# National Interests in International Stabilization Schemes

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## ABSTRACT

The present paper tries to show the limitations of the traditional approach to evaluating commodity stabilization schemes. It is asserted that no definite answer can be given concerning the global welfare aspects of such schemes. The emphasis of the study, therefore, lies on the clarification of the distributional effects of international stabilization schemes on exporting and importing nations. Starting with rather general assumptions about demand and supply curves, we determine the effects of international stabilization schemes on the revenue (expenditure) overtime and on the fluctuation of revenue (expenditure) of individual countries. However, without knowing the parameters of the domestic supply and demand curves and of the world market supply and demand curves, no definite conclusions can be drawn. This, clearly, contradicts some recent findings in the literature which were derived from very special assumptions and resulted in definitive statements.

This study is not intended to provide a conclusive answer as to whether to establish international stabilization schemes or not. To answer this question, more information is required about a number of factors such as the probability, direction and magnitude of fluctuations in supply at the national and the international level, the total cost of the stabilization scheme and the contribution required of an individual country, and, above all, the feasibility of finding the trend equilibrium quantity of a commodity which ought to be stabilized.

## 1. INTRODUCTION

The interest in national and international commodity market stabilisation schemes seems to have increased in the 1970s due to wide fluctuations in the prices of commodities such as coffee, tea and wheat on the world market. Hence, the number of publications on this subject has increased considerably. However, most of the contributions follow the framework set up by F. Waugh in 1944 and P. Massell in 1969. See for example H. Gsänger and G. Schmidt (1977), S. Reutlinger (1976), A. Subotnik and J.P. Houck (1976), E.M. Brook, E.R. Grilli and J. Waelbroeck (March 1977 and July 1977), D. Hueth and A. Schmitz (1972), and R. Edwards (1977). All these authors and others have taken for granted the analytical framework applied by Massell as well as his results.

In this paper it is shown that Massell's approach (from now on to be referred to as the traditional approach) implies some specific assumptions which are not adequate for a proper treatment of the problem. Hence, the results derived are not as general as generally claimed, and policy recommendations may be misleading, especially from the national point of view. To clarify our arguments it is necessary first to give a short presentation of the traditional approach. Then the limitations of the analysis will be pointed out. A presentation of a new approach follows, considering the global welfare aspects of stabilization schemes, their effects on individual countries, and the comparative advantages of national versus international stabilization schemes.

The focus of the study lies in an analysis of the divergence of national interests in international stabilizations schemes. Information about the determinants of national interests is not only important in designing an adequate national policy, but also in establishing an international order which provides some equivalence between national benefits and national contributions. As this aspect seems to have been neglected in the literature, a reconsideration and an extension of this widely discussed topic seems appropriate.

The analysis will be carried out in a rather abstract form. An application of the theoretical framework developed in this paper will be presented in a forthcoming study of Kenyan economic policy with respect to the world coffee market.

## 2. THE LIMITATIONS OF TRADITIONAL ANALYSIS

Traditional analysis of international commodity stabilisation schemes applies the well-known concept of cost-benefit analysis in working out the effects of stabilization on consumer and producer surplus. The feasibility of this appraoch can only be judged if the implicit assumptions of the analytical framework are made clear. The crucial hypotheses are that the market demand curve corresponds to the aggregated marginal utility curve and that the supply curve corresponds to the aggregated marginal opportunity cost curve and, thereby, to the aggregated marginal disutility curve. However, such hypotheses can only hold true if the implied assumptions are realistic. These assumptions are (A.K. Dasgupta and D.W. Pearce, 1972 p. 51):-

a) The marginal utility of income is equal for all persons, and
b) Policy activities will have no effect on the distribution of income.

From the second assumption follows it that - from the theoretical point of view - the framework is not adequate to analyse distributional effects, as attempted in evaluating stabilization schemes with regard to producers and consumers. However, this objection may not be so serious if the producers of the commodity under consideration are only a small proportion of all individuals in a country - and therefore factors which affect them will only affect the total marginal unility curve to a negligible extent. This may indeed be a valid counter-argument if we consider a national stabilisation scheme for a commodity which is only produced by a small percentage of the population, as, for example, producers of agricultural products in highly industrialised economies. However, for less developed countries and, above all, for the world as a whole this counter-argument has to be rejected because there is no justification for the underlying assumptions.

The inadequacy of the traditional approach to the problem of evaluating welfare on a world wide basis is even more evident with regard to the first assumption mentioned above. As world wide income distribution is very uneven, it seems impossible to prove that the marginal utility of income is equal for all individuals in the world. Hence, a study in the traditional vein which assumes that the marginal utility of income is equal on a world wide basis (see for example S. Reutlinger, 1976) comes out with specific figures for world welfare which are meaningless.

The authors cited above not only follow Massell in accepting the cost-benefit approach to the evaluation of the effects on consumers and producers of stabilization schemes, they also accept a second crucial assumption about the causes of price instability: that fluctuations are due to parallel shifts of supply or demand curves.

The importance of this assumption for the results derived can easily be seen in the case of supply fluctuations caused by weather. According to the traditional analysis, a bad harvest leads to an upward shift of the supply curve; the opposite holds true for a good harvest. This implies that marginal costs differ with weather conditions and that the marginal opportunity costs of producing a certain product are high when the weather is not favourable for this crop and low when the weather conditions are favourable. A justification for such an assumption is difficult to find. It seems more appropriate to assume that production is predetermined for normal weather conditions, and herewith also the bulk of variable costs. Weather conditions cause much more unexpected variations in supply than in marginal opportunity costs. In many cases, weather conditions which influence yields may not affect the opportunity costs at all, as harvesting costs are often not influenced by the yield per acre.

Parallel shifts of supply curves are even less likely if supply fluctuations are price induced. In this case - as in the well known cobweb theorem - there is only one move on a given supply curve.

From this it follows that the assumption of parallel shifts of the supply curve has to be replaced by more realistic assumptions to derive relevant policy recommendations. An assumptions of parallel shifts in the demand curves in the case of demand-caused instability is not compatible with the traditional theory of demand. It is well known that in the normal case income elasticities, as well as price elasticities, decline with increasing income. This means that the shifts in the demand curve due to a change in income are not parallel. It may be assumed that demand curves become steeper with an upward shift. The replacement of the assumption about the kind of shift of the demand curve will lead to a modification of the results derived within the traditional approach.

To simplify the analysis, it is assumed in the traditional approach that demand and supply curves are linear. From this assumption follows, for example, that the mean for prices always corresponds to the mean for quantities. It should not be surprising that this specific assumption will lead to very special results, and will not explain every case. The effects of non-linear demand and supply curves has to be included.

In summary, the main feature of traditional analysis is that it is much too ambitious. It is not possible - with the present state of knowledge - to give a specific figure for the welfare effect of a stabilization programme. Furthermore, it is not possible to generalise concerning the effects on consumers and producers when starting from very specific assumptions. The following

analysis, therefore, tries to be less ambitious. It is not intended to derive very general results, but to show that particular assumptions, which may be seen as realistic, lead to quite different results particularly from the national point of view.

## 3. GLOBAL WELFARE ASPECTS

In this section it is assumed that the short-term equilibrium quantity fluctuates randomly and hence prices as well. It is assumed that stabilization aims at reducing the fluctuation of quantities through the use of buffer stocks or quotas and in this way of prices. Only in the case of linear demand and supply curves and parallel shifts of the supply or demand curves will the mean of the quantity coincide with the mean of prices. However, such an assumption is not made here.

Of course the effects of stabilization schemes depend upon the level at which prices are stabilized (Waugh, 1972). Therefore, the level of stabilization must be clearly specified. In this study it is assumed that the amount of a commodity should be stabilized at the level of the average quantity which has been coming on the market before stabilization. However, the stabilization scheme should not be set for the same quantity in all periods. This will be shown in the argument which follows.

Concerning the global welfare aspects of stabilization schemes, only very conditional statements can be made. This is especially true since we cannot take account of distributional effects.

Three main arguments may be given to justify the positive impact of stabilization schemes on overall welfare:-

a) Stabilization aims at the reallocation of quantities consumed over time. It is well known from household theory that consumer welfare is maximized if present prices are equal to discounted future prices, and the discount rate depends on the individual's time preference. It is very likely that fluctuating quantities and prices may lead to a suboptimal situation and hence some degree of stabilization may increase welfare. However, if prices are stabilized completely, this will allow for a disequilibrium situation again. This is true above all if we take into consideration the storage and and other costs of the stabilization scheme. Neglecting distributional effects, we may define an optimal level of stabilization as a situation where the marginal opportunity costs of stabilization are equal to the marginal utility. Obviously, this cannot be a situation with zero price variance over time.

b) In the case of price-induced supply fluctuations, stabilization leads to more rational price expectations and, hence to an improvement in the allocation of resources. Instead of having in one period excessive production capacity and in another an overutilisation of capacity, stabilized markets can make possible a more even utilization of capacity and therefore achieve lower average costs.

c) In the case of supply fluctuations caused by weather, stabilization may lead to a reduction of the producer's risk. But this will only be true if revenue is stabilised as well as markets. With market stabilization, the the percentage change of revenue is equal to the percentage change of quantities supplied.

Hence we have

(1) $$\frac{dR}{R} = \frac{dq}{q}$$

The general relationship between price/quantity fluctuations and revenue fluctuation is given below.

We set out the hypotheses:

(1) $q^D = q^D(P)$

(2) $q^S = q^S(P, a)$

(3) $q^D = q^S = q$

and the definition:

(4) $R = P.q$

where:

$q^D$ = World market demand

$q_i^S$ = Domestic supply of country i

$q_i^D$ = Domestic demand of country i

Solving this system of equations we get for $\frac{dP}{P}$ and $\frac{dq}{q}$

(5) $$\frac{dp}{P} = \frac{1}{\varepsilon^S - \varepsilon^D} - \frac{da}{a}$$

(6) $$\frac{dq}{P} = \frac{\varepsilon^D}{\varepsilon^S - \varepsilon^D} - \frac{da}{a}$$

and for the relative change in R

(7) $$\frac{dR}{R} = \frac{\varepsilon^D + 1}{\varepsilon^S - \varepsilon^D} - \frac{da}{a}$$

Equation (7) clearly shows that $|\varepsilon^D| < 0.5$ is a necessary condition for revenue stabilization via market stabilization. If $|\varepsilon^D| > 0.5$ then revenue will be destabilized irrespective of the magnitude of the elasticity of supply. If $|\varepsilon^D| < 0.5$ the result depends on the elasticity of supply. In general, it holds that the demand elasticity has to be smaller, the greater the supply elasticity to achieve revenue stabilization. If, for example, $\varepsilon^S$ were 0.8, demand elasticity would have to be $|\varepsilon^D| 0.1$. With $\varepsilon^S > 1$ no revenue stabilization effect would be possible irrespective of the demand elasticity. In summary, the necessary conditions for revenue stabilization via market stabilization are $|\varepsilon^D| < 0.5$ and $\varepsilon^S < 1$. (compare to this the less concise conclusions of the World Bank Group, July 1977, p. 6 and pp. 2 of Annex 1.)

Of course, equation (7) includes the special case for $\varepsilon^S = 0$ and $\frac{dq}{q} = \frac{da}{a}$, we get:

$$\frac{dR}{R} = \frac{dq}{q} \left(1 + \frac{1}{\varepsilon^D}\right) \tag{8}$$

According to (8) a necessary and sufficient condition for the stabilization of revenue via market stabilization is $|\varepsilon^D| < 0.5$.

It cannot be taken for granted that $|\varepsilon^D| < 0.5$ holds true for all world commodity markets. Especially if we keep in mind that $\varepsilon^D$ is determined by domestic supply and demand elasticities (see below).

Summing up the effects of stabilization on global welfare, it must be emphasised that some partial effects tend to increase total welfare. However, a definitive statement is not possible as long as the distributional effects of the stabilization scheme are not incorporated in the analysis. The following analysis mainly deals with these distributional effects. Special emphasis is given to the effects of international stabilization schemes on exporting and importing nations. However, the conclusions derived are equally valid for the effects of national stabilization schemes on individual producers and consumers.

## 4. THE NATIONAL INTERESTS OF EXPORTING NATIONS IN INTERNATIONAL STABILIZATION SCHEMES

### 4.1 Market Stabilization and Revenue Stabilization

#### 4.1.1 Market Stabilization and Revenue Stabilization in the Case of Fluctuations Caused by Weather.

One of the main motivations for agreeing to an international stabilization scheme is that such a scheme may bring about a reduction in the

fluctuation of exporting earnings. However, for exporting countries this can only be true if the price elasticity of demand on the world market is smaller than 0.5 and the supply elasticity is zero. (For proof of this, see above p. 5 )

It is not necessarily true that for all primary products which may be considered for stabilization schemes the demand elasticity will be smaller than 0.5, and the price elasticity of demand on the world market cannot be estimated adequately from consumer surveys in individual countries. We have to keep in mind that total demand on the world market is equal to the aggregated demand for imports of individual countries. However, demand for imports not only depends on domestic demand elasticity, but also on domestic supply elasticity and the degree of self-sufficiency. An algebraic proof of this relationship is given below.

By definition we have for total world market demand:

$$(9) \quad q^D = \bar{q}_1^D + \bar{q}_2^D$$

with $\bar{q}_{1,2}^D$ - Import demand of country 1, 2

and

$$(10) \quad \frac{dq^D}{q^D} = \frac{\bar{q}_1^D}{q^D} \times \frac{d\bar{q}_1^D}{\bar{q}_1^D} + \frac{\bar{q}_2^D}{q^D} \times \frac{d\bar{q}_2^D}{\bar{q}_2^D}$$

For import demand of country i we get:

$$(11) \quad \bar{q}_i^D = q_i^D - q_i^S$$

and

$$(12) \quad \frac{d\bar{q}_i^D}{\bar{q}_i^D} = \frac{q_i^D}{\bar{q}_i^D} \times \frac{dq_i^D}{q_i^D} - \frac{q_i^S}{\bar{q}_i^D} \times \frac{dq_i^S}{q_i^S}$$

If (12) is inserted in (10), and (10) is divided by $\frac{dP}{P}$ we get:

$$(13) \quad \frac{\frac{dq^D}{q^D}}{\frac{dP}{P}} = \frac{\bar{q}_i^D}{q^D} \left( \frac{q_i^D}{\bar{q}_i^D} \times \frac{dq_i^D}{q_i^D} - \frac{q_i^S}{\bar{q}_i^D} \times \frac{dq_i^S}{q_i^S} \right) : \frac{dP}{P}$$

$$- \frac{\bar{q}_2^D}{q^D} \left( \frac{q_2^D}{\bar{q}_2^D} \times \frac{dq_2^D}{q_2^D} - \frac{q_2^S}{\bar{q}_2^D} \times \frac{dq_2^S}{q_2^S} \right) : \frac{dP}{P}$$

writing for:

$$(14) \qquad \frac{q_i^D}{\frac{-D}{q_i}} = \frac{1}{1 - DSS_i}$$

and for

$$(15) \qquad \frac{q_i^S}{\frac{-D}{q_i}} = \frac{DSS_i}{1-DSS_i}$$

with $DSS_i$ for degree of self-sufficiency, and taking into consideration the definitions for the different elasticities we have:

$$(16) \qquad \varepsilon^D = \frac{\frac{-D}{q_i}}{q^D} \left( \frac{1}{1 - DSS_1} \cdot \varepsilon_i^D - \frac{DSS_1}{1-DSS_1} \cdot \varepsilon_i^S \right) + \frac{q_i^D}{q^D} \left( \frac{1}{1-DSS_2} \times \varepsilon_2^D - \frac{DSS_2}{1-DSS_2} \times \varepsilon_2^S \right)$$

where: $\varepsilon^D$ = Price elasticity of world market demand

$\varepsilon_i^D$ = Price elasticity of domestic demand of country i

$\varepsilon_i^S$ = Price elasticity of domestic supply of country i

Equation (16) clearly shows that an individual country's demand on the world market will be - in the case of no domestic production at all - more price elastic than domestic demand. If, however, domestic production is price elastic the individual price elasticity of demand on the world market may be higher, equal or smaller than the domestic demand elasticity. At any rate low domestic demand elasticities are not always followed by low world demand elasticities. Therefore, a careful consideration is needed of the factors pertaining to each individual commodity. With given domestic demand and supply elasticities, world demand elasticity will be smaller the less the degree of self-sufficiency of the importing countries.

The problem is even more complicated from the point of view of an individual country. Only in the case where world market supply fluctuations are inverse to domestic supply fluctuations would a stabilization of world market supply and prices necessarily lead to a stabilization of domestic revenue. The determinants of this effect will be worked out in an algebraic form.

The notation is as above, and $R_i^D$ = domestic revenue. The equation of definition for domestic revenue is:

(17) $R_i^D = P \times q_i^S$

As the world market price is affected by total world market supply we may write:

(18) $P = P(q^D)$

(18) Substituted into (17) gives:

(19) $R_i^D = P(q^D) \times q_i^S$

The percentage change in domestic revenue due to changes in prices and quantities may be calculated from (3). It results in:

(20) $$\frac{dR_i^D}{R_i^D} = \frac{dq_i^S}{q_i^S} + \frac{\partial P}{\partial q^D} \times \frac{dq^D}{P}$$

or

(21) $$\frac{dR_i^D}{R_i^D} = \frac{dq_i^S}{q_i^S} + \frac{1}{\varepsilon^D} \times \frac{dq^D}{q^D}$$

where $\varepsilon^D$ - price elasticity of world market demand.

Equation (21) gives the percentage change of domestic revenue without stabilization. This has to be compared with the situation with stabilization, i.e., with:

(22) $$\frac{dR_i^D}{R_i^D} = \frac{dq_i^S}{q_i^S}$$

The comparison of (21) and (22) clearly shows that in the case of inverse fluctuations of supply between the domestic and the world market, stabilization always stabilizes domestic revenue. If, however, the fluctuations are synchronized, the result depends on the amplitudes of domestic and world market supply and on the price elasticity of demand. If the percentage change in domestic supply is equal to the percentage change in world market supply, the necessary condition for revenue stabilization via price stabilization is $|\varepsilon| < 0.5$.

If $\left|\frac{dq_i^S}{q_i^S}\right| > \left|\frac{dq^D}{q^D}\right|$ the magnitude of the elasticity has to be even smaller.

If $\left|\frac{dq_i^S}{q_i^S}\right| < \left|\frac{dq^D}{q^D}\right|$ revenue will be stabilized even with an elasticity greater than 0.5.

Up to now we have assumed that the national supply elasticity and the world market supply elasticity were 0. These assumptions will be relaxed in the following equations.

The shift in the world market supply curve will be $\frac{da}{a}$. Therefore, we get for the world market supply:

$$(23) \qquad \frac{dq^S}{q^S} = \varepsilon^S \times \frac{dP}{P} + \frac{da}{a}$$

For world market demand we have:

$$(24) \qquad \frac{dq^D}{q^D} = \varepsilon^D \times \frac{dP}{P}$$

and for the equilibrium

$$(25) \qquad \frac{dq^S}{q^S} = \frac{dq^D}{q^D}$$

Solving these equations with respect to p and q results in

$$(26) \qquad \frac{dq}{q} = \frac{\varepsilon^D}{\varepsilon^S - \varepsilon^D} \times -\frac{da}{a}$$

and

$$(27) \qquad \frac{dp}{p} = \frac{-\frac{da}{a}}{\varepsilon^S - \varepsilon^D}$$

with $\varepsilon^D$ and $\varepsilon^S$ the relevant world market elasticities.

For the domestic supply ($q_i^S$) we get in the case of a supply shift $\left(\frac{da_i}{a_i}\right)$ and price elastic of supply ($\varepsilon_i^S > 0$):

$$(28) \qquad \frac{dq_i^S}{q_i^S} = \varepsilon_i^S \times \frac{dp}{p} + \frac{da_i}{a_i}$$

For the relative change of domestic revenue ($R_i^D$), the following definition always holds true:

$$(29) \qquad \frac{dR_i^D}{R_i^D} = \frac{dq_i^S}{q_i^S} \times \frac{dP}{P}$$

By substituting equations (27) and (28) into (29), we get:

$$(30) \qquad \frac{dR_i^D}{R_i^D} = \frac{da}{a} \cdot \frac{1 + \varepsilon_i^S}{\varepsilon^S - \varepsilon^D} + \frac{da_i}{a_i}$$

The interpretation of equation (30) runs as follows: a shift of the world market supply curve leads to a change in world market prices: ($\frac{da}{a} \downarrow - \frac{dP}{P} \downarrow$). Because of lower world market prices, domestic supply ($q_i$) may change as well ($\frac{dP}{P} \downarrow \rightarrow \frac{dq_i}{q_i} \downarrow$).

Hence, there are two factors which tend to affect national revenue negatively due to an upward shift of the world market supply curve, i.e., a decrease in prices and a price-induced decrease in domestic supply. These two factors are partly or completely compensated by the upward shift of the domestic supply curve. Consequently, the result depends on the magnitude of the shift of the supply curve, the domestic and world market elasticity of supply, and the world market elasticity of demand.

Equation (30) clearly shows that for $|\varepsilon^D| < 0$ world market revenue may be stabilized, but not national export earnings. To clarify this, let $\frac{da}{a} = \frac{da_i}{a_i}$. Then, we get from equation (30)

$$(31) \qquad \frac{dR_i^D}{R_i^D} = \frac{da}{a} \left(1 - \frac{1 + \varepsilon_i^S}{\varepsilon^S - \varepsilon^D}\right)$$

A national stabilization effect will arise if:-

$$(32) \qquad \frac{1 + \varepsilon_i^S}{\varepsilon^S - \varepsilon^D} > 2 \text{ or}$$

$$(33) \qquad \varepsilon_i^S - 2\varepsilon^S > -2\varepsilon^D - 1$$

If the country's supply elasticity is smaller than double the world market supply elasticity ($\varepsilon_i^S < 2\varepsilon^S$), $\varepsilon^D$ has to be smaller than 0.5 to obtain a positive national stabilization effect.

If, however, $\varepsilon_i^S > 2\varepsilon^S$ a positive national stabilization effect will arise even with $|\varepsilon^D| > 0.5$.

In order to evaluate the effects of international stabilization schemes from the national point of view we need information about all the parameters mentioned above. It should be possible to obtain figures for these parameters by a priori reasoning and by checking the available statistical data.

So far we have only analyzed the effects of stabilization schemes on revenue fluctuations in the case of fluctuations caused by weather. However, as some fluctuations on special commodity markets are price induced or demand induced, we have to analyse the effects in these cases.

4.1.2 Market Stabilization and Revenue Stabilization in the Case of Price-induced Supply Fluctuations. The result in this case is very obvious. With stabilization we achieve stable prices and, hence, can abolish price-induced supply reactions. Therefore, market stabilization will always lead to revenue stabilization.

4.1.3 Market Stabilization and Revenue Stabilization in the Case of Demand-induced Fluctuations. To evaluate the effects of market stabilization on revenue stabilization, we apply the same analytical framework as above. There will no longer be any fluctuation of revenue as market stabilization has to aim at stabilizing the mean quantity demanded and the corresponding equilibrium price. Therefore, we only have to analyse the effects of demand fluctuations on the revenue of an individual country. We assume:

$$(34)\quad q^D = q^D(P, a)$$

$$(35)\quad q^S = q^S(P)$$

$$(36)\quad q_i^S = q_i^S(P)$$

$$(37)\quad q^D = q^S$$

$$(38)\quad R_i = P.q_i^S$$

From this set of equations we get:

$$(39)\quad \frac{dq^D}{q^D} = \varepsilon^D . \times \frac{dP}{P} + \frac{da}{a}$$

$$(40)\quad \frac{dq^S}{q^S} = \varepsilon^S \frac{dP}{P}$$

$$(41)\quad \frac{dq^S}{q^S} = \frac{dq^D}{q^D}$$

$$(42)\quad \frac{dq_i^S}{q_i^S} = \varepsilon_i^S . \times \frac{dP}{P}$$

$$(43) \quad \frac{dR^{i}}{R_i} = \frac{dP}{P} \times \frac{dq_i S}{q_i S}$$

Solving these equations with respect to $\frac{dR_i}{R_i}$ we get:

$$(44) \quad \frac{dR_i}{R_i} = \frac{\varepsilon_i^S + 1}{\varepsilon^S - \varepsilon^D} \times \frac{da}{a}$$

The coefficient $\frac{\varepsilon_i^S + 1}{\varepsilon^S - \varepsilon^D}$ has to be zero if the market stabilization scheme is not to have a destablising effect. However, as long as the shape of demand and supply curves is normal, $\frac{\varepsilon_i^S + 1}{\varepsilon^S - \varepsilon^D}$ will always be greater than 0. Hence, market stabilization will in the normal case lead to revenue stabilization. The stabilization effect will be greater:

- the greater the country's supply elasticity
- the smaller the world market's supply elasticity
- the smaller the world market's demand elasticity
- the greater the shifts of the demand curve.

## 4.2 Market Stabilization and Average Revenue Over Time

Exporting countries may be interested in international stabilization schemes only for their revenue stabilization effect, but also for their effects on the average size of exporting earnings.

4.2.1 The Effect of Market Stabilization on the Size of Export Earnings in the Case of Supply Fluctuations Caused by Weather. To analyse the effects of market stabilization on the average revenue, we have to compare the average revenue in a free market with the average revenue in a stabilized market. In a stabilized market, fluctuations of export earnings are equal to fluctuations in supply. Hence, the average revenue is equal to the equilibrium price multiplied by the average quantity ($\bar{R} = \bar{P} \times \bar{q}$)

To find out the average revenue in a free market we have to compare the percentage of revenue for situations of below average and above average supply. In accordance with our results above, we get for two periods'.

$$(45) \quad (45) \quad \frac{dR_{il}}{R_{il}} = - \frac{da}{a} \quad \frac{1 + \varepsilon_{il}^S}{\varepsilon_1^S - \varepsilon_1^D} + \frac{da_i}{a_i}$$

$$(46)\quad \frac{dR_{i2}}{R_{i2}} = -\frac{da}{a}\;\frac{1+\varepsilon^{S}_{i2}}{\varepsilon^{S}_{2}-\varepsilon^{D}_{2}} + \frac{da_i}{a_i}$$

Average revenue will be greater with stabilization if the positive percentage change of revenue in period 1 due to a negative supply shift is smaller than the negative percentage change of revenue in period 2 due to a positive supply shift. Hence the condition is:

$$(47)\quad \frac{1+\varepsilon^{S}_{i1}}{\varepsilon^{S}_{1}-\varepsilon^{D}_{1}} < \frac{1+\varepsilon^{S}_{i2}}{\varepsilon^{S}_{2}-\varepsilon^{D}_{2}}$$

For the case of normally behaved supply and demand curves, we may hypothesize:

$\varepsilon^{S}_{i1} < \varepsilon^{S}_{i2}$ because $\frac{d\varepsilon^{S}_{i}}{dq}$ declines in the normal case

$\varepsilon^{S}_{1} < \varepsilon^{S}_{2}$ because $\frac{d\varepsilon_{1,2}}{dq}$ declines in the normal case

$|\varepsilon^{D}_{1}| > |\varepsilon^{D}_{2}|$ because $\frac{d\varepsilon^{D}}{dq}$ increases with higher prices,

Therefore, equation (47) does not always hold true; but only if, i.e. all $\varepsilon^{S}$ are 0 or $\varepsilon^{S}_{i1} = \varepsilon^{S}_{i2}$ and $\varepsilon^{S}_{1} = \varepsilon^{S}_{2}$. Therefore market stabilization does not always lead to an increase in average revenue for the case of market fluctuations induced by weather.[1] The same result holds true if supply fluctuations are price induced. However, with respect to demand induced fluctuations the result may differ.

4.2.2. The Effect of Market Stabilization on the Size Export Earnings in the Case of Demand-induced Fluctuations. Applying the same analytical procedure as above we have to compare:

$$(48)\quad \frac{dR_{i1}}{R_{i1}} = \frac{\varepsilon^{S}_{i1}+1}{\varepsilon^{S}_{1}-\varepsilon^{D}_{1}}\;\frac{da}{a}$$

and

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1. This finding contradicts those of the World Bank Group (July 1977) p. 9. The difference is due to the special assumption of parallel shifts of the supply curve made in the World Bank Group's study.

$$(49) \quad \frac{dR_{i2}}{R_{i2}} = \frac{\varepsilon^S_{i2} + 1}{\varepsilon^S_2 - \varepsilon^D_2} \frac{da}{a}$$

As $\frac{da}{a} > 0$ indicates an upward shift of the demand curve and $\frac{da}{a} < 0$ a downward shift, we may hypothesize that:

$$\varepsilon^S_{i1} < \varepsilon^S_{i2}$$

$$\varepsilon^S_1 < \varepsilon^S_2$$

$$|\varepsilon^D_1| < |\varepsilon^D_2|$$

From this it follows that $\left|\frac{dR_{i1}}{R_{i1}}\right| \gtrless \left|\frac{dR_{i2}}{R_{i2}}\right|$

As $\frac{dR_{i1}}{R_{i1}} > 0$ and $\frac{dR_{i2}}{R_{i2}} < 0$, the average level of revenue earned from exports may be higher or lower if there is no market stabilization scheme.[2]

4.3 The Importance of Product Diversification.

Up to now we have analysed the determinants of national interests in international stabilization schemes under the assumption of a homogeneous product. However, on most world markets there is some product diversification - different countries offer different qualities of the same product. The effect of price stabilization on these different qualities has to be taken into account. If the stabilization scheme intervenes mainly by buying and selling quantities which are of inferior quality to those sold from an individual country, then the scheme is less favourable to that country. The relative disadvantage will be the greater the larger the price differential between the different qualities of the product and the larger the elasticity of substitution of demand. For special markets, such the world coffee market with its different qualities, this aspect may be quite important in evaluating the benefits of an international stabilization scheme from the national point of view.

4.4 The Importance of Commodity Export Earnings out of Total National Export Earnings

Even if all determinants discussed so far are in favour of an individual country, the national interest in an international stabilization scheme

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2. Again this finding contradicts the World Bank Group (July 1977) p. 9.

may be negligible if only a small share of national resources are employed in the production of the commodity in question, and if export earnings from this commodity only account for a small percentage of total export earnings In this case, the country may be aBLe to bear the risk of an unstable world market without cooperating in a stabilization scheme.

## 5. THE NATIONAL INTERESTS OF IMPORTING NATIONS IN INTERNATIONAL STABILIZATION SCHEME

Having analysed the national interests of exporting nations in international stabilization schemes at some length, we may discuss the importing nations' interests very briefly as the same analytical framework may be applied. The only difference is that instead of hypothesising that the national and world market supply is sensitive to price, we have to postulate that national and world market demand is sensitive to price.

For import expenditures ($\varepsilon x$) under free market conditions where supply fluctuations are caused by weather, we get:

$$(51) \qquad \frac{d\,\varepsilon x_i}{\varepsilon x_i} = \frac{1 + \varepsilon_i^D}{\varepsilon^S - \varepsilon^D} - \frac{da}{e} - \frac{da_i}{a_i}$$

where $\varepsilon_i^D$ = national world demand elasticity and the other notations are as above.

Again (51) has to be compared with the situation under a stabilizations scheme:

$$(52) \qquad \frac{d\varepsilon x_i}{\varepsilon x_i} = \frac{da_i}{a_i}$$

The comparison of (51) and (52) shows that in the case of inversely correlated domestic and world market fluctuations, the domestic import expenditure may fluctuate more with an international stabilization scheme than without one. The outcome depends on the magnitude of the fluctuations as well on the elasticities.

If the fluctuations of domestic and world production are positively correlated and are of the same order of magnitude the outcome depends solely on the elasticities. A stabilization effect will arise if

$$1 - 2\varepsilon^D > 2\varepsilon^S - \varepsilon_i^D$$

Without knowing the magnitude of the elasticities no definite statement can be made concerning the advantages to an importing nation of an international stabilization scheme.

At any rate equation (51) clearly shows that the determinants of the stabilization effect for exporting and importing nations are quite similar. The only difference is that our conclusions are based in one case on the supply elasticity and in the other case the demand elasticity of the individual country.

Hence we have for the case of demand-induced fluctuations:

$$\frac{d\epsilon x_i}{\epsilon x_i} = \frac{-\frac{da}{a}\left(1 + \epsilon_i^D\right)}{\epsilon^S - \epsilon^D}$$

This equation may be interpreted in the same way as these discussed above. No further remarks on the effects of international stabilization schemes on the average expenditure of importing nations is necessary. The same results which we derived for exporing countries hold true, but with an opposite sign.

## 6. NATIONAL VERSUS INTERNATIONAL STABILIZATION SCHEMES

An individual country's decision concerning whether to join an international stabilization scheme does not only depend on expected net benefits, but also on a comparison with the possible costs and benefits of a national stabilization scheme. Of course, this may arise to a further cause of national interests in international programmes. This consideration is explored here in some detail.

If exporting as well as importing nations were to aim at stabilizing export earnings or import expenditures by national stabilization schemes a crucial difference of interests would appear: it would be very costly for exporting nations to stabilize export earnings via a national stabilization scheme because the individual countries would have to accomodate all potential world market fluctuations with national storage programme. The costs of such a programme would very likely be higher than the possible benefits, and the national costs were to be the same as total costs for an international buffer stock with the same benefit.

For an importing nation, however, the result of such calculations may turn out to be quite different. Of course, the storage capacity had to be larger in the case of positively correlated national and world market supply fluctuations. Domestic storage capacity should be great enough to accomodate domestic supply fluctuations and the effects of world market price changes on import expenditures. With increasing world market prices, some of the stocks should be released to stabilize the level of import expenditures. The necessary

condition for stabilizing import expenditures via a national stabilization scheme is, therefore, a negative import demand elasticity. Such a situation may be assumed as realistic in most cases.

The necessary storage capacity is expressed in the following equation:

$$(53) \quad C = dq_i^S + \frac{dp}{P} \left( q_i^D - q_i^S \right)$$

where $C$ = storage capacity

$dq_i^S$ = domestic supply fluctuations

$q_i^S$ = domestic supply

$q_i^D$ = domestic demand

$\frac{dP}{P}$ = percentage change of world market price.

The second term on the right side of equation (53) indicates that a one per cent change in world market prices had to be compensated for by a one per cent change in the quantity imported. It is very simply to calculate from (53) the necessary storage capacity as a percentage of total domestic production. We get:

$$(54) \quad \frac{C}{q_i^S} = \frac{dq_i^S}{q_i^S} + \frac{q_i^D - q_i^S}{q^S} \times \frac{dP}{P}$$

and

$$(55) \quad \frac{C}{q_i^S} = \frac{dq_i^S}{q_i^S} + \frac{1 - DSS_i}{DSS_i} \times \frac{dP}{P}$$

where $DSS_i$ = degree of self-sufficiency $\frac{q_i^S}{q_i^D}$

Even where there is an international stabilization scheme, some national storage capacity up to $\frac{dq_i^S}{q_i^S}$ is needed. The storage capacity saved by an individual country with an international stabilization scheme comes to

$$(56) \quad \frac{C_s}{q_i^S} = \frac{1 - DSS_i}{DSS_i} \times \frac{dP}{P}$$

Equation (56) shows that the national storage capacity which is needed to compensate for world market price fluctuations is determined entirely by the

degree of self-sufficiency and the expected fluctuations of world market prices. For a $DSS_i$ of 0.9, the storage capacity had to be 11 per cent of national production, and for a $DSS_i$ of 0.4 it should be 150 per cent. This shows that the storage capacity necessary to compensate for world market price fluctuations increases progressively with decreasing self-sufficiency.

This finding has important political relevance. As the comparative disadvantage of national stabilization schemes versus international schemes is much smaller for importing countries with a degree of self-sufficiency of nearly 100 per cent than for highly deficiency regions or exporting countries, the bargaining power may be quite unequal. The unequal benefits derived by individual countries from an international stabilization scheme should be taken into account when setting the level of national contributions, so that those who benefit most are required to pay most. If countries which only benefit marginally from a stabilization scheme are asked to make large contributions, they may refuse to cooperate thus endangering the stability of the entire scheme.

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