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MODELLING TRQs IN MULTI-COMMODITY MODELS

by

P. LIAPIS* and W. BRITZ**

1 Background

Tariff rate quotas (TRQs) were introduced as a policy mechanism during the Uruguay Round Agreement on Agriculture (URAA) to ensure minimum and current market access. Generally, tariffication (conversion of non-tariff barriers to tariffs) was seen as the main instrument to a more liberal and transparent trade regime for agricultural products, besides limits for export subsidies and domestic support. However, the high level of supports observed in the reference period (1986-88) lead in many cases to potentially prohibitive MFN tariffs, preventing access into these markets and probably even closing import avenues open under the previous policy regime. As countries were obligated to provide a minimum level of import opportunities for products previously protected by non-tariff barriers, the TRQs were introduced in cases were the MFN tariffs did not provide these opportunities.

A TRQ defines the relevant tariff and quota volume. This definition typically covers:

(1) product definition, regarding to quality, processing etc. as well as possible origins

(2) tariff rates applied for in-quota and out-of-quota imports (specific and/or ad valorem)

(3) quota quantity, and

(4) quota administration methods to allocate the quotas.

2 How a TRQ works

The TRQ can be seen as a two-tier tariff (see Figure 1 below, showing the small country case where world market prices are taken as given), with three possible stages (compare e. g. SKULLY 2001):

(1) **Quota under-fill**: As long as the net import demand at given world market price P_w is below the TRQ, the in-quota tariff t_{iq} is the binding instrument and determines the internal price level (i. e., the effective tariff t_e equals t_{iq}).

(2) **Out of Quota imports**: If net imports are above the quota, the out-quota tariff t_{oq} is binding, defining internal prices.

(3) **Binding Quota**: with imports exactly at quota level. The tariff equivalent of the quota t_e can be deduced from the difference between the internal and world market price plus in-quota tariff (i. e., $t_{iq} \leq t_e \leq t_{oq}$).

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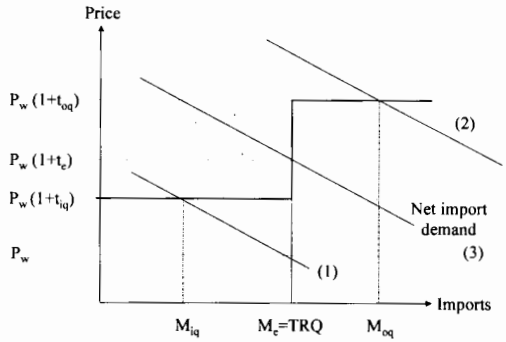
The views expressed in this paper are solely the authors', and not that of their institution.

Figure 1: TRQ in a net trade model for given world market prices



Quota rents occur only under case (2) and (3). Changes to the quota quantity, in quota and MFN tariff have different effects depending on the observed stage of a TRQ market. In case (1), quota under-fill, the in-quota tariff is the relevant policy instrument. Increasing the quota quantity or lowering the MFN tariff in direction of the in-quota tariff has c. p. no effect. If imports exceed the quota in case (2), the MFN tariff determines the level of imports. Only in case (3) is the quota itself the relevant instrument.

3 Empirical findings

3.1 TRQ scheduled and average fill rates

As of May 2001, a total of 37 countries, including all OECD Member countries other than Turkey, scheduled 1371 TRQs (883 or 61 % of which by OECD members), spanning the whole spectrum of agricultural products[1]. Table 1 indicates the number of TRQs scheduled and notified (as of May 2001) by OECD Member countries, and the average fill rate based on those notifications.

Although derived from the same data and computed in the same way, (that is, the ratio of the notified imports under the TRQ regime to the reported quota volume), the average fill rates calculated here are different from those reported by the WTO (2000a, 2000b) and the OECD's report "*The Uruguay Round Agreement on Agriculture: An Evaluation of its Implementation in OECD countries*". Both truncate the fill rate distribution at 100 %. The WTO does this to assure consistency between countries as some report imports only up to the quota level while others report all their in-quota imports. The calculations here include all of the notified information because the interest here is in total notified trade for a particular product and in preserving all relevant information, especially how countries implement the system and under which regime. A quota with 100 % fill rate may be in the quota regime (case 3) or in the out-of-quota regime (case 2) (depending on volume of total imports). But if a country voluntarily expands the quota leading to more than 100 % fill, the binding instrument may in fact be the in-quota tariff, a very different regime with different implications about quota rents and domestic prices.

[1] Data on tariffs and TRQs used in this analysis are derived from Agricultural Market Access Database (AMAD: http://www.amad.org). The product aggregates discussed in the following are identical to the ones modelled in AGLINK and thus are mostly temperate-zone products.

Table 1: Number of TRQs and average fill rates for OECD member countries

Country	Total TRQs	Number of notified TRQs					Average fill rate (percent)				
		1995	1996	1997	1998	1999	1995	1996	1997	1998	1999
Australia	2	2	2	2	2	2	117	112	103	99	103
Canada	21	21	21	21	21	n.a.	82	98	91	118	n.a.
Switzerland	28	28	26	28	28	n.a.	338	413	364	420	n.a.
Czech Republic	24	24	24	24	24	24	50	55	60	69	46
European Union	87	54	83	82	83	82	75	71	72	69	70
Hungary	75	66	67	67	67	65	55	51	43	43	41
Japan	20	18	18	18	18	18	78	77	74	69	71
Korea	67	67	67	67	64	n.a.	117	128	126	141	n.a.
Poland	109	17	22	28	28	32	45	45	39	31	30
Iceland	90	88	87	87	86	86	791	985	1641	2502	1608
Mexico	11	1	1	1	1	1	112	131	143	122	132
Norway	232	221	221	221	221	220	372	823	275	616	485
New Zealand	3	3	3	3	3	3	69	50	34	27	82
Slovak Republic	24	24	24	24	24	24	77	47	46	43	n.a.
United States	40	26	38	39	39	39	51	62	60	62	69
TOTAL OECD	**833**	**660**	**704**	**712**	**709**	**596**	..	..	..	..	..

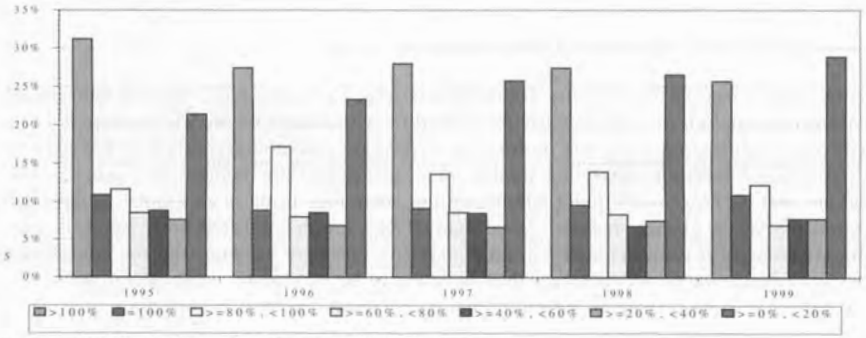
n.a. : Not available

Source: OECD calculations based on the AMAD database.

Data in Table 1 indicate that some TRQs have fill rates of over 100 % while others are close to zero. Although the average fill rate for some OECD countries is well above 100 %, undue attention should not be given to this average fill rate as it is biased because in the calculation equal weight is given to all TRQs irrespective of volume or value.

Another indicator of developments in market access is the distribution of fill rates among different fill rate ranges. This provides information on the number of TRQs with particular fill rate and is not unduly influenced by the relatively high fill rates of a few TRQs. Figure 2 shows the distribution of fill rates across various fill rate ranges. Fill rates exceeding 100 % formed the largest share of notified quotas (until 1999) with about 28 % during the 5-year period. These data illustrate why truncating the fill rate at 100 % may provide misleading information on the relevant regime, giving an upward bias to the number of quotas that are binding.

Figure 2: Percent of fill rates by fill-rate categories



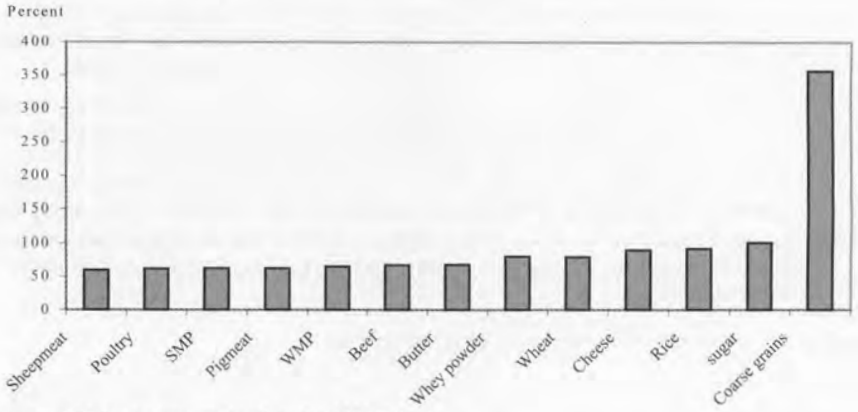
Source: OECD calculations based on the AMAD database.

Interestingly, Figure 2 suggests a bimodal distribution, as about 25 % of quotas fall within the very low fill-rate range (less than 20 %). Furthermore, whereas the share of quotas exceeding 100 % decreased slightly during the 5-year period, the share of quotas with less than 20 % fill rate increased and in 1999 contained more quotas than the others. The data suggest that a large number of quotas are severely under filled (37 % in 1999 below 40 %

fill rate), suggesting that for a large number of TRQs the in-quota tariff rate is the binding instrument. On average, 60 % of all quotas are essentially not enforced (fill rates exceeding 100 %) or severely under filled (fill rates less than 40 %). For the majority of the TRQs therefore, expanding quotas without also reducing tariffs, can not be expected to materially improve market access opportunities.

Shifting the analysis to the more aggregate product levels found in AGLINK, requires a mapping of the Harmonised Commodity Description and Coding System (HS) from the TRQ schedules, a process necessarily including a certain amount of arbitrariness. This mapping reduces the originally 785 TRQs scheduled by OECD countries to only 169 in our sample. Looking at individual commodities reveals some interesting results. First of all, TRQs for oilseeds (7) and their products (3) are few. Further, average fill rates differ between product aggregates as shown in Figure 3. The average fill rate for coarse grains, with an average fill rate of 346 % over the 5 year period is the highest, followed by sugar with an average fill rate of about 101 %. Sheep meat, with an average fill rate of 60 % is the lowest. But, whether calculations are performed for all TRQs or for the sample here, most TRQs have an average fill rate which is less than 100 %.

Figure 3: Average fill rates (1995-1999)



Source: OECD calculations based on the AMAD database.

Quota administration has become a contentious issue, as some have blamed the lack of quota fill on implicit or explicit costs associated it. A weakness of the TRQ compared to a tariff only regime (assuming non prohibitive tariffs) are potential non-tariff barriers linked to quota administration costs that hinder trade, affecting both volume and prices. How relevant and by how much quota administration costs bias trade is an empirical question beyond the scope of this analysis. Since many TRQs are under-filled however, it is a legitimate concern if in-quota tariffs or administrative costs are binding. But the complexity and data requirements are such that they have yet to be tackled by other researchers. Undoubtedly, the answer depends on individual country and commodity situations.

Table 2: Average and standard deviation of MFN bound rates

	1995		1996		1997		1998		1999		2000	
	average	std	average	std	average	std	average	std	average	std	average	std
Argentina	33.62	5.18	33.62	5.18	33.62	5.18	33.62	5.18	33.62	5.18	33.62	5.18
Australia	5.36	11.43	5.49	11.88	5.18	11.49	4.92	11.19	4.84	11.48	4.45	10.66
Canada	74.38	115.46	72.45	112.68	72.33	112.38	69.65	108.35	67.58	105.54	65.61	103.07
European union	95.30	119.72	88.20	109.45	74.96	83.02	72.75	75.90	75.73	78.20	60.20	60.38
Hungary	50.43	29.92	47.45	27.77	44.46	25.67	41.47	23.66	38.48	21.74	35.50	19.94
Japan	188.02	324.01	173.75	294.55	160.07	269.84	158.72	257.17	189.19	312.18	190.96	317.91
Korea	70.87	148.25	70.43	147.82	69.34	145.99	68.26	144.06	67.66	143.07	66.82	141.54
Mexico	79.34	70.41	78.51	69.72	77.67	69.03	76.84	68.35	76.01	67.66	75.17	66.99
New Zealand	9.01	10.21	8.26	9.41	7.51	8.65	6.76	7.95	6.01	7.32	5.26	6.78
Poland	83.72	76.60	81.58	75.59	76.61	69.19	75.94	72.70	76.46	72.73	66.10	58.46
USA	26.15	35.93	25.97	36.12	26.63	37.32	28.90	42.74	29.68	44.25	28.41	42.23
Total for aglink endogenous countries *	76.37	144.31	72.06	133.25	66.44	120.19	65.35	115.46	68.93	131.32	63.65	129.59
Iceland	202.30	239.53	186.09	209.38	175.36	198.90	173.78	222.84	165.86	224.32	149.63	194.64
Norway	288.55	218.72	277.03	201.27	268.87	196.27	269.59	202.38	260.07	196.11	240.39	169.11
Switzerland	218.62	279.82	230.68	275.91	195.91	249.23	220.30	262.49	218.66	252.77	218.25	256.62
Total *	114.07	189.21	109.81	178.10	100.77	163.23	102.24	167.27	103.56	172.74	96.96	166.76

Source: OECD calculations based on the AMAD database.

3.2 Tariffs

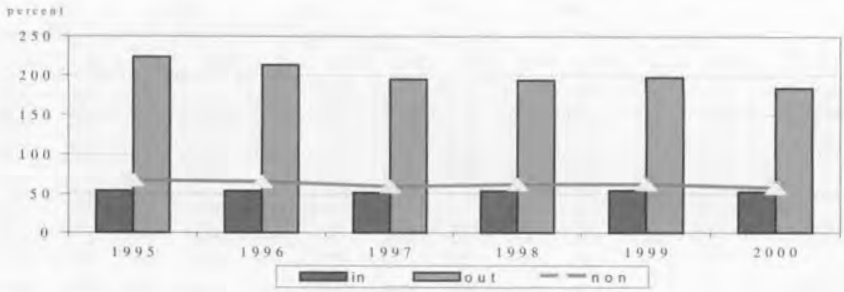
Analysing and understanding the effects of the TRQ system also needs information on tariffs resulting from the URAA, useful both for describing protection levels and to determine the rotation of the excess demand curves. This section thus provides information on average Most Favoured Nation (MFN) bound rates for the countries and commodities in our sample, including differences if any, between the scheduled and applied rates.

The protection level that emerges is very high. The calculated average tariff (in-quota, out-of-quota, and non-quota) for the countries and commodities covered was 114 % in 1995, falling to 97 % in 2000 (Table 2). The average, although still quite high, is lower for the countries that are endogenous in AGLINK, with an average in 2000 of about 64 %. This is based on calculations using AGLINK world prices to convert specific tariffs to *ad valorem* equivalents. The average is slightly lower when the calculations are based on world import unit values.

3.2.1 Average tariff by in-quota, out-of-quota and no-quota

The results reported in Table 2 mask the fact that there are different types of tariffs: in-quota, out-of-quota, and non-quota. Out of almost 3.200 tariff lines analysed, TRQ products account for more than half of the total, (25 % in-quota and 32 % out-of-quota rates). Figure 4 illustrates the evolution of the analysed tariff rates during the implementation period.

Figure 4: Average scheduled tariff for AGLINK commodities and selected countries



Source: OECD calculations based on the AMAD database.

The average in-quota tariff rate has changed very little over this time period as few countries scheduled reductions in these rates, whereas the non-quota and out-of-quota rates fell. Average out-of-quota rate is still very high at the end of the implementation period at 184 %, some 18 % below the 1995 rate. The graph shows that average in-quota tariff rates are not trivial with an average more than 50 %, but substantially lower than the out-of-quota rates and somewhat lower then non-quota tariffs (average 58 % in 2000). In-quota rates thus represent a significant hurdle, which may be one of the reasons for the relatively low fill rates discussed above.

Similar information for the year 2000, broken out by country, is reported in Table 3. It is worth to note that the protection given to quota products is very high as illustrated by the fact that the average out-f-quota rate is more than 200 % in five countries. This table also contains information on the total number of tariff lines included for each country and their distribution by the different tariff-types. This latter information is an indication of the degree of specificity in each country's tariff schedule as these lines represent the tariff structure for the same set of commodities for each country. It is also evident by the data in this table and Figure 4 that the gap between the in-quota and out-of-quota tariffs is tremendous, greatly reducing the possibility of out-of-quota imports.

3.2.2 Average tariffs by products

When this same information is looked at from a commodity rather than from a country angle, what jumps out is the relatively large diversity in the protection provided to the various commodities (Figure 5). Countries in this sample appear to provide the highest tariffs and thus the largest protection, to the dairy products. The average tariff for whey powder at 217 % is the highest among the sampled products, followed by butter at 167 % and whole milk powder at 150 %.

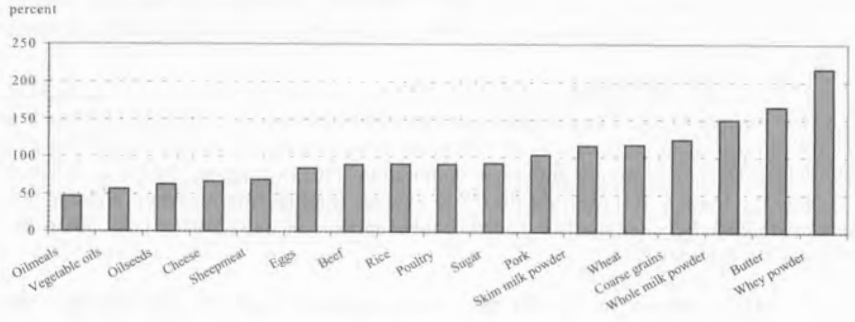
Table 3: Average scheduled tariff rates for countries and commodities in AGLINK

	Average tariff				Number of lines			
	All*	In-quota	Out of quota	Non-quota	Total	In-quota	Out of quota	Non-quota
	Percentage				Number			
Argentina	33.62	na	na	33.62	138	na	na	138
Australia	4.45	3.46	43.93	2.73	98	5	4	89
Canada	65.61	2.64	201.52	3.67	213	61	67	85
European Union	60.20	23.99	97.33	59.44	679	227	226	226
Hungary	35.50	19.84	43.86	20.63	149	19	96	34
Japan	190.96	18.83	657.79	58.01	245	58	58	129
Korea	66.82	18.78	203.35	25.34	186	45	45	96
Mexico	75.17	46.15	184.06	40.57	168	39	39	90
New Zealand	5.26	na	na	5.26	107	na	na	107
Poland	66.10	30.05	105.53	6.13	79	36	39	4
United States	28.41	10.56	90.82	10.16	329	84	74	171
Total for aglink endogenous countries *	63.65	20.40	162.35	30.18	2391	574	648	1169
Iceland	149.63	58.92	189.76	247.08	250	85	146	19
Norway	240.39	245.65	234.69	244.11	203	66	90	47
Switzerland	218.25	128.82	255.13	232.15	308	69	124	115
Total *	96.96	52.67	184.18	57.89	3152	794	1008	1350

na: not applicable
* Commodities included in this average are listed in Box 2

Source: OECD calculations based on the AMAD database.

Figure 5: Average scheduled tariffs in 2000



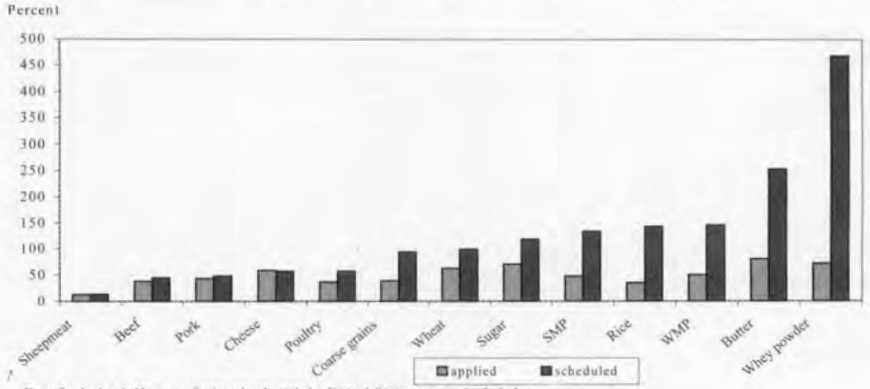
Source: OECD calculations based on the AMAD database.

3.2.3 Applied rates are also substantial

The tariff profile for the selected countries and commodities described above focused on the MFN rates found in each country's schedule (excluding mark-ups or other fees). These rates may overstate the extent of protection provided as (1) these rates do not include preferential tariff rates countries may have, such as between NAFTA, the European Agreements, nor the Generalised System of Preferences some developed countries have with developing countries and (2) applied rates are in some cases different from the

scheduled MFN rates. Differences between MFN bound and applied rates, using data for 1997, are explored in Figure 6.

Figure 6: Applied and scheduled tariffs for selected commodities: 1997



Data for Iceland, Norway, Switzerland, and the United States are not included.
Data for the European Union are included only for wheat and coarse grains.

Source: OECD calculations based on the AMAD database.

Figure 6 covers only a selected range of countries according to the information currently available in AMAD, for example, excluding Korea and Poland in 1997. In addition, applied rates for Canada, the EU (except for grains as a result of the Blair House Agreement), and the US are not included as these countries do not apply tariffs different from their schedule. Japan is the only Quad country with applied tariff rates that are significantly different from her MFN bound rates. Interestingly, some countries define their applied tariff schedule at a more detailed level than their MFN schedule and this can affect the calculated average tariff rate. For example, Hungary's applied tariff schedule contains 397 lines whereas her MFN bindings schedule for the same set of commodities contains 145 lines.

Figure 6 reveals that the average applied rate for the products in AGLINK is substantial, albeit, less than scheduled rates. For all commodities, the average applied MFN rate in 1997 based on 1040 tariff lines was 41 % compared to a scheduled average tariff based on 1819 lines of 80 %. Examining individual commodities, the average applied rate on butter, at 81 % is the highest followed by the 72 % average applied rate on whey powder. The largest difference between applied and scheduled rates is in dairy particularly butter and whey powder, and rice.

3.3 TRQ expansion and tariff rate cuts: expected reactions and results from modelling exercises

Many of the TRQs covered by the country and product definition of AGLINK are in the under-fill regime. We would hence expect that an expansion of such TRQs would have little effect. Decreasing tariffs could increase imports, but domestic policies defending internal prices would probably hamper the effect. Given in average high MFN tariffs, the effect of MFN tariff cuts should be more pronounced and wide spread.

Only a few studies have explicitly addressed the TRQ issue, and results between these are not directly comparable because either the modelling frameworks and/or the scenarios examined differ. ABBOTT and PAARLBERG (1998) using a net-trade model examined the Philippine pork TRQ. They found that the relevant instrument to liberalise is the out-of-

quota tariff rate. LARIVIÈRE and MEILKE (2001), also using a net-trade model, examined the implications of alternative liberalisation scenarios, (including quota expansion and tariff reduction), on dairy markets. They report rather small changes in world prices. Furthermore, their results indicate that compared to quota expansion, tariff reduction leads to larger changes in world prices, supporting our analysis based on the empirical findings. TSIGAS (2000) and ELBEHRI et al. (1999) use a general equilibrium framework to examine the TRQ issue. The trade component of their model is based on Armington specification, able to track bilateral flows but restricted to dealing with allocated quotas only. TSIGAS 2000 found that reducing tariffs (and export subsidies) lead to greater welfare gains in most regions than expanding the quota. ELBEHRI et al. (1999), even though using a CGE model, only examined the sugar TRQ in the EU and the US. They focus their analysis on the welfare effects for the two importing countries and their developing country trading partners through changes in bilateral trade and changes in quota rents. They found that reducing out-of-quota tariff rates increases the welfare for the importing countries (the US and the EU) while reducing the welfare of their exporting partners through lower quota rents. They also found that expanding the quota while reducing the out-of-quota tariff results in larger gains for the exporters as quota rents fall less.

4 Implementation of TRQs into AGLINK

There are three main problems related to the integration of TRQs into AGLINK

1. A *product aggregation problem*, as the product definition in the UAA schedules typically is more detailed as the model's product grouping. Many TRQs are defined at 6 or even 8 Digit-HS-Codes. Aggregating over the HS-codes does not only ask for definition of aggregation weights (values or physical quantities, imports only or total market appearances, base or current year figures), but typically leads to a mixture of in-quota, out-of-quota and no-quota imports.
2. A *spatial problem*, if TRQs are open to specific trading partners not matching the system's regional break down, a problem further accentuated in a net-trade system as AGLINK.
3. The *discontinuity of the function, which describes the tariff as a function of the import quantity,* not suited for gradient based solvers used by many existing trade models.

Up to now, many modelling systems have either neglected TRQs or handled them by setting lower bounds on the imports equalling the TRQ quantities, for example FAO's World Food Model. In the latter case, it is assumed that in-quota tariffs ensure imports at TRQ level, and the price linkage function is defined based on the out-of-quota tariff. Implicitly, the case with quota under fill is neglected, and the case where the quota is binding occurs at the wrong domestic price.

In the following, three approaches to incorporate TRQs are shortly discussed:

(1) A discontinuous price linkage function, introducing endogenous tariff (equivalents)

(2) Replacing the price linkage by a continuos quantity linkage

(3) Smoothing the discontinuous price linkage function.

4.1 Discontinuous price linkage function implementing a TRQ

The relations between the applied tariff respective the tariff equivalent of the quota t_{ar}, the TRQ quantity trq and the import quantity *imp* can be written as:

equation (1)
$$t_a = \begin{cases} t_{iq} & \forall \quad imp < trq \\ t_e & \forall \quad imp = trq \\ t_{oq} & \forall \quad imp > trq \end{cases} \Leftrightarrow tar = t_{iq} + \begin{cases} 0 & \forall \quad imp - trq < 0 \\ t_e - t_{iq} & \forall \quad imp - trq = 0 \\ t_{oq} - t_{iq} & \forall \quad imp - trq > 0 \end{cases}$$

The tariff equivalent of the quota t_e is defined by equations clearing regional markets at quota levels. The system requires to double all regional behavioural functions and market clearing equations for markets under a TRQ in order to determine internal prices at TRQ quantities, thus determining the tariff equivalent of the quota. Most TRQs in AGLINK are modelled according to this solution. Interestingly, the solver worked quite stable in our tests, probably due to the fact that few regime switches were required and, that the recursive-dynamic framework distributed the total changes over the individual years, so that in each year only minor shifts were modelled.

4.2 Continuous quantity link

A policy regime as currently applied in the EU presents a specific case, where subsidised exports are used to release internal market pressure. Higher imports, as provoked by the introduction of TRQs, increase market appearance, and the resulting price reaction may trigger higher subsidised exports. A net trade approach is hence not suitable. AGLINK employs behavioural functions for subsidised exports and intervention purchases, driven by the difference between domestic EU market and intervention prices. The market price in the EU can hence no longer be directly defined by a price linkage function. Instead, imports are written as a function of domestic prices p_d and import prices derived from world market prices p_w and the relevant in and out-of-quota tariffs:

equation (2)
$$imp = \begin{cases} trq & [p_w + t_{iq}] < p_d < [p_w + t_{oq}] \\ trq\left(p_d / [p_w + t_{oq}]\right)^s & \forall \quad p_d \geq [p_w + t_{oq}] \\ trq\left(p_d / [p_w + t_{iq}]\right)^s & p_d \leq [p_w + t_{iq}] \end{cases}$$

The step-wise differentiable equation states that the imports are equal to the TRQ quantity if the domestic price is between import price at in-quota and out-of-quota tariff. Imports rise rapidly if the domestic price exceed import prices plus out-of-quota tariff (second line), and fall rapidly if internal prices undercut import prices at in-quota tariffs. The exponent *s* applied to the price relation defines the steepness of the response and must be chosen as a compromise between accuracy and solvability.

4.3 Smoothing the discontinuous price linkage function

Discontinuous functions are hard to handle by gradient based solvers, and are therefore typically smoothed out by appropriate functions, choosing an optimal combination of accuracy of deviation from the non-smooth function and feasibility for the solver. The following sigmoid function can be used to smoothen a 0-1 variable depending on x (DRUD 2000):

equation (3)

$$sigm(x) = \exp(\min(0,x))/(1+b\exp(-abs(x)))$$
$$with \quad sigm(0) = 1/(1+b) \equiv a \Leftrightarrow b = 1/a - 1$$

equation (4) sigm(x) takes on values between 0 and 1 with

$$\lim_{x\to-\infty} sigm(x) = 0\,,\ \lim_{x\to+\infty} sigm(x) = 1\,.$$

The formulation was successfully tested by Martin v. Lampe in the WATSIM modelling system. In order to adjust the spread to the difference between in and out-of-quota tariff, the expression is simply multiplied with it. Driving the function at quota values through the tariff equivalent requires $b = \frac{t_{oq} - t_{iq}}{t_e - t_{iq}} - 1$.

As it turned out, the above formulation was not necessary to be employed for the current scenarios in AGLINK.

5 Summary and conclusion

The TRQ system that emerged from the URAA was a useful first step to increase market access by converting non-tariff barriers to tariffs and opening market opportunities for "sensitive" products by establishing quotas. Minimum access quotas were supposed to increase during the implementation period and out-of-quota tariffs were to be reduced, while imports within the quota were to be facilitated by relatively "low" in-quota tariffs.

This paper examines only one aspect of market access - the TRQ system and the associated tariff structure, while abstracting from quota administration issues that also influence market access. Market access, or lack there of, also depends on factors such as domestic policies, non-tariff barriers, such as sanitary and phyto-sanitary standards and the possible anti-competitive behaviour of some state trading enterprises, among others.

The analytical framework shows that only one instrument is binding at any time, that the binding instrument may change over time and that it can change for different commodities within a country and among commodities between countries. An ex-post analysis of the fill-rate of the TRQs during the last years shows that many TRQs in OECD countries were under-filled, and accompanied by non-quota imports under HS-tariff lines aggregated into the same product for the current analysis. Increased market access in that cases can be expected if (1) the in-quota tariffs are reduced and/or (2) MFN tariffs are lowered. The few modelling exercises found hint in the same direction: general MFN tariff cuts held a higher liberalisation potential compared to changes of the quota quantities or in-quota-tariffs.

From a methodological perspective, modelling TRQs faces similar regional and product aggregation problems as the design of multi-commodity models in general. The TRQs are often defined rather specifically at 6 or even 8-digit level HS code, and in certain cases such as the EU, partly allocated to individual trading partners, and in some cases historical shares are used, even at import firm level. Additionally, TRQs introduce a non-differentiable relation between import tariff and import quantity, more easily modelled using a Mixed Complementary Approach. Where the latter is not accessible, smooth approximation may be used. Last not least, certain policy regimes as simultaneous imports under TRQs and subsidised exports in the EU may require specific solutions.

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