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CBI Sucrose to Ethanol: The Sugar Cane Market Diversification Opportunity

INTRODUCTION

In recent years, enormous stress has been placed on the agriculture sectors of sugar producing countries. It is asserted and briefly discussed below, that the declines in the price and quantity demanded of raw sugar, are not now cyclical, they are structural. Given this context, no reasonable forecast would predict a return to former prices or values. The structural deterioration in the demand for cane sugar cannot be overcome by short term welfare programmes to artificially bolster sugar exports from most favoured nations. The supply response to these market conditions must be forward looking, first by diversifying the products derived from sugar cane. Secondly, a deliberate and rigorous programme to diversify crops for export and domestic consumption must be started with a simultaneous effort to build appropriate markets.

An important presumption is that preferential market substitutes are not available. That is, loss of preferential market privileges results in an equivalent output addition to the world market or reduced total output.

U.S. sponsorship of a programme to support sugar market diversification from sweetener to ethanol production for domestic consumption and export is one forward looking strategy to alleviate the loss of U.S. quota sugar imports. Such a programme can provide genuine support to integrate the agriculture and energy sectors of these economies. Annual appropriations for capital and raw materials, bearing some relation to the revenues otherwise generated by the quota could finance such a programme. This represents an efficient use of such unilateral aid, as it will allow reasonable adjustment to the market place while maintaining a stable agriculture sector.

STRUCTURAL DETERIORATION OF THE
WORLD SUGAR MARKET

The world sugar market is one of the most dynamic and highly cyclical of the

commodity markets. Average raw sugar prices reached U.S.\$0.40 per pound in 1980, but have been depressed since then and are now fluctuating from U.S.\$0.06 to U.S.\$0.10 per pound. The world price of sugar does not reflect all market prices. On the contrary, it reflects only the value of the minority of supply that does not have a protected market outlet.

The overall sugar market is affected by traditional climatic factors, in addition to a number of market specific technology and public policy variables. Every sugar producing country in the world provides subsidies or has established market distortions through some form of fiscal or financial intervention.

The structural deterioration in the market for raw sugar may be attributed to the following:

- (a) Growth in sugar consumption has not kept pace with population growth. Although developing countries have a higher propensity to increase their sugar consumption as real incomes rise, the recent austerity programmes associated with debt crises in many developing countries have held back the growth of disposable household income, therefore sugar consumption.
- (b) High fructose corn syrup (HFCS) sweeteners are taking a growing market share away from sucrose, especially in the U.S. While refined sugar wholesales in the U.S. at about 23 cents a pound an equivalent volume of HFCS costs 20 cents. U.S. protectionism has been damaging to the market as high U.S. support prices have provided a fiscal umbrella such that HFCS sales increase while U.S. imports decline.
- (c) Sugar beet productivity has increased significantly.
- (d) The European Economic Community (EEC) is now a major exporter of re-

efined sugar. Until recently a significant net importer, the EEC is now responsible for 15% of world net exports. The USSR's share of world imports has moved from 10% to 25%.

- (e) Refined sugar imports have grown from 23% of total trade in 1972 to 38% in 1983.

Two results are that the structure of international trade has significantly altered and the pricing structure has been altered. As an importer, the U.S. share has declined from 25% to less than 10% of world net imports, since 1972. The traditional pricing cycle exhibited 2-year high and 6-year low prices for 40 years. Price levels have closely mirrored the changes in world stock-consumption ratios, that move in a cyclical fashion. Since 1980, with recent slow growth in demand, noted above, the stock-consumption ratio has continuously grown. Together the factors listed above have altered the pattern of sugar prices by reducing peak prices and extending the periods of low prices (Brown).

The world price of sugar is said to be in position to firm up in 1988 for the first time since 1981. The price is about U.S.\$0.10 per pound now (June, 1988), compared with a high of US\$0.08, in 1987. It is forecasted to reach U.S.\$0.12 to U.S.\$0.13 before the 1988 crop year ends in October.

The reality for poor sugar-producing nations is that the current boomlet, if it really is one, will be short-lived. Once cane is planted a crop will be harvested for between 3 and 5 years and once the price rises above 10 cents, it becomes profitable to produce more. The last boom proved this out. In 1980-81, the price boom prompted such an outpouring of production that a 7 million ton global surplus accumulated over the next 3 years. Sugar prices went into a free-fall finally bottoming out in July 1986 at just below 3 cents.

Sugar has always been the region's most important agricultural commodity and earner of foreign exchange. Given the Caribbean Basin's anemic trade record with the U.S. since the CBI began and the 83% drop in the U.S. sugar quota since 1981, and given the focus of this analysis and the significance of the U.S. quota in the region, further consideration of the U.S. programme follows.

THE UNITED STATES SUGAR PROGRAMME

In the U.S., domestic cane and beet producers successfully lobbied for protection, which has resulted in publicly stated and apparently irreversible declines in the U.S. sugar import quota. Current cuts in sugar imports were required by the Food Security Act of 1985. It requires that the sugar programme be run at no cost to the Government. This means that the Government carries no stocks of sugar, as it does of other price supported commodities such as wheat and soybeans. Therefore, as domestic production rises, imports have to fall.

Since 1985, U.S. production has risen from 6 million tons to 7.4 million tons. U.S. sugar beet growers plan to increase their plantings by 1.6% in 1988 and increase to 1.29 million acres. If sugar cane growers follow, higher domestic sugar production would force the 5th consecutive reduction in U.S. sugar import quotas. Within 2 years the U.S. will be a net exporter of sugar.

The litany of losses from this structural change in demand can be presented in maudlin prose worthy of my Irish ancestors or with savage efficiency. For now the latter approach will be utilized.

In 1981, the quota equalled 5.0 million tons, but has steadily declined to the current 750,000 tons for the 1988 crop year; 83% decline in 7 years. This is having both political and economic repercussions in the Caribbean.

Caribbean, Latin American, Asian and African sugar exporters have seen their sugar sales drop from U.S.\$2.2 billion to just under U.S.\$400 million since 1981. The Caribbean quota has decreased from about 893,000 metric tons in 1982/83 to the 226,000 metric tons for 1988. According to the CBI Sugar Group, revenue losses for the last 2 years alone have exceeded U.S.\$80.0 million. Considering the time value of losses, the total foreign exchange loss for CBI countries, since 1981, is quite probably near U.S.\$1.0 billion.

During the period 1983-85 sugar-exporting countries in the hemisphere lost an estimated 425,000 jobs, attributable to quota reductions. In 1985, the sugar industry in OAS member countries accounted for a total of 1.5 million direct jobs and for 2.1 million indirect jobs, a total 3.6 million jobs in countries already with severe unemployment problems.

The U.S. is trying to mitigate the effects of the quota cuts by offering surplus U.S. food commodities to sugar exporting countries for the local governments to sell on their local markets. But surplus food cannot compensate for lost jobs.

Few governments are yet willing to contemplate a complete shutdown of mills and total diversification of sugar cane fields to other products. Many Caribbean Basin countries are trying to switch to other crops, but diversification takes both time and money. To make matters worse, recent Caribbean attempts to export non-traditional products, such as ethanol and cut flowers, have been hurt by U.S. protectionism.

DIFFICULTIES AND SUCCESS IN DIVERSIFICATION

There exists widespread general knowledge of the structural deterioration in the region's sugar sector. U.S. technical assistance in agriculture, in the face of their evaporating preferential sugar market, has included investment promotion to reduce production of sugar cane and increase production of alternative agricultural commodities.

Even though significant attention and effort have been applied, diversification from sugar production has achieved only modest success. The reasons range from the condition of the soil in a particular country, to the opportunity for sufficient scale marketing. For example, Annual Sugar Reports, from the U.S. Foreign Agricultural Service, for a number of Caribbean countries indicate the dilemma, constraints and cost of failure in redirecting the structure of agricultural production in the region (USDA).

In the case of Barbados, for example, there exists a technically efficient sugar industry with high wages and highly skilled labour. Because of its high labour costs, the sugar industry, in the hands of the private sector, produces for the European Economic Community (EEC) and U.S. quota markets. With reduction in the U.S. quota, the Government was forced, more than a year ago, to ask producers to cut back cultivation area by 15%. As an indication of the severity of the situation, prior to 1986, Government fiscal policy effectively forced most arable land to be cultivated. With the quota cutback in 1988, cultivation area will have to be cut back further.

Three obstacles are given to smooth diversification away from sugar production. First, labour costs are among the highest in the Caribbean. Second, new crops and production systems require tremendous capital which is not available. Third, the extent and type of the country's soils will not allow a wide variety of alternate cropping programmes. The high likelihood of serious soil erosion from alternate cropping systems places a limit on their application. For example, sea island cotton and peanuts, two of the most important sugar substitutes under cultivation, offer little soil cover when compared to sugar cane. In addition, because the soil of Barbados is coralline, rather than volcanic, it tends to exist as thin layers over coral bedrock and is, therefore, much more susceptible to erosion.

The case of the Dominican Republic is briefly referenced here to illustrate a variation on the need to diversify the agriculture sector. One of the dominant factors of the sugar industry during 1986 and 1987 crop seasons was the decline in sugar cane yields from 51.4 metric tons per hectare in 1986 to 50.5 metric tons per hectare. In the last 2 years the Government spent U.S.\$35 million to subsidize 60,000 labourers or 40% of the labour force.

The most serious and worrisome indicator of failure to adjust to market conditions was evidenced by the declining use of fertilizers and other agro-chemicals. This occurred because of the desire to reduce variable cost in production, where possible, to maintain profitability. With sugar stocks growing in the Dominican Republic, it would appear that without a quick and profitable product market diversification, soil fertility, the most important input in the agricultural production function, is certain to decline, leading eventually to dire circumstances.

About one-third of the operational sugar mills in the region are currently idle and there is excess productive capacity of 10.7 million tons (Brown). The sugar industry employs 12.5 million people in the region and with such a high proportion of regional employment dependent on this industry, this current crisis can only be effectively managed through explicit and deliberate sugar market and agricultural product diversification.

Attempts at product diversification, ordinarily will be executed along the following lines. First, an evaluation of opportunities for tourism will be made, given the

recent strong growth in the industry and the obvious environmental attributes of the region. Second, alternative crops will be considered. Very often this step requires both investment and management from expatriate sources, thereby reducing domestic participation in management, particularly determining factor proportions in production, that is, labour intensity. Also, leakages from the domestic economy will be exaggerated, under both outcomes.

Jamaica, Belize and possibly, Costa Rica, represent examples where both product and constructive market diversification measures are underway. In Jamaica, sugar output is expected to continue expanding as new markets for sugar cane are being developed. In this instance, ethanol fermentation for export. The USDA reports indicate that investment in sugar producing infrastructure will increase the productivity of the industry. New hauling equipment and improved road conditions will reduce cane losses. The incentives for this investment are derived from the development of the ethanol industry in Jamaica by the Petroleum Company of Jamaica and Tropicana. Both firms have high demand for feedstock that is straining stock reserves such that new sugar plantings over the next several years are expected. In the meantime, Jamaica may be forced to import molasses to provide sufficient feedstock as productive capacity is expanded. There is serious consideration to reopen sugar refineries that had been closed

and stock levels, unlike other sugar producers in the region, are at desired levels.

The reported failure of an attempt to diversify sugar land to produce winter vegetables in the Spring Plains region raised serious concern over the efficacy of abandoning sugar production in favour of new products. The Governments's effort to diversify crop production are being met with stiff resistance from the cane farmers themselves, that is, those who stand to lose the most.

AGRO-ENERGY SECTORAL RELATIONSHIPS

The region is poised for vigorous alcohol fuels development. The market diversification of sugar cane from sugar to ethanol should occur for the following reasons

1. These countries generally rely heavily on oil imports to meet energy demand
2. Much foreign exchange is earned through sugar trade and depressed commodity prices make it much more difficult to pay for imported oil.

Table 1 illustrates that, even in 1982 (the last year before sugar quotas were drastically reduced), virtually every large regional sugar producer was also a large net petroleum importer. The terms of trade have obviously deteriorated since then.

TABLE 1. *Oil Imports & Sugar Exports of Selected Countries, 1982* (Millions S.U.S.)

Country	Oil Imports	Sugar Exports
CENTRAL AMERICA		
Costa Rica	169	64
El Salvador	143	16
Guatemala	151	27
Honduras	167	22
Panama	364	24
CARIBBEAN		
Barbados	33	30
Jamaica	419	48
Dominican Republic	327	288

Source: JAYCOR, Alexandria, Virginia, *Worldwide Review of Biomass Based Ethanol Activities* (pg. 11)

On the other hand, the process of diversification away from sugar to alternate crops is difficult for the following reasons:

1. A large proportion of agricultural resources are committed to sugar production in typical cases, therefore, the fiscal and institutional implications of change are often extraordinary and complex.
2. The social and political aspects of this sector are complex.
3. There is usually a conspicuous ab-

sence of appropriate alternatives (Brown).

For these reasons, sugar producing countries and private producers are, therefore, more likely than not, to attempt to continue producing sugar for as long as conditions allow.

As the data in Table 2 indicate, CBI ethanol producers have made a somewhat tentative effort to invest in plant capacity for export. This appears to be due to a perceived lack of a stable U.S. alcohol fuels public policy and Caribbean legislative policy.

TABLE 2: CBI Ethanol Exports to the U.S.: 1985-1987

Country	Year		
	1985	1986	1987 (est.)
 ('000 Gallons).....		
Costa Rica	3,908.7	2,068.3	3,814.6
El Salvador	2,465.5	2,070.8	-
Guatemala	-	687.1	-
Jamaica	6,031.2	21,255.3	17,099.5
TOTAL	12,405.4	26,081.5	20,914.1

est. - estimated

Source: U.S. Dept. of Commerce, Bureau of the Census.

CASE STUDIES - ST. KITTS AND NEVIS AND BARBADOS

In what follows, a brief analysis is made of a very general scenario in which technical assistance and funding are allocated to reimburse for decreases in the U.S. sugar quota. In the example the following assumptions are made.

- (a) Annual appropriations equal to the value of the quota priced at peak year (U.S.\$0.21 per pound) (calendar year/crop year conversions aside) minus current year quota value are made to finance capital and operating expenses of a 5,300 gallon (20,000 L) per day fermentation/dehydration ethanol facility. For this example, the capital cost of the plant is assumed to be U.S.\$2.0 million.

- (b) Ethanol sales in the domestic economy equal the current price of gasoline, U.S.\$1.82 per gallon Barbados and U.S.\$1.75 per gallon St. Kitts and Nevis.
- (c) Sugar recovery rates used, are the averages since 1983.
- (d) Cost of production is assumed to equal U.S.\$1.00 per gallon ethanol (World Bank).

Table 3 shows the import energy consumption-export agriculture balance in St. Kitts and Nevis, though confined to transportation fuel for this analysis. Since 1980, with the available data, gasoline imports have tracked the market place in value, though volume growth has been somewhat unsteady in recent years. Retail prices have also tracked the movement in world oil prices.

Table 3: Import Energy Consumption-Export Agriculture Balance, St. Kitts and Nevis: 1980-86.

Year	No. Vehicles	Gasoline Consumption			Sugar Exports	
		Import		Ret. Price	US\$/M	US\$Pound
		Mill. Gal.	US\$M	US\$/Gal.		
1980	4153	1.2	1.25	1.74	14.4	.20
1981	4652	1.2	1.50	1.81	14.7	.23
1982	4975	1.1	1.62	1.80	11.1	.15
1983	5139	1.5	1.76	1.66	10.0	.19
1984	5235	1.1	1.41	1.73	11.3	.20
1985	5744	NA	1.83	1.72	NA	NA
1986	6106	NA	1.17	1.75	9.5	.14

Source: St. Kitts and Nevis Government Planning Unit.

Receipts from sugar exports have declined throughout this period, though unit prices have held relatively well. This indicates strong dependence on preferential markets.

The relationship between foreign exchange allocated to import gasoline and sugar export receipts, indicates that, though gasoline imports are less than 20% of sugar receipts, the proportionate relationship is growing.

In the case of Barbados, gasoline con-

sumption has increased steadily as the number of vehicles has grown. Retail prices have apparently been established from an administrative perspective. Crude oil is obtained from domestic sources and imported for domestic refining. It should be noted, however, that oil imports as a proportion of total consumption have increased by 20 points since 1985. Although sugar export receipts have held up rather well since 1983, expenditures on imported oil are likely to continue, so as to support economic growth (Table 4).

TABLE 4: Import Energy Consumption-Export Agriculture Balance, Barbados: 1980-86.

Year	No. Vehicles	Gasoline Cons.		Oil Imports		Sugar Exp.
		Mill. Gal.	US\$/Gal.	US\$M	As % of Tot. Cons.	US\$M
1980	37,300	NA	NA	NA	NA	55.0
1981	39,200	14.6	2.08	NA	82.7	25.7
1982	41,100	14.4	2.08	NA	76.1	31.0
1983	43,200	14.5	2.08	19.7	63.1	18.7
1984	45,400	14.9	2.08	17.7	48.1	28.6
1985	47,600	15.4	2.08	15.0	44.0	25.0
1986	50,000	16.4	1.82	11.2	56.8	24.3
1987	52,500	17.9	1.82	16.4	63.5	28.4

Source: Barbados Government, Industrial Development Corp.

Using rough and ready calculations, Table 5 shows a scenario, as described above, could operate to assist in a genuine diversification of the market for sugar cane. Using 1987 as a base year, and the case of Barbados for discussion, a U.S. technical assistance appropriation of U.S.\$3.5 million would finance a portion of the discounted value of the ethanol plant and sugar cane for operation. Given the capacity of the plant in this example, it is likely that two would be needed to operate to fully utilize all available sugar cane during the season. About 1.9

million gallons of ethanol would be fermented from the 12,511 metric tons of sugar, representing the differential between the peak quota and the current quota.

The market value of this ethanol would be approximately U.S.\$3.5 million and given that production costs can be kept at about U.S.\$1.00 per gallon the rate of return would be sufficient. The economy's capacity to blend ethanol with gasoline at a 10% to 20% rate, is approximately 1.5 to 3.0 million gallons per year.

TABLE 5: Caribbean Basin-Sugar Production, Consumption, U.S. Sugar Quota Allocation and Reallocation. Barbados and St. Kitts and Nevis: 1983-87.

	1983	1984	1985	1986	1987
 (Metric tons)				
Barbados					
Production	101,000	99,000	110,000	90,000	90,000
Consumption	14,000	14,000	14,000	14,000	14,000
U.S. Quota	17,777	19,314	17,127	11,338	6,803
Quota Differential from peak year			2,187	7,976	12,511
Value of Differential @ U.S.\$0.21/pd. U.S.\$ million			1.0	3.7	5.8
Ethanol from Differential (million gallons)			0.3	1.2	1.9
Ethanol Value @ U.S.\$1.82/gal. U.S.\$ million			0.6	2.2	3.5
St. Kitts and Nevis					
Production	30,000	32,000	32,000	32,000	32,000
U.S. Quota	14,966	15,216	11,338	11,338	6,803
Quota Differential from peak year			3,878	3,878	8,413
Value of Differential @ U.S.\$0.21/pd. U.S.\$ million			1.8	1.8	3.9
Ethanol from Differential (million gallons)			0.6	0.6	1.1
Ethanol Value @ U.S.\$1.75/gal.			1.0	1.0	1.9

Source: USDA, FAS, World Sugar and Molasses Situation and Outlook, May 1987.

CONCLUSION

The very basic scenario presented here reveals that there is great efficacy in seriously considering a Caribbean Public Policy programme to substitute technical assistance to diversify products from sugar cane, in this case, ethanol, for dollar appropriations as transfer payments for sugar at quota prices. In this example, those same dollars can be put to work to:

- (a) Increase employment in agriculture, construction, operations and maintenance.
- (b) Establish a programme to increase energy self-sufficiency.
- (c) Introduce new science and technology to the agricultural sector
- (d) Secure participation in preserving environmental integrity.
- (e) Diversify output from sugar cane

and integrate the domestic economy, all from a commodity for which the region has an international comparative advantage.

This programme scenario may appear complex and the prospect for development and administration could be perceived onerous. However, it should be noted that the programme described above bears a remarkable resemblance in format and goals with the ethanol fuel programme begun in the U.S. in 1978.

REFERENCES

- ¹Brown, James G. (1987). "The International Sugar Industry, Development and Prospects" *World Bank Staff Commodity Working Paper No 18*
- ²United States Department of Agriculture (USDA) *Foreign Agriculture Service Year Reports* (various issues).
- ³World Bank (1980). *Alcohol Production from Biomass in Developing Countries*. Washington D.C., September.