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Optimal Export Taxes for Exporters of Perennial Crops

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Governments relying heavily on export taxes for revenue tend to tax commodity exports more heavily, which is consistent with short-run elasticities of demand and supply. But this makes them more susceptible to losing their market share over the long run.

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Since the estimate of the optimal export tax is based on the price elasticity of demand and the price response of the commodity from other sources, should policymakers look at short- or long-term elasticities? The difference is crucial, especially where there is a large gap between the two. Governments weighing the optimal export tax have a choice — accepting lower tax revenues now and reaping higher revenues in the future, or setting their sights on high short-term tax revenues and losing out in the long run.

A comparison of the estimated optimal export tax rates for major developing country producers of cocoa, coffee, tea, and rubber with current tax rates shows the following. When the government depends heavily on the tax for its revenue, it taxes on the basis of the short-run elasticities. This tax rate is much higher than if the long-run elasticities were used, which is usually the case when the taxes are a small proportion of government revenues. But the higher tax rate makes the country susceptible to the loss of market share over time because it reduces the incentive for its own producers (while raising world prices) and encourages the substitution of other commodities by other producers.

Actual export tax rates applied by Cameroon and Nigeria on cocoa and by Sri Lanka on natural rubber were much higher than the optimal rate even when based on short-run elasticity estimates and may well have contributed to reductions in their world market shares.

Recent reductions in export taxes by dominant rubber exporters appear to have exerted downward pressure on world prices, which is consistent with theory.

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I. INTRODUCTION*

1. Primary commodity exports are subject to substantial export taxes in a large number of developing countries. In many cases such taxes may be the major viable source of government revenue, primarily for the reason that in low-income countries the necessary infrastructure for the efficient collection of other taxes, such as income taxes, is lacking. The use of export taxes is, at times, based upon the assumption that the tax-imposing country has a degree of monopoly power in the world market, i.e., that the demand for its imports is less than perfectly elastic and therefore restriction of its exports will increase its national welfare. The optimal export tax is the rate of tax that maximizes its national income from the commodity.

2. The main purpose of this paper is to determine [illegible]timal export tax for major exporters of cocoa, tea, coffee and natural rubber--the primary commodities most heavily taxed by developing countries.

3. Since the estimate of the optimal export tax is based in part upon the estimate of the foreign elasticity of demand and the supply response from the rest of the world, the question arises whether it is the long-run elasticities or the short-run elasticities that are relevant to the tax-setting behavior. The choice of the appropriate elasticities may be crucial, especially if they differ considerably between the short and long run. In making the decision, the choice arises between lower foreign exchange earnings

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in the short run and higher earnings later on or higher export earnings now and lower revenues later. It is hypothesized that those countries with a heavy dependence upon revenues from this source will tend to set the tax with respect to the short-run elasticities. It is shown here that the optimal tax will also depend upon the length of the adjustment period between the short run and the long run and the government's rate of time discount.

4. The immediate effect of the imposition of an export tax is a change in the relationship between prices received for domestic consumption and those for exports. Whereas prices received for exports rise, domestic prices can be expected to decline. Therefore, domestic consumption increases and exports decline while total production and farm income are reduced. The effects of changes in export taxes in the major exporting countries on producer prices, production, export prices and export revenues are examined. In recent years there have been several important changes in export tax policy involving these commodities. The impact of these changes on world prices is of interest in analyzing recent commodity price movements and for studying the likely impact of future tax changes on individual countries and on world markets.

5. Many countries which have very small shares of world markets also tax these four commodities heavily, but because they have no market power there is no question of an optimal export tax in the sense we use it here. We recognize that though national income is reduced by the export tax in these cases, such taxes may remain the best form of raising government revenue due to its low collection costs. But beyond discussing the implications of different social discount rates, we do not go further into tax policy.

II. THEORETICAL DERIVATIONS

Price Elasticity of Import Demand

6. The price elasticity of world demand for imports of commodities varies from the price elasticity of demand faced by each individual exporter. While the world demand for imports may be inelastic, the demand for imports facing a particular exporter may be elastic; it is perfectly elastic for "small country" exporters. It is this latter elasticity that is relevant to each supplier to the world market and to the question of the optimal export tax. Calculation of this elasticity depends on the following: (a) the world import elasticity of demand for the commodity, (b) the export share of the commodity, and (c) the elasticity of supply from the rest of the world.

7. The relationship is presented as follows: 1/

$$\eta_{ii}^{j} = \frac{\eta_{ii}^{w} - \lambda_{i}^{row} \quad \varepsilon_{ii}^{row}}{\lambda_{i}^{j}} \qquad (1)$$

where η_{ii}^{j} = elasticity of demand facing country j for the ith commodity

η_{ii}^{w} = elasticity of world demand of commodity i

λ_{i}^{row} = rest of the world's export share of ith commodity

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1/ The derivation is presented in Annex 1

λ_i^j = country j's export share of commodity i

ε_{ii}^{row} = elasticity of supply of commodity i by the rest of the world.

8. This relationship states that for any given value of the world demand elasticity, the demand elasticity faced by a particular supplier will be greater the smaller its market share and the larger the supply response by the rest of the world.

Optimal Export Tax

9. In the following, a simple import demand model is presented which leads to the development of the formula for the calculation of an optimal export tax. The tax formula is derived for both short- and long-run elasticities of import demand. 1/ The derivation assumes that the foreign import supply elasticities are infinite.

10. Import demand $x_{(t)}$ as a function of weighted past prices of import goods relative to their substitutes $(p_{(s)})$ is given as

$$x_{(t)} = A - bB \int_{-\infty}^{t} e^{-b\,(t-s)} p_{(s)}\, ds \qquad (2)$$

The short-run response to price changes is given as

$$\frac{\partial x_{(t)}}{\partial p_{(t)}} = -bB, \qquad (3)$$

1/ The formulation draws on Repetto (1972).

The total demand response to a change in price at a given time (s) is

$$\int_s^\infty \frac{\partial x_{(t)}}{\partial p_{(s)}} \delta t = -bB \int_s^\infty e^{-b(t-s)} dt = -B \qquad (4)$$

It is seen, therefore, that the short-run elasticity differs from the long-run elasticity by a factor (b). The value of (b) is between 0 and unity. A larger value of (b) implies a faster demand response.

The objective function in terms of net national benefits Z is given as the difference between export revenue and the resource costs of exports (C)

$$Z_{(t)} = x_{(t)} \, p_{(t)} - C \left(x_{(t)}\right) \qquad (5)$$

In an intertemporal framework, the objective is taken to be the maximization of a discounted stream of net national benefits over an infinite horizon. The discount factor (r) is interpreted as the social rate of time discount.

$$\int_0^\infty e^{-rt} \, Z_{(t)} \, dt = \text{maximum} \qquad (6)$$

The method of solution to the problem is to invert the demand function to express price as a function of quantity demanded. It is a convenient characteristic of the exponentially-weighted demand function that it can be easily inverted through differentiation with respect to time such that

$$\frac{d_x}{d_t} = -bB \left(p_{(t)} + \frac{x_{(t)} - A}{B}\right) \qquad (7)$$

which is solvable for price in terms of demand and its rate of change over time (x')

$$P_{(t)} = \frac{A - x}{B} - \frac{x'}{bB} \tag{8}$$

This expression for price is then substituted into the objective function

$$\text{Max} = \int_0^\infty e^{-rt}\left(\frac{(A - r)}{B} x - \frac{x'x}{bB} - C(x)\right) dt \tag{9}$$

$$= \int_0^\infty W\left(t,x,x'\right) dt \tag{10}$$

According to Euler's theorem in the calculus of variations, a necessary condition for a maximization function is

$$\frac{d}{dt} W_{x'} = W_x \tag{11}$$

This is worked out as follows

$$W_x = e^{-rt}\left(\frac{A - 2x}{B} - \frac{x'}{bB} C'(x)\right) \tag{12}$$

$$\frac{d}{d_t} W_{x'} = \frac{e^{-rt}}{bB}\left(rx - x'\right) \tag{13}$$

Which leads to the necessary condition

$$\frac{A - 2x}{B} - \frac{rx}{bB} = C'(x) \tag{14}$$

It also follows that

$$x' = 0 \text{ and } p = \frac{A - x}{p}, \text{ so}$$

$$p - x\,\frac{(r + \beta)}{bB} = C' \tag{15}$$

$$p\left(1 + \frac{1}{e_\ell}\,\frac{(r + \beta)}{\beta}\right) = C' \tag{16}$$

Where e_ℓ is the long-run demand elasticity $[p/x]\,[-B]$. Since in competitive equilibrium, producer receipts will be equated with marginal resource costs, the optimal export tax can be estimated as a percentage of the export price as follows:

$$T^* = \frac{1}{e_\ell}\left(\frac{r + b}{b}\right) = \frac{1}{e_\ell}\left(1 + \frac{r}{b}\right) = \frac{r + b}{e_s} = (r+b)T^s \tag{17}$$
$$= (r + b)\,T^s$$

where e_ℓ is the long-run demand elasticity $\left(\frac{p}{x}\right)(-B)$; e_s is the short-term demand elasticity $(p/x)(-bB)$; and T^s is the tax that would be levied if only the short-term demand elasticity was taken into consideration and all lagged-demand responses were ignored or treated as exogenous technological "trend." It is seen from the above that the optimal tax depends upon the long-term and short-term elasticities, the relationship between them, and on the social rate of time discount. In the absence of overt measures of the social discount rate for each country, the long-term bond rate, or something approaching that concept was used (such as the central bank discount rate, the money market rate or the T-Bill rate). In highly inflationary countries, however, the

market rates may not be a good measure of the social rate of time discount. Hence, optimal taxes calculated using the discount factor for such economies may be biased.

11. At the estimation stage, besides the simple import demand function specified above, other specifications of the import demand function have also been estimated. In such specifications, imports are regressed over GDP per capita, relative prices and the prices of substitutes.

12. While the specification of import demand functions is rather straightforward, the specification of perennial crop supply functions is a complex question which has been the focus of much research. The most appropriate approach to model the supply response of perennial crops is the vintage capital approach (Wickens and Greenfield, 1973). The vintage capital approach suggests the direct specification and estimation of the structural relationships, i.e., an investment function, a harvesting decision function and a vintage capital production function. The main thrust of the approach, expressed in a simplified way, is that potential output is related to past plantings. A limitation of the approach is that it implies that past applications of inputs (labor, other capital, fertilizers, etc.) and past harvesting decisions do not significantly affect the output currently obtained from a given stand of trees. This criticism applies more in the case of rubber than to other perennial crops. The rate at which a rubber tree is tapped does affect potential output in later periods. Also, the rate of extraction can be increased from a given tree if the stand is expected to be cut earlier.

13. Other factors of production such as labor are not included in this specification on the assumption that they are used in fixed proportions. It also implicitly assumes that all factors are fully utilized such that all

potential output is harvested. If indeed all output is not harvested, discontinuity in the derivative of output with respect to price is introduced; which would have serious repercussions on the estimation of supply responses to changes in prices. Therefore, it may be appropriate to use an approach whereby the age composition determines the weights of the distributed lag response of supply to changes in relative prices. Again, this assumption may be more relevant for rubber than for other crops. A further limitation of this approach is that it does not allow the assignment of correct weights to past responses. In light of these limitations, both specifications have been used to estimate the price elasticity of supply where such estimates have been necessary.

III. OPTIMAL EXPORT TAX ESTIMATES

14. In this section, the estimates adopted for the world import demand and supply-price elasticities are set out and the import demand elasticities for each of the countries/commodities are calculated. The optimal export taxes for each country/commodity are then calculated and compared with the actual tax situation in each country. Alternative calculations of the optimal export tax are made for short- and long-term elasticities and for when the discount rate for each country is taken into account to give some idea of the likely trade-off between more export revenue now and more export revenue later.

Export Shares and Supply Elasticities

15. In Table 1, the average export shares for the four commodities held by the major exporters for the period 1980-84 are given in column 1. Column 2 gives estimates of the short-run supply elasticity for each exporter and for the rest of the world. Column 3 gives short-run supply elasticity estimates for the rest of the world as defined for each major exporter. Most of these supply elasticity estimates are taken from recent published studies--mostly by the International Commodity Markets Division of the World Bank. The remainder were estimated by the authors using the almon lag approach described above.

16. The cocoa export industry is dominated by Brazil, Cameroon, Côte d'Ivoire, Ghana and Nigeria. The world production share of these countries is about 75% while they account for about 80% of world cocoa exports. Côte d'Ivoire holds the dominant share of the world market for cocoa. The next most important during this period was Ghana with 14%; it has since been overtaken by Brazil.

17. Tea is mainly produced in India, Sri Lanka, China and the USSR. In 1982, 67% of the total world production took place in these four countries. In 1984, the export shares of India and Sri Lanka, the two most important exporters, totaled slightly less than one half of world exports.

18. Coffee is the major export of a large number of developing countries. As can be seen from Table 1, however, the world market is dominated by Brazil and Colombia. While countries such as Burundi have about 85% of total exports coming from coffee, their world share is so small (0.7%) that even large changes in their exports could not influence world prices. However, two small exporters have been included to illustrate the results of the optimal export tax calculations for small exporters.

19. The export market for natural rubber is dominated by Malaysia which supplied about 41% of the total in 1985. The 5-year average (1980-84) for natural rubber exports shows that the combined share of Indonesia, Malaysia and Thailand is about 90% of the total.

20. Looking across the short-run supply elasticity estimates one is struck by the fact that the elasticities for cocoa and natural rubber are much higher than for tea and coffee--at least for the major suppliers. There are good reasons for believing that the elasticities for the various crops should be more alike. There are simultaneity problems in estimating supply responses for the larger suppliers--as their production changes affect the level of prices. This reason may explain why the supply response for coffee in Brazil and Colombia is so much lower than the others. The much lower estimates for tea producers may be partly explained by another statistical problem. Tea is produced from leaf shoots and their production appears to be much more affected by weather than the fruits--coffee and cocoa. Therefore, there is a

Table 1: WORLD MARKET SHARES AND SUPPLY ELASTICITIES FOR MAJOR EXPORTING COUNTRIES

	Share of Total Exports (%) a/	Supply Elasticities b/ Domestic Short-run	Supply Elasticities b/ Rest of the World c/ Short-run
Cocoa			
Brazil	11.9	0.21 d/	0.31
Cameroon	8.1	0.68	0.29
Côte d'Ivoire	32.7	0.30 e/	0.22
Ghana	14.2	0.53 f/	0.25
Nigeria	10.4	0.31	0.31
Rest of the World	22.7	0.20	0.29
Tea g/			
Bangladesh	3.4	0.17	0.17
China	13.0	0.15	0.16
India	24.6	0.13	0.14
Indonesia	8.3	0.16	0.16
Kenya	10.0	0.17 h/ 0.25 i/	0.13
Malawi	4.1	0.21	0.17
Sri Lanka	20.9	0.03	0.17
Rest of the World	15.9	0.11 j/	0.14
Coffee k/			
Brazil	26.9	0.09	0.16
Colombia	14.4	0.07	0.17
Côte d'Ivoire	6.4	0.55	0.15
Kenya	2.3	0.64 l/	0.17
Rest of the World	50.0	0.20	0.95
Natural Rubber m/			
Indonesia	27.7	0.43 n/	0.34
Malaysia	44.0	0.49 n/	0.24
Sri Lanka	3.8	0.63	0.43
Thailand	16.6	0.39	0.39
Rest of the World	7.9	0.41	0.42

a/ 1980-84 average.
b/ Unless otherwise noted, the elasticities were estimated using the almon lag specification outlined in the text.
c/ The supply elasticities for the rest of the world have been calculated as weighted averages of supply elasticities for all other countries.
d/ From Akiyama and Bowers (1984).
e/ The average of the elasticities calculated by Behrman (1968) for old medium and new areas.
f/ From Behrman (1968).
g/ Supply elasticity estimates from Akiyama and Trivedi (1987).
h/ Smallholders.
i/ Estates.
j/ Estimate for rest of Africa.
k/ Supply elasticity estimates from Akiyama and Duncan (1982).
l/ From Maitha (1970).
m/ From Tan (1984). Grilli (1981), using the Nerlovian approach, estimated the short-run elasticities in Malaysia, Indonesia and Thailand to be 0.19, 0.1 and 0.24, respectively.
n/ Average of estates and smallholders.

lot of "noise" in the tea production data which biases the price response downward. On the other hand, the opportunities for short-term responses through fertilizer applications and tapping frequency appear to be greater for rubber than for the other crops. In summary, therefore, the short-run elasticity estimates appear reasonable, except that the estimates for tea may be low, as may the estimates for the coffee response in Brazil and Colombia.

21. Estimates of long-run supply response to price changes have been much less commonly undertaken for these commodities. Therefore, it is more difficult to come to confident judgments about them. Estimates obtained for cocoa, coffee and natural rubber are given in Table 2. There is a tendency to underestimate long-run supply responses in agriculture because the specifications used do not allow for the long-term effects of intersectoral resource flows. Therefore, the estimates obtained for cocoa and coffee may well be on the low side. Of course, the response will differ depending on whether the price is changed in isolation or in unison with other competing products (in the latter case the elasticity will be much lower). Between countries it may differ because of, for example, the differences in availability of suitable land. Given the uncertainties about the long-run supply response, but believing that a conservative estimate--even for long-established producers--is in the range 1.5-2.0, values in this range have been used for the rest-of-the-world supply response in subsequent calculations.

22. A final point which should be made relates to a comparison of elasticity estimates across countries. It is commonly argued that supply response in African countries is slower than in other countries. There is no support for that argument in the above estimates.

Table 2: ESTIMATES OF LONG-RUN SUPPLY ELASTICITIES: COCOA, COFFEE AND NATURAL RUBBER

	Coffee a/	Cocoa	Natural Rubber b/
Brazil	1.10		
Cameroon		1.81 c/	
Colombia	0.96		
Côte d'Ivoire	0.73	0.80 c/	
Indonesia			2.53
Kenya	1.33 d/		
Malaysia			3.35
Nigeria		0.71 c/	
Sri Lanka			4.20
Thailand			3.95

a/ From Akiyama and Duncan (1982) unless otherwise noted.
b/ From Tan (1984) unless otherwise noted.
c/ Behrman (1968).
d/ Maitha (1970). Ford (1971) estimated the long-run supply elasticity for Kenya coffee for estates and smallholders to be 1.18 and 1.55, respectively.

Table 3: COCOA: IMPORT DEMAND ELASTICITY ESTIMATES

	Income Elasticity	Price Elasticity Short-run	Price Elasticity Long-run	Substitute a/
Time Series	0.46 (5.9)	0.17 ~-0.25 (7.3) (1.9)	-0.34 ~-0.43 b/ (5.17) (5.18)	-0.19 (5.3)
North America	-	-0.12 ~-0.15 (1.86) (1.3)	-0.47 (3.5)	-0.1 (1.1)
Western Europe	0.26 (6.6)	-0.11 (3.7)	-0.50 (3.4)	-0.026 (1.3)
Eastern Europe	0.86 (3.2)	-0.17 (2.5)	-0.45 ~-0.63 (2.5) (4.4)	0.11 (2.5)
Pacific	-	-0.13 c/ (4.2)	-0.30 (1.11)	-0.09 (1.5)
Rest of the world	-	-0.21 (2.11)	-0.35 (1.87)	-0.11 (1.1)

a/ Price of sugar.
b/ Estimate using expected price specification.
c/ Coefficient of lagged price.

Import Demand Elasticity Estimates

23. Estimates of cocoa import demand elasticities are presented in Table 3. From these estimates the short-run world price elasticity appears to be around -0.2 and the long-run elasticity about -0.4. Import demand functions were estimated for the major consuming/importing regions as well as for total world import demand. These country estimates provide a useful check of the estimates from the world demand function as well as supplying useful information on the import responsiveness of these various regions. More than 90% of cocoa consumption takes place in the industrial countries and centrally planned economies.

24. Estimates of the import demand elasticities for tea are presented in Table 4. Tea is mainly consumed in India, China, the United Kingdom, the USSR and Japan. There appears to be a tendency for increasing per capita tea consumption in the developing countries while per capita consumption in industrial countries seems to be declining. Again, the global short-run price elasticity is around -0.2 and the long-run elasticity about -0.4.

25. Estimates of world import demand elasticities for coffee and demand elasticities for major importers are presented in Table 5. Both the short- and long-run price elasticities appear somewhat lower than for tea and cocoa. Given the increasing domination of the EEC over the United States in the consumption of coffee, the global price elasticities appear likely to fall to even lower levels in the future.

26. In Table 6, the results from estimating the import demand models for natural rubber are presented. It is apparent that the estimates for the world market generally reflect the relatively high short- and long-run price elasticities of natural rubber imports for North America. The substitution

Table 4: TEA: ESTIMATES OF IMPORT DEMAND ELASTICITIES

	Income Elasticity	Price Elasticity Short-run	Price Elasticity Long-run	Substitute
Time Series	0.66 (3.8)	-0.17 ~ -0.3 a/ (7.4) (5.4)	-0.38 (9.8)	-0.42 b/ (1.8)
North America	-	-0.21 (2.1)	-0.28 (5.3)	-0.05 b/ c/ (0.48)
Western Europe	-	-0.09 (1.2)	-0.1 (0.56)	-
Eastern Europe	-	-0.23 (1.02)	-0.46 (1.6)	0.11 b/ (0.8)
Pacific	-	-0.13 (0.43)	-0.13 (0.48)	
Rest of the world	-	-0.19 (3.4)	-0.34 (9.5)	0.07 c/ (1.67)

a/ Expected price.
b/ Unit value of manufactured exports from industrial countries (MUV).
c/ Real price of coffee.

Table 5: COFFEE: ESTIMATES OF IMPORT DEMAND ELASTICITIES

	Income Elasticity	Price Elasticity Short-run	Price Elasticity Long-run	Substitute
Time Series		-0.15 ~ -0.19 (5.19) (4.3)	-0.23 (3.7)	-0.09 a/ (0.59)
North America		-0.17 ~ -0.20 (2.1) (2.4)	-0.44 (2.5)	0.24 a/ (2.8)
Western Europe	0.78 (4.3)	-0.11 (3.27)	-0.12 (2.5)	0.05 a/ (1.16)
Eastern Europe	0.97 (4.5)	-0.14 (2.6)	-0.14 b/ (2.1)	0.31 c/ (1.47)
Pacific	1.67 (11.8)	-0.32 (1.78)	-0.35 (2.1)	
Rest of the world	-	-0.12 (2.5)	-0.28 (2.69)	0.49 c/ (11.6)

a/ Price of tea.
b/ Coefficient of lagged price.
c/ MUV.

Table 6: NATURAL RUBBER: ESTIMATES OF IMPORT DEMAND ELASTICITIES

	Income Elasticity	Price Elasticity Short-run	Price Elasticity Long-run	Substitute a/
Time series	0.40 (4.9)	-0.27 b/ (1.37)	-0.76 (2.7)	0.12 (0.53)
North America	n.s.	-0.27 c/ (3.6)	-0.72 (4.16)	0.56 (1.67)
Western Europe	-	-0.12 (2.1)	-0.27 (1.1)	0.004 (0.02)
Eastern Europe	-	-0.07 (1.18)	-0.25 (1.18)	-
Pacific	-	-0.07 c/ (0.72)	-0.46 (0.86)	0.06 (0.56)
Rest of the world	-	-0.18 c/ (2.5)	-0.87 (2.76)	0.25 (5.8)

a/ Price of synthetic rubber.
b/ Estimates with expected price.
c/ Coefficient of lagged price.

elasticity between synthetic rubber and natural rubber is also fairly high in North America mainly because of the greater flexibility in the input mix in tire production and greater availability of domestically-produced synthetic rubber in the United States; Western European tire manufacturers most use superior quality natural rubber imported from Malaysia in order to meet the demand for higher standard tires, thereby restricting the use of synthetic rubber. Short-run elasticities for other regions are low in general. The long-run import demand elasticity estimate is -0.76, again reflecting the influence of the North American market and the developing countries which make up the rest-of-the-world category.

Calculation of Optimal Export Taxes

27. In this section the import demand elasticities facing each major exporter and their optimal export taxes are calculated using the formulas derived earlier. The optimal tax calculations are made for short- and long-run world import price elasticities, for short- and long-run rest-of-the-world supply elasticities and with and without application of the social discount rate. The discount rates have not been applied to the calculation of long-run optimal export taxes since the rate of time preference and time discount are expected to change over a longer term. Hence, calculations of the long-run optimal taxes based upon a fixed rate used for the short run may lead to misleading conclusions.

(i) Cocoa

28. The demand elasticities faced by major suppliers to the world cocoa market and the optimal export taxes for each country are presented in Table 7.

29. The import demand elasticity facing each supplier is inversely related to its share in the world market and inversely related to its optimal export tax. Côte d'Ivoire faces the least elastic demand because it holds the largest share. In the short run the demand elasticities are quite low, but become much more elastic when using long-run coefficients for world import demand and world supply. The optimal tax for Côte d'Ivoire is the highest of the five countries. Again, these vary considerably depending on the assumptions used. Of the taxes in effect in May 1982, Côte d'Ivoire had by far the lowest and it was lower than its optimal tax calculated using short-run elasticities but not lower than that calculated using long-run parameters. The export taxes levied in the remaining countries are much higher than their

Table 7: COCOA: IMPORT DEMAND ELASTICITIES FACING MAJOR SUPPLIERS AND THEIR OPTIMAL EXPORT TAXES

	Import Demand Elasticities		Export Taxes (Percent)			
				Optimal Tax		
	Short-run a/	Long-run b/	Actual c/	Without Discount Rate		With Discount Rate
				Short-run	Long-run	Short-run
Brazil	-4.3	-14.5	55 d/	11.7	3.4	15.9
Cameroon	-5.9	-22.0	40	8.5	2.2	10.0
Côte d'Ivoire	-1.3	-4.3	25.12	37.7	11.6	45.0
Ghana	-3.2	-11.9	70 e/	15.6	4.2	21.0
Nigeria	-4.8	-16.8	50 f/	10.4	3.0	12.5

a/ Based on a short-run world import demand elasticity of -0.20 and short-run rest-of-the-world supply elasticities from Table 1.

b/ Based on a long-run world import elasticity of -0.4 and long-run supply elasticity for the rest of the world of 1.5.

c/ Export taxes on cocoa beans as of May 1982 (source: Gill and Duffus, London). Refer also to notes 1, 2 and 12 at back of text.

d/ In 1983 Brazil dropped its export tax on cocoa to about 20% of the f.o.b. price.

e/ Ghana is in the midst of simplifying its export procedures and regulations with the aim of increasing exports.

f/ In December 1986, Nigeria abolished its cocoa board (as well as other commodity boards). The export taxes to be applied are still to be announced.

optimal level under all calculations. In 1983 Brazil reduced its tax to 20%. The downward revision has brought the tax close to its optimal level in terms of short-run elasticities. The existing levy on Ghanaian exports is 70%, of which 57% is the export tax while 23% goes to the cocoa marketing board net of marketing costs. This is a much larger tax than the optimal level under any considerations. The same is true of Cameroon, Ghana and Nigeria.

30. To examine the impact of these countries adjusting toward their optimal export taxes, details on actual export taxes, export unit values,

export revenues, production, and producer prices are presented in Table 8 for each country for the period 1980-84. The indices of world export unit values and international cocoa prices are given in Table 9 for the same period. The analysis is only descriptive and the conclusions drawn cannot be definitive because of the multiple possible sources of variation for each variable.

31. As Brazil is the only exporter which has altered its export tax in recent years, the analysis will mainly focus on Brazil. It appears from an examination of the Brazilian data that changes in export taxes affect producer prices and output. The tax reduction in Brazil from 55% in 1982 to about 20% in 1983 was followed by an increase in the producer price by about 76% over its 1982 level and by about 30% over the 1981 level. Production increased by 7% in 1983 and by 10% in 1984 over the 1982 level. The conclusion drawn from these observations is lent more weight if Brazilian behavior is compared to the behavior of the other major suppliers. In 1983, real producer prices in the Côte d'Ivoire increased by only 6.3% and output declined over its 1982 level. Producer prices measured in real terms declined in Ghana, Nigeria and Cameroon between 1982 and 1984. It may be deduced from these observations, therefore, that the large increases in producer prices and output in Brazil in 1983 and 1984 were at least partially due to the tax reduction.

32. The effect of the tax reduction on export unit values for Brazil is less clear. Theoretically, a decline in the unit value for Brazilian exports would be expected as well as a decline in the world price in proportion to the Brazilian share of the world market. To the contrary, the unit value of Brazilian exports increased during the two years following the reduction in the export tax. This was most likely due to the fact that during 1983 the West African countries experienced production losses due to widespread drought and

Table 8: COCOA: EXPORT TAXES, EXPORT UNIT VALUES, EXPORT VOLUMES, PRODUCER PRICES AND PRODUCTION FOR MAJOR EXPORTERS, 1980-84

		Export Tax as Percent of Export Unit Value	Index of Export Unit Value Real a/	Index of Export Unit Value Nominal	Index of Real b/ Producer Prices	Production (Tons)	Exports (Tons)	Value of Export US$'000
Brazil	1980	55	100.00	100.00	100.00	296,000	123,580	291,690
	81	55	81.30	81.70	74.65	349,000	125,246	240,420
	82	55	64.34	63.78	54.85	314,000	143,462	217,940
	83	20	81.55	78.70	96.35	336,000	152,773	294,070
	84	20	103.77	98.38	133.60	346,000	107,289	262,790
Côte d'Ivoire c/	1980	23	100.00	100.00	100.00	376,000	283,678	794,410
	81	23	59.50	59.80	92.00	403,000	438,395	730,900
	82	23	55.13	54.63	85.50	456,000	326,432	503,990
	83	23	54.58	52.66	91.00	355,000	286,382	437,620
	84	23	75.34	71.42	92.40	405,000	390,000	822,780
Ghana	1980	70	100.00	100.00	100.00	296,000	194,679	655,921
	81	70	61.25	61.56	61.58	258,000	191,503	395,240
	82	70	47.86	47.43	113.30	225,000	239,931	386,870
	83	70	48.14	46.44	76.20	178,000	153,397	248,700
	84	70	55.14	52.26	77.00	188,000	142,000	263,701
Nigeria	1980	50	100.00	100.00	100.00	169,000	133,861	243,390
	81	50	79.24	79.63	88.40	155,000	194,567	280,290
	82	50	90.57	89.75	82.10	181,000	136,656	225,030
	83	50	87.17	84.12	70.48	156,000	170,000	269,430
	84	50	104.43	98.99	52.00	115,000	108,500	206,010
Cameroon	1980	40	100.00	100.00	100.00	122,000	82,764	210,842
	81	40	68.94	69.28	93.26	120,000	82,580	145,030
	82	40	73.56	70.71	85.68	122,000	68,983	125,400
	83	40	67.08	64.73	84.00	106,000	80,052	136,790
	84	40	89.36	84.70	80.42	115,000	106,829	243,160

a/ Index based upon prices deflated by MUV

b/ Index based upon prices deflated by local CPI.

c/ The current rate of export tax is 25.2% of the reference price.

Table 9: COCOA: INDICES OF WORLD EXPORT UNIT VALUE AND WORLD PRICES

	World Export Unit Value		World Price
	Real a/	Nominal	Real b/
1980	100.00	100.00	100.00
81	66.25	66.56	79.52
82	59.13	59.67	67.07
83	63.62	61.39	84.84
84	81.14	76.92	96.78

a/ Based upon price deflated by MUV.
b/ Based upon ICCO price deflated by MUV.

bush fires. Consequently, the demand for Brazilian cocoa increased, bidding up the export unit value for Brazil. In 1983, the export unit value for all other major suppliers declined relative to the 1982 level. From Tables 8 and 9 it can be seen that the export unit value for Brazil is correlated with the world (ICCO) price of cocoa. This price correspondence can be explained by the timing of Brazilian shipments of cocoa to the world market. Brazilian cocoa is harvested twice a year; hence the supply to the world market is evenly distributed. On the other hand, output from the African countries is more skewed; it comes mostly at the end of the year and in the early months of the following year. Moreover, Brazil sells in the spot market while other countries are engaged in forward selling.

33. It is observed that after the reduction in its export tax, Brazilian export revenue increased. Between 1982 and 1983, the value of cocoa exports from Brazil increased by about 35%. Existing taxes in Ghana, Nigeria and Cameroon are much higher than the optimal. A reduction in the tax rates of

these countries might, in fact, increase their tax revenues. This is particularly true for Ghana, which has imposed the largest tax on its exports and has been experiencing a steady decline in its export revenues.

(ii) Tea

34. The import demand elasticities for major exporters of tea are given in Table 10 together with the optimal export tax estimates.

Table 10 TEA: IMPORT DEMAND ELASTICITIES FACING MAJOR SUPPLIERS AND THEIR OPTIMAL EXPORT TAXES

	Import Demand Elasticities		Export Taxes (Percent)			
				Optimal Tax		
	Short-run a/	Long-run b/	Actual c/	Without Discount Rate		With Discount Rate
				Short-run	Long-run	Short-run
Bangladesh	-10.9	-54.9	nil	4.5	0.9	5.5
China	-2.7	-13.2	n.a.	18.2	3.8	d/
India	-1.4	-6.2	nil	36.4	8.0	43.7
Indonesia	-4.4	-21.4	nil	11.5	2.3	13.8
Kenya	-3.3	-17.6	10 to 15 e/	15.0	2.8	19.0
Malawi	-9.0	-44.9	10	5.5	1.1	6.8
Sri Lanka	-1.8	-7.6	10.36	28.3	6.6	35.7

a/ Based on a short-run world demand elasticity of -0.2 and short-run rest-of-the-world supply elasticities from Table 1.
b/ Based on a long-run import elasticity of -0.4 and long-run rest-of-the-world supply elasticity of 1.5.
c/ Refer to Annex 2.
d/ There is no available measure of the discount rate for China.
e/ 10% export tax applies to Preferential Trade Area countries, while about 15% applies to nonpreferential Trade Area Countries.

35. Export taxes imposed by these countries are low to zero. The tax policies followed are consistent with the optimal taxes applicable under long-

run elasticity assumptions where tax rates are all less than 10%. However, under short-term assumptions, India and Sri Lanka would be justified in raising their taxes significantly, but because of their level of development they should not be under any pressure to move towards such a policy. In fact, in 1986 Sri Lanka lowered its export tax close to the long-run optimal tax. In 1986 Malawi also moved to its long-run optimal rate by abolishing its tax. As Chinese pricing policy is not clearly understood, it is difficult to say whether they would be justified in raising or lowering tax rates.

36. The export tax levied by Sri Lanka has been declining as a percentage of the export unit value for tea over the period 1980-84, therefore it is of interest to see what has been the impact of this change on its export prices, producer prices and export revenues.

37. From the data set out in Tables 11a and 11b for the 1980-84 period, Sri Lanka's export price has not been affected by changes in export taxes in the way expected. World prices have increased as the export tax has declined. The producer price, on the other hand, increased sharply as the tax declined. Both production and exports initially fell in 1983 but increased sharply in 1984. However, because 1984 performance was influenced by the boom in tea prices in that year it would be difficult to attribute any response to export tax changes in Sri Lanka.

(iii) Coffee

38. The import-demand elasticities facing each major coffee exporter have been calculated and are shown in Table 12 together with estimates of the export taxes on coffee in these countries in 1985 and estimates of the optimal taxes under various assumptions. Under short-term elasticity assumptions

Table 11a: TEA: EXPORT TAXES, EXPORT UNIT VALUES, EXPORT VOLUMES, PRODUCER PRICES AND PRODUCTION FOR SRI LANKA, 1980-84

	Export Tax as Percent of Export Unit Value	Export Unit Value Index		Producer Price Index		Production (tons)	Export Volume (tons)	Value of Exports (US $'000)
		Real a/	Nominal	Real b/	Nominal			
Sri Lanka								
1980	22.47	100.00	100.00	100.00	100.00	191,375	184,728	372,156
81	23.44	90.28	90.71	83.81	98.85	210,148	183,362	335,089
82	20.77	83.24	83.52	102.50	134.00	187,816	181,215	304,897
83	13.81	116.22	112.11	168.99	252.00	179,287	157,938	356,720
84	10.36	169.60	160.81	186.00	324.00	230,000	204,471	662,445

Table 11b: TEA: INDICES OF WORLD EXPORT UNIT VALUE AND WORLD PRICES

	World Export Unit Value		World Price	
	Real a/	Nominal	Real a/	Nominal
1980	100.00	100.00	100.00	100.00
1981	95.76	96.21	90.14	90.57
1982	89.11	88.35	87.32	86.58
1983	103.16	99.92	108.45	104.61
1984	140.67	133.44	163.38	154.96

a/ Index based upon prices deflated by MUV

b/ Index based upon prices deflated by local CPI.

Table 12: COFFEE: IMPORT DEMAND ELASTICITIES FACING MAJOR SUPPLIERS AND THEIR OPTIMAL EXPORT TAXES

	Import Demand Elasticities		Export Taxes (Percent)			
				Optimal Tax		
	Short-run a/	Long-run b/	Actual c/	Without Discount Rate		With Discount Rate
				Short-run	Long-run	Short-run
Brazil	-1.2	-4.9	22.0	60.0	15.0	75.0
Colombia	-2.4	-10.5	6.5	30.7	7.0	42.1
Côte d'Ivoire	-5.0	-25.5	25.0	14.8	2.9	17.0
Kenya	-14.8	-73.7	15.0	5.0	1.0	5.9

a/ Based on a short-run world import demand elasticity of -0.17 and short-run rest-of-the-world supply elasticities from Table 1.

b/ Based on a long-run import demand elasticity of -0.23 and a long-run rest-of-the-world supply elasticity of 1.5.

c/ Tax rates in force in 1985, see Annex 2.

Brazil and Colombia would be justified in increasing their export taxes considerably. In Brazil's case the Government would take up to 75% of export prices compared to its present tax of about 20%. Colombia would collect up to 40% of export receipts compared to the present tax of below 10%. The trade-off between short- and long-run revenue collections becomes very marked in the case of these two countries. Under long-run elasticity assumptions the optimal tax for Brazil is 15% and for Colombia it is 7%. Their present taxation policies are close to the optimal long-run tax.

39. Under long-run elasticity assumptions optimal tax rates for Côte d'Ivoire and Kenya are near to zero. Because of the highly elastic demand faced by Kenya, its existing tax level is well above the optimal under even short-run elasticity assumptions. Côte d'Ivoire's tax rate is also well above its optimal rate even on short-term assumptions.

40. Since 1980, coffee exports have been subject to control under the International Coffee Agreement's global export quota. Each exporting member country is allocated a share of this quota. The main expressed purpose of the Agreement is price stabilization. However, inasmuch as the export control is used to attempt to raise average coffee prices, the question arises as to the consistency of any export tax imposed with the quota held by the country. For example, the tax imposed could be so high as to prevent the quota from being filled. We do not go into this question.

41. It should be noted that both Brazil and Colombia are economies that are experiencing very high rates of inflation. Hence the estimates of optimal taxes taking into account current discount rates, may be unduly magnified.

(iv) Natural Rubber

42. The elasticities of demand faced by the four major natural rubber exporters are presented in Table 13, together with the optimal tax estimates.

43. If short-run elasticities are considered, the results suggest a case for the imposition of an export tax on rubber exports for all exporters, with the exception of Sri Lanka. In the short-run case, where Malaysia's foreign demand elasticity is -1.2, the tax that maximizes short-term revenues from rubber exports is as high as 35% of the export price. The rate at which Malaysia taxes its exports has been declining over time. In 1984, the export tax was only about 4% of the export unit value, which is well below the optimal level estimated from the short-run import demand elasticities. Malaysia, however, may be adjusting to its long-run situation, which appears reasonable given its lessened reliance on the tax for government revenues and given the threat to the natural rubber industry from synthetics. Moreover, with Malaysia's share of the export market expected to steadily decline as Indonesia's and Thailand's shares increase, its optimal tax rate will decline.

Table 13: NATURAL RUBBER: IMPORT DEMAND ELASTICITIES FACING MAJOR SUPPLIERS AND THEIR OPTIMAL EXPORT TAXES

	Import Demand Elasticities		Export Taxes (Percent)				
					Optimal Tax		
	Short-run a/	Long-run b/	Actual c/		Without Discount Rate		With Discount Rate
			1980	1984	Short-run	Long-run	Short-run
Indonesia	-2.2	-8.0	5.0	0.0	16.0	4.5	20.6
Malaysia	-1.2	-4.3	23.0	4.0	30.6	8.3	35.0
Sri Lanka	-18.6	-70.6	53.4	30.5	1.9	0.5	2.6
Thailand	-4.0	-14.6	20.0	9.0	8.9	2.4	11.7

a/ Estimated with a short-run world demand elasticity of -0.27 and short-run rest-of-the-world supply elasticities from Table 1.

b/ Estimated with a long-run world demand elasticity of -0.76 and long-run supply elasticities for the rest of the world of 2.0.

c/ See Annex 2.

44. Indonesia abolished its tax on rubber exports in 1981. Calculation of the optimal tax from the short-run world import demand elasticity estimate of -0.27 shows that in the short run a tax of up to 21% of the export unit value can be justified. In the long run the optimal tax rate is 4.5%. However, Indonesia's export share has been increasing and is expected to continue to increase so that its optimal tax rate will increase.

45. Based on its short-run import demand elasticity the existing tax in Thailand is almost the same as the optimal export tax. However, taking a long-run view its optimal export tax should be near zero. Even on the basis of the short-term elasticity of import demand, the optimal tax on exports from Sri Lanka is close to zero. Therefore, there appears to be no "optimal tariff" argument for the large tax being applied (although it declined substantially over the 1980-84 period). Over the long run, a tax of such a magnitude must have a damaging effect on its exports. These have in fact been on a declining trend for the past two decades.

46. Given the domination of the world rubber market by Indonesia and Malaysia, it is of interest to examine the interrelationships between their export taxes and producer prices, production and export revenues.

47. From the data in Tables 14a and 14b below it is likely that the short-run effect on the export unit values and world prices of a reduction in export taxes is fairly substantial. The reduction of the export tax by Malaysia from 23% to 14% between 1980 and 1981 is associated with in a decline in the unit value of Malaysian exports by 22%. A further decline of the tax from 14% in 1981 to 4% in 1982 is associated with a further decline in the export price to 40% below its 1980 level and 23% below its 1981 level. Similar observations can be made for Indonesia. The unit value of Indonesian exports declined by 25.3% in real terms in 1982 after the tax was abolished. However, export unit values increased in 1983 in nominal and real terms for both Malaysia and Indonesia. The rate of increase was greater for Malaysia (25%) than for Indonesia (22%); the difference may be explained by the fact that Malaysia's export tax increased during that time from 4% to 7%. World prices display a similar tendency. For instance, the world export unit value, the Singapore spot price and the New York dealer price all declined in the 1980-82 period by about 40% in real terms and rose again in 1982. However, a relationship between export taxes and domestic producer prices cannot be observed from the data. One would expect that as a result of lower taxes, producer prices would rise--at least in the short run. Movements in real producer prices in Malaysia and Indonesia, however, show a pattern similar to the export price, i.e., declining with lower taxes and increasing with higher taxes. A comparison of prices between 1981 and 1982 (the year when the Indonesian tax was eliminated and the Malaysian tax was cut sharply) shows that the decline

Table 14a: NATURAL RUBBER: EXPORT TAXES, EXPORT UNIT VALUES, EXPORT VOLUMES, PRODUCER PRICES AND PRODUCTION FOR MALAYSIA AND INDONESIA, 1980-84

	Export Tax as Percent of Export Unit Value	Export Unit a/ Value Index		Producer Price b/ Index		Production ('000 tons)	Exports (000 mt)	Value of Exports US$ 000 (Constant 1980) c/
		Real c/	Nominal	Real d/	Nominal			
Malaysia								
1980	23	100.00	100.00	100.00	100.00	1,530.00	1,525.77	2,121,394
81	14	77.74	78.13	73.70	81.00	1,510.00	1,483.99	1,604,100
82	4	59.80	59.35	62.30	72.40	1,494.00	1,378.11	1,147,500
83	7	75.30	72.66	79.80	76.00	1,563.70	1,562.77	1,635,800
84	4	75.90	72.00	72.00	90.00	1,529.00	1,588.50	1,676,200
Indonesia								
1980	5	100.00	100.00	100.00	100.00	1,020.00	980.70	1,173,810
81	5	85.40	85.88	75.25	80.60	867.00	812.56	831,250
82	zero	63.81	63.24	55.00	65.50	880.00	801.43	612,450
83	zero	78.00	75.27	67.70	87.20	997.20	941.35	878,660
84	zero	82.60	78.28	57.20	84.00	1,115.60	1,013.60	1,002,100

a/ Index based upon export unit value in US dollars.
b/ Index of farm-gate price in local currency.
c/ Deflated by MUV
d/ Deflated by local CPI.

Table 14b: NATURAL RUBBER: INDICES OF WORLD EXPORT UNIT VALUE AND WORLD PRICES

	World Export a/ Unit Value		World Prices: RSS 1				
			Singapore (F.O.B. Buyers' Closing Spot)			New York	
	Real b/	Nominal	Singapore $	U.S. $ Real b/	U.S. $ Nominal	Real b/	Nominal
1980	100.00	100.00	100.00	100.00	100.00	100.00	100.00
1981	81.70	82.00	75.42	84.08	84.50	77.98	77.37
1982	61.35	60.80	59.38	68.87	68.25	62.38	61.72
1983	73.75	71.20	73.70	91.67	88.46	78.98	76.22
1984	74.70	70.80	65.66	86.69	82.18	71.30	67.96

a/ Index based upon export unit value in U.S. dollars.
b/ Deflated by MUV.

in the Malaysian producer price was less than the decline in export prices or the decline in Indonesia's producer price. Hence, theMalaysian producer price relative to the world price increased during this period. The rate of decline of the producer price in Indonesia is comparable to the rate of decline of its export unit value in real terms, i.e., about 26%. In nominal terms, however, the export unit value fell by about 26% and the domestic producer prices fell by only 19%. It seems, therefore, that producer prices respond to changes in export taxes with a lag. Hence, short-term relationships between changes in output, changes in producer prices and changes in export taxes should be interpreted with caution.

48. An analysis of the short-run effects of reductions in export taxes on real producer prices and production is presented for Malaysia and Indonesia below.

	Rates of Changes in Percentage		
	Export Tax	Real Prices	Production
Malaysia			
1981-82	-71	-15.4	-1
1982-83	+75	+28	+4.5
1981-83	-50	+8.3	3.5
Indonesia			
1981-82	5 to zero	-26.7	+1.5
1982-83	-	+19.0	+13.3
1981-83	-	+12.7	+14.9
1982-84	-	+4.00	+26.00

49. Over the period 1981-83 the export tax in Malaysia was reduced by 50%, the producer price increased by 8.3% and production increased by about 3.5%. Output appears to be more responsive to changes in the producer price in

Indonesia. Elimination of the export tax in Indonesia is associated with a 4% increase in the producer price, while output increased by 26%. The producer price response to changes in export taxes also appears to be greater in Indonesia than in Malaysia.

50. It appears from the data presented above that the short-run effect of a reduction in export taxes on export revenues has been in the direction of reducing the total revenues from exports. In the case of Malaysia, a reduction of the export tax from 23% in 1980 to 14% in 1981 and 4% in 1982 is associated with a loss of export revenues of 24%. 1/ This period, however, is characterized by a general decline in exports from Malaysia and Indonesia. Between 1980 and 1982, exports from Malaysia declined by 9.7% and from Indonesia by about 18%. The decline in total world exports during this period was about 6.8% and that of world production was about 2.6%.

51. The huge loss of export revenues may have justified export taxes in the short term. On the assumption that the short-run demand and supply elasticities are very low, and that demand for exports does not change in the short run, application of optimal taxes of 20.6% on Indonesian exports and 35% on Malaysian exports should have led to export revenues from natural rubber for 1982 being about 20% higher for Indonesia and about 30% higher for Malaysia. Indonesian export revenues would have been fairly close to the actual revenues in 1981 with an export tax of about 28%. The revenues collected by Malaysia with a 35% tax on its exports for 1982 would still be only about 6% lower than the actual revenues collected in 1981. These results

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1/ Malaysia has been diversifying its export sector. The loss of export revenue from rubber is being compensated by increases in revenues from palm oil exports.

are based upon the actual 1982 export figures and should be interpreted with caution. However, in the long run, it is clear that the no-tax situation is almost as good as the taxed situation in terms of export revenues. It is seen that the value of exports in 1984, though lower than that of 1980, is higher than any other year when the tax was in existence. In fact, both the volume of exports and the value of exports in real terms for Malaysia and Indonesia have been steadily increasing since 1982--the year after which the tax on Malaysian exports was reduced considerably and was completely eliminated on exports from Indonesia.

Annex 1

Derivation of Import Demand Elasticities Facing Individual Exporting Countries

1. The demand for commodity i facing country j (D_i^j) is identically the difference between the sum of the total world demand for that commodity ($\sum_i D_i^w$) except country j and the sum of the quantity supplied by all other exporters to the world market ($\sum_{row} S_i^{row}$).

The relationship is presented as follows:

$$D_i^j \equiv \sum_i D_i^w - \sum_{row} S_i^{row} \qquad (1)$$

By differentiating the above identity with respect to the price of the commodity i, P_i, we get:

$$\partial D_i^j/\partial P_i = \sum_i(\partial D_i^w/\partial P_i) - \sum_{row} (\partial S_i^{row}/\partial P_i) \qquad (2)$$

Since the elasticity of demand is given as:

$$\eta_{ii} = \partial D_i/\partial P_i \cdot P_i/D_i \qquad (3)$$

by multiplying and dividing both sides and rearranging equation (2) becomes:

$$\partial D_i^j/\partial P_i \cdot P_i/D_i^j = \sum_i(P_i/D_i^j \cdot \partial D_i^w/\partial P_i \cdot D_i^w/D_i^w) \qquad (4)$$

$$- \sum_{row} (P_i/D_i^j \cdot \partial S_i^{row}/\partial P_i \cdot S_i^{row}/S_i^{row})$$

$$\eta_{ii}^{j} = D_i^w/D_i^j \cdot \eta_{ii}^{w} - S_i^{row}/D_i^j \cdot \varepsilon_{ii}^{row} \tag{5}$$

where ε_{ii}^{row} = the elasticity of supply of the rest of the world since

$$D_i^w/D_i^j = 1/\lambda_i^j = \frac{1}{\text{(the market share of the j th country)}}$$

Then the elasticity of demand for commodity i facing country j is presented as follows:

$$\eta_{ii}^{j} = \frac{1}{\lambda_i^j}\,\eta_{ii}^{w} - \frac{\lambda_i^{row}}{\lambda_i^j}\,\varepsilon_{ii}^{row} \tag{6}$$

or

$$\eta_{ii}^{j} = \frac{\eta_{ii}^{w} - \lambda_i^{row}\,\varepsilon_{ii}^{row}}{\lambda_i^j} \tag{7}$$

Annex 2

Details of Export and Other Commodity Taxes for Cocoa, Coffee, Tea and Natural Rubber

Export Restrictions and Taxes

(i) Cocoa

1. Until recently, export of cocoa beans was the sole responsibility of the Cocoa Board in Nigeria. The Cocoa Marketing Board has been abolished. Each private exporter must now obtain an export license from the Nigerian Government. Export licenses are issued on presentation of confirmed letters of credit from banks and foreign buyers. The relative ease of obtaining export licenses is expected to reduce smuggling.

(ii) Tea

2. Effective November 14, 1984, the export duty on all types of teas exported from Sri Lanka, except tea bags, was reduced by Rs2/kg. Further reductions were implemented on November 14, 1986. The export taxes on various types of teas are presently as follows:

Bulk and green tea	Rs5/kg
Packeted tea	Rs3/kg
Instant tea	Rs10/kg
Tea bags	Rs0.5/kg

Based upon an exchange rate of SL rupees 27 per US dollar, the existing average tax on all types of tea is calculated to be about 15% of the Colombo gross auction price and about 9% of the London auction price.

3. Sri Lankan tea exports are also subject to a Tea Board Cess, payable at the point of export by the exporter. In November 1984, the cess was raised by 25 cents to SL Rs1.50/kg ($0.059). Exports are also subjected to a Medical Aid Cess leviable at 0.0035 cents/kg and the proceeds are given to the Health Department.

4. Sri Lankan exporters of value-added forms of tea are given export incentives in the form of cash subsidies under the Export Development Board Expansion Grant Scheme. The rate of cash subsidy on tea bags, tea packets, instant tea and green tea are 4%, 3%, 4% and 3% of the f.o.b. value.

5. The following are the current export duties on tea exported from Kenya to its preferential trade area (PTA) countries and nonpreferential trade area (NPTA) countries.

Average price per ton	PTA	NPTA
	----------%----------	
KL 1,000 or less	Nil	Nil
> KL 1,000 < KL 1,500	7.0	10.0
> KL 1,500 < KL 2,000	8.75	12.5
> KL 2,000 < KL 2,500	10.5	15.0
> KL 2,500 < KL 3,000	12.25	17.5
> KL 3,000 < KL 3,500	14.0	20.0
> KL 3,500	17.5	25.0

6. Duty on tea exported from India was abolished with effect from February 14, 1979. The Government of India allows full rebate of excise duty on all tea export sales. The rate of subsidy is 10% of the FOB value of tea

bags and Darjeeling tea exported in caddies and packets, and 10% for instant tea subject to various conditions. However, tea production and marketing is subjected to very heavy taxation by the federal and state governments.

7. Indian tea exports have recently been subject to quota restriction which was 220,000 tons for 1985. Every contract for export of tea has to be registered with the Tea Board within a specified period from the date of its conclusion. Previously, there was a minimum export price restriction which, according to the tea industry, was acting as a major constraint in increasing tea exports. This restraint was abolished from August 12, 1985, due to oversupply of tea and a steep decline in the tea price in the international market.

8. As of March 23, 1985 the export duty on tea from Malawi was 10% of the f.o.b. price. The tax was abolished on April 1, 1986.

(iii) Coffee

9. The Brazilian Coffee Institute's (IBC) recent resolutions regarding export taxes are the following:

a. Resolution 2/86: Provides that the value of the export tax be calculated on the basis of the minimum export price set by IBC and not on the effective export sales price of coffee.

b. Resolution 5/86: Reduces the value of the export tax applicable to exports of type 6 Arabica coffee from 33% to 15% of the minimum export price set by IBC.

c. Resolution 7/86: Reduces the value of the export tax applicable to exports of the type 7 Arabica coffee with Rio zone flavor from 33% to 25% of the minimum export price set by IBC.

d. Resolution 9/86: Reduces the value of the export tax applicable to type 7 Robusta coffee from 33% to 25% of the minimum export price set by IBC.

10. In Colombia, coffee is the only commodity where exports are levied with taxes and other charges. Most of the other commodity exports are encouraged by an export rebate (CERT). There is an ad-valorem export tax on coffee the equivalent of 6.5% of the "Repatriation Requirement" (locally known as "Reintergo"). Of the tax, 4.5% of the funds are channeled to the national coffee fund, while the remaining 2% goes to the national treasury. The repatriation requirement is defined as the minimum price in US dollars per each 70 kg bag of green coffee exported.

11. In Côte d'Ivoire the export tax on coffee and cocoa is fixed at 100 CFA/kg based upon the reference price.

12. The Government of Kenya levies export taxes on coffee based on auction prices in excess of KL 1,000 per ton. (No other export commodities are not taxed.) Export taxes were introduced during the 1977-79 coffee boom as an additional source of income for the Government. In addition, the local district governments levy cesses on coffee for improvement of roads and running of local offices in their respective areas.

13. The current rates of export taxes are:

Prices KL/ton	% Rate of Duty
Before 1,000	Nil
Next 500	10
Next 500	12½
Next 500	15
Next 500	17½
Next 500	20
Over 3,500	25

(iv) Natural Rubber

Research and Replanting Cesses

(Presented as % of Total Rubber Export Revenues)

	Malaysia	Thailand
1970	8.8	5.8
1975	6.7	5.3
1980	8.5	5.2
1981	9.3	4.8
1982	7.0	5.2
1983	5.6	5.6
1984	5.6	5.2
1985	6.5	5.6

Source: Ministry of Finance, Customs Department and other government documents.

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