

Herrmann, Roland

**Working Paper — Digitized Version**

## A welfare analysis of non participation in an export quota scheme: The case of importing countries

Kiel Working Paper, No. 272

**Provided in Cooperation with:**

Kiel Institute for the World Economy – Leibniz Center for Research on Global Economic Challenges

*Suggested Citation:* Herrmann, Roland (1986) : A welfare analysis of non participation in an export quota scheme: The case of importing countries, Kiel Working Paper, No. 272, Kiel Institute of World Economics (IfW), Kiel

This Version is available at:

<https://hdl.handle.net/10419/46928>

**Standard-Nutzungsbedingungen:**

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

**Terms of use:**

*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*

*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*

# Kieler Arbeitspapiere

# Kiel Working Papers

---

Working Paper No. 272

A Welfare Analysis of Non-Participation in  
an Export Quota Scheme: The Case of  
Importing Countries

by

Roland Herrmann\*

Institut für Weltwirtschaft an der Universität Kiel

ISSN 0342 - 0787

Kiel Institute of World Economics  
Department IV  
Düsternbrooker Weg 120, D-2300 Kiel 1

Working Paper No. 272  
A Welfare Analysis of Non-Participation in  
an Export Quota Scheme: The Case of  
Importing Countries

by  
Roland Herrmann\*

October 1986

A 94869/86  
Weltwirtschaft  
Kiel

- \* The author himself, not the Kiel Institute of World Economics, is solely responsible for the contents and distribution of each Kiel Working Paper. Since the series involves manuscripts in a preliminary form, interested readers are requested to direct criticisms and suggestions directly to the author and to clear any quotations with him.

ISSN 0342 - 0787

### Abstract

It has been largely ignored in the commodity stabilization literature that export quota schemes can cause a co-existence between a controlled and an uncontrolled market. This article analyzes the welfare implications of such a scheme on non-participating importing countries. The determinants of the welfare effects are elaborated. It is shown that non-participation in the export quota scheme may increase or decrease the importing countries' welfare compared to the situation of a liberalized world market. Magnitude and sign of the welfare impacts are shown to depend crucially on the rigidity of the quota policy. From the individual importing country's point of view, it is derived that non-participation instead of entering the agreement may raise national welfare, even if the export quota policy lowers its welfare level compared to a free trade situation.

## 1. Introduction

There are various world commodity markets on which export quota schemes are planned or where exports are already restricted by export quotas (Maizels, 1982; UNCTAD, 1985). However, economic analysis on commodity price stabilization schemes have mainly focused on buffer stocks (e.g., Newbery/Stiglitz, 1981). In the few existing studies on export quotas, their relative efficiency has been discussed primarily as a device of market stabilization. Export quotas were compared with export taxes (Ffrench-Davis, 1968) and with buffer stocks (Berlage, 1984; Dick/Gupta/Mayer/Vincent, 1982). Where price-raising export quota schemes were analyzed and proposed (Maizels, 1982), their welfare implications for importing countries have not been elaborated<sup>1</sup>. This seems interesting, however, as recent empirical evidence for the coffee market has shown that importing countries may gain from a price-raising export quota scheme by staying outside the agreement (Herrmann, 1986).

This article analyzes the following questions theoretically: Which welfare effects occur for importing non-member countries under an export quota scheme compared to the situation of a uniform world market? Which welfare impacts arise for the individual non-member country compared to a uniform world market and compared to a situation of entering the agreement? Which factors determine these welfare impacts and how are the impacts depending on the kind of realized export quota policy?

## 2. Welfare Effects of an Export Quota Scheme on Non-Participating Importing Countries

Applying welfare analysis to international markets<sup>2</sup>, the effect of export quota policy on economic welfare of the non-participating importing countries is

$$(1) \quad W_{IN} - W_{IN}^* = \Delta W_{IN} = \int_{\bar{p}_N}^{\bar{p}_N} q_N^{ID}(p_N) dp_N.$$

$W$  is welfare,  $q^{ID}$  is the quantity imported and  $p$  is the price. The subscript I indicates importing countries, N the non-member market. \* symbolizes the situation without export quota policy and  $\bar{\phantom{x}}$  equilibrium values. (1) shows the difference in welfare levels of the non-participating importing countries in the situations with and without export quotas. This difference is mainly determined by the difference in equilibrium prices on the non-member market in the situations with and without export quota policy:

$$(\Delta W)_{IN} \geq 0, \text{ if } \bar{p}_N^* \geq \bar{p}_N.$$

Let us assume that an export quota arrangement exists which fixes the maximum export quantity to be sold on the member market. There are no direct sanctions toward selling oversupply on the non-member market. Let us further assume that the hypothetical situation without export quotas is characterized by a uniform market price ( $\bar{p}^* = \bar{p}_M^* = \bar{p}_N^*$ ). Assuming linear functions, the situations without export quotas (signed by \*) and with export quotas are then represented by the following equations:

$$(2) \quad q_M^{ES*} = a_M + b_M p^*$$

$$(3), (3') \quad q_M^{ID*} = c_M + d_M p^*; \quad q_M^{ID} = c_M + d_M p_M$$

$$(4) \quad q_N^{ES*} = a_N + b_N p^*$$

$$(5), (5') \quad q_N^{ID*} = c_N + d_N p^*; \quad q_N^{ID} = c_N + d_N p_N$$

$$(6) \quad q_M^{ES*} + q_N^{ES*} = q_M^{ID*} + q_N^{ID*}$$

$$(7) \quad q_M^{ES} = \bar{q}$$

$$(8) \quad q_N^{ES} = a_N + b_N p_N + r(a_M + b_M p_M - \bar{q})$$

$$(9) \quad q_M^{ES} = q_M^{ID}$$

$$(10) \quad q_N^{ES} = q_N^{ID}$$

$a, b, c$  and  $d$  are parameters determining the levels and slopes of the export supply and import demand curves. The signs are:

$$c_M > 0, c_N > 0, d_M < 0, d_N < 0, a_N < 0, a_M < 0, b_M > 0, b_N > 0.$$

The hypothetical situation without export quotas is given by the equations (2) to (6). The situation with export quotas is given by the equations (3'), (5'), and (7) to (10). It can be seen that export quota policy is combined with other equilibrium

conditions and will probably lead to different prices and quantities on both markets compared to the non-quota situation. Equations (7) and (8) show two policy parameters which are allowed for in the model:

1. Export quota policy directly fixes  $\bar{q}$ , the maximum quantity sold on the member market. It is assumed that  $0 < \bar{q} < \tilde{q}_M^{ES*}, \tilde{q}_M^{ID*}$ .
2. The commodity control authority may use indirect sanctions to discriminate the selling of oversupply from the member market on the non-member market. This will influence the coefficient  $r$  in equation (8).  $r$  is a coefficient indicating the willingness of exporting member countries to transmit oversupply, due to binding quotas, from the member market to the non-member market.  $r$  is assumed to be an exogenous variable with  $0 < r < (a_M + b_M p^* - \bar{q}) / (a_M + b_M p_M - \bar{q}) < 1$ .

Calculating the equilibrium market prices from (2) to (10) for both situations, then introducing it into (1) and solving the definite integral yields

$$(11) \quad \Delta W_{IN} = c_N \bar{p}^* + 0.5 d_N \bar{p}^{*2} - c_N \bar{p}_N - 0.5 d_N \bar{p}_N^2$$

with

$$(12) \quad \bar{p}^* = (c_M + c_N - a_M - a_N) / (b_M + b_N - d_M - d_N)$$



and

$$(13) \quad \bar{p}_N = \{c_N - a_N - r (a_M + (b_M \bar{q} - b_M c_M)/d_M - \bar{q})\}/(b_N - d_N).$$

Equation (11) rewrites equation (1), and equations (12) and (13) specify the kind of price formation in the situations with and without export quota policy. Introducing (12) and (13) into (11) shows how the welfare effect of an export quota policy is affected by parameters and exogenous variables of the market under consideration.

Equation (1) as well as equation (11) show the general result that the welfare of non-participating importing countries may increase or decrease if they stay outside the export quota arrangement. If the uniform world market price in the hypothetical situation without quotas exceeds the price on the non-member market in the quota situation ( $\bar{p}^* > \bar{p}_N$ ), their welfare increases compared to the free-market situation. The welfare gain increases with a rising difference between  $\bar{p}^*$  and  $\bar{p}_N$ . Equation (11) in combination with (12) and (13) can be used additionally to show how the welfare effects for non-participating importing countries depend on the restrictiveness of the export quota policy on the member market. The change of the welfare effects in dependency of  $\bar{q}$  and  $r$  will be analyzed in the following.

### 3. The Importance of the Degree of Intervention for the Effects of Quota Policy on the Non-Participating Importing Countries

Equation (11) showed the effect of an export quota policy on the welfare of non-participating importing countries compared to a situation of a free market. How does this effect change if the rigidity of the export quota policy will be altered? This question can be answered if the equations (12) and (13) are introduced into (11) and if (11) is differentiated with respect to the policy parameters  $\bar{q}$  and  $r$ . A change in the rigidity of the direct export quota policy finds expression in a change of  $\bar{q}$  and this alters the welfare effects as follows:

$$(14) \quad (\Delta W_{IN})_{\bar{q}} = -\left\{ c_N + d_N \left( \frac{c_N - a_N - r(a_M + (b_M \bar{q} - b_M c_M) / d_M - \bar{q})}{b_N - d_N} \right) \right\} \\ \cdot \left( \frac{-r b_M}{d_M (b_N - d_N)} + \frac{r}{b_N - d_N} \right) < 0$$

$$(15) \quad (\Delta W_{IN})_{\bar{q}\bar{q}} = -d_N \cdot \left( \frac{-r b_M}{d_M (b_N - d_N)} + \frac{r}{b_N - d_N} \right)^2 > 0$$

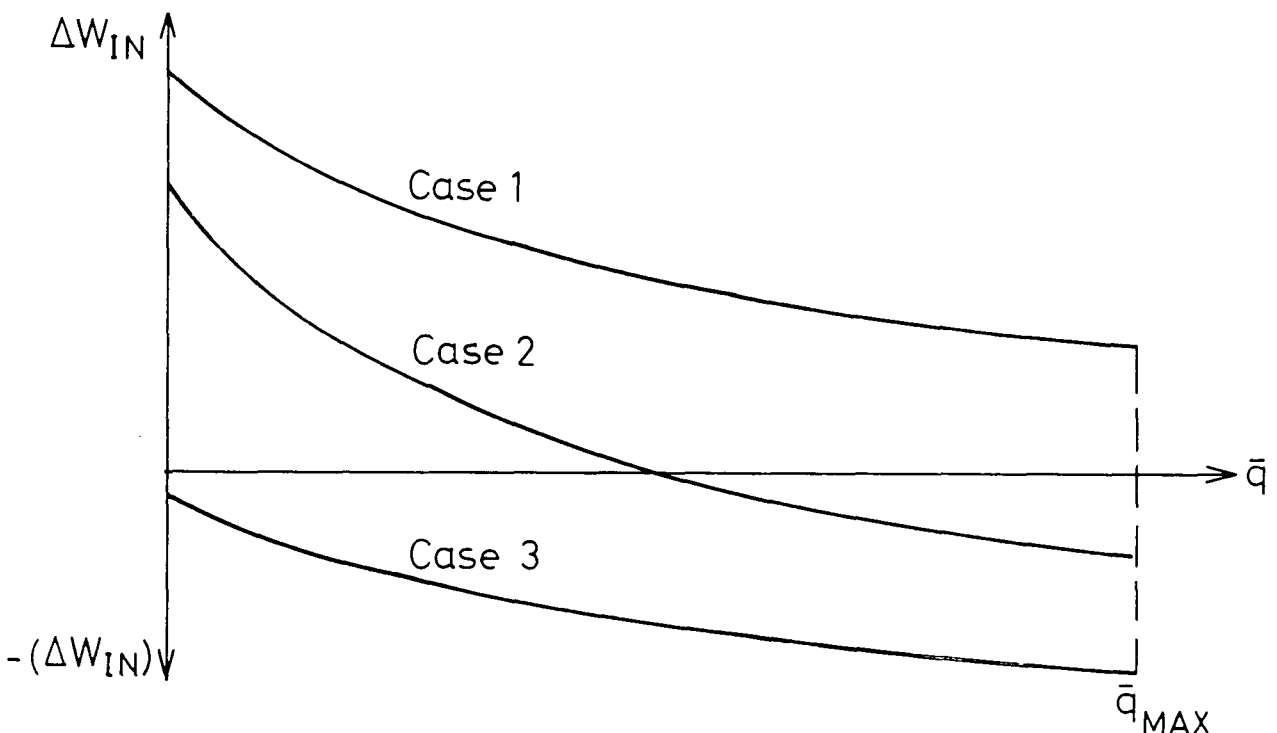
$(\Delta W_{IN})_{\bar{q}}$  indicates the first partial derivative and  $(\Delta W_{IN})_{\bar{q}\bar{q}}$  the second partial derivative of  $(\Delta W_{IN})$  with respect to  $\bar{q}$ .

The equations (14) and (15) have interesting economic implications. The welfare effects on non-participating importing countries, caused by quota policy on the member market, decrease with an increase in  $\bar{q}$  and are a strictly convex function of  $\bar{q}$ . The first derivative shows that a marginal reduction of the export quota fixed on the member market will accelerate a welfare-in-

creasing effect for the non-participating importing countries or will dampen a welfare-decreasing effect for these countries. The second derivative shows that a welfare-increasing effect for the non-participating importing countries will be accelerated the more, the lower  $\bar{q}$  and the more restrictive the export quota policy on the member market. Analogously, a welfare-decreasing effect for these countries will be dampened the more, the lower  $\bar{q}$ .

From the signs of (11) and (14) it follows that the export quota policy on the member market will rather increase welfare of non-participating importing countries the lower the fixed export quota. The signs of the equations (11), (14) and (15) can be used to derive possible policy-effects functions depending on  $\bar{q}$ . These functions are shown in Figure 1.

Figure 1: Possible Policy-Effects Functions  $\Delta W_{IN} = f(\bar{q})$



At  $\bar{q}_{MAX}$ , a market separation occurs between the member and the non-member market. Quotas lower than  $\bar{q}_{MAX}$  are binding on the importers' and on the exporters' side of the member market. Figure 1 illustrates that a welfare-increasing effect on non-participating importing countries can be expected the more, the lower the fixed export quota on the member market. In case 1, welfare would increase over the whole range of binding export quotas with a decreasing  $\bar{q}$ . In case 2, it would increase for the lower values of  $\bar{q}$ . The welfare-increasing case 1 would arise if the autarky price on the non-member market exceeded that on the member market.

Indirectly, the commodity control authority may influence  $r$ . A change in  $r$  can be realized by introducing more or less restrictive sanctions towards exporting member countries that sell quota-induced surpluses on the non-member market. A change in  $r$  can also be realized by changing the intensity of control measures towards these sales to the non-member market. A change in these policy measures that indirectly affects  $r$  will alter the welfare effects on non-participating importing countries as follows:

$$(16) \quad (\Delta W_{IN})_r = \left( \frac{a_M + (b_M \bar{q} - b_M c_M) / d_M - \bar{q}}{b_N - d_N} \right) \cdot \left\{ c_N + d_N \left( \frac{c_N - a_N - r(a_M + (b_M \bar{q} - b_M c_M) / d_M - \bar{q})}{b_N - d_N} \right) \right\} > 0$$

$$(17) \quad (\Delta W_{IN})_{rr} = \left( \frac{a_M + (b_M \bar{q} - b_M c_M) / d_M - \bar{q}}{b_N - d_N} \right)^2 \cdot (-d_N) > 0$$

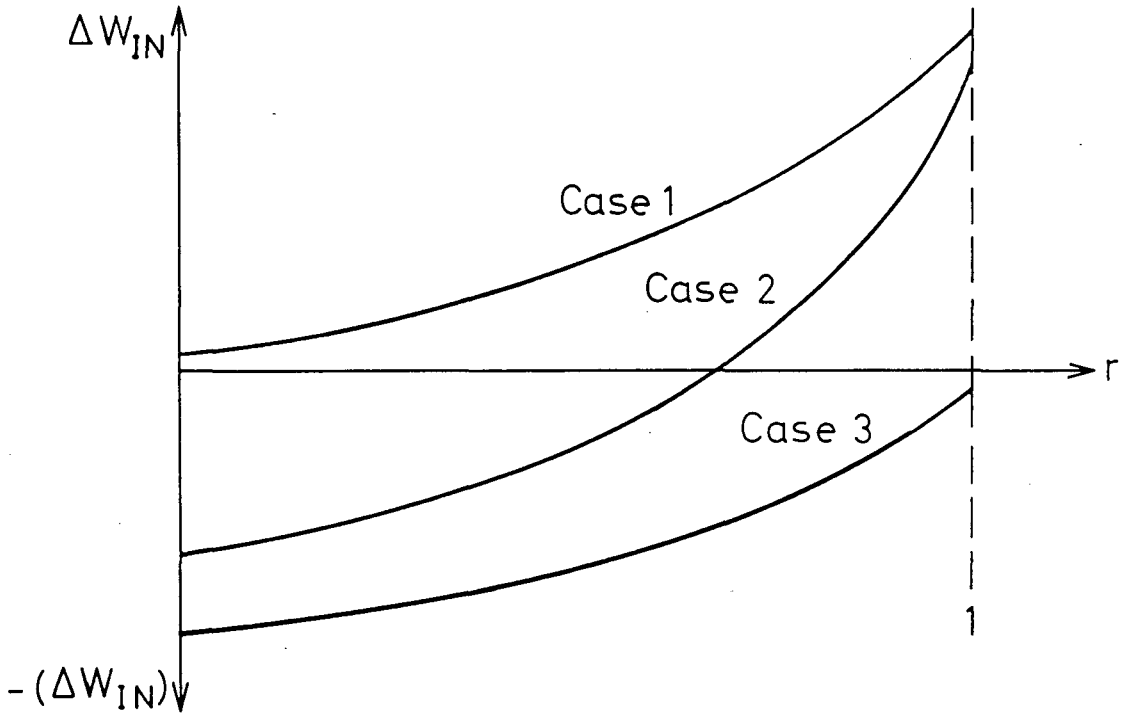
$(\Delta W_{IN})_r$  symbolizes the first partial derivative and  $(\Delta W_{IN})_{rr}$  the second partial derivative of  $(\Delta W_{IN})$  with respect to  $r$ .

The equations (16) and (17) show that the welfare effects on non-participating importing countries, caused by quota policy on the member market, increase with a rising  $r$  and are a strictly convex function of  $r$ . The first derivative shows that a marginal increase in the transmission coefficient  $r$  will accelerate a welfare-increasing effect for the non-participating importing countries or will dampen a welfare-decreasing effect for these countries. The second derivative shows that a welfare-increasing effect for the non-participating importing countries will be accelerated the more, the higher  $r$  and the more liberalized the sanctions towards the sale of quota-induced surpluses on the non-member market. Analogously, a welfare-decreasing effect for these countries will be dampened the more, the higher  $r$ .

From the signs of (11) and (16) it can be concluded that the export quota policy will rather increase welfare of non-participating importing countries, the weaker the sanctions towards the sale of quota-induced surpluses to the non-member market.

The signs of the equations (11), (16) and (17) can be used to derive possible policy-effects functions depending on  $r$ . These functions are shown in Figure 2.

Figure 2: Possible Policy-Effects Functions  $\Delta W_{IN} = f(r)$



With  $r = 1$ , the whole oversupply from the member market is transmitted to the non-member market. For  $r < 1$ , only a particular share is transmitted. Figure 2 illustrates that a welfare-increasing effect on non-participating importing countries can rather be expected, the lower the restrictions on the shifting of quantity surpluses to the non-member market. In case 1, welfare would increase for the whole range of possible transmission coefficients  $r$ . In case 2, it would increase for the highest values of  $r$ . The welfare-increasing case 1 would arise if the autarky price on the non-member market exceeded that on the member market.

#### 4. Welfare Effects on Non-participating Importing Countries under Modified Assumptions

a)  $r = 0$

The welfare impacts of an export scheme on non-participating importing countries, as analyzed up to now, are based on the assumption  $0 < r \leq 1$ . This implies that the export supply curve on the non-member market shifts to the right in the quota situation since quota-induced overages are transmitted to the non-member market. How does this assumption influence the results? Assume that the commodity control authority succeeds in a total market separation so that quota-induced trade between member and non-member countries does not take place. The reason might be high penalties and strict controls of the trade with non-member countries. In this case,  $r$  is equal to zero and market price formation on the non-member market coincides with a situation of autarky on this market. The general welfare impacts shown in formulae (1) and (11) are still valid. Moreover, the hypothetical uniform world market price shown in (12) holds further. The equilibrium price on the non-member market under the quota system changes, however, to

$$(13') \quad \bar{p}_N = (c_N - a_N) / (b_N - d_N).$$

This is equal to the autarky price on the non-member market. Introducing (12) and (13') into (11) and differentiating with respect to  $\bar{q}$  yields the following results:

$$(14') \quad (\Delta W_{IN}) \bar{q} = 0$$

$$(15') \quad (\Delta W_{IN}) \bar{q} \bar{q} = 0$$

The following results can be derived from (11), (12), (13'), (14'), and (15'):

1. If  $r = 0$ , export quota policy on the member market induces a welfare impact on non-participating importing countries. It can be positive, negative, or arbitrarily zero. The effect is again positive if the price on the non-member market is lower in the quota situation than the uniform world market price in the situation without quotas.

2. If  $r = 0$ , the welfare impact on non-participating importing countries is only a consequence of market separation between the member and the non-member market. It is totally independent of  $\bar{q}$  and, therefore, of the restrictiveness of the export quota policy on the member market.

Additionally, the comparison of (11) to (13) with (11), (12) and (13') shows that the price in the situation with export quota policy is higher with  $r = 0$  than with  $0 < r \leq 1$ . Therefore, the welfare gains from quota policy are lower or the welfare losses are higher with  $r = 0$  than with  $0 < r \leq 1$ .



- b) The individual non-participating importing country's point of view

The following questions are answered in the sections 2 and 3: Which welfare effects occur as a consequence of an export quota scheme for all non-participating importing countries compared to the situation of a liberalized world market? How do these effects depend on the kind of quota policy? From the national point of view of a single non-participating importing country, more relevant questions are: Which welfare effects occur for the own country as a consequence of an export quota scheme compared to the situation of a liberalized world market? How do these national effects depend on the kind of quota policy? To answer these questions for an individual country  $i$ , the import demand quantity of all non-participating importing countries has to be divided into that of country  $i$  ( $q_{Ni}^{ID}$ ) and that of all others ( $q_{No}^{ID}$ ). It follows that

$$(18), (18') \quad q_N^{ID*} = q_{Ni}^{ID*} + q_{No}^{ID*} ; \quad q_N^{ID} = q_{Ni}^{ID} + q_{No}^{ID}$$

with

$$(19), (19') \quad q_{Ni}^{ID*} = c_{Ni} + d_{Ni} p^* ; \quad q_{Ni}^{ID} = c_{Ni} + d_{Ni} p_N$$

and

$$(19''), (19''') \quad q_{No}^{ID*} = c_{No} + d_{No} p^* ; \quad q_{No}^{ID} = c_{No} + d_{No} p_N.$$

Export quota policy on the member market will lead to the following welfare effects for the non-participating importing country i:

$$(20) \quad W_{INi} - W_{INi}^* = \Delta W_{INi} = \bar{p}_N \int_{\bar{p}_N}^{\bar{p}_N^*} q_{Ni}^{ID}(p_N) dp_N$$

$$\geq 0, \text{ if } \bar{p}_N^* \geq \bar{p}_N.$$

Solving the definite integral in equation (20) and introducing (19) and (19') into (20) yields:

$$(20') \quad \Delta W_{INi} = c_{Ni} \bar{p}_N^* + 0.5 d_{Ni} \bar{p}_N^{*2} - c_{Ni} \bar{p}_N - 0.5 d_{Ni} \bar{p}_N^2.$$

The equilibrium market prices to be used in (20') follow from the equation system (2) to (10), where (5) and (5') are substituted by (18) to (20'):

$$(21) \quad \bar{p}_N^* = (c_M + c_{Ni} + c_{No} - a_M - a_N) / (b_M + b_N - d_M - d_{Ni} - d_{No})$$

and

$$(22) \quad \bar{p}_N = \{c_{Ni} + c_{No} - a_N - r(a_M + (b_M \bar{q} - b_M c_M) / (d_M - \bar{q}))\} / (b_N - d_{Ni} - d_{No}).$$

The combination of (20'), (21), and (22) shows which welfare effect results from an export quota scheme for a non-participating importing country i and how the effect depends on the parameters and exogenous variables under consideration. Introducing (21) and (22) into (20') and differentiating (20') partially with respect to the policy parameters  $\bar{q}$  and r shows how the national

welfare effects for a non-participating importing country i change if the quota policy changes. The following results occur:

$$(23) (\Delta W_{INi})_{\bar{q}} = -\{c_{Ni} + d_{Ni} \left( \frac{c_{Ni} + c_{No} - a_N - r(a_M + (b_M \bar{q} - b_M c_M)/d_M - \bar{q})}{b_N - d_{Ni} - d_{No}} \right) \} \\ \cdot \left( \frac{-r b_M}{d_M(b_N - d_{Ni} - d_{No})} + \frac{r}{b_N - d_{Ni} - d_{No}} \right) < 0$$

$$(24) (\Delta W_{INi})_{\bar{q}\bar{q}} = -d_{Ni} \cdot \left( \frac{-r b_M}{d_M(b_N - d_{Ni} - d_{No})} + \frac{r}{b_N - d_{Ni} - d_{No}} \right)^2 > 0$$

$$(25) (\Delta W_{INi})_r = \left( \frac{a_M + (b_M \bar{q} - b_M c_M)/d_M - \bar{q}}{b_N - d_{Ni} - d_{No}} \right).$$

$$\{c_{Ni} + d_{Ni} \left( \frac{c_{Ni} + c_{No} - a_N - r(a_M + (b_M \bar{q} - b_M c_M)/d_M - \bar{q})}{b_N - d_{Ni} - d_{No}} \right) \} > 0$$

$$(26) (\Delta W_{INi})_{rr} = \left( \frac{a_M + (b_M \bar{q} - b_M c_M)/d_M - \bar{q}}{b_N - d_{Ni} - d_{No}} \right)^2 (-d_{Ni}) > 0$$

$(\Delta W_{INi})_{\bar{q}}$  and  $(\Delta W_{INi})_{\bar{q}\bar{q}}$  symbolize the first and second derivatives of  $(\Delta W_{INi})$  with respect to  $\bar{q}$ .  $(\Delta W_{INi})_r$  and  $(\Delta W_{INi})_{rr}$  are the first and second derivatives with respect to  $r$ . The equations (20) to (26) indicate that an export quota scheme on a market of participating countries creates welfare effects for a non-participating importing country that are similar to those for all non-participating importing countries. The main results from (20) to (26) are:

1. An individual non-participating importing country may gain or lose from an export quota scheme carried out on the member market. It gains from the export quota scheme if its national import price in the quota situation is lower than in the hypothetical non-quota situation.
2. As long as the participating exporting countries will transmit a part of the quota-induced oversupply from the member to the non-member market ( $0 < r \leq 1$ ), the magnitude of the welfare effect for a non-participating importing country is a function of the policy parameters.  $(\Delta W_{INi})$  is a decreasing and strictly convex function of  $\bar{q}$ . Moreover,  $(\Delta W_{INi})$  is an increasing and strictly convex function of  $r$ . Therefore, export quota policy on the member market will rather increase welfare of the non-participating importing country,
  - the more restrictive the quota policy on the member market, and
  - the lower the penalties for participating exporting countries selling quota-induced oversupply to non-participating importing countries.

The policy effects functions which were shown in Figure 1 and 2 for all non-participating importing countries, are also valid for the individual non-participating importing country.

The national point of view can be further elaborated if we make the small-country assumption. This assumption implies

$$(\bar{p}^*)_{q_{Ni}^{ID}} \sim 0; \quad (\bar{p}_N)_{q_{Ni}^{ID}} \sim 0; \quad q_N^{ID*} \sim q_{No}^{ID*}; \quad q_N^{ID} \sim q_{No}^{ID}.$$

Again, (20') show the export quota policy's welfare effect for the non-participating importing country. However, prices entering into (20') are now independent of the coefficients of the individual country's import demand function <sup>3</sup>. It follows that

$$(21') \quad \bar{p}^* = (c_M + c_{No} - a_M - a_N) / (b_M + b_N - d_M - d_{No})$$

and

$$(22') \quad \bar{p}_N = \{c_{No} - a_N - r(a_M + (b_M \bar{q} - b_M c_M) / d_M - \bar{q})\} / (b_N - d_{No}).$$

From (20') to (22'), it can be immediately shown how the national welfare effects depend on the level and slope of the national import demand function:

$$(27) \quad (\Delta W_{INi})_{c_{Ni}} = \bar{p}^* - \bar{p}_N \geq 0$$

$$(28) \quad (\Delta W_{INi})_{d_{Ni}} = 0.5 (\bar{p}^{*2} - \bar{p}_N^2) \geq 0$$

$$(29), (29') \quad (\Delta W_{INi})_{c_{Ni} c_{Ni}} = (\Delta W_{INi})_{d_{Ni} d_{Ni}} = 0$$

This implies: If the welfare of the non-participating importing country increases due to export quota policy ( $\bar{p}^* > \bar{p}_N$ ), this welfare gain will be the larger,

- the higher  $c_{Ni}$ , i.e. the higher the import demand level of country i for the product under quotas;

- the higher  $d_{Ni}$ , i.e. the more price-inelastic the import demand function of country  $i$  for the product under quotas.

On the other hand, a given welfare decrease of the non-participating importing country due to export quota policy ( $\bar{p}^* < \bar{p}_N$ ) will also be the larger the higher  $c_{Ni}$  and the higher  $d_{Ni}$ . Obviously, high national import demand levels and absolutely low national price elasticities of import demand cause strong quota-induced welfare effects in either direction.

Up to now, it was analyzed which effects occur from the non-participating importing country's view compared to the non-quota situation. This is an important question of positive economics. Once an quota system is implemented, however, this is not the relevant question for the decision calculus of the non-participating importing country. The country can decide to stay outside the agreement or to enter the agreement as a member country. It cannot decide by itself to restore a non-quota situation. From the decision-oriented point of view, the relevant import price for this country is again  $\bar{p}_N$ , if it stays outside the agreement, but  $\bar{p}_M$  instead of  $\bar{p}^*$  if it enters the agreement. The welfare effect for the non-participating importing country from deciding not to participate in the quota arrangement is then

$$(30) \Delta W_{INi} = \int_{\bar{p}_N}^{\bar{p}_M^*} q_{Ni}^{ID}(p) dp \geq 0, \text{ if } \bar{p}_M \geq \bar{p}_N.$$

The hypothetical situation when country  $i$  entered the agreement would be represented by the following import demand relationships:

$$(31) \quad q_M^{ID*} = q_{Mi}^{ID*} + q_{Mo}^{ID*}$$

$$(32) \quad q_{Mi}^{ID*} = c_{Mi} + d_{Mi} p_M^*$$

$$(33) \quad q_{Mo}^{ID*} = c_{Mo} + d_{Mo} p_M^*$$

$q_M^{ID*}$  is the import demand quantity of all member countries in the hypothetical situation,  $q_{Mo}^{ID*}$  is that of the current group of member countries and  $q_{Mi}^{ID*}$  is the additional quantity of country i. In comparison with equation (19), it holds that  $c_{Ni} = c_{Mi}$ ,  $d_{Ni} = d_{Mi}$ . In comparison with equation (3), it holds that:  $c_{Mo} = c_M$ ;  $d_{Mo} = d_M$ . Solving the definite integral in (30) and introducing (19) and (32) into (30), it follows:

$$(30') \quad \Delta W_{INi} = c_{Mi} \bar{p}_M^* + 0.5 d_{Mi} \bar{p}_M^{*2} - c_{Ni} \bar{p}_N - 0.5 d_{Ni} \bar{p}_N^2.$$

The equilibrium market price in the hypothetical situation with country i as a member country can be derived from the equation system (2) to (6) where (3) is substituted by (31) to (33):

$$(34) \quad \bar{p}_M^* = (\bar{q} - c_{Mi} - c_{Mo}) / (d_{Mi} + d_{Mo}).$$

The equilibrium market price on the non-member market in the existing situation is again represented by equation (22).

The combination of (30'), (34) and (22) shows which welfare effect results for a non-participating importing country from staying outside instead of entering the export quota agreement. Introducing (34) and (22) in (30') and differentiating (30')

partially with respect to the policy parameters  $\bar{q}$  and  $r$  shows how this national welfare effect changes if the quota policy changes. The following results can be derived:

$$(35) \quad (\Delta W_{INi})_{\bar{q}} = \{c_{Mi} + d_{Mi} \frac{(\bar{q} - c_{Mi} - c_{Mo})}{(d_{Mi} + d_{Mo})}\} \left( \frac{1}{d_{Mi} + d_{Mo}} \right) \\ - \{c_{Ni} + d_{Ni} \left( \frac{c_{Ni} + c_{No} - a_N - r(a_M + (b_M \bar{q} - b_M c_M)/d_M - \bar{q})}{b_N - d_{Ni} - d_{No}} \right)\} \\ \left( \frac{-r b_M}{d_M(b_N - d_{Ni} - d_{No})} + \frac{r}{b_N - d_{Ni} - d_{No}} \right) < 0$$

$$(36) \quad (\Delta W_{INi})_{\bar{q}\bar{q}} = \frac{d_{Mi}}{(d_{Mi} + d_{Mo})^2} - d_{Ni} \cdot \left( \frac{-r b_M}{d_M(b_N - d_{Ni} - d_{No})} + \frac{r}{b_N - d_{Ni} - d_{No}} \right)^2 \geq 0$$

$$(37) = (25) \quad (\Delta W_{INi})_r = \left( \frac{(a_M + (b_M \bar{q} - b_M c_M)/d_M - \bar{q})}{b_N - d_{Ni} - d_{No}} \right).$$

$$\{c_{Ni} + d_{Ni} \left( \frac{c_{Ni} + c_{No} - a_{No} - a_N - r(a_M + (b_M \bar{q} - b_M c_M)/d_M - \bar{q})}{b_N - d_{Ni} - d_{No}} \right)\} > 0$$

$$(38) = (26) \quad (\Delta W_{INi})_{rr} = \left( \frac{(a_M + (b_M \bar{q} - b_M c_M)/d_M - \bar{q})}{b_N - d_{Ni} - d_{No}} \right)^2 \cdot (-d_{Ni}) > 0$$



The following results can be derived from equations (30'), (34), (24) and (35) to (38):

1. The decision of a non-participating importing country to stay outside of an export quota agreement may be correct or wrong from purely economic reasons. The decision causes a welfare gain, as far as the country's national import price is lower if it stays outside than if it enters the agreement.
2. If  $0 < r \leq 1$ , the magnitude of the welfare effect for a non-participating importing country is a function of the policy parameters.  $(\Delta W_{INi})$  is a decreasing function of  $\bar{q}$  that may be either convex or concave. Moreover,  $(\Delta W_{INi})$  is an increasing and strictly convex function of  $r$ . Therefore, the decision of the importing country to stay outside instead of entering the agreement is rather correct,
  - the more restrictive the quota policy on the member market, and
  - the lower the penalties for participating exporting countries who sell quota-induced oversupply to non-participating importing countries.

How did the results change due to a change in the reference system? Does it matter whether the welfare effects for the non-participating importing country are measured in a decision-oriented perspective or by the comparison with and without policy? Comparing equations (30') and (34) to (38) with (20) to (26) yields the following results:

1. Generally, the welfare gains are higher or the welfare losses are smaller if the alternative staying outside or entering the agreement is considered. The reason is that a binding export quota policy raises the hypothetical import price on the member market beyond the level of the non-quota situation. Hence, it becomes more favorable to stay outside the quota agreement due to the change of the reference system.
2. The comparison of (35) and (23) shows that  $(\Delta W_{INi})$  increases at a higher rate with a marginal decrease in  $\bar{q}$  if the alternative staying outside or entering the agreement is considered. However,  $(\Delta W_{INi})$  must no longer be a strictly convex function of  $\bar{q}$  under this reference system.
3. The national policy-effects function  $(\Delta W_{INi}) = f(r)$  remains unaffected by the change in the reference system.

From these comparisons, an important conclusion follows. A non-participating importing country may be made worse off by introducing export quotas on an otherwise liberalized market. However, it is possible that the country realizes a welfare gain in this situation by staying outside instead of entering the agreement.

c) Cost of participation in the agreement

Up until now, it has been assumed that participation in the agreement would be costless. However, financial contributions to the commodity control authority will be necessary if the country

enters the agreement. Let  $C_i (> 0)$  be the financial cost of participating in the agreement. Due to rising decision-making cost with lowering  $\bar{q}$ , it can be assumed that  $(C_i)_{\bar{q}} < 0$ . The signs of  $(C_i)_{\bar{q}\bar{q}}$ ,  $(C_i)_r$ , and  $(C_i)_{rr}$  are ambiguous. The decision to stay outside or to enter the agreement will be affected as follows. Instead of (30) and (30'), the welfare implication of non-participation in the agreement is:

$$(39) \quad \Delta W_{INi} = \int_{\bar{p}_N}^{\bar{p}_M} q_{Ni}^{ID}(p) dp - C_i$$

and

$$(39') \quad \Delta W_{INi} = c_{Mi} \bar{p}_M^* + 0.5 d_{Mi} \bar{p}_M^{*2} - c_{Ni} \bar{p}_N - 0.5 d_{Ni} \bar{p}_N^2 - C_i$$

Introducing (34) and (22) into (39') and differentiating (39') partially with respect to  $\bar{q}$  and  $r$  yields:

$$(40) \quad (\Delta W_{INi})_{\bar{q}} = \left\{ c_{Mi} + a_{Mi} \frac{(\bar{q} - c_{Mi} - c_{Mo})}{(d_{Mi} + d_{Mo})} \right\} \cdot \left( \frac{1}{d_{Mi} + d_{Mo}} \right) \\ - \left\{ c_{Ni} + d_{Ni} \left( \frac{c_{Ni} + c_{No} - a_N - r(a_M + (b_M \bar{q} - b_M c_M)/d_M - \bar{q})}{b_N - d_{Ni} - d_{No}} \right) \right\}$$

$$\left( \frac{-r b_M}{d_M (b_N - d_{Ni} - d_{No})} + \frac{r}{b_N - d_{Ni} - d_{No}} \right) - (C_i)_{\bar{q}} < 0$$

$$(41) \quad (\Delta W_{INi})_{\bar{q}\bar{q}} = \frac{d_{Mi}}{(d_{Mi} + d_{Mo})^2} - d_{Ni} \cdot \left( \frac{-r b_M}{d_M (b_N - d_{Ni} - d_{No})} \right) + \left( \frac{r}{b_N - d_{Ni} - d_{No}} \right)^2 - (C_i)_{\bar{q}\bar{q}} \geq 0$$

$$(42) \quad (\Delta W_{INi})_r = \left( \frac{(a_M + (b_M \bar{q} - b_M c_M) / d_M - \bar{q})}{b_N - d_{Ni} - d_{No}} \right).$$

$$\{c_{Ni} + d_{Ni} \left( \frac{c_{Ni} - c_{No} - a_N - r(a_M + (b_M \bar{q} - b_M c_M) / d_M - \bar{q})}{b_N - d_{Ni} - d_{No}} \right)\} - (C_i)_r \geq 0$$

$$(43) \quad (\Delta W_{INi})_{rr} = \left( \frac{(a_M + (b_M \bar{q} - b_M c_M) / d_M - \bar{q})}{b_N - d_{Ni} - d_{No}} \right)^2 \cdot (-d_{Ni}) - (C_i)_{rr} \geq 0$$

The following results can be derived, if the equations (39) to (43) are compared with the preceding results:

1. If the financial costs of participation in the agreement are taken into account, the decision to stay outside the export quota agreement becomes even more favorable. The non-participating importing countries may realize welfare gains from this decision even if the import price is lower if it enters the agreement than if it stays outside.
2. Including costs of participation, a reduction of export quotas on the member market becomes more favorable for the non-participating importing countries than without considering these costs.

3. The policy-effects function  $\Delta W_{INi} = f(r)$  may be increasing, decreasing, or constant and may be either convex or concave if  $C_i$  is additionally considered. The shape of the cost function in dependency of  $r$  is crucial for the result.

## 5. Summary and Conclusions

In the preceding analysis, impacts of an export quota agreement on the welfare of non-participating importing countries were investigated theoretically. It was assumed that quotas are fixed for exports to importing member countries, whereas exports to the non-member countries are not controlled. The main results are:

1. Individual non-participating importing countries as well as the whole group of these countries may gain or lose from such an export quota agreement compared to the non-quota situation. They will gain if their import price in the quota situation is lower than in the non-quota situation. This is more likely to occur, the lower the export quota on the member market and the higher the willingness of exporting member countries to shift surpluses from the member to the non-member market.
2. If the small-country assumption is valid, an existing welfare gain for the non-participating importing countries will be larger the larger its import demand level and the more price-inelastic its import demand function for the product under quotas.

3. If the alternative of entering the agreement or staying outside the agreement is taken into account, the outsider position becomes more favorable than if it is compared to the non-quota situation. This holds even more if the financial costs of participating in the agreement are considered.

Generally, the analysis shows that strong economic incentives can exist for importing countries to stay outside an export quota arrangement.

In future research, the analysis could be extended in several directions. Theoretically, it could be investigated how the results change if the model's assumptions are changed. Non-linear functions, dynamic relationships, a non-competitive market, a multi-dimensional objective function, or uncertainty could be introduced into the model. The analysis could also be carried out for exporting countries. Empirically, this or an extended model could be applied to various regulated markets like oil, rubber, or tin.

### Notes

- 1) A purely price-stabilizing system of flexible export quotas has been recommended by Kaldor (1964), pp. 112 et seq.
- 2) See Just/Hueth/Schmitz (1982), Section 4, 5, 6, and 8.6.
- 3) In a strong sense, the following equations in this section should be interpreted as approximations although the equality sign is used.

## Literature

Berlage, L. (1984), Commodity Price Stabilization by Buffer Stocks and by Export Quotas. "Tijdschrift voor Economie en Management", Vol. 29, pp. 437-448.

Dick, H., S. Gupta, T. Mayer and D. Vincent (1982), Indexation of UNCTAD Core Commodity Prices by Buffer Stocks or Export Quotas? A Comparison of the Benefits for Two Developing Economies. "Journal of Development Economics", Vol. 11, pp. 379-401.

Ffrench-Davis, R.M. (1968), Export Quotas and Allocative Efficiency under Market Instability. "American Journal of Agricultural Economics", Vol. 50, pp. 643-659.

Herrmann, R. (1986), Free Riders and the Redistributive Effects of International Commodity Agreements: The Case of Coffee. "Journal of Policy Modeling", forthcoming.

Just, R.E., D.L. Hueth and A. Schmitz (1982), Applied Welfare Economics and Public Policy. Englewood Cliffs, NJ.

Kaldor, N. (1964), Stabilising the Terms of Trade of Underdeveloped Countries. In: Kaldor, N., Essays on Economic Policy, Volume II, London, pp. 112-130.

Maizels, A. (1982), Selected Issues in the Negotiation of International Commodity Agreements: An Economic Analysis. UNCTAD TD/B/C.1/224, Geneva.

Newbery, D.M.G. and J.E. Stiglitz (1981), The Theory of Commodity Price Stabilization. A Study in the Economics of Risk. Oxford.

UNCTAD (1985), The Role of International Commodity Agreements or Arrangements in Attaining the Objectives of the Integrated Programme for Commodities. Study by the UNCTAD Secretariat, Geneva, 3 April.