

Agricultural Trade Liberalisation in the Doha Round: Impacts on Spain¹

George Philippidis

ABSTRACT: Whilst there is a growing literature of computable general equilibrium (CGE) studies examining the impacts of the current Doha Proposals, estimates for the EU are highly aggregated (i.e., EU15). Employing a detailed baseline scenario and a plausible Doha outcome, we examine the long run costs for the European Union, in particular focusing on Spain. Moreover, we implement recent CAP reforms through explicit modelling of CAP mechanisms to provide greater credibility in assessing the long run asymmetric budgetary and welfare impacts on EU member states. The estimates forecast resource substitution effects between Spanish agro-food sectors and resource shifts from agro-food activities into manufacturing and services production. In Spain, the impacts of proposed Amber box reductions on fishing subsidies and the relatively smaller GDP contribution result in negative CAP budgetary impacts on regional income. In contrast, France, Germany and the UK all realise small real income gains.

KEY WORDS: Doha Round, Spain, EU, CAP, Computable General Equilibrium.

JEL classification: F1, F13, F17.

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Dirigir correspondencia a: George Philippidis. Centro de Investigación y Tecnología Agroalimentaria (CITA). Avda. Montañana, 930. 50059 Zaragoza.
E-mail: gphilippidis@aragon.es.

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La liberalización de comercio agrícola en la Ronda de Doha: los impactos sobre España

RESUMEN: Los estudios de equilibrio general (EG) que examinan el impacto de las propuestas de la Ronda Doha se han centrado en la Unión Europea (UE) como un agregado. Partiendo de un escenario base detallado y un resultado plausible de las negociaciones de Doha, se examinan los costes a largo plazo para la UE, con especial énfasis en España. Se examinan además, las recientes reformas de la PAC para proporcionar una mayor credibilidad a la estimación de los efectos presupuestarios y sobre el bienestar de los países miembros. En España, el modelo predice una reorientación de los recursos desde el sector agro-alimentario hacia el manufacturero y de servicios. Asimismo, el impacto de la reducción en la caja Ámbar sobre los subsidios a la pesca y la relativamente menor contribución al PIB conducen a impactos negativos del presupuesto de la PAC sobre la renta regional. Por el contrario, Francia, Alemania y el Reino Unido se benefician de pequeñas ganancias reales en renta.

PALABRAS CLAVE: Ronda de Doha, España, UE, PAC, Equilibrio General.

Clasificación JEL: F1, F13, F17.

1. Introduction

The conclusion of the sixth Ministerial WTO meeting in Hong Kong, in December 2005, was the latest in a series of high profile summits to forge ahead with multi-lateral trade liberalisation. Officially launched at the Fourth WTO Ministerial Conference in Doha in November 2001, it was agreed that this round should focus the talks on the themes of growth and development. Originally the Doha Round was scheduled to conclude in January 2005, however, it has suffered numerous setbacks largely due to intransigence by WTO members to agree firm commitments on agricultural protection and support. Indeed, tensions came to a head at the Fifth WTO Ministerial meeting at Cancún in September 2003, where acrimonious differences between developing and industrialised countries arose over a lack of resolve to support earlier rhetoric on «development issues» which had been banded at the official launch two years prior.

A number of computable general equilibrium (CGE) assessments on the effect of the agricultural agreement have surfaced in the applied trade literature in recent years (Francois *et al.*, 2005; Bouet *et al.*, 2005; Anderson *et al.*, 2006). The key advantage of CGE characterisations is that they enable the modeller to simulate detailed bilateral trade protection and support «shocks» across a range of countries, whilst yielding useful estimates of the impacts of such economic shocks on prices and quantities, both traded and domestic. Indeed, common to each of the forementioned studies is the use of the Global Trade Analysis Project (GTAP) database, which with its detailed input-output trade and final demand accounts as well as detailed support and protection data across numerous regions and sectors, is the most up to date and comprehensive global trade database of its type.

All of the studies reviewed in this paper present results for broad regional aggregates (i.e., EU), focusing more on the relative impacts of policy instruments (i.e.,

market access, export subsidies, domestic support) whilst in this study an explicit aim is to examine the potential welfare impacts of the Doha Round proposals in their current form on Spain from a «likely scenario» and contrast these where appropriate with other select EU members and the European Union average. As well as incorporating a fully inclusive baseline scenario including long run «background» trade policy shocks (Projections, Chinese Accession, Everything But Arms, Uruguay Round Constraints, EU Enlargement), a further unique feature of this study compared with the studies above is that we explicitly model all major CAP support mechanisms (i.e., quotas, set-aside, EU budget contributions, single farm payment) and reform policies (e.g., Agenda 2000, the Mid Term Review, Mediterranean products reform package) to provide greater accuracy on the long run asymmetric effects the Doha Round may have on different EU member states².

2. Background

Prior to the Uruguay Round (UR), agricultural trade had been largely exempt from the trade laws applicable to other sectors. For example, export subsidies employed prolifically by the European Union (EU) faced no disciplines, whilst the ubiquity of non-tariff barriers had, hitherto, been untouched. Furthermore, whilst manufacturing tariffs declined from highs of 30 to 5% in the three decades leading up to 1985, agricultural support prices, whilst declining in real terms, appreciated relative to world prices leading to raised levels of protection.

With the power of hindsight, the UR came up short in its attempts to radically liberalise agricultural trade, however, the agreement can be earmarked as a success in that it set up a firm platform for future trade rounds. For example, as a forum of debate, the three pillar framework (i.e., market access, export subsidies, domestic support) greatly improved the degree of transparency through both «tariffication» and the introduction of the Amber, Blue and Green Box measures. Moreover, the dispute settlement procedure has been used effectively to bring many countries» policies into compliance with new disciplines. Notwithstanding, in the wake of the UR a number of issues remained unresolved.

Firstly, average tariff rates in agricultural trade remained some way above non-agricultural tariffs. This is because «tariffication» permitted WTO members significant latitude in establishing tariff-equivalents³, whilst allowing average tariff reductions to apply across all agricultural products. Secondly, the administration of Tariff Rate Quotas (TRQs) gave countries considerable flexibility in allocating their market access quantities at the in-quota tariff. Accordingly, TRQs lock in preferential access to traditional trading partners thereby limiting access to other WTO members. Expanding TRQ levels or reducing high over-quota tariffs would further open markets and

² To the author's knowledge, only one study (Brockmeier *et al.*, 2003) explicitly incorporates modeling of the CAP in the policy scenarios, although they only report a limited range of results for the EU27 composite region rather than across specific EU regions.

³ Subsequently known as «dirty tariffication».

new rules could reduce or eliminate unfair practices associated with administering TRQs.

Thirdly, though outlawed in principle, non-tariff barriers remain through the TRQ schemes and, *inter alia*, technical barriers (e.g., labelling, size, quality), health and safety requirements, sanitary and phytosanitary standards and red tape. Fourthly, the rules regarding the use of export credit system favoured by the USA and other forms of marketing assistance for exports, remained unresolved. Finally, commitment on domestic support only applied to aggregate support categories rather than individual commodities, thus allowing high support to continue for more sensitive products. In addition, member countries have strategically employed exemptions on the Blue Box (Peace Clause) and Green Box due to the lack of clarity on what exactly constitutes minimally trade distorting trade programmes.

3. The Harbinson Proposals and the July 2004 Framework

Following the submission of proposals by WTO member countries in February 2003, the Chairman of the Agriculture Negotiating Committee (Stuart Harbinson) produced his *Negotiations on Agriculture: First Draft of Modalities for the Further Commitments* (WTO, 2003a), subsequently revised in March 2003 (WTO, 2003b). 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 lack of alternatives; and reflected a mix of negotiating countries» various positions.

In *market access*, it was proposed that tariffs, except in-quota tariffs, shall be reduced by a simple average for all agricultural products subject to a minimum reduction per tariff line. The base for the reductions shall be the final «bound» rather than «applied» tariffs. The tariff reductions shall be implemented in equal annual instalments over a period of five years for developed countries, applying the formula in table 1 column II.

As can be seen in Table 1, the lower the initial tariff, the lower the tariff cut. This was seen as advantageous over the UR market access agreement in that it reduces tariff peaks, whilst «trade-offs» between cutting higher and lower tariffs to meet the average tariff cut can only be made in the respective groups of tariffs. The Harbinson Paper also proposes increased market access through increases in tariff rate quotas to 10% of present domestic consumption.

Export subsidy reduction commitments will use the final bound levels from 2000 as their starting point and be eliminated entirely over a nine year time frame with a heavy «front-loading» emphasis on the first five years. Indeed, this initiative was ratified at the Hong Kong summit, where it was agreed to totally eliminate export subsidies in cotton and agriculture by the end of 2006 and 2013 respectively. Finally, 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 over 5 years. Blue Box spending is to be bound at 1999-2001 (average) levels and reduced by 50 per cent

TABLE I
Illustration of the Harbinson Formula for tariff reductions

Developed Countries		Average reduction rate		
Existing tariff level	(I) Low (S1)	(II) Harbinson proposal (S2)	(III) High (S3)	
Greater than 90 per cent	40%	60%	80%	
Between 15 and 90 per cent	30%	50%	70%	
Lower than or equal to 15 per cent	20%	40%	60%	
Developing Countries		Average reduction rate		
Existing tariff level	(I) Low (S1)	(II) Harbinson proposal (S2)	(III) High (S3)	
Greater than 120 per cent	20%	40%	60%	
Between 60 and 120 per cent	15%	35%	55%	
Between 20 and 60 per cent	10%	30%	50%	
Lower than or equal to 20 per cent	5%	25%	45%	

Adapted from: WTO (2003a, 2003b).

over 5 years, or included in the Amber Box and effectively cut by 60 per cent. Green Box exemptions shall be maintained with a general tightening of certain criteria for program inclusion. However, one Green Box category, «environmental programs», is expanded to permit payments for animal welfare programs (as a legitimate non-trade concern).

Given the large discrepancies between the negotiating positions of the member countries to the Harbinson proposals, the decisions reached in the *July 2004 Framework* (WTO, 2004) could be criticised for being somewhat nebulous. Proponents of the July 2004 Framework, however, point out that it provides firm commitments across all three agricultural pillars and that, while it does not prescribe the exact nature of the cuts, it provides a platform for further negotiations.

Further issues also arose from the July 2004 Framework pertaining to market access for «sensitive products» and the extension of export subsidisation to include export credit programmes, state trading enterprises and food aid not conforming with various disciplines. 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. Moreover, the *de minimis* level of support is to be discussed whilst product-specific Amber Box support will be capped in order to avoid shifting support between different products. Since the tiered formula applies to the total of support on all products, the text also states that cuts in support will be specified for some products. Blue Box support, previously protected by the «Peace Clause» is facing a cap of no more than 5% of agricultural production, although flexibility will be allowed for countries (i.e., EU) whose Blue Box supports are an exceptionally large proportion of their trade distorting subsidies. Moreover, the definition of the Blue Box will

be re-examined to ensure that this class of payments (linked to fixed production limits) are genuinely less trade-distorting than Amber Box measures.

4. Empirical Studies of the Doha Round

A review of the recent trade literature on the effects of the Doha Round is presented in table 2. As noted in the introduction, a common feature of these studies is the use of the GTAP multi region data base. However, it is surprising to note that given the usage of a single data source, the outcomes for global EV changes can still differ quite substantially between studies. One explanation for these differences is the variation in model assumptions employed which have the effect of boosting the welfare estimates. For example in dynamic CGE models (Beghin *et al.*, 2001; Anderson *et al.*, 2006) capital accumulation effects through successive time periods can greatly increase household incomes compared with comparative static CGE model counterparts⁴. The assumption of imperfect competition also raises the welfare estimates through introduction of additional non-standard market distortions such as «pro-competitive» (Hertel, 1994) or «love of variety» effects (Dixit and Stiglitz, 1977).

Welfare magnification effects in developing countries also occur through the imposition of trade-productivity linkages as productivity improvements in developing countries are greatly enhanced through assumptions of technology transfer. In addition, the inclusion of non-tariff barrier (NTB) estimates in the GTAP services protection data can dramatically change model outcomes.⁵ The study by Francois *et al.*, (2005) includes «approximations» of NTB equivalents which are inserted into the services protection data in GTAP. The impacts of this addition are considerable, where the welfare gains recorded are the largest of all the «partial» (i.e., non 100% elimination) liberalisation studies reviewed in Table 2. The effects of some of these modifications, whilst advantageous in that they incorporate aspects of «modern trade theory», may possibly introduce some degree of uncertainty as to their validity⁶.

Other sources of variation stem from the benchmark year of the GTAP data. Version 5 employed is benchmarked to 1997, which implies greater tariff peaks than included in version 6 (2001 benchmark year). Thus under tariff reform scenarios, this may imply greater welfare impacts in the former data version. Moreover, version 6 is based on applied tariff rates only, whilst version 5 used both applied and bound rates

⁴ In CGE models, it is normally assumed that the household(s) own the factors of production.

⁵ Due to their pervasiveness and variation in design, NTBs are challenging to enumerate. This constitutes an important weakness of the current GTAP database.

⁶ 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.

TABLE 2
Previous trade liberalisation estimates

Study	Model	Liberalisation Scenario	Notes	Welfare (US\$bill)		
				Agric	Other	Total
Anderson <i>et al.</i> (2000) ^a	GTAP	100% Liberalisation, all sectors, all tariffs all regions		165	90	254
Beghin <i>et al.</i> (2001) ^a	LINKAGE Dynamic GTAP data	100% Liberalisation, agriculture only, all policies high income countries only	Dynamic model	82		
USDA (2001) ^a	CGE Dynamic	100% Liberalisation, agriculture only, all policies	Standard version	31	na	na
OECD (2003) ^a	GTAP	100% Liberalisation, all sectors, all tariffs		34	63	97
Francois <i>et al.</i> (2003) ^a	GTAP	100% Liberalisation, all sectors, all tariffs all regions	Increasing returns to scale	109	257	366
		50% Liberalisation, all sectors, all tariffs all regions	Standard version	28	104	132
Brockmeier <i>et al.</i> (2003)	GTAP	Harbinson Proposals (includes CAP modelling)	Standard version	na	na	na
World Bank (2004) ^a	LINKAGE Dynamic GTAP v6 data	100% Liberalisation, all sectors, all policies all regions	Standard version	193	98	291
Beghin & Van Mensbrugge (2004) ^a	LINKAGE Dynamic GTAP v6 data	100% Liberalisation, all sectors, all tariffs all regions	Dynamic model	120	264	384
Francois <i>et al.</i> (2005)	GTAP v6	50% Liberalisation, all sectors, all tariffs all regions	Increasing returns to scale	30	138	168 ^b
Anderson <i>et al.</i> (2006)	LINKAGE GTAP v6 data	Harbinson proposal	Dynamic model			66 ^c 119 ^d

Notes: a) Studies adapted from Van Tongeren *et al.* (2001), Osbourne (2005) and Renwick *et al.* (2005); b) Includes services liberalisation; c) Harbinson proposal on agricultural commodities only; d) Harbinson proposal on agricultural commodities plus 50% cut in non agro-food tariffs.

(where applied rates were unavailable). This has implications for the treatment of the binding overhang (difference between bound and applied rates), such that when the scenarios reduce applied levels of tariffs, they may overstate the true effect on market access. Finally, a further cause of variation occurs from the «scenario design» where the *degree* of reform in tariffs, export subsidies and Amber Box and the choice of reforming regions in the aggregation vary between studies.

5. Modelling and Scenarios

5.1. GTAP Data and Aggregation

This study employs the GTAP CGE model (Hertel, 1997) and accompanying version 6 database (Dimaranan and McDougall, 2005). Version 6 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 data⁷.

The choice of regional aggregation covers the Spanish economy and the «big three» (Germany, the UK and France), with the rest of the EU15 region (REU15) and accession ten (EU10) making up the EU. The remaining regions are key players on world agricultural markets (USA, Brazil, China, India, Japan) whilst the Rest of the World (ROW) region captures «residual» production and trade flows in our chosen model aggregation.

FIGURE 1

Aggregation of Regions and Sectors

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

Wheat (wheat) – Soft Wheat, Durum Wheat; **Other Grains** (ograins) – Rye, sorghum, barley, oats, maize, millet, other cereals; **Oilseeds** (oilseeds) – Rape and mustard seed, sunflower seed, soyabean, 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; **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** (pigs poultry) – 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) – Meat products (bovine, sheep and goat); **Other meat processing** (omeatpro) – Eggs and egg products, 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 (12 Regions)

Spain; UK, France, Germany, REU15; EU10; USA; Brazil; China; India; Japan; Rest of the World (ROW).

⁷ The improvements in the collection, reconciliation and application of the tariff data sources are documented in chapter 16.D of Dimaranan and McDougall (2005).

As noted at the beginning of this paper, tariff peaks in agro-food trade are considerably greater than in non-food sectors, whilst a key focus of the round has been the improvement of market access in agricultural markets to facilitate trade led growth in developing countries. For these underlying reasons, the choice of sectoral aggregation (see Figure 1) is biased toward the agricultural and food processing sectors, whilst non-food sectors are captured through composite sector aggregates.

5.1.1. Spanish Agriculture and GTAP data

Whilst the CAP has been reformed, it still favours larger farming units since payments are indirectly awarded on the basis of production levels (i.e., the amount of inputs used). This has resulted in considerable restructuring of farming in many EU partners including Spain, with many smaller farmers being left marginalised or forced to leave the land and the emergence of a rationalisation of the agricultural sector into fewer large-scale farming units⁸. Indeed, on the one hand the real value of agricultural output in Spain between 1990 and 2003 has been steadily increasing (MAPA, 2004), particularly in cereals, fruit, olive oil, cattle and pork production. This is largely in response to the European reforms introduced during the 1990s. On the other hand, the industry has seen a continuing exodus of farmers where MAPA (2002a) figures suggest that the reduction in agricultural labour between 1990 and 2001 could be as large as 36 per cent.

TABLE 3

Comparative descriptive statistics for agriculture and food – GTAP v6 database

(%)	France	Germany	Spain	UK	EU15	EU10
1. Share of EU15 GDP	16,7	23,4	7,4	18,0	100,0	n.a.
2. Share of EU25 GDP	15,9	22,4	7,0	17,2	95,6	4,4
3. Agric. share of national GDP	2,2	1,3	3,4	0,9	1,9	3,7
4. Food share of national GDP	5,0	4,5	6,2	5,3	5,1	9,3
5. Agro-food share of nat. GDP (3+4)	7,2	5,8	9,6	6,2	7,0	13,0
6. Agric. share of EU15 production	18,3	16,8	12,3	8,3	100,0	n.a.
7. Agric. share of EU25 production	16,5	15,2	11,1	7,5	90,2	9,8
8. Food share of EU15 production	15,6	21,3	8,5	18,8	100,0	n.a.
9. Food share of EU25 production	14,1	19,3	7,7	17,1	90,8	9,2
10. Agro-food share of EU15 production	16,3	20,1	9,5	16,0	100,0	n.a.
11. Agro-food share of EU25 production	14,8	18,2	8,6	14,5	90,6	9,4

Source: Dimaranan and McDougall (2005)

Notwithstanding, compared with fellow EU members, the Commission's figures for 2002 (EC, 2002) suggest that primary agriculture in Spain is still relatively important accounting for 3% of national GDP compared with a corresponding EU15 average of 2%, whilst approximately 13% of EU15 agricultural production comes from Spain. These figures largely concur with the descriptive statistics from the GTAP data

⁸ However, Spanish farming still remains largely fragmented relative to the EU15 average.

in Table 3 which compares the Spanish economy with the «big three» and the EU averages. Equally, processed food production is also important to the Spanish economy accounting for 16% of total industry revenue, and 10% of EU15 output, whilst between 1995 and 2000 food processing growth was 20% with accompanying employment growth of 6% (MAPA, 2002a).

Examining the GTAP 2001 domestic support data for Spain reveals much about the sectoral allocation of the CAP payments. Spain is the biggest recipient in the EU of production related (i.e., Amber Box) payments⁹ (€ 1,365bn in 2001) largely through payments on production of olive oil (€ 0,999 bn), bananas (€ 0,167 bn) and tobacco (€ 0,116 bn) in the «oilseeds», «ocrops» and «vegfruitnuts» aggregate sectors respectively. Spain is also the fourth largest recipient of decoupled payments (area and set-aside payments) to the cereals sector (after France, Germany and Italy) and the third largest recipient of CAP funding in the cattle and sheep sector (cow, ewe and goat premia, extensification premia) after France and the UK. Of the € 45bn spent on agricultural support, Spain received €5.872bn., third after France (€ 9,978 bn) and Germany (€ 6,908 bn). Indeed, given the relative size of the Spanish economy, this explains why Spain is consistently the largest net beneficiary from the CAP budget in nominal terms¹⁰. Interestingly, the allocation of support in Spain reveals that (in order) the five regions of Andalucía, Castilla-León, Castilla-La Mancha, Extremadura and Aragón received approximately 70% of CAP support in 2000 (MAPA, 2002b).

In terms of trade protection, the largest export subsidies across the EU regions appear in the aggregate «meatpro», «sugarpro», «ograins» and «dairy» sectors¹¹. Finally, aggregate *ad valorem* tariff protection in Spain is skewed heavily toward the agro-food sectors, whilst tariff peaks appear for «meatpro» (76%), «sugarpro» (35,8%), «dairy» (30,9%), «ograins» (24,7%), «omeatpro» (22,1%), «vegoilsfats» (20,6%) and «oagric» (19,8%) (see Figure 2).

5.2. GTAP Model¹²

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. To characterise consumer demands, neoclassical utility maximisation procedures are employed to determine three types of «regional household»¹³ final demand: private expen-

⁹ Represented in the GTAP database as output subsidies.

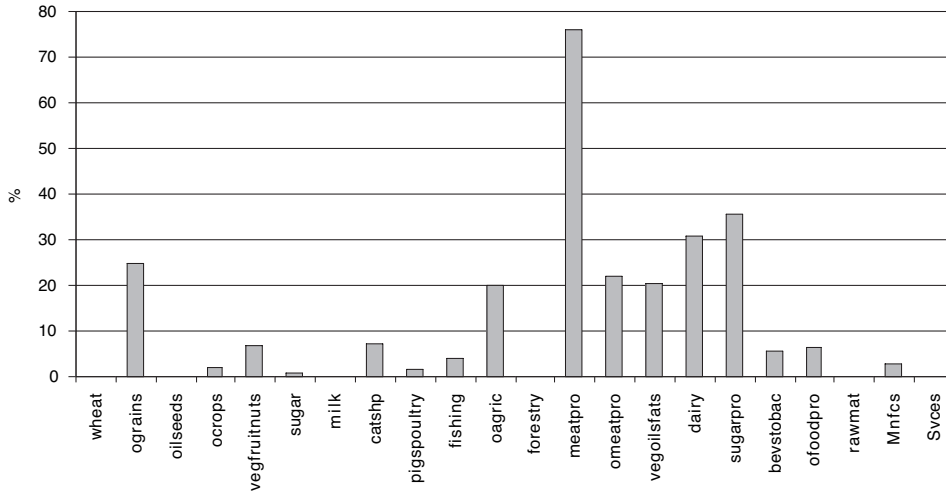
¹⁰ As a proportion of GDP the largest gainers are Portugal and Greece.

¹¹ See figure 1 for a detailed composition of the aggregate sectors.

¹² A full description of the GTAP model structure can be found in Hertel (1997).

¹³ 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.)

FIGURE 2
Average *ad valorem* tariff rates on Spanish imports by sector



Source: Dimaranan and McDougall (2005).

ditures (import and domestic demands for goods/services), public expenditures (import and domestic demands for goods/services) and savings (investment expenditure). Thus, in the model, a Cobb-Douglas utility function for region «r» consisting of private consumer demands (UP_r), government (or public) consumer demands (UG_r) and savings (investment demands) ($USAVE_r$), where α , β , and δ are elasticities:

$$U_r = UP_r^\alpha UG_r^\beta USAVE_r^\delta \quad [1]$$

Maximising [1] subject to the regional budget constraint, yields Cobb-Douglas (CD) regional Marshallian aggregate demands by each agent:

$$UP_r = \frac{Y_r}{PRIV_r} \alpha \quad UG_r = \frac{Y_r}{PGOV_r} \beta \quad USAVE_r = \frac{Y_r}{PSAVE_r} \delta \quad [2]$$

Weak separability assumptions are employed to further partition aggregate private and public consumer decisions into «nests» (multi-stage budgeting) based on conventional neo-classical behaviour (cost minimisation). Thus, at the second level of the nest, private expenditures are minimised subject to a non-homothetic constant differences in elasticities (CDE) function¹⁴ to yield «composite» (i.e., imports and

¹⁴ The CDE function is allows the modeller to calibrate differing price and income elasticities which offer an much richer characterisation of final demands than the standard Cobb-Douglas (CD) or CES functions. Unlike CD or CES, the CDE function is non-homothetic, which means that demand patterns

domestic) Hicksian commodity demands. At the third layer of the nest, expenditure is minimised subject to a constant elasticity of substitution (CES) function, which yields disaggregated Hicksian demands by origin (i.e., domestic vs. composite imported). The composite imports and then disaggregated by region of origin at the fourth level of the nest employing a CES expenditure minimisation procedure¹⁵. The nesting structure of public expenditures is the same, except in the second level of the nest, the CDE function is substituted for a simpler CD treatment.

The production structure is also nested. At the top nest, production is a Leontief function of all primary factor (value added) and all intermediate input demands. At the second level of the production nest, factor or input «i» demands are determined employing CES cost minimisation, whilst the derivation of intermediate input demands into domestic and composite imports (nest level 2) and imports by region of origin (nest level 3) follows the same CES treatment as the consumption nested structure. Production activities are characterised as perfectly competitive and constant returns to scale, whilst supply by each sector is «demand driven» employing zero profit equations (i.e., supply equals final demand)¹⁶. Thus, value of production of good «j» in region «r» ($VOA_{j,r}$) is determined by total primary factor (enow) and intermediate input (input) demand costs by using sector «j» in region «r» ($VFA_{i,j,r}$).

$$VOA_{j,r} = \sum_{i \in enow} VFA_{i,j,r} + \sum_{I \in input} VFA_{i,j,r} \quad [3]$$

The total supply or endowment of primary (enow) factor «i» ($QO_{i,r}$), is classified as either mobile or «sluggish». The price of each mobile factor is determined by a single regional market clearing equation (i.e., total demand equals total supply), such that the price is uniform across *all* using sectors (prod) «j» within a region «r» (perfect factor mobility). In the case of a sluggish factor, their movement is controlled through a constant elasticity of transformation (CET) function:

$$QO_{i,r} = A_{i,r} \left[\sum_{j \in prod} \delta_{i,j,r} QOES_{i,j,r}^o \right]^{\frac{1}{\rho_i}} \quad \sigma_i = \frac{\rho_i}{1 - \rho_i} \quad [4]$$

where $\delta_{i,j,r}$ is a CET share parameter; $A_{i,r}$ is a scale parameter; and ρ_i is an elasticity parameter. Maximising the returns to the factors of production yields sluggish factor

are now a function of income level (indifference curves are not radial projections from the origin). Thus, unlike a homothetic function, we cannot assume that the population of consumers in a region behave in the same way as the individual. GTAP gets around this aggregation by introducing an exogenous population variable into the model demand structure. Technically, the maximisation function [1] in the top nest is a *per capita* utility function.

¹⁵ This third level disaggregation is also known as the Armington (1969) specification which permits two-way trade in otherwise homogeneous products through use of the elasticity of substitution between competing products. Thus, the larger the elasticity value, the greater the degree of substitutability between competing products. Effectively, this specification differentiates otherwise homogeneous products by linking product differentiation with exogenous considerations related to region of origin.

¹⁶ In GTAP there are no explicit supply functions for goods and services.

«i» supplies to each sector «j» ($QOES_{i,j,r}$), where the elasticity of transformation (σ_i) determines the degree of supply responsiveness to relative price changes between using sectors «j». To maintain equilibrium, market clearing equations between sluggish primary factor demands ($QFE_{i,j,r}$) and supplies ($QOES_{i,j,r}$) are implemented for each using sector «j»:

$$QFE_{i,j,r} = QOES_{i,j,r} \quad [5]$$

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 apportion investment demands (i.e., regional savings) across regions, GTAP employs a fictitious agent, known as the «global bank», which collects global investment funds (all regions» savings) and disburses them to each region based on fixed regional investment shares. Assuming all domestic and trade markets clear, the supply of global capital/investment goods ($WALRAS_SUP$) must be equal to the sum of all savings demands ($WALRAS_DEM$). This is checked in the model where a non-zero value of the endogenous variable, $WALRASLACK$ (which is swapped with the numeraire global factor price index «pfactwld») implies a violation of Walras» Law.

$$WALRAS_SUP = WALRAS_DEM + WALRASLACK \quad [6]$$

Once the model structure is formalised and calibrated to the 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, primary factor supplies, technical change variables, etc.). The model responds with the interaction of economic agents within each market, where an outcome is characterised by a new series of equilibrium conditions.

6. 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 Scenarios. The composition of the baseline scenario is presented in figure 3, whilst details of the modelling of the baseline are presented in the appendix¹⁷.

In comparison with the baseline we examine 3 alternative scenarios. In Scenario 2, we include the baseline shocks and in addition examine a «likely» outcome based on the Harbinson proposal and the subsequent July 2004 Framework. Thus, «average» *ad valorem* tariffs in scenario 2 are reduced in accordance with table 1¹⁸. In the

¹⁷ It should be noted that a potential source of bias to the model results is the relatively simplistic baseline treatment of non-food sectors (focusing only on the Uruguay Round market access commitments).

¹⁸ Given broader sector aggregates in the GTAP, we do not attempt implement minimum tariff line reductions.

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 present consumption. Moreover, the study follows the spirit of Anderson *et al.* (2006) by employing a stylised tariff reduction in the non-agricultural sectors equivalent to the Harbinson tariff tiers employed in agro-food sectors. Furthermore, we follow the current Doha proposals by abolishing all export subsidies, whilst reducing Amber Box (output subsidies) support by 60 (40) percent for developed (developing) countries. In the EU, since the single farm payment (SFP) effectively transfers payments out of the Blue Box (as argued by the EU) no expenditure limits are implemented. The findings in the empirical trade literature suggest that market access accounts for the majority of regional welfare gains (Renwick *et al.*, 2005). Thus in scenarios 1 and 3 we conduct a sensitivity analysis on the tariff reductions (see Table 1)¹⁹.

6.1. Baseline Impacts in the Member States.

Table 4 reports the impacts of the baseline scenario on the key summary statistics reported in Table 3. Thus, comparing between 2001 (Table 3) and 2020 (Table 4), the results show slight reductions in the size of the French and German economies, whilst the UK economy grows slightly in relative terms. These positions reflect the greater macroeconomic growth forecasts for the UK in comparison with France and Germany.

TABLE 4
Comparative descriptive statistics for agriculture and food in 2020 – GTAP v6 database

(%)	France	Germany	Spain	UK	EU15	EU10
1. Share of EU15 GDP	16,3	21,9	7,4	18,4	100,0	n.a.
2. Share of EU25 GDP	15,3	20,7	7,0	17,3	94,3	5,7
3. Agric. share of national GDP	1,9	1,2	2,9	0,8	1,7	3,2
4. Food share of national GDP	4,5	4,2	5,4	4,7	4,6	9,3
5. Agro-food share of nat. GDP (3+4)	6,4	5,4	8,3	5,5	6,3	12,5
6. Agric. share of EU15 production	18,1	15,6	12,0	8,3	100,0	n.a.
7. Agric. share of EU25 production	16,2	14,0	10,9	7,4	89,0	11,0
8. Food share of EU15 production	15,5	20,3	8,5	18,5	100,0	n.a.
9. Food share of EU25 production	13,8	18,0	7,4	16,4	88,6	11,4
10. Agro-food share of EU15 production	16,2	19,1	9,4	15,8	100,0	n.a.
11. Agro-food share of EU25 production	14,4	16,9	8,3	14,0	88,8	11,2

Author's own calculations.

Spain's relative economic position remains relatively unchanged in 2020. The post baseline statistics also show a slight relative improvement in the EU10's economic size. Again, this reflects higher GDP growth forecasts in the EU10 compared

¹⁹ Another important form of sensitivity analysis is the variation in the exogenous elasticities of substitution chosen in the GTAP model. Due to limitations of space only one sensitivity analysis has been conducted in this paper.

FIGURE 3
Assumptions shaping the baseline scenario

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. 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 ROW.

with the EU15. The calibrated income elasticities in the GTAP private demand function are considerably higher in non-agricultural activities (especially in services), implying relative reductions in the consumption of agro-food products as per capita incomes rise (from increases in endowment income). Thus, the relative importance of the agro-food sector falls across the EU25, particularly in Spain which has a relatively larger farming base than its EU15 counterparts. Finally, it is worth noting that the benefits of EU membership lead to a redistribution in agro-food production activity towards the «newer» EU10 members. This change largely reflects the projected increases in agricultural intensive unskilled labour in the EU10 *relative to the EU15*.

6.2. Results for Spain – Factor Prices, Trade Balances, Output and Market Prices²⁰

Table 5 shows the percentage changes on returns to land, labour, capital and the regional factor price index (pfactor) in Spain relative to the baseline. Land is specific to the agriculture sector²¹, where the overall contraction of the primary agricultural sector relative to the baseline is reflected in falling land prices. Moving from scenario 1 to 3, arable land slight price falls are driven largely by contractions in «vegetables, fruit and nuts» production. In «other» land, the opposite trend occurs largely due to increased production in the «pigs and poultry» sector²². Unskilled labour wages also marginally fall compared with the baseline, whilst moving across the scenarios, this fall increases slightly. This is due to the relatively higher intensity of unskilled labour in the agriculture sector. Resource reallocations into non-food sectors (manufacturing and services) push up the factor returns on skilled labour and capital. In Spain, greater market access re-enforces this effect which leads to increases in the regional factor price index.

TABLE 5
Percentage Changes in Spanish Factor Prices

(%)	S1 – Low Tariff cuts	S2 – Harbinson Proposal	S3 – High Tariff cuts
Arable Land	-3,87	-4,13	-4,64
Other Land	-2,19	-2,10	-1,97
Unskilled Labour	-0,25	-0,27	-0,28
Skilled Labour	-0,04	0,05	0,09
Capital	-0,02	0,01	0,02
pfactor	-0,02	0,04	0,07

Table 6 shows changes in Spanish market prices, trade balances and output from implementation of the Round relative to the baseline scenario. The market price estimates are aggregated over domestic and import purchases. Since import tariff rate reductions reduce the «insulation» between artificially high internal market prices and world prices, market prices fall in most sectors, although the magnitude of the long run price falls appears to be fairly small. The main exceptions are «dairy», «sugar-pro» and «vegoilsfats» sectors²³ which have relatively significant trade activity (com-

²⁰ It should be noted that all value estimates in the results are in 2001 prices, in millions of euro (€m) and relative to the baseline. Further, note that percentage changes (also relative to the baseline) are in some cases from a large base as in composite sectors such as manufacturing and services.

²¹ In this study, land has been separated into «arable» and «other» uses (see appendix, section 4). Note that in GTAP, all land is employed in production (i.e., there is no fallow land).

²² In value terms the «vegfruitsnuts» sector is the largest primary agricultural sector in Spain followed by «pigs/poultry» and «fishing».

²³ Meatpro market price falls are relatively small despite having heavy import protection in Spain. This is because the level of import trade in the Spanish data is relatively small compared with domestic production.

pared with domestic sales). In the upstream «sugar» and «milk» sectors, market price falls are a function of declining quota rent values (compared with the baseline) due to reduced demand from downstream «dairy» and «sugarpro» sectors. Successively higher foreign access to Spanish «dairy» and «sugarpro» markets leads to a greater drop off in intermediate demand for upstream «sugar» and raw «milk» leading greater falls in rents and market prices. In the «oilseeds» and «fishing» sectors, market prices are dominated by the 60% reduction in production related (Amber Box) support, represented in GTAP as a production subsidy²⁴.

TABLE 6
Spanish Trade Balances, Market Prices and Output

	Trade Balance (€m 2001)			Market Prices (%)			Output (%)		
	S1	S2	S3	S1	S2	S3	S1	S2	S3
wheat	4,6	7,7	11,5	-	-	-	-	1,16	2,70
ograins	-	-	-1,5	-	-	-	-1,11	-	-
oilseeds	-73,6	-64,3	-54,7	1,95	1,84	1,74	-4,41	-4,69	-5,00
ocrops	30,7	40,6	51,7	-	-	-	+	1,40	1,93
vegfruitnuts	-34,8	-81,1	-127,2	-	-	-	-	-1,47	-2,22
sugar	+	+	+	-3,35	-4,69	-5,81	0,00*	0,00*	0,00*
milk	nt	nt	nt	-2,12	-2,16	-2,26	0,00*	0,00*	0,00*
catshp	1,0	+	1,0	-	-	-	-1,07	-1,10	-1,26
pigspoultry	+	2,5	4,4	-	-	-	-	+	+
fishing	-16,9	-16,7	-16,5	2,82	2,81	2,81	-1,68	-1,68	-1,69
oagric	22,0	19,3	12,0	+	+	-	3,65	2,82	1,30
forestry	-	-	-	+	+	+	+	+	+
meatpro	-20,8	-21,6	-22,3	-	-	-	-1,03	-1,05	-1,21
omeatpro	-21,6	6,5	37,8	-	-	-	-	+	+
vegoilsfats	-85,2	-131,4	-179,8	-2,07	-2,11	-2,15	-3,80	-5,37	-6,99
dairy	-8,7	-9,0	-9,5	-2,14	-2,96	-3,11	-	-	-
sugarpro	+	+	-	-4,34	-5,93	-7,39	-	-	-
bevstobac	5,2	7,0	9,0	-	-	-	+	+	+
ofoodpro	-54,0	-64,1	-74,7	-	-	-	-	-	-1,03
rawmat	12,5	29,8	48,0	+	+	+	+	1,22	1,85
Mnfcs	469,4	616,7	777,0	-	+	+	+	+	+
Svces	171,7	217,0	257,4	-	+	+	+	+	+
TOTAL	402,5	558,9	722,9						

+/- indicates less than + or -1%; nt = non-tradable; * quota constrained output

Increased multilateral market access increases Spanish imports resulting in deteriorating sectoral trade balances (e.g., «dairy», «meatpro», «oagric», «ofoodpro», «ograins», «sugarpro», «vegfruitsnuts», «vegoilsfats») and declining domestic pro-

²⁴ In the baseline, 60% of olive production subsidies are transferred to the single farm payment scheme under the CAP reforms for Mediterranean products, leaving 40% in the Amber Box. Under the Common Fisheries Policy, fishing activities receive considerable production related support. Currently Spain receives approximately 45% of the EU's Financial Instrument for Fisheries Guidance (FIFG) funds. Further discussion of this point appears in the conclusions.

duction. The trade balance (–€ 34,8 m to –€ 127,2 m) and output contractions are worrying in the case of the «vegfruitnuts» sector which houses many of Spain’s «sensitive» Mediterranean crops. More encouragingly, «wheat» and «ocrops» sectors are comparatively competitive (low/zero benchmark tariff rates), resulting in trade balance (€ 4,6 m to € 11,5 m; € 30,7 m to € 51,1 m) and output (–0,04 to 2,70%; 0,97 to 1,93%) improvements above the baseline²⁵.

Furthermore, «pigsoultry» and the «omeatpro» sector (which encompasses pork and poultry meat production), undergo relative improvements in the trade balance and export led sectoral output. This result is largely attributed to Spain’s relatively strong export trade links with the ROW region whilst both regions have similar tariff protection. Primary «sugar» and «milk» production levels are quota controlled, where the simulations suggest that the quota in both sectors remains binding²⁶.

Spain’s aggregate trade balance improves between € 402,5 m to € 722,9 m compared with the baseline through the reallocation of resources from agro-food to manufacturing and services activities. This is reflected in the increased levels of production activity in both composite manufacturing (0,33 to 0,42%) and services (0,010 to 0,014%), their improved trade balances (€ 469,4 m to € 777,0 m; € 171,7 m to € 257,4 m) and factor price increases in skilled labour and capital (noted in Table 5).

6.3. Aggregate welfare results

Changes in welfare are measured using a regional equivalent variation (EV) summary statistic²⁷. Table 7 shows the impacts of S1-S3 in Spain relative to the three largest EU countries (i.e., France, Germany, UK), the EU15 and the EU25. The decomposition of regional equivalent variation is divided into terms of trade (ToT) effects, efficiency effects, CAP budget effects and «other». 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 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.

²⁵ In the case of the oilseeds sector, the 60% removal of Amber box support reduces output relative to the baseline.

²⁶ Examining the GTAP data, sugar cane/beet and processed sugar production are not amongst the more important agricultural activities in Spain. In the GTAP model, raw milk is a non-tradable product in GTAP, where trade occurs through the downstream «dairy» sector.

²⁷ 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.

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 states²⁸. 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 welfare²⁹. The total of these «other» effects are *relatively* small given that these exogenous shocks also feature in the baseline scenario.

Perhaps the most important result is that from a European perspective, the current Doha proposals have a very minor impact on welfare gains. Even under the high market access scenario, estimates suggest EU15 (EU25) average gains of around 0,04 % in *per capita* utility. At the global level, the EV gains are estimated at € 12,8 bn (S1), € 23,4 bn (S2) and € 32,5 bn (S3) respectively. Compared with the range of estimates from section 3, this would appear at the lower end of the estimates in the literature. There are a number of reasons to explain this result. Firstly, we are using GTAP version 6 data benchmarked to 2001 (rather than 1997 in GTAP version 5) resulting in lower tariff and subsidy rates. Secondly, we do not incorporate additional modelling features such as imperfect competition. Thirdly, we have completely isolated the impacts of the Doha proposals, whilst all remaining long run trade policy changes (i.e. Chinese accession, CAP reforms, etc.) are all characterised in the baseline scenario. Finally, given EU importance on agricultural markets, the explicit representation of EU agricultural market rigidities (quotas, set-aside, SFP) restricts the responsiveness of resource shifts from the agricultural sectors to non-agricultural uses from to policy change. Accordingly, the efficiency effect estimates reported in Table 7 are likely to be muted.

Examining the results from the Spanish perspective reveals that under S1 and S2, Spain records an EV loss (–€ 228,4 m and –€ 109,5 m respectively) compared with small estimated gains for France, Germany and the UK. In Spain, the efficiency effects are positive relative to the baseline, largely due to the reduction/elimination of

²⁸ 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.

²⁹ 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.

TABLE 7
Aggregate EU welfare effects

S1 (Low market access)	Spain	France	Germany	UK	EU15	EU25
Equivalent variation (€ m)	-228,4	440,4	1113,9	750,8	2422,6	2614,6
<i>Per capita</i> utility (%)	-0,04	0,04	0,07	0,06	0,04	0,04
Of which:						
Terms of Trade (€ m)	-19,8	276,9	586,8	274,2	1579,0	1675,5
Allocative efficiency (€ m)	149,4	120,3	248,3	118,0	1258,6	1223,7
CAP budget (€ m)	-334,8	81,1	334,3	368,7	-135,8	-18,6
Other (€ m)	-23,2	-37,9	-55,5	-10,1	-279,2	-266,0
S2 (Harbison)	Spain	France	Germany	UK	EU15	EU25
Equivalent variation (€ m)	-109,5	439,2	1134,9	768,0	2942,5	3088,2
<i>Per capita</i> utility (%)	-0,02	0,04	0,07	0,06	0,04	0,04
Of which:						
Terms of Trade (€ m)	93,9	395,0	698,3	265,7	2310,6	2399,2
Allocative efficiency (€ m)	135,0	13,2	170,2	128,6	1008,2	936,7
CAP budget (€ m)	-344,5	79,6	344,6	377,8	-137,9	-22,3
Other (€ m)	6,1	-48,6	-78,2	-4,1	-238,4	-225,4
S3 (High market access)	Spain	France	Germany	UK	EU15	EU25
Equivalent variation (€ m)	20,0	405,0	1182,0	779,4	3365,3	3468,7
<i>Per capita</i> utility (%)	0,01	0,04	0,07	0,06	0,05	0,05
Of which:						
Terms of Trade (€ m)	215,5	512,5	810,7	256,9	3062,4	3147,3
Allocative efficiency (€ m)	121,7	-121,6	113,9	136,9	652,2	532,8
CAP budget (€ m)	-353,1	74,0	358,4	387,3	-149,7	-24,6
Other (€ m)	35,9	-59,9	-101,0	-1,7	-199,6	-186,8

Amber Box and export subsidies and the subsequent reduction in resource usage. However, these positive gains are eroded under greater levels of market access since regional tariff rates fall by a greater proportion than the rise in import quantities. Conversely, under greater market access, the ToT in Spain improves due to the larger resource reallocation effects which bids up skilled labour and capital prices. Accordingly, Spain does not have to reduce its factor prices as much to balance its external account whilst also benefiting from higher world prices in its principal exports. The ToT improvement improves Spain's net welfare position sufficiently to yield a small gain of € 20,0 m to Spain, although this is tempered by continued net losses on the CAP budget, which are not apparent in France, Germany and the UK.

A breakdown of the CAP budget for Spain is shown in Table 8³⁰, which reveals that Spain's CAP receipts fall from -€ 605,0 to -€ 619,5 million compared with the baseline. Further decomposition of this result reveals that Spain's principle losses

³⁰ Note that decoupled payments do not change as the single farm payment under the mid term review of the CAP is already incorporated in the baseline.

come from the removal of export subsidies (–€ 119,9 m to –€ 122,8 m) and most importantly Amber Box support reductions (–€ 482,2 m to –€ 493,3 m). Unlike France, Germany and the UK, Spain receives 45% of the production related support from the Common Fisheries Policy (CFP) and will still have remaining production aids on «sensitive» products. Furthermore, Spain contributes a smaller share to the own resources of the CAP budget rendering it a net beneficiary. Thus, contractions in the EU25 CAP budget from Amber Box and export subsidy reductions benefit large contributors (i.e., Germany, the UK and to a lesser extent France) through compensating falls in GDP contributions, whilst Spain's GDP fall does not offset the losses in support.

TABLE 8
Equivalent Variation changes (€ millions) in Spanish net CAP contributions compared with the baseline

	S1	S2	S3
CAP Budget	–334,8	–344,5	–353,1
CAP expenditure	–605,0	–612,2	–619,5
Of which:			
Direct Payments	0,0	0,0	0,0
Export Subsidies	–119,9	–121,4	–122,8
Amber Box Support	–482,2	–487,9	–493,3
Intermediate input subsidies	–2,7	–3,0	–3,4
Tariff Revenues	–7,1	–13,3	–20,9
GDP contribution	–262,8	–254,2	–245,2

7. Conclusions

Whilst there is a growing literature examining the impacts of the current Doha Proposals, from an EU perspective most studies merely employ broad regional aggregates (i.e., EU15, EU25, EU27) whilst in this paper we examine the proposals for the European Union, in particular focusing on the Spanish economy. Other distinguishing features of this paper are (i) that we employ an inclusive baseline scenario including key long term developments in the Global economy up to 2020, thereby allowing us to isolate and evaluate the long term costs of the Doha proposals and (ii) we employ explicit CAP modelling and include the latest CAP reforms which provides greater credibility in assessing the long run asymmetric budgetary and welfare impacts from the proposals on EU member states³¹.

The sectoral results for Spain suggest that there is substitution in arable activities from «vegetable, fruits and nuts», «oilseeds» (including olive production) and «other

³¹ It should, however, be noted that since the model simulations take a long run view, they have nothing to say about the short to medium term frictional costs of resource reallocation, particularly labour (i.e., unemployment).

grains» into «wheat», «other crops» and «oagric» production. Spanish livestock production appears to focus slightly more on white meat production, with small concurrent declines in red meat output. In broader terms, there is an expected shift from agro-food activities into manufacturing and services production leading to allocative efficiency gains. The analysis suggests that the regional EV effects are small, although the discussion throughout the paper suggests that the size of the model estimates are a function of the choice of additional modelling features (e.g., imperfect competition, dynamics, non-tariff barriers, explicit CAP modelling), the use of version 6 GTAP data, and the choice of scenario design (i.e., baseline shocks, food vs. non food regions) and aggregation.

The model estimates suggest that the Spanish economy will make a marginal loss from the Doha proposals in the «low» (S1) and «Harbinson» (S2) market access scenarios, whilst terms of trade improvements in the «high» (S3) access scenario result in a marginal welfare gain of € 20,0 m. In the case of France, Germany and the UK, welfare is set to rise marginally in each region, largely due to favourable changes in their net CAP budget contributions (which do not occur in Spain). As noted above, the CAP budgetary positions are largely due to Spain's relatively smaller GDP contribution and considerable Amber Box support payments, mainly to fishing activities.

Presently, the WTO does not have specific provisions dealing with fisheries subsidies. Instead fishing subsidies are disciplined by the general subsidies rules found in the current WTO Subsidies and Countervailing Measures (SCM) agreement. Currently, there are no special safeguards linking fisheries support with environmental considerations relating to depleted fish stocks and pollution³². Whilst there is much debate on how best to reform fishing subsidies in the context of international trade law, at the time of writing there is no general consensus. Accordingly, in this paper we maintained the *status quo* assumption of treating fishing production subsidies equal to other sectors (i.e., Amber Box reductions). The results from this analysis appear to indicate that not only will the outcome of this debate have clear ramifications for Spain's fishing industry, but also for Spain's net contributions to Brussels and ultimately regional welfare.

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³² This view is held by Iceland, Australia, Chile, Ecuador, New Zealand, Peru, The Philippines, USA. However, other nations, notably Japan and South Korea maintain that there is no causal link between subsidies and the depletion of fish stocks.

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Appendix - Additions to the Standard GTAP model Framework

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. For export subsidies, we employ WTO subsidy expenditure notifications data to calculate actual subsidy limits in 2001 as a percentage of allowable UR subsidy expenditure limits³³. 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 7/10th of the UR commitments (1994-2004) have been met. Thus, remaining UR commitments are based on the remaining 3/10th of the required total tariff 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 (7/10th) of the commitments have been met, with a remaining 3/10th 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.

³³ 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).

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 in 2001 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 endogenous 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 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 totals³⁴ received in the GTAP 2001 database are indicative of the value of the **single farm payment** (SFP) reference payment total for each 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

³⁴ That is, land subsidies and capital subsidies in each region.

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% 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 needs³⁵. 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 90% of agricultural tariffs and modulation funds 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 the total CAP budget balances at zero. This implies that at the member state level, a region may be a net loser (e.g., UK, Germany) or a net gainer (e.g., France, Spain) from the budget. In the case of 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.

³⁵ Modulation begins at a rate of 3% of direct aid payments in 2005, climbing to a ceiling limit of 5% from 2007 onwards.

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 EU14 (EU24) 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 Ianchochina 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 Malawi, Mozambique, Tanzania, Zambia, Uganda and composite regions Other South Africa and Rest of Sub-Saharan Africa. Since these regions appear in the ROW composite, then a trade weighted tariff reduction by the EU25 regions is imposed on ROW imports.