Trade Liberalisation in the Doha Development Round

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Joseph Francois, Hans van Meijl, Frank van Tongeren

Erasmus University Rotterdam; Agricultural Economics Research Institute LEI, Wageningen University;
Agricultural Economics Research Institute LEI , Wageningen University[1]

TECHNICAL ANNEX: An Overview of the Computational Model

1. Introduction

This annex provides an overview of the basic structure of the global CGE model employed for our assessment of Doha Round-based multilateral trade liberalization. The model is implemented in GEMPACK -- a software package designed for solving large applied general equilibrium models. The reader can download and replicate our results, but will need access to GEMPACK to make modifications to the code or data. The model is solved as an explicit non-linear system of equations, through techniques described by Harrison and Pearson (1994). More information can be obtained at the following URL -- http://www.monash.edu.au/policy/gempack.htm. The reader is referred to Hertel (1996) for a detailed discussion of the basic algebraic model structure represented by the GEMPACK code. While this appendix provides a broad overview of the model, detailed discussion of mathematical structure is limited to added features, beyond the standard GTAP structure covered in that document.

The model is a standard multi-region computable general equilibrium (CGE) model, with important features related to the structure of competition (as described by Francois and Roland-Holst 1997). The capital accumulation mechanisms are described in Francois et al (1996b) while imperfect competition features are described in detail in Francois (1998:). Social accounting data are based on Version 6 of the GTAP dataset (www.gtap.org), updated to reflect Agenda 2000, China's accession to the WTO, and EU enlargement, as discussed in the body of the paper.

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2. General structure

The general conceptual structure of a regional economy in the model is as follows. Within each region, firms produce output, employing land, labour, capital, and natural resources and combining these with intermediate inputs. Firm output is purchased by consumers, government, the investment sector, and by other firms. Firm output can also be sold for export. Land is only employed in the agricultural sectors, while capital and labour (both skilled and unskilled) are mobile between all production sectors. Capital is fully mobile within regions.

All demand sources combine imports with domestic goods to produce a composite good. In constant returns sectors, these are Armington composites. In increasing returns sectors, these are composites of firm-differentiated goods. Relevant substitution and trade elasticities are presented in Appendix Table 1.

3. Taxes and policy variables

Taxes are included in the theory of the model at several levels. Production taxes are placed on intermediate or primary inputs, or on output. Some trade taxes are modeled at the border. Additional internal taxes can be placed on domestic or imported intermediate inputs, and may be applied at differential rates that discriminate against imports. Where relevant, taxes are also placed on exports, and on primary factor income. Finally, where relevant (as indicated by social accounting data) taxes are placed on final consumption, and can be applied differentially to consumption of domestic and imported goods.

Trade policy instruments are represented as import or export taxes/subsidies. This includes applied most-favored nation (mfn) tariffs, antidumping duties, countervailing duties, price undertakings, export quotas, and other trade restrictions. The two exceptions are service-sector trading costs, which are discussed in the next section, and agricultural quotas, discussed in the subsequent section. The full set of post-Uruguay Round tariff vectors are based on WTO tariff schedules, augmented with data on trade preferences. The set of services trade barrier estimates is described below. Tariff rates for China's accession to the WTO are taken from Francois and Spinanger (2001, 2004).

4. Trade and transportation costs and services barriers

International trade is modeled as a process that explicitly involves trading costs, which include both trade and transportation services. These trading costs reflect the transaction costs involved in international trade, as well as the physical activity of transportation itself. Those trading costs related to international movement of goods and related logistic services are met by composite services purchased from a global trade services sector, where the composite "international trade services" activity is produced as a Cobb-Douglas composite of regional exports of trade and transport service exports. Trade-cost margins are based on reconciled f.o.b. and c.i.f. trade data, as reported in version 5.2 of the GTAP dataset.

A second form of trade costs is known in the literature as frictional trading costs. These are implemented in the service sector. They represent real resource costs associated with producing a service for sale in an export market instead of the domestic market. Conceptually, we have implemented a linear transformation technology between domestic and export services. This technology is represented in Annex Figure

1. The straight line AB indicates, given the resources necessary to produce a unit of services for the domestic market, the feasible amount that can instead be produced for export using those same resources. If there are not frictional barriers to trade in services, this line has slope -1. This free-trade case is represented by the line AC. As we reduce trading costs, the linear transformation line converges on the free trade line, as indicated in the figure.

The basic methodology for estimation of services barriers involves the estimation of sector-specific gravity equations, based on aggregate GTAP data (which reports detailed trading patterns in services) for total imports outside of intra-NAFTA and intra-EU trade. These equations have been estimated at the level of aggregation corresponding to the sectors of our CGE model.

The gravity equations are estimated using ordinary least squares with the following specification:

(1) $$M_{i,j} = a_1 + a_2 PCY_j + a_3 POP_j + a_4 EU_j + \varepsilon_j$$

where $M_{i,j}$ represents imports in sector i by country j, PCY_i represents per-capita income in the importing country, POP_j is population, EU_j is a dummy for EU countries, and ε is an error term.

Deviations from predicted imports are taken as an indication of barriers to trade. These tariff equivalent rates are then backed out from a constant elasticity import demand function as follows:

(2) $$\frac{T_1}{T_0} = \left[\frac{M_1}{M_0}\right]^{\frac{1}{e}}$$

Here, T_1 is the power of the tariff equivalent $(1+t_1)$ such that in free trade $T_0 = 1$, and $[M_1/M_0]$ is the ratio of actual to predicted imports. This is a reduced form, where actual prices and constant terms drop out because we take ratios. The term e is the demand elasticity (taken to be the substitution elasticity from Annex Table 1). Regression results from this approach are reported in Annex Table 2, while the relevant estimates of tariff equivalents for the model sectors and regions are reported in Annex Table 3.

5. Agricultural quotas

An output quota places a restriction on the volume of production. If such a supply restriction is binding, it implies that consumers will pay a higher price than they would pay in case of an unrestricted interplay of demand and supply. A wedge is created between the prices that consumers pay, *PM* and the marginal cost for the producer, *PS*. Annex Figure 2 below illustrates this point. The vertical distance between PM and PS at quota levels is known as the tax equivalent of the quota rent. Instead of applying a quota, an equivalent level of output taxation could be administered which has the same output reducing and price increasing effect. This is illustrated by the dashed line in the figure. The shaded area indicates the value of the quota rent: the wedge between consumer and producer prices times the level of output. It is an empirical matter to determine who is actually earning the quota rent. It represents income to someone in the economy, usually the holder of the quota right, though the rent distribution depends on the institutional set-up of quota allocation and tradability.

In our model both the EU milk quota and the sugar quota are implemented at the national level. Technically, this is achieved by formulating the quota as a complementarity problem. This formulation allows for endogenous regime switches from a state when the output quota is binding to a state when the quota becomes non-binding. In addition, changes in the value of the quota rent are endogenously determined. If τ denotes the tax equivalent of the quota rent, and $Y = (\bar{q} - q)$ denotes the difference between the output quota $\bar{q}$ and output q, then the complementary problem can be written as:

(3) $$\tau \geq 0 \perp Y$$

where either

	$\tau > 0$ and $Y = 0$	the quota is binding
or	$\tau = 0$ and $Y \geq 0$	the quota is not binding

Ignoring other tax and subsidy instruments that might be in place, the market price *pm* for commodities that are subject to a quota rent is

(4) $$pm = ps \cdot (1 + \tau)$$

where *ps* denotes the producer price, which equals marginal cost in the model. The value of the quota rent $\tau \cdot ps \cdot q$ is allocated as income to the regional household. The modelling of this class of non-continuous policy instruments has been greatly facilitated by the latest release of GEMPACK.

The effects of the quota, or the effect of a possible extension of quota rights, depend crucially on the size of the quota rent. For intra-EU distributional analysis it is also important to have estimates of the size of the quota rent at member state level. Such estimates are hard to obtain. Our quota rent estimates are obtained form recent studies on the EU dairy sector and sugar sector. The rent estimates for dairy are obtained from Berkhout et al. (2002), Bouamra-Mechemache et al. (2002) and Kleinhanss et al. (2002). The estimates for sugar have been obtained from Frandsen and Jensen (2002). For the Netherlands, the percentage increase of the market price above marginal productions cost, i.e. the tax equivalent of the quota rent, is estimated at 30% for milk. This is the highest figure within the EU and shows that Dutch dairy producers are very quota constrained. For sugar, France and Germany are most quota constrained, with rent estimates as high as 140%.

We have also applied milk and sugar quota in the accession candidate countries (CEECs). At the time of writing the allocation of production quota to CEEC producers is still subject to negotiations. We have followed the suggestions of the European Commission (2002) to allocate production quota to CEECs. For milk, the EC proposes allocations based on average deliveries for direct sales during the reference period 1997-99. For sugar, this amounts to allocation based on average production in the historic reference period 1995-1999. This quota allocation allows CEECS to expand their output slightly beyond current levels, i.e. the quota is currently not binding. But it would constrain them to attain the high output levels of the pre-reform period.

6. The composite household and final demand structure

Final demand is determined by an upper-tier Cobb-Douglas preference function, which allocates income in fixed shares to current consumption, investment, and government services. This yields a fixed savings rate. Government services are produced by a Leontief technology, with household/government transfers being endogenous. The lower-tier nest for current consumption is also specified as a Cobb-Douglas. The regional capital markets adjust so that changes in savings match changes in regional investment expenditures. (Note that the Cobb-Douglas demand function is a special case of the CDE demand function employed in the standard GTAP model code. It is implemented through GEMPACK parameter files.)

7. Market Structure

7.1 Demand for imports: Armington sectors

The basic structure of demand in constant returns sectors is Armington preferences. In Armington sectors, goods are differentiated by country of origin, and the similarity of goods from different regions is measured by the elasticity of substitution. Formally, within a particular region, we assume that demand goods from different regions are aggregated into a composite import according to the following CES function:

(5)
$$q_{j,r}^{M} = \left[\sum_{i=1}^{R} \alpha_{j,i,r} M_{j,i,r}^{\rho_j} \right]^{1/\rho_j}$$

In equation (5), $M_{j,i,r}$ is the quantity of M_j from region i consumed in region r. The elasticity of substitution between varieties from different regions is then equal to σ^{M}_{j}, where $\sigma^{M}_{j}=1/(1-\rho_j)$. Composite imports are combined with the domestic good q^{D} in a second CES nest, yielding the Armington composite q.

(6)
$$q_{j,r} = \left[\Omega_{j.M.r} \left(q_{j,r}^{M} \right)^{\beta_j} + \Omega_{j,D,r} \left(q_{j,r}^{D} \right)^{\beta_j} \right]^{1/\beta_j}$$

The elasticity of substitution between the domestic good and composite imports is then equal to σ^{D}_{j}, where $\sigma^{D}_{j}=1/(1-\beta_j)$. At the same time, from the first order conditions, the demand for import $M_{j,i,r}$ can then be shown to equal

(7)
$$\begin{aligned} M_{j,i,r} &= \left[\frac{\alpha_{j,i,r}}{P_{j,i,r}} \right]^{\sigma_i^m} \left[\sum_{i=1}^{R} \alpha_{j,i,r}^{\sigma_j^M} P_{j,i,r}^{1-\sigma_j^M} \right]^{-1} E_{j,r}^{M} \\ &= \left[\frac{\alpha_{j,i,r}}{P_{j,i,r}} \right]^{\sigma_j^M} \left(P_{j,r}^{M} \right)^{\sigma_j^M - 1} E_{j,r}^{M} \end{aligned}$$

where $E^{M}_{j,r}$ represents expenditures on imports in region r on the sector j Armington composite.

In practice, the two nests can be collapsed, so that imports compete directly with each other and with the corresponding domestic product. This implies that the substitution

elasticities in equations (1) and (2) are equal. (These elasticities are reported in Annex Table 1).

7.2 Imperfect competition

As indicated in Annex Table 1, we model manufacturing sectors and service sectors as being imperfectly competitive. The approach we follow has been used in the Michigan and the WTO assessment of the Uruguay Round. Recent model testing work indicates that this approach works "best" vis-à-vis Armington models, when tracked against actual trade patterns. (See Fox 1999, who uses the U.S.-Canada FTA as a natural experiment for model testing).

Formally, within a region *r*, we assume that demand for differentiated intermediate products belonging to sector *j* can be derived from the following CES function, which is now indexed over firms or varieties instead of over regions. We have

(8) $$q_{j,r} = \left[\sum_{i=1}^{n} \gamma_{j,i,r} X_{j,i,r}^{\Gamma_j} \right]^{1/\Gamma_j}$$

where $\gamma_{j,i,r}$ is the demand share preference parameter, $X_{j,i,r}$ is demand for variety *i* of product *j* in region *r*, and $\sigma_j = 1/(1-\Gamma_j)$ is the elasticity of substitution between any two varieties of the good. Note that we can interpret *q* as the output of a constant returns assembly process, where the resulting composite product enters consumption and/or production. Equation (8) could therefore be interpreted as representing an assembly function embedded in the production technology of firms that use intermediates in production of final goods, and alternatively as representing a CES aggregator implicit in consumer utility functions. In the literature, and in our model, both cases are specified with the same functional form. While we have technically dropped the Armington assumption by allowing firms to differentiate products, the vector of γ parameters still provides a partial geographic anchor for production. (Francois and Roland-Holst 1997, Francois 1998).

Globally, firms in different regions compete directly. These firms are assumed to exhibit monopolistically competitive behaviour. This means that individual firms produce unique varieties of good or service *j*, and hence are monopolists within their chosen market niche. Given the demand for variety, reflected in equation (8), the demand for each variety is less than perfectly elastic. However, while firms are thus able to price as monopolists, free entry (at least in the long-run) drives their economic profits to zero, so that pricing is at average cost. The joint assumptions of average cost pricing and monopoly pricing, under Bertrand behaviour, imply the following conditions for each firm f_i in region i:

(9) $$\zeta_{j,f_i} = \sum_{r=1}^{R} \frac{X_{j,f_i,r}}{X_{j,f_i}} \left(\sum_{k=1}^{n} \left(\frac{\alpha_{j,k,r}}{\alpha_{j,f_i,r}} \right)^{\sigma_j} \left(\frac{P_{j,k,r}}{P_{j,f,r}} \right)^{1-\sigma_j} \right)^{-1}$$

(10) $$P_{f,i} = AC_{f,i}$$

The elasticity of demand for each firm f_i will be defined by the following conditions.

(11) $$\varepsilon_{j,f,i} = \sigma_j + (1-\sigma_j)\zeta_{j,f,i}$$

(12)
$$\frac{P_{f,i}\,MC_{f,i}}{P_{f,i}} = \frac{1}{\varepsilon_{f,i}}$$

In a fully symmetric equilibrium, we would have $\zeta=n^{-1}$. However, the calibrated model includes CES weights γ, in each regional CES aggregation function, that will vary for firms from different regions. Under these conditions, ζ is a quantity weighted measure of market share. To close the system for regional production, we index total resource costs for sector *j* in region *i* by the resource index *Z*. Full employment of resources hired by firms in the sector *j* in region *i* then implies the following condition.

(13)
$$Z_{j,i} = \sum_{f=1}^{n_i} TC_{j,i,f}$$

Cost functions for individual firms are defined as follows:

(14)
$$C(x_{j,i}) = (a_{j,i} + b_{j,i}\ x_{j,i})\ P_{Z_{j,i}}$$

This specification of monopolistic competition is implemented under the “large group” assumption, which means that firms treat the variable n as "large", so that the perceived elasticity of demand equals the elasticity of substitution. The relevant set of equations then collapses to the following:

$$q_{j,r} = \left[\sum_{i=1}^{R} \bar{\gamma}_{j,i,r}\ \bar{x}_{j,i,r}^{\Gamma_j}\right]^{\frac{1}{\Gamma_j}}$$

(15)
$$\bar{\gamma}_{j,i,r} = \alpha_{j,i,r}\, n_{j,i\,0}^{\,1-\Gamma_j}$$

$$\bar{x}_{j,i,r} = \left(\frac{n_{j,i}}{n_{j,i\,0}}\right)^{(1-\Gamma_j)/\Gamma_j} X_{j,i,r}$$

(16)
$$\bar{x}_{j,i} = \left(\frac{Z_{j,i\,1}}{Z_{j,i\,0}}\right)^{(1-\rho_j)/\rho_j} X_{j,i}$$

In equation (16), n_0 denotes the number of firms in the benchmark. Through calibration, the initial CES weights in equation (16) include the valuation of variety. As a result, the reduced form exhibits external scale effects, determined by changes in variety based on firm entry and exit, and determined by the substitution and scale elasticities.

7.3 Markups

Our average markup estimates are reported in Annex Table 1. The starting point for these is recent estimated price-cost markups from the OECD (Martins, Scarpetta, and Pilat 1996). These provide estimates of markups, based on methods pioneered by Hall

(1988) and Roeger (1995). The Martins et al paper provides an overview of the recent empirical literature.

Both Hall and Roeger focused their work on the United States. In contrast, Martins et al provide estimates for most OECD Members. However, because of data limitations, they did not provide estimates for the full matrix of countries and sectors. (In other words there are empty cells in the matrix.) To produce a complete matrix, Francois (2001) runs a cross-country regression, with dummy variables allowing for variations in markups by country (a general index of the degree of competition within a country) and by sector. The resulting coefficients were then used to fill in missing values within the table. The values reported in Annex Table are used either to calibrate the cost-disadvantage ratios and substitution elasticities under monopolistic competition. They are taken from Francois (2001) and Martins et al (1996). Their application, in terms of parameterizing the model, is explained in Francois (1998).

8. Aggregation scheme

The basic aggregation scheme for the model is presented in Annex Tables 4 and 5. Annex Table 4 provides a basic overview of the sectors and regions in the model, while Annex Table 5 provides a mapping to underlying GTAP sectors and regions. This provides a sense of what products are in the sector aggregates, and what countries are in the regional aggregates. Industrial sectors have been aggregated into three groups: Chemicals, Metal and electrotechnical, and Other manufactures. The sectoring scheme is then translated into GTAP sectors through Table 5.

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Annex Table 1

Model Parameters

		A	B	C	D = (B-1)/B	E = 1/D	F = D/(1-D)
		trade substitution elasticities (regional differentiation)	average markup levels	elasticity of substitution in value added	implied CDRs	trade substitution elasticity (firm differentiation)	Variety-scaled output scale elasticity (firm differentiation)
CERE	Cerals	2.20	1.00	0.25	0.00	2.20	0.00
HORT	Horticulture & other crops	2.20	1.00	0.25	0.00	2.20	0.00
SUGA	Sugar, plants and processed	2.20	1.00	0.64	0.00	2.20	0.00
INTLIV	Intensive livestock &products	2.50	1.00	0.55	0.00	2.50	0.00
CATLE	Cattle & beef products	2.45	1.00	0.57	0.00	2.45	0.00
DAIRY	Milk & dairy	2.20	1.00	0.65	0.00	2.20	0.00
OAGR	Other agriculture	2.75	1.00	0.20	0.00	2.75	0.00
PROCF	Processed food products	2.47	1.13	1.12	0.11	8.98	0.13
TEXT	Textiles, leather & clothing	3.32	1.13	1.26	0.11	8.91	0.13
EXTR	Extraction industries	2.80	1.18	0.20	0.15	6.64	0.18
CHEM	Petro & chemicals	2.05	1.20	1.26	0.17	6.01	0.20
MELE	Metal and electotechnical industry	3.39	1.21	1.26	0.17	5.72	0.21
OIND	Other industries	2.30	1.20	1.26	0.17	5.95	0.20
TRAD	Trade services	1.90	1.27	1.68	0.21	4.67	0.27
TRAN	Transport services	1.90	1.27	1.68	0.21	4.67	0.27
BSVC	Business, financial & communnications services	1.90	1.27	1.26	0.21	4.67	0.27
OSVC	Other private and public services	1.97	1.27	1.29	0.21	4.67	0.27

sources: columns A, C are from the GTAP database. Columns B, D, E, and F are from estimates discussed in this annex.

Annex Table 2

Services regression results

TRADE: trade services

Regression Statistics	
Multiple R	0.80
R Square	0.64
Adjusted R Square	0.55
Standard Error	0.65
Observations	16

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	8.955	2.985	7.097	0.0053
Residual	12	5.047	0.421		
Total	15	14.002			

	Coefficients	*Standard Error*	*t Stat*
Intercept	0.317	1.995	0.159
pop	0.728	0.173	4.202
PCI	0.500	0.158	3.170
EU	0.684	0.466	1.467

TRAN: transport and logistics services

Regression Statistics	
Multiple R	0.98
R Square	0.96
Adjusted R Square	0.94
Standard Error	0.27
Observations	16

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	18.313	6.104	86.036	0.000
Residual	12	0.851	0.071		
Total	15	19.165			

	Coefficients	*Standard Error*	*t Stat*
Intercept	-2.645	0.819	-3.229
pop	0.803	0.071	11.288
PCI	0.919	0.065	14.183
EU	0.307	0.192	1.605

Annex Table 2 – continued

BSRV: business services

Regression Statistics	
Multiple R	0.88
R Square	0.78
Adjusted R Square	0.72
Standard Error	0.59
Observations	16

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	14.490	4.830	14.083	0.0003
Residual	12	4.116	0.343		
Total	15	18.606			

	Coefficients	*Standard Error*	*t Stat*
Intercept	-1.179	1.801	-0.654
pop	0.789	0.156	5.045
PCI	0.766	0.143	5.377
EU	0.535	0.421	1.271

OSVC: other services

Regression Statistics	
Multiple R	0.88
R Square	0.77
Adjusted R Square	0.71
Standard Error	0.68
Observations	16

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	18.611	6.204	13.279	0.0004
Residual	12	5.606	0.467		
Total	15	24.217			

	Coefficients	*Standard Error*	*t Stat*
Intercept	-3.287	2.102	-1.564
pop	0.844	0.183	4.623
PCI	0.909	0.166	5.466
EU	0.409	0.492	0.832

Annex Table 3

Estimated services barriers (extra-EU trade)

Estimated Services Trade Barriers (percent trade cost equivalents)

Label	Region	trade	transport and logistics	business services	other services
NLD	Netherlands	0.0	0.0	0.0	0.0
FRA	France	12.3	12.1	18.3	19.2
DEU	Germany	0.0	13.7	9.5	0.0
REU15	Rest of EU	12.3	0.0	0.0	0.0
CEEC	CEECs	1.6	0.0	0.0	0.0
MED	Mediterranean and Middle East	2.3	0.0	0.0	0.0
NAM	North America	0.0	22.6	1.2	16.0
SAM	South America	13.8	10.4	8.6	5.9
CHINA	China	0.0	14.5	37.4	3.7
INDIA	India	61.3	63.9	32.1	62.2
HINCAS	High income Asia	0.0	0.0	6.3	0.0
OASPAC	Other Asia-Pacific	0.0	0.0	0.0	0.0
AUSNZ	Australia and New Zealand	0.0	2.3	9.5	15.2
SAF	South Africa	28.3	17.5	32.8	22.6
SSA	Sub-Saharan Africa	0.0	0.0	0.0	0.0
ROW	Rest of World	7.2	0.0	0.0	0.0

Based on gravity equation estimates.

Annex Table 4
Model Aggregation Scheme

Model Sectors and Regions

Label	Region		Label	Sector
NLD	Netherlands		CERE	Cerals
FRA	France		HORT	Horticulture & other crops
DEU	Germany		SUGA	Sugar, plants and processed
REU15	Rest of EU		INTLIV	Intensive livestock &products
CEEC	CEECs		CATLE	Cattle & beef products
MED	Mediterannean and Middle East		DAIRY	Milk & dairy
NAM	North America		OAGR	Other agriculture
SAM	South America		PROCF	Processed food products
CHINA	China		TEXT	Textiles, leather & clothing
INDIA	India		EXTR	Extraction industries
HINCAS	High income asia		CHEM	Petro & chemicals
OASPAC	Other Asia-Pacific		MELE	Metal and electotechnical ind
AUSNZ	Australia and New Zealand		OIND	Other industries
SAF	South Africs		TRAD	Trade services
SSA	Sub-Saharan Africa		TRAN	Transport services
ROW	Rest of World		BSVC	Business, financial & communnications services
			OSVC	Other private and public services

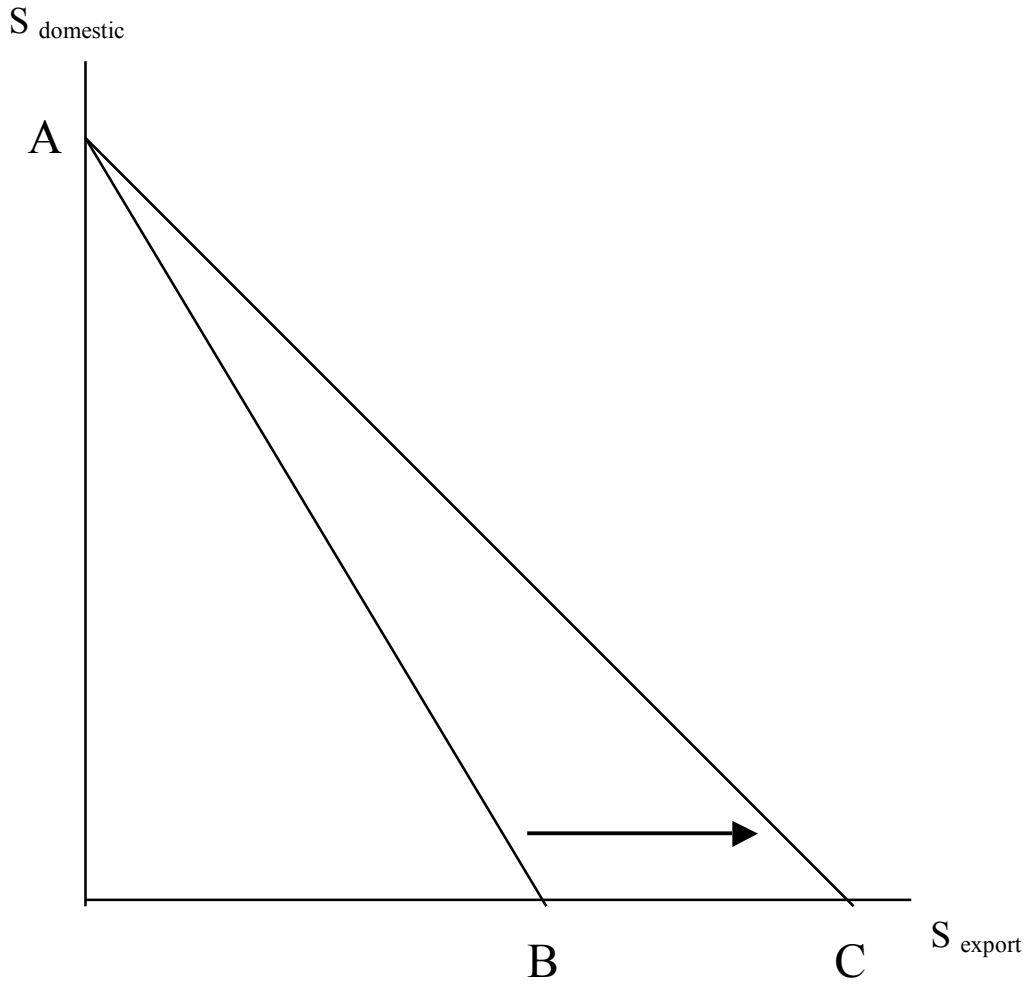
Annex Table 5

Mapping to GTAP Sectors and Regions

Model Sector	GTAP Sector
CERE	pdr, Paddy rice
CERE	wht, Wheat
CERE	gro, Cereal grains nec
HORT	v_f, Vegetables, fruit, nuts
HORT	osd, Oil seeds
SUGA	c_b, Sugar cane, sugar beet
HORT	pfb, Plant-based fibers
HORT	ocr, Crops nec
CATLE	ctl, Cattle,sheep,goats,horses
INTLIV	oap, Animal products nec
DAIRY	rmk, Raw milk
OAGR	wol, Wool, silk-worm cocoons
OAGR	for, Forestry
OAGR	fsh, Fishing
EXTR	col, Coal
EXTR	oil, Oil
EXTR	gas, Gas
EXTR	omn, Minerals nec
CATLE	cmt, Meat: cattle,sheep,goats,horse
INTLIV	omt. Meat products nec
PROCF	vol, Vegetable oils and fats
DAIRY	mil, Dairy products
PROCF	pcr, Processed rice
SUGA	sgr, Sugar
PROCF	ofd, Food products nec
PROCF	b_t, Beverages and tobacco products
TEXT	tex, Textiles
TEXT	wap, Wearing apparel
TEXT	lea, Leather products
OIND	lum, Wood products
OIND	ppp, Paper products, publishing
CHEM	p_c, Petroleum, coal products
CHEM	crp, Chemical,rubber,plastic prods
CHEM	nmm, Mineral products nec
MELE	i_s, Ferrous metals
MELE	nfm, Metals nec
MELE	fmp, Metal products
MELE	mvh, Motor vehicles and parts
MELE	otn, Transport equipment nec
MELE	ele, Electronic equipment
MELE	ome, Machinery and equipment nec
OIND	omf, Manufactures nec
OSVC	ely, Electricity
OSVC	gdt, Gas manufacture, distribution
OSVC	wtr, Water
OSVC	cns, Construction
TRAD	trd, Trade
TRAN	otp, Transport nec
TRAN	wtp, Sea transport
TRAN	atp, Air transport
BSVC	cmn, Communication
BSVC	ofi, Financial services nec
BSVC	isr, Insurance
BSVC	obs, Business services nec
OSVC	ros, Recreation and other services
OSVC	osg, PubAdmin/Defence/Health/Educat
OSVC	dwe, Dwellings

Model Region	GTAP Region
AUSNZ	aus, Australia
AUSNZ	nzl, New Zealand
CHINA	chn, China
CHINA	hkg, Hong Kong
HINCAS	jpn, Japan
HINCAS	kor, Korea
HINCAS	twn, Taiwan
OASPAC	idn, Indonesia
OASPAC	mys, Malaysia
OASPAC	phl, Philippines
HINCAS	sgp, Singapore
OASPAC	tha, Thailand
OASPAC	vnm, Vietnam
OASPAC	bgd, Bangladesh
INDIA	ind, India
OASPAC	lka, Sri Lanka
HINCAS	xsa, Rest of South Asia
NAM	can, Canada
NAM	usa, United States
SAM	mex, Mexico
SAM	xcm, Central America, Caribbean
SAM	col, Colombia
SAM	per, Peru
SAM	ven, Venezuela
SAM	xap, Rest of Andean Pact
SAM	arg, Argentina
SAM	bra, Brazil
SAM	chl, Chile
SAM	ury, Uruguay
SAM	xsm, Rest of South America
REU15	aut, Austria
REU15	bel, Belgium
REU15	dnk, Denmark
REU15	fin, Finland
FRA	fra, France
DEU	deu, Germany
REU15	gbr, United Kingdom
DEU	grc, Greece
REU15	irl, Ireland
REU15	ita, Italy
REU15	lux, Luxembourg
NLD	nld, Netherlands
REU15	prt, Portugal
REU15	esp, Spain
REU15	swe, Sweden
ROW	che, Switzerland
ROW	xef, Rest of EFTA
CEEC	bgr, Bulgaria
CEEC	hrv, Croatia
CEEC	cze, Czech Republic
CEEC	hun, Hungary
CEEC	mlt, Malta
CEEC	pol, Poland
CEEC	rom, Romania
CEEC	svk, Slovakia
CEEC	svn, Slovenia
CEEC	est, Estonia
CEEC	lva, Latvia
CEEC	ltu, Lithuania
ROW	xsu, Rest of Former Soviet Union
MED	cyp, Cyprus
MED	tur, Turkey
MED	xme, Rest of Middle East
MED	mar, Morocco
MED	xnf, Rest of North Africa
SSA	bwa, Botswana
SAF	xsc, Rest of SACU
SSA	mwi, Malawi
SSA	moz, Mozambique
SSA	tza, Tanzania
SSA	zmb, Zambia
SSA	zwe, Zimbabwe
SSA	xsf, Other Southern Africa
SSA	uga, Uganda
SSA	xss, Rest of Sub-Saharan Africa
ROW	xrw, Rest of World

Annex Figure 1
Trading Costs in the Service Sector



Annex Figure 2
Agricultural quotas