Learning from Financial Markets:
Auctioning Tariff-Rate Quotas in Agricultural Trade

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1. Introduction

An important result of the Uruguay Round was the shift from the earlier quantitative restrictions towards tariff-rate quotas (TRQs). A TRQ is a hybrid of a simple tariff and a simple quota. An in-quota tariff is applied up to a given quantity. All subsequent imports are then taxed with the higher over-quota tariff. In principle, TRQs do not impose a quantity restriction like a simple quota would do. Anyone is free to import as much as they like as long as they are prepared to pay the over-quota tariff. Yet, in practice, many over-quota tariffs are so high that they have a prohibitive effect on trade (Tangermann, 1996).

The following two substantial advantages of using auctions for allocating TRQs should not give rise to too much debate. One advantage is in the domain of competition policy, the other is fiscal. We briefly explain these two aspects.

First, it is obvious that trade restrictions reduce competition. Bhagwati (1995) demonstrates that import quotas create more market power than tariffs, and McCorriston (1996, p. 372) shows how import quotas create oligopsony power. This is particularly worrisome since many agricultural markets feature a high and even increasing concentration on the side of the buyers (Dobson et al., 2000; Rogers and Sexton, 1994).[1] Therefore, it matters greatly who acquires

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1 It is noteworthy that the concentration in primary product markets is higher than in markets for processed products, where substitutes are generally more frequent. For Switzerland, Table 1 (appendix) shows the concentration ratios for different degrees of processing.

the quotas. The fact that auctions are an anonymous allocation device makes them ideal for allocating the TRQs in a non-discriminatory fashion, which is in line with the Uruguay Round Agreement (SKULLY, 2001).

Second, because of the two tier tariff, TRQs create quota rents for those who can import at the lower in-quota tariff. Auctions offer an attractive means for the government to collect some of this rent, simply because TRQs are not given away but sold (BERGSTEN ET AL., 1987).

Yet, despite these great advantages, the practice of TRQ administration is far more conventional: only 42 or 3.1 percent of the total number of 1,379 TRQs were auctioned off in 2000 (WTO, 2001). One reason why auctions are rarely used in this domain may be the opposition governments face from current quota holders who would lose from the move to auctions. Another possible reason could be that agricultural markets are considered to be a particularly tough terrain for auctions. Given the tendency to monopsonize agricultural markets, the problem of collusion among bidders in TRQ auctions is likely to arise. DE GORTER (1999, p. 9) explains the situation as follows: "It is possible for one group to purchase the entire portion of the right to import (domestic or foreign), and then withhold part of the licenses to maximize revenues." It seems that auctions might not work well for allocating TRQs under these conditions. Yet, the situation described by De Gorter is contingent on the lack of potential competition and on the specific design of the auction. The first claim, that a contestable market does not allow for large rents to the incumbents, is quite obvious. We substantiate this claim empirically with the cases of the Swiss white wine market and the market for Parma ham, where the TRQs have been auctioned off since 1997 (Chapter 2). The second claim, that auctions can be designed in a way that inhibits or at least reduces collusion, is based on experiences that have been made by Treasuries when auctioning off government debt (Chapter 3). We show how an *auction with variable supply* can be used to mitigate the danger of collusion. In Chapter 4 we adapt this auction design for the sale of the TRQs to the Swiss meat market.

2. Contestability and Cartels: Experience with Auctioning TRQs

The virtues of the contestability of markets is well known and need no explanation. Unfortunately, many agricultural markets today are far from this ideal. Cartels are more the rule than the expection in these markets. Nevertheless, despite strong opposition of the involved groups, some TRQs have been auctioned off in recent years. As for Switzerland, we discuss first how an originally very screwed up system – that of the Swiss white wine market – was completely liberalized in only a few years with the help of TRQ auctions. Second, we give evidence of contestability from bidding results in the Parma ham TRQ auctions.

2.1. The Role of Auctions in Liberalizing TRQs: The Case of Swiss White Wine
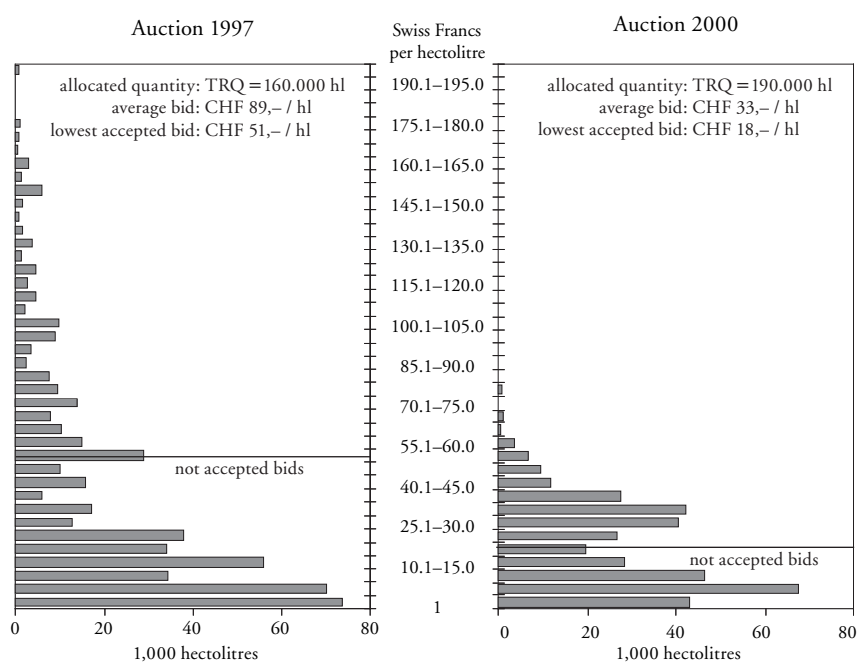
The case of Swiss white wine illustrates the different administration methods that have been used for quotas since import restrictions were first implemented in the 1930s (Haniotis, 1998).

Historical shares: Before the Uruguay Round Agreement on Agriculture was implemented, import quotas were allocated on the basis of historical shares. As the gap between border- and domestic prices was relatively wide, large rents were collected by the quota holders. Strong rent-seeking was characteristic and quotas were considered "historical rights" of the quota holders.

"First come, first served": In line with the Uruguay Round Agreement on Agriculture, TRQs were implemented on 1 January 1996. The Swiss government decided to allow imports at the lower in-quota tariff on a first come, first served basis. As the gap between the in- and over-quota tariffs still remained wide, there was a strong incentive to bring the imported wine through customs as quickly as possible, in order to obtain the rents. A few big firms were able to organize transport capacities so that the whole quota was completely used at the end of the first week in January 1996. This rent-seeking behavior had two distortionary effects: low quality wine displaced high quality products and overseas wine suppliers were disadvantaged. After the collapse of the system, all other firms had to import white wine at the high over-quota tariff.

Auctioning TRQs: After these turbulences, the first come, first served system was replaced by an auction. At the same time, the government expanded the quota amount from 160,000 hl in 1997 to 190,000 hl in 2000. This was a remarkable step towards a liberalized and market-oriented system. An important element of the auction was the fact that all interested firms and persons resident in Switzerland were allowed to send their (sealed) bids to the administration. There is no

**Figure 1: Tariff-Rate Quota Auction of White Wine
by the Swiss Ministry of Agriculture**

Auction 1997   Swiss Francs   Auction 2000
                              per hectolitre

allocated quantity: TRQ = 160.000 hl   allocated quantity: TRQ = 190.000 hl
average bid: CHF 89,– / hl   average bid: CHF 33,– / hl
lowest accepted bid: CHF 51,– / hl   lowest accepted bid: CHF 18,– / hl

not accepted bids   not accepted bids

1,000 hectolitres   1,000 hectolitres

Source: Swiss Ministry of Agriculture.

evidence that bidders successfully colluded in these auctions. The results of two of these auctions are shown in the Figure 1. The results reflect the existence of quota rents that were hidden under all the previous systems of quota allocation. This transparency was a necessary condition for broad political acceptance of the auction system. Consumers became aware of the fact that the reason for higher domestic prices was the restriction imposed by the import quota and not the fact that quota holders had to pay for the right to import. Auctioning the quotas did not increase the price for imported wine but the rents were transferred to the government. The TRQ auction put an end to the extensive rent-seeking activities, and improved access to import rights by breaking up the cartelistic market structures. The result was a more efficient allocation of TRQs.

Auctions as a "Bridge from TRQ regimes to tariff only systems": When the lowest bid in the year 2000 TRQ auctions for white wine became relatively small, the government decided as of 2001 to integrate the TRQ for white wine into a larger *global* TRQ for wines of all categories, origins and qualities. Importers can select

**Figure 2: Bid Functions of Quota Holders and Potential Entrants
(TRQ-Auction Parma Ham 1999)**
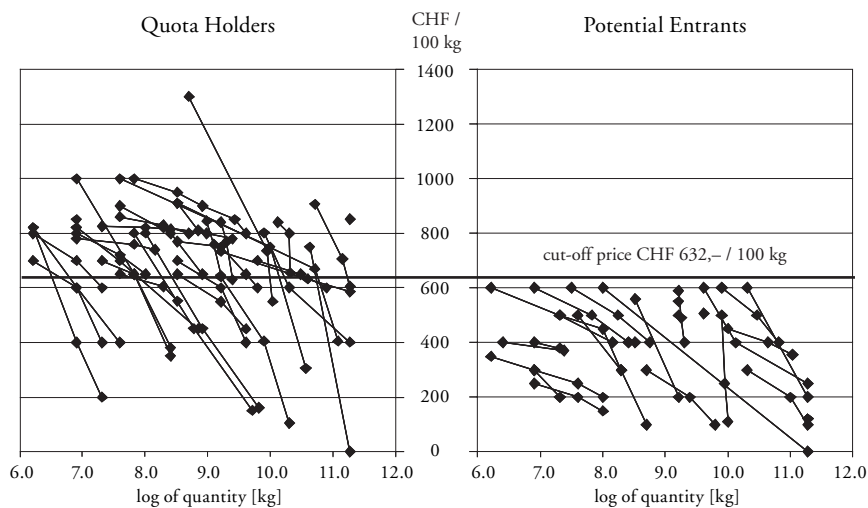
Source: Swiss Ministry of Agriculture.

their wines without any limits of origin or quality. The new TRQ has not been entirely used because the consumption of wine is changing significantly towards "less quantity and better quality." Under these market conditions, the TRQ will not be binding and no danger of rent-seeking should be expected. Therefore, imports will be allowed again on the first come, first served basis. The final result after the years of TRQ auctions is a tariff system that allows imports of wine at the lower in-quota tariffs.

2.2. Evidence for Contestability in the Parma Ham TRQ Auctions

It is reassuring that another agricultural market, the one for Parma ham, does also seem to be quite contestable. The evidence for this finding stems from a TRQ auction that was run in this market. The auction was uniform price, and every bidder was allowed to submit three different combinations of price and quantity. The maximum share allocated to each bidder was limited to 15 percent of the total TRQ. Figure 2 shows the bid functions of the quota holders and the potential entrants. The rather high willingness to pay of the quota holders reflects their special know-how in purchasing Parma ham from Italy. Retailers who lack this expertise formulated bids that turned out to be below the cut-off price. But

the fact that many retailers continuously participate in the auctions reflects their latent interest in quotas. These are potential entrants, and it is only their existence that keeps the incumbents from getting away with lower bids. This pattern suggests that this market is quite contestable after all.

3. Design of an Anti-Collusive Auction

The inherent transparency of auctions stands in stark contrast to the secretive bargaining and logrolling that is so typical for many existing arrangements. We argue that using auctions instead of the procedures that are ordinarily used to allocate TRQs not only improves the efficiency of the allocation (a rather obvious impact), but also provides new options for agricultural policy, and can have a deep impact on how agricultural markets function. In this section we entertain the idea that agricultural policy may benefit from studying financial market institutions.

3.1. Insights from Recent Theoretical Research

Potential collusion in an auction is an obvious headache, especially in markets with few bidders who know each other well. The same problem, maybe to a lesser extent, causes Treasuries around the world to worry when they try to sell their government debt. The most famous case of a breakdown of competition happened in the May 1991 auction of U. S. Treasury two-year notes. Salomon Brothers was able to acquire control over 94 percent of these notes, and squeezed out large amounts of money after the auction from traders that had gone short in this note prior to its issue (Jegadeesh, 1993).

Ever since that event (and maybe already before), competition in an auction of a divisible good, such as Treasury bonds, has been a hotly debated issue. The focus was initially put on the distinction between uniform price and pay-your-bid auctions. In both auction formats, bidders are requested to submit multiple price-quantity pairs, expressing the quantity they are at most willing to purchase at any given price. In the uniform price auction, the auctioneer sets a cut-off price and all bids at or above the cut-off are honored, but all honored bids only pay the cut-off price. In the pay-your-bid auction, the honored bids pay the price bids at which they were submitted.[2]

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2   *Prima facie* one may think that the pay-your-bid auction harvests a far superior revenue, since the bidders' rent is taxed away. But such a conclusion is faulty because the bidders' behavior is not independent of the auction rules (Smith, 1966).

If quantity is fixed, it is most likely that bids will have to be rationed. Typically, only marginal bids are rationed pro rata. WILSON (1979) has shown that the uniform price divisible good auction of this type has many equilibria, and especially equilibria with arbitrarily low cut-off prices. The problem is that this auction format invites quasi-collusive behavior, where all bidders submit very low quantities at high prices, but large quantities at low prices. BACK and ZENDER (1993) have shown that similarly bad equilibria (from the seller's point of view) exist if supply is uncertain (in their example, due to small bidders who submit only quantity bids without specifying a price).

Several designs have been proposed that have the purpose of removing the low price equilibria. BACK and ZENDER (1993) have concluded that the pay-your-bid auction format is less vulnerable to the implicit collusion underlying the low price equilibria. The reason for this finding is that in the uniform price auction bidders are effectively interested only in a single point on their bid function, namely the one at the cut-off price. All other points on the bid function can be used for strategic purposes to make the collusion self-enforcing. This is not true in the pay-your-bid auction because there, all prices on the bid function that exceed the cut-off price are payoff relevant for the bidder.

Another remedy that has been proposed addresses the supply side. The conclusion that uniform price auctions are particularly vulnerable to collusion is not valid if the seller can change the offered quantity after observing the bids (LENGWILER, 1999; BACK and ZENDER, 2001; MCADAMS, 2002).[3] The intuition for this result is straightforward: the Wilson-type quasi-collusive equilibria rely on very steep bid functions that force the seller to choose a low cut-off price in order to sell the whole quantity that he is committed to. If the seller has the possibility to reduce the supply, though, he will do so if bidders submit steep bid functions to ensure a low price. As a result, steep bid functions do not affect the cut-off price very much, but simply reduce the quantity that is sold. Yet, this hurts bidders, so that sticking to the quasi-collusive strategy is not an equilibrium anymore. In other words, the elasticity of the supply limits the elasticity of the equilibrium bid functions, and thus removes the quasi-collusive low price equilibria. The ability of the seller to reduce quantity if needed thus entails a powerful strategic effect that removes the ability of the bidders to collude via steep bid functions.

Other design changes have also been proposed. For instance, KREMER and NYBORG (forthcoming) have recently suggested a very minor amendment to the

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3   LICALZI and PAVAN (forthcoming) is a bit different. They study the implications if the seller commits to some increasing supply schedule before the auction. They show that this device avoids low price equilibria as well.

standard auction with supposedly large effects. Instead of rationing only marginal bids, they suggest that *all* the successful bids should be rationed instead. They show that this simple change destroys all low price equilibria. Other designs that depart more fundamentally from the uniform- and pay-your-bid designs have been analyzed, eg., by Ausubel (forthcoming) and Perry and Reny (2001). These designs offer the prospect of generating Pareto efficient allocations – something that the standard auctions we have discussed so far cannot deliver. Yet these designs have not been tested until now, and we feel that more laboratory experiments and small field experiments are needed before we would recommend them for application in the substantial market that is the subject of our study. So, in order to avoid being too adventurous, we constrain ourselves to mechanisms that have already been used in real markets.

3.2. Empirical and Experimental Evidence

There is a lot of experience with pay-your-bid and with uniform price auctions with fixed supply. There is also much experience with uniform price auctions with elastic supply. We review the empirical evidence with respect to these auctions in the following. We start with some recent experimental evidence and then move to empirical evidence using government auction data.

Sade, Schnitzlein, and Zender (2003) run a series of experiments to shed light on the relative performance of the different mechanism. They study uniform fixed supply (UFS), pay-your-bid fixed suppy (PFS), and uniform variable supply (UVS) auctions. They run some experiments with students that are new to the material, but they also run some sessions with professionals from the Treasury bond market (professional traders on both sides of the market). For both groups of subjects, the experiments yield the following ordering in terms of revenue: UVS ≥ UFS > PFS. This is partially good news and partially bad news for theorists. First of all, the inequality UFS > PFS is a striking reversal of the prediction of Back and Zender (1993) and is much more in line with Friedman's (1959) intuition.[4] The weak inequality UVS ≥ UFS is at least consistent with the theory of the effects of making supply elastic, but it is not a strong verification of these predictions either.

There is also plenty of data on real auctions, namely the auctions for various government assets, mostly Treasury bills and bond. In one of the following studies the asset is foreign currency, in another it is gold. In sum, the results in terms of

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4   See also Chari and Weber (1992).

generated revenue are inconclusive. Some studies find an advantage of the uniform auction (Tenorio, 1993; Umlauf, 1993; Feldman and Reinhart, 1995; Malvey and Archibald, 1998), others find evidence that the pay-your-bid auction worked better for the seller (Simon, 1994; Hortaçsu, 2002).

The auctions that are being studied in these papers all have an ex ante fixed supply. Luckily, we can test the variable supply auction as well, because there are at least two Treasuries that explicitly determine the sold quantity only after observing the bids. These Treasuries are the Swiss and the Finnish. Keloharju et al. (2002) study empirically the performance of the Finnish Treasury auctions and find no evidence for low price equilibria of the Wilson-Back-Zender type. Heller and Lengwiler (2001) study the Swiss Treasury auctions and also find no evidence for excessive profits of the bidders.[5] In the case of Switzerland, this may be surprising because two large bidders regularly acquire a large share of the total issue. There is, however, significant potential competition in the form of a large number of smaller banks that have the right to participate in the auction but typically do not. Excessive profits of the incumbents would incite these potential rivals to enter the auctions and quickly compete away any excessive profits. The lack of collusion may be even more surprising in the Finnish case, because there, participation in the auction is restricted to primary dealers (between five and ten entities during the sample of the study), so there is no imminent potential competition.[6] Yet, collusion does not survive in this market either. This is so despite the fact that competition is restricted and the auctions keep being repeated on a regular basis, which should ease collusion.[7] Yet, as an empirical fact, the design seems to work fine. We conclude that the ability of the seller to restrict supply after the fact is a potent antidote against collusion.

3.3. The Swiss Treasury Auction Rules as a Model

The Swiss Treasury has a long experience with selling government debt through an auction with variable supply. The rules they use seem to work well in an environment which is characterized by a potentially significant concentration of bidders. After all, the two largest Swiss banks typically buy between two thirds

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5   The cut-off prices do not significantly differ from the pre-auction secondary market prices of the bonds that are about to be issued.
6   In the longer run, there could of course still be potential competition from banks that acquire primary dealership status.
7   The Folk Theorem of repeated games tells us that many more payoff combinations (including "quasi-collusive allocations") can be supported as equilibria in an infinitely repeated game.

and three quarters of an issue. Yet, no events of market cornering or excessive profit taking have been observed in these auctions. For this reason we will use the rules set out by the Swiss Treasury as a model for TRQ auctions. We begin by explaining the rules in some detail, and then briefly discuss an example of one such auction.

The auctions take place on a bimonthly basis. Shortly before the auction, the Treasury announces the characteristics of the bonds that are to be issued, such as time to maturity, coupon, and callability. The Treasury also states the maximum number of bonds that will be issued. Almost always, however, this maximum supply is so large that this constraint is not binding. The Treasury also reserves the right to cancel an auction if it does not deem the bids satisfactory. The circle of bidders is restricted to institutions holding accounts with the Swiss National Bank (SNB), currently some 400 entities. Under the current regulation, these are all banks based in Switzerland. All bidders are treated equally, i.e. there are no primary dealers.

The bidders are invited to submit as many price-quantity bids as they wish.[8] The bids have to be in by 12 o'clock on the day of the auction. Until spring 2001, the bids were submitted by fax, then the Treasury switched to a proprietary electronic platform. After all the bids have been submitted, the Treasury decides on the cut-off price. With this cut-off price, the Treasury also decides on the quantity that is sold; it is simply the amount of bids that have been submitted at or above the cut-off price. The Treasury typically chooses a point on the bid function where it is the flattest, or maybe one price tick below. Figure 3 depicts the aggregate bid function of a sample Treasury bond auction, as well as the Treasury's choice. We see here clearly how the Treasury and the aggregate bids together effectively determine the price and the quantity simultaneously.[9] This system has several advantages:

1. If demand for the bonds is weak, few will be sold. The system automatically adapts the supply to the demand of the bidders.
2. As a consequence, price volatility is reduced.

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8   In addition to submitting price-quantity pairs, bidders may place pure quantity bids without a price. These unpriced bids have to be less than CHF 100,000 each. Unpriced bids are relatively unimportant. They account for about 7 percent of the total amount sold in an average Treasury bond auction.

9   In this example, the bond that was auctioned then had ten years time to maturity and a 4 percent annual coupon. The Treasury chose a cut-off price of 103.75, which is equivalent to a yield to maturity of 3.55 percent, and sold bonds with a total face value of CHF 1.191 billion.

Figure 3: Auction of Swiss Treasury Bonds (February 2002)
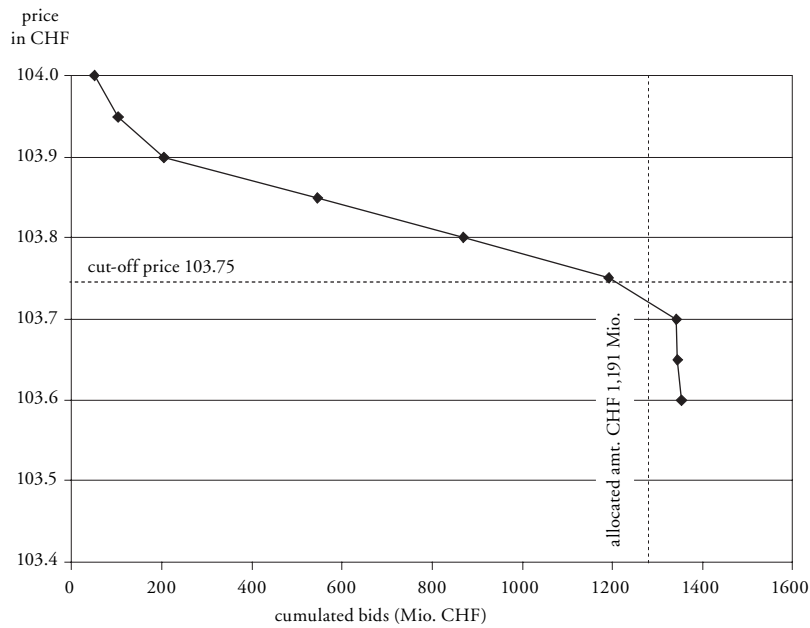
Source: Swiss National Bank.

3. The fact that the quantity is determined only after the bids have been submitted has far reaching strategic effects. As discussed before, this is a potent measure against collusion.

This third property is of particular interest for the application we have in mind. Clearly, in many agricultural markets there is great scope and opportunity for monopsony power. Yet, the flexibility of the auctioneer to restrict the supply makes it very difficult for the bidders to enforce a low price, and thus ensure a large profit.

4. Rules for TRQ-Auctions: The Case of the Swiss Meat Market

4.1. The Present System:
Rent-seeking, Bargaining, and a Government Sanctioned Cartel

There is not much competition in the Swiss meat market, but the bargaining and collusion between professional market participants does not take place in smoke-filled rooms. To the contrary, in Switzerland, the market for meat is run by a government sanctioned interest group called *Proviande*.[10] Farmers, butchers, traders, importers, and consumers are members of this institution.[11] The government regulates the market by adapting the import quantity periodically to the changing conditions on the market. Prior to this decision, the market players represented in *Proviande* bargain and make a recommendation to the Ministry of Agriculture. Of course, the Ministry remains nominally in charge, but typically does not care to deviate from *Proviande's* recommendation.

The stated goal of Proviande is to ensure a "high quality and competitive meat business", to "facilitate cooperation among the representatives of the meat industry", and to "represent the meat industry" (presumably in the policy debate). These stated aims make clear that *Proviande* is a classic cartel.

Proviande allocates import quotas to its members proportional to the amount of meat and cattle they buy from the domestic producers. This system is known as "prise en charge" system, under which tariff quota access is contingent on the purchase of domestic products. The Swiss competition commission has repeatedly criticized this system, and similar criticism has been expressed in the Uruguay Round negotiations (WTO, 1996). The system violates fundamental principles of competition policy and has enhanced the process of concentration in the meat industry (see Table 1 in the appendix). A recent analysis by ABDULAI (2002, p. 679) shows that price transmission in the Swiss pork market is asymmetric, "in the sense that increases in producer prices that lead to declines in marketing margins are passed on more quickly to retail prices than decreases in producer prices that result in increases in the marketing margins." We claim that the use of TRQ auctions lead to a more competitive and transparent meat market.

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10 www.proviande.ch
11 The influence of consumers is marginal: only 2 of the 14 members represent consumer organizations.

4.2. The New System: Auctions with Variable Supply

Instead of the bargaining and logrolling that takes place within *Proviande*, in the new system that we propose, the Ministry of Agriculture allocates TRQs as a result of an auction with variable supply. We propose the following sequence of events:
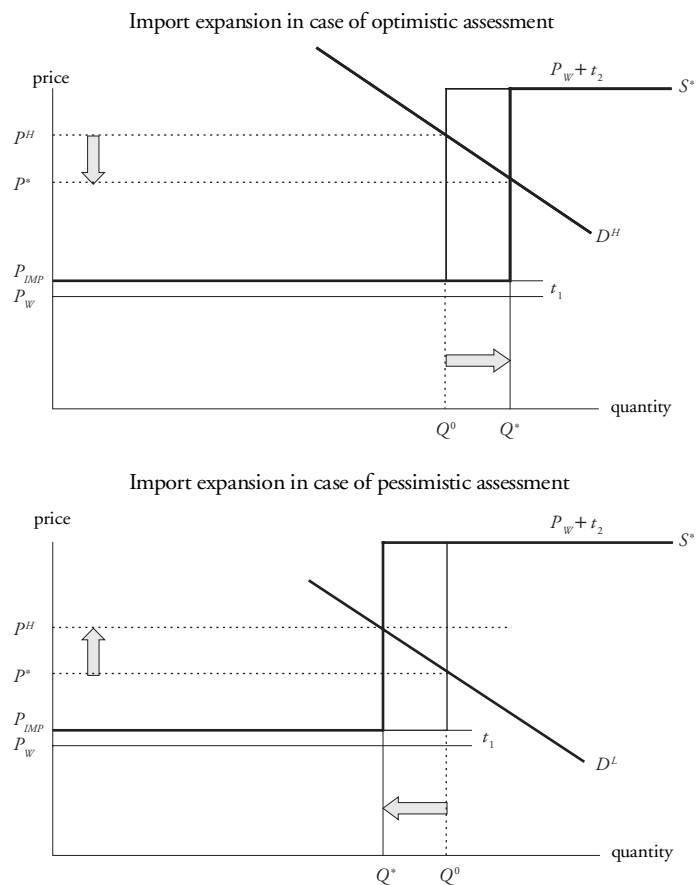
1. Following the principle of contestable markets, entry barriers should be as small as possible. As a result, all firms interested in purchasing import quotas are free to submit bids. The auctions have to be announced to a large enough audience, and sufficient time has to be reserved between the announcement and the deadline for bid submission.
2. Based on the received bids, the Ministry of Agriculture allocates the TRQs. Because the total quantity is not fixed in advance, the system gives the Ministry a certain leverage by which it can trade off quantity versus price. As an example, the Ministry could, if it wishes to do so, implement a domestic price target through its supply decisions. Suppose bidding in one auction was stronger than expected (the result of an optimistic expectation of the meat importers for meat demand). This is reflected in the top half of Figure 4 by the "optimistic" demand (D^H).[12] To support the price level P^*, the Ministry would expands the aggregate amount of TRQs from Q^0 to Q^*. Conversely, if bidding is unexpectedly weak (low demand D^L), the Ministry would reduce the total amount of TRQs, as shown in the bottom half of Figure 4.

Of course, the Ministry is constrained by the WTO access commitments. It cannot arbitrarily reduce the total amount of TRQs. This constraint is not binding, however, on an auction by auction basis, but rather over longer averages and for larger classes of various kinds of meat. The Ministry should therefore not face any real constraint from this side. The WTO constraint will become relevant only if bidding is weak for an extended period of time or for many kinds of meat at the same time. In that case, the Ministry will simply satisfy all bids and the price of the TRQ will drop to zero (or the lowest submitted bid price). Alternatively, if this situation emerges, the Ministry could also decide to drop the need to have TRQs for importing meat altogether until the next auction.

The specific, practical implementation needs to be adapted from the way Treasury bond auctions are administered. For instance, we do not consider the exact formal requirement of bid submissions to be of any significance. No electronic

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12 We assume the simple model of a small importing country; t_1: in-quota tariff, t_2: over-quota tariff; p_W: world market price, $p_{IMP} = p_W + t_1$; S: supply.

Figure 4: Import Regulation under a Regime of Auction With Variable Supply

Import expansion in case of optimistic assessment

Import expansion in case of pessimistic assessment

platform is needed and simple written bids are perfectly acceptable.[13] One might also think that the frequency of the auctions would have to be adapted. It would not make much sense to auction TRQs which are valid only for e. g. two months. To allow for sensible planning by the importers, TRQs should be valid for at least six months. Alternatively, TRQs with one year validity could also be auctioned at higher frequency, with overlapping periods of validity. For instance, there could be a December auction for importing meat from the following January on during

13 In fact, any sophisticated requirements for bid submissions would only constitute an entry barrier.

the next twelve months. There would also be a March auction for importing from April on, again for twelve months, and so on.[14]

4.3. Benefits of the New System …

One of the most important benefits of this system is certainly that the considerable private information and expertise of the importers affects the total amount of TRQs that are issued. It is quite obvious that an auction that gives bidders an incentive to bid close to their true expectation of the future development of the market is much better suited to predict the aggregate need for TRQs than the negotiations that take place within *Proviande* today. Bidding not in accordance to the best estimate of market development is potentially very costly for a bidder: if he bids too high, he is likely to make a loss; if he bids too low, he runs the risk of not being allocated sufficient quota and lose the business altogether. But the auction not only regulates the total amount of TRQs, it also allocates the TRQs to those bidders that are most likely to make the best use of them. The bidders that have the best outlook for gainful importing will bid highest, and will therefore receive the largest share of the TRQs. Another advantage is that the rents that the quota holders were able to reap will be transferred to the government. This form of taxation is *distortion free* because the price of the TRQs is simply a measure of scarcity. Moreover, as we argued before, the variable supply feature constitutes an important strategic weapon against collusion. Finally, because it makes the aggregate amount of TRQs flexible, it offers the Ministry a way to smoothly phase out a tariff-quota regime in favor of a tariff-only regime.

4.4. … and Limits

There is one desirable property of the equilibrium allocation that the system we propose does not deliver, and that is efficiency in the sense of maximizing aggregate welfare. The strategic situation induces bidders to misrepresent their true demand to some extent. Thus, it is possible, even likely, that in equilibrium some bidders get more, some less TRQs than what is optimal for them, given the price they had to pay and their market expectation. The system will almost

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14 Such an overlapping structure would have the additional advantage that the Ministry would be more at ease with reducing supply significantly in one auction if colluding bidders try to enforce a low price by submitting steep bid functions. Because some TRQs are already on the market (from previous auctions), the Ministry can reduce the supply in any particular auction without running a great risk of causing shortages.

surely deliver a less than perfectly efficient allocation. But there is no doubt that the allocation it delivers is much closer to efficiency than the arbitrary allocation that the current practice produces. The new system, we think, is good, but it is not perfect. And we would like to argue that we should not allow perfection to be the enemy of enhancement.

But the prefect (efficient) mechanism exists! We mentioned earlier that recently some mechanisms have been designed that should produce an efficient allocation in theory (AUSUBEL, forthcoming; PERRY and RENY, 2001). We think that these are very interesting possibilities, and yet we shun from blindly applying theory to politically sensitive markets such as agriculture. Despite its lack of welfare maximization, the auction we propose has the undeniable advantage that it is based on a true and tried set of rules, which is a priceless asset in this domain.

5. Conclusions

Most TRQs today are allocated in an intransparent and hardly efficient way. In many cases, TRQs are not much more than sinecures for their owners. Agricultural policy measures, which were intended to protect domestic producers, have effectively given rise to arbitrary beneficiaries and do no longer contribute to the original goals. Moreover, the inefficient allocations of the TRQs imposes a significant deadweight loss on society.

We argue in this paper that auctions offer an attractive way out of this *cul-de-sac*. The specific auction design we propose is inspired by a method that has been used very successfully for auctioning off government debt. The variable supply auction offers several benefits. First, it allocates TRQs to the users with the highest willingness to pay, and therefore, one hopes, to the most efficient users. Second, it adapts the total amount of quotas according to market needs. Third, auctions divert rents from the quota holders to the government and constitute a non-distortionary form of taxation. Fourth, the allocation of TRQs is perfectly transparent. If an importer does not receive a sufficient quota, it is not because he was not nice enough to his fellow cartel members, but simply because he did not bid high enough. Fifth, the auction design we propose gives the administration a flexible bridge for slowly phasing out import restrictions in favor of a tariff-only regime. Finally, the variable supply feature of the auction is designed to keep the potential of bidders for collusion in check.

The implementation of this new system is currently being debated in Switzerland. Given the many advantages that these auctions offer, we are eager to observe their functioning in practice.

Appendix

Table 1: Concentration Ratios for Raw, Intermediate and Processed Product Imports to Switzerland in 1998

Tariff-rate quota	Number of importers	Concentration ratio CR4 in %
Processed products		*36*
Red wine	1000	10
White wine	500	17
Dried ham	83	33
Dried meet	51	40
Sausage	97	40
Corned Beef	30	53
Fontal (cheese)	59	58
Intermediate products		*67*
Potatoes (for consumption)	84	61
Poultry	86	67
Eggs (for consumption)	25	74
Raw products		*90*
Frozen vegetables	40	66
Wheat	29	67
Wheat durum	19	77
Milk powder	17	84
Lamb & goat meet	18	90
Potatoes (for processing)	6	93
Loins (beef)	6	98
Eggs (for processing)	7	98
Seed potatoes	8	98
Slaughterhouse by-products	6	99
Veal	2*	100
Pork	2*	100
Beef for Buendnerfleisch	2*	100

Source: Report from the Federal Council, dated February 24th 1999, on custom tariffs measures 1998 (allocation of tariff-rate quotas).

* The "Viehbörse" imports on behalf of its members (approx. 1,500 butchers); The "GVFI", Association for the Import of Cattle and Meet, imports on behalf of large whole sellers

CR4: market share of the biggest 4 firms

References

Abdulai, Awudu (2002), "Using Threshold Cointegration to Estimate Asymmetric Price Transmission in the Swiss Pork Market", *Applied Economics*, 34, pp. 679–687.

Ausubel, Lawrence M. (forthcoming), "An Effcient Ascending-Bid Auction for Multiple Objects", *American Economic Review* [www.ausubel.com/auction-papers/efficient-ascending-auction-r.pdf].

Back, Kerry and Jaime F. Zender (1993), "Auctions of Divisible Goods: On the Rationale for the Treasury Experiment", *The Review of Financial Studies*, 6, pp. 733–764.

Back, Kerry and Jaime F. Zender (2001), "Auctions of Divisible Goods with Endogenous Supply", *Economics Letters*, 73, pp. 29–34.

Bergsten, C. Fred, Kimberly Ann Elliot, Jeffrey J. Schott, and Wendy E. Takacs (1987), *Auction Quotas and United States Trade Policy*, Institute for International Economics, Washington D. C.

Bhagwati, Jagdish N. (1965), *On the Equivalence of Tariffs and Quotas*, in: Baldwin, R. E. *et al.* (eds.), Trade Growth and the Balance of Payments, Chicago.

Chari, Varadarajan V. and Robert J. Weber (1992), "How the U. S. Treasury Should Auction Its Debt", *Federal Reserve Bank of Minneapolis Quarterly Review*, Fall, pp. 3–12.

De Gorter, Harry (1999), "Market Access, Export Subsidies and Domestic Support Measures: Issues and Suggestions for New Rules", World Bank Conference on Agriculture and The New Trade Agenda, October 1–2, 1999.

Dobson, Paul, Roger Clarke, Stephen Davis, and Michael Waterson (2000), "Buyer Power and its Impact on Competition in the Food Retail Distribution Sector of the European Union", paper prepared for the 4th INRA-IDEI Conference, Toulouse [www.idei.asso.fr/Commun/Conferences/ Food %20Processing/ Juin2000/ %20Papiers/Dobson.pdf].

Feldman, Robert A. and Vincent Reinhart (1995), "Flexible Estimation of Demand Schedules and Revenue Under Different Auction Formats", IMF Working Paper 95/116 (November).

Friedman, Milton (1959), "Testimony in Employment, Growth, and Price Levels", Hearings before the Joint Economic Committee, 86th Congress, 1st Session, October 30, pp. 3023–3026.

Haniotis, Toni (1998), "Auctions as a Trade Instrument", in: T. Cottier and P. C. Mavroidis (eds.), *State Trading in the Twenty-First Century*, The University of Michigan Press.

HELLER, DANIEL and YVAN LENGWILER (2001), "Should the Treasury Price-Discriminate? – A Procedure for Computing Hypothetical Bid Functions", *Journal of Institutional and Theoretical Economics*, 157, pp. 413–429.

HORTAÇSU, ALI (2002), "Mechanism Choice and Strategic Bidding in Divisible Good Auctions: An Empirical Analysis of the Turkish Treasury Auction Market", Manuscript, University of Chicago [home.uchicago.edu/~hortacsu/ttreas.pdf].

JEGADEESH, NARASIMHAN (1993), "Treasury Auctions Bids and the Salomon Squeeze", *Journal of Finance*, 48, pp. 1403–1419.

KELOHARJU, MATTI, KJELL G. NYBORG, and KRISTIAN RYDQVIST (2002), "Strategic Behavior and Underpricing in Uniform Price Auctions – Evidence from Finnish Treasury Auctions", Nota di Lavoro 25.2003, Fondatione Eni Enrico Mattei [papers.ssrn.com/sol3/papers.cfm?abstract_id=301922].

KREMER, ILAN and KJELL G. NYBORG (forthcoming), "Divisible Good Auctions – The Role of Allocation Rules", *Rand Journal of Economics*.

LENGWILER, YVAN (1999), "The Multiple Unit Auction with Variable Supply", *Economic Theory*, 14, pp. 373–392.

LICALZI, MARCO and ALESSANDRO PAVAN (forthcoming), "Tilting the Supply Schedule Enhances Competition in Uniform Price Auctions", *European Economic Review*.

MALVEY, PAUL F. and CHRISTINE M. ARCHIBALD (1998), "Uniform-Price Auctions: Update of the Treasury Experience", Technical Report, Office of Market Finance, U. S. Treasury.

MCADAMS, DAVID (2002), "Modifying the Uniform-Price Auction to Eliminate 'Collusive-Seeming Equilibria'", Manuscript, MIT [www.mit.edu/~mcadams/papers/mupa.pdf].

MCCORRISTON, STEVE (1996), "Import Quota Licenses and Market Power", *American Journal of Agricultural Economics*, 78, pp. 367–372.

PERRY, MOTTY and PHILIP J. RENY (2001), "An Effcient Multi-Unit Ascending Auction", Manuscript [www.ma.huji.ac.il/~motty/papers/ascend. pdf].

ROGERS, RICHARD T. and RICHARD J. SEXTON (1994), "Assessing the Importance of Oligopsony Power in Agricultural Markets", *American Journal of Agricultural Economics*, 76, pp. 1143–1150.

SADE, ORLY, CHARLES SCHNITZLEIN, and JAIME F. ZENDER (2003), "Competition and Cooperation in Divisible Good Auctions: An Experimental Examination", Manuscript, AMD Conference, Milano [www-bus.colorado.edu/faculty/Zender/papers/auction-16aug03.pdf].

SKULLY, DAVID W. (2001), "The Economics of TRQ Administration", ERS Technical Bulletin No. 1893, April [www.ers.usda.gov/publications/tb1893/].

Simon, David P. (1994), "The Treasury's Experiment with Single-Price Auctions in the Mid 1970's: Winner's or Taxpayer's Curse?" *Review of Economics and Statistics*, 76, pp. 754–760.

Smith, Vernon L. (1966), "Bidding Theory and the Treasury Bill Auction: Does Price Discrimination Increase the Bill Price?" *Review of Economics and Statistics*, 48, pp. 141–146.

Tangermann, Stefan (1996), "Implementation of the Uruguay Round Agreement on Agriculture: Issues and Prospects", *Journal of Agricultural Economics*, 47, pp. 315–337.

Tenorio, Rafael (1993), "Revenue Equivalence and Bidding Behavior in a Multi-Unit Auction Market: An Empirical Analysis", *Review of Economics and Statistics*, 75, pp. 302–314.

Umlauf, Steven R. (1993), "An Empirical Study of the Mexican Treasury Bill Auction", *Journal of Financial Economics*, 33, pp. 313–340.

Wilson, Robert (1979), "Auctions of Shares", *The Quarterly Journal of Economics*, 93, pp. 675–689.

World Trade Organization (1996), "Trade Policy Review Body: Review of Switzerland", Press Release TPRB/31 and Summary of Secretariat's Report [www.wto.org/english/tratop_e/tpr_e/tp31_e.htm].

World Trade Organization (2001), "Tariff Quota Administration Methods and Tariff Quota Fill", Background Paper by the Secretariat, May 2001.

SUMMARY

Most tariff-rate quotas (TRQs) around the world are allocated in rather intransparent ways. Yet, according to the fundamental WTO principles, TRQs are supposed to be allocated in a transparent, equitable and non-discriminatory manner. We argue that auctions offer a promising way to achieve these goals, and at the same time enhance the efficiency of the allocation. Moreover, they provide the means to slowly phase out a quota regime in favor of a tariff-only regime. The biggest challenge in this endeavour is to find an auctioning procedure that operates also well in situations otherwise prone to collusive bidding behavior. We draw from experiences made in government debt auctions to come up with a system that would resist collusion.

ZUSAMMENFASSUNG

Die Zollkontingente in der WTO werden weltweit nach Kriterien verteilt, die nicht transparent sind. Gemäss den Prinzipien der WTO sollten Zollkontingente jedoch den Importeuren nach einem Verfahren zugeteilt werden, das transparent ist und niemanden diskriminiert. Wir zeigen, dass die Versteigerung dieses Ziel erreicht und eine effizientere Verteilung der Kontingente gewährleistet. Versteigerungen können überdies auch dazu dienen, ein bestehendes Quoten-Regime durch ein reines Zollsystem abzulösen. Die wichtigste Herausforderung besteht nun darin, ein Versteigerungsverfahren zu finden, das auch in einer Situation von nur wenigen Bietern funktioniert. Aufgrund der Erfahrung mit der Auktion von öffentlichen Anleihen des Bundes schlagen wir ein Verfahren vor, das gegen Kollusion unter den Bietern resistent ist.

RÉSUMÉ

La plupart des contingents tarifaires dans le monde sont distribués de manière assez opaque. Les principes fondamentaux de l'OMC stipulent pourtant que les contingents tarifaires soient distribués de manière transparente, équitable et non discriminatoire. Nous considérons que les enchères sont une voie prometteuse pour atteindre ces buts; pareillement pour améliorer l'efficience de la distribution des contingents. En plus, elles sont un moyen pour passer sereinement d'un système de contingents à un système pur de tarifs. Le grand défi de cet effort est de trouver une procédure de mise à l'enchère qui fonctionne aussi dans des situations normalement prédisposées à un comportement collusoire d'offres. Nous nous inspirons d'expériences faites d'enchères des emprunts de la Confédération suisse pour proposer un système résistant à la collusion.