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Tariff rate quotas: structural and stability impacts in growing markets

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Abstract

This paper examines several aspects of tariff rate quotas (TRQ) as adopted during tariffication of agricultural policies under the Uruguay Round of GATT. Quota rents and non-tariff barrier effects may remain under TRQs, contrary to the objectives of the tariffication process. Further, price stability impacts of a TRQ are more complex than those for either tariffs or quotas, and under certain circumstances TRQs may be more stabilizing than either case, since TRQs truncate domestic production distributions much like price bands policies. This complexity results from the possibility of regime switching, and may reflect behavior under either a tariff, a quota, or a combination of cases. A TRQ policy may affect the timing of import decisions based on incentives created under quota allocation procedures envisioned for this institution. It may also allow increased imports as demand growth occurs because the quota is not necessarily a binding constraint. This means the above quota tariff is the critical policy instrument. An empirical study of Philippines pork imports illustrates these issues.

Keywords: Tariff rate quota; Tariffication; GATT; Pork; Philippines; Uruguay Round; Trade policy

1. Introduction

With the variety of pre-existing agricultural trade interventions and their lack of transparency, non-tariff barriers were converted to tariff equivalents (tariffication) and bound under the recent Agreement on Agriculture in the Uruguay Round of the General Agreement on Tariffs and Trade (GATT, 1994). This reinstrumentation was intended to liberalize markets in a manner similar to GATT's success in previous rounds for industrial goods by setting new bindings from which future tariff reductions are to be specified (IATRC, 1994). Further, it was believed that tariffication would help stabilize world commodity prices as more nations would share adjustments to global shocks (Tyers and Anderson, 1992).

Improved market access was another centerpiece of the Uruguay Round negotiations for agriculture (Hathaway, 1994). Concerns about limitations on trade arising from non-tariff barriers led negotiators to insist on including minimum market access commitments as part of the agreement. These concerns may have also reflected fears over the relatively high tariff bindings proposed by many countries (Ingco, 1995a, b; Hathaway and Ingco, 1995).

Tariff rate quotas (TRQs) were selected as a compromise measure to implement both tariffication and market access in both GATT and the North American Free Trade Agreement (NAFTA). In NAFTA, TRQs

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were set according to the original vision of this instrument for most goods. Trade would be free up to the minimum access commitment. A tariff at the bound level would then be applied on subsequent imports. In the GATT agreement, however, 'below-quota tariffs' applied to imports under the minimum access commitment were often bound at or above historical levels, and 'above-quota tariffs' were at times bound at prohibitive levels (Ingco, 1995a, b).

This paper argues that the use of TRQs has circumvented the reforms sought under GATT and the conversion of non-tariff barriers into TRQs during the Uruguay Round may not be as attractive as it was once thought. Tariffication was not achieved because a TRQ regime allows a nation to effectively reimpose a quota if it maintains a prohibitive above-quota tariff. Transparency was not improved and quota rents may remain. A tariff rate quota affects both domestic and world price stability, but does not give the sharing of global shocks that would have occurred with a pure tariff. Furthermore, while the GATT agreement took a rather static view of markets, the actual impacts of TRQs will depend strongly on demand growth and market adjustments. As demand grows, the above-quota tariff will often become the critical policy instrument, not the below-quota tariff or the market access commitment.

This paper is divided into two major sections. Section 2 uses a simple conceptual model to examine the impacts of a TRQ for a small importing country. Quota rents, price stability implications and incentives on the timing of transactions are considered. In Section 3 the conversion of an import quota for pork by Philippines into a TRQ is empirically modeled. Those results demonstrate why the above quota tariff is the critical policy instrument, and that quota rents remain. Price variability is affected by the switch to a TRQ policy, and only behaves like pure tariffication after the above quota tariff takes full effect. Simulations of the domestic Phillippines pork price under a TRQ policy, as well as under pure tariffs and a quota, demonstrate the complexity of this outcome.

2. Replacing a quota with a TRQ

The analysis of a TRQ regime is developed here using a simple trade model for a small importing country. A tariff rate quota regime has three components. First, there is the quota (QR), which is the minimum access commitment in the GATT agreement. On import quantities below that quota the country levies a low (below quota) tariff (t_l), while above the quota a higher (above quota) tariff (t_h) applies to quantities imported above the minimum access commitment (QR). Both tariffs are initially treated as ad valorem tariffs, and depending on supply and demand in the domestic market, imports may be at, above or below QR

Fig. 1 presents this trade policy regime graphically using a standard two-panel diagram for the case where the TRQ behaves much like a pure quota. The first panel represents supply demand equilibrium in the domestic market. In the second panel, net import

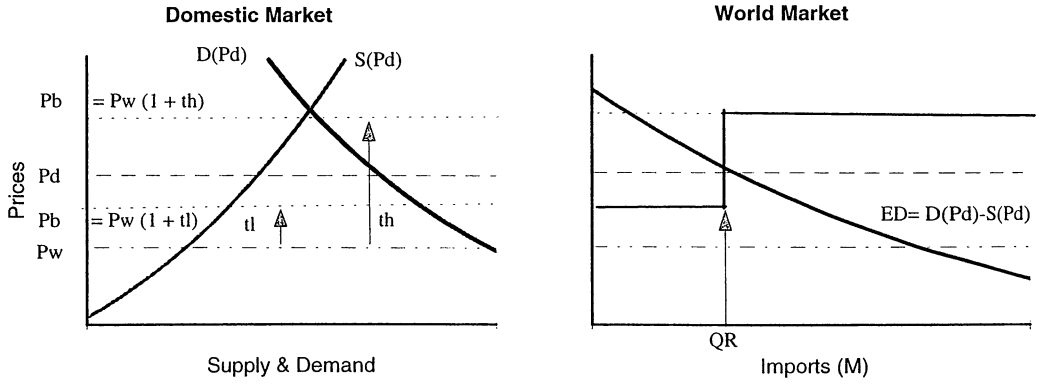

Fig. 1. Pure quota or TRQ with imports at QR.

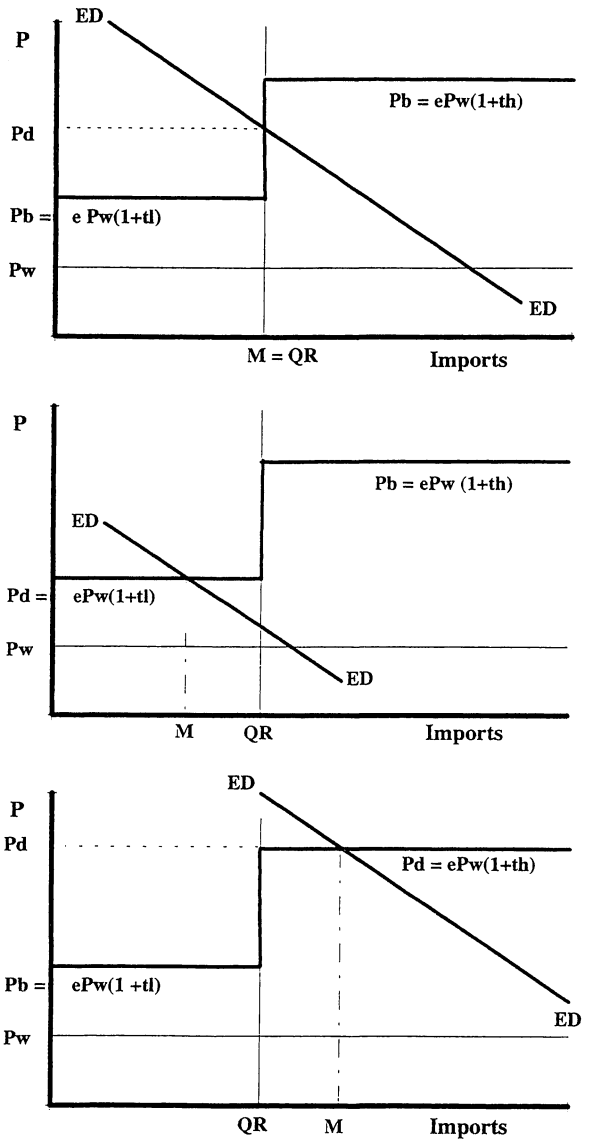

Fig. 2. Alternative trade regimes under a TRQ.

demand is derived from domestic supply and demand. In both panels, the quantitative restriction (QR) is determining a level of imports above that which would occur at the world price plus the above quota tariff. Imports are above a level at a domestic price above the world price plus the below quota tariff. The tariffs are shown explicitly in the domestic market panel, and may be used along with QR to generate in the world market panel the step function corresponding to net export supply to a small country. Fig. 2 illustrates the three possible outcomes in the second panel – imports in the world market are at, above or below QR depending on net import demand and prices at t_l and t_h.

The specification of this as a mathematical model to analyze the economic impacts of this trade regime begins with linear supply (S) and demand (D) functions:

$$S = S_0 + E_{sp}S_0/P_{d0}(P_d - P_{d0}) + G_sS_0T$$
$$D = D_0(1 + G_n)^T[1 - E_{dp}(P_d - P_{d0})/P_{d0} + E_{dy}(1 + G_y)^T - 1] \quad (1)$$

where P_d is the domestic price, E_{sp} and E_{dp} are the domestic supply and demand elasticities. Because the subsequent model for the Philippines includes dynamic forces, Eq. (1) includes a growth rate in supply (G_s), a growth rate in population (G_n), a growth rate in per capita income (G_y), and a time index (T). In order to benchmark this model, an initial equilibrium (S_0, D_0 and P_{d0}) determine intercepts for these functions.

Imports (M) are the difference between the demand and supply at the market equilibrium price:

$$M = D - S \quad (2)$$

Thus, a net import demand function may be specified as $M(P_d) = D(P_d) - S(P_d)$

A border price (P_b) is calculated based on a fixed world price (P_w), the exchange rate (e), and any tariff (t), based on the small country assumption:

$$P_b = eP_w(1 + t) \quad (3)$$

Solving for market equilibrium depends on the policy regime in place. For the case of a quantitative restriction, imports equal the quota level (QR), and the domestic price equates supply plus imports to demand (as in Fig. 1 and Fig. 2a):

$$M = QR = D(P_d) - S(P_d) \quad (4)$$

This occurs when net import demand (ED in Fig. 2a) intersects excess supply at QR (with a domestic price falling between that which would be determined by either the low or high tariff under a TRQ regime). This case applies both to the policy we assume applied prior to GATT – a pure quota – and one possible outcome under the TRQ regime. A quota rent (R) accrues if the

quota is binding as the domestic price is higher than the border price:

$$R = P_d - P_b = P_d - eP_w(1 + t_l) \quad (5)$$

In the case of a pure quota, the rent is the difference between the domestic and border price, and with a mixed policy, such as the TRQ, part of the potential rent is captured as tariff revenue. The quota rent is assumed to accrue to trading companies or exporting country.[1] In practice, who gets the rents depends on the quota allocation mechanism in place. As long as a rent is generated under a TRQ, some allocation mechanism will exist (either implicitly or explicitly).

The original quota sets a quantity trigger under the TRQ where imports below the trigger pay a reduced specific tariff (t_l) and imports above the trigger pay a higher specific tariff (t_h).[2] The excess supply schedule effectively facing the importer is the given world price plus the appropriate tariff. For imports up to QR it is the horizontal line segment at $eP_w(1+t_l)$. For imports above the trigger the excess supply is given by the horizontal line segment $eP_w(1+t_h)$. At the quota the excess supply is represented by the vertical line at QR.

In most instances, minimum access commitments under GATT were equal to existing import levels. Only in a few cases is the requirement that countries import at least 3–5% of consumption binding, and so will generate increased imports. In some cases, if prior quotas had led to high domestic prices, expanded imports could occur at t_h, unless t_h sets a price which is so high as to prevent further imports.

2.1. Static impacts

Under the TRQ regime there are three cases to consider. First, when imports equal the minimum access commitment the TRQ acts like a quota and a per unit rent (R) is earned:

$$\text{TRQ} = D(P_d) - S(P_d) \quad R = P_d - P_b \quad (6)$$

This was shown in Figs. 1 and 2a, and described above. With the TRQ a tariff revenue $t_l \times$QR is collected by the government of the importer. If $eP_w(1+t_l) < P_d$ for imports at QR there remains a rent, although its amount is reduced by the tariff revenue. A TRQ is similar to the case where a tariff is levied in addition to a quota. The TRQ allows the government of the importing country to appropriate some of the rent.

In Case 2a, the below quota tariff (t_l) is effective, as imports are less than the minimum access commitment:

$$P_d = P_b = eP_w(1 + t_l) \quad M = D(P_d) - S(P_d) < QR \quad (7)$$

If the excess demand is that which is shown in Fig. 2b and intersects the excess supply schedule to the left of the quota, then the TRQ allocates all of the former rent to the importing country's government as tariff revenue. The TRQ in this case acts like a pure tariff.

Finally, imports can exceed the minimum access level (QR) and the higher tariff (t_h) is levied. This occurs when ED intersects the excess supply function as in Fig. 2c. The per unit rent in this case is the difference between the domestic price and the world price plus the lower tariff (t_l). This rent is earned only on below quota imports:

$$P_d = eP_w(1 + t_h) \quad M = D(P_d) - S(P_d)$$
$$R = P_d - eP_w(1 + t_l) \quad (8)$$

The tariff revenue on quantities below the quota is $t_l \times QR$ and a tariff revenue of $t_h \times (M-\text{QR})$ is paid for imports above the quota (Fig. 2c). The total rent paid is $R \times \text{QR} = (P_d - eP_w(1+t_l)) \times \text{QR}$, since rent only accrues to the below-quota imports (whoever has the rights to the minimum access commitment). The domestic market price associated with the above quota imports is P_d. The TRQ allows larger imports than does a pure quota, but there is a rent to trading companies because the tariff revenue does not extract the full rent arising from the intervention. In rapidly growing markets, this rent can become quite small, but will not disappear, requiring whatever institution which allocates that rent to remain.

[1] As usual, added assumptions are needed to allocate this rent. In principle, the rights to import could be sold or an added tariff imposed so that the importing country's government could capture the rent. If the quota is allocated on a first come basis at no cost, it goes to either the exporting country or traders.

[2] There is an issue as to which tariff is paid when imports equal the quota for the excess supply functions graphed here (the cases in Fig. 1 and Fig. 2a. We assume that the lower tariff applies at imports QR and the higher tariff applies only for imports beyond QR.

2.2. Price instability

Tariffs allow nations to share the instability arising from production or demand shocks, whereas quotas confine the instability to the markets where the instability is generated (Bale and Lutz, 1978; Zwart and Meilke, 1979; Bigman, 1985). A TRQ has elements of both tariffs and quotas as well as introducing the possibility that the policy regime changes in response to stochastic influences.

To analyze the inter-annual price stability implications of a TRQ, we first assume that while excess demand and excess supply are stochastic, the shifts are not large enough to cause a policy regime change. Three cases are considered (the same as discussed above, and in Fig. 2): when imports are always below the quota; when imports are always at the quota; and when imports are always above the quota. Subsequently, the issue of regime changes is considered.

When excess demand intersects excess supply either always below or above the quota, the price variations and market behavior are like those under a tariff. Random shifts in the excess supply (world price) are reflected in the domestic price. Random shifts in the excess demand (e.g., domestic supply) do not affect the world price in this small country model, so they are reflected in import quantity variation, but not in the domestic price.

When imports remain at the quota level the stochastic shocks produce price movements that match those of a standard quota. Variation in the excess demand causes variation in the domestic price of the importer, but has no influence on the world market price. Variation in the excess supply is reflected in the world market price, but not in the importer's domestic price.

However, the shocks to excess supply and excess demand can be enough to alter the policy regime and when that occurs the price stability consequences become more complex. Assume that in the 'normal' case excess demand and excess supply intersect below the quota – as in Fig. 2b. An inward shift in the excess demand will affect imports, but not price, as happens for a tariff. An outward shift in the excess demand can cause imports to rise to the quota level (QR) and push the domestic price higher, like a quota would. In this case, for a given set of excess demand shifts the TRQ creates more domestic price instability than would a pure tariff policy, but less instability than would a pure quota.

Stochastic influences on excess supply alter the world price. As the world price rises in Fig. 2b, the domestic price will rise in concert, again the tariff result. If the world price falls, the higher tariff could be triggered (as in Fig. 2c) or the quota may be effective (Fig. 1 and Fig. 2a). Thus, the impact of rising world prices is fully reflected in the domestic price while the impact of falling world prices can be dampened.

When the higher tariff is in effect (in normal years), as in Fig. 2c, random shifts in the excess demand give the same type of price impacts as with the low tariff, but in the opposite direction. Years with random increases in the excess demand affect import levels, but not the domestic price. Years with random negative shocks to excess demand can result in imports at or below the quota, when the low tariff policy becomes effective. This means the domestic price falls in such circumstances.

Random downward movements in the world price will be reflected in the domestic price in the situation shown in Fig. 2c. In years when random shocks cause world price increases, the quota on imports can become effective. This occurs because the excess demand intersects the vertical segment of the excess supply. The increase in the domestic price is then bounded until the world price increases so much that the low tariff becomes effective.

When the TRQ is set such that imports are normally at the quota level random shifts in the excess demand generate domestic price movements that are limited to the gap between the tariffs. Thus, a TRQ truncates the distribution of prices that would occur with production variations under a pure quota. Stochastic increases in the excess demand can generate domestic price increases until the price rises to $eP_w(1+t_h)$. Stochastic reductions in the excess demand create declines in the domestic price until the price falls to $eP_w(1+t_l)$. Thus, with imports at the quota level the domestic price variability is like a quota, but once the imports are above or below the quota the price variability of a tariff is obtained. However, even if the world price is varying, the domestic price variability will be less than or equal to that under a quota, since price swings will never, under this case, exceed those which would be obtained under the pure quota. This is somewhat like a price bands policy used in LDCs to stabilize

domestic prices from extreme movements in demand (Abbott, 1994; Abbott et al., 1993).

When the excess supply is stochastic there are again price variability effects similar to both a quota and a tariff. A fall in the world price leaves the domestic price unaffected – like a quota – until the world price drop is large enough that the world price plus the high tariff is less than the domestic price. Increases in the world price also leave the domestic price unaffected until the new world price plus the low tariff exceeds the domestic price.

Overall, for random shifts in the importer's excess demand (such as production variability), the domestic price is more stable under the TRQ than under a pure quota. Yet, for excess demand shifts, the TRQ allows more domestic instability than does a pure tariff policy. When the excess supply is stochastic and the excess demand stationary the domestic price stability implications are more difficult to generalize. The outcome depends on the position of the excess demand and whether the movement in the world price alters the intervention. A subsequent empirical simulation will illustrate possible outcomes, and show that when TRQ parameters are set properly, this regime switching can lead in some circumstances to lower domestic price stability than would be obtained under a pure tariff or pure quota.

In determining the price stability implications of a TRQ policy relative to other trade regimes, the form of the tariff matters, just as it does for stability implications of a pure tariff. That is, since ad valorem tariffs are applied as a percentage of whatever the world price turns out to be, they magnify world price variability – the stochastic component of world price is also multiplied by the tariff, and the domestic price is increased (or decreased) by that component. For a specific tariff, the standard deviation of world and domestic price are equal, since the stochastic component of world price is not multiplied by the tariff - only a constant tariff is added. Thus, for TRQs, domestic price stability will be greater when the above and below quota tariffs are specific rather than ad valorem.

2.3. *Timing of transactions*

Unlike tariffs and quotas, a TRQ affects the timing of transactions because the actual tariff can differ from that expected by the importing agent or over the course of a marketing year. Until the quota is reached the lower tariff applies and the price is $eP_w(1+t_l)$. If the quota will not be reached, traders do not care when the good is imported or sold, as the domestic price is set and there is no rent to be gained. However, if the quota will be filled or exceeded at some time during a year, the allocation and timing of imports and sales become important to the importing agent.

Once the quota is exceeded the higher tariff is levied and the domestic price jumps to eP_w+t_h. Quantities imported and sold before the quota is reached receive no rent. Quantities imported and sold after the higher duty is in effect also obtain no rent. The rent is captured by those quantities imported before the quota is reached and sold at the higher price after the increased duty is imposed. (In practice, if importers anticipate the higher tariff becoming effective they have an incentive to import as soon as possible and then store the commodity until the higher price is reached). The original vision of the TRQ suggested that policy makers assumed this switch in tariffs would occur unexpectedly during the year, with importers naively responding and with no quantity restriction effects.

A trading company has the incentive to import early and sell late if the quota is expected to be reached or exceeded. Thus, the ability to store a product is critical to capturing TRQ rents. For commodities that are very storable, like grains, there is an incentive to quickly import the goods, store them, and wait until the higher price is triggered. For more perishable products the incentive is to delay imports until just before the quota is exceeded.

Different time lags for dispatch and arrival add an element of uncertainty. An exporter can dispatch a shipment expecting to pay the low tariff, but on arrival be obligated to pay a higher tariff. Consequently, the time length from departure to arrival can become a critical variable in deciding which markets to supply. (In the EU this problem with the variable levy led to a mechanism whereby trading companies could pre-commit to a levy.)

3. The Philippine TRQ for pork

The above model is used to analyze the replacement of quantitative restrictions on Philippine pork imports

by the TRQ mechanism adopted in the Uruguay Round, as occurred in that country. The model illustrates the mechanics of the TRQ as developed above and provides measures of how the policy shift affects this market.

An important aspect of TRQs not captured in the conceptual framework presented is its dynamic consequences in a growing market. The GATT agreement calls for a reduction in the above quota tariff over 10 years. Also, Philippine pork demand has been growing rapidly. Thus, both the TRQ policy and the market conditions in which it operates will be much different after the GATT agreement is fully implemented.

The Philippine pork industry corresponds well to the conceptual framework. As world pork trade is just under 5 million tons and the Philippines imports 1000 tons, the small country assumption is appropriate. Annual growth rates for Philippine pork production and consumption have been quite rapid. From 1986 to 1988 production grew at 3.4% per year and imports expanded at 40% per year. Quantitative restrictions (an import ban) were then used to limit these imports which generated rapidly rising domestic prices. Under the new trade agreement the quantitative restriction was replaced with a TRQ which allows larger imports as excess demand expands.

When the Philippine government was setting its GATT offer it was greatly concerned with the minimum access commitment and producer concerns about increased import competition. However, roughly one year later, increased domestic demand pushed domestic prices to a point where imports at the high tariff were competitive with domestic production, making the level of the minimum access commitment irrelevant (except to generate rents to whomever could import small quantities at the low tariff)

An empirical model presented below illustrates these consequences.

3.1. Model implementation

The model corresponds to Eqs. (1)–(8) shown previously, with the basic data presented in Table 1. The base supply, use, and price data are for 1994, with the tariffs and quotas taken from the Philippine GATT offer. The supply and demand price elasticities used to generate the domestic supply and demand relations with respect to market prices are from a survey of several studies (Department of Agriculture, 1992a, b; ERS, USDA, 1993; World Bank, 1991; Abbott et al., 1993; Carl Bro International, 1992).

Table 1
Base model assumptions and notation

Base supply and use balance:
S = Supply–production; 750 000 tons
D = Demand–Consumption; 750 000 tons
M = Imports; 0 ton
QR = Import Quota; 0 ton
Base prices and tariffs:
P_d = Domestic price; 45 pesos/kg
P_w = World price; $1000/ton
e = Exchange rate; 25 pesos per dollar
T = Base tariff; 20%
TQR = Minimum access commitment; 32.5×1000 tons
T_l = Below-quota tariff; 30%
T_h = Above-quota tariff; 100%
Elasticities and growth rates:
Elasticities
Supply-price; 0.45
Demand-price; 0.7
Demand-income; 0.8
Growth rates
Supply; 3.8%
Population; 2.2%
Income per capita; 3.8%

3.2. Model solutions

The model is solved for the 1994–2004 period assuming underlying historical growth rates for Philippine pork demand and supply. Inclusion of the growth rates highlights the dynamic issues which for a rapidly growing market like the Philippines are important.

Table 2 gives the results under a continuation of the quantitative restriction (import ban) and reports the market price, per unit quota rent, supply, and demand. Table 3 reports similar results for a TRQ based on the initial GATT offer by the Philippines. The very low minimum access commitment under GATT is 33 000 tons. In that case the low tariff (30%) is largely irrelevant. The above quota tariff is initially 100%, but in accordance with the Uruguay Round agreement is reduced over a 10 year transition period (to 40%, more than was required in GATT).

Table 2
The Philippine pork market under base quota, 1994–2004

Year	Supply ($\times 10^3$ ton)	Demand	Imports	Market price (Pesos/kg)	Border price	Quota rent
1994	750	750	0	45.00	30.00	15.00
1995	783	783	0	45.58	30.00	15.58
1996	816	816	0	46.26	30.00	16.26
1997	851	851	0	47.05	30.00	17.05
1998	886	886	0	47.94	30.00	17.94
1999	922	922	0	48.94	30.00	18.94
2000	959	959	0	50.05	30.00	20.05
2001	997	997	0	51.28	30.00	21.28
2002	1035	1035	0	52.62	30.00	22.62
2003	1075	1075	0	54.08	30.00	24.08
2004	1115	1115	0	55.66	30.00	25.66

The model results reveal some interesting insights into Philippine pork trade. If the quantitative restriction continued to restrict imports over the 1994–2004 period with demand growth exceeding supply growth market prices would rise – a bit over 10 pesos/kg after 11 years in these simulations. While the TRQ permits a very small increase in imports initially at the minimum access level, the demand growth relative to domestic supply makes imports profitable at the higher tariff and imports over time expand greatly. Since the minimum access commitment is a small fraction of demand its impact on prices, supply, and demand is extremely limited. The higher tariff for above quota imports rather than the minimum access level is the critical policy instrument, determining import levels and domestic prices. Reductions in that tariff lead to the projected declining domestic prices as imports are rapidly expanding.

With imports above the quota as shown in Fig. 2c, there remain quota rents to allocate, even if on a very small percentage of imports. The shift to a TRQ policy from a quota may reduce the size of the rents to allocate, but does not eliminate them. Under the pure quota policy the rent rises from 15 pesos/kg to nearly 26 pesos/kg as the domestic market price rises. The TRQ policy shows a pattern of falling rents as the market price falls due to the declining above quota tariff. In the early years the per ton difference between the above-quota domestic price and the below-quota border price is between 10 and 12.68 pesos/kg. As domestic prices fall in the later years through tariff reductions and larger imports, the price gap between

Table 3
The Philippine pork market under a TRQ, 1994–2004

Year	Supply ($\times 10^3$ ton)	Demand	Imports	Market price (Pesos/kg)	Below-quota price	Quota rent
1994	750	750	0	45.00	32.50	12.50
1995	770	803	33	43.91	32.50	11.41
1996	803	838	35	44.49	32.50	11.99
1997	837	874	37	45.18	32.50	12.68
1998	864	924	60	45.00	32.50	12.50
1999	883	990	106	43.75	32.50	11.25
2000	902	1059	157	42.50	32.50	10.00
2001	912	1150	238	40.00	32.50	7.50
2002	922	1245	323	37.50	32.50	5.00
2003	932	1345	414	35.00	32.50	2.50
2004	960	1415	455	35.00	32.50	2.50

above- and below-quota imports shrinks to 2.5 pesos/kg. Unfortunately, the Philippines may be required to maintain an institutional mechanism to allocate the minimum access commitment and these rents on a very small fraction of pork imports.

To illustrate the price instability issues raised previously, a stochastic term is added to the Philippine pork supply function and world price is also treated as stochastic. Both random variables are assumed to be normally distributed and independent of one another. The standard deviation of Philippine pork supply is obtained from the standard error of regressions which models pork supply as a time trend. This gives a standard deviation of 67.53 on a mean for production of 750 ton in 1994. The mean value for the shock is zero. The standard deviation for the world price is obtained from real import unit values over the period 1980–1993. The coefficient of variation for world price equals 0.245.

Table 4 shows the standard deviations obtained for the domestic Philippine pork price with 100 shocks. Four policy scenarios are simulated: free trade, pure quota, high tariff, low tariff, and a TRQ. In each scenario solutions are obtained when both random variables are active as well as when only one random variable affects the market. Table 4 also considers the initial year – year 1 – instability effects and the effects in year 10 to highlight the role of demand growth in the market. In year 1 the mean import level is at the quota of 33 000 tons. In year 10, demand growth for pork in Philippines means that mean imports of 455 000 tons exceeds the quota and the high tariff is levied in most cases. Finally, Table 4 also reports year 1 and year 10 results for simulations where tariffs are modeled as specific rather than ad valorem, both to show the greater stability under specific tariffs generally, and to show more clearly under this regime that a TRQ is more stabilizing under this circumstance than either a pure quota or tariff.

The first four results for both year 1 and year 10 correspond to the outcomes expected from earlier studies. When excess demand is stochastic, excess supply is non-stochastic, and there is a direct link between the domestic and world price (as under free trade and pure tariff policies), then no variation in the world price means no variation in the domestic price. The pure quota policy severs the link between these prices and hence the stability in Philippines reflects the instability in domestic supply. The opposite situation occurs when excess supply is stochastic and excess

Table 4
Standard deviations for the Philippine pork price under alternative policies

	Free trade	Low tariff	High tariff	Quota	TRQ
All tariffs ad valorem					
Year 1					
Excess demand stochastic	0	0	0	3.55	3.46
Excess supply stochastic	6.39	8.31	12.78	0	5.32
Both stochastic	6.19	8.04	12.37	3.94	5.74
Year 10					
Excess demand stochastic	0	0	0	3.13	0
Excess supply stochastic	6.39	7.67	8.97	0	8.85
Both stochastic	6.19	7.42	8.66	3.04	8.60
All tariffs specific					
Year 1					
Excess demand stochastic	0	0	0	3.55	3.46
Excess supply stochastic	6.39	6.39	6.39	0	6.39
Both stochastic	6.19	6.19	6.19	3.44	3.26
Year 10					
Excess demand stochastic	0	0	0	3.13	0
Excess supply stochastic	6.39	6.39	6.39	0	6.39
Both stochastic	6.19	6.19	6.19	3.04	6.19

demand is not. World price instability is reflected in the domestic price under the free trade and tariff regimes, with the tariffs showing more instability. The quota policy isolates the market so there is no domestic price instability as a result of variations in the world price.

The TRQ policy introduces two major differences. In year 1 the standard deviations of domestic prices under the TRQ are a blend of those under the quota and the tariff. Only when the excess demand is stochastic the instability in the domestic Philippine pork price is similar to that of the pure quota, but is slightly lower as explained previously. For a stochastic excess supply, the Philippine price instability is positive, like the free trade and tariff scenarios, but of a lower magnitude – in the direction of the quota result which yields no instability.

When both the production and the world price are stochastic Philippine price instability is somewhat less than that for free trade. From the Philippines perspective when both variables are stochastic the TRQ gives a lower domestic price variation than free trade, but more than the pure quota regime it replaces. Price variability increases under a TRQ because the high tariff in years of low prices induces a lower (not higher) domestic price than would obtain under a pure quota regime. Thus, the upper limit of the 'price band' is moving below a normal price (mean world price plus the low tariff), due to the high variability under ad valorem tariffs.

When specific tariffs are used, excess demand shocks induce the same price variability regardless of the magnitude of the tariff. Moreover, when both excess supply and demand are stochastic, the lowest variability is now found for the TRQ regime. There is, in this case, less variability in the limits, due to tariff regimes becoming active on the quota regime prices.

In year 10 Philippine demand growth generates solutions where the high above quota tariff most often applies and the price instability results reflect that. They exhibit the same patterns noted above, but are much more similar to the high tariff results than to the quota results. A stochastic excess demand causes no domestic price variation, like free trade or tariffs, whereas a quota would. The stochastic excess supply gives a domestic price instability much like that of the high tariff. Indeed overall, the TRQ results are very similar to those for the high tariff scenario and both lie above those for free trade because imports are so far above the quota there is rarely a change in regime. Compared to the original quota policy when both relationships are stochastic the TRQ allows much more domestic price instability. Specific tariffs would cause domestic price variability in this case to be very similar to the free trade result, a standard deviation of 6.19, except in the pure quota case. While quotas yield the lowest price variability in this case, it is at a much higher mean price, since imports are severely limited.

4. Conclusions

In the Uruguay Round tariffication was implemented through the adoption of tariff rate quotas (TRQ). This article examines how TRQs operate and uses a model of Philippine pork trade to illustrate their major features.

One issue is that a TRQ may continue to generate quota rents. When imports are below the minimum access commitment (quota) the TRQ appears like a pure tariff. However, when imports are at or above the quota, the higher tariff creates the opportunity for a welfare gain by trading companies or exporting countries, unless a quota allocation institution is put into place. The empirical model for the pork sector in the Philippines shows that rents under the TRQ remain even if the above quota tariff determines most market outcomes.

Uncertainty about the import regime and the possibility of rents affects the timing of imports as importers seek to import before the quota is breached and sell afterwards. Thus, the transparency sought in the negotiations is only partially achieved, at best.

Price stability concerns were also important in the negotiations. While tariffs and quotas have relatively clear impacts on world and domestic price stability, a TRQ policy is much more complex. This complexity arises due to the possibility of regime switching. So long as the regime is stable the TRQ will affect price stability either like a tariff or like a quota, depending on which is applicable. But shocks can be sufficiently large to alter the policy regime which introduces instability characteristics of both tariffs and quotas. For random excess demand shifts the domestic price is more stable under a TRQ than under a quota, but less stable than that for the pure tariff. This pattern is

demonstrated in the empirical model. When the excess supply is stochastic, the domestic price stability outcomes are hard to generalize. The empirical model for the Philippines shows that, when all tariffs are ad valorem, the domestic pork price under the TRQ is more stable than with a pure tariff, but less stable than for a pure quota. When all tariffs are specific, a TRQ regime in the initial year offers the greatest domestic price stability, acting much like a price bands regime with variable bands following world price variability. Variable levy like setting of tariffs (to counter world price fluctuations) is likely when this regime is used in a country where domestic price stability is important. Quota levels may also be varied endogenously in such cases, to counteract domestic production variability. In any case, the greater is domestic price stability for importers collectively, and the less they share in adjustments to shocks worldwide, the greater is world price instability, as importers who stabilize their domestic markets export that instability (Johnson, 1973).

The empirical model illustrates another important feature of TRQs – unlike a quota, demand growth can make the minimum access commitment largely irrelevant. Much of the policy discussion on implementing TRQs has focused on setting the level of the quota (ASAP, 1994; Development Alternatives Inc., 1993; Castillo and Manzo, 1995). As demand for Philippine pork grows, the above quota tariff becomes the critical policy instrument, not the level of the quota. This may become the case in other countries as well, unless the above quota tariff binding results in a prohibitive tariff. With growing domestic demand (as is expected in much of Asia–ERS), imports may expand even at the high above-quota tariffs many countries offered in GATT.

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