Foreign Exchange Earnings and Price Stabilization Schemes

Whether price and output stabilization schemes for primary commodities are likely to increase or decrease foreign exchange earnings from what they would be otherwise is a question of great importance to the countries contemplating the formation of such institutional arrangements. This paper sheds some light on this question and clarifies under what circumstances Ragnar Nurkse's assertion[1] is valid that countries will fail to maximize foreign exchange earnings if they do stabilize prices.

The analysis abstracts from other benefits that underdeveloped countries can allegedly be expected to derive from a stabilization of world primary commodity prices, such as, for instance, increased long-run demand for these products from the industrial countries, on the grounds that stable prices would remove one of the incentives for finding substitute and synthetic materials. This conclusion follows from the idea that manufacturers often prefer a raw material with a stable price over a raw material with similar physical qualities that has a highly fluctuating price, even if that price may turn out to be somewhat lower over the long run.

On the supply side and benefiting underdeveloped countries more directly, stable product prices and demand make it possible to plan agricultural, mining, and industrial outputs so that average cost per unit of output would be at a technical minimum. Another benefit of stable prices of primary products may be more stable foreign exchange earnings which in turn would facilitate long-run development planning and the importation of capital goods. (See [5, pp. 139–276].)

However, if Nurkse's suggestion is correct and price stabilization schemes would tend to reduce over-all foreign exchange earnings, this effect could outweigh all of the other potential benefits and would thus make altogether undesirable the institution of such schemes.

I. *The Model*

For purposes of exposition the following assumptions are made: The material is produced only in underdeveloped countries and requires no input costing foreign exchange. Production is responsive to domestic price as indicated by the supply curve shown in Figure 1, which does not shift throughout the length of the business cycle. The specific shape or position of the supply curve is of no importance at this point of the analysis as long as it has neither a zero nor a negative slope. The business cycle in the industrialized countries consists of two periods of equal length, a depression period during which the demand curve looks like D_1D_1 and a boom period with a demand curve D_2D_2, parallel above D_1D_1. Domestic frictional costs

[1] "Stabilizing the prices received by producers interferes with the incentive to produce more when export prices are high, and serves perversely to keep up production for export when export prices are low. This is obviously not a pattern that maximizes the producing country's export proceeds over the business cycle" [2, p. 149].

of adjusting output from period to period, i.e., external diseconomies not reflected in the supply curve itself, are zero. It is clear that these assumptions imply that variations in demand are responsible for existing price fluctuations.[2] It is also implied that futures markets and storage of the product are insufficient to offset these cyclical variations in demand. Whatever the size of these equilibrating forces, their influence is assumed to be reflected in the shape of the supply curve or demand curve.[3]

In the framework of this model total foreign exchange earnings without stabilization schemes over the full cycle are equal to $(OA \cdot OK)+(OC \cdot OM)$.

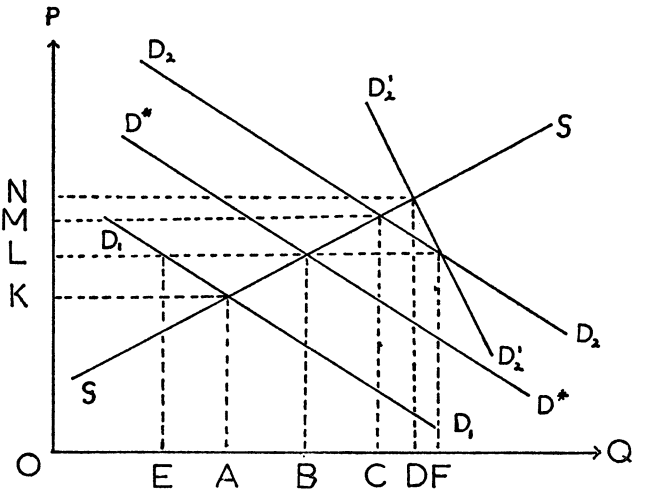

FIGURE 1

The basic question of this paper can now be reformulated to the following: Does the introduction of a stabilization scheme increase or decrease the full-cycle export earnings equivalent to $(OA \cdot OK)+(OC \cdot OM)$? As is intuitively obvious, the answer to this question depends on what type of stabilization scheme is chosen and what the elasticities of the demand and supply functions are. In the following the buffer-stock and buffer-fund schemes will be examined and a brief reference to two other types of funds will be made.

II. *Buffer Stocks*

Under this scheme the stabilization board acts essentially as a storage agent. It is assumed to make no profits, to accumulate stocks during depres-

[2] An analysis of export proceeds of primary producing countries during 1901–51 made by the United Nations [4] shows frequent parallel movements of export prices and export quantities. This reflects the dominant influence of demand conditions. J. D. Coppock also found substantial correlation between export quantity and proceeds [1, p. 143].

[3] Since this paper was written, an article has been published which uses much the same basic model but explores the implications which variable home demand and backward sloping supply curves have on foreign exchange earnings when prices are allowed to fluctuate and when a buffer-fund scheme is employed [3].

sion, and to decumulate them during booms. It sets an equal price for both users and suppliers and maintains it from period to period. These conditions mean that the sum of the quantities demanded during boom and depression must be equal to output at that price over the entire time interval. The demand schedule D^*D^* in Figure 1 shows the average quantity demanded at each price per half of the cycle. The condition that demand should equal supply over the entire cycle is met at a price OL. At this price output in the first period is OB, of which OE is sold and EB is stored. Second-period demand at price OL is OF, which exceeds production OB by the amount BF. Since BF is equal to EB, the amount stored in the first period is just equal to meet the excess demanded in the second and the net accumulation of stock over the cycle is zero.

Total foreign revenue at the price OL is equal to $2(OL \cdot OB)$ and the relevant comparison is whether this quantity is equal to, smaller, or greater than $(OA \cdot OK)+(OC \cdot OM)$. The general mathematical formulation of these conditions is complicated even under the assumption of linear schedules, and depends on the elasticities of the functions.

By the use of the diagram, however, it is possible to show the properties of a special case from which some interesting generalizations can be made. Assume that the boom and depression demand curves in Figure 1 shift parallelly. Now it is true that during one period the increase in revenue from the buffer-stock scheme is equal to the area $(OB \cdot OL)-(OA \cdot OK)$, i.e., the two strips making up the area $ABKL$. Analogously the loss in revenue during the second period is represented by the area $BCLM$. But it is true that $ABKL$ is smaller than $BCLM$ because, on the basis of the assumptions and the shape of the schedules, $AB=BC$ and $KL=LM$, so that the widths of the strips are equal but, as the diagram shows clearly, their lengths and heights differ. Thus under the given assumptions the increase of revenue in one period fails to compensate for the decrease during the second period so that the buffer stock always reduces foreign exchange earnings below what they would be if the unrestricted market were allowed to function.[4]

[4] The following algebraic proof of this theorem is due to A. C. Harberger.

(1) $q = a_1 + bp$ demand schedule during depressions

(2) $q = a_2 + bp$ demand schedule during boom

(3) $q = e + fp$ supply schedule

(4a) $e + fp_1 = a_1 + bp_1 \qquad p_1 = \dfrac{a_1 - e}{f - b}$

(4b) $e + fp_2 = a_2 + bp_2 \qquad p_2 = \dfrac{a_2 - e}{f - b}$

(4c) $e + fp = \dfrac{a_1 + a_2}{2} + bp \qquad p = \dfrac{\dfrac{a_1 + a_2}{2} - e}{f - b}$

But

(5) $$\frac{p_1 + p_2}{2} = \left(\frac{a_1 - e}{f - b} + \frac{a_2 - e}{f - b}\right) \Big/ 2 = \frac{\dfrac{a_1 + a_2}{2} - e}{f - b}.$$

This conclusion confirms the validity of Nurkse's proposition for the case of a parallel shift in the demand curve [2, p. 249]. Nurkse in his paper, however, concentrated on the supply side of the problem and failed to investigate what happens when the assumption of a parallel shift in demand is abandoned. The alternative boom demand schedule $D_2'D_2'$ drawn in the diagram shows that the amount by which revenue changes as a result of the introduction of a buffer-stock scheme depends on the slope of the demand schedules. Thus by the way in which $D_2'D_2'$ has been drawn, the buffer-stock revenue would be unchanged because the new $D_2'D_2'$ curve (not shown) coincides with the old one at the critical price OL. But under the unrestricted market system boom-period revenue would be $(OD \cdot ON)$, which is greater than $(OC \cdot OM)$, while the depression revenue remained unchanged at $(OA \cdot OK)$. By analogous reasoning it follows that flatter $D_2'D_2'$ schedules will reduce boom-period revenue from what it is under the parallel-shift case. In fact, a sufficiently elastic $D_2'D_2'$ curve can lead to an excess of buffer-stock revenues over unrestricted market revenues.

Using the technique just developed and starting again from the case of parallel schedules, it is easy to see that changes in the slope of the depression demand curve have effects opposite from those experienced by changes in the same direction of the slope of the boom demand curve. More inelastic (elastic) depression schedules yield smaller (larger) depression revenues without altering boom or buffer-stock revenues if the D_1D_1 curve is rotated around the price OL.

How do different supply schedules influence the conclusions reached so far? The method used to show that the introduction of a buffer-stock scheme will always reduce foreign exchange earnings in the case of parallel shifts in the demand curves is valid for any positive slope of the supply curve. However, the exact size of the reduction is dependent upon the slope. Perfectly horizontal and vertical supply curves are the limiting cases where the introduction of the buffer-stock scheme will cause no changes in foreign exchange revenues. For the sake of completeness it is worth mentioning also that a negatively sloped supply curve, given parallel shifts in the demand curves, causes buffer-stock revenues always to be greater than un-

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Therefore,

(6) $$\frac{p_1 + p_2}{2} = p, \qquad \text{from which it follows that}$$

(7a) $$p_1 = p + \Delta p$$

(7b) $$p_2 = p - \Delta p.$$

Revenue during each period is equal to q times the equilibrium prices, i.e., period-one receipts $[e+f(p+\Delta p)](p+\Delta p)$, etc., so that the formulation of the revenue question becomes:

(8) $$[e + f(p + \Delta p)](p + \Delta p) + [e + f(p - \Delta p)](p - \Delta p) \leqq 2(e + fp)(p)$$

which reduces to

(9) $$2f\Delta p^2 \lesseqgtr 0.$$

Δp^2 will always be positive. When f is also positive (i.e., the supply curve slopes upward and to the right), the left side will be larger than the right, which means that buffer-stock revenue will always be smaller than unrestricted market revenue. For the case of negative values of f (i.e., a backward-sloping supply curve) the conclusion is reversed.

restricted-market revenues. (For proof see the algebraic treatment in the last footnote.)

From a purely logical point of view the conclusion from this model is that the introduction of a buffer-stock scheme may or may not increase foreign exchange earnings from what they are under an unrestricted-market system. While this in itself is a valuable insight, the analysis would be more useful if it were possible to establish whether in the real world boom or depression demand schedules are typically more elastic. Unfortunately, no empirical investigations of this question seem to have been undertaken. From a statistical point of view it is probably possible but difficult because of the paucity of data to distinguish between shifts in demand curves and changes in their slopes. On the theoretical level, however, one reason comes to mind why it is likely that boom schedules are less elastic than depression schedules.

Many of the commodities for which price stabilization schemes are considered serve as factor inputs for firms in industrial countries, and demand for them is derived from the demand for the manufacturing firms' products. When during a period of high demand for this output the price of the factor input rises, firms are usually reluctant to substitute another one because such substitutions typically require changes in production processes which are often accompanied by technical uncertainties and temporary reductions in output. While it is likely that there is always some critical difference in the prices of competing inputs at which the switch is undertaken in spite of these difficulties, the point is here that the critical difference is greater during periods when demand for the firms' output is high than when it is depressed. Such a reluctance to switch to a substitute expresses itself statistically in a more inelastic demand curve for factor inputs during boom and leads to the conclusion that under the assumption of a positively sloped supply curve the introduction of buffer-stock schemes will reduce foreign exchange earnings from their free-market level.

III. *Buffer Funds*

The basic analytical model developed above can be used to examine the influence of a second type of stabilization scheme. Instead of storing the product and setting a uniform price for both users and suppliers, the agency under this scheme sets a stable price only for the producers and lets the market in each period find a price which equilibrates quantity supplied with the quantity demand. If the stabilization agency is required to make no profit and pay out as much to producers as it receives from buyers over the entire cycle, then the price paid to the producers and the quantity supplied by them are uniquely determined. To see how such a scheme would work, consider Figure 2. The basic assumptions are the same as those underlying the first graph. D_1D_1 and D_2D_2 are depression and boom demand schedules, SS is the supply curve. The locus of points an equal vertical distance from the two demand curves is shown as D^*D^*. Where this schedule intersects the supply curve, the conditions are met that the agency's excess revenue during boom is exactly offset by the

deficient revenue during depression, and the total earnings over the cycle are equal to the value paid to producers. At price OL quantity OB will be produced in each period. The price to users will be established at OJ during the depression period and OQ during the boom period, yielding a revenue over the entire cycle of $(OB \cdot OJ)+(OB \cdot OQ)=2(OB \cdot OL)$.

The problem of what happens to total foreign exchange earnings as a result of the introduction of the price stabilization scheme in terms of this diagram comes down to the question of comparing the areas of three rectangles. Is $(OA \cdot OK)+(OC \cdot OM) \gtrless 2(OB \cdot OL)$? For the case of parallel demand curves the conclusions arrived at for the buffer-stock scheme are equally applicable to this scheme because the geometric properties of the

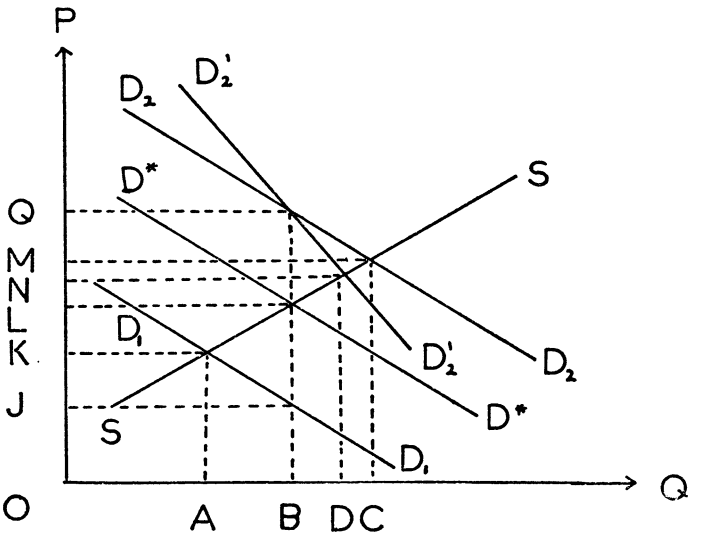

FIGURE 2

functions again are such that the relevant comparison is of the strips $ABKL$ and $BCLM$. Thus the introduction of a buffer fund will always reduce foreign exchange earnings. However, different slopes of the boom demand schedule will have opposite effects from those encountered under the buffer-stock scheme. As can be seen from $D_2'D_2'$ in Figure 2, a boom schedule less elastic than a depression schedule *reduces* the excess of free-market revenue from what it was under the parallel-shift case. In general the steeper the boom demand curve, the greater the likelihood that the buffer-fund scheme will increase foreign exchange earnings above their free-market level.

The influence which different combinations of the two demand and the supply schedules have on total revenue can be discovered by reasoning in the same way as for the buffer-stock scheme. This analysis is not presented here. The conclusion from such an exercise is again that as a matter of logic

alone the introduction of buffer-fund schemes can either raise or lower foreign exchange earnings. If, however, it is assumed that the boom schedule is less elastic than the depression schedule and that the supply curve is positively sloped, then it follows that buffer-fund schemes are likely to lead to higher and not, as in the case with the buffer-stock scheme, to lower foreign exchange earnings.

IV. *Other Marketing Schemes*

Space limitations make it impossible to explore in detail the application of the basic model to schemes under which the authority is not expected to break even but where instead it seeks to pursue other objectives such as the maximization of foreign exchange earnings or the optimum exploration of its monopoly position. Suffice it to indicate briefly that the first maximization principle requires setting price and output at the points of unitary elasticity on the two demand curves. While such a scheme guarantees maximum foreign exchange earnings, the supply-curve elasticity determines whether the quantities sold can be obtained from domestic producers at an average price greater or smaller than that at which it is sold in the outside world. Thus it depends on the supply elasticity whether the scheme can be used as a taxation device or whether it requires a subsidy.

The second objective leads to a choice of output and prices on the basis of the marginal-cost-equals-marginal-revenue principle. The agency's behavior under the scheme parallels that of a monopolist discriminating in two markets. While this scheme will always improve the terms of trade for the sellers of the product, total foreign exchange earnings may increase or decrease, and simple generalizations about necessary conditions for a specific outcome cannot be made.

V. *Conclusions*

The model just presented could be modified to take account of such real world phenomena as typically longer recovery than depression periods of business cycles, storage costs, shifts in demand curves in response to monopoly pricing, etc. It is not likely, however, that the most general conclusion that can be drawn from this analysis would be changed. This conclusion is that the introduction of world primary commodity stabilization schemes does not necessarily increase total foreign exchange earnings accruing to the producing countries.

By introducing assumptions that are in addition to those underlying the basic model itself, it is possible to draw more specific conclusions. If demand is typically less elastic during periods of high demand than it is during periods of depression, buffer-stock schemes are likely to decrease foreign exchange earnings below what they would have been in the absence of such schemes because stable prices over the cycle forego the opportunity to exploit the inelasticity of demand during boom periods. Under these circumstances buffer-stock schemes therefore lead to a conflict between the stabilization and earnings-maximization objectives pursued by government agencies.

Given the same demand conditions, however, buffer-fund schemes do

not present such a conflict between objectives because they allow foreign prices to fluctuate and exploit the inelasticity of boom demand schedules.

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Fluctuations in Economic Activity: Planned and Free-Market Economies, 1950-60

Three of the many claims to superiority made for planned economies over free-market economies stand out clearly: first, that they grow faster; second, that they provide full employment; and, third, that they are not subject to fluctuations in outputs [12, pp. 95-102] [23, pp. 19-35]. The first claim has been discussed at some length in Western literature. Independent indexes of growth for the planned economies have been developed by Western scholars, and the results have been analyzed and compared with similar indexes for the free-market economies [1] [11]. Considerably less attention has been paid to the second claim, possibly because measuring the degree to which the two systems utilize available inputs is an even more complex problem than the calculation of growth indexes.[1] Little attention has been devoted to the third claim[2] that "Socialism is characterized, above all, by the absence of cyclical disturbances in production" [14, p. 9]; no statistical comparisons of fluctuations in economic activity in the two systems are available.

The purpose of this paper is to compare the year-to-year fluctuations in output for a group of planned and a group of free-market economies. The first section describes the scope of the project and the data used, the second presents the results, and the third comments on the findings.

[1] The possibility of underutilization of inputs in planned economies has been pointed out, among others, by Joseph Berliner [2, pp. 358, 363-66], Emily Brown [3, pp. 181-82], Robert Campbell [4], Naum Jasny [9], Alec Nove [15, p. 579], Alfred Oxenfeldt [21], and Lazar Volin [35, p. 306].

[2] Fluctuations in the Soviet Union are discussed by Naum Jasny [10, pp. 11-13], G. W. Nutter [18, pp. 204, 221], and Eugene Zaleski [36, pp. 264-83].