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## Demand and Prospects for Cocoa in the 1980's

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Cocoa is an important commodity for less-developed countries (LDC's). In terms of value it is their fifth largest agricultural export, averaging over \$1 billion annually during recent years. For a number of countries, most notably Ghana, Cameroon, and the Ivory Coast, cocoa is a major source of foreign exchange. Ghana alone obtains over 60 percent of its overseas earnings from cocoa. In the other two countries the proportion is a sizable 20-25 percent. For these producers, and others, demand prospects in the world cocoa market are extremely important.

The "developed" nations of Western Europe, North America, and Japan and the centrally-planned economies of Eastern Europe import more than 90 percent of the world's cocoa exports (beans and products). They are also the main consumers of cocoa. During the period 1970-75 the nine-member European Community (EC), the United States, the Soviet Union, and Japan collectively accounted for 76 percent of total world cocoa bean imports. This paper presents estimates of cocoa demand functions for each of these four major consuming markets and uses them to evaluate the consumption and revenue prospects for cocoa in 1985.

### The Demand for Cocoa in Major Consuming Markets.

Per capita consumption is primarily a function of per capita income, the price of cocoa, and the price of other close substitutes or complements. A priori expectations are that consumption will be positively related to income (unless cocoa is an inferior good) and negatively related to the price of cocoa. Theory stipulates that consumption should be positively related to the price of substitutes and negatively related to that of complements.

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In this analysis consumption is defined as the apparent per capita disappearance of cocoa products (both manufactured domestically and imported). It is obtained by adjusting total annual grindings in each market unit for net exports of cocoa products in bean equivalent and dividing by mid-year population estimates.

Price data for both intermediate and final cocoa products are grossly inadequate for most countries. However, such prices closely reflect the price of cocoa beans (Weymar, p.6). Therefore, the average annual import price of beans in each market unit is employed. These are deflated by the consumer price index (base year 1970) for each unit to convert them to real terms. Viton and Weymar have suggested that a 6 to 9 month lag exists in response to price therefore a one-year lag is specified in the current analysis.

The principal substitute for, and complement to, cocoa is sugar (Weymar, p.99). It is a substitute in that it is used in the manufacture of products which compete with cocoa such as non-chocolate candies or carbonated beverages. It is a complement in that it is also used in the production of most cocoa products. The deflated wholesale price of refined sugar was used as an explanatory variable in the analysis.

Average annual real per capita personal disposable income reflects individual buying power and is appropriate for demand estimation. For the US, personal disposable income data are readily obtainable. For Japan and the EC aggregate national income statistics are used as proxies for disposable income. The closest approximation to personal disposable income in the USSR is Net Material Product (NMP) and this is therefore employed.

Secondary data are used in the analysis, with Gill and Duffus as the major source. Further details and a listing of the data employed are

contained in Okorie and Blandford.

Two types of demand model are used in the analysis: the static and the Nerlovian partial adjustment model. The static form was chosen for application to the free-market economies of the United States, European Community, and Japan. In these economies individual or household decisions are the principal determinant of consumption. There is no reason to believe that a dynamic model is necessary to reflect these decisions in the case of cocoa. However, the centrally-planned economy of the USSR is more likely to be characterized by greater rigidity and lagged consumption response. In such an economy, the consumption of an imported commodity like cocoa is strongly influenced by an availability decision made by government planners. Current availability is largely determined on the basis of the previous year's consumption and a target growth rate. It is therefore likely that the partial adjustment model will provide a better reflection of Soviet cocoa consumption than the static model.

The linear functional form was chosen for Japan and the USSR where cocoa products are a relatively new item in the consumer budget and tend to be regarded as a "luxury good". Linearity implies that demand for a product becomes more elastic at higher prices and more inelastic at lower prices. In these two economies it is to be expected a priori that there will be greater switching out of cocoa at higher prices due to the "luxury" nature of consumption. At lower prices consumption is limited by absorptive capacity in economies where cocoa is a relatively new good.

For the traditional markets of the United States and the European Community, where per capita cocoa consumption is relatively high, the double-logarithmic form seems a priori to be more appropriate. This implies constant price elasticity of demand which is probably a reasonable assumption for these

two markets, at least over the relevant range. Cocoa products have become a regular feature in the household's basket of purchases and the proportion of household income spent on food is relatively small. Both suggest that significant changes in consumer response to price are not to be expected.

Ordinary least-squares was used to estimate equations for the period 1953-75, the longest possible given available information. Due to lack of price data it was necessary to use the period 1956-75 for the USSR. The results obtained are presented in table 1.

The coefficients are of an acceptable magnitude and generally of reasonable sign. One possible exception is the seeming inconsistency between the positive sign for sugar in the EC and the negative sign on the same variable in the US and Japan. As explained above, sugar is both a complement and a substitute for cocoa and its products. Where the former relationship outweighs the latter a negative sign is to be expected and vice versa. Previous researchers have encountered the phenomenon of both positive and negative sign on the price of sugar (Behrman, 1965; 1968).

The relevant statistics are satisfactory with generally high "t" values and acceptable adjusted  $R^2$  for all equations. The values of the Durbin-Watson statistic (DW) for the EC and US equations do not imply rejection of the null hypothesis of zero autocorrelation of residuals at the 5 percent confidence level. The value for Japan lies in the inconclusive region of the test. In the USSR equation, which contains a lagged dependent variable, the Durbin-Watson statistic is not valid and Durbin's h-statistic is given. Its value does not support rejection of the null hypothesis at the 5 percent level of confidence.

In table 2 the elasticities derived from the estimated equations are presented. Elasticities with respect to income and price for the US, EC, and

Table 1. Estimated Demand Equations.

Dependent Variable	Intercept	$C_{t-1}$	$P_{t-1}$	$\ln P_{t-1}$	$P_{t-1}$	$\ln P_{t-1}$	$Y_t$	$\ln Y_t$	$\bar{R}^2$	D.W.	h
USSR $C_t$	-0.069 (-1.19)	0.591 (3.15)	-0.075 (-2.42)				0.029 (2.38)		0.98		-0.14
EC $\ln C_t$	-.502 (-0.86)			-0.249 (-6.09)		0.171 (2.73)		0.292 (2.28)	0.88	2.10	
US $\ln C_t$	-0.657 (-1.91)			-0.165 (-3.71)		-0.155 (-1.72)		0.272 (3.24)	0.68	1.79	
Japan $C_t$	0.475 (5.73)		-0.069 (-5.72)		-0.040 (-2.17)		0.029 (2.60)		0.87	1.39	

Note: "t" values in parentheses.

#### Variables

C = Per capita consumption of cocoa in bean equivalent (kilograms).

P = Real price of cocoa beans. Units: USSR = rubles/100 kg.; EC = deutschemarks/100 kg.; US = dollars/100 kg.; Japan = yen/kg.

Ps = Real wholesale price of refined sugar (import price in the case of Japan). Units: same as for price of cocoa.

Y = Real per capita income. Units: USSR = rubles; EC = thousand deutschemarks; US = dollars; Japan = thousand yen.

All prices/values in constant 1970 units.

Table 2. Elasticity Estimates From This and Other Studies.

Researcher/Interval/ Market	Elasticities			$\bar{R}^2$
	Income	Own Price	Cross-Price (with respect to sugar)	
<u>Okorie and Blandford</u>				
(1956-75)				
USSR (short-run)	.79	-.13	N.A.	0.98
(long-run)	1.92	-.31	N.A.	
(1953-75)				
EC	.29	-.25	.17	0.88
US	.27	-.17	-.16	0.68
Japan	.38	-.88	-.10	0.87
<u>Viton (1953-68)</u>				
Planned Economies	0.25	-0.25	N.A.	0.92
Western Europe	0.29	-0.29	N.A.	0.92
US	0.18	-0.18	N.A.	0.80
<u>Behrman (1951-61)</u>				
US	-1.97	-0.40	-0.23	0.96
Fed. Rep. of Germany	0.77	-0.05	-0.03	0.91
United Kingdom	-0.35	-0.01	0.05	0.76
Netherlands	0.13	0.17	0.59	0.50
France	0.22	-0.01	0.99	0.41
<u>Behrman (1948-64)</u>				
US	N.R.	-0.25	0.08	.97
Fed. Rep. of Germany	0.93	-0.18	N.R.	.98
United Kingdom	0.71	-0.16	N.R.	.97
Netherlands	0.62	-0.89	N.R.	.36
France	0.68	-0.38	0.15	.96

N.A. = not applicable      N.R. = not recorded

Sources: Viton, Behrman 1965, 1968.



Japan are all less than unity; these markets all have inelastic demand for cocoa with respect to price and income. The income elasticity ranges from .27 (US) to .38 (Japan), while price elasticity ranges from  $-.17$  (US) to  $-.88$  (Japan). The USSR presents an interesting case. The short-run income elasticity is below unity (.79), though much higher than the income elasticities for the other three markets. However, long-run demand is much more elastic (1.92). Also while short-run price elasticity in the USSR is lower than in the EC, long-run elasticity is greater.

These estimates can be compared to those from other studies, also given in table 2. While Behrman (1965) reports a negative income elasticity for the US (and the United Kingdom) this study indicates a positive elasticity. Also the results indicate much higher income elasticities for the USSR and US than Viton's findings. In general, the estimates are more optimistic with respect to income than Viton's and Behrman's (1965) results but Behrman's (1968) income elasticity estimates appear to be rather high. With respect to cocoa price elasticities, the US estimate of .17 is comparable to Viton's .18, but both are lower than Behrman's .40 and .25.

The different time periods and specifications involved make a complete evaluation of the different elasticity estimates difficult but some general observations can be made. First, in all studies the US is found to have a lower income elasticity than the EC or other western European countries. Secondly, on the average both income and price elasticities are less than unity for western countries and markets. Thirdly, the planned economies are more income-elastic than the US market.

#### Demand Prospects in the Major Markets in 1985.

Projections of cocoa consumption in 1985 for the four markets are made under four different scenerios, involving different levels of income and cocoa

price. These are: (I) high income growth and high price; (II) high income growth and low price; (III) low income growth and high price; (IV) low income growth and low price.

The projections are made using the base year of 1975. Average annual population growth rates for 1970-75 (IBRD) and assumed high/low real income growth rates are employed to compute real per capita income in each market in 1985. The "low" rates are 2 percent for the EC and US, 3 percent for the USSR, and 4 percent for Japan. The "high" rates are 4 percent for the US, 5 percent for the EC, 6 percent for the USSR, and 8 percent for Japan. High/low prices of cocoa beans adopted correspond to average real price in those years within the estimation period when prices were persistently higher and lower respectively, than the sample average. The sugar price employed was the average for the period of estimation.

Per capita and total consumption and producer revenue in the four markets under the four different scenarios are given in table 3. As might be expected per capita consumption is consistently highest across the markets, when there is high income growth and low price; it is least in all markets when there is low income growth and high price.

The figures reveal the high sensitivity of the Japanese and Soviet markets to income and price changes. Japan's total consumption drops from 85 to 36 thousand metric tons from scenario II to III and total Soviet consumption is reduced from 392 to 256 thousand metric tons. The EC and US markets are less sensitive. Total consumption figures under different regimes demonstrate that the USSR could become an important consumer of cocoa by 1985.

From the cocoa producers' perspective revenue rather than consumption is more important. The total revenue generated in each market under the

Table 3. Total and Per Capita Cocoa Consumption and Total Revenue in the Four Markets in 1985 Under Various Real Income Growth and Real Price Scenarios.

Income Growth and Price Scenarios	USSR		EC		US		Japan		Sum of the Four Markets
	Total Consumption (in '000 m-tons)	Total Revenue in million 1970 rubles	Total Consumption (in '000 m-tons)	Total Revenue in million 1970 DM	Total Consumption (in '000 m-tons)	Total Revenue in million 1970 dollars	Total Consumption (in '000 m-tons)	Total Revenue in million 1970 yen	
I. High Income Growth & High Price	356 (1.28)	397	424 (1.56)	2,906	419 (1.81)	573	52 (0.41)	33,227	1,251
II. High Income Growth & Low Price	392 (1.41)	165	538 (1.98)	1,395	476 (2.06)	292	85 (0.67)	22,563	1,491
III. Low Income Growth & High Price	256 (0.92)	285	389 (1.43)	2,666	395 (1.71)	540	36 (0.28)	23,003	1,076
IV. Low Income Growth & Low Price	289 (1.04)	122	495 (1.82)	1,283	451 (1.95)	276	69 (0.54)	18,316	1,304

a/ The figures in brackets are per capita consumption in kilograms.

different scenarios is also presented in table 3. In all markets it is greatest when income growth and prices are high. Despite large total consumption for scenario II (high income growth-low price) the revenue generated is considerably less than for scenario I. This is due to the inelastic nature of demand with respect to price in the markets. Differences in earnings between the two scenarios range from 60 percent less in the case of the USSR to about 30 percent less in the case of Japan.

#### Overall Price and Revenue Prospects for Cocoa.

In order to make an assessment of the prospects for cocoa in the 1980's it is important to discuss the likely supply/demand balance. The International Cocoa Organization (ICCO) has recently forecast world production of 1,853 thousand metric tons in 1985. This is equivalent to a compound annual growth rate of 2.5 percent (base 1975). If it is assumed that the four major markets analyzed in this paper continue to maintain their 1975 share of 60 percent of world cocoa consumption, then estimated world consumption in 1985 under scenarios I through IV would range from 1,771 thousand metric tons (scenario III) to 2,454 thousand metric tons (scenario II). When compared to the estimated production of 1,853 thousand metric tons these figures suggest that the high price scenarios I and III are the most relevant indicators of general consumption/revenue prospects for cocoa in the 1980's.

In the case of the low income growth scenario III a production growth rate of 2.0% per annum would be needed for supply/demand equality. Under the high income growth scenario I production growth of 3.6% per annum is required. In order to realize the worst scenario from producers' point of view (II) a growth rate of 5.4% in production would be necessary. This is more than double the growth rate projected by the ICCO.

These estimates, although not intended to provide a definitive assessment of future consumption and revenue, suggest that market prospects for cocoa producers in the 1980's look favorable. They support the assessment of Gill and Duffus experts and the Ivory Coast but are at variance with the view of the International Cocoa Organization and Ghana that there could be "too much" cocoa in the 1980's (Wall Street Journal).

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