 2002 US Farm Bill into account. However, most of the other quantitative analyses of the 2002 Farm Bill do not have a significant effect on US production, agricultural prices or world trade (see e.g., FARPI, 2003, p. 15).

Table 1
Scenarios for the implementation of the Doha Round^a

Developed countries		Developing countries		Developed countries		Developing countries	
Tariff bands	Tariff cuts (%)	Tariff bands	Tariff cuts (%)	Tariff cuts	Tariff cuts (%)	Tariff bands	Tariff cuts (%)
<i>Scenario 1: Reference Scenario^b</i>				<i>Scenario 2: Progressive tiered formula^c</i>			
>80	80	>130	40	>80	80	>130	40
>60 ≤ 80	72	>80 ≤ 130	36	>60 ≤ 80	72	>80 ≤ 130	36
>40 ≤ 60	64	>30 ≤ 80	32	>40 ≤ 60	64	>30 ≤ 80	32
>20 ≤ 40	56	0 ≤ 30	28	>20 ≤ 40	56	0 ≤ 30	28
0 ≤ 20	48			0 ≤ 20	48		
Tiered formula: Linear Capping: No				Tiered formula: Progressive Capping: No			
<i>Scenario 3: Lower tariff cuts</i>				<i>Scenario 4: Shrunk tariff bands</i>			
>80	20	>130	10	>50	80	>70	40
>60 ≤ 80	18	>80 ≤ 130	9	>40 ≤ 50	72	>50 ≤ 70	36
>40 ≤ 60	16	>30 ≤ 80	8	>30 ≤ 40	64	>30 ≤ 50	32
>20 ≤ 40	14	0 ≤ 30	7	>20 ≤ 30	56	0 ≤ 30	28
0 ≤ 20	12			0 ≤ 20	48		
Tiered formula: Linear Capping: No				Tiered formula: Linear Capping: No			
<i>Scenario 5: Tariff capping</i>				<i>Scenario 6: Lower number of tariff bands</i>			
>80	80	>130	40	>80	80	>130	40
>60 ≤ 80	72	>80 ≤ 130	36	>50 ≤ 80	70	>80 ≤ 130	36
>40 ≤ 60	64	>30 ≤ 80	32	>20 ≤ 50	59	>30 ≤ 80	32
>20 ≤ 40	56	0 ≤ 30	28	0 ≤ 20	48	0 ≤ 30	28
0 ≤ 20	48						
Tiered formula: Linear Capping: 100% in developed and 150% in developing countries				Tiered formula: Linear Capping: No			

^a The Reference Scenario is characterized by (a) linear tiered formula, (b) high tariff cuts, (c) wide tariff bands, (d) no tariff capping and (e) five tariff bands in ICs and four tariff bands in DCs. Scenarios 2–6 deviate from the Reference Scenario by one of these characteristics as indicated in the column header of each scenario.

^b The average agricultural tariff cut in ICs and DCs in the Reference Scenario is 64% and 28%, respectively. The average agricultural tariff cut is calculated taking bound and applied rates into account (for the calculation compare European Commission, 2005, p. 2).

^c In Scenario 2, the average agricultural tariff cut in ICs and DCs is 51% and 26%, respectively.

thus only include the effects provoked by the implementation of the WTO negotiations.

The Doha Work Programme leaves a lot of room for speculations on how market access will be improved through agricultural trade negotiations. Thus, in six scenarios, some of the market access variables still under negotiation (compare Chapter 2) will be varied to see how they affect the outcome of the Doha Round. Table 1 shows how the six scenarios are shaped. The scenarios are put together in such a way that the Scenarios 2–6 always differ from Scenario 1 (Reference Scenario) in one variable. Scenario 2 employs a progressive tiered formula⁶ instead of the linear tiered formula. Thereby, the set up of the progressive tiered formula leads to agricultural tariff

cuts that are lower than in the Reference Scenario. Scenario 3 applies lower tariff cuts than Scenario 1. In Scenario 4, the tariff bands are shrunken compared to Scenario 1, whereas Scenario 5 additionally applies a tariff capping at 100% in ICs and 150% in DCs. Finally, Scenario 6 uses only four tariff bands instead of five bands in Scenario 1 for tariff cuts in developed countries. We did not include sensitive and special products in our analysis, because their selection has proved to be very resource intensive.

Additionally to the tariff cuts to open agricultural markets, we implemented tariff cuts in all scenarios that decrease tariffs of non-agricultural commodities by 50% and 33% in the IC and the DC, respectively. Agricultural export subsidies are also eliminated in all scenarios. Concerning domestic support, we follow the assessment of Brink (2006) and Blandford (2005) that neither of the currently available proposals will highly constrain domestic support. Therefore, domestic support is kept unchanged in all countries and regions. In so doing, we particularly assume that the EU direct payments are decoupled due to the MTR reform of the CAP and only minimally trade distorting. Thus, the EU direct payments are assumed to

⁶ A tariff with an initial level of 90% is cut by 80% in the Reference Scenario, which leads to a final tariff of 18%. In Scenario 2 the initial tariff of 90% is divided into four proportions of 20% each and one proportion of 10%. The four proportions of 20% are cut by 48%, 56%, 64% and 72%, respectively, while the proportion of 10% is cut by 80%. In so doing, an overall cut of 56% (9.6% + 11.2% + 12.8% + 14.4% + 8%) is applied, that leads to a higher final tariff of 34% in Scenario 2.

qualify for the Green Box, which neither of the currently available proposals on domestic support foresees for reduction.⁷ According to the Special and Differential Treatment, we assume that DCs only have to reduce their tariffs by half of the ICs tariffs. LDCs are exempted from tariff reductions in all scenarios.

Extension of the database and calculation of tariff cuts

WTO negotiations are based on bound tariff rates, while the economic effect of tariff cuts depends on the effectively applied tariff. The gap between bound and applied rates results from two origins. First, the gap is a consequence of the difference between the bound rate and the MFN rate which was adequately termed as binding overhang by Francois and Martin (2003). Second, the gap arises due to preferential rates causing a difference between MFN and applied rate (Anderson and Martin, 2006). Our calculations consider the difference between bound and applied rates taking MFN rates as well as preferential rates into account.

Starting point of the analysis is the Market Access Map (MAcMap) database on applied protection. The source files of MAcMap include preferences, AVEs, and TRQs taken from TRAINS as well as the WTO and the AMAD database. Information on preferences from the TRAINS database is additionally augmented with national data sources. AVEs are calculated on the basis of the median unit value of world wide exporters using an average flow of the years 2000–2003. Finally, TRQs are taken into consideration by utilizing the fill rate from the AMAD database. If the fill rate is less than 90%, the in-quota tariff is used. The out-of-quota rate is employed if the fill rate is higher than 99%. If the fill rate is higher than 90%, but smaller than 99%, a simple average of the in-quota and out-of-quota rate is applied (compare Bouët et al., 2004).

Bchir et al. (2006) offer bound tariff data which is fully consistent with the applied tariffs of the MAcMap database. This bound tariff data is gathered from the WTO Consolidated Tariff Schedule (CTS) database and from national sources.

Tariff cuts are implemented at the 6-digit tariff line level with the help of an additional module programmed in SAS (Statistical Analysis System). WTO members negotiate tariff cuts at the 6-digit level, so that this procedure has the advantage of being as close as possible to the negotiation process. Additionally, it takes account of the tariff peaks that are most clearly identifiable at this detailed tariff line level. Due to its resource intensity this approach is, however, only rarely used in the literature (e.g., Jean et al., 2005; Anderson et al., 2006).

⁷ It has not yet been decided, whether EU direct payments qualify for the Green Box after the implementation of the MTR. If they are still to be kept in the Blue Box, it is more likely that the proposed cuts to domestic support will be binding for the EU.

In the simulations, tariffs are cut according to the specific WTO scenarios defined above. The aggregation from the 6-digit tariff line level to the model level is based on import weighting and utilizes source generic world import values from the COMTRADE database of the year 2001, excluding intra-EU trade. Import weighting is the most commonly used aggregation scheme (Anderson and Neary, 2005). Advantageously, trade weights take the relative importance of trade flows into account. The import weighted aggregation scheme leads, however, to a so called endogenous bias, as the weight for every individual tariff decreases with an increase of the tariff. Accordingly, prohibitive tariffs impeding market access, and thereby, reducing the trade volumes to zero, are not taken into account by import weighting. Trade barriers and the effect of their reductions are therefore underestimated with this method.⁸

The gap between bound and applied rates will lead to country-specific reduction commitments on applied rates, even if the same tariff cut is implemented on identical bound tariffs. Due to the ceiling binding option, developing countries were allowed to implement the tariff binding without reference to former protection levels. As a result, the bound tariffs in developing countries are much higher than in developed countries (Anderson and Martin, 2006). Therefore, developing countries might experience an implicit preferential treatment that might be added to the already granted Special and Differential Treatment. The gap between applied and bound rates also varies between sectors within a country, so that some sectors are discriminated, while others are favored. With our modeling approach, it is possible to capture the interregional and intersectoral effects of the gap between bound and applied rates.

Results

In this section, the results of different options for expanding market access are discussed. We mainly focus on the trade effects on the EU-27 and whether ICs, DCs, LDCs or the ROW⁹ are able to expand their exports relative to imports if the EU-27 liberalizes its markets. The results are discussed on the basis of the trade balance¹⁰ which shows the change in trade pattern by agricultural product. Additionally, we present the change in the equivalent variation for the different scenarios to report the overall effect on a country's welfare.

⁸ For more information about the magnitude of trade weighted average agricultural tariff rates used as the base in this analysis please refer to Anderson et al. (2006, pp. 362–369), Bouët et al. (2004) and Bchir et al. (2006).

⁹ ICs, DCs, LDCs and ROW are classified according to the WTO classification. The simulations were conducted on a more disaggregated base. Due to limited space we only report the results of the EU-27 and the four country groups.

¹⁰ The change in the trade balance represents the change in the value of fob exports minus the value of cif imports. When summed across regions, this gives the change in international trade margin supplied for each product.

Table 2
Changes in trade balance (million US\$)^{a,b}

	EU-27	IC	DC	LDC	ROW	EU-27	IC	DC	LDC	ROW
	<i>Scenario 1: Reference Scenario</i>					<i>Scenario 2: Progressive tiered formula</i>				
Cereals	–408	1391	–810	–54	–430	–574 (–166)	1053 (–338)	–277 (533)	–47 (7)	–404 (26)
Sugar	–2778	–999	5526	–2000	57	–1650 (1128)	–538 (461)	3499 (–2027)	–1386 (614)	30 (–27)
Beef	–17,759	1024	12,356	86	3781	–11,984 (5775)	1802 (778)	7130 (–5226)	81 (–5)	2749 (–1032)
Other meat	1317	–1516	–369	116	18	–433 (–1750)	–129 (1387)	212 (581)	75 (–41)	44 (26)
Milk products	–8025	2912	3310	869	1198	–8108 (–83)	3374 (462)	3234 (–76)	884 (15)	963 (–235)
	<i>Scenario 3: Lower tariff cuts</i>					<i>Scenario 4: Shrunk tariff bands</i>				
Cereals	–596 (–188)	1467 (76)	–743 (67)	–3 (51)	–144 (286)	–312 (96)	1537 (146)	–1107 (–297)	–44 (10)	–394 (36)
Sugar	–542 (2236)	46 (1045)	879 (–4647)	–280 (1720)	–1 (–58)	–2771 (7)	–1179 (–180)	5672 (146)	–2000 (0)	62 (5)
Beef	–5777 (11,982)	2008 (984)	1817 (–10,539)	74 (–12)	2025 (–1756)	–17,712 (47)	971 (–53)	12,331 (–25)	87 (1)	3786 (5)
Other meat	–2553 (–3870)	1180 (2696)	1408 (1777)	21 (–95)	27 (9)	916 (–401)	–1391 (125)	–113 (256)	116 (0)	17 (–1)
Milk products	–8262 (–237)	3261 (349)	3672 (362)	994 (125)	812 (–386)	–8339 (–314)	3155 (243)	3329 (19)	869 (0)	1231 (33)
	<i>Scenario 5: Tariff capping</i>					<i>Scenario 6: Lower number of tariff bands</i>				
Cereals	–417 (–9)	1387 (–4)	–774 (36)	–71 (–17)	–435 (–5)	–410 (–2)	1389 (–2)	–808 (2)	–55 (–1)	–430 (0)
Sugar	–2777 (1)	–1005 (–6)	5549 (23)	–2014 (–14)	53 (–4)	–2778 (0)	–949 (50)	5483 (–43)	–2000 (0)	55 (–2)
Beef	–17,870 (–111)	637 (–387)	12,409 (53)	83 (–3)	4200 (419)	–17,768 (–9)	1062 (38)	12350 (–6)	86 (0)	3778 (–3)
Other meat	1652 (335)	–2023 (–507)	–178 (191)	89 (–27)	1 (–17)	1307 (–10)	–1530 (–14)	–345 (24)	116 (0)	18 (0)
Milk products	–8018 (7)	2877 (–35)	3354 (44)	853 (–16)	1198 (0)	–7979 (46)	2876 (–36)	3309 (–1)	870 (1)	1187 (–11)

Source: Own calculations.

^a The Reference Scenario is characterized by (a) linear tiered formula, (b) high tariff cuts, (c) wide tariff bands, (d) no tariff capping and (e) five tariff bands in ICs and four tariff bands in DCs. Scenarios 2–6 deviate from the Reference Scenario by one of these characteristics as indicated in the column header of each scenario. Numbers in brackets show the deviation of the prevailing result from the Reference Scenario.

^b IC = Industrialized Countries; DC = Developing Countries; LDC = Least Developed Countries; ROW = non-WTO member countries.

Due to limited space, we further restrict the discussion of the results to the main agricultural trading products of the EU-27. Results are presented in millions of US\$ for the year 2001 of the GTAP database. The calculations are based on GEMPACK (Version 9.0) and RunGTAP (Harrison and Pearson, 1996). A fixed trade balance is adopted as macroeconomic closure in all scenarios.¹¹

¹¹ We assumed the top level Armington elasticities between domestic goods, and the import composite to be equal to lower-level Armington elasticities between imports from different countries. For convergence we also set the Armington elasticity for rice to be equal to 2.

Changes of the trade balances

In Table 2 the changes in the trade balances of the EU-27, the ICs, the DCs, the LDCs and the ROW is displayed by commodity for the Policy Scenarios 1–6. How is trade affected by the different market access options?

Depending on the agricultural product, the trade effects differ in the surveyed regions. The results of the Reference Scenario reveal a decrease of the EU trade balance in the highly protected beef sector, while exports in relation to imports increase in all the other regions, particularly in DCs. The relative increase of the EU beef imports is mainly evoked by the magnitude of the tariff cuts. Accordingly, the

change of the EU trade balance in the Reference Scenario (–17,759 million US\$) declines, when a progressive tiered formula¹² or the assumed tariff reductions leads to lower tariff cuts in Scenarios 2 (–11,984 million US\$) and 3 (–5777 million US\$), respectively. These changes are mirrored by third countries, whereby DCs' relative beef exports decrease significantly from 12,356 million US\$ to 7130 million US\$ and 1817 million US\$, respectively. In contrast, a comparison of Scenarios 4–6 with the Reference Scenario shows that neither capping nor the number or width of tariff bands has a significant impact on the beef sectors in all regions.

The sugar sector's reaction to the implementation of the Doha Round is somewhat different. Here, the relative increase of the EU sugar imports (–2778 million US\$) is accompanied by a decrease of the ICs' (–999 million US\$) and the LDCs' (–2000 million US\$) sugar trade balance in the Reference Scenario. The effect in the EU-27 and the ICs is mainly attributable to the reduction of their own import barriers, while the non-participating LDCs undergo an erosion of their preferences. In addition, the sugar exports of the DCs are strongly increased in relation to their sugar imports. The differences between the Reference Scenario and the other scenarios show that the effect of the highly protected sugar is also clearly dominated by the height of the tariff cuts and invariant to the width and the number of tariff bands as well as the tariff capping.

Table 2 also shows the decrease of the EU trade balance for milk products in the Reference Scenario that is matched by opposite developments in all other considered regions. The relative increase of the EU milk imports is almost unchanged between the scenarios (–7979 million US\$ to –8339 million US\$). This is an indication for the indifference of the EU milk sector with respect to tariff cuts and bands as well as implemented formulas and capping. Consequently, the relative decrease of EU milk exports comes mainly from the elimination of EU export subsidies.¹³ In contrast to the EU-27, the ICs and the ROW are responsive to lower tariff cuts, the more moderate progressive tiered formula and to a lesser extent also to shrunken bands. Accordingly, the ICs relative milk exports increase from the Reference Scenario to Scenarios 2–4, while the milk trade balance of the ROW decreases.

The EU-27, as well as the LDCs and the ROW, seem to almost be only casual bystanders in the cereal sector after the implementation of the Doha Round, while the ICs and DCs are somewhat more strongly affected. This can be seen from the Reference Scenario, where a declining

DCs' cereal trade balance of –810 million US\$ is accompanied by a relative increase of ICs' cereal exports of 1391 million US\$. Lower tariff cuts (Scenario 3) influence these developments slightly, so that the value of the DCs' trade balance for cereals is changed to 1467 million US\$. Accordingly, the ICs cereal trade balance shows a comparable decrease in its relative exports. Furthermore, it is interesting to note that a moderate effect is observable when tariff bands are shrunken (Scenario 4).

Finally, the results for other meats (pig and poultry) are presented in Table 2. In the Reference Scenario it can be seen that major changes of the trade balance for other meat are concentrated on ICs (–1516 million US\$) and EU-27 (1317 million US\$), when the Doha Scenarios are implemented. In contrast, the results indicate only a slight relative decrease of DC imports for other meat (–369 million US\$). These developments change significantly in Scenario 3. Lower tariff cuts obviously reduce the opportunity of the EU-27 to export other meat to ICs, but particularly to DCs. Accordingly, the EU trade balance for other meat decreases here by –2553 million US\$. At the same time, exports in relation to imports increase significantly in ICs and DCs compared to the Reference Scenario. In analogy to the cereal sector, a moderate influence of tariff capping and shrunken tariff bands can be identified for the other meat sector as well.

Welfare changes

Table 3 provides an overview of the welfare impacts achieved through agricultural and non-agricultural trade liberalization. The worldwide welfare effect varies between 41 billion US\$ and 80 billion US\$ depending on the implemented scenario. The highest overall welfare gain arises in Scenario 5, where tariffs cuts are high and tariffs are additionally capped. Capping only applies to a very low number of tariff lines, particularly for rice and corn in Japan and Korea. If we had chosen an aggregation of the database that singles out Korea, we would probably have found a higher overall welfare effect for DCs in the tariff capping scenario (compare Anderson et al., 2006, p. 371).

Welfare gains are significantly smaller when tariff cuts are lower (Scenario 3). The highest contribution to the global welfare gain results from agricultural market access liberalization in Scenarios 1, 2, 4, 5, and 6, while the liberalization of the non-agricultural market access, and particularly the elimination of export subsidies, only play a minor role for the improvement of global welfare. The lower tariff cuts of Scenario 3 reduce the share of agricultural market access liberalization, while the move towards a more liberal merchandise market access dominates the welfare results.

This picture is somewhat changed on a regional and disaggregated agricultural basis. Comparing the different components in the Reference Scenario, it can be seen that the EU-27 experiences a higher share of its total welfare gain through the elimination of export subsidies than

¹² See Footnote 5 for the difference between a linear tiered and a progressive tiered formula.

¹³ These results would most likely be somewhat different if we were able to further disaggregate the milk products sector in bulk commodities (e.g., butter, whole and skim milk powder) and the much more diversified other milk products (e.g., cheese). Bulk commodities, particularly butter, are most likely to be much more sensitive to EU tariff cuts, while diversified milk products like cheese are mostly affected by the elimination of export subsidies.

Table 3
Welfare effects for the different regions (million US\$)^{a,b}

	EU-27	IC	DC	LDC	ROW	World	EU-27	IC	DC	LDC	ROW	World
	<i>Scenario 1: Reference Scenario</i>						<i>Scenario 2: Progressive tiered formula</i>					
<i>Agriculture</i>												
Market access	8467	18,277	25,166	97	457	52,463	6833	12,689	22,677	219	305	42,723
Export subsidies	10,199	-1838	-5751	-782	-1499	328	9989	-1727	-5723	-782	-1501	255
Total agriculture	18,666	16,438	19,414	-685	-1043	52,791	16,822	10,962	16,954	-563	-1197	42,979
<i>Merchandise</i>												
Market access	3468	1907	13,124	3200	3930	25,629	3469	1911	13,136	3198	3931	25,644
Total (all products)	22,134	18,345	32,538	2515	2888	78,420	20,291	12,873	30,089	2635	2734	68,623
	<i>Scenario 3: Lower tariff cuts</i>						<i>Scenario 4: Shrunk tariff bands</i>					
<i>Agriculture</i>												
Market access	1296	1932	11,467	344	174	15,213	8410	18,531	25,241	92	467	52,740
Export subsidies	9721	-1496	-5788	-785	-1500	152	10,229	-1836	-5758	-781	-1501	353
Total agriculture	11,017	435	5679	-440	-1327	15,365	18,640	16,694	19,483	-689	-1034	53,093
<i>Merchandise</i>												
Market access	3469	1905	13,158	3192	3933	25,657	3470	1907	13,122	3200	3930	25,628
Total (all products)	14,486	2340	18,838	2751	2606	41,022	22,110	18,602	32,604	2510	2896	78,722
	<i>Scenario 5: Tariff capping</i>						<i>Scenario 6: Lower number of tariff bands</i>					
<i>Agriculture</i>												
Market access	8615	19,378	25,562	200	504	54,259	8465	18,184	25,156	98	455	52,358
Export subsidies	10,221	-1853	-5749	-782	-1499	338	10,202	-1838	-5751	-781	-1499	332
Total agriculture	18,836	17,525	19,812	-582	-994	54,598	18,667	16,346	19,404	-684	-1044	52,690
<i>Merchandise</i>												
Market access	3466	1909	13,121	3199	3930	25,625	3468	1906	13,125	3200	3930	25,629
Total (all products)	22,302	19,434	32,933	2618	2936	80,223	22,136	18,252	32,529	2516	2886	78,320

Source: Own calculations.

^a The Reference Scenario is characterized by (a) linear tiered formula, (b) high tariff cuts, (c) wide tariff bands, (d) no tariff capping and (e) five tariff bands in ICs and four tariff bands in DCs. Scenarios 2–6 deviate from the Reference Scenario by one of these characteristics as indicated in the column header of each scenario. Numbers in brackets show the deviation of the prevailing result from the Reference Scenario.

^b IC = Industrialized Countries; DC = Developing Countries; LDC = Least Developed Countries; ROW = non-WTO member countries.

through market access liberalization. Low tariff cuts, and to a lesser extent a progressive tiered formula that also leads to lower tariff cuts, reduce the welfare gain of the EU-27 derived from market access.

Other ICs are also able to increase their welfare as a result of improved agricultural market access in the Reference Scenario. Their welfare gain is, however, very sensitive to the height of agricultural tariff cuts and deteriorates from 16,438 million US\$ to 435 million US\$, when only low tariff cuts are implemented. A moderate effect is also noticeable if a capping of tariffs is in place.

The EU-27 and other ICs receive more than half of the world's welfare gain in the Reference and other Policy Scenarios. This result deviates from the findings of Hertel and Keeney (2006) and Anderson et al. (2006), who quantify a share of around 74% and 86%, respectively, which goes to developed countries. The main reason for this difference lies in the liberalization of domestic support that both authors included in their Policy Scenarios. Domestic support is mainly given to farmers in developed countries, so that a cut in or elimination of domestic support, particularly of direct payments, largely increases the developed countries' share of total welfare.

The DCs gain most from agricultural trade reforms and receive almost half of the world's welfare gain in the Reference and all other scenarios. This result is mainly induced by the expansion of agricultural market access. In contrast, the elimination of export subsidies leads to negative welfare impacts for DCs. Many of these countries are net importers of agricultural products, so that the rise of the world market prices which follows the abolishment of export subsidization deteriorates their terms of trade. DCs experience the highest welfare improvement in Scenario 5, where high tariff cuts are supplemented by a tariff capping at the determined maximum level.

LDCs experience an overall welfare gain of 2515 million US\$ in the Reference Scenario. Due to preference erosion, the LDCs, however, show the highest welfare gain if tariffs cuts are lowest (Scenario 3). In all scenarios, a negative contribution to the welfare of LDCs, but also in IC, DC and ROW can be observed, that represents the effect of increasing world market prices following the elimination of mainly EU export subsidies. The welfare effect of agricultural and merchandise liberalization for LDCs and the non-participating ROW is positive because of a positive terms of trade effect. In contrast to the LDCs, the welfare

gain of ROW is highest in Scenario 5, where the liberalization grants the highest access to participating WTO member countries markets. The results for the LDCs and the ROW are however, more or less invariant in all scenarios.

Conclusion

The WTO negotiations on market access are a central issue in the public debate. This paper analyzes the economic effects of variations in the magnitudes of tariff cuts, different tariff cutting formulas, the tariff capping as well as different numbers and width of tariff bands. The simulations are conducted with an extended version of the GTAP model. Furthermore, an extended version of the GTAP database (6.0) including bound and applied rates is used. Tariff cuts are implemented at the 6-digit tariff line level with the help of an additional module programmed in SAS.

Market access variables still under negotiation are analyzed in six simulations. The Reference Scenario assumes five bands with inflection points of tariff rates of 20%, 40%, 60% and 80% for developed countries, and a tiered reduction formula with marginal agricultural tariff rate reduction of 48%, 56%, 64%, 72% and 80%. For developing countries the reductions are 28%, 32%, 36% and 40% within four bands, with inflection points of tariff rates of 30%, 80% and 130%. Due to the implementation of this Reference Scenario the EU-27 shows an increase of its relative imports of its highly protected agricultural markets, particularly for beef, milk and sugar products. These changes are mirrored by developing countries, whereby a significant increase of relative beef, milk and sugar exports can be observed.

The other five Policy Scenarios differ from the Reference Scenario in one market access variable. Due to this setting we are able to conclude that the trade balance of beef, sugar and other meat are mainly influenced worldwide by the magnitude of the tariff cuts and the kind of tiered formula which also implicates lower tariff cuts. Neither the width and number of tariff bands nor the tariff capping are important for the changes of trade patterns of beef, sugar and milk products which follow the implementation of the Doha Scenarios. An exception to the commodities mainly influenced by the magnitude of tariff cuts and the kind of tiered formula represents the trade with milk products which is predominantly influenced by the elimination of EU export subsidies.

The magnitude of the tariff cuts and the kind of tiered formula also plays the major role for the trade flows of cereals and other meat. However, the width of tariff bands, as well as the tariff capping, also moderately influence the trade pattern of these commodities in all considered regions, but particularly in the participating WTO member countries. The number of tariff bands is of negligible importance for the trade with cereals and meat as well.

The potential global welfare gains of multilateral trade reforms are mainly derived from the cut of agricultural tariffs, while the enlargement of non-agricultural markets and

particularly the elimination of agricultural export subsidies do not play an important role for the outcome. The welfare results are also highly sensitive to the magnitude of tariff cuts and the kind of tiered formula applied to implement the tariff cuts. Global welfare gain shrinks to half of the welfare gain of the Reference Scenario if the implemented tariff cuts are reduced to one fourth. In contrast, due to preference erosion, the LDCs show the highest welfare gain if tariffs cuts are lowest. The cap of tariffs also moderately influences the welfare results in participating WTO member countries, while the number and width of tariff bands is of no significance for the outcome.

In sum, we can conclude that the heights of the tariff cuts and the kind of tiered formula applied are most important for the outcome of the Doha Round, while the width of tariff bands and the tariff capping only have a moderate influence on the countries' trade patterns and welfare. In contrast, the number of tariff bands is not important for the results.

Acknowledgements

The authors are very grateful to Rainer Klepper for programming the SAS-module and to Cornelia Berns and Jobst Jungehülsing for support in developing the Policy Scenarios. Our thanks also extend to the anonymous referees who provided useful comments on the entire manuscript.

References

- Abreu, M.P., 1996. Trade in manufactures: the outcome of the Uruguay Round and developing countries. In: Martin, W., Winters, L.A. (Eds.), *The Uruguay Round and the Developing Countries*. Cambridge University Press, Cambridge, pp. 59–88.
- Anderson, K., Martin, W., 2006. Scenarios for global trade reform. In: Hertel, T.W., Winters, L.A. (Eds.), *Putting Development Back into the Doha Agenda: Poverty Impacts of a WTO Agreement*. World Bank, Washington, DC, pp. 31–57.
- Anderson, J.E., Neary, J.P. (Eds.), 2005. *Measuring the Restrictiveness of International Trade Policy*. The MIT Press, Cambridge, MA.
- Anderson, K., Martin, W., van der Mensbrugge, D., 2006. Doha merchandise trade reform and developing countries: what's at stake? *The World Bank Economic Review* 20 (2), 169–195.
- Behir, M.H., Jean, S., Laborde, D., 2006. Binding overhang and tariff-cutting formulas. *Review of World Economics* 142 (2), 207–232.
- Blandford, D., 2005. Discipline on domestic support in the Doha Round. *International Agricultural Trade Research Consortium (IATRC) Trade Policy Issue Paper* 1.
- Bouët, A., Decreux, Y., Fontagné, L., Jean, S., Laborde, D., 2004. A consistent ad-valorem equivalent measure of applied protection across the world. *The MACMap-HS6 Database*. CEPII Working Paper 22.
- Brink, L., 2006. WTO constrains on the US and the EU domestic support in agriculture: the October 2005 proposals. *The Estey Centre Journal of International Law and Trade Policy* 7 (1), 96–115.
- Brockmeier, M., Kurzweil, M., Pelikan, J., 2005. Agricultural market access: striking the balance between formulas and water in the tariffs. *The International Agricultural Trade Research Consortium (IATRC)*, Sevilla.
- Bureau, J.C., Salvatici, L., 2004. WTO negotiation on market access in agriculture: a comparison of alternative tariff cut proposals for the EU and the US. *Topics in Economic Analysis & Policy* 4 (1) (Article 8).

- De Groter, H., Kliauga, E., 2005. Reducing tariffs versus expanding tariff rate quotas. In: Anderson, K., Martin, W. (Eds.), *Agricultural Trade Reform and the Doha Development Agenda*. World Bank, Washington, DC, pp. 117–160.
- European Commission, 2005. MAP-Brief, Monitoring Agri-Trade Policy. <http://ec.europa.eu/agriculture/publi/map/brief4.pdf>.
- FARPI, 2003. Implications of the 2002 US farm act for world agriculture. FAPRI-UMC Report 02-03. University of Missouri.
- Francois, J.F., Martin, W., 2003. Formulas for success? Formula approaches to market access negotiations. *World Economy* 26(1), 1–28.
- Harrison, J.W., Pearson, K.R., 1996. Computing solutions for large general equilibrium models using GEMPACK. *Computational Economics* 9, 83–127.
- Hertel, T.W. (Ed.), 1997. *Global Trade Analysis: Modeling and Applications*. Cambridge University Press, Cambridge.
- Hertel, T.W., Keeney, R., 2006. What's at stake: the relative importance of import barriers, export subsidies, and domestic support. In: Anderson, K., Martin, W. (Eds.), *Agricultural Trade Reform and the Doha Development Agenda*. World Bank, Washington, DC, pp. 37–62.
- Jales, M., Josling, T., Nassar, A., Tutweiler, A., 2005. Market Access. The International Agricultural Trade Research Consortium (IATRC), Sevilla.
- Jean, S., Laborde, D., Martin, W., 2005. Consequences of alternative formulas for agricultural tariff cuts. In: Anderson, K., Martin, W. (Eds.), *Agricultural Trade Reform and the Doha Development Agenda*. World Bank, Washington, DC, pp. 81–116.
- Jensen, H.G., Frandsen, S.E., 2003. Impacts of the Eastern European Accession and the 2003-Reform of the CAP. Consequences for Individual Member Countries. FØI Working Paper No. 11/2003.
- Tongeren, F.W., van, Huang, J., 2004. China's food economy in the early 21st Century; Development of China's food economy and its impact on global trade and on the EU. The Hague, Agricultural Economics Research Institute (LEI).
- WTO, 2003. Negotiations on Agriculture, First Draft of Modalities for the further Commitments. Revision TN/AG/W/1/Rev1. WTO, Geneva, www.wto.org.
- WTO, 2004. Doha Work Programme, Decision adopted by the General Council on 1 August, WT/L/579. WTO, Geneva.