The liberalization of Tariff Rate Quotas under oligopolistic competition ¹

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Abstract: The paper uses a two-stage capacity constrained model to investigate the impact of different liberalization options of Tariff Rate Quotas (TRQs). The results show that the impacts of the various liberalization options - the reduction in the in-quota and out-of-quota tariffs, improvements in the TRQ administration system - are rather diverse from those predicted by models assuming perfect competition.

Keywords: tariff rate quotas, oligopoly, trade liberalization

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1. Introduction

A growing share of agricultural trade occurs within Tariff Rate Quotas (TRQs). In 2004, 1,429 TRQs were notified to the WTO (WTO, 2006); more than 15% of agricultural tariff lines in the EU are currently covered by TRQs, and other countries use TRQs even more intensively; in Norway, for example, almost 40% of agricultural tariff lines involve TRQs.

TRQs are two-tiered tariffs, with a lower tariff applied to in-quota imports and a higher tariff applied to additional out-of-quota imports. The Uruguay Round Agreement on Agriculture has introduced several TRQs in order to guarantee minimum market access where there had previously been no significant imports because of high protection, or to maintain access opportunities where tariffication would otherwise have reduced them. Whether or not the implementation of TRQs has really improved market access is an open question (Abbott, 2002) and several proposals for liberalizing agricultural TRQs have been brought to the WTO in the Doha Development Agenda (DDA). Three major topics dealing with the issue of TRQ liberalization are currently under discussion in the DDA negotiations (WTO, 2008): the reduction of MFN tariffs, as this implies a decrease also in out-of-quota tariffs; the reduction of the in-quota tariffs for existing TRQs; and the reform in the TRQs administration method. TRQs are also intensively used under preferential trade agreements, especially by developed countries to limit preferential access to products from developing countries. One of the core issues in negotiations between (potential or actual) members of preferential trade agreements is how to liberalize agricultural trade when TRQs are in place.

In both contexts, multilateral and preferential agreements, a key issue is which strategy for TRQ liberalization is more desirable from the trade and welfare points of view. The literature on TRQs has provided several hints about the possible impact of a reduction in the in-quota or the out-of-quota tariffs, of an expansion of the quota or of an improvement in the efficiency of TRQs administration (e.g. Boughner et al., 2000; Skully, 2001a, 2001b; Rude, Gervais, 2006). Most contributions rely on the assumption that international markets for agricultural products are competitive, even though this is often not the case. There are several cases in which international markets are dominated by oligopolistic traders. This paper aims at contributing to the literature on the economics of TRQs by investigating the impact of TRQs and of different liberalization options in oligopolistic markets.

Oligopolistic models used in the analysis of tariff and quotas, by and large, assume a priori the mode of competition either to be à la Cournot or to be à la Bertrand, even though there are good reasons to expect both types of behaviour depending on market conditions. As a consequence, comparative statics is generally performed by keeping the mode of competition fixed; however, the nature of the strategic interaction between firms may be affected by trade policy. This paper develops a two-stage capacity constrained model in which the mode of competition is endogenous and is affected by the trade policy; in this setting, the impact of TRQs liberalization depends also upon whether and how the policy change affects the strategic interaction between firms. The model is based
on Maggi (1996) who developed a duopoly capacity constraint model in which the constraint is flexible and the mode of competition is endogenous to address strategic trade policy issues. Firms in the first stage choose capacity while in the second stage, after observing the rivals’ capacity, compete on price. The capacity constraint faced by firms is flexible as firms can always increase quantities above the capacity chosen in the first period, albeit at a higher cost. The model predicts that the game moves from a pure Bertrand outcome to a Cournot outcome as the effectiveness of the capacity constraint increases. This depends upon the value of the costs of adjusting capacity in the two periods; the greater the gap between the cost of adjusting capacity between the two periods, the higher the effectiveness of the capacity constraint.

This kind of models appears to be suited to analyse TRQs: in the case of TRQs the capacity is given by the amount of licences that firms acquire to import within the quota; the cost of adjusting capacities in the first period is given by the cost of obtaining licences plus the in-quota tariff; in the second stage firms may adjust capacities only by importing out-of-the quota at the cost of a higher tariff. The framework is here extended to the \( N \) firms case and used to examine and compare the impact of different TRQ liberalization options on the mode of competition, trade and welfare. The results emphasize how the consideration of strategic interactions between firms may provide some unconventional conclusions on the impact of the different TRQ liberalization strategies.

The paper is organised as follows; the next section presents the model, the third analyses how different liberalization scenarios affect firms’ strategic interactions and the fourth illustrates, by means of numerical examples, the trade and welfare effects together with the impact on firms’ market power. The last section offers some concluding remarks.

### 2. The model

The model considers \( N \) symmetric firms importing a differentiated product in one country. The assumption that products are differentiated appears reasonable in the context of many products covered by TRQs; a large part of them are processed goods which may be quite similar, though not perceived as identical by consumers; also when considering trade in raw products, there is no agreement about their homogeneity and some papers have emphasised the importance of product differentiation even in the case of commodities such as cereals and beef (e.g. Carter, Mac Laren, 1997; Lavoie, 2005; Ramos et al. 2007).

Each trader imports the quantity \( q_i \) and faces the following inverse demand function:

\[
p_i = \alpha - \beta q_i - \lambda \sum_{j \neq i} q_j
\]

with \( p_i \) being the price, and \( \beta > \lambda \). The direct demand function is:

\[
q_i = a - \beta p_i + c \sum_{i \neq j} p_j
\]
with \( a = \frac{\alpha}{\beta + (N - 1) \lambda}, b = \frac{\beta + (N - 2) \lambda}{(\beta + (N - 1) \lambda)(\beta - \lambda)}, c = \frac{\lambda}{(\beta + (N - 1) \lambda)(\beta - \lambda)} \) \( (3) \)

The importing country employs a TRQ, with \( Q, t \) and \( T \) being the import quota, the in-quota tariff and the out-of-quota tariff, respectively. In order to obtain the right to import within the quota, each trader is assumed to face the unit cost \( l \). This is because traders very often face certain costs in order to obtain the quota licences. When they are allocated on demand or on a first-come-first served criteria, firms spend resources in rent-seeking activities in order to obtain the quota rents (Hraianova, de Gorter, 2005). Under the historical allocation system, in most cases licences are transferable and firms have to purchase licences on the market if they wish to increase imports above their historical level. ² Finally, with auction quotas - a method which is hardly ever used, accounting for less than 1% of agricultural TRQs in force (WTO, 2006) - traders purchase the licences directly from the government.

The cost of the licence plus the in-quota tariff is always lower than the out-of-quota tariff, i.e. \( l + t < T \). The \( N \) firms face identical marginal costs, \( m \), which are assumed to be constant. The profits of the \( i \) trader are:

\[
\Pi_i = \begin{cases} 
 q_i \leq Q_i & \text{then } \Pi_i = q_i(p_i - t - l - m) \\
 q_i > Q_i & \text{then } \Pi_i = q_i(p_i - (t + l + m)Q_i - (q_i - Q_i)(T + m)) 
\end{cases} \]

with \( Q_i = \frac{Q}{N} \). There are two stages in this game. In the first stage firms choose capacity, i.e. they choose the amount of licences they wish to obtain. By doing this, they commit themselves to import a certain volume of the product in the second stage of the game. In the second stage, after observing the capacity that their rivals have chosen in the first stage, firms compete on price. In this stage firms may still choose to increase their capacity, but only by importing out of the quota. In other words, it is assumed that the amount of product to be imported within the quota can be chosen only in advance (in the first stage). This reflects reasonably well the way in which the allocation of licences works under most commonly used allocation methods; in fact, licences are allocated well in advance with respect to the date of the effective entry of the product into the importing country, and most traders consider that the only way to increase capacity afterwards is to import out of the quota. Thus, in this model, the amount of licences obtained in the first stage works as a commitment of the firm to import a certain amount of the product in the second stage. Maggi (1996) has shown that in this setting the prevailing mode of competition and the outcome of the game depend upon the effectiveness of this commitment; as the effectiveness of the commitment increases, the game moves from a pure Bertrand outcome to a Cournot outcome. The effectiveness of the capacity commitment depends upon the relative costs of increasing capacities in the two stages. We can identify two possible benchmarks for

² We assume that firms face the cost \( l \) for each unit of product imported within the quota. Under the historical allocation method firms face the cost of purchasing licences only if they import above their historical level. This specific case is addressed in Scoppola (2008).
the solution of this game. On one hand, if the cost of increasing capacity in the second stage is equal to
that incurred by firms in the first stage, then the capacity chosen in the first stage does not work as a
commitment device; in this case, the capacity constraint is negligible and firms compete on price, i.e.
the outcome of the game is Bertrand. On the other hand, if the cost of increasing capacity in the
second stage is very high, then the capacity commitment becomes relevant and firms compete on
quantities, i.e. the outcome of the game is Cournot.

The subgame perfect equilibrium implies that (Maggi, 1996):

\[
p = \begin{cases} 
  p_b^i (m, T) & \text{if } l + t < T^* \\
  p^c_i (m, t, l) & \text{if } T \geq T^*
\end{cases}
\]  

(5)

with \( p_b^i \) e \( p^c_i \) being the Bertrand and Cournot equilibrium prices, respectively, and \( T^* \) being
a critical value of the out-of-quota tariff defined implicitly by \( p_b^i (m, T) = p^c_i (m, t, l) \). As
aforementioned, when the value of the out-of-quota tariff is equal to the cost of increasing capacity in
the first stage \( l + t = T < T^* \) there is no capacity constraint and the outcome of the game is Bertrand
with long run cost equal to \( l + t + m \). If \( l + t < T < T^* \) then the equilibrium can be identified as the
outcome of a one-shot Bertrand game in which firms compete on price and have long run costs equal
to \( m + T \). The basic intuition is that when the cost of increasing capacity in the first stage is lower than
in the second stage \( l + t < T \), investment in capacity in the first stage sustains a higher price
\( (p^i_b (m, T)) \), than the one that would prevail in a “pure” Bertrand one-shot game \( (p^i_b (m, t, l)) \).
Finally, when \( T > T^* \) the capacity commitment is effective and firms compete à la Cournot.

It is worth noting that this is the outcome of the game if \( q_i \leq Q_i \). Conversely, equation (5)
cannot be the equilibrium when \( q_i > Q_i \). This is because when demand and cost conditions are such
that there are out-of-quota imports, firms acquire all available licences and import additional
quantities at the price of the out-of-quota tariff. Under these circumstances, the amount of purchased
licences, which is always \( Q_i \), does not represent the capacity chosen by firms and, thus, does not work
as a capacity commitment. The capacity constraint is ineffective and this implies that the outcome is
always the Bertrand one. This is a relevant difference with respect to the setting of the paper by Maggi
(1996); in that paper firms can increase capacity at lower costs in the first stage without limit; under
the TRQ this happens when the equilibrium quantities are lower than the quota and the licences work
as the chosen capacity. However, when the equilibrium quantities are higher than the quota, the
marginal cost of adjustment in the first period is equal to that of the second period (i.e., the out-of-
quota tariff) and the capacity constraint becomes ineffective. Firms perceive the policy as a “pure”
tariff regime with the tariff being equal to \( T \). Thus when \( q_i \geq Q_i \) the subgame perfect equilibrium
implies always that \( p = p_b^i (m, T) \).
The Bertrand price $p^*_{i}(m,T)$ may be obtained by maximising (4) by holding fixed the rivals’ price, when costs are $m,T$:

$$\max_{p_i} \Pi_i = p_i q_i - (m + T)q_i$$

which yields the following reaction curve:

$$p_i = \frac{a + c \sum_{j \neq i} p_j + b(T + m)}{2b}$$

(6)

(7)

Given the symmetry assumption, the equilibrium price is:

$$p^B = \frac{a + b(T + m)}{2b - c(N - 1)}$$

(8)

The Cournot equilibrium price is obtained by solving the maximisation problem:

$$\max_{q_i} \Pi_i = q_i p_i - (m + t + l)q_i$$

(9)

from which the reaction curve is:

$$q_i = \frac{\alpha - (t + l + m) - \lambda \sum_{j \neq i} q_j}{2\beta}$$

(10)

The Cournot equilibrium price $p^C_{i}(m,t,l)$ is:

$$p^C_i = \frac{\alpha \beta}{2\beta + \lambda(N - 1)} + \frac{(t + l + m)(\beta + \lambda(N - 1))}{2\beta + \lambda(N - 1)}$$

(11)

The critical value of the out-of-quota tariff $T^*$ above which the mode of competition shifts to Cournot may be obtained from (8) and (11) and depends upon the values of the demand parameters, of marginal cost, and of $l,t$ and $N$. While $l$ and $t$, as expected, both positively affect the value of the critical tariff – the higher their values, the weaker the capacity commitment, the higher $T^*$ - the impact of the number of rivals depends upon the value of $N$, as it will be shown in the next section by means of a numerical example.

The literature on TRQs has shown how the equilibrium depends upon which instrument is binding: the quota itself, the in-quota or the out-of-quota tariff. Import demand and the level of $Q$, $t$ and $T$ jointly determine which of the three instruments is binding. In a perfect competitive framework, the in-quota tariff is binding when the world price plus the in-quota tariff is greater than the domestic price determined by the import quota alone; in this case, imports are lower than the quota. The out-of-quota tariff is binding when the world price plus the out-of-quota tariff is lower than the domestic price determined by the quota alone; imports are thus higher than the quota. The quota is binding when the world price plus the in-quota tariff is less than the domestic price determined by the import quota and the world price plus the out-of-quota tariff is greater than the domestic price determined by the

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3 More details are provided in the Appendix.
quota; in this case, imports are equal to the quota (Boughner et al. 2000; Skully, 2001). Under perfect competition, when imports are lower than the quota, both $T$ and $Q$ are redundant, as the price is determined by another instrument, i.e. $t$. This may not be always the case in the model developed in this paper.

The outcome of the game - for given values of demand parameters and $m$ - depends first, upon the maximum amount of licences available to each operator ($Q_i$); and second, upon the values of $l, t$ and $T$ which ultimately determine the effectiveness of the capacity commitment (i.e. whether or not the out-of-quota tariff is greater than the critical tariff) (Table 1).

When $Q_i > q_i(p^g), q_i(p^c)$, then the outcome of the game is (5): if $T > T^*$ a Cournot outcome prevails and, as expected, the price is determined by the in-quota tariff, while $T$ is redundant (equation 11); but when $T < T^*$ the equilibrium is Bertrand (equation 8) and the price is determined by the out-of-quota tariff; this means that, although imports are lower than the quota, the in-quota tariff is redundant, while $T$ determines the level of the price.

Conversely, when $Q_i < q_i(p^g), q_i(p^c)$, firms operate as if there is no capacity constraint and the outcome is always Bertrand, with long run marginal costs equal to $T + m$ (equations 5). In this case, as expected, the binding instrument is $T$, while $t$ and $Q$ are redundant. Finally, when $q^g < Q_i < q^c$ and $T > T^*$ neither Cournot nor Bertrand are Nash equilibrium. This is because if firms choose the capacity $q^*$, imports are lower than the quota; but in this case, firms are in equilibrium by choosing the Cournot capacity; however, if they choose $q^c$ they import a volume which is higher than the quota; but in that case the equilibrium is Bertrand which implies the capacity $q^*$.

3. Liberalizing TRQs: the impact on the mode of competition

To investigate the impact of liberalization on the mode of competition five possible options are here taken into account; 4 in addition to the reduction in $T$ and $t$ and the increase in $Q$, two further scenarios are considered. First, the government may reform the TRQ regime by improving the efficiency of the allocation system and this results in a reduction of the cost $l$ for obtaining licences for firms 5. Second, reforms of TRQs may also result in the entry of new firms (an increase in $N$). This occurs when, for some reason, traders which are as efficient as incumbents do not entry into the

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4 The issue of the TRQ tariffication, that is, the elimination of the TRQ and its replacement with a tariff equivalent under oligopoly, is addressed in Scoppola (2008).

5 Other types of cost due to inefficiencies in the administration system, such as administrative and other transaction costs are not considered here. It is worth noting that in this setting, the assumption of symmetry rules out the possibility of inefficiencies due to the misallocation of licences to high-cost traders.
market because they face barriers in obtaining licences; the removal of these obstacles may imply an increase in the number of rivals on the market.

When under the TRQ \( q_i > Q_i \), firms behave as under a tariff and the mode of competition is always Bertrand. In general terms, none of the liberalization options affects the mode of competition, although they have trade and welfare effects. Only if the expansion of the quota leads to a change in the binding instrument (\( Q_i > q_i \) and thus the binding instrument is \( t \)) then the mode of competition may shift from Bertrand to Cournot.

Things are different when initially there are no over quota imports (\( q_i \leq Q_i \)). Out of the five possible liberalization methods, in four cases the liberalization of the TRQ may affect firms’ behaviour. The mode of competition depends upon the value of the critical tariff \( T^* \) with respect to the out-of-quota tariff \( T \). An increase in \( Q_i \) does not affect either \( T^* \) or \( T \) and, thus, does not change the behaviour of firms. Conversely, an increase in the number of firms, and the reduction in \( t \) or \( l \) influence the value of \( T^* \) and, thus, may imply a change in the mode of competition. The reduction of \( T \), if \( T > T^* \), may also change the mode of competition.

Figure 1 reports the values of the critical tariff, as a function of \( N \), the number of firms.\(^6\) In this example, with a low number of firms (\( N < 13 \)) the quantity imported by each firm is higher than \( Q_i \) and, thus, there are out-of-quota imports and Bertrand competition prevails. When \( N \geq 13 \), \( q_i < Q_i \) and the mode of competition is determined by the value of the critical tariff, which, in our example, for low values of \( N \) is lower than the out-of-quota tariff; thus, firms compete on price. As \( N \) increases, the critical tariff decreases; if the number of new operators is high (in the Figure this happens if \( N > 30 \)), the critical tariff may become lower than \( T \) and the equilibrium shifts to the Cournot one. Hence, the model suggests that if \( N \) is high enough, then, everything else held constant, an increase in the number of rivals makes stronger the capacity commitment and more likely the Cournot outcome.\(^7\) This is due to the fact that when \( N \) is very high the market share of firms becomes very limited and this reinforces the capacity commitment; a similar effect is determined by an overall decrease in market size, while keeping constant the number of firms.\(^8\) It is worth noting that, as a consequence of the increase in the number of firms, market power in any case decreases, but less than

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\(^6\) In Figures 1, 2 and 3 and in the Tables (baseline scenario) the following values for variables and parameters are assumed: \( \alpha = 400 \), \( \beta = 0.8 \), \( \lambda = 0.1 \) \( l = 3 \), \( m = 2 \), \( t = 5 \), \( T = 15 \), \( N = 15 \). As for the individual quota, this is assumed to be \( Q_i = 140 \) which, in the baseline, is higher than both \( q_i^B \) and \( q_i^C \). Different values for parameters, while affecting the changes in the variables, do not influence the direction of changes and, thus, the main conclusions of the paper.

\(^7\) The shape of Figure 1 is stable across different values of demand parameters and costs satisfying the model’s constraint.

\(^8\) As equation 12 reported in the Appendix shows, a decrease in \( \alpha \), which implies a reduction in firms’ market share, results in an increase in \( T^* \).
if a fixed mode of competition (i.e. Bertrand) is assumed. In the limit case in which \( N \to \infty \), then \( T^* \to 0 \) and the Cournot price approaches the perfect competitive equilibrium price.

The impact of a reduction in \( t \) on the critical tariff is shown in Figure 2. The reduction of the in-quota tariff in this model implies, everything else held constant, an increase in the effectiveness of the capacity commitment, and thus a move towards the pure Cournot outcome. As the in-quota tariff decreases, the critical tariff also declines and may become even lower than the out-of-quota tariff. In Figure 2, the shift to a pure Cournot equilibrium occurs when \( t < 3.5 \). In contrast to liberalization by means of increasing \( N \), the market power of firms in this case always increases, as a consequence of the reduction in costs. The reduction in \( I \) has a similar effect (Figure 3), as it also strengthens the effectiveness of the capacity commitments and, thus, may shift the mode of competition toward Cournot.

Finally, a decrease in \( T \), everything else held constant, reduces the gap between the costs of adjusting capacities in the two periods and, thus, reduces the effectiveness of the capacity commitment. This is shown in Figure 4: when \( T \) become lower than \( T^* \) there is a shift from Cournot to Bertrand.

The model shows that in four out of five policy options for TRQ liberalization, firms’ market power is affected; in general terms, this declines if the reform implies an increased in the number of firms, but market power increases if liberalization involves a reduction in firms’ costs, either by reducing the in-quota or the out-of quota tariff or by improving the efficiency of the allocation system. This impact on firms’ market power can be amplified or mitigated by possible changes in the mode of competition among firms, as will be seen in more detail in the next section.

4. Trade, welfare and competition effects of TRQs liberalization

Trade and welfare effects under the various options for TRQs liberalization are reported in Table 2 together with firms’ market power, measured by the Lerner index. In the numerical example, the binding instrument in the baseline scenario is always the in-quota tariff. As aforementioned, when the binding instrument is the out-of-quota tariff, firms behave as under a tariff; thus, liberalization does not change the mode of competition and trade and welfare effects are those due to the simple reduction of the tariff. Further, the case of an increase in the quota \( Q \) is not reported because there are no effects on trade, welfare and competition.

The reduction in \( t \), when the in-quota tariff is binding, is usually mentioned as an example of effective liberalization, as under perfect competition the price is determined by the marginal costs, \( t + l + m \) (Boughner et al 2000; Skully, 2001b). In this model, the reduction of the in-quota tariff may or may not affect imports depending on the mode of competition: if the outcome of the game is Cournot, then the equilibrium price \( p^c \) is negatively affected by a decrease in \( t \) (equation 11) and imports increase; however, if the outcome is Bertrand then a reduction of \( t \) has no trade effect, as the
equilibrium price is determined by the costs in the second stage of the game \( T \). In our example, as Table 2 shows, a small reduction in the in-quota tariff (up to 20%) has no trade effects, because the mode of competition is Bertrand. However, a larger reduction makes the capacity commitment effective and shifts the outcome of the game to the pure Cournot solution. Under this mode of competition, firms’ behaviour is driven by the marginal costs of increasing capacity in the first period and, thus, a decrease in \( t \) reduces prices and increases imports. A small reduction of the in-quota tariff, even in the absence of trade effects, improves the welfare of firms while taxpayers are worse-off; firms’ market power increases as a consequence of the reduction in the costs. With a larger decrease in \( t \), the price declines, imports increase and market power continues to increase; nevertheless, consumers and firms gain because of the decrease in the price and costs, respectively. Despite the considerable losses in government revenues, total welfare improves as a consequence of TRQ liberalization.

In perfect competitive models, the reduction of the out-of-quota tariff is ineffective as the price is determined by the marginal costs, \( t + l + m \) (Boughner et al 2000; Skully, 2001b). This may not be the case in this model. The reduction of the out-of-quota tariff may have trade effects if the mode of competition is Bertrand, while if initially firms compete à la Cournot is ineffective. In Table 2, when \( T \) is high and the outcome of the game is Cournot, a reduction in \( T \) does not affect price and imports; however, a 30% reduction shifts the mode of competition away from Cournot and, thus, further reductions increase imports and decrease prices. Unlike the predictions of perfect competitive models, this model suggests that, if the capacity constraint is weak, a reduction in the out-of-quota tariff may increase imports, even if there are no out-of-quota imports. There will be welfare effects anyway, with a shift of resources from taxpayers to firms that will benefit from an increase in profits.

Reforms resulting in an increase in the number of rivals on the market always have significant positive effects, whatever the mode of competition. Table 2 shows how an increase in the number of firms, everything else held constant, always reduces price, increases imports, improves overall welfare and reduces market power. Thus, reforms improving the ability of firms to access licences, by increasing the number of firms and the degree of competition on the market, may be more effective in liberalizing trade than the reduction of tariffs. This provides a further argument to the idea that trade liberalization to be effective should be implemented along with an improvement of competition on international markets.

Finally, improvements in the administration of the TRQ by lowering the cost \( l \) do not have any impact on trade if the mode of competition is Bertrand. In our example, this happens if \( l \) is reduced by less than 30%; the price and the quantities do not change, but market power and firms’ profits increase; taxpayers and consumers are not affected by liberalization and, as a consequence, global welfare improves. On the contrary, when firms compete à la Cournot, that is, when \( l \) is so low that the gap between the cost of adjusting capacities in the two periods is very wide, then a reduction
in \( l \) reduces price and increases imports. As can be seen in Table 2, if \( l \) is reduced by more than 60%, firms, consumers and taxpayers all benefit from liberalization and overall welfare improves considerably, despite an increase in market power from the reduction in costs. Thus, the main implication of the model is that liberalization by means of an improvement in the administration of TRQs that leads to a reduction in firms’ costs may be effective only under certain circumstances, i.e. when the out-of-quota tariff is high enough - with respect to the in-quota tariff plus the cost of obtaining licenses - to make the capacity commitment effective and firms competing à la Cournot. Alternatively, TRQ liberalization has no trade effects and yields only an increase in firms’ profits. 9

5. Conclusions

The aim of this paper was to investigate the impact of TRQs and of their liberalization when international agricultural markets are dominated by oligopolistic traders. A two-stage capacity constrained model has been used in which the mode of competition is endogenous and the constraint is flexible; the presence of a TRQ, in fact, introduces a capacity constraint to traders – the quota – which, however, is flexible, as traders can always increase their imports out of the quota, albeit at a higher trading cost. Building on Maggi (1996), the paper has shown how the mode of competition between firms and the final equilibrium depend upon the costs of adjusting capacities in the two periods, that is, the values of the in-quota and out-of-quota tariffs and the cost of the licences to import within the quota.

Despite all the simplifying assumptions, this paper has shown how the liberalization of TRQs may have rather diverse results when oligopolistic competition is taken into account. The most prominent finding of the paper is that the consideration of strategic interaction between traders could undermine some of the usual conclusions about the (in)effectiveness of the various liberalization options. The paper has shown, for example, how under certain circumstances (e.g. a weak capacity commitment), even if imports are lower than the quota, a reduction in the out-of-quota tariff is effective, while the reduction in the in-quota-tariff does not increase trade.

These unconventional results basically are the consequence of the consideration of strategic interactions between firms. Although the oligopoly framework here used is a two-stage (finite) game and cannot be considered as a “pure” dynamic game, the two-stage structure, nevertheless, represents “an intermediate step toward dynamics“ (Vives, 2001, p. 199). It is this inherent, although limited, dynamic which explains the results; for example, the finding that a reduction in the out-quota-tariff could be effective even when there are no out-of-quota imports, is due to the fact that, if the capacity constraint is weak, then a firm’s pricing decision is affected by the marginal cost rivals face in the second period of the game, that is, the cost of importing out of the quota, rather than those of the first

9 The consideration of other costs due to the inefficiency of the administration method – those which are paid not only by firms, like the administrative costs - would not change the results as for the trade effects, even though it would modify the welfare impact of reforms.
period (the cost of importing in quota). This result would not be obtained in static games, assuming either Bertrand or Cournot.

A second feature of the model here developed, which helps to explain the results, is the endogeneity of the mode of competition. Trade policy may affect the nature of the strategic competition among firms by changing the effectiveness of the capacity commitment. This means that by changing certain trade policy instruments – namely, the in-quota and out-of-quota tariffs, and the cost of the licences – the government influences the strategic interaction between firms. This has a number of interesting implications; first, trade liberalization affects firms’ market power and, in some cases, it may even increase it; second, even if before liberalization a certain policy change might be effective, it may become ineffective as a consequence of the liberalization itself, if this leads to a change in the mode of competition.

Overall, the findings of the paper suggest that, when dealing with markets where traders are concentrated and when there are good reasons to believe that they exert market power, then liberalising TRQs by reducing the tariffs may not produce the desired results in terms of improvement in market access; this paper has shown that there are many cases - more than those suggested by the literature under perfect competition - in which this is not the case. Further, the model has shown how policy removing barriers to the entry of newcomers may be more effective in liberalising trade than a reduction of tariffs. This adds a further argument to those already supporting the view that trade liberalization to be effective should proceed along with an increase of competition on the international markets.

References


Table 1: Trade policy instruments and the outcome of the game

<table>
<thead>
<tr>
<th>$Q_i = Q/N$</th>
<th>Mode of competition</th>
<th>Binding Instrument</th>
</tr>
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<tbody>
<tr>
<td>$T &gt; T^*$</td>
<td>$T &lt; T^*$</td>
<td>$T &gt; T^*$</td>
</tr>
<tr>
<td>$T &lt; T^*$</td>
<td>$T &gt; T^*$</td>
<td>$T &lt; T^*$</td>
</tr>
<tr>
<td>$Q_i &gt; q_i^C, q_i^B$</td>
<td>Cournot</td>
<td>Bertrand</td>
</tr>
<tr>
<td>$q_i^C &lt; Q_i &lt; q_i^B$</td>
<td>Bertrand</td>
<td>Bertrand</td>
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<tr>
<td>$Q_i = q_i^B$</td>
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<tr>
<td>$Q_i = q_i^C$</td>
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Table 2: Trade, welfare and competition effects of liberalization

<table>
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<tr>
<th>Increase in $N$</th>
<th>Baseline</th>
<th>20%</th>
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<th>60%</th>
<th>80%</th>
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<td>123</td>
<td>128</td>
<td>133</td>
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<tr>
<td>Total profits</td>
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<td>97</td>
<td>95</td>
<td>92</td>
<td>90</td>
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<td>Consumers' welfare</td>
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<td>113</td>
<td>123</td>
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</tr>
<tr>
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<td>109</td>
<td>116</td>
<td>123</td>
<td>128</td>
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</tr>
<tr>
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<td>113</td>
<td>117</td>
<td>121</td>
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<td>95</td>
<td>93</td>
<td>90</td>
<td>88</td>
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<table>
<thead>
<tr>
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<th>40%</th>
<th>60%</th>
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<th>100%</th>
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<td>101.8</td>
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<td>104.8</td>
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<th>60%</th>
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<tr>
<td>Price</td>
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<td>Market power</td>
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Note: in yellow when firms compete à la Cournot
Figure 1: The critical tariff as a function of the number of firms

Figure 2: The critical tariff as a function of the in-quota tariff
Figure 3: The critical tariff as a function of the cost of obtaining licences

Figure 4: The out-of-quota tariff and the mode of competition
Appendix

a) The Cournot equilibrium

The maximization problem is the following:

\[
\max_{q_i} \Pi_i = q_i (\alpha - \beta q_i - \lambda \sum_{i \neq j} q_j - t - l - m)
\]

First order conditions are:

\[
\frac{\partial \Pi_i}{\partial q_i} = \alpha - 2\beta q_i - \lambda \sum_{i \neq j} q_j - (t + l + m) = 0
\]

From which we obtain the reaction curve

\[
q_i = \frac{\alpha - (t + l + m) - \lambda \sum_{i \neq j} q_j}{2\beta}
\]

The equilibrium quantity is given by:

\[
q_i^C = \frac{(\alpha - (t + l + m))}{2\beta + \lambda(N - 1)}
\]

By substituting the equilibrium quantities in the demand (2) the Cournot price (11) is obtained.

b) The Bertrand equilibrium

The maximization problem is:

\[
\max_{p_i} \Pi_i = (a - bp_i + c \sum_{i \neq j} p_j)(p_i - T - m)
\]

First order conditions are:

\[
\frac{\partial \Pi_i}{\partial p_i} = a - 2bp_i + c \sum_{i \neq j} p_j + b(T + m) = 0
\]

from which we obtain the reaction curve:

\[
p_i = \frac{a + c \sum_{i \neq j} p_j + b(T + m)}{2b}
\]

Given the symmetry assumption:
\[ p = \frac{a + c(N - 1)p + b(T + m)}{2b} \]

from which
\[ p^b = \frac{a + b(T + m)}{2b - c(N - 1)} \]

c) The critical tariff

The critical out-of-quota tariff \( T^* \) is defined implicitly by \( p^*(m, T) = p^c(m, t, l) \). The closed form expression for \( T^* \) is:
\[
T^* = \frac{K(l + t) + \lambda^2 (1 + N)(m - \alpha) + \lambda NZ(l + t)}{W}
\]

with \( K = 2\beta^2 - 5\beta\lambda + 3\lambda^2, W = \beta(2\beta + \lambda(3N - 5)) + \lambda^2 (2 + N(N - 3)), \) and \( Z = 3\beta + \lambda N - 4\lambda \).

Given that \( \beta > \lambda, K, Z > 0 \). A sufficient condition for \( W > 0 \) is \( N > 1 \).