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A CGE Analysis of the Harbinson Proposal:
Outcomes for the EU25

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Abstract

In this study, we employ the Harbinson proposal and July Framework to compare a 'likely' Doha scenario with an 'inclusive' baseline. The key aim is to assess the impacts across EU member states. More specifically, we (i) employ the latest version 6 of the GTAP database, (ii) explicitly model CAP mechanisms (e.g., quotas, decoupled payments, set-aside, CAP budget etc.) to more accurately assess the asymmetric trade led welfare effects on selected EU member states, and (iii) introduce binding overhangs into domestic support, export subsidies and more importantly market access commitments. Whilst the EU regions benefit from the multilateral reform proposals, the gains are weakened considerably by the tariff binding overhangs, where the EU25 only gain ten per cent of their potential trade led welfare gain from the proposals. On this basis, a more positive stance must be applied if the Doha Reforms are to yield a meaningful outcome for all.

A CGE Analysis of the Harbinson Proposal: Outcomes for the EU25[1]

1. Background

After six days of intense negotiations, the sixth Ministerial WTO meeting in Hong Kong concluded with a partial deal in agriculture: total elimination of export subsidies in cotton and agriculture by the end of 2006 and 2013 respectively. Whilst the conference, held between the 13th and 18th of December 2005, could be regarded as a minor success for achieving concrete commitments and time scales,[2] the fact remains that the Doha trade talks as a whole have languished since their 2001 launch. Indeed, the ongoing impasse over the agricultural 'modalities' of market access and domestic support has blocked progress in non-agricultural areas, whilst obstructing the objective of 'special and differential treatment' for developing countries, which constitutes a key component of the Doha Declaration's mandate (Anania and Bureau, 2005).

At the current time, the Harbinson draft report (WTO, 2003a; 2003b), named after the then Chairman of the Agriculture Negotiating Committee, remains the main point of reference in the agricultural modalities negotiations. The 'Harbinson Proposal' was not the result of negotiations and as such countries were under no obligation to accept it. However, the document carried considerable weight owing to the fact that it proposed a precise range of commitments and still broadly reflects the consensus of negotiating countries' various positions (Anania and Bureau, 2005). Under *market access*, Harbinson suggested the usage of a tiered formula with average tariff reductions in *bound* or ceiling rates for each tariff rate tier (see Table 1), subject to a minimum tariff cut per tariff line.[3] The inclusion of a tiered formula, which is a compromise between the Uruguay Round and Swiss Formula,[4] circumvents strategic high tariff reductions by WTO members in commodities of lesser political importance to meet average reduction commitments as occurred in the Uruguay Round. Tariff cuts would

[1] The author would like to thank the Department of Environment, Food and Rural Affairs (DEFRA), Government of the UK, for sponsoring an earlier version of this research.

[2] Even a partial agricultural agreement was seen as politically essential given the failure of the Fifth Ministerial Meeting in Cancun (see Anania and Bureau (2005) and Swinbank (2005) for further discussion of the political history and development of the Doha Round).

[3] In-quota tariff rates are not affected by these reductions.

[4] The Swiss Formula employs a single mathematical formula to produce a narrow range of final tariff rates from a wide set of initial tariffs implying deeper cuts in tariff peaks than proposed by Harbinson. The Swiss formula is a function of the initial tariff rate and an exogenous 'coefficient'. For example, a value of 30 for the coefficient implies that all tariffs will be below 30% at the end of the implementation period (i.e., 'tariff harmonisation').

be in equal annual instalments over a period of five years for developed countries. The Harbinson Proposals also include increased market access through increases in tariff rate quotas to 10 % of present domestic consumption. In *Export subsidies*, the proposal favoured full elimination with a heavy frontloading of 50% reductions over the first five years, with the remaining half eliminated four years thereafter.

Developed Countries		Developing Countries	
Existing tariff level	**(Harbinson's proposal**	**Existing tariff level**	**Harbinson's proposal**
> 90 per cent	60%	> 120 per cent	40%
> 15 and ≤ 90 per cent	50%	> 60 ≤ 120 per cent	35%
≤ 15 per cent	40%	> 20 ≤ 60 per cent	30%
		≤ 20 per cent	25%

Table 1 – Illustration of the Harbinson Formula for average tariff rate reductions
Adapted from: WTO (2003)

Under *domestic support*, the proposals suggested a 60 per cent reduction in Amber Box commitments, whilst *de minimis* spending is to be reduced from 5 per cent to 2.5 per cent of the value of agricultural production on product- and non-product-specific Amber Box programs over 5 years.[5] Blue Box spending is to be bound at 1999-2001 (average) levels and reduced by 50 per cent over 5 years, or included in the Amber Box and effectively cut by 60 per cent. Green box exemptions are maintained with a general tightening of certain criteria for program inclusion, although 'environmental programs' are expanded to permit payments for animal welfare schemes (as a legitimate non-trade concern).

After a series of missed deadlines for agreement owing to large disparities in the negotiating countries' positions, an attempt to revitalise the talks and open further debate prompted the 'July 2004 Framework' (WTO, 2004), although this document was attacked for being devoid of detail pertaining to specific cuts and time frames for each of the agricultural modalities. In terms of *domestic support*, the consensus was to allow gentler cuts over longer periods for the developing countries, whilst a 'tiered formula' is under consideration such that higher levels of support (those in higher 'tiers') will have steeper cuts. A much more contentious area was the creation of new criteria for inclusion in the Blue Box. The US, which had moved away from Blue Box support, successively lobbied to expand the criteria for Blue Box exclusion with a view to

[5] *De minimis*: If agricultural support is less than or equal to the *de minimis* level (expressed as a percentage of the value of production) then subsidies are exempt from cuts.

including its counter-cyclical programs introduced in the 2002 Farm Bill.[6] Should the US succeed with this initiative, it would grant them considerable flexibility in dealing with the proposed reductions (Hart and Beghin, 2006). The Framework also stipulates a re-examination of the Blue Box support to ensure that this class of payments (linked to fixed production limits) are genuinely less trade-distorting than Amber Box measures. Moreover, the text includes a proposed cap of five per cent of the value of agricultural production on Blue Box measures and a minimum cut of 20 per cent in the Aggregate Measure of Support (classified in the Amber Box) within the first year of the agreement implementation period. The treatment of Green Box also remains controversial, with specific wording in the text to ensure that the basic principle of no or only minimal trade distortion is respected. However, the EU is gradually transferring most of its pillar one CAP payments to meet current Green Box criteria and will therefore be reluctant to see (and unable to comply with) further tightening of disciplines in this area.

In *export competition*, the July Framework remained committed to eliminate export subsidies by an agreed end date, whilst accounting for EU concerns by broadening the definition of export competition to incorporate export credit programmes, state trading enterprises and food aid not conforming to various disciplines.[7] In *market access*, the July Framework renewed the commitment toward banded tariff reductions on bound rates, although the number of bands are the level of the reductions are still to be negotiated. Moreover, the text set up *three* exceptions to the application of the reduction formula: sensitive products, special products and the special safeguard mechanism. In the first category, *all* countries may specify an 'appropriate' number of sensitive products which in turn will face lesser tariff cuts and tariff quota increases. In the second category developing countries have recourse, subject to food security, livelihood and rural development criteria, to a certain number of 'special products'. Finally, a special safeguard mechanism will be established to protect developing countries against, for example, import surges or large drops in prices, however, the precise scope and application of this scheme have still yet to be clearly defined.

[6] Counter-Cyclical (CC) payments create a floor price which if touched triggers an automatic farm payment to producers paid per output unit. CC payments are decoupled in that they apply regardless of the level of production although the more produced the more received. Moreover, they are price dependent, rendering them not eligible for inclusion under current Blue Box criteria. Should the US succeed with this initiative, this would, give the US a great deal of flexibility in dealing with the proposed Doha constraints.

[7] The US has made extensive usage of export credits and food aid, whilst Canada has employed State Trading Enterprises for specific commodities.

2. Literature Review and Study Aims

The Global Trade Analysis Project (GTAP) database has become something of a standard workhorse in multi-region computable general equilibrium (CGE) multilateral trade reform analysis, giving rise to a number of CGE undertakings on the potential effects of the Doha Round in the trade policy literature (see Table 2).

Study	Model	Liberalisation Scenario	Notes	Welfare (US$bill)		
				Agric	Other	Total
OECD (2003)[a]	GTAP Model, GTAP v5 data	100% Liberalisation, all sectors, all tariffs	Standard version	34	63	97
Francois *et al.* (2003)[a]	GTAP Model, GTAP v5 data	100% Liberalisation, all sectors, all tariffs all regions	Imperfect competition	109	257	366
		100% Liberalisation, all sectors, all tariffs all regions	Standard version	28	104	132
Brockmeier *et al.* (2003)	GTAP Model, GTAP v5 data	Harbinson Proposals (includes CAP modelling)	Standard version	n.a.	n.a.	n.a.
Beghin & Van Mensbrugge (2004)[a]	LINKAGE, GTAP v6 data	100% Liberalisation, all sectors, all tariffs all regions	Dynamic model	120	264	384
Francois *et al.* (2005)	GTAP Model, GTAP v6 data	50% Liberalisation, all sectors, all tariffs all regions	Imperfect competition	30	138	168
Yu & Jensen (2005)	GTAP Model, GTAP v5 data	Harbinson Proposal and Swiss Formula scenarios (includes CAP modelling)	Standard Version			42[b] 95[c]
Bouet *et al.* (2005)	MIRAGE, Modified v5 GTAP data	Harbinson Proposal (includes CAP modelling)	Imperfect competition	29		
Anderson *et al.* (2006)	LINKAGE, GTAP v6 data	Harbinson Proposal	Dynamic Model			66[b] 119[d]

Table 2 – Previous trade liberalisation estimates

Notes a) Adapted from Renwick *et al.* (2005); b) Harbinson proposal on agricultural commodities only ; c) Swiss Formula on agricultural commodities only; d) Harbinson proposal on agricultural commodities plus 50% cut in non agro-food tariffs.

A cursory view of the global welfare gains from the studies in Table 2 reveals global estimates ranging from $29bn to $384bn, despite the usage of the same base data (GTAP). A primary source of change between model results is the choice of modelling assumptions, which have the effect of 'boosting' welfare estimates. For example in inter-temporal dynamic CGE models, 'capital accumulation' through successive time periods can greatly increase household incomes compared with comparative static CGE model counterparts.[8] The assumption of imperfect competition also raises the welfare estimates through introduction of additional market distortions such as 'pro-

[8] In CGE models, it is normally assumed that the household(s) own the factors of production.

competitive' effects in production (Hertel 1994) or 'love of variety' effects (Dixit and Stiglitz, 1977) in consumption, which via liberalisation release additional welfare gains in comparison with the standard model estimates. Welfare magnification effects in developing countries occur through the imposition of trade-productivity linkages as productivity improvements in developing countries are greatly enhanced through assumptions of technology transfer. It should be noted, however, that such model modifications may be based on tentative estimates which may introduce an issue of credibility into model outcomes.[9]

A secondary source of variation stems from the benchmark year of the GTAP data. Version 6 is benchmarked to 2001 instead of 1997 (version 5), and represents a significant advance on version 5 in terms of (*inter alia*) broader regional coverage (87 regions), improved trade and demand elasticity estimates and perhaps most importantly, significant refinements to the tariff protection data. The new protection data come from a joint CEPII (Paris)/ITC (Geneva) project. The end product of this collaboration is the MAcMaps bilateral tariff database integrating trade preferences, specific tariffs and a partial evaluation of non-tariff barriers (NTBs), for example tariff rate quotas (TRQs) through the calculation of bilateral applied *ad valorem* tariff equivalents. Accordingly, version 6 has lower tariff peaks than version 5, due to the inclusion of bilateral trade preferences and policy reforms between 1997 and 2001 (Uruguay Round reductions, Chinese Accession). Thus, under tariff reform scenarios, this implies greater welfare impacts in the former data version.

Thirdly, estimates may diverge due to the choice of benchmark for comparison. Some CGE studies employ a status quo baseline against which a Doha experiment is compared, including additional multilateral reform policy shocks. Clearly, the result of the Doha experiment is conditioned by the underlying assumptions in the baseline pertaining to exogenous growth, endowment and productivity shocks, as well the choice of policy shocks (i.e., Chinese Accession, EU Enlargement etc.) over the time line of the model experiment. Moreover, further variation occurs within the Doha experiment itself based on the tariff reduction formula (see Yu and Jensen, 2005), the treatment of the tariff binding overhang (see below), export subsidy and Amber Box ceiling limits,

[9] For example, in imperfectly competitive industries, data limitations do not allow accurate calibration of all industries' concentration ratios and ensuing benchmark mark-up ratios for each region. Clearly this coefficient is critical, where the larger is the mark-up ratio the greater are the potential 'pro-competitive' welfare gains from liberalisation. In a similar manner, trade productivity growth is determined by an 'arbitrary' technology transfer function.

the depth and scope of the reforms (e.g., inclusion domestic support and export subsidy cuts? agriculture only or 'total' trade reform?) and the choice of reforming regions in the aggregation.

Of the Doha Agenda studies reviewed, Brockmeier *et al.*, (2003), Yu and Jensen (2005) and Bouet *et al.*, (2005) have vastly improved the model treatment from the perspective of the European Union through explicit implementation of CAP policy reforms and their associated WTO ceiling constraints.[10] Indeed, all three studies are similar in that they all employ version 5 GTAP data and the reforms are measured against a long run baseline scenario including relevant 'background' macro (GDP, productivity etc.) and policy (CAP Reform, Chinese Accession, Uruguay Round finishing commitments) shocks. Moreover, each of the three studies employ the Harbinson tiered tariff reduction formula,[11] although only Brockmeier *et al.*, (2003) and Bouet *et al.*, (2005) include export subsidy elimination and domestic support reductions.

The real income gains to the EU25 in Yu and Jensen (2005) and Bouet *et al.*, (2005) are US$9.109bn and US$8.235bn (1997 prices) respectively.[12] While these estimates are relatively consistent, this is a surprising result given that in addition to market access shocks in both studies, Bouet *et al.*, (2005) also include 55 per cent reductions in Amber and Blue Box support, export subsidy eliminations and imperfectly competitive scale effects. The important difference between these studies lies in the treatment of the tariff reductions, where Bouet *et al.*, (2005) check for binding overhang (difference between the bound (ceiling) and applied rates), where a large binding overhang has little or no effect on real market access (i.e., applied tariff reductions).[13] Indeed, employing version 6 GTAP data, Anderson *et al.*, (2005) also incorporates a Harbinson type scenario (excluding CAP modelling) whilst excluding treatment of the tariff binding overhang. Accordingly, the gains to the EU25 *and* EFTA composite region relative to a *status quo* baseline are considerably higher than Bouet *et al.*, (2005),

[10] In modelling EU domestic agricultural policies, the decoupling of support from production will further moderate the welfare and trade effects (from CAP liberalization) compared with the remaining the studies in Table 2.

[11] Yu and Jensen (2005) also examine the Swiss Formula, whilst acknowledging that the tiered approach is the more realistic scenario in light of the July 2004 Framework.

[12] In Brockmeier *et al.* (2003) no welfare gain estimates are presented. Employing the Swiss Formula, Yu and Jensen (2005) estimate welfare gains of up to $US24.610bn for the EU25.

[13] The percentage binding overhang, or 'water in the tariff', is a percentage point measure calculated as ((binding-applied)/binding)*100. Thus, an overhang of 50% would suggest that a reduction of at least 51% would be required in the bound rate before real inroads into market access will be achieved.

estimated at $US28.2bn (agricultural reform only) and $US35.7bn (reform in all sectors) dollars (2001 prices).

In this study, we employ the Harbinson (WTO, 2003a; 2003b) and subsequent July Framework (WTO, 2004) documents to compare a 'likely' Doha scenario with a baseline scenario and assess the impacts on the EU25. The key features of this study are that (i) we employ version 6 of the GTAP database, (ii) we explicitly model CAP mechanisms (e.g., quotas, decoupled payments, set-aside, CAP budget etc.) to more accurately assess the asymmetric effects on selected EU member states, and (iii) we introduce ceiling limits into both domestic support and export subsidy pillars, as well as calculating *actual* tariff reductions employing data on tariff binding overhangs.

3. GTAP Model and Data

3.1 GTAP Data and Aggregation

This study employs the GTAP CGE model (Hertel, 1997) and accompanying version 6 database (Dimaranan and McDougall, 2006), which contains a broader regional coverage (87 regions) than version 5 (66 regions) and most importantly from the perspective of this study, a full choice of EU25 member states. To maintain the model at a 'manageable' size, the larger EU regions from the EU15 (France, Germany, Italy, UK) and new EU10 members (Czech Republic, Hungary, Poland) are disaggregated, along with the Netherlands, Greece and Spain.[14] The EU is completed with a rest of the EU15 (Ro15) and a rest of the EU10 (Ro10) region. The remaining regions are key players on world agricultural markets (USA, China, India, Japan, Cairns[15]), and the 'Everything But Arms' (EBA) group of poor Sub-Saharan and South African countries. A Rest of the World (ROW) region captures 'residual' production and trade flows in our chosen model aggregation. Given the focus on agriculture and food, all major EU crops and livestock sectors are disaggregated from the GTAP database, with remaining non-agricultural regions aggregated into 'raw materials', 'manufacturing' and 'services' (see Figure 1).

I. Chosen Sectoral Aggregation (22 GTAP Sectors in **bold**)

Wheat (wheat) – Soft Wheat, Durum Wheat; **Other Grains** (ograins) – Rye, sorghum, barley, oats,

[14] The Netherlands (Greece) is the largest net payer (net recipients) per capita to (from) the CAP budget. Spain is the largest net recipient from the CAP budget in nominal terms.

[15] Bolivia, Costa Rica, Guatemala, Pakistan and Paraguay are not included in the Cairns region since in the GTAP database, they appear in regional composites.

maize, millet, other cereals; **Oilseeds** (oilseeds) - Rape and mustard seed, sunflower seed, soyabeans, olives for oil, cotton seed, sesame seed; **Other Crops** (ocrops) - Plant-based fibers, flax and hemp, coffee, cocoa beans, tea, coconuts, spices, tobacco, table grapes, table olives, table wine, other wine nursery plants, flowers, ornamental plants, other final crop products; **Vegetables, Fruit and Nuts** (vegfruitnuts)– Potato, peas, cauliflower, tomato, pulses, other vegetables, nuts, olives, onions, apple, pears and peaches, bananas, other fruits, citrus fruits; **Sugar** (sugar) – Sugar cane, sugar beet; **Raw Milk** (milk) – Dairy cows and other cows; **Cattle and Sheep** (catshp) – Male adult cattle for fattening, calves for fattening, calves, rearing, heifers, sheep and goats for fattening; **Pigs and Poultry** (pigspoultry) – Pigs for fattening, pig breeding, laying hens, poultry for fattening, other animals; **Fishing** (fishing) – All fishing activities; **Other Agriculture** (oagric) – Paddy rice, wool, silk-worm cocoons; **Forestry** (forestry) – Forestry; **Meat processing** (meatpro) – Red meat products (bovine, sheep and goat); **Other meat processing** (omeatpro) – Eggs and egg products, white meat products (pigs, poultry); **Vegetable oils and fats** (vegoilsfats) – Coconut oil, cottonseed oil, groundnut oils, oilseed oils, olive oil, palmkernel oils, rice bran oils, rape and mustard oils, soyabean oil, sunflower seed oils, animal fats; **Dairy** (dairy) – Butter, cheese, cream, whey and products, skimmed milk; **Sugar processing** (sugarpro) – Refined sugar, sweeteners; **Beverages and Tobacco** (bevstobac) – Cigarettes, Cigars etc., Wines and Spirits, Beer; **Other Food Processing** (ofoodpro) – Processed rice, sea food products, hides and skins, meat and blood meal, edible offals; **Raw materials** (rawmat) – Coal, oil, gas, minerals, Petroleum and coal products; **Manufacturing** (mnfcs) – Textiles; wearing apparel; leather products; wood products; paper products and publishing; chemical, rubber and plastic products; ferrous metals; Other metal products; motor vehicles and parts; transport equipment; electronic equipment; machinery and parts.

Services (svces) – Utilities (Gas, water, electricity); construction; trade services; transport (air, sea, road); communications; financial services; insurance; other business services; recreation and other services; dwellings; public administration/defence/health, education.

II. Chosen Regional Aggregation (19 Regions)

France, Germany, Greece, Italy, Netherlands, Spain, UK, REU15 (Austria**,** Belgium, Denmark, Finland, Ireland, Luxembourg, Portugal, Sweden); **Czech Republic, Hungary, Poland, RoEU10** (Cyprus, Estonia, Latvia, Lithuania, Malta, Slovakia, Slovenia)**; USA; Japan, China; India; Cairns** (Argentina, Australia, Brazil, Canada, Chile, Columbia, Indonesia, Malaysia, New Zealand, Philippines, South Africa, Thailand, Uruguay), **Everything But Arms (EBA)** (Botswana, Madagascar, Malawi, Mozambique, Tanzania, Uganda, Zambia, Zimbabwe and composite regions for the rest of South- and Sub-Saharan Africa)**, Rest of the World (ROW)**

Figure 1: Aggregation of Regions and Sectors.

3.2 GTAP Model[16]

[16] The standard GTAP model and accompanying database have been used in numerous applied trade policy studies on themes ranging from European enlargement (e.g., Bach *et al.,* 2000) and CAP reform (e.g., Philippidis and Hubbard, 2003), to multilateral liberalisation scenarios (e.g., Francois *et al.,* 2005) and even global climate change (e.g., Burniaux and Troung, 2002). For this reason, we do not provide a detailed explanation of the model framework. For further information consult Hertel (1997).

In the standard GTAP model framework, utility maximisation is employed to determine three types of 'regional household'[17] final demand: private expenditures (import and domestic demands for goods/services), public expenditures (import and domestic demands for goods/services) and savings (investment expenditure). Production activities are characterised as perfectly competitive and constant returns to scale. Supply is determined through market clearing equations (i.e., supply equals final demand), which in turn drive cost minimising intermediate and factor demands by producers.[18] The model incorporates five types of primary factors, of which land is exclusively employed in agricultural activities and moves 'sluggishly' between sectors. Given the assumption of a long run time horizon in the simulations, we assume full employment and perfect mobility in all labour (i.e., wages are fully flexible) and capital markets.

To ensure a general equilibrium (i.e., simultaneous market clearance), a large system of market clearing equations are introduced to guarantee that all factor, input and commodity markets clear. Moreover, accounting identities ensure that regional households and producers remain on their budget and cost constraints respectively, household expenditures equal household incomes (i.e., tax/tariff revenues and ownership of factors of production), and that long-run zero profits prevail in all production sectors. Finally, to apportion investment demands across regions, a fictitious agent, known as the 'global bank', collects global investment funds (all regions' savings) and disburses them based on fixed regional investment shares.

Once the model structure is formalised and calibrated to our chosen data aggregation, specific macroeconomic or trade policy scenario questions may be addressed by imposing exogenous *shocks* to key policy variables (i.e., changes to tax/subsidy rates, labour supply, technical change variables etc.). The model responds with the interaction of economic agents within each market, where an outcome is characterised by a new set of interdependent equilibria.

4. GTAP Model Extensions, Scenario Design and Results

In this study we extend the standard GTAP framework to include a plausible long run baseline scenario projected from the benchmark year (2001) to 2020 against which we compare our Doha Round Scenario. The composition of the baseline scenario

[17] The regional household is a 'representative' accounting entity designed to encompass the activities of all individuals in each region (i.e., as consumers, businessmen (investors and ownership of factors), government activity (tax and spend) etc.)

[18] In GTAP there are no explicit supply functions for goods and services.

is presented in Figure 2, whilst full details of the modelling of the baseline are presented in the appendix.

Baseline Scenario Assumptions: 2001 - 2020

1. Projections
Productivity, population change, real growth, skilled and unskilled labour changes.

2. Uruguay Round Commitments
Enforce developed country commitments
Complete developing country commitments

3. EU Enlargement
Remove all border protection (i.e., export subsidies, import tariffs) between existing and 'new' member states.
Impose common external tariff for all new EU members of the customs union.

4. Agenda 2000 (A2000) commitments and the Mid Term Review (MTR)
Modelling of CAP mechanisms (CAP budget, modulation, quotas, set-aside, intervention prices)
Reduction of intervention prices under A2000 and MTR reforms
Imposition of set-aside for the 'new' EU member states
Milk quota adjustments under the MTR. Sugar quota unchanged.
Full implementation of the single farm payment (i.e., total decoupling) under the MTR
Additional compensation for milk and proposed sugar reforms.
Full decoupling of direct support to tobacco and olive production under the CAP reforms for Mediterranean products.
CAP budget including the implementation of Modulation funding and the UK Rebate mechanism (which is abolished by 2020).

5. Chinese Accession
Unilateral tariff reductions by China

6. Everything But Arms (EBA) deal
Developing country trade weighted tariff rate eliminations by the EU25 on imports from the EBA.

Figure 2: Assumptions shaping the baseline scenario

Comparing with the baseline, we implement a likely scenario based on the Harbinson proposal and July 2004 framework. Thus, 'average' *ad valorem* tariffs are reduced in accordance with Table 1.[19] In addition, we employ bound and applied tariff rate data for a large number of GTAP sectors provided in Buetre *et al.* (2004) to calculate the binding overhang[20] for each of the chosen regions, which is then factored into the Harbinson percentage reductions (see Tables 3 and 5 below). In the case of the tariff rate quota routes, we reduce the over-quota tariff rates by the same percentages, whilst increasing the quota to 10% of current consumption**.**

[19] Given broader sector aggregates in the GTAP, we do not attempt to implement minimum tariff line reductions for arbitrary sectors, but merely impose the average reduction for each sector.
[20] See footnote 13.

Moreover, it is assumed that the non-agricultural sectors also have the same average tariff rates reductions as suggested by Harbinson for the agricultural sectors. Furthermore, we abolish export subsidies and reduce Amber Box (represented as output subsidies in GTAP) support by 60 (40) percent for developed (developing) countries. Once again, we employ secondary data sources (WTO, 2006) to ascertain the output subsidy expenditure overhang when implementing Amber Box reductions. In the EU, since the single farm payment (SFP) effectively transfers payments out of the Blue Box (as argued by the EU) no respective expenditure limits are implemented, whilst Blue Box expenditures in non EU countries are capped at 5% *de minimis*.[21]

A full discussion of all of the model estimates is unwieldy. Thus, in this paper we restrict ourselves to an examination of EU trade balances and production, world prices and EU welfare measures. To aid the exposition of the results, we have decomposed the Harbinson package into its *domestic support*, *export competition* and *market access* components.

4.1 - EU25 Protection, Support and Trade Effects

In Table 3 are presented the average *ad valorem* applied tariff rates (column 1), the water in each tariff (column 2), export subsidy (column 3) and output subsidy rates (column 4). Column 1 clearly shows a bias in EU25 protective structure toward the agro-food sectors (GTAP does not include protection data in services – see conclusions section) with average applied tariff rates ranging between 0.1% (oilseeds) to 112.7% (sugar processing). A cursory view also reveals consistently higher tariff protection across processed food sectors, whilst in primary agriculture tariff peaks appear in 'other grains' (16.6%) and 'vegetable fruits and nuts' (16.8%). In column 2, the binding overhang is indicative of the rate of bound tariff reduction necessary to have an impact on 'real' market access (i.e., reductions in applied rates). Thus, in the EU25, the binding overhang is prohibitively high in 'primary sugar' (95%) and 'other meat processing' (85.7%) sectors, whilst featuring strongly in 'meat processing' (45.0%), cereals (41.2%), 'sugar processing' (37.6%), 'pigs and poultry' (33.3%) and 'dairy' (6.2%) sectors.

[21] Counter-cyclical (CC) payments constitute a considerable component of US domestic support. Thus, it would appear politically improbable that the USA (if successful in transferring CC into the Blue Box) will accept significant Blue Box reduction disciplines (of 50% as in Brockmeier *et al.*, 2003), especially if the EU succeeds in transferring the majority of its domestic support payments into the Green box under the single farm payment.

(%)	1. Applied tariff rates	2. Binding overhang	3. Export subsidy rates	4. Output subsidy rates
wheat	1.2	41.2	7.8	0.9
ograins	16.6	41.2	29.6	0.2
oilseeds	0.1	0.0	0.0	24.2
ocrops	2.8	0.0	0.0	2.3
vegfruitnuts	16.8	0.0	2.2	0.2
sugar	8.4	95.0	0.0	0.3
milk*	-	-	-	-
catshp	5.6	0.0	0.0	0.5
pigspoultry	1.9	33.3	0.6	-0.2
fishing	2.5	0.0	0.0	3.5
oagric	11.9	0.0	0.0	-0.2
forestry	0.1	0.0	0.0	2.5
meatpro	45.7	45.0	78.5	0.0
omeatpro	21.0	85.7	5.1	0.0
vegoilsfats	12.0	0.0	0.0	0.0
dairy	36.7	6.2	27.2	0.0
sugarpro	112.7	37.6	53.1	-0.1
bevstobac	9.3	0.0	0.9	-8.3
ofoodpro	10.3	0.0	3.2	-0.6
rawmat	0.3	0.0	0.0	-0.5
Mnfcs	2.2	0.0	0.0	0.2
Svces	0.0	0.0	0.0	-1.8

Table 3: Average applied tariff rates, binding overhangs, average export subsidy rates and output subsidy rates for the EU25.

Source: Dimaranan and McDougall, 2006, Buetre *et al.* (2004) and author's own calculations.

* Raw milk production is non tradable in GTAP, where all dairy related exports occur in the downstream 'dairy' sector.

Column 3 shows export subsidy protection is largely limited to processed 'meat' and 'sugar', 'dairy' and cereals sectors. Indeed, as a policy tool export subsidies have declined in importance, partly due to the reforms of the Uruguay Round, partly due to the sharp increases in world prices in 2000/2001 (benchmark year of analysis). In the case of beef carcass trade, the BSE epidemic decimated extra-EU exports from numerous member states resulting in zero export subsidies in the benchmark. Average output subsidy rates in column 4 incorporate production aid payments (e.g., milk, fibre flax, hemp, silkworms) agri-monetary aid, other miscellaneous national payments, and national clearance of previous year's farming accounts (i.e., recovery of overpayments to member states etc.), whilst the remainder is transferred into land (e.g., area aid payments) and capital (e.g., headage payments) subsidies to characterise the decoupled nature of EU support.[22] In oilseeds and other crops, higher average subsidy rates largely reflect direct support in the olive oil (oilseeds) and tobacco (ocrops) sectors. In accordance with the 2004 CAP reforms for Mediterranean products, we transfer all

[22] Indeed, a number of negative entries under the 'clearance of accounts' procedure for 2001 result in GTAP data output tax estimates in 'pigs and poultry' and 'other agriculture' sector.

tobacco and olive oil production subsidies into the SFP in the baseline (see appendix). In non-primary agricultural sectors, the negative entry is indicative of a tax.

	USA	Japan	China	India	Cairns	EBA	ROW
wheat	0.2	183.0	1.0	28.1	4.1	9.1	9.3
ograins	0.0	38.7	87.7	29.4	4.0	7.7	72.6
oilseeds	2.9	0.2	100.9	35.2	5.0	6.6	54.6
ocrops	2.4	0.9	14.6	12.5	13.6	8.4	9.3
vegfruitnuts	0.6	14.0	24.8	40.2	2.7	15.3	13.9
sugar	0.2	0.0	8.9	3.4	0.7	7.0	20.1
milk*	-	-	-	-	-	-	-
catshp	0.0	19.0	3.1	19.8	1.1	14.3	3.1
pigspoultry	0.2	1.9	8.4	7.7	7.3	14.6	4.5
fishing	0.2	3.7	11.5	3.7	4.0	5.2	5.9
oagric	2.0	210.9	1.1	15.7	1.8	5.9	16.2
forestry	0.0	0.1	0.3	6.8	0.3	3.9	2.9
meatpro	2.8	43.2	15.7	24.1	6.4	12.8	18.7
omeatpro	0.6	50.3	14.2	59.5	26.8	20.9	20.6
vegoilsfats	1.0	2.3	12.8	82.6	5.0	17.9	12.7
dairy	18.2	53.1	20.1	33.8	17.7	12.3	15.9
sugarpro	25.3	244.1	18.8	45.7	6.8	18.8	24.1
bevstobac	1.4	15.1	41.3	124.8	16.9	41.1	28.7
ofoodpro	2.5	20.0	17.1	41.0	11.1	23.1	11.3
rawmat	0.1	0.3	3.1	16.1	1.4	9.0	2.6
mnfcs	1.9	1.7	12.8	28.4	4.7	14.3	5.3
svces	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 4: The average applied tariff structure of the Non-EU25 countries.
Source: Dimaranan and McDougall, (2006)
* Milk is non tradable

Table 4 shows the stratification of applied tariff rate protection across the non-EU countries. In general, there is a bias toward higher protection in the agro-food sectors, although the composition of protection is strongly a function of national country interests. Thus in Japan, high tariffs are levied in 'wheat', 'other agriculture' (includes rice) and 'sugar processing' sectors, whilst in China tariff peaks are in 'other grains' and 'oilseeds' sectors. Note that in India, tariff protection is strong across all sectors, whilst in the US and Cairns regions, applied tariff protection is much lower. The binding overhangs for the non-EU regions in Table 5 show a clear disparity between the less developed regions (India, EBA, ROW) where the water in the tariff is considerable, and the developed countries of the USA and Japan, where the overhang is concentrated in a handful of sectors. Thus, the implication is that multilateral liberalisation will open up *developed* country markets considerably more. The Cairns composite region is a mixture of industrialised and developing countries, although comparing across sectors,

the binding overhang is the most prohibitive of all the regions in the aggregation.[23] In the opposite direction, China constitutes something of an outlier with a zero tariff binding overhang, suggesting that the WTO accession package is far more constraining than the UR agreement for remaining WTO members.

	USA	Japan	China	India	Cairns	EBA	ROW
wheat	0.0	45.5	0.0	61.3	80.0	64.3	34.5
ograins	0.0	45.5	0.0	61.3	80.0	64.3	34.5
oilseeds	0.0	0.0	0.0	61.0	82.1	55.8	66.7
ocrops	0.0	0.0	0.0	69.4	65.2	54.1	56.0
vegfruitnuts	0.0	0.0	0.0	65.3	59.3	31.5	61.4
sugar	100.0	0.0	0.0	68.8	68.6	55.1	57.1
milk*	-	-	-	-	-	-	-
catshp	0.0	0.0	0.0	61.0	88.2	6.7	51.9
pigspoultry	0.0	0.0	0.0	71.1	69.2	36.7	57.1
fishing	0.0	0.0	0.0	65.5	70.8	20.0	38.5
oagric	0.0	100.0	0.0	48.3	66.8	44.8	38.7
forestry	0.0	0.0	0.0	64.1	38.7	36.4	61.5
meatpro	84.6	22.0	0.0	65.0	47.3	45.5	41.7
omeatpro	0.0	0.0	0.0	62.8	31.1	44.3	62.5
vegoilsfats	0.0	0.0	0.0	67.5	47.1	46.7	58.6
dairy	56.3	0.0	0.0	43.3	50.2	43.4	41.9
sugarpro	38.1	66.1	0.0	66.9	54.0	53.0	68.8
bevstobac	0.0	0.0	0.0	67.5	47.1	46.7	58.6
ofoodpro	0.0	0.0	0.0	67.5	47.1	46.7	58.6
rawmat	0.0	0.0	0.0	23.5	86.9	72.7	50.0
mnfcs	0.0	0.0	0.0	11.1	47.3	48.6	50.0
svces	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 5: Binding overhang in the non-EU25 regions

Source: Dimaranan and McDougall, 2006, Buetre *et al.* (2004) and author's own calculations.
* Milk is non tradable

Calculating the EU25's import trade shares from the GTAP database, the main agro-food trade partners are the Cairns region (38%) followed by the ROW (33%) and the USA (12%). Comparing with these trade partners, EU25 protection is comparable or higher in many cases, whilst the binding overhang in the Cairns and ROW regions is greater suggesting lower market access for EU25 producers from multilateral reform. These factors explain the deterioration in the EU25 agro-food trade balance of €2.161bn in Table 6 compared with the baseline scenario. Given zero binding overhang in EU25 manufacturing, the trade balance deteriorates -€0.924bn. This is largely due to 50% binding overhang in the ROW, which is the largest trade partner in this sector (38%).

[23] The Cairns binding overhangs are calculated employing available applied and bound tariff data for Argentina, Australia, Brazil, Canada and New Zealand.

Meanwhile, given resource reallocation into services production, the services trade balance improves by €2.491bn leading to a net trade balance of -€0.404bn.[24]

	1. 2001 Benchmark	2. Harbinson Proposal	3. Domestic Support	4. Export Competition	5. Market Access
wheat	405.5	-147.6	17.1	-222.9	48.7
ograins	187.7	-119.3	2.5	-120.0	-1.0
oilseeds	-3664.7	51.3	-7.2	24.8	29.7
ocrops	-8330.3	119.6	-36.6	155.7	-3.3
vegfruitnuts	-7843.0	-244.8	30.9	7.7	-285.2
sugar	-7.0	2.7	0.0	0.8	1.8
milk*	-	-	-	-	-
catshp	92.8	-4.8	-12.5	20.2	-14.5
pigspoultry	-805.0	53.2	-12.6	31.0	33.2
fishing	-1149.8	11.5	-4.9	10.5	5.4
oagric	-1058.7	-66.8	13.7	47.5	-128.0
forestry	-1486.6	28.6	-1.0	1.4	28.1
meatpro	-1196.5	-229.2	-6.3	-233.2	12.2
omeatpro	1671.5	-272.4	-40.5	-942.5	720.9
vegoilsfats	-77.9	-245.4	-77.0	29.1	-202.0
dairy	3900.5	-345.8	3.1	-238.3	-80.3
sugarpro	-851.2	-55.7	0.5	-13.6	-42.8
bevstobac	7929.9	-95.4	2.7	-27.2	-71.3
ofoodpro	-5934.9	-572.3	27.3	-70.5	-551.5
rawmat	-88258.9	161.7	-5.1	0.8	166.5
Mnfcs	82540.2	-924.1	165.6	1553.8	-2646.6
Svces	-8129.6	2490.9	42.9	352.6	2086.6
EU25 Agro-Food	**-16731.1**	**-2161.2**	**-99.8**	**-1540.9**	**-528.0**
EU25 Non-Food	**-15334.9**	**1757.1**	**202.4**	**1908.6**	**-365.4**
EU25 Total	**-32066.0**	**-404.1**	**102.6**	**367.7**	**-893.4**

Table 6: Extra EU25 Trade Balance data (€millions, 2001) compared with the baseline scenario.

* Milk is non tradable

A decomposition of the Harbinson proposal by pillar (columns 3 to 5) suggests that export subsidy elimination has by far the greatest negative impact on the agro-food trade balance (€1.541bn) due to reductions in exports of cereals, processed meat products, 'dairy' and 'other food' processing.[25] This in turn leads to a resource reallocation effect which improves both manufacturing and services sector trade balances by €1.554bn and €0.353bn respectively. Since Amber Box expenditures in the EU25 are someway below ceiling in 2001 (WTO, 2006),[26] their reduction in the Harbinson package only slightly reduces the agro-food trade balance. Similarly, the

[24] The intra EU-25 trade balance by convention must sum to zero. We do not include intra-EU25 trade flows since relative to the baseline, no policy shocks change (i.e., all protection eliminated on enlargement). Accordingly, changes in intra-EU25 trade balances are very small.

[25] Whilst the 'other food processing' sector has a much smaller export subsidy rate than, say, sugar processing, exports from this composite sector are greater.

[26] The ceiling ratios are: EU15, 58.5%; Czech Republic, 40.4%; Hungary, 100%; Poland, 14.5%; RoEU10, 24.9%.

market access component of the Harbinson package has a muted impact on agro-food trade due to the binding overhang. Indeed, in EU sectors with higher (> 10%) average applied tariff rates and a low binding overhang (see Table 3) (e.g., 'vegfruitnuts', 'oagric', 'vegoilsfats', 'dairy', 'ofoodpro') the trade balance deteriorates. A similar result occurs in the manufacturing sector as noted above. In contrast, in 'other meat' processing, the binding overhang is high (86% - see Table 3) resulting in no real tariff reductions by the EU25 and a trade balance improvement of €0.721bn.

	1. 2001 Benchmark	2. Harbinson Proposal	3. Domestic Support	4. Export Competition	5. Market Access
France	1721.0	-442.5	-2.3	-367.4	-76.5
Germany	-4876.3	-504.5	11.3	-278.8	-236.3
Greece	255.5	-40.7	5.9	-32.7	-12.9
Italy	-2194.3	-209.5	-48.2	-59.5	-100.5
Netherlands	-1903.7	-245.4	-17.3	-180.1	-48.6
Spain	-3115.1	-252.0	-30.5	-150.3	-69.0
UK	-4494.4	-258.9	10.5	-90.7	-178.3
Czech Republic	-232.1	-2.6	0.1	1.8	-4.6
Hungary	467.9	36.5	-1.9	19.4	18.6
Poland	-65.1	50.2	0.9	29.2	20.5
Rest of EU15	-1922.1	-313.7	-30.2	-169.8	-111.3
Rest of EU10	-372.4	21.9	1.9	32.0	-13.1
EU15 Total	**-16529.4**	**-2267.2**	**-100.8**	**-1329.3**	**-833.4**
EU10 Total	**-201.7**	**106.0**	**1.0**	**82.4**	**21.4**
EU25 Total	**-16731.1**	**-2161.2**	**-99.8**	**-1246.9**	**-812.0**

Table 7: EU25 Agro-Food Trade Balances (€millions, 2001) relative to baseline

Table 7 shows the decomposition of the agro-food trade balance deterioration (-€3.171bn) by selected EU25 members. Importantly, the 'old' EU15 constitutes 105% of this loss, where in the 'new' EU member states, export subsidies are very minor or zero,[27] whilst Amber Box support (with the exception of Hungary) is minimal. In terms of market access, the improvement in the Polish and Hungarian agro-food trade balance is due to the binding overhang (86%) on EU25 'other meat processing' trade. Poland trades significantly with the USA in this sector which has zero water in its tariff whilst a similar line of reasoning applies to Hungary's 'other meat processing' trade with Japan. In the EU15, export subsidy eliminations constitute the most important source of agro-food trade balance deterioration, mainly affecting France (-€0.367bn), Germany (-€0.279bn) and the Netherlands (-€0.180bn). Multilateral tariff reductions mostly affect Germany (-€0.236bn), the UK (-€0.178bn) and Italy (-€0.101bn).

[27] With the exception of sugar processing export subsidies in Poland and dairy export subsidies in the Czech Republic.

4.2 Production and Factor Prices in the EU25

Predictably, multilateral eliminations/reductions in agro-food support result in production falls in almost all agro-food sectors in Table 8. Notwithstanding, production and factor price effects are generally small, largely due to the lack of multilateral market access (binding overhang), particularly across developing countries. The largest production falls are in the cereals, 'vegetables fruits and nuts', red meat (upstream and downstream), 'dairy' and 'sugar processing' sectors. Elsewhere, white meat ('pigs and poultry' and 'other meat processing') production rises marginally, whilst in the quota constrained sectors ('milk' and 'sugar') only the sugar quota is slightly non-binding,

Decomposing the results by pillar, export subsidies have the largest negative impacts in the cereals, dairy, sugar and meat sectors.[28] Indeed, given that the majority of total export subsidies accrue to the EU, this elimination is almost unilateral in nature. As noted above, EU25 Amber box expenditures are someway below their UR ceiling limits in 2001, whilst the role of this component of CAP support in the post MacSharry phase has been much reduced. Thus, 60% Amber Box reductions have negligible output impacts.

In the case of market access, the impact on EU25 production is a function of its relative competitiveness (applied bilateral tariff), the degree of binding overhang and the composition of the EU25's trade patterns. For example, EU25 'wheat' has a higher binding overhang than in the ROW (largest trading partner). Thus, tariff reductions lead draw in additional wheat imports to the ROW from the EU25 stimulating EU25 production. A similar argument applies in 'other meat processing' ('pigs and poultry') on EU25 trade with its principal trading partners, Japan and the USA (USA, China, Japan), both of which have zero binding overhangs in their tariff. In remaining agro-food sectors, market access has a deteriorating effect on EU25 production levels. Impacts in non-food sectors are negligible.

With reductions in primary agricultural production, agricultural specific land factors fall in value. This impact is stronger in arable land due to contractions in cereals and 'vegetables fruits and nuts' sectors. Moreover, note that the returns to unskilled labour, a significant proportion of which work in the agro-food sector, fall by 0.6%. Finally, in skilled labour and capital markets, factor returns are close to zero.

[28] The exception is the 'cattle and sheep' sector, which includes beef production. This is attributed to the BSE crisis in 2000 (one year prior to the benchmark data), which led to extra-EU import bans on several EU members.

	1. Harbinson Proposal	2. Domestic Support	3. Export Competition	4. Market Access
	Production (%)			
wheat	-1.4	0.0	-2.2	0.8
ograins	-3.0	0.0	-2.9	-0.1
oilseeds	-0.1	-0.2	0.3	-0.2
ocrops	0.1	-0.2	0.4	-0.1
vegfruitnuts	-1.5	-0.4	-0.2	-0.9
sugar	0.0	0.0	0.0	0.0
milk	-0.1	0.0	0.0	-0.1
catshp	-1.1	-0.2	0.0	-0.9
pigspoultry	0.2	-0.1	-0.8	1.1
fishing	-0.4	-0.4	0.0	0.0
oagric	-0.3	0.1	0.2	-0.6
forestry	0.1	0.0	0.0	0.1
meatpro	-2.0	-0.1	-1.4	-0.5
omeatpro	0.3	-0.1	-0.9	1.3
vegoilsfats	-0.9	-0.1	0.0	-0.8
dairy	-2.5	0.0	-1.6	-0.9
sugarpro	-1.6	0.0	-0.8	-0.8
bevstobac	-0.1	0.0	-0.1	0.0
ofoodpro	-0.9	0.0	-0.4	-0.5
rawmat	0.3	0.0	0.0	0.3
Mnfcs	-0.1	0.0	0.0	-0.1
Svces	0.0	0.0	0.0	0.0
	Factor Returns EU25 (%)			
Arable Land	-4.5	-0.8	-2.4	-1.3
Other Land	-1.6	-0.1	-0.5	-1.0
UnSklab	-0.7	0.0	0.0	-0.7
SkLab	-0.1	0.0	0.0	-0.1
Capital	-0.1	0.0	0.0	-0.1

Table 8: Production and Factor prices in the EU25 relative to baseline. [29]

4.3 World Prices

As expected, eliminations/reductions in trade protection stimulate global trade demand thereby bidding up world prices relative to the baseline (see Table 9), although once again, the limited depth of the reforms has muted impacts on price increases. Sectors with world price increases greater than 1% are 'wheat', 'other grains', 'cattle and sheep' and 'other meat processing', whilst only 'dairy' and 'sugar processing' have world price rises of greater than 2%. Amber Box support reductions have a negligible effect on world prices, whilst export subsidies and market access pillars have varying degrees of influence on final world price estimates depending on the product. In dairy, the elimination of EU and US subsidies appears to have a greater impact on world prices than tariff reductions under the Harbinson proposal. A similar pattern can be

[29] Note that percentage changes in some cases are from a large base as in composite sectors such as manufacturing and services.

found for 'sugar processing' and 'other meat processing'. In the remaining agro-food sectors, market access has an equal or greater weighting on world price rises. Note that in primary sugar, the world price falls due to the implementation of the tariff rate quota. Thus, increases in quotas and reductions in out-of-quota tariffs reduce quota rent, which has the effect of reducing the world price.[30]

(%)	1. Harbinson Proposal	2. Domestic Support	3. Export Competition	4. Market Access
wheat	1.1	0.1	0.3	0.7
ograins	1.0	0.2	0.4	0.4
oilseeds	0.3	0.1	0.1	0.1
ocrops	0.6	0.3	0.1	0.2
vegfruitnuts	0.8	0.2	0.2	0.4
sugar	-0.3	0.1	0.6	-1.0
milk*	-	-	-	-
catshp	1.2	0.2	0.3	0.7
pigspoultry	0.7	0.0	0.2	0.5
fishing	0.6	0.1	0.0	0.5
oagric	0.8	0.4	0.2	0.2
forestry	0.2	0.0	0.0	0.2
meatpro	0.8	-0.1	0.4	0.5
omeatpro	1.5	-0.1	1.3	0.3
vegoilsfats	0.9	0.7	0.0	0.2
dairy	2.9	0.0	1.8	1.1
sugarpro	2.4	0.1	1.4	0.9
bevstobac	0.2	-0.1	0.1	0.1
ofoodpro	0.7	0.1	0.3	0.3
rawmat	0.1	0.0	0.0	0.1
Mnfcs	-0.1	0.0	0.0	-0.1
Svces	-0.1	0.0	0.0	-0.1

Table 9: Changes in world prices relative to baseline

* Milk is non tradable

4.4 Regional Welfare – Harbinson Proposal

Table 10 shows equivalent variation (EV) changes in millions of euros (€m) in 2001 prices for select EU25 member states and at the global total. [31] The decomposition of regional equivalent variation is divided into allocative efficiency effects, terms of trade (ToT) effects, a CAP budget effect and 'other'.[32] The ToT reflect changes in the ratio of export to import prices and is a function of a region's trade pattern, elasticity of substitution parameters and level of relative competitiveness (i.e., benchmark tariff rates). In short, the ToT is a measure of the gains/losses from changes in trade flows. For example, with unilateral reductions in tariffs, import demands increase (determined

[30] A similar effect for sugar is noted in Bouet *et al.*, (2005).

[31] Welfare changes are defined as Hicksian equivalent variation, which is the income given (or taken away) measured in 'pre-shock' regional prices (i.e., money metric measure) which is equivalent to the utility change in national welfare that follows from the implementation of the Harbinson Package.

[32] For a full discussion of equivalent variation welfare decomposition, see McDougall (2003).

by the elasticity of substitution). To ensure balance of payments exports must also rise to compensate, which implies a reduction in the real exchange rate, or regional factor price index to improve competitiveness. *Ceteris paribus*, this would result in a ToT deterioration.

Efficiency is measured as the value of changes in resource or product usage from changes a given market distortion (e.g., tax or subsidy). Thus, a tariff on a product implies an under usage of resources as the economy is using less compared with free or undistorted market forces. Conversely, subsidies encourage over-production (i.e., more than under free market conditions) and therefore are a waste of resources (Huff and Hertel, 2001). Thus, those activities which are taxed (subsidised) have a positive (negative) marginal social value (Huff and Hertel, 2001). In GTAP, a welfare measure of *changes* in efficiency is based on the quantity usage of a product multiplied by its tax/subsidy distortion in money metric terms. For example, reduced (increased) usage of a subsidised (taxed) activity implies an efficiency welfare gain.

The CAP budget effect measures the EV changes in the net budgetary positions of each of the EU member states.[33] The 'other' category is an EV (money metric) measure of changes in: (i) returns to factors of production from exogenous endowment shocks, (ii) values of production and demands from exogenous productivity shocks and (iii) population impacts on per capita welfare.[34] The total of these 'other' effects are *relatively* small given that these exogenous shocks also feature in the baseline scenario.

The underlying result is that the Harbinson proposal has a minor positive impact of €1.205bn ($US1.349bn) on EU25 real income (0.02% of EU25 GDP). From the selected EU member states, the largest gainers as a proportion of GDP are Italy (0.05%), the UK and Poland (0.04%), whilst the largest net loss accrues to Hungary and the rest of the EU10 (-0.07%). Examining the welfare decomposition, the terms of trade (ToT) effect is negative in all EU regions. On the one hand, reductions in output and export subsidies increase agricultural production prices and free on board export prices respectively, thereby improving the ToT. On the other hand, these effects are outweighed by the market access pillar, where a larger binding overhang on many competing sector tariffs results in asymmetric market access and sizeable net inflows of

[33] The CAP budget does not net to zero across the EU25 because the changes are measures in money metric (EV) terms which is a function of the price index in each EU region.

[34] Due to non-homotheticity of the CDE private demand function, utility is measured in per capita terms (see footnote 15). To measure changes in total regional welfare, the equivalent variation measure is the income equivalent of the per capita income welfare change multiplied by the change in total population.

trade to the EU25. To bring balance to the external account, the EU25 must increase exports. This can only be achieved through improved competitiveness which implies falls in factor prices (as seen in Table 8), export prices, and subsequently a ToT deterioration of -€0.691bn. This loss is dominated by the EU15 (-€0.634bn) owing to its considerably larger non-EU25 trade links.

	% of GDP	Total EV	Efficiency Effect	Terms of Trade Effect	CAP Budget Effect	'Other' Effect
France	0.02	248.5	297.2	-116.5	72.3	-4.5
Germany	0.03	526.6	276.4	-42.5	294.1	-1.4
Greece	-0.06	-58.1	44.6	-26.1	-73.4	-3.2
Italy	0.05	466.0	222.8	-30.3	278.9	-5.4
Netherlands	-0.05	-169.4	160.0	-143.0	-186.2	-0.2
Spain	-0.02	-128.0	158.4	-77.8	-203.8	-4.8
UK	0.04	452.9	212.4	-53.0	296.4	-2.9
Czech Rep	0.01	7.1	-1.1	-11.5	21.8	-2.1
Hungary	-0.07	-31.9	-2.6	-20.0	-5.8	-3.5
Poland	0.04	67.5	-9.3	-12.8	90.7	-1.1
Rest of EU15	-0.01	-131.9	410.6	-144.8	-385.7	-12.0
Rest of EU10	-0.07	-44.5	2.6	-13.1	-30.5	-3.5
EU15 Total	**0.02**	**1206.8**	**1782.4**	**-634.0**	**92.8**	**-34.4**
EU10 Total	**0.00**	**-1.9**	**-10.4**	**-57.4**	**76.1**	**-10.2**
EU25 Total	**0.02**	**1204.9**	**1772.0**	**-691.4**	**168.9**	**-44.6**
Global	**0.03**	**7135.3**	**7054.3**	**38.0**	**0.0**	**43.0**

Table 10: EV impacts (€2001 millions)

Reductions/eliminations in market distortions (output subsidies, export subsidies, import tariffs) have net positive efficiency impacts of €1.772bn in the EU25 from improved resource reallocation. Notably, 101% of this gain accrues to the EU15 due to its relative size vis-à-vis the EU10. Moreover, in the EU10 domestic support and export subsidy distortions are minimal/zero and the majority of trade is intra-EU in nature such that resource reallocation effects are muted. Examining the EV result at the global level reveals a real income gain of €7.135bn ($US7.992bn) or 0.03% of global GDP, mainly from efficiency gains of €7.054bn.

In the context of the literature review in section 2, our EU25 and global estimates appear at the lower end of the range of results. There are a number of reasons for this outcome. Firstly, we are using GTAP version 6 data benchmarked to 2001 (rather than 1997 in GTAP version 5) resulting in lower tariff peaks and subsidy rates, as noted in section 2. Secondly, and most overwhelmingly, we have incorporated a tariff binding overhang, which limits the degree of real market access and therefore trade gains and welfare. Indeed, the market access pillar in the Harbinson proposal accounts for the lion's share of global welfare gains at €7.014bn (not shown), or 98% of the full

Harbinson package.[35] In this context, the comparison of the results between Yu and Jensen (2005) and Bouet *et al.*, (2005) in section 2, demonstrates the significance that tariff bindings have on potential trade led growth.

Thirdly, we do not incorporate additional modelling features such as imperfect competition ('pro-competitive' and/or 'love of variety' effects), trade-productivity linkages or NTB protection (e.g., in services), which whilst 'boosting' welfare gains, may introduce greater subjectivity into the model framework.[36] Fourthly, the inclusive nature of our baseline discounts additional sources (e.g., Enlargement, Chinese accession, Everything but Arms) of trade led welfare gains, whilst we assume that all blue box support in the EU faces no discipline as it is transferred into the Green Box under the SFP.

Finally, given the EU significant share of world agricultural market activity, the explicit representation of CAP policy market rigidities (arable specific land factor, quotas, set-aside, single farm payment) restricts the responsiveness of resource shifts from the agricultural sectors to non-agricultural uses from a policy change. In terms of the results, this will have a moderating impact on the efficiency estimates reported in Table 10, both within and outside of the EU25.

4.5 EU Budget Effects

The decomposition of the CAP budget for the member states is provided in Table 11, where column 1 shows the change in the net position of each member state. This net total is a function of 'CAP Expenditures' from Brussels, composed of changes in export subsidies, Amber Box support and intermediate input subsidies, *minus* changes in regional contributions to the CAP budget, namely, 75% of agricultural tariff revenues and GDP Contributions.[37] Under the Harbinson proposal, CAP expenditures shrink by -€3.624bn relative to the baseline due to reductions in export subsidies and Amber Box support. Tariff revenues fall from improved market access conditions, whilst an additional fall in EU25 GDP contributions is necessary to balance the CAP budget.

[35] The importance of 'market access' as a proportion of the total potential trade gains is also a feature of other CGE Doha studies in the literature (Renwick *et al.*, 2005)
[36] See footnote 9.
[37] In the mid term review modelled in the baseline, all blue box support is placed into the single farm payment thereby making EU farm support eligible for current green box conditions. Thus, under the Harbinson proposal simulation, no further changes in blue box occur compared with the baseline. See the appendix for more detail on the modelling of the CAP budget.

	1.CAP Budget	2.CAP exp.	2a.Export subs.	2b.Amber Box	2c.Interm. subs.	3.CAP Tariff	4.GDP Contrib.
Fra	72.3	-723.6	-620.6	-80.2	-22.8	-46.6	-749.3
Ger	294.1	-394.1	-384.7	-1.2	-8.1	-66.1	-622.1
Gre	-73.4	-119.6	-82.1	-36.8	-0.6	-3.5	-42.7
It	278.9	-456.8	-367.6	-78.5	-10.7	-27.0	-708.8
NL	-186.2	-390.6	-374.9	-11.5	-4.3	-35.4	-169.0
Spa	-203.8	-430.2	-113.5	-313.1	-3.6	-16.7	-209.7
UK	296.4	-183.7	-133.7	-46.3	-3.7	-51.9	-428.2
Cze Rep	21.8	-7.4	-6.3	-0.8	-0.3	-1.8	-27.4
Hun	-5.8	-19.6	-0.8	-18.3	-0.6	-0.4	-13.3
Pol	90.7	-7.5	-1.3	-5.6	-0.6	-2.7	-95.5
Ro15	-385.7	-816.2	-566.1	-220.1	-30.0	-28.7	-401.8
Ro10	-30.5	-74.7	-0.8	-73.9	-0.2	-3.0	-41.2
EU15	**92.8**	**-3514.8**	**-2643.2**	**-787.7**	**-83.9**	**-276.0**	**-3331.6**
EU10	**76.1**	**-109.2**	**-9.1**	**-98.7**	**-1.7**	**-7.9**	**-177.4**
EU25	**168.9**	**-3624.0**	**-2652.2**	**-886.4**	**-85.6**	**-283.9**	**-3509.0**

Table 11: Breakdown of the CAP Budget Effect relative to the baseline (€millions 2001)

Since the UK, Germany and to a lesser extent, Italy, are large net contributors, a reduction in the size of the CAP budget brings benefits of €0.296bn, €0.294bn and €0.279bn respectively. At the other end of the spectrum, Greece and Spain are large net beneficiaries from CAP funding and consequently lose -€0.073bn and -€0.204bn respectively from a reduced agricultural budget. France also contributes heavily to the CAP budget, but given its large agricultural sector, it also receives substantial market support from the CAP. These flows of income largely cancel each other out resulting in a net budget effect of €0.072bn. The Netherlands is also a large net contributor, but actually loses from a reduced CAP budget since its share of export subsidies, which are eliminated, is considerable in proportion to its relative size. The Czech Republic and Poland are net beneficiaries from the CAP, although the impact of the Harbinson proposal is very minor since neither has significant Amber Box or export subsidy protection (the majority is tied up in the single farm payment). Hungary has historically been close to or above its Amber Box ceiling limit in local currency terms due to inflationary problems. Thus, its Amber Box reductions from the 2001 benchmark result in net CAP budgetary losses.

4.6 Regional Welfare – Total Elimination of Support and Protection.

Before concluding, we compare the welfare impacts from our Harbinson scenario with an alternative simulation involving complete elimination of protection and

support. By comparing the welfare gains relative to the same baseline, one may gauge the relative depth of the Harbinson package from the perspective of the EU25.

	% of GDP	Total EV	Efficiency Effect	Terms of Trade Effect	CAP Budget Effect	'Other' Effect
France	0.13	1545.0	1340.1	395.3	-207.6	17.2
Germany	0.52	8411.5	1060.9	2396.8	4986.1	-32.3
Greece	-1.52	-1577.9	110.5	-400.1	-1296.5	8.2
Italy	0.80	7691.6	779.6	2292.9	4598.9	20.2
Netherlands	0.83	2797.7	481.3	382.8	1929.1	4.5
Spain	-0.30	-1552.0	520.0	-265.8	-1823.9	17.7
UK	0.55	7078.4	618.5	2008.3	4433.0	18.6
Czech Rep	-4.45	-2157.6	131.8	-473.0	-1823.7	7.3
Hungary	-3.80	-1711.7	217.2	-697.6	-1242.2	10.9
Poland	-5.23	-8142.3	782.0	-1656.3	-7281.0	13.0
Rest of EU15	0.05	513.2	371.0	122.5	-1.4	21.1
Rest of EU10	-1.74	-1188.7	308.9	-186.5	-1325.6	14.5
EU15 Total	**0.36**	**24907.5**	**5281.9**	**6932.7**	**12617.7**	**75.2**
EU10 Total	**-4.15**	**-13200.3**	**1439.9**	**-3013.4**	**-11672.5**	**45.7**
EU25 Total	**0.16**	**11707.1**	**6721.8**	**3919.3**	**945.1**	**120.9**
Global	**0.24**	**67170.6**	**66424.0**	**208.9**	**0.0**	**537.7**

Table 12: EV impacts from total protection and support abolition (€2001 millions)

In Table 12, the global impact of total reform is €67.171bn (US$75.231bn) in 2001 prices, or 0.24% of global GDP, the majority of which are efficiency gain effects. For the EU25, the corresponding statistic is €11.707bn (US$13.112bn), or 0.16% of EU25 GDP. Moreover, comparing Tables 10 and 12 the Harbinson proposal accounts for 10.6% of the potential net global gains from trade liberalisation. A corresponding comparison for the EU25 reveals that the Harbinson package only yields 10.3% of the 'potential' net welfare gains.

The changes in EU welfare are largely explained by the net CAP budget effect. The estimates predict large welfare gains to the EU15 and equivalent losses to the newer EU members, principally due to the abolition of all the single farm payment. In the EU15, the losses to net beneficiaries such as Greece and Spain are far outweighed by gains to net contributing EU15 regions (UK, Germany, Italy and the Netherlands). Meanwhile, of the net loss in CAP budgetary support of -€11.673bn to the EU10, over half (-€7.281bn) accrues to Poland. Full liberalisation also leads to sizeable increases in efficiency gains (€6.722bn), whilst full reciprocal access to non-EU25 markets yields greatly improved terms of trade gains of €3.919bn as the EU15 take advantage of greater market access and substantial improvements in world prices. Given the EU10's greater emphasis on intra-EU trade, these members are not able to take advantage of higher world prices, whilst also losing trade activity with EU15 members, resulting in a

ToT loss of -€3.013bn. It should, however, be stressed that losses to the EU10 are *relative* to the baseline, that is they erode to an extent the significant gains accruing to these members from EU membership in the baseline.

5. Conclusions.

Over recent years, the applied trade literature has consolidated with respect to the current WTO trade talks with coverage of a broad range of potential scenario outcomes. However, given the emphasis on development issues in the Round, there is a dearth of analysis on the European perspective from the trade round. In this study, we employ the Harbinson (WTO, 2003a; 2003b) and subsequent July Framework (WTO, 2004) documents to compare a 'likely' Doha scenario with a baseline scenario. A specific aim is to assess the impacts across EU member states. More specifically, the key features of this study are that we (i) employ the latest version 6 of the GTAP database, (ii) explicitly model CAP mechanisms (e.g., quotas, decoupled payments, set-aside, CAP budget etc.) to more accurately assess the asymmetric trade led welfare effects on selected EU member states, and (iii) introduce binding overhangs into domestic support, export subsidies and more importantly market access commitments.

Comparing with other similar Doha studies, we note that our EU and global long run estimates are limited. This is largely due to the tariff binding overhang, which to our knowledge is a modelling feature of only one other published study (Bouet et al., 2005). Other factors are also cited to explain the relatively smaller size of our welfare estimates including the choice of modelling assumptions (no imperfect competition, no productivity gains, no NTB estimates, explicit CAP modelling), the use of version 6 GTAP data and our scenario design (no EU25 blue box disciplines, binding overhangs on Amber Box support[38], inclusive baseline scenario). Furthermore, there are possible additional effects from export credits, food aid and State Trading Enterprises (STEs) and non tariff barriers, particularly in services sectors. In the former, none of the CGE Doha studies incorporate speculative market management instruments, whilst an assessment of their potential trade distorting effects is unclear. Hoekman and Messerlin (2006) take the view that credits and STE's are of little significance relative to export subsidies, whilst McCorriston and Maclaren (2005) conclude that STE's may, under the correct circumstances, have notable trade distorting effects. In the latter, the standard

[38] Indeed, it is noted in Anderson *et al.*, (2006) that, "extraordinarily large reductions in bound Aggregate Measure of Support are required before any reductions in actual support would occur" (p338).

GTAP database does not include services trade protection, although one CGE Doha study (Francois *et* al., 2005) attempts to bridge this gap by estimating tariff equivalents for service sector NTBs. The welfare estimates of their study (including NTB reform) are the largest of all the 'partial' (i.e., non 100% elimination) liberalisation studies reviewed in Table 2, although the 'true' values could be considerably larger.

Summarising our results for the EU25, we estimate a slight long run decline in arable, dairy and processed sugar activities, whilst there is substitution from red meat into white meat production. Given the contraction in primary agriculture, returns on agricultural specific land factors fall (mainly from export subsidies in the case of arable land), whilst unskilled labour wages also fall slightly. With asymmetric market access due to the tariff binding overhangs, the EU25 agro-food trade balance deteriorates €2.161bn. World prices, as expected rise from the Doha reform scenario, although such rises are less than 2 per cent for most sectors (except 'dairy' and 'processed sugar' sectors).

In the welfare results decomposition, tariff binding overhangs lead to limited efficiency gains and negative terms of trade effects in the EU. Decomposing the welfare gains, the global estimates show that market access accounts for the vast majority of real income trade gains. A similar pattern is observed for the EU, although as the main employer of export subsidies, their elimination has proportionally much greater impact on the positive efficiency gains which offset the terms of trade losses in the EU25. Comparing across EU members, the EU15 benefit considerably more from greater extra-EU trade linkages, whilst net contributing EU members (Germany, Italy, UK) reap the largest gains from the Harbinson package. Clearly, considerable work is to be done at the negotiating table if a trade deal is to be struck. However, if the results of our analysis are to be believed – that the EU25 is only realising 10% of its potential welfare benefit from implementing the Harbinson tiered formulae – the EU, US and Japan must take a much more positive stance in forging a meaningful outcome from the ongoing trade talks.

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7. Appendix – Characterising the Baseline in the GTAP Model.

1. Projections:

Annual average percentage changes over the long run period are collected from other CGE studies (Frandsen and Jensen, 2001; Jensen and Frandsen, 2003) other data sources (World Bank, 2005) and the author's own calculations to reflect increases in skilled and unskilled labour endowments; population; total factor productivity (TFP) in agriculture, industry and services sectors; and real GDP growth. Capital endowment growth is calibrated to changes in the projections shocks.

2. Uruguay Round (UR) Commitments.

Given the benchmark year for the data is 2001, developed countries (DCs) have completed their UR commitments. Thus, in the baseline we merely enforce the ceiling limits on **output and export subsidy expenditure** for the developed countries such that WTO members do not breach their UR commitments. For export and output subsidies, we employ WTO subsidy expenditure notifications data

(Elbehri, 2005; WTO, 2006) to calculate applied subsidy expenditures in 2001 as a percentage of allowable UR subsidy expenditure limits.[39] The allowable ceiling limits are imposed employing complementary slack conditions in GEMPACK (Bach and Pearson, 1996). For the developing countries, a linear time path is assumed where in 2001 it is assumed that $7/10^{ths}$ of the UR commitments (1994 – 2004) have been met. Thus, remaining UR commitments are based on the remaining $3/10^{ths}$ of the required total expenditure reduction.

Bilateral tariff rate reductions are implemented as percentage reductions in the exogenous tariff variable in the GTAP model. As in the previous section, for the developed countries it is assumed that in 2001 all the tariff rate commitments of the UR have been met. For the developing countries we again assume that a linear time proportion ($7/10^{ths}$) of the commitments have been met, with a remaining $3/10^{ths}$ proportion reduction imposed. For the Rest of the World (ROW) composite region, a component part consists of developing country members. Thus, a GDP share weighted reduction in the ROW's tariffs is incorporated to account for the remaining developing country UR commitments.

On a number of bilateral routes in the model, we have included **tariff rate quotas** (TRQs), that is, we have simulated an import quota with in-quota and over-quota tariff rates. In the model, TRQ's are represented by a conditional complementary slack statement pioneered by Elbehri and Pearson (2005) which is a function of the 'fill rate' of the import quota (i.e., in-quota, on-quota, or over-quota) and the tariff rate (in-quota tariff, over-quota tariff, on quota tariff).

To identify TRQ bilateral routes, we employ the Agricultural Market Access Database (AMAD), which provides necessary estimates of in-quota tariff rates, over-quota to in-quota tariff ratios and quota fill rates. However, in some cases the broad sectoral aggregation excludes the possibility of including TRQ's on narrow product definitions which will only account for a minority proportion of trade along the route. A similar argument also applies to the composite ROW region which includes a considerable number of regions which do not employ TRQs and for simplicity is excluded from the TRQ treatment. Furthermore, given the completion of the EBA deal, EU TRQs on ACP countries are also excluded.

3. Enlargement Shocks – Border Protection

All tariff rates and export subsidy expenditures are eliminated on trade between the EU15 and the accession members and on intra EU10 trade. Further tariff shocks are introduced on accession member non-EU imports to mimic the EU15 average common external tariff (CET) in 2020.

4. Agenda 2000 (A2000) commitments and the Mid Term Review (MTR)

To characterise **sugar and milk quotas** we employ complementary slack equations (Bach and Pearson, 1996) to allow binding/non-binding status of the quota. Changes in the milk quota allocations under the MTR are imposed as shocks to the exogenous production limit variable, whilst actual production is endoegenous and may be less than or equal to this level of production. For the 'new' accession members milk quota rights in 2001 (EC, 2003) are compared with granted quota rights on accession (Jensen and Frandsen, 2003) to calculate quota allocation reductions. Quotas in the primary sugar sector remain untouched for the EU regions, whilst the EU10 sugar quota is set at the level of production in the accession year (2004). Equally, we follow Lips and Rieder (2005) by assuming that the

[39] In this model, we ignore the agreed quantity constraints on exports under the UR round. Rather, we focus on export expenditure since between the two constraints, this is usually the more binding (Frandsen and Jensen, 2001).

quota rent accruing to EU15 members is already capitalised within the value of sugar/milk production in the GTAP model. Employing estimates of milk and sugar quota rents by EU15 region from Francois *et al.*, (2005) and Frandsen *et al.*, (2003) respectively, we strip out the quota rent from the payments to the factors of production in the 2001 benchmark database such that zero profit production decisions in the model are based on shadow prices (i.e., net of quota rent values) in accordance with the microeconomic analytics of quota behaviour. The remaining quota rent is now inserted as a separate income identity in the regional household income function. Since the benchmark period is a pre-accession time point for the EU10, their quota rents are zero in 2001. Subsequent imposition of the quota through complementary slack conditions allows the model to calculate endogenously the level of quota rent in the 'new' member states.

To characterise the **set aside** of land we employ a productivity variable (afeall), where a percentage reduction in afeall in the arable land using sectors by 10% implies that for every hectare used, only 0.9ha is productive. We assume that for the EU15, the GTAP benchmark data implicitly includes set aside reflected by the levels of production and demand for land in 2001 (benchmark year). Thus, no change to EU15 set-aside is implemented. In the EU10, the Commission's "prospects for agricultural markets" document (2004-2011) suggests that due to 'small farm exemptions', set-aside will be some way below the mandatory 10%. Thus an arbitrary 5% set-aside is imposed. To eliminate the possibility of land reallocation from arable to non arable sectors (as in the standard GTAP specification) in response to productivity reductions in arable land, we explicitly separate the land endowment into arable and non arable components (i.e., create two land factors). In this way, the elasticity of substitution between arable and non-arable using sectors is zero. This also reflects the notion that very little arable land is used for pasture purposes. The total arable (and pasture) land endowment is held fixed to reflect a fixed base arable land area. The quasi-decoupled nature of area and set-aside payments in 2001 is characterised as an input subsidy to the land factor in the GTAP model data.

Comparative static CGE models are generally based on medium to long run model assumptions (i.e., full employment, perfect mobility of factors, long run investment behaviour). As a result, we choose not to incorporate intervention buying which is a short run market management mechanism, thereby having limited effects on long run price and output trends. Following Frandsen *et al.*, (2003), **intervention price** falls are introduced in the 'wheat', 'other grains', 'meat processing', 'dairy' and 'sugar processing' sectors as percentage reductions in export subsidy border support. In the former three sectors, intervention price reduction shocks account for the fact that the reductions began before 2001. In accordance with the Mid Term Review agreement, we reduce the dairy sector intervention price 25% (introduced from 2005 in three equal stages). Finally, the proposed reforms for the sugar sector suggest a 39% reduction in the intervention price for white sugar and a 42.6% reduction in the intervention price for beet sugar. The GTAP data does not separate beet from cane production. Thus, we assume an aggregated 40% reduction in the sugar sector intervention price.

The benchmark year (2001) of the GTAP data falls within the reference period (2000-2002). Thus, as a starting point it is assumed that the EU15 direct payment totals[40] received in the GTAP 2001 database are indicative of the value of the **single farm payment** (SFP) reference payment total for each

[40] That is, land subsidies and capital subsidies in each region.

EU15 region. This total is adjusted to account for the fact that the SFP only applies to 10% of the set aside area. Thus, if a farm (region) has 14% of the land area set aside in the reference period, that region will only receive 10/14th's of the payment from set aside, and 90/86th's of the payment from the area premium. Further adjustments to the SFP totals are also made to incorporate additional milk and sugar sector premium payments to compensate for approved and planned (respectively) intervention price reductions. Estimates of member state milk premium totals are based on projections of output per cow per EU member multiplied by dairy herd projections for each member multiplied by premium per unit. For the sugar sector, the EU has set aside 1.5 billion euro to compensate all 25 member countries for the 40 per cent price cuts. Thus, each EU region's projected allocation is based on regional sugar beet area shares. Once each EU region's SFP is calculated, 5% of the total is removed as part of the modulation scheme to divert funds to rural development needs.[41] Finally, in accordance with the **CAP reforms for Mediterranean products**, all tobacco and olive oils production subsidies are to be included in the SFP. In addition, the Spanish government negotiated additional compensation of €20million from the Mediterranean products reform package.

It is assumed that by 2020, all EU regions will have adopted the 'maximum decoupling scenario'. Thus, to model the single farm payment, all direct payments are removed from each of the regions and reintroduced as a uniform input subsidy (i.e., hectare premium) payment on the land factor (Jensen and Frandsen, 2003). In this way, all agricultural activities receive the same reward, thereby making the payment production neutral. To implement SFPs and modulation contributions for ALL 25 EU members we follow a three-stage process. Firstly, calculated net totals (after removal of modulation contributions) for the EU15 members are allocated such that land premiums are equal across all using sectors whilst respecting precalculated payment totals. Subsequently, an average EU15 land premium is calculated and uniformly imposed in the EU10 regions. This provides an estimate of the accession members SFP totals as calculated by the model. Finally, EU10 accession member SFP totals are reduced 5% for modulation and then re-implemented ensuring that hectare premium values are equal across all agricultural sectors.

The allocation of total **modulation** contributions from across the EU25 follows the Commission's proposals. Thus, regional allocation shares are based on the agricultural area shares (65% weighting) and agricultural employment shares (35% weighting). This weighted estimate is subsequently corrected employing a relative GDP per capita weighting. A further constraint is imposed within the model to ensure that all regions receive at least 80% (as specified by the European Commission) of their initial modulation contributions.

In the 2001 benchmark, the **CAP budget** only applies to the EU15 regions. Thus, each EU15 regions makes contributions to Brussels in the form of modulation funds and 75% of agricultural tariffs, and gains receipts on output subsidies (Amber Box), direct payments (land and capital subsidies) and intermediate input subsidies (i.e., payment aids on seeds, forage, silage, disease and pest management etc.). The difference between total receipts and total contributions by each member gives the net resource cost of the CAP which is met by uniform percentage GDP contributions by each member state such that

[41] Modulation begins at a rate of 3% of direct aid payments in 2005, climbing to a ceiling limit of 5% from 2007 onwards.

the total CAP budget balances at zero. This implies that at the member state level, a region may be a net contributor (e.g., UK, Germany) or a net beneficiary (e.g., France, Spain) from the budget. In the case of, for example, Spain (UK), this would imply that regional incomes exceed (are less than) regional expenditures. Thus, to restore general equilibrium, regional savings are increased (reduced) to restore parity. Thus, at the EU level, savings remain unchanged. Over the time frame of the experiment, the EU and consequently the CAP budget expands from 15 to 25 members. Thus, dummy variables are employed to introduce the accession members into the budget mechanisms. The analysis also includes the UK rebate mechanism, where 66% of the UK's net contribution is refunded, whilst the remaining EU members fund the bill based on GDP shares. In the case of Austria, Germany, the Netherlands and Sweden, their share of the refund bill is reduced to only one quarter of their GDP share. In each of the simulations, it is assumed that the rebate mechanism is eliminated by 2020.

5. Chinese Accession

To characterise **Chinese Accession**, we exogenously reduce unilateral tariff rates to meet target projected post accession tariff estimates from Ianchovichina and Walmsley (2003)

6. Everything But Arms

In the **Everything But Arms** (EBA) deal, we capture long run tariff eliminations by the EU25 on imports from Botswana, Madagascar, Malawi, Mozambique, Tanzania, Uganda, Zambia, Zimbabwe and composite regions for the rest of South- and Sub-Saharan Africa.