PN-ACB-515

95600

BOLIVIA'S COCA-COCAINE SUB-ECONOMY IN 1996: A COMPUTER MODEL

USAID

USAID/BOLIVIA

Oscar Antezana

MAY, 1997

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INTRODUCTION

For the ninth consecutive year, USAID/Bolivia has estimated the economic impact of illicit coca and coca derivatives in the Bolivian economy. This analysis relies on simple techniques of value added calculations to estimate production, exports, value added and employment in the coca-cocaine sub-economy. It is used by USAID/Bolivia to aid its planning, but is not an official estimate of the United States government.

Unlike other available, more general, estimates, this computer model includes important variables that reflect more precisely the actual size and impact of the coca-cocaine industry in Bolivia. That is, the calculations include real factors in the processing and marketing chain such as coca leaf spoilage before it is processed, a separate calculation of coca yields among three main areas of coca leaf production, the amount of coca leaf and derivatives seized during the period, and some educated assumptions on the percentage of base exported and further refined and the value added remaining in country at every stage of the production process.

Other estimates simply calculate the number of hectares cultivated with coca, multiplied by the coca leaf yield and divided by a conversion factor to estimate cocaine production. Although these calculations should be consistent with the numbers presented here, they only provide a general idea of the coca-cocaine subeconomy in the Bolivian economy.

The present computer model was originally designed in 1988. Although the basic methodology remains the same, the model has evolved over the years as more and better information became available. For instance, coca leaf and coca derivative seizures were included beginning in 1990 and conversion factors continuously changed. The model evolved also as a result of new "technologies" adopted by the coca growers/narcotraffickers and further vertical integration. Thus coca paste, as an intermediate processing stage, was eliminated in 1993 as it is no longer encountered in any significant seizures. This confirmed the model's odd negative value added results at this stage during the previous two years.

Results of the model have not been adjusted retroactively since it is difficult to know the level of precision of the data used in earlier years, or the speed with which operations of the industry changed and improved over the years. Thus, the reader should be cautioned not to make strict comparisons between years. Nevertheless, this report presents data that are relatively good estimates of order of magnitude and trends.

The net area of cultivated coca nationwide since 1988 has remained relatively stable at about 48,000 hectares, and about 33,000 hectares in the Chapare. The number of hectares of mature (producing) coca fluctuates more and is a function of new plantings

and eradication (see tables 5-7). This area has ranged between 21,000 and 28,000 hectares in the Chapare.

After a slow and gradual increase during 1988-1993, coca leaf production reached a peak in 1994 of more than 72,000 metric tons. Coca base production was estimated at 195 metric tons (of which part was transformed into cocaine HCL) and cocaine HCL at 86 metric tons (see table 1).

Production of coca base and HCL appear to have been higher in earlier years, particularly in 1990, mostly as a result of different conversion factors used. That is, the coca leaf yield, the amount of coca leaf needed to process one kilogram of base (before 1993, one kilogram of paste), or the amount of base needed to get one kilogram of cocaine HCL, have changed. It is difficult to say whether this was a result of change in technologies or better available data. Conversion factors currently used are derived from DEA's Operation Breakthrough report of 1994.

The value of coca leaf, base, and cocaine HCL, as measured by net production market value, net value added and exports, is estimated to have been higher in earlier years particularly due to higher prices in all three stages of production. For instance, while coca leaf price ranged between $70 and $100/100 lbs. during 1988, it declined to $40 and $75/100 lbs. in 1996. Likewise, the average price (fob) of cocaine HCL declined from an estimated $3,250/kg. in 1988 to $1,250 in 1996. In large part, these trends seem to be the result of a market "glut" and gradual accomodation of supply and demand.

Thus, while in 1988 the net value added of the coca-cocaine sub-economy was estimated at $425 million (of which some $280 million is estimated to have remained in country), or 8.5 percent of GDP (5.6% remaining in country), in 1996 it declined to about $131 million in 1996 ($95 million remaining in country), or 2.1 percent of GDP (1.5% remaining in country). Likewise, coca-cocaine exports declined from 87 percent of legitimate merchandise exports in 1988, to less than 15 percent in 1996. See table 1. Although the 1996 values are some 27 percent lower in 1988 dollars, the estimates as a proportion to GDP and exports for 1996 still reflect the "real" importance of the coca-cocaine sub-economy.

Finally, it is interesting to note that since 1988, seizures of coca leaf, base and cocaine have increased to annual amounts that fluctuate around ten metric tons of HCL equivalent. These amounts are estimated to have had a export (fob) price between $13 million and $34 million. The U.S. wholesale value of these seizures were estimated between $250 million and $300 million (see table 17), and the U.S. street value between $1.0 billion and $1.3 billion (see table 18).

The first section of this report focusses on 1996 and also contains a summary of results. The second section outlines base line assumptions and is followed by a "control variables" table where changes are made for automatic calculation. The fourth section presents the model and the fifth contains an appendix of support tables to the model. The following section presents selected graphs that show the relative importance of the coca-cocaine sub-economy in Bolivia and the world, and the last section contains graphs and tables on coca prices, eradication and seizures.

I. SUMMARY OF RESULTS

TABLE 1

The Coca-cocaine Sub-economy During 1996

The coca-cocaine sub-economy has diminished in size and its impact on the rest of the Bolivian economy has been quite limited during 1996. Two main factors accounted for this phenomenon: a 21 percent reduction in the area of mature (producing) cultivated coca and a drop in prices of coca leaf and all derivatives ranging from 17 to 36 percent. Can a reduction in supply push prices down contrary to basic economic laws?

The coca-cocaine industry does not operate in a normal, competitive market. It operates more like a monopsonistic market, i.e., one (or few) sole buyer (the narcotraffickers) and many sellers (the coca growers), and it is likely that the former have a significant influence in the behavior of prices through changes in the supply and demand for Bolivian coca products.

In addition, there seems to be a short and a long-term relationship between the price of coca, interdiction and eradication. In the short term, interdiction activities cause coca prices to drop because demand declines as narcotraffickers reduce coca leaf purchases. Since coca eradication is basically voluntary, farmers are also influenced by the benefits of alternative development programs and do not make their decisions free of exogenous incentives and/or potential punishments. Expectations of coca growers and/or narcotraffickers related to leaf supplies and law enforcement in the future also influence coca prices.

In the long term, the lower the number of hectares under cultivation, the higher the price of coca, everything else constant. It is important to note, however, that since the final product (cocaine HCL) is an international commodity, prices in Bolivia are also a reflection of supply and demand conditions internationally.

Please note that since the estimated number of hectares with immature cultivated coca in 1996 was more than 4,800 hectares higher than the year before, coca leaf production in 1997 is expected to bounce back as these immature plants become productive and are harvested.

The area of net cultivated coca nationwide of 48,100 hectares in 1996 was roughly the same as it was in 1988, estimated at 48,900 hectares. Cultivated coca in the Chapare, estimated at 33,000 hectares, was 700 hectares less than in 1988. New coca cultivation in the Chapare is estimated to have exceeded gross eradication by 5,000 hectares since 1988 (the eradication program began in late 1987).

The total harvest of illicit coca leaf is estimated to have increased by almost 9 percent between 1988 and 1995. In 1996, this coca leaf production declined by about 21 percent, to some 54,900 metric tons, mainly due to a reduced area under mature coca

As a result, the net market value of illicit coca leaf in 1996 is estimated to have declined to about $63 million, down from $99 million in 1995, representing about 11 percent of Bolivia's agricultural sector value added. The drop in the price of coca leaf from $65 per 100 lbs. in 1995 to $52 per 100 lbs. in 1996 further contributed to this reduction in production value.

Gross production of base and HCL hydrochloride in 1996 are estimated at 147 and 51 metric tons, respectively. Net value added at these processing stages is estimated at only $26 million, down from $101 million in 1995, representing about 4 percent of Bolivia's legal manufacturing sector. These reductions reflect diminished coca leaf production and also a drop in prices for coca derivatives (from an average of $860 to $550 per kilo of base, and from $1,500 to 1,250 per kilo of HCL).

While net value added in the illicit coca-cocaine sub-economy in 1996 is estimated at only $87 million, equivalent to 1.4 percent of GDP (see graphs 4A and 4B in section VI), it might actually be higher if some $44 million from international trafficking operations are included. Income retained in country from these activities, including this latter stage, is estimated at $95 million, or 1.5 percent of GDP (see graphs 5A and 5B in section VI). Net value added retained in country had increased continuously since 1992. This is mainly due to a relative increase in the share of coca leaf net value added which is estimated to remain all in country since labor (coca growers) are nationals and profits also are accrued in country. On the other hand, significant percentages of the earnings from processing base and cocaine are estimated to leave the country. However, since coca leaf production suffered a considerable decline of about 21 percent and prices of coca leaf and derivatives dropped, the net value added retained in country also declined in 1996 to some $95 million. The total income effect of this retained income derived from direct linkages with the rest of the economy and indirect economic activity in 1996 is estimated at $191 million, equivalent to 3.0 percent of GDP. Coca-cocaine exports are estimated at $166 million, or 15 percent of legal merchandise exports (see graphs 6A and 6B, section VI).

The average value of one kilogram of cocaine HCL at the farm, export (fob), U.S. wholesale and retail levels are estimated at $420, $1,250, $21,000 and $110,000, respectively. Similarly, the average annual value of a hectare equivalent to the number of HCL produced is estimated at $2,163 at the farm level, $6,438 at the export (fob) price, $108,150 at U.S. wholesale level and $556,500 at U.S. retail level.

TABLE 1

SUMMARY OF RESULTS
BOLIVIA'S COCA-COCAINE SUB-ECONOMY

Description	1988	1989	1990	1991	1992	1993	1994	1995	1996
Area of Cultivated Coca:									
Nationwide (Has.)	48,900	52,900	50,300	47,900	45,500	47,200	48,100	48,600	**48,100**
Mature	35,302	37,488	38,269	39,305	39,804	40,394	42,045	40,649	**35,095**
Immature	13,598	15,412	12,031	8,595	5,696	6,806	6,055	7,951	**13,005**
Chapare (Has.)	33,700	37,200	35,200	33,600	31,600	32,900	33,900	33,700	**33,000**
Mature	23,350	25,106	24,228	24,070	25,054	26,424	28,427	26,493	**20,913**
Immature	10,350	12,094	10,972	9,530	6,546	6,476	5,473	7,207	**12,087**
Coca Leaf Production for Illicit Processing:									
Gross Production (MT)	63,525	65,888	70,613	70,088	70,389	70,459	72,615	69,145	**54,918**
Seized Production (MT)	na.	na.	62.0	5.4	189.0	201.2	202.1	51.0	**76.0**
Net Production market value (mill of US$)	84	79	34	66	59	87	82	99	**63**
Net value added (mill of US$)	82	76	31	63	56	86	80	97	**61**
Exports (mill of US$)	0	0	0	0	0	0	0	0	**0**
Coca Paste Production:									
Gross Production (MT)	652	677	726	718	723	*	*	*	*
Seized Production (MT)	na.	na.	11.2	0.9	0.3	*	*	*	*
Net Production market value (mill of US$)	179	132	109	58	59	*	*	*	*
Net value added (mill of US$)	82	39	60	(23)	(14)	*	*	*	*
Exports (mill of US$)	0	0	0	0	0	*	*	*	*
Coca Base Production:									
Gross Production (MT)	210	216	233	229	232	192	195	185	**147**
Seized Production (MT)	na.	na.	2.3	3.1	7.7	5.3	6.9	4.6	**6.8**
Net Production market value (mill of US$)	315	239	140	92	105	134	136	159	**81**
Net value added (mill of US$)	125	96	19	22	34	30	40	50	**5**
Exports (mill of US$)	157	120	70	46	52	56	60	71	**42**
Cocaine Hydrochloride Production:									
Gross Production (MT)	91	95	101	88	101	80	86	82	**51**
Seized Production (MT)	na.	na.	0.2	0.3	0.7	0.3	1.0	3.4	**3.2**
Net Production market value (mill of US$)	296	236	152	176	202	136	172	123	**63**
Net value added (mill of US$)	136	114	81	129	148	79	110	51	**21**
Exports (mill of US$)	296	236	152	176	202	136	162	112	**55**
Cocaine Hydrochloride Trafficking:									
Gross Volume Marketed (MT)	**	**	**	**	**	**	**	11	**7**
Seized Volume (MT)	**	**	**	**	**	**	**	4.2	**0**
Net Volume at trafficker market value (mill of US$)	**	**	**	**	**	**	**	141	**69**
Net value added of trafficking (mill of US$)	**	**	**	**	**	**	**	90	**44**
Exports (mill of US$)	**	**	**	**	**	**	**	88	**69**
TOTAL ILLICIT PRODUCTION:									
Production market value (mill of US$)	874	686	435	392	425	357	390	522	**276**
Net value added of coca/cocaine processing (mill of US$)	425	325	191	191	224	195	230	198	**87**
Net value added of coca/cocaine processing as a % of GDP	8.5	6.7	4.3	3.8	4.3	3.6	4.0	3.4	**1.4**
Net value added of cocaine trafficking (mill of US$)	**	**	**	**	**	**	**	90	**44**
Net value added of cocaine trafficking as a % of GNP (1)	**	**	**	**	**	**	**	1.6	**0.7**
Net value added retained in country (mill of US$)	279	208	127	93	107	131	143	199	**95**
Net value added retained in country as a % of GDP	5.6	4.0	2.8	1.9	2.0	2.4	2.5	3.4	**1.5**
Total income effect (mill of US$)	461	353	207	226	260	326	356	399	**191**
Total income effect as a % of GDP	9.2	6.8	4.6	4.5	5.0	6.1	6.2	6.8	**3.0**
Exports (mill of US$)	453	356	222	222	254	192	222	270	166
Exports as a % of legitimate merchandise exports	87.3	65.7	30.7	26.7	33.4	27.0	23.0	25.9	**14.9**

n.a.= data not available

* Due to improvements in processing technologies for producing HCL, this stage of production has been largely eliminated.

** The existence of a forward linkage in the national trafficking industry has been evidenced in 1995 by the shipment seized on its way to México.

(1) Since most of this activity takes place outside national boundaries, it is part of GNP, not GDP.

Note. Comparison between years is not completely consistent since the Model has been refined continuously and conversion factors have changed over the years. GDP series have changed, beginning in 1990.
Significant changes at the base and HCL stages between 1992 and 1993 are mainly due to new conversion factors. Prior to 1993, 92.5 Kg. of leaf was assumed to produce 1 Kg. of coca paste; 2.8 Kg. of paste to produce 1 Kg. of coca base; and 1.15Kg. of base to produce 1 Kg. of HCL. In addition, 16 percent leaf humidity was not taken into account in calculations before 1993. 1993 and 1994 conversion factors are based on the Operation Breakthrough report of 390 Kg. of leaf to make 1 Kg. of HCL, adjusted to 367 Kg. due to a probable error in the report.
Dollar value increases at the HCL stage between 1993 and 1994 are mainly due to higher HCL prices. The contrary is true for 1995.

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II. ASSUMPTIONS

TABLE 2

Most of the data in this table are based on information gathered mainly by the law enforcement agencies in La Paz. They are treated as assumptions due to the difficulty of precisely tracking illicit market behavior. Assumptions for the percentages of income and exports generated by the industry and retained in country are speculative.

TABLE 2

SUMMARY TABLE OF BASIC ASSUMPTIONS FOR 1996

Hectares	
Gross number of hectares under cultivation (1)	55,612
Gross eradication (2)	7,512
Net no. of hectares of cultivated coca (3)	48,100
Acreage devoted to production for legal consumption	14,519
Chapare 5% of regional production	1,046
Yungas 95% of regional production	12,808
Apolo 95% of regional production	665
Total estimated hectares with immature (not producing) plants (3)	13,005
Prices	
Coca leaf ($ per 100 lbs.) (4)	52.10
Base ($ per kilo) (5)	500 - 600
Hydrochloride ($ per kilo) (5)	1,100 - 1,400
U.S. wholesale price of HCL per kilogram (6)	21,000
Assumed narcotrafficker price paid for 1 kg. of HCL (50% of U.S. wholesale price)	10,500
Assumed cost of trafficking 1 kg. of HCL ,e.g. gasoline, pilots and bribes (50% of narcotrafficker price)	5,250
Conversion Factors	
Coca yield (MT per Ha)(7)	
Chapare	2.7
Yungas & Apolo	1.8
Kilograms of coca leaves to base (per kilo of base) (7)	367.0
Kilograms to hydrochloride (per kilo of HCL)(7)	1.00
Allowance for coca leaf spoilage (7)	2%
Base exported as a % of total base production (8)	60%
HCL transported and marketed to narcotrafficker countries as a % of total HCL production (8)	15%
% Total Direct Value Added Remaining in Country at Each Stage of Production	
Coca leaf	100%
Base	75%
Hydrochloride	30%
Trafficking	55%

Source:(1) Crime and Narcotics Center - Central Intelligence Agency and NAS-U.S. Embassy

(2) Dirección Nacional de Reconversión Agrícola, DIRECO and NAS- U.S. Embassy 05/15/97

(3) NAS- U.S. Embassy, and USAID/Bolivia

(4) Dirección Nacional de Reconversión Agrícola, DIRECO

(5)Drug Enforcement Administration (DEA), U.S. Embassy in Bolivia

(6) Based on INCSR basic information and DEA price reports

(7) Operation Breakthrough report of 1994 from the Drug Enforcement Administration

(8) DEA & NAS- U.S. Embassy OAssum

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III. CONTROL VARIABLES

TABLE 3

This is the "control" table that contains values for exogenous variables to the model. Since the "model" includes only formulas that interrelate variables, changes or updates of information (e.g., prices of coca leaf and derivatives, conversion factors) are reflected in this table, and automatically update the model.

TABLE 3

CONTROL VARIABLES OF THE 1996 MODEL

COCA LEAF STAGE			
Total estimated area under cultivation (Has)			55,612
Chapare			40,512
Yungas			14,400
Apolo			700
Less:			
Area devoted to production for legal domestic consumption (Has)			
Chapare			5%
Yungas			95%
Apolo			95%
Total eradication during the year			7,512
Chapare			7,512
Yungas			0
Apolo			0
Total estimated area with immature (not producing) plants (Has)			13,005
Chapare			12,087
Yungas			918
Apolo			0
Average yield (MT/Ha/Yr)			
Chapare			2.7
Yungas			1.8
Apolo			1.8
Allowance for spoilage at the coca leaf stage			2%
Allowance for leaf moisture			16%
Amount of coca leaves seized (MT)			76
Price per "carga" (US$)	52.1	to	52.1
COCA BASE STAGE			
Conversion factors from dried coca leaf to coca base (Kg)			
Chapare			367
Yungas			311
Apolo			311
Kgs. of coca base (incl. "agua rica" base equivalent) seized			6,782
Price of base per Kg (US$)	450	to	600
Estimated domestic consumption (Kg.)			13,896
Base exported as a % of total base production			60%

TABLE 3 (pg.2, cont.)

COCAINE HYDROCHLORIDE STAGE		
Conversion factor from coca base to hydrochloride (Kg)		1.00
Kgs. of hydrochloride seized (net of HCL marketed to narcotrafficker countries)		3,168
Price of HCL per Kg (US$)	1,100 to	1,400
Estimated domestic consumption (Kg.)		3,424
COCAINE HYDROCHLORIDE TRAFFICKING STAGE		
Percentage of total production of HCL transported/marketed to narcotrafficker countries		15%
Kgs. of HCL seized before reaching destination		0
U.S. wholesale price of HCL per kilogram		21,000
Assumed "narcotrafficker" price paid for 1 kg. of HCL (50% of U.S. wholesale price)		10,500
Assumed cost of trafficking (e.g. gasoline, pilots and bribes) at 50% of "narcotrafficker" price		5,250
Percentage of total cost payments made in country		50%
Legitimate Merchandise Exports (mill US$)		1,117
Gross Domestic Product (mill US$)		6,275
Gross National Product (mill US$)		5,910
Percentage of value of:	Exports / Value Added	
Coca Leaf	100% / 100%	
Coca Base	75% / 75%	
Cocaine Hydrochloride Remaining in Country	30% / 30%	
Cocaine Hydrochloride Sold to Narcotrafficker Countries	55% / 55%	
Linkage factors at each stage:		
Coca Leaf		1.01
Coca Base		1.61
Cocaine Hydrochloride		1.00
Income Multiplier		2.60
EMPLOYMENT		
Number of person/days per hectare to cultivate 1 ha. of coca		158
Assumed employment multiplier		1.5
Total estimated labor force for 1996		2,689,113
Total estimated labor force for Cochabamba for 1996		507,385

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IV. THE MODEL

TABLE 4

This is the main model based on formulas. All variables are interrelated so that a change of data through the "control variable table" (table 3) automatically recalculates all values.

The model, in turn, is also fed by tables 5 through 12 which contain number of hectares cultivated production costs of all stages for the coca industry, and domestic consumption of base and HCL, among others. Changes in the values of these tables will also feed in the model for automatic update.

TABLE 4

ESTIMATES OF ECONOMIC IMPACT OF
COCA AND DERIVATIVES IN 1996: VALUE OF
PRODUCTION, EXPORTS, VALUE ADDED AND EMPLOYMENT

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I. AREA UNDER CULTIVATION AND ESTIMATED PRODUCTION OF COCA LEAVES:

Total estimated area under cultivation in 1996 (Has.)	(See Tables 5 through 7)		**55,612**
Chapare			40,512
Yungas			14,400
Apolo			700
Less:			
Total eradication for the year (Has.)			7,512
Chapare			7,512
Yungas			0
Apolo			0
Less:			
Total estimated area with immature (not producing) plants (Has.)			13,005
Chapare			12,087
Yungas			918
Apolo			n.a.
Less:			
Total estimated area devoted to production for legal domestic consumption (Has.)			14,519
Chapare	5%		1,046
Yungas	95%		12,808
Apolo	95%		665
Total estimated area devoted to production for illegal processing (Has.)			20,576
Chapare			19,867
Yungas			674
Apolo			35
YIELDS (Metric Tons/Ha/Yr)			
Chapare		2.7	
Yungas		1.8	
Apolo		1.8	
TOTAL PRODUCTION OF COCA LEAVES FOR THE ILLEGAL MARKET			**54,918 tons**
Chapare			53,642
Yungas			1,213
Apolo			63

II. VALUE OF PRODUCTION AND EXPORTS:

1. Value of Coca Leaves Available for Processing into Base:

Amount:		54,918
Less allowance for spoilage:	2%	1,098
Net production of coca leaves (air dried)		53,820 tons
Less:		
Amount of coca leaves seized (air dried)		76 tons
Net production of coca leaves available for further processing		**53,744 tons**

Price per "carga" in US$ **52** (Average price for the year, see Graph 12C)
Price per kilo in US$ 1.147

TOTAL PRODUCTION VALUE OF COCA LEAVES:

54,918,000 Kg. x 1.147 = **US$ 62,990,946**

TOTAL PRODUCTION VALUE OF LEAF OUTPUT FOR FURTHER PROCESSING:

53,744,000 Kg. x 1.147 = **US$ 61,644,368**

Exports: 0

TABLE 4 (pg. 2, cont.)

2. Value of Coca Base (Oxido Base) Produced and Exported:

Net production of air dried coca leaves available for further processing		**53,744 tons**
Less allowance for moisture content:	16%	8,599
Net production of dried coca leaf equivalency		45,145 tons

Given that:

Chapare's coca leaf alkaloid content of:	0.0072 of 1 percent & laboratory efficiency of:	45%
Yungas' coca leaf alkaloid content of:	0.0085 of 1 percent & laboratory efficiency of:	45%
Apolo's coca leaf alkaloid content of:	0.0085 of 1 percent & laboratory efficiency of:	45%

In Chapare:	367 kilos of dried coca leaves is needed to produce 1 kilo of base
In Yungas:	311 kilos of dried coca leaves is needed to produce 1 kilo of base
In Apolo:	311 kilos of dried coca leaves is needed to produce 1 kilo of base

TOTAL PRODUCTION OF COCA BASE	**147,262 Kg. of base produced**
In Chapare:	143,240 Kg. of base produced
In Yungas:	3,824 Kg. of base produced
In Apolo:	199 Kg. of base produced

Minus: 6,782 kilos of coca base (incl. "agua rica" base equivalent) seized

Minus:
Estimated domestic consumption: 13,896 Kg. (See Table 8)

Net production of coca base available for further processing: **126,584 Kg.**

Price of base in US$ 500 to 600 per kilo.

VALUE OF BASE FOR FURTHER PROCESSING	147,262 Kg.x US$	500 =	US$	73,631,000 to
	147,262 Kg.x US$	600 =	US$	88,357,200

Percentage of Base exported: 60% or 75,950 Kg.

VALUE OF BASE EXPORTED:	75,950 Kg.x US$	500 =	**US$**	**37,975,000 to**
	75,950 Kg.x US$	600 =	**US$**	**45,570,000**

3. Value of Hydrochloride Produced and Exported:

Given that: 1 kilo of 100% base to produce 1 kilo of hydrochloride

Amount of base available for conversion into hydrochloride:

126,584 Kg. x	40% =	50,634 Kg.	
50,634 Kg.of base divided by	1 =	**50,634 Kg. of HCL produced**	

Assumed price of hydrochloride in US$: 1,100 to 1,400

VALUE OF HYDROCHLORIDE PRODUCED:	50,634 Kg. x US$	1,100 =	**US$**	**55,697,400 to**
	50,634 Kg. x US$	1,400 =	**US$**	**70,887,600**

Minus: 3,168 kilos of hydrochloride seized

Minus:
Estimated domestic consumption: 3,424 Kg. (See Table 8)

Net production of HCL available for export: **44,042 Kg.**

VALUE OF HYDROCHLORIDE EXPORTED: **US$ 48,446,200 to**
US$ 61,658,800

TABLE 4 (pg. 3, cont.)

4. Value of Hydrochloride at Trafficker Market Value:

Assuming that:

15% of net HCL production is transported/marketed to narcotrafficker countries at
50% of the U.S. wholesale price of 21,000 /Kg.

44,042 Kg. x 15% = 6,606 Kg.
6,606 Kg. x US$ 10,500 = **US$ 69,366,150**

Minus: 0 kilos of hydrochloride seized before reaching destination

Net production marketed to narcotrafficker countries: 6,606 Kg.

VALUE OF HCL AT TRAFFICKER MARKET VALUE: **US$ 69,366,150**

5. Total Value of Production, Export and Trafficking:

Production Stages	Total Produced		Total Seized		Exported		Converted	
		to		to		to		to
Coca Leaves	63	63	0.1	0.0	0	0	63	63
Coca Base	74	88	3.4	4.1	38	46	33	38
Hydrochloride	56	71	3.5	4.4	48	62	0	0
Trafficking	69	69	0.0	0.0	69	69	0	0

(In millions of US$)

RECAPITULATION: TOTAL VALUE OF EXPORTS: (In millions of US$)

Of Coca Base	38	to	46
Of Hydrochloride	48	to	62
	86		108
Of Trafficking	69	to	69

6. Coca/Cocaine Exports as a Percentage of Legitimate Merchandise Exports:

Low Estimate: US$ 86 / US$ 1,117 x 100 = **7.7%**

High Estimate: US$ 108 / US$ 1,117 x 100 = **9.7%**

Mid-point Average: US$ 97 / US$ 1,117 x 100 = **8.7%**

7. Cocaine at Trafficker Market Value as a Percentage of Legitimate Merchandise Exports:

Mid-point Average: US$ 69 / US$ 1,117 x 100 = **6.2%**

8. Exports Proceeds Retained in Country:

(in mill of US$)

Production Stages	Total Exports		Imported Inputs	Percentage Remaining in Country	Net Exports Remaining in Country	
		to				to
Coca Leaves	0	0	1	100%	(1)	(1)
Coca Base	38	46	13	75%	19	25
Hydrochloride	48	62	1	30%	14	18
SUBTOTAL	86	108	14		**32**	**42**
Trafficking	69	69	0	55%	38	38
TOTAL	155	177	14		**70**	**80**

TABLE 4 (pg. 4, cont.)

9. Total Retained Exports as a Percentage of Legitimate Merchandise Exports:

Low Estimate:	70 million / 1,117 x 100 =	6.3%
High Estimate:	80 million / 1,117 x 100 =	7.2%
Mid-point Average:	75 million / 1,117 x 100 =	6.7%

III. VALUE ADDED BY COCA AND DERIVATIVES (or contribution to informal GDP):

A. DIRECT EFFECTS: **(in US$)**

1. Value Added by Coca Leaf Production:

Total Coca Leaf Production Value (incl. leaf seizures):	63 million
Less: Cost of agricultural inputs (e.g. seeds, fertilizers, insecticides): (See Table 9 for detailed calculations)	77 per Ha/Yr
Equal:	2 million
Equal: TOTAL NET VALUE ADDED OF COCA LEAVES:	**61 million**

2. Value Added by Coca Base Production:

Total Coca Base Production Value (incl. coca base seizures):	74 million to 88 million
Less: Coca Leaf Production Value (previous stage):	62 million
Cost of precursors: US$ 98 per kilo of coca base. (See Table 10 for detailed calculations)	14 million
Equal: TOTAL NET VALUE ADDED OF COCA BASE:	**(2) million to 12 million**

3. Value Added by Hydrochloride Production:

Total Hydrochloride Production Value (incl. HCL seizures):	56 million to 71 million
Less: Cost of coca base (previous stage) used into the processing of HCL:	38 million to 46 million
Cost of precursors: (See Table 11 for more detailed calculations)	1 million
Equal: TOTAL NET VALUE ADDED OF HYDROCHLORIDE:	**17 million to 24 million**

4. Value Added by Hydrochloride Trafficking:

Total Hydrochloride Trafficker Market Value (incl. HCL seizures):	**69 million**
Less: Cost of HCL (previous stage) at FOB prices:	**7 million to 9 million**
Less: Payments made outside the country for transporting and marketing HCL estimated at 50% of the total cost paid estimated at 50% of the "narcotrafficker" price or: 10,500 x 50% x 50% x 6,606 Kg.	**17 million**
Equal: TOTAL NET VALUE ADDED OF TRAFFICKING HYDROCHLORIDE	**43 million to 45 million**

TABLE 4 (pg. 5, cont.)

5. Direct Value Added Of Coca/Cocaine Processing:

Lower estimate: **76 million to**
Upper estimate: **97 million**

6. Direct Value Added Of HCL Trafficking:

Lower estimate: **43 million to**
Upper estimate: **45 million**

7. Direct Value Added of Coca/Cocaine Processing as a % of legitimate GDP

Low Estimate: $\frac{76 \text{ million}}{6{,}275} \times 100 =$ 1.2%

High Estimate: $\frac{97 \text{ million}}{6{,}275} \times 100 =$ 1.5%

Mid-point Average: $\frac{87 \text{ million}}{6{,}275} \times 100 =$ 1.4%

8. Direct Value Added of HCL Trafficking as a % of legitimate GNP*

Low Estimate: $\frac{43 \text{ million}}{5{,}910} \times 100 =$ 0.7%

High Estimate: $\frac{45 \text{ million}}{5{,}910} \times 100 =$ 0.8%

Mid-point Average: $\frac{44 \text{ million}}{5{,}910} \times 100 =$ 0.7%

*Although this operation of HCL trafficking is assumed to take place by Bolivian nationals, it takes places outside national boundaries. Therefore, value added of this marketing stage is part of GNP, not GDP.

B. VALUE ADDED RETAINED IN COUNTRY:

(in mill of US$)

Stages	Value Added		in Country (1)		Net Direct Value Added in Country	
		to				to
Coca Leaves	61	61	100%	of all labor and profit	61	61
Coca Base	(2)	12	75%	of labor and profit	(2)	9
Hydrochloride	17	24	30%	100% of labor and 30% of profit	5	7
SUBTOTAL	76	97			64	77
Trafficking	43	45	55%	50% of total costs (or 25 of total value) and 30% of profit	24	25
TOTAL	119	142			88	102

(1) See Table 9 for details on labor costs and profit.

Direct Value Added Retained in Country as a % of GDP:

Low Estimate: $\frac{88 \text{ million}}{6{,}275} \times 100 =$ 1.4%

High Estimate: $\frac{102 \text{ million}}{6{,}275} \times 100 =$ 1.6%

Mid-point Average: $\frac{95 \text{ million}}{6{,}275} \times 100 =$ 1.5%

TABLE 4 (pg. 6, cont.)

C. LINKAGE EFFECTS (Excludes international trafficking operations)

Production Stages	(in mill of US$) Total Value Remaining in Country (1)		Linkage Factor* (2)	Total Direct Income Effect (3)		Linkage Effect (4)= (3)-(1)	
		to			to		to
1. Coca Leaf Production	61	61	1.01	62	62	1	1
2. Coca Base Production	-2	9	1.61	-3	14	-1	5
3. Hydrochloride Production	5	7	1.00	5	7	0	0
TOTAL	64	77		**64**	**83**	-0	6

* See Table 12.

D. INDIRECT INCOME EFFECTS:

	(in mill of US$) Total Direct Income Effect (1)		Estimated Income Multiplier* (2)	Total Income Effect (3)		Indirect Effect (4)= (3)-(1)	
		to			to		to
All Production Stages	64	83	2.60	**166**	**217**	102	133

* UDAPE estimate.

RECAPITULATION: DIRECT PLUS LINKAGE AND INDIRECT INCOME EFFECTS

Direct Income:	64	to	77	million
Linkage Effect:	(0)		6	million
Indirect Effect:	102		133	million
Total Direct, Linkage and Indirect Multiplier Effects:	**166**	**to**	**217**	**million**

D. ESTIMATED TOTAL INCOME GENERATED BY NARCOTICS INDUSTRY IN BOLIVIA AS A % OF LEGITIMATE 1996 GDP

Low Estimate: $\frac{166 \text{ million}}{6{,}275} \times 100 =$ **2.6%**

High Estimate: $\frac{217 \text{ million}}{6{,}275} \times 100 =$ **3.5%**

Mid-point Average: $\frac{191 \text{ million}}{6{,}275} \times 100 =$ **3.0%**

IV. EMPLOYMENT GENERATION: (in coca production for export)

A. DIRECT EMPLOYMENT

Based on coca cultivation cost structure (see table 9), it takes:

158 person/days to cultivate 1 hectare of coca which is equivalent to 6.6 person/months

or

0.55 persons/year

Multiplied by the total number of hectares under cultivation for the illicit market 20,576 has.

TOTAL NUMBER OF PERSONS/YEAR DIRECTLY INVOLVED IN COCA LEAF PRODUCTION 11,317 workers

Plus employment generated at the coca base stage:

Based on the cost structure of coca base processing, it takes:

4.50 person/days to process 1 kilogram of coca base which is equivalent to 0.012 person/year

Multiplied by the total production of coca base which is 147,262 Kgs.

TABLE 4 (pg. 7, cont.)

TOTAL NUMBER OF PERSONS/YEAR DIRECTLY INVOLVED IN COCA BASE PROCESSING	1,816 workers
Plus employment generated at the coca HCL stage assumed at	1,000 persons
TOTAL NUMBER OF PERSONS/YEAR DIRECTLY INVOLVED IN THE COCA-COCAINE INDUSTRY	14,133 persons/yr

Assuming that one-third of the time is devoted to coca-cocaine related activities, the number of persons involved at least part-time in the coca-cocaine industry would be:

14,133 persons/year divided by 1/3 = 42,826 workers

B. INDIRECT EMPLOYMENT

Given the high underemployment rate nationwide,
the employment multiplier is assumed to be lower than the income multiplier

	Total Direct & Linkage Employment	Employment Multiplier	Total Employment	Indirect Effect
	(1)	(2)	(3)	(4)= (3)-(1)
Full time	14,133	1.5	21,199	7,066
Inc. part-time	42,826	1.5	64,239	21,413

RECAPITULATION: DIRECT PLUS LINKAGE AND INDIRECT EMPLOYMENT EFFECTS

	Full Time	Inc. Part-Time
Direct Employment:	14,133	42,826
Indirect Effect:	7,066	21,413
Total Direct, Linkage and Indirect Multiplier Effects:	**21,199**	**64,239**

C. ESTIMATED DIRECT AND INDIRECT EMPLOYMENT IN THE COCA/COCAINE INDUSTRY AS A % OF TOTAL LEGITIMATE EMPLOYMENT

Estimated Legitimate Employment Nationwide: 2,689,113

Estimated Full-Time Employment as a % of Legitimate Employment Nationwide: $\frac{21,199}{2,689,113} \times 100 =$ 0.8%

Estimated Employment (inc. part-time) as a % of Legitimate Employment Nationwide: $\frac{64,239}{2,689,113} \times 100 =$ 2.4%

Estimated Legitimate Employment for Cochabamba: 507,385

Estimated Full-Time Employment as a % of Legitimate Employment in Cochabamba: $\frac{21,199}{507,385} \times 100 =$ 4.2%

Estimated Employment (inc. part-time) as a % of Legitimate Employment in Cochabamba: $\frac{64,239}{507,385} \times 100 =$ 12.7%

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V. APPENDIX TO THE MODEL

V.A. AREA OF CULTIVATED COCA (1986-1996)

TABLE 5

AREA OF CULTIVATED COCA NATIONWIDE (Has.)						
YEAR	TOTAL NO. OF HECTARES OF CULTIVATED COCA (1)	GROSS ERADICATION(*) (2)	TOTAL NET NO. OF HECTARES OF CULTIVATED COCA(**) (3)=(1)-(2)	MATURE COCA CULTIVATION (4)=(3)-(5)	IMMATURE COCA CULTIVATION (5)=(6)+(***)	NEW COCA CULTIVATION (6)=(1)-(3)(X)
1986	38,027	227	37,800	37,800	-	-
1987	42,409	1,109	41,300	36,691	4,609	4,609
1988	50,289	1,389	48,900	35,302	13,598	8,989
1989	55,323	2,423	52,900	37,488	15,412	6,423
1990	58,508	8,208	50,300	38,269	12,031	5,608
1991	53,287	5,387	47,900	39,305	8,595	2,987
1992	50,609	5,109	45,500	39,804	5,696	2,709
1993	49,597	2,397	47,200	40,394	6,806	4,097
1994	49,158	1,058	48,100	42,045	6,055	1,958
1995	54,093	5,493	48,600	40,649	7,951	5,993
1996	55,612	7,512	48,100	35,095	13,005	7,012

(*) Based on official information provided by DIRECO. Includes new coca eradicated.

(**) Based on photogrametric information.

(***) The sum of new cultivation in previous year and in the current year.

(X) The difference between the current total number of has. cultivated with coca and the total net number of has. cultivated with coca the previous year.

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TABLE 6

AREA OF CULTIVATED COCA IN CHAPARE (Has.)						
YEAR	TOTAL NO. OF HECTARES OF CULTIVATED COCA (1)	GROSS ERADICATION(*) (2)	TOTAL NET NO. OF HECTARES OF CULTIVATED COCA(**) (3)=(1)-(2)	MATURE COCA CULTIVATION (4)=(3)-(5)	IMMATURE COCA CULTIVATION (5)=(6)+(***)	NEW COCA CULTIVATION (6)=(1)-(3)(X)
1986	26,027	227	25,800	25,800	-	-
1987	29,109	1,109	28,000	24,691	3,309	3,309
1988	35,041	1,341	33,700	23,350	10,350	7,041
1989	38,753	1,553	37,200	25,106	12,094	5,053
1990	43,119	7,919	35,200	24,228	10,972	5,919
1991	38,811	5,211	33,600	24,070	9,530	3,611
1992	36,535	4,935	31,600	25,054	6,546	2,935
1993	35,141	2,241	32,900	26,424	6,476	3,541
1994	34,832	932	33,900	28,427	5,473	1,932
1995	39,175	5,475	33,700	26,493	7,207	5,275
1996	40,512	7,512	33,000	20,913	12,087	6,812

(*) Based on official información provided by DIRECO. Includes new coca eradicated.

(**) Based on photogrametric information.

(***) The sum of new cultivation in previous year and in the current year.

(X) The difference between the current total number of has. cultivated with coca and the total net number of has. cultivated with coca the previous year.

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TABLE 7

AREA OF CULTIVATED COCA IN YUNGAS (Has.)						
YEAR	TOTAL NO. OF HECTARES OF CULTIVATED COCA (1)	GROSS ERADICATION(*) (2)	TOTAL NET NO. OF HECTARES OF CULTIVATED COCA(**) (3)=(1)-(2)	MATURE COCA CULTIVATION (4)=(3)-(5)	IMMATURE COCA CULTIVATION (5)=(6)+(***)	NEW COCA CULTIVATION (6)=(1)-(3)(X)
1986	12,000	-	12,000	12,000	-	-
1987	13,300	-	13,300	12,000	1,300	1,300
1988	14,102	2	14,100	11,998	2,102	802
1989	15,030	430	14,600	12,868	1,732	930
1990	14,249	249	14,000	13,421	579	(351)
1991	13,293	93	13,200	14,258	(1,058)	(707)
1992	12,902	102	12,800	13,805	(1,005)	(298)
1993	13,175	75	13,100	13,023	77	375
1994	13,156	56	13,100	12,669	431	56
1995	14,018	18	14,000	13,026	974	918
1996	14,400	0	14,400	13,482	918	0

(*) Based on official información provided by DIRECO. Includes new coca eradicated.

(**) Based on photogrametric information.

(***) The sum of new cultivation in previous year and in the current year.

(X) The difference between the current total number of has. cultivated with coca and the total net number of has. cultivated with coca the previous year.

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V.B. ESTIMATED DOMESTIC CONSUMPTION OF COCA BASE AND COCAINE HCL IN BOLIVIA

TABLE 8

ESTIMATED DOMESTIC CONSUMPTION OF COCA BASE AND HCL IN BOLIVIA

1. Annual prevalent consumption in urban populations greater than 30,000 inhabitants of:

Habitual (monthly prevalence consumption)(1)

Base	0.7%	of 3,310,444	million (est. urban pop. > 30,000 in 1996)(2)
HCL	0.5%	of 3,310,444	million (est. urban pop. > 30,000 in 1996)(2)

Recreational (3)

Base	1.0%	of 3,310,444 million	(est. urban population in 1996)
HCL	1.0%	of 3,310,444 million	(est. urban population in 1996)

2. Consumption of base and HCL (number of persons)

	Habitual(1)	Recreational(3)	Total
Base	11,587	33,104	44,691
HCL	8,276	33,104	41,381

3. Daily consumption (in grams)

	Habitual(4)	Recreational(4)
Base	3.0	3.0 per month or 0.10 each day on average
HCL	1.0	1.0 per month or 0.03 each day on average

4. Annual consumption of base and HCL in an HABITUAL manner:

Base	3.0	x	365 days	x	11,587 persons=	12,687 Kgs./year
HCL	1.0	x	365 days	x	8,276 persons=	3,021 Kgs./year

5. Annual consumption of base and HCL in RECREATIONAL manner:

Base	0.10	x	365 days	x	33,104 persons=	1,208 Kgs./year
HCL	0.03	x	365 days	x	33,104 persons=	403 Kgs./year

6. Total annual consumption of base and HCL:

Base	13,896 Kgs.
HCL	3,424 Kgs.
TOTAL	17,319 Kgs.

(1) Based on "El Uso Indebido de Drogas en Bolivia Estudio Comparativo", CELIN, 1996. The monthly prevalence consumption measures current consumption. About one-half of this population is estimated to require treatment, therefore, are considered to be habitual consumers. Habitual consumption refers to consumption levels that are health damaging.

(2) CELIN target population for 1993 of 2,926,059 was adjusted for 1996 by the urban population growth rate of 4.2%. Drug use and dependence may not have increased necessarily in the same proportion, although it is likely.

(3) Based on "El Uso Indebido de Drogas en Bolivia Estudio Comparativo", CELIN, 1996. The closest available indicator for recreational prevalence is the difference between annual prevalence and monthly prevalence.

(4) Rough estimate provided by INTRAID (Instituto Nacional de Tratamiento, Rehabilitación e Investigación en Drogodependenci

V.C. COST STRUCTURE AT EACH STAGE OF PRODUCTION

TABLE 9

PRODUCTION COSTS FOR 1996 AT THE COCA LEAF STAGE				
	Quantity	Price per Unit	Total (US$/Ha)	
Investment				
Land (imputed rental value of 1 Ha.)		200	200	
Land Preparation (M/D)	110	5	550	
Equipment (various)	0	-	50	
Coca Seeds (units)	46	6.6	303.6	
Divided by 12 Yrs. (1)			92.0	Ha/Yr
Multiplied by the number of Has. cultivated			20,576	Has
Equal:		**US$**	**1.89**	**million**
Labor Costs				
Hand Weed (M/D)	60	5	300	
Agroch. Application (M/D)	17	5	85	
Harvesting & Drying (M/D)	41	5	205	
Transportation (M/D)	40	5	200	
TOTAL			790	Ha/Yr
Multiplied by the number of Has. cultivated			20,576	Has
Equal:		**US$**	**16.26**	**million**
	Amount/ Ha/Yr	Unit Price (US$)	Total/ Ha/Yr (US$)	
Agrochemicals				
Herbicides (lts)	1	8.0	8	
Insecticides (lts)	4	10.0	40	
Sub-Total			48	
Other (mainly bags)			43	
Percentage of farmers using chemicals			70%	
Weighted cost of chemicals per Ha/Yr			**76.5**	**per Ha/Yr**
Multiplied by the number of Has. cultivated			20,576	Has
Equal:		**US$**	**1.57**	**million**

(M/D) = Man/Day

(1) Coca's production life cycle is assumed to be 12 years.

Note.- All agrochemicals are imported.

Source: Based on DIRECO and USAID's "Economic Analysis of Coca and the Most Promising Alternative Cash Crops".

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TABLE 10

VARIABLE COSTS FOR 1996 IN THE PROCESSING OF COCA BASE			
	Amount/ per Kg of Coca Base Processed	Unit Price (US$)	Total (US$)
Precursors			
Sulphuric Acid (liter)	3	19.30	57.9
Potassium Permanganate (gr)	200	0.08	16.0
Concent. Ammonia (liter)	1	12.00	12.0
Kerosene, net (liter)*	10	0.70	7.00
Lime (kg)*	10	0.48	4.80
Total			**97.7**
Multiplied by the number of Kg. of base produced			147,262 Kgs
Equal:		**US$**	**14.39 million**
Labor Costs/Kg of Base			**18**
Multiplied by the number of Kg. of base produced			147,262 Kgs
Equal:		**US$**	**2.65 million**

* Domestically supplied.

Source: Based on DEA figures.

TABLE 11

VARIABLE COSTS FOR 1996 IN THE PROCESSING OF HYDROCHLORIDE*		
Precursors	(in US$)	
About $20 per kg.		1.01 million
	1%	
Labor Costs	(in US$)	
1/2% on the production value of hydrochloride		0.32 million

(*) Due to lack of data, figures are rough estimates.

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V.D. LINKAGE FACTOR ESTIMATES

TABLE 12

COMPONENTS OF THE VALUE ADDED AND LINKAGE EFFECTS IN EACH STAGE (*)
(US$ mill)

Processing Stage	Labor Costs (1)	Profit (2)	Net Value Added (1)+(2)=(3)	Intermediate Consumption Domestic(**) (4)	Intermediate Consumption Imported (5)	Backward Linkage Factors A	Backward Linkage Factors B
Coca Leaves	16.3	45.2	61.4	0.9	0.7	1.01	1.03
Coca Base	2.7	2.0	4.6	1.7	12.6	1.61	-0.47
Hydrochloride	0.3	20.0	20.3	0.0	1.0	1.00	1.05
TOTAL	19.2	67.1	86.3	2.6	14.4	1.03	1.24

A = Includes only domestic intermediate consumption.
B = Includes both domestic and imported intermediate consumption.

(*) Mid-points of ranges are used. Calculations are rounded. Excludes seizures.
(**) From the rest of the economy.

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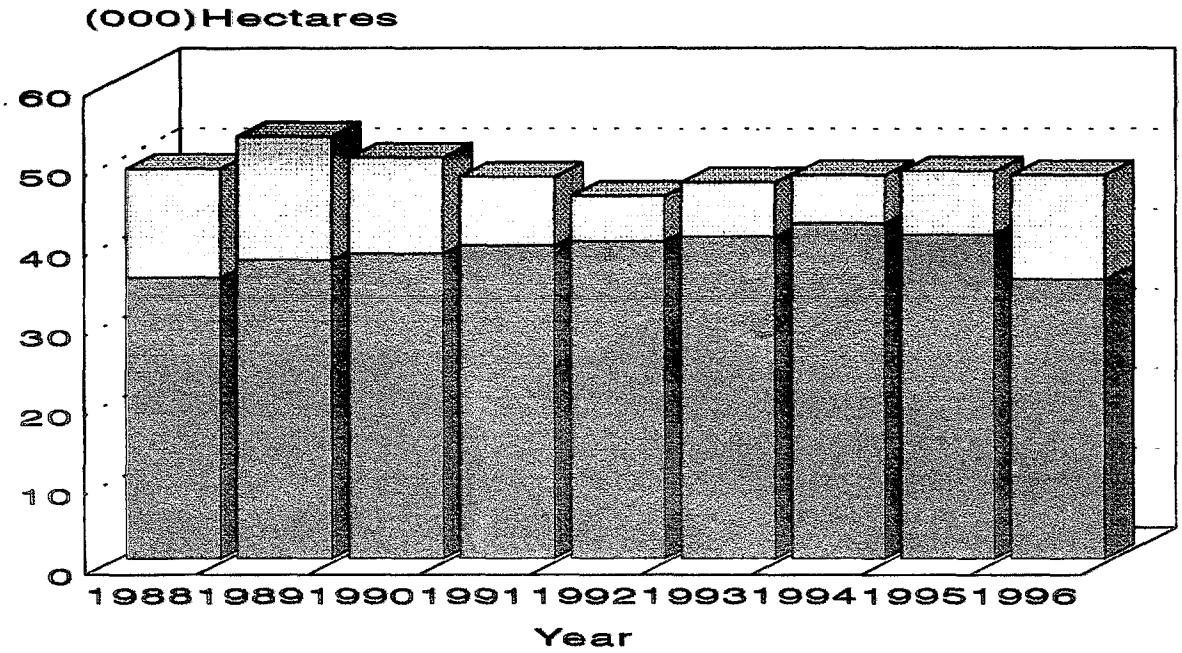
VI. THE COCA-COCAINE SUB-ECONOMY AND BOLIVIA

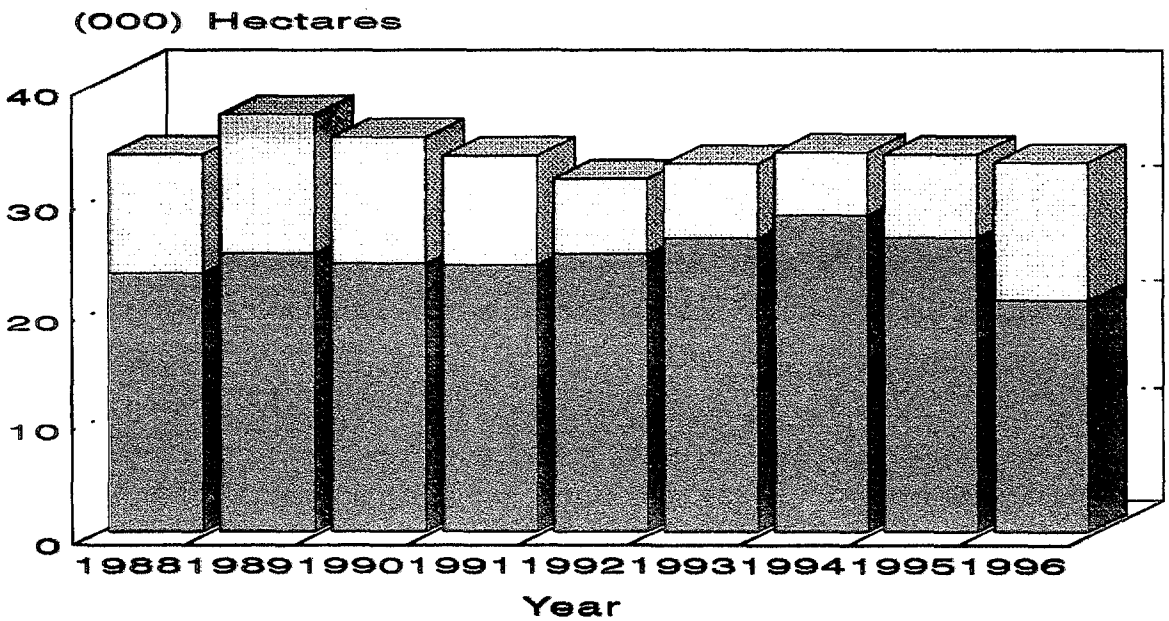
NET AREA OF CULTIVATED COCA: NATIONWIDE
(Has.)



Mature Immature

GRAPH 1A

NET AREA OF CULTIVATED COCA: CHAPARE
(Has.)



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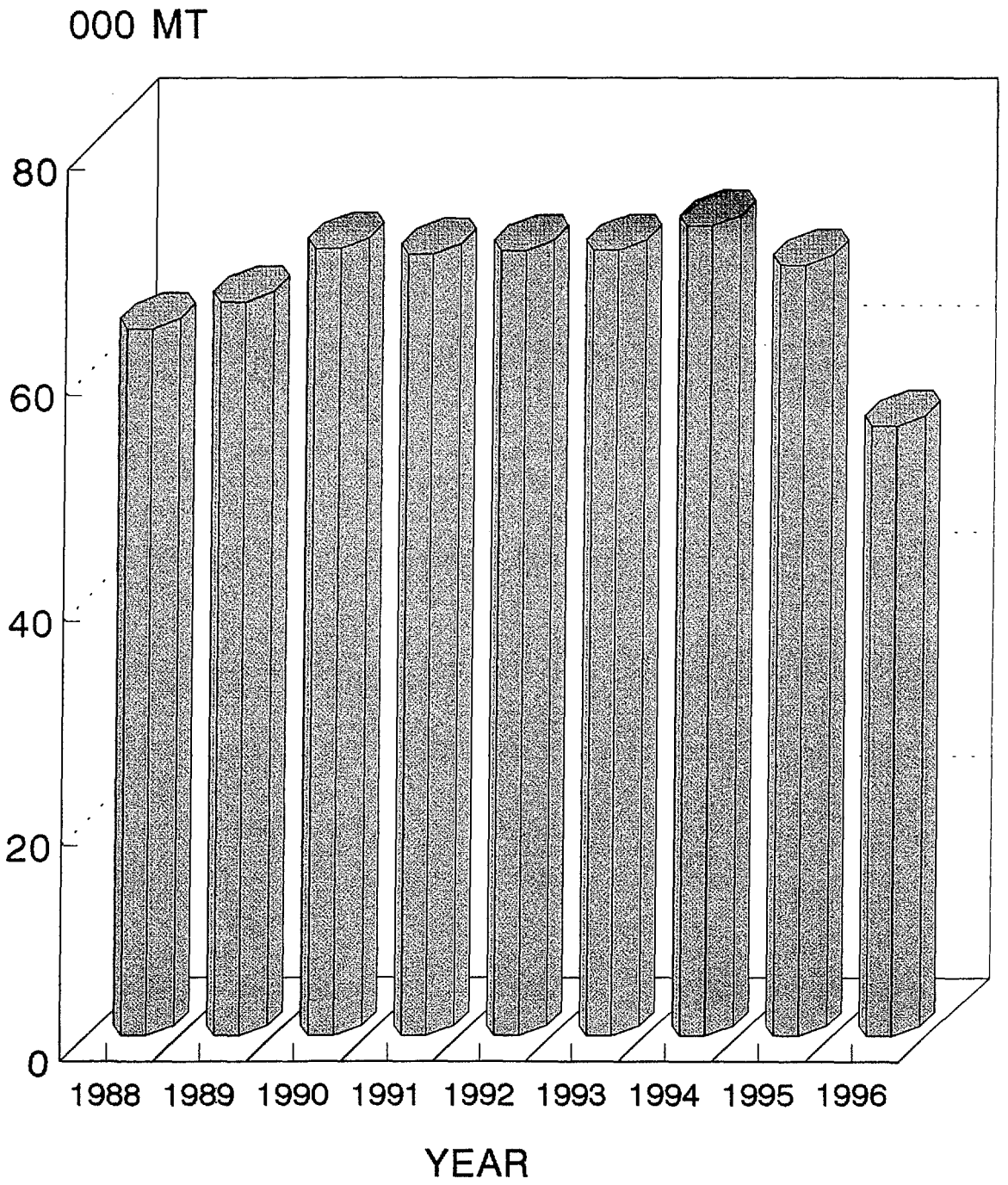
GRAPH 1B

ILLICIT COCA LEAF PRODUCTION

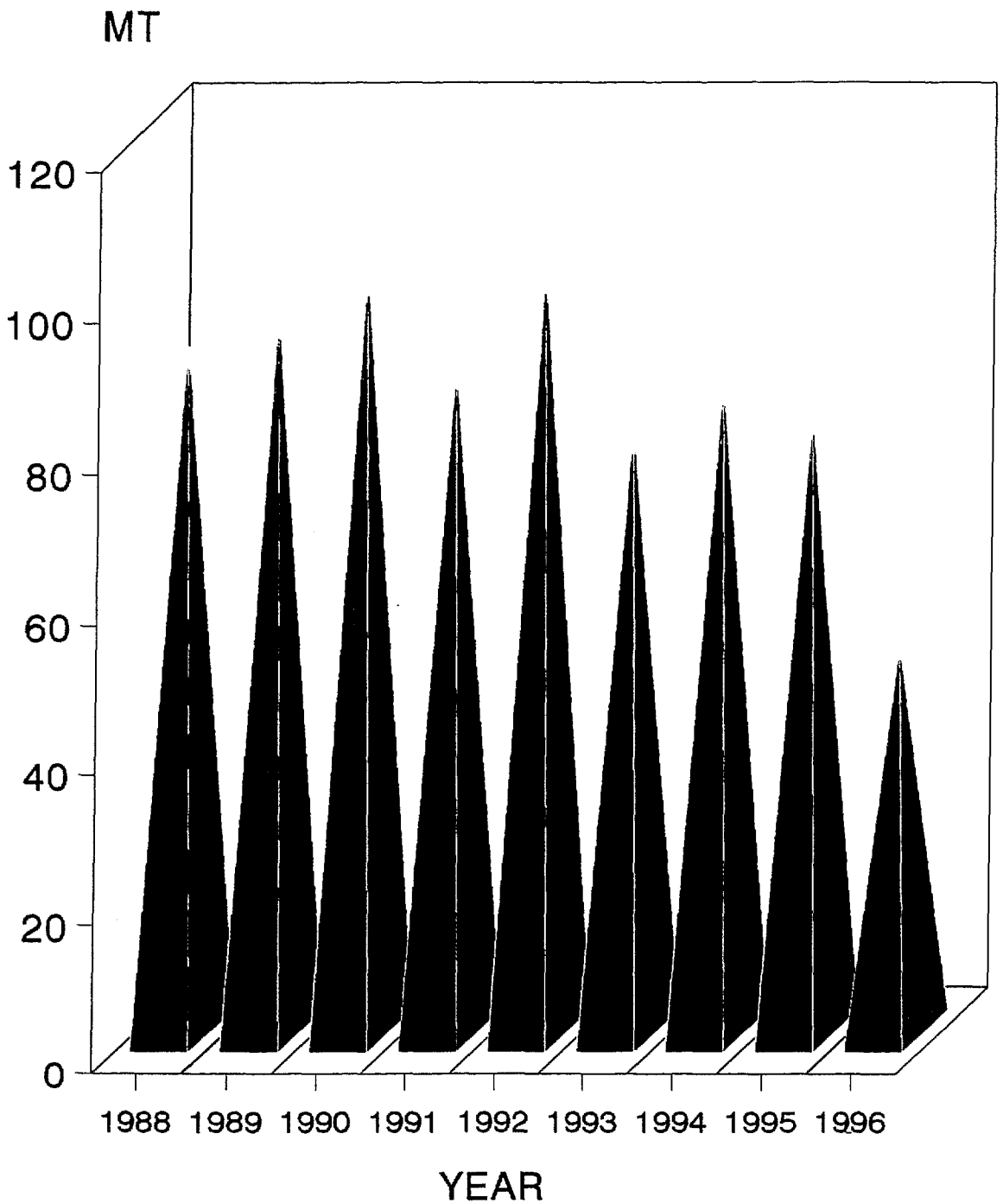
Gross Production



GRAPH 2

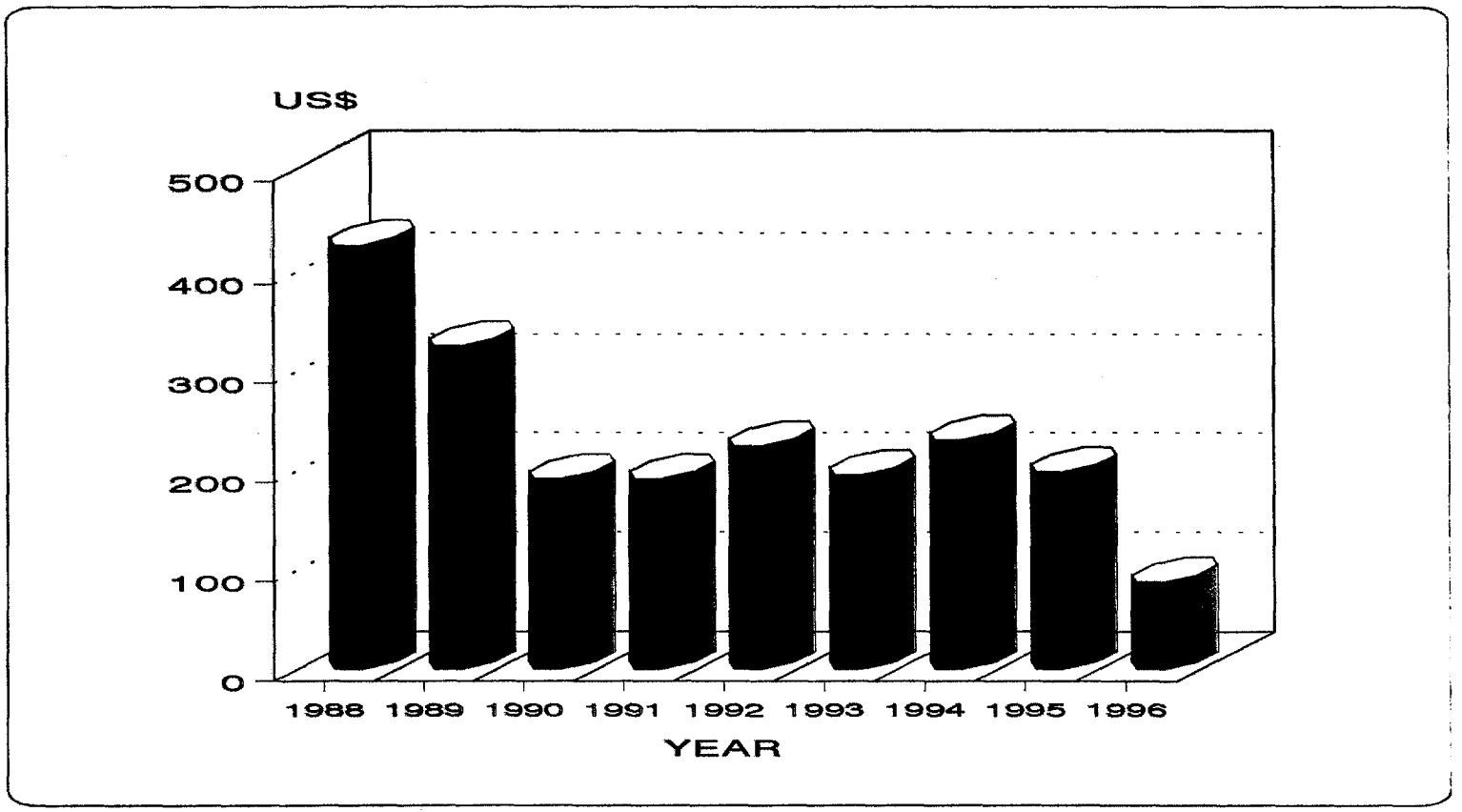
COCAINE HYDROCHLORIDE PRODUCTION

Gross Production



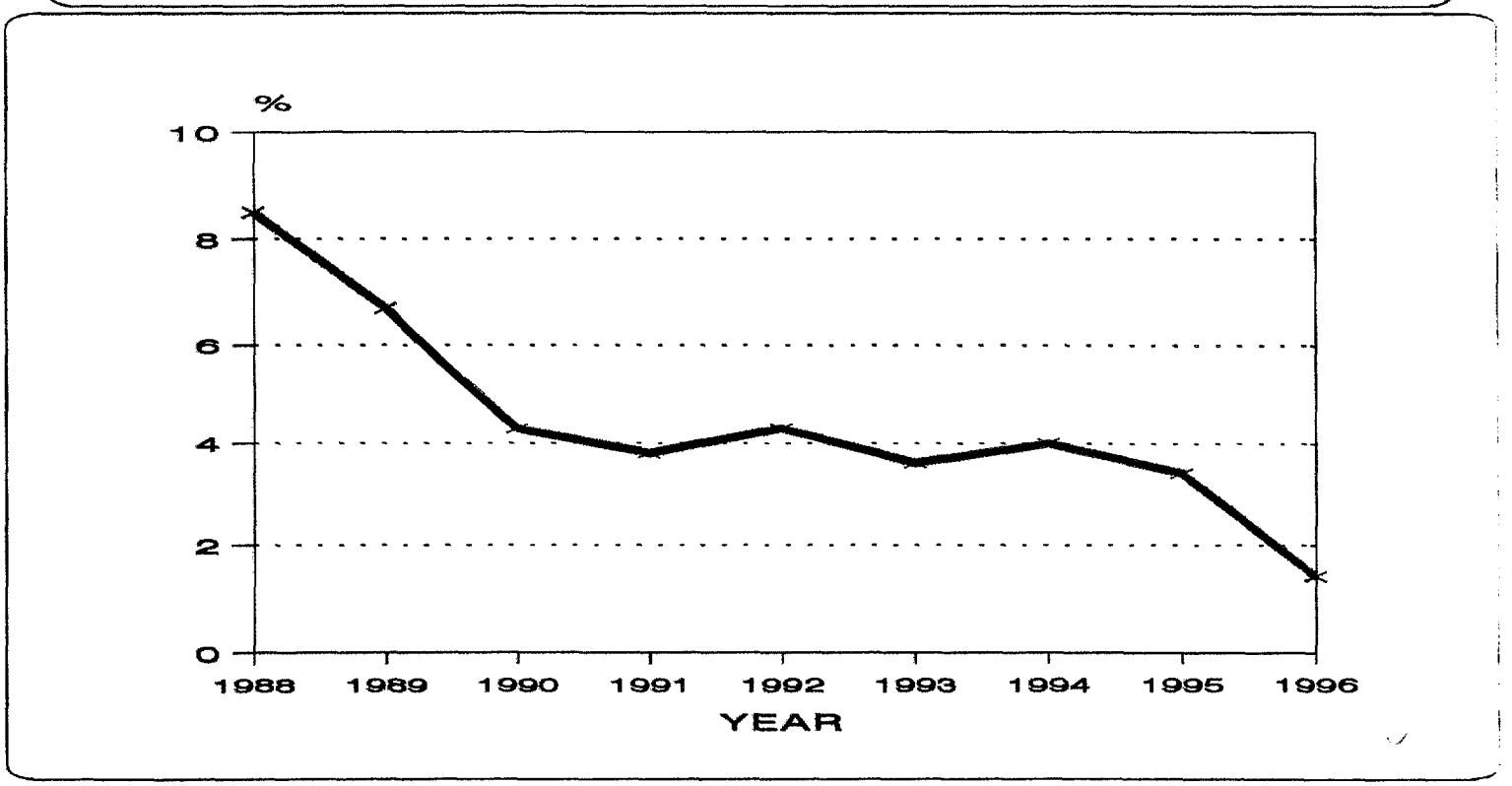
GRAPH 3

NET VALUE ADDED
(mill of US$)



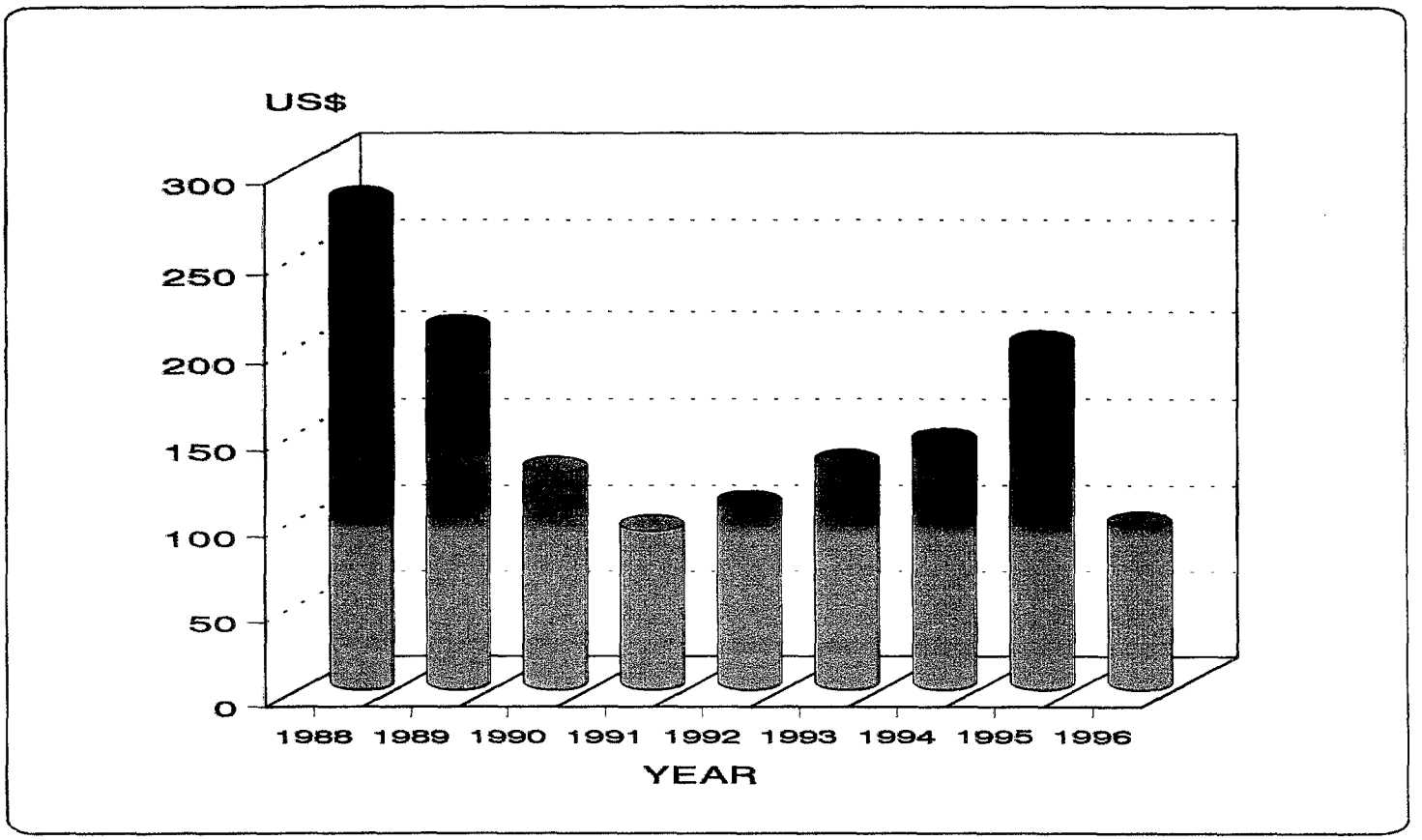
GRAPH 4A

NET VALUE ADDED AS A % OF GDP



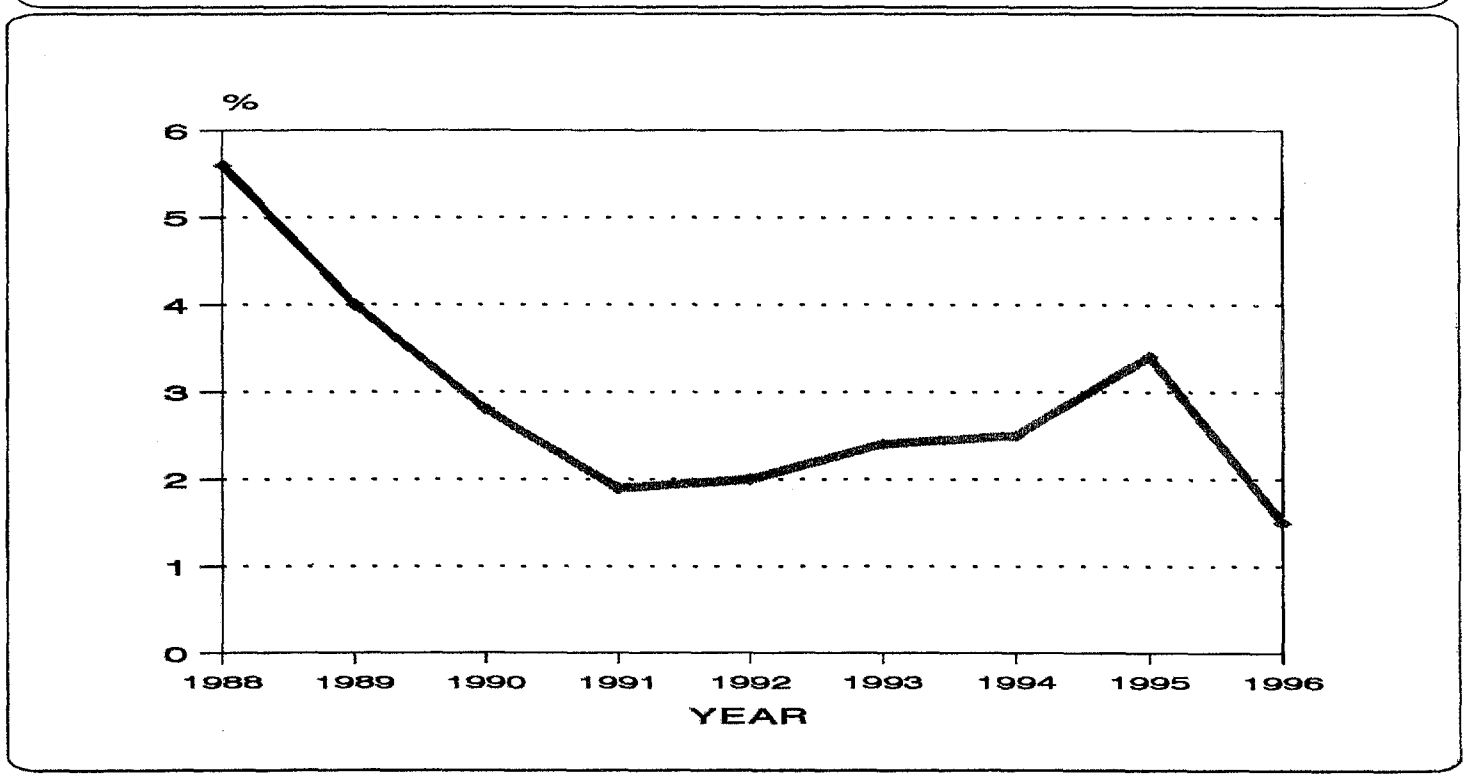
GRAPH 4B

NET VALUE ADDED RETAINED IN COUNTRY
(mill of US$)



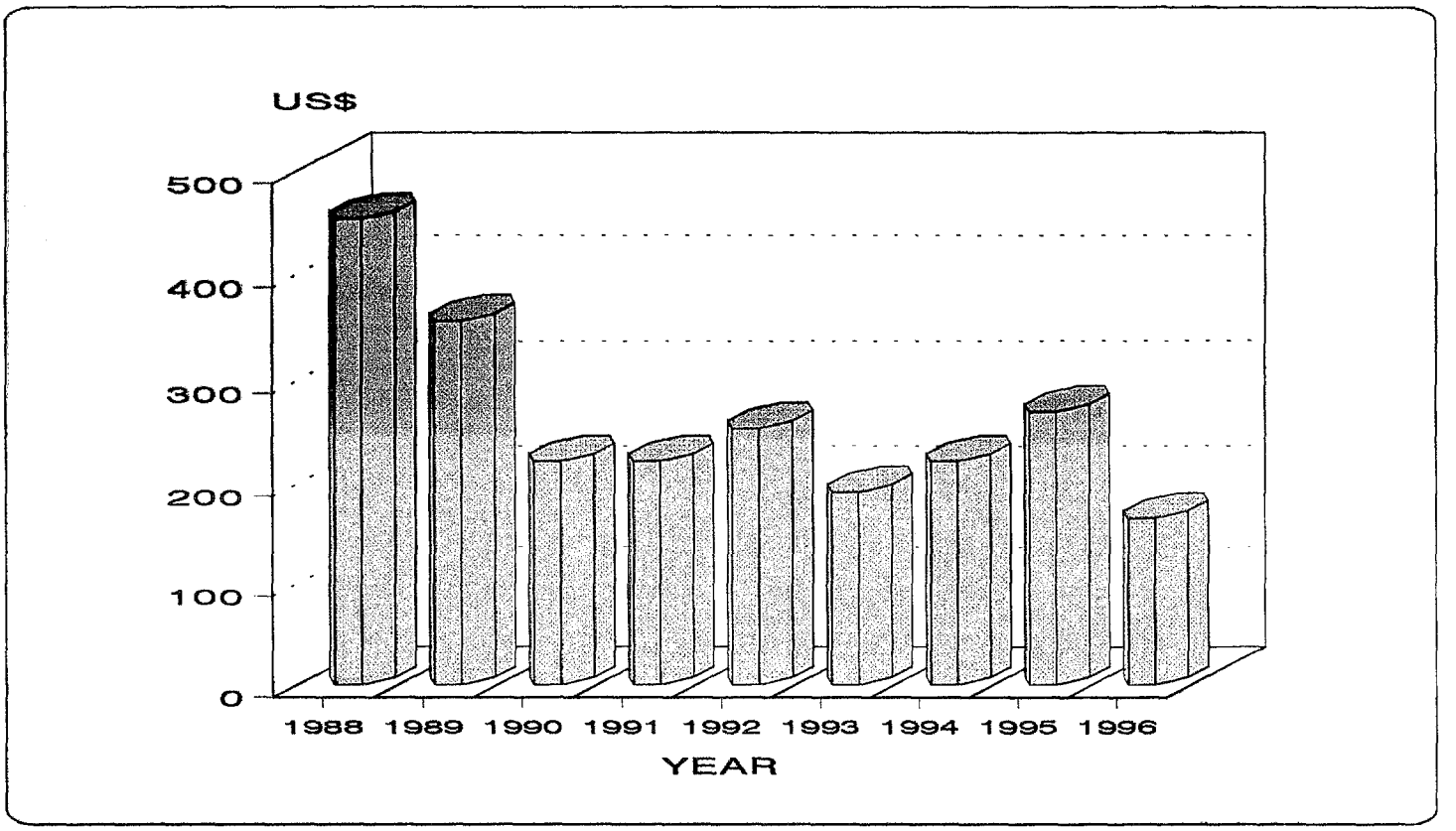
GRAPH 5A

NET VALUE ADDED RETAINED IN COUNTRY AS A % OF GDP



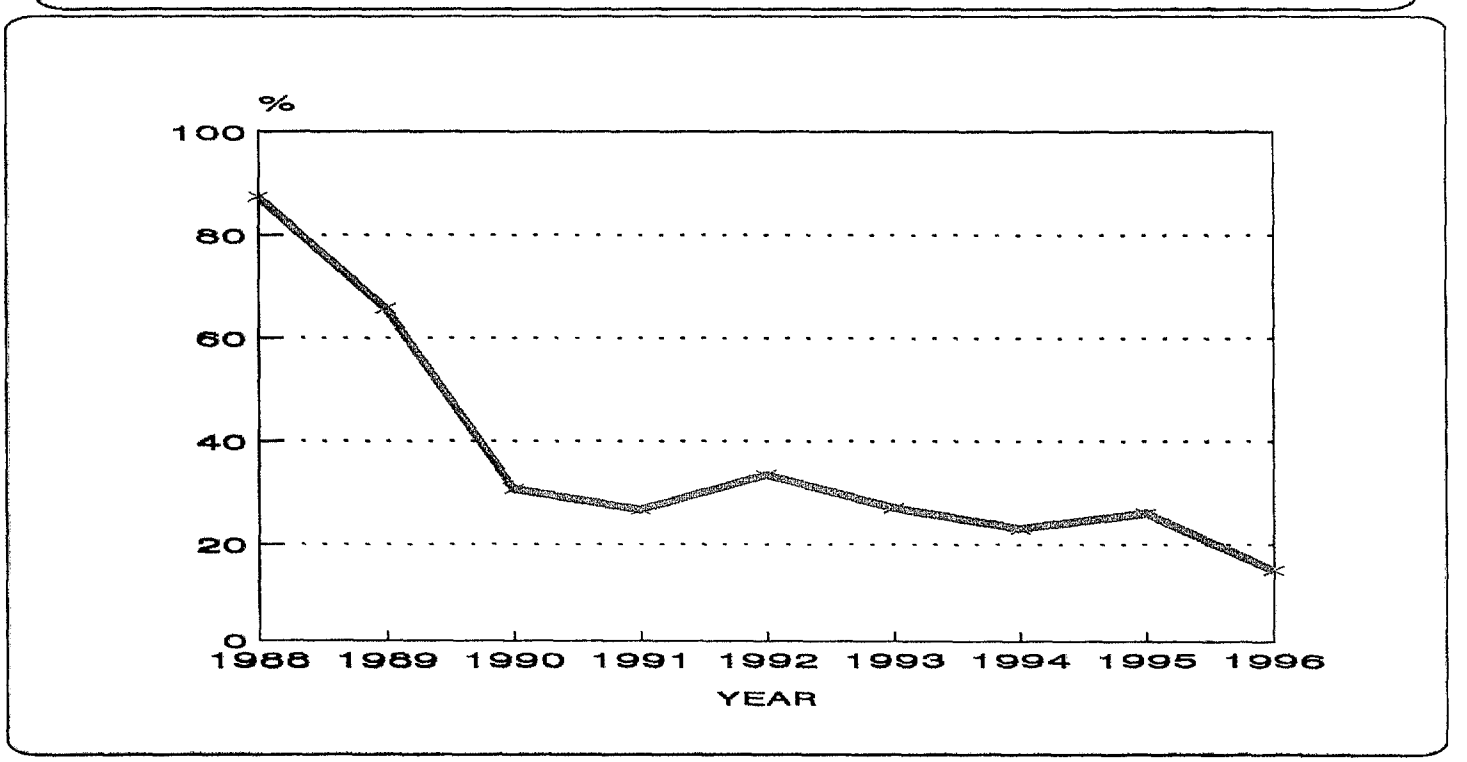
GRAPH 5B

COCA-COCAINE EXPORTS
(mill of US$)



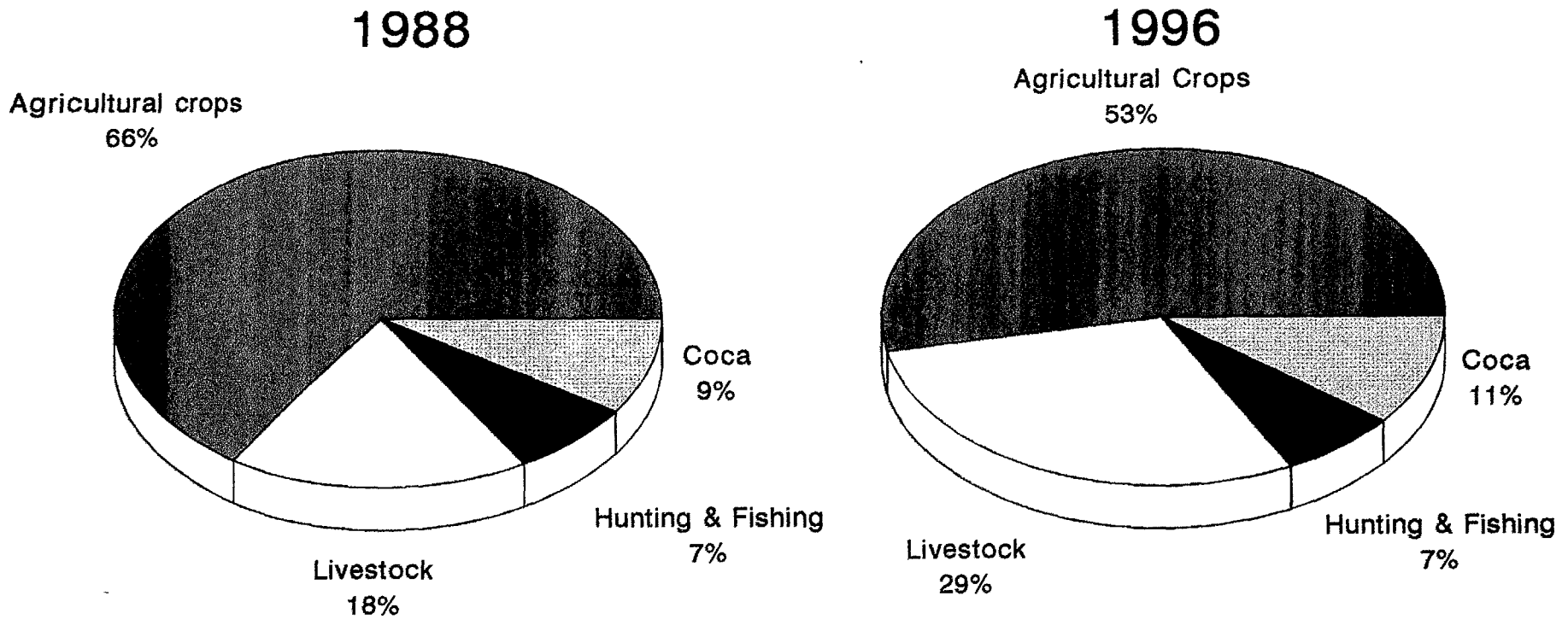
GRAPH 6A

COCA-COCAINE EXPORTS AS A % OF LEGITIMATE MERCHANDISE EXPORTS



GRAPG 6B

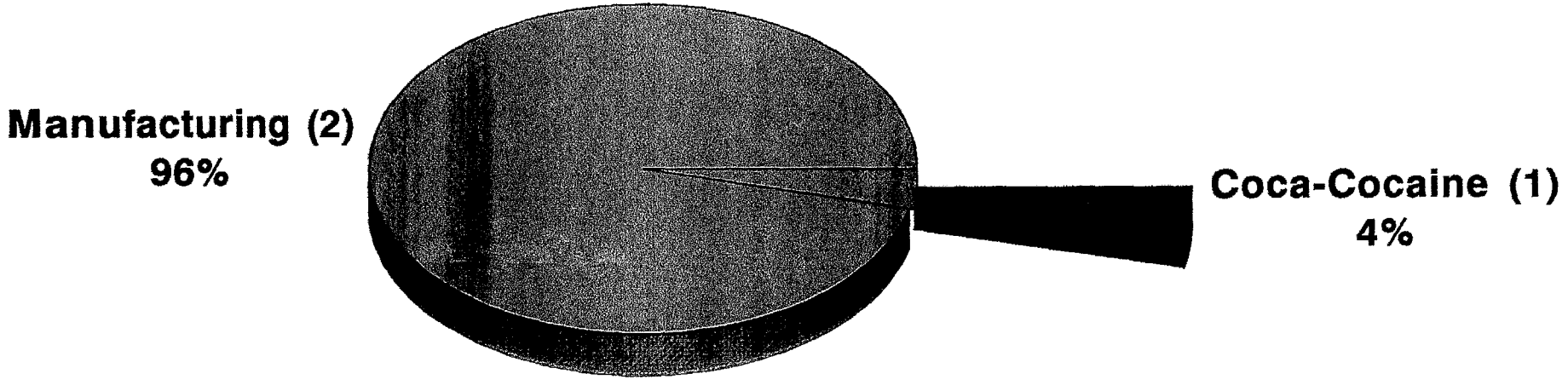
BOLIVIAN AGRICULTURAL SECTOR
(Includes Excess Coca Production)



GRAPH 7

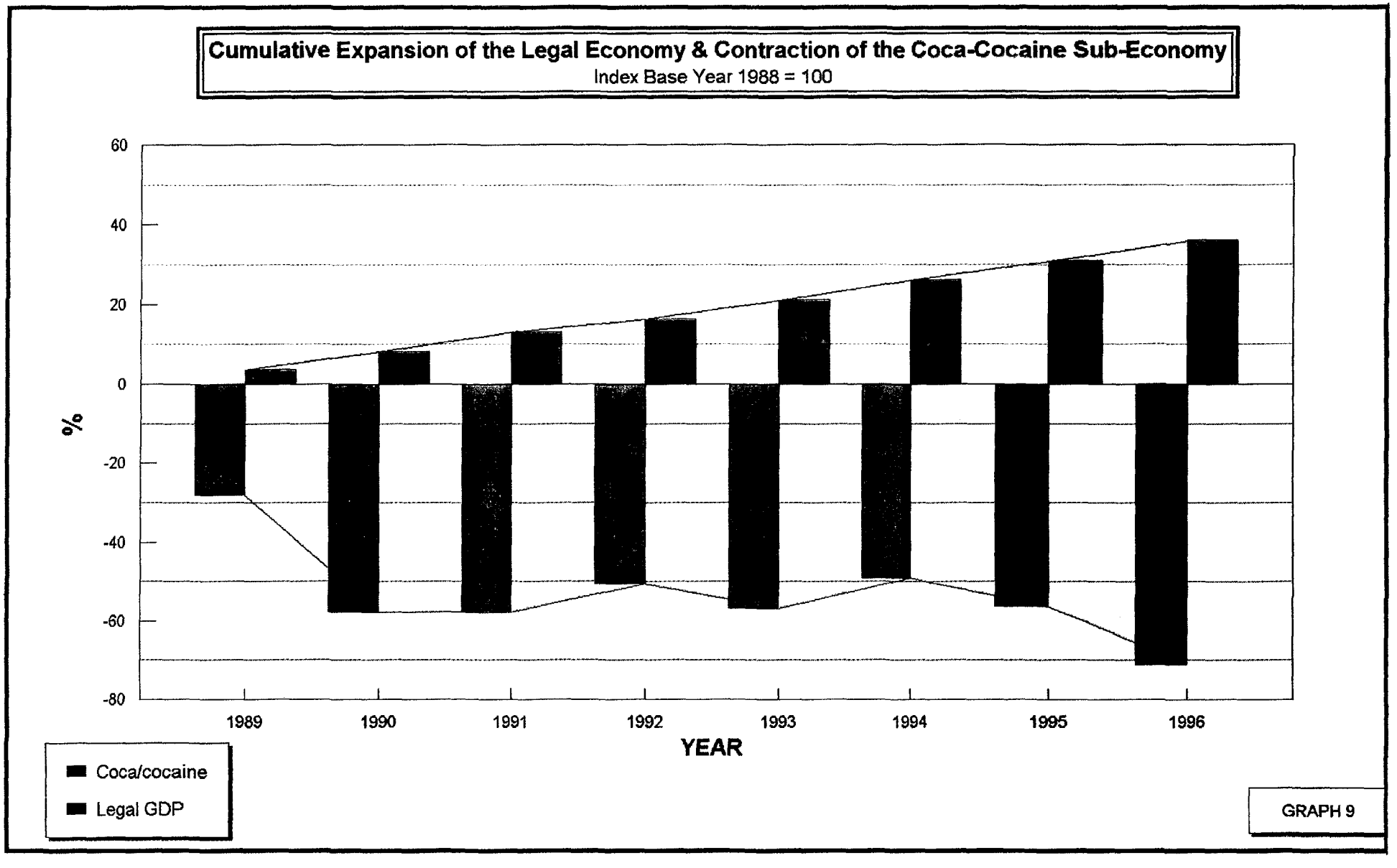
BOLIVIA'S "MANUFACTURING" SECTOR: 1996

Cocaine vs. Non-cocaine



1) (excl. coca leaf production)
2) (manufacturing sector value added)

Graph 8


Cumulative Expansion of the Legal Economy & Contraction of the Coca-Cocaine Sub-Economy
Index Base Year 1988 = 100
60
40
20
0
-20
-40
-60
-80
%
1989
1990
1991
1992
1993
1994
1995
1996
YEAR
Coca/cocaine
Legal GDP
GRAPH 9

VII. COCA PRICES, SEIZURES AND ERADICATION

GRAPHS 10 - 12

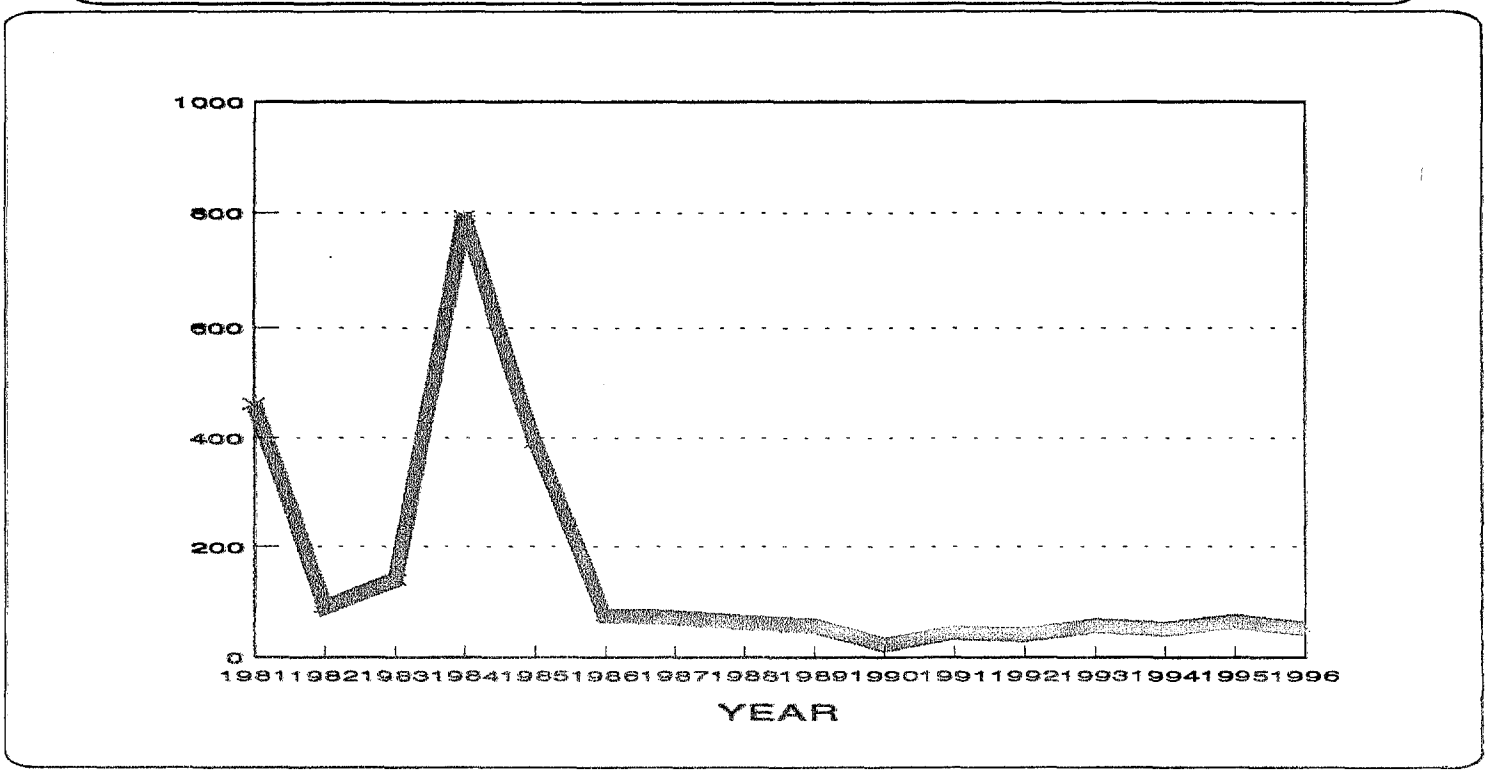
Prices for 1981-1985 are based on scattered but consistent available data. Due to the hyperinflation and the nascent state of the coca/cocaine industry, prices fluctuated considerably among markets and even within the same day.

Coca price behavior has always been hard to predict. While in 1986 and 1987 prices had a downward trend, from a high price of $150/100 lbs. in April of 1986, to about $41 by December of 1987, prices increased again in 1988 exceeding $100 in some periods (see graph 11A). In 1989, prices declined again and in 1990 rebounded. Although coca prices have always fluctuated, its trend in 1991 remained relatively stable for the year. During the period of 1992 through 1994 coca prices had an upward trend increasing from $26/100 lbs. in January 1992 to almost $80 in December 1994. Prices remained relatively stable in 1995 averaging about $65/100 lbs. for the year. The average price in 1996 declined to $52/00 lbs.

Since a formal eradication program began, the lowest 12-month moving average of 79 eradicated hectares was recorded in March, 1995 (see graph 12). However, after the USG announced a possible decertification of Bolivia, eradication jumped to a record high of 1,569 hectares in June 1995. The 12-month moving average has increased gradually and reached a record high of 671 hectares in November 1996.

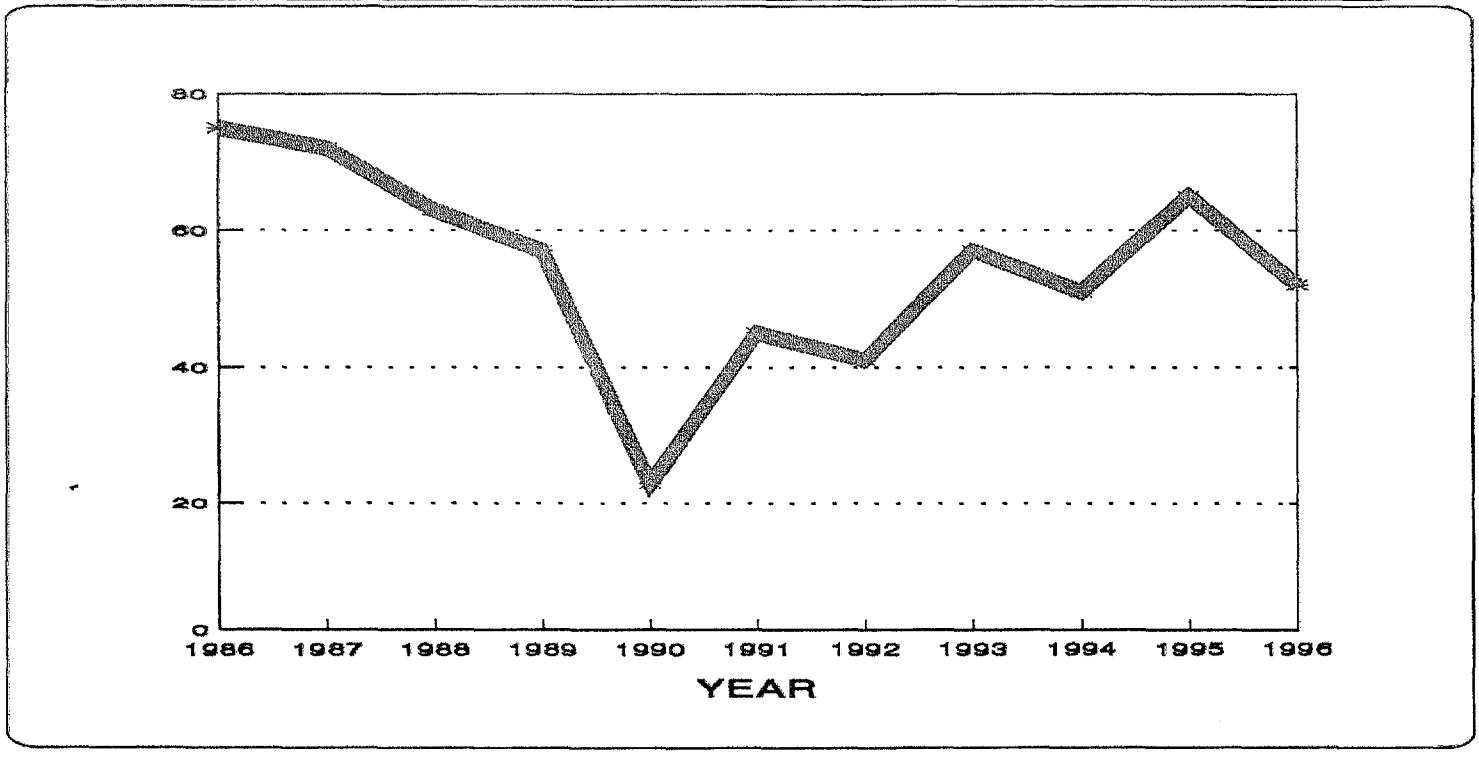
Finally, graph 12 also shows a negative correlation between the number of hectares eradicated and coca prices.

ANNUAL AVERAGE COCA PRICES: 1981 - 1996
(per 100 lb)



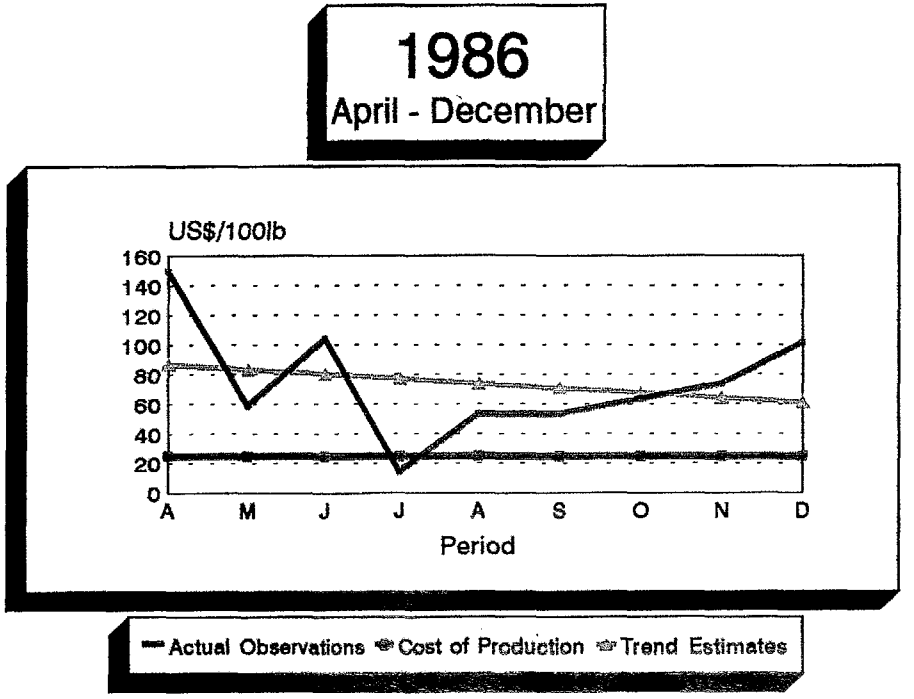
GRAPH 10A

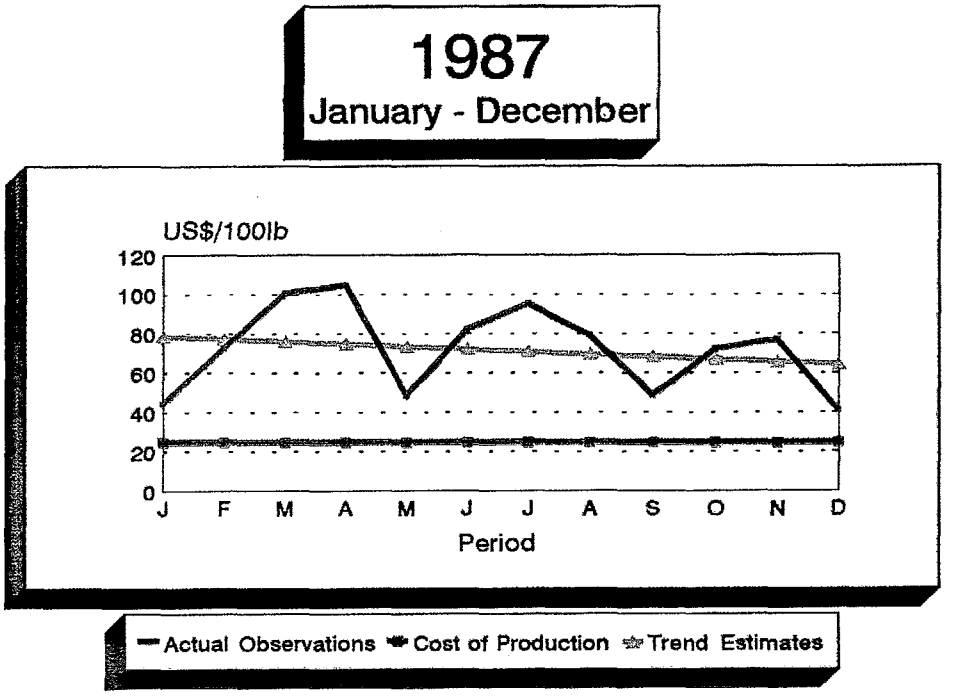
ANNUAL AVERAGE COCA PRICES: 1986 - 1996
(per 100 lb)

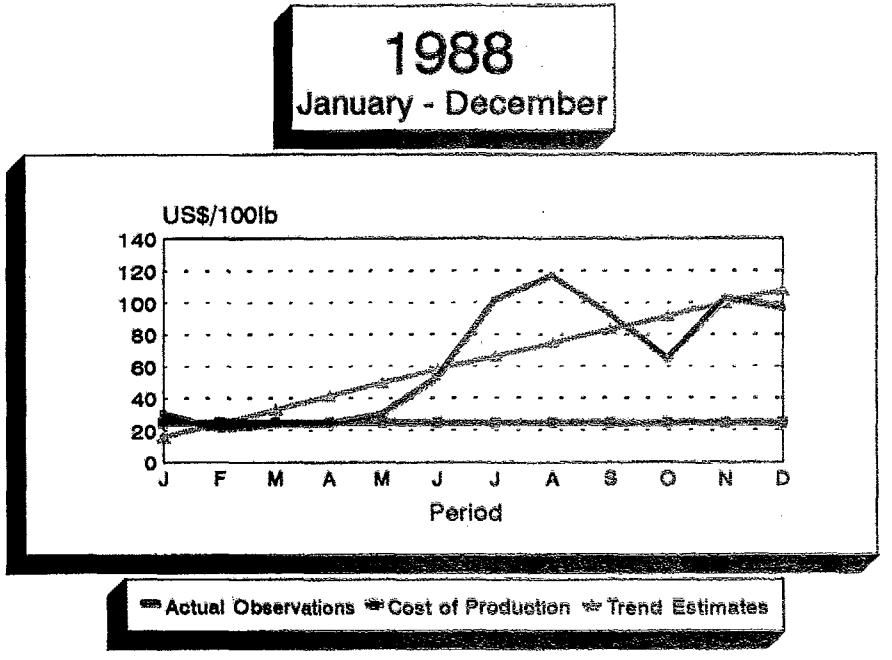


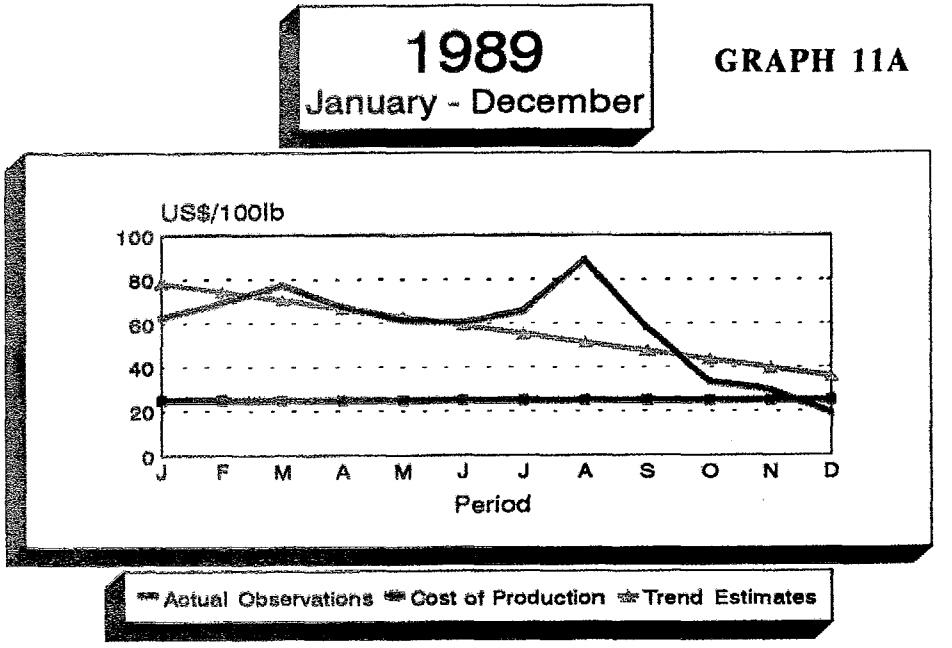
GRAPH 10B

COCA PRICES AND THEIR TREND
1986 - 1989



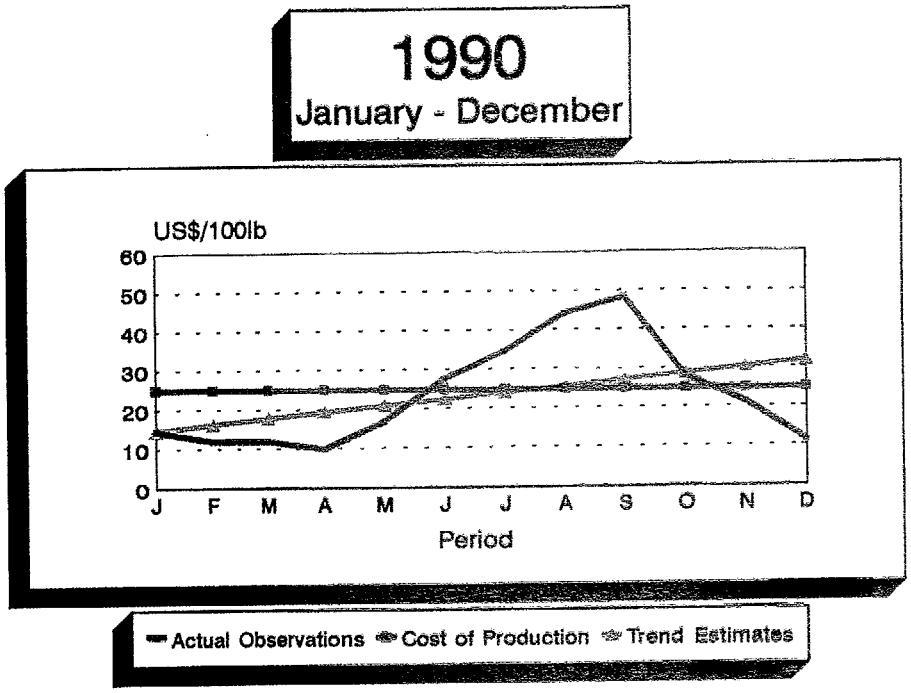


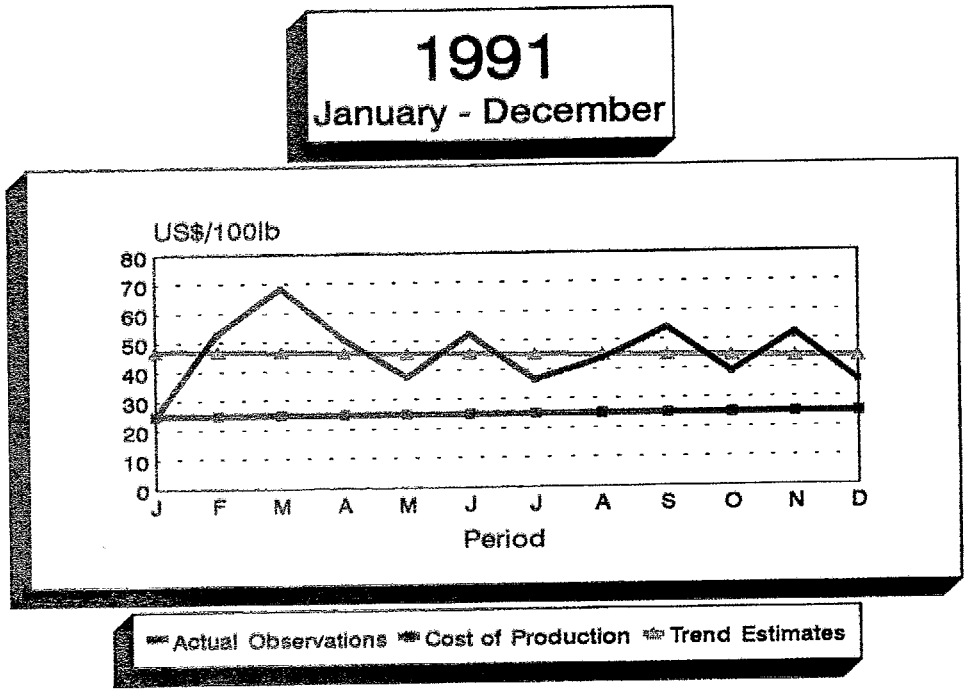


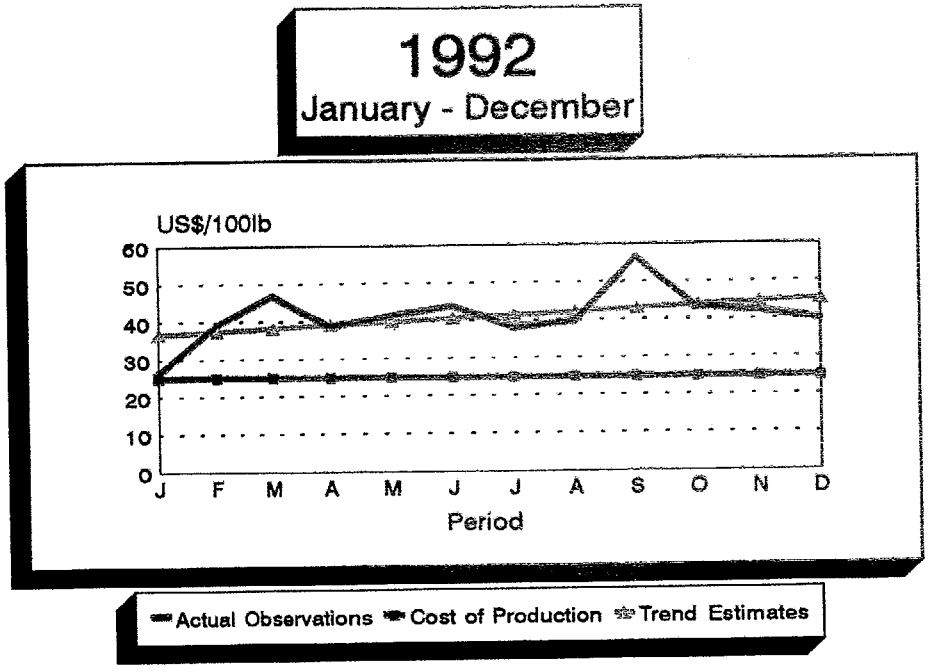


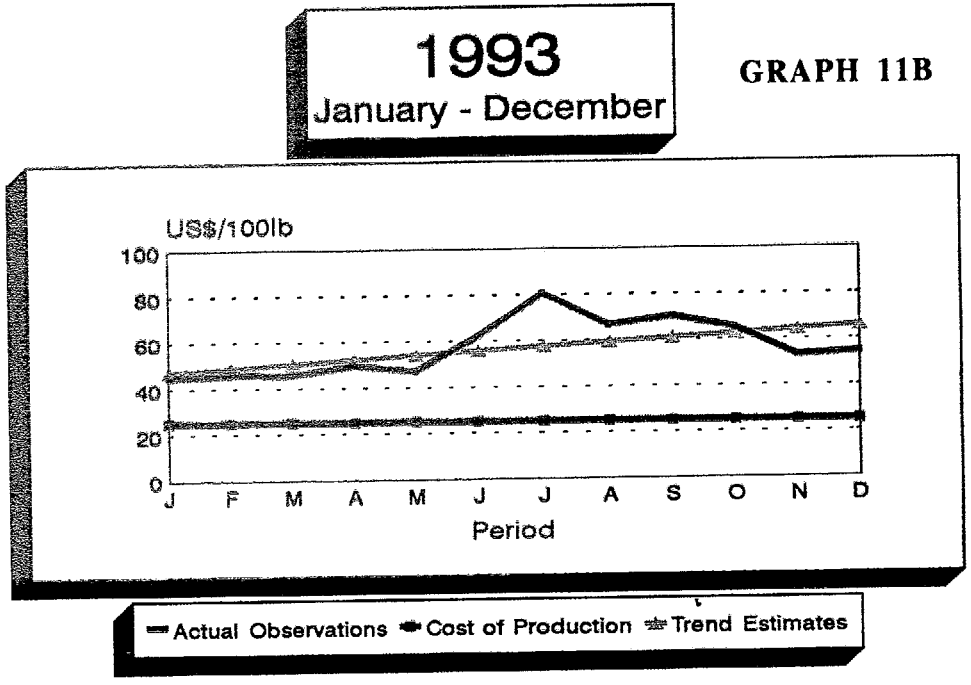
GRAPH 11A

COCA PRICES AND THEIR TREND
1990 - 1993



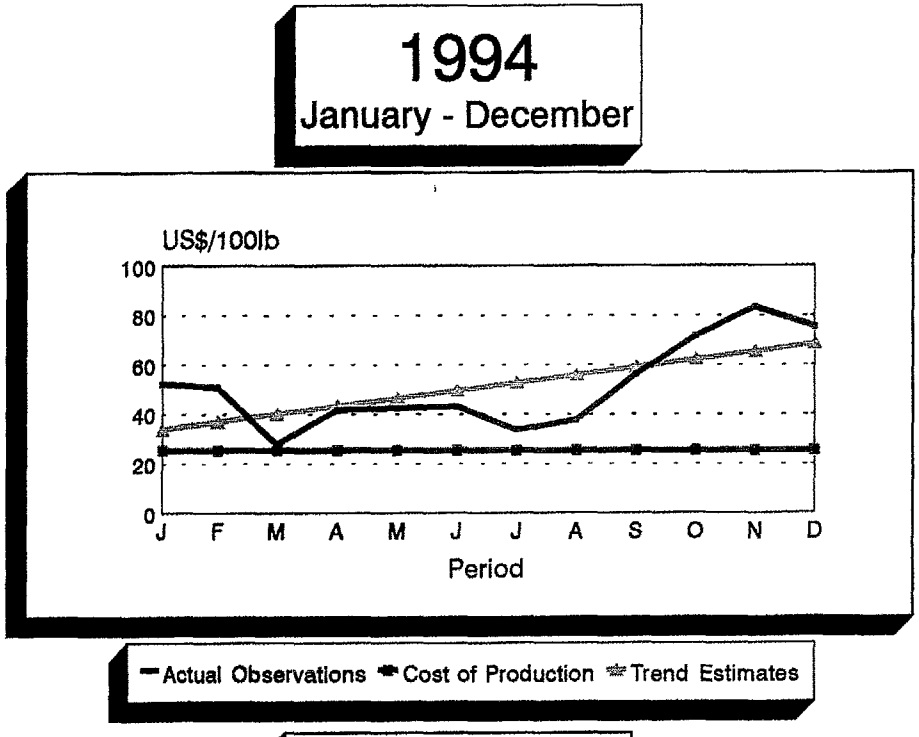


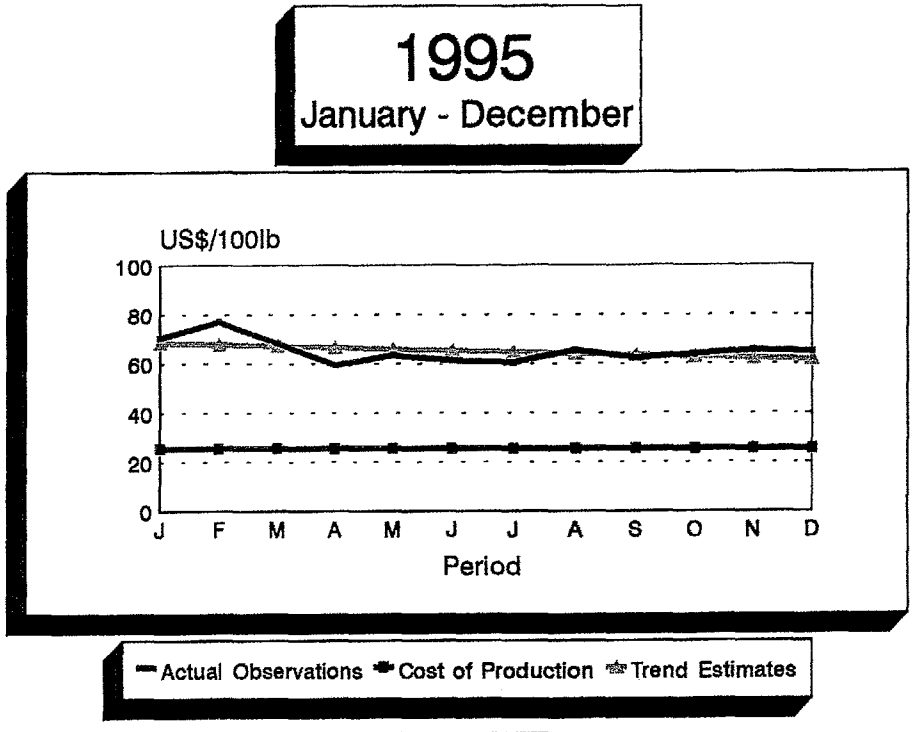


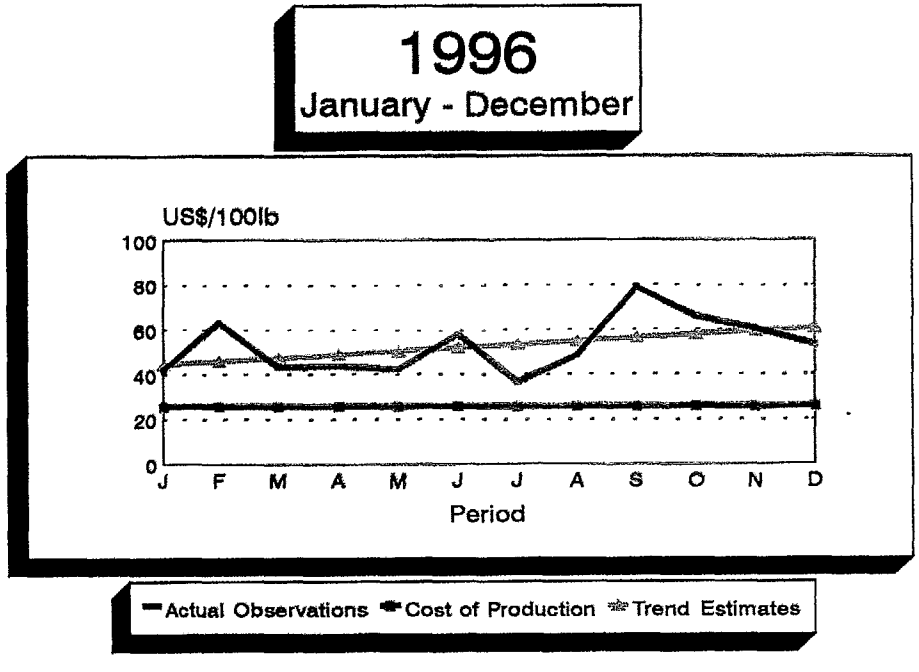


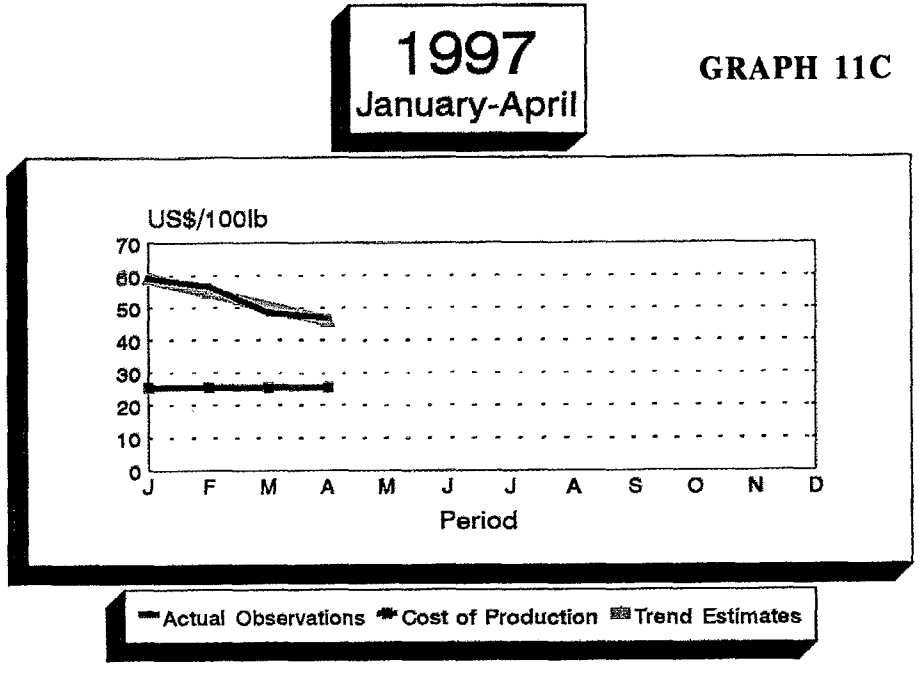
GRAPH 11B

COCA PRICES AND THEIR TREND
1994 - 1997





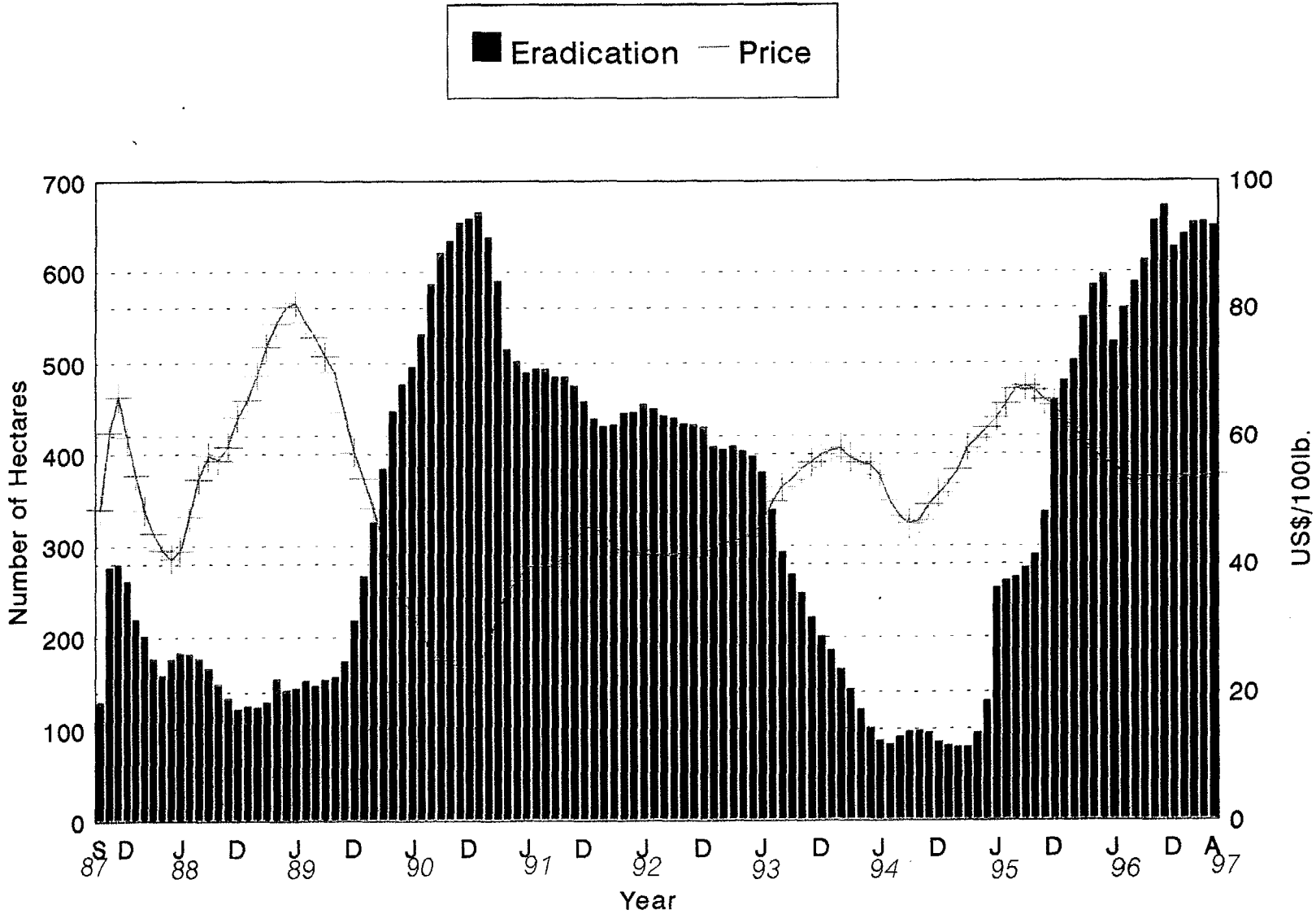




GRAPH 11C

MOVING AVERAGE ERADICATION AND PRICES

September 1987 - April 1997



GRAPH 12

POINT INDICATORS (Has. and US$)

Apr97 eradication 374	Mar97 eradication 626	Erad.Mov.Avg.Apr97 649	Erad.Mov.Avg.Apr96 583
Apr97 coca price 46.4	Mar97 coca price 47.9	Price Mov.Avg.Apr97 53.8	Price Mov.Avg.Apr96 57.6

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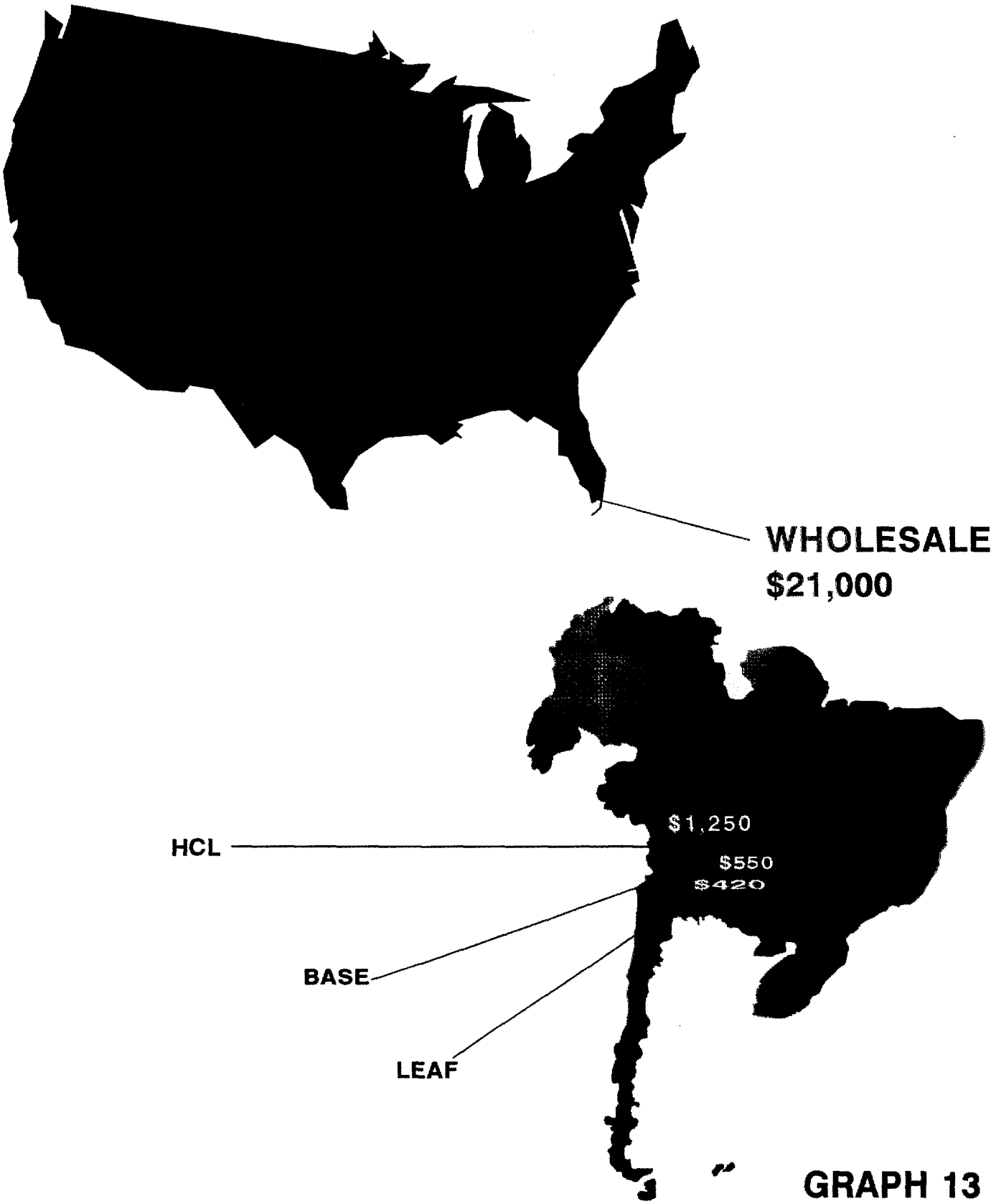
Average Value of 1 Kg. of HCL
Producer, Wholesale and Retail Prices



GRAPH 13

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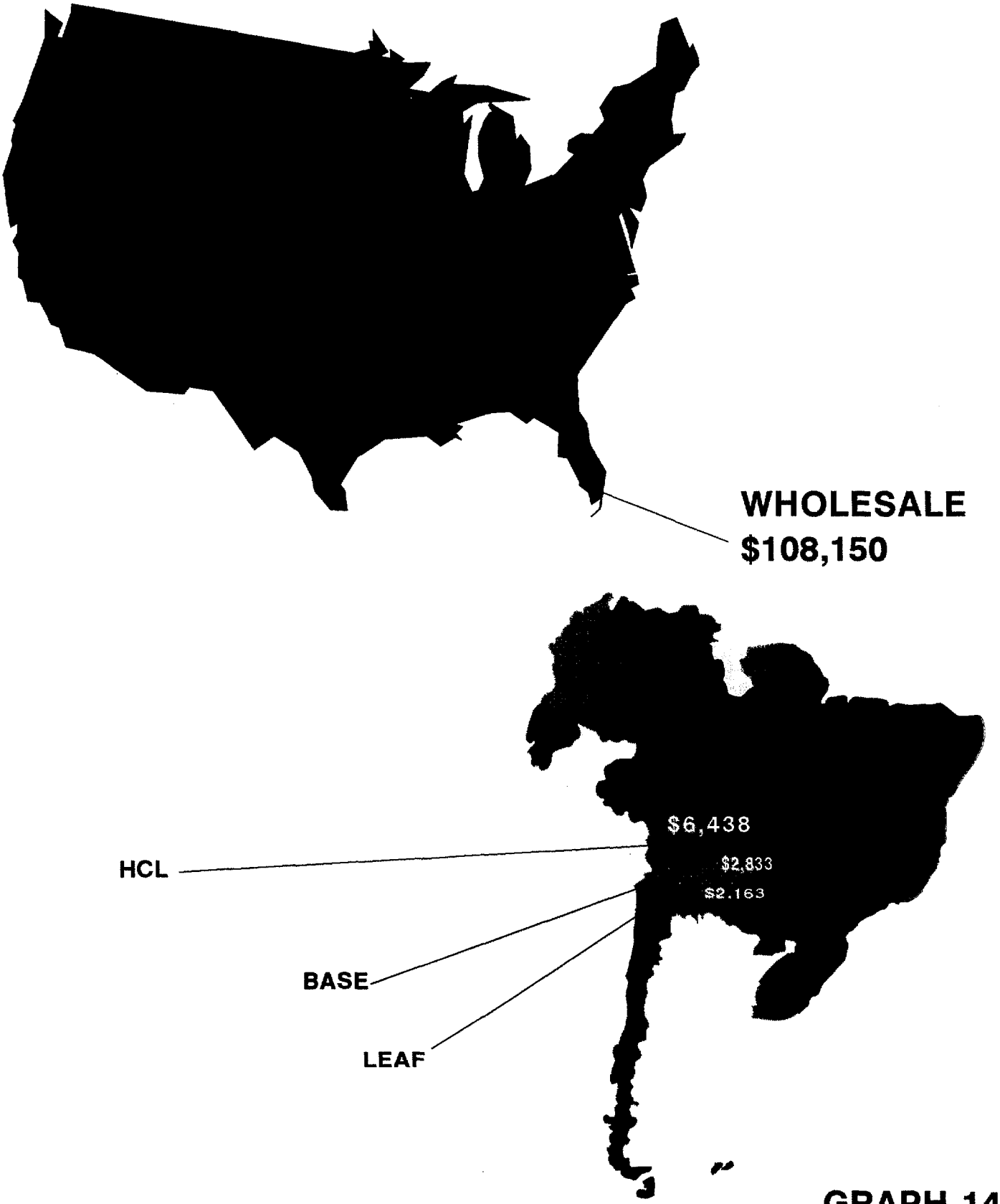
Average Value of HCL per Hectare Producer, Wholesale and Retail Prices



GRAPH 14

TABLE 13

ESTIMATED NET INCOME AT DIFFERENT STAGES OF THE MARKETING CHAIN (Mill US$)			
	Net Value Added of the Coca-Cocaine Economy in Bolivia	Wholesale Net Value Added in the U.S.(1)	Retail Value Added in the U.S.(2)
Total	131	-	-
Coca Leaf	61	-	-
Coca Base	5	-	-
HCL	65		
Estimated Annual Average Value Added	-	3,292	8,432
Low Range	-	1,045	1,143
High Range	-	4,171	17,091

(1) Based on DEA data. The low range is estimated at $10,500/Kg and the high range at $40,000/Kg., for an average of $25,250/Kg. The net value added is measured by a rough estimate of wholesale market value minus HCL market value at Bolivian (fob) prices.

(3) Based on DEA data. The low range is estimated at $20,000/Kg. and the high range at $200,000/Kg., for an average of $110,000/Kg. The net value added is measured by a rough estimate of retail market value minus wholesale market value.

SOURCE:ECON/USAID

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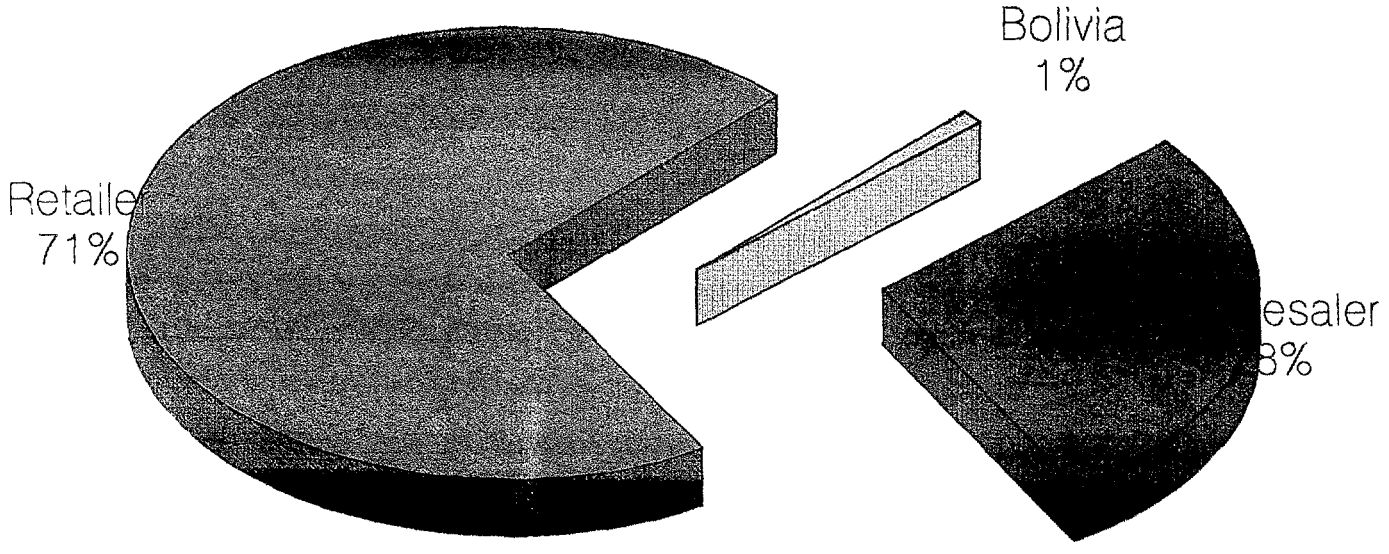
WHO PROFITS FROM BOLIVIA'S COCA-COCAINE ECONOMY

(% of total value added)



GRAPH 15

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TABLES 14 - 18

Tables 14 through 18 attempt to estimate the value of seized coca leaf and coca derivatives for the period of 1988 to 1995.

Table 14 shows the seized amounts and as a percentage of Bolivian gross production for each stage.

Table 15 shows the seized amounts in cocaine hycrochloride equivalent. Seizures in 1996 were equivalent to about 10.2 metric tons, some 2 metric tons less than in 1995.

Table 17 shows the U.S. wholesale of these seizures. In 1996, the GOB-US interdiction efforts prevented the entrance into the U.S. of some $256 million worth of HCL.

Table 18 shows the U.S. retail value of the amount of drug that did not get distributed in the consuming countries which totaled more than $1.1 billion in 1996.

TABLE 14

SUMMARY OF RESULTS SEIZED COCA LEAF AND COCA DERIVATIVES	1988	1989	1990	1991	1992	1993	1994	1995	1996
Coca Leaf									
Seized (MT)	17.00	42.00	62.00	5.45	188.90	201.25	202.13	50.95	76.22
as a % of Gross Production	0.03	0.06	0.09	0.01	0.27	0.29	0.28	0.08	0.14
Coca Paste									
Seized (MT)	8.16	9.95	11.23	0.94	0.33	0.01	0.02	0.05	0
as a % of Gross Production	1.25	1.47	1.55	0.13	0.05	*	*	*	*
Coca Base									
Seized (MT)	1.34	10.90	2.30	3.12	7.70	5.30	6.44	4.45	4.32
as a % of Gross Production	0.64	5.05	0.99	1.36	3.32	2.76	3.30	2.49	2.94
Cocaine									
Seized (MT)	0.21	1.04	0.16	0.32	0.70	0.31	1.02	7.59	3.17
as a % of Gross Production	0.23	1.09	0.16	0.36	0.69	0.39	1.19	9.61	6.26
"Agua Rica" (base equivalent)									
Seized (MT)	**	**	**	0.63	1.37	0.39	0.46	0.16	2.46
as a % of Gross Production	**	**	**	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

(*) Due to improvements in processing technologies for producing HCL, this stage of production has been largely eliminated beginning in 1993.
(**) Agua rica is s suspension of cocaine base in a weak acid solution. First seizures occurred in late 1991. According to DEA, 37 liters of "agua rica" equals one kilogram of cocaine base.

SOURCES: International Narcotics Control Strategy Report, 1988-1996.
Bolivia's Coca Subeconomy in 1996: A Computer Model, ECON/USAID, May 1997.

TABLE 15

SEIZURES IN HCL EQUIVALENT (Kgs.)	1988	1989	1990	1991	1992	1993	1994	1995	1996
Coca Leaf (1)	57	141	208	18	634	548	551	139	208
Coca Paste (2)(3)	2,534	3,090	3,488	292	102	-	-	-	-
Coca Base (4)	1,165	9,478	2,000	2,713	6,696	5,300	6,440	4,450	4,323
Cocaine	210	1,040	160	320	700	310	1,020	7,591	3,168
"Agua Rica" (base equiv.)(4)	0	0	0	546	1,194	385	456	163	2,459
TOTAL	3,966	13,749	5,856	3,889	9,326	6,544	8,467	12,342	10,158

(1) For the period 1988-92, 298 Kgs. of leaf is needed to produce 1 Kg. of HCL. For 1993-96, a conversion factor of 367 Kgs. is used.
(2) Coca paste to base conversion factor of 2.8 Kgs.
(3) Due to improvements in processing technologies for producing HCL, this stage of production was largely eliminated beginning in 1993.
(4) A conversion factor of 1.15 is used from coca base to HCL for the period 1988-92. A 1:1 conversion factor is used for 1993-96.

SOURCE: ECON/USAID

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TABLE 16

FOB (BOLIVIA) VALUE OF SEIZURES (Mill US$)	1988	1989	1990	1991	1992	1993	1994	1995	1996
Coca Leaf	0.19	0.35	0.36	0.04	1.27	1.10	1.10	0.28	0.26
Coca Paste (1)	8.24	7.73	6.10	0.58	0.20	0.00	0.00	0.00	0.00
Coca Base	3.79	23.70	3.50	5.43	13.39	10.60	12.88	8.90	5.40
Cocaine	0.68	2.60	0.28	0.64	1.40	0.62	2.04	15.18	3.96
"Agua Rica" (base equiv.)	0.00	0.00	0.00	1.09	2.39	0.77	0.91	0.33	3.07
TOTAL	12.89	34.37	10.25	7.78	18.65	13.09	16.93	24.68	12.70

(1) Due to improvements in processing technologies for producing HCL, this stage of production was largely eliminated beginning in 1993.

SOURCE: ECON/USAID based on INCSR basic information and DEA price reports.
1988 HCL prices: $2,500-4,000 per Kg., for an average of $3,250/Kg.
1989 HCL prices: $1,800-3,200 per Kg., for an average of $2,500/Kg.
1990 HCL prices: $1,000-2,500 per Kg., for an average of $1,750/Kg.
1991-95 HCL prices: $1,500-2,500 per Kg., for an average of $2,000/Kg.
1996 HCL prices: $1,100-1,400 per Kg., for an average of $1,250/Kg.

TABLE 17

U.S. WHOLESALE VALUE OF SEIZURES (Mill US$)	1988	1989	1990	1991	1992	1993	1994	1995	1996
Coca Leaf	1.31	3.24	5.31	0.47	16.80	13.85	13.91	3.51	5.24
Coca Paste (1)	58.29	71.07	88.93	7.44	2.72	0.00	0.00	0.00	0.00
Coca Base	26.80	218.00	51.00	69.18	177.43	133.83	162.61	112.36	109.16
Cocaine	4.83	23.92	4.08	8.16	18.55	7.83	25.76	191.67	79.99
"Agua Rica" (base equiv.)	0.00	0.00	0.00	13.92	31.65	9.73	11.52	4.11	62.09
TOTAL	91.23	316.23	149.32	99.17	247.15	165.23	213.79	311.65	256.49

(1) Due to improvements in processing technologies for producing HCL, this stage of production was largely eliminated beginning in 1993.

SOURCE: ECON/USAID based on INCSR basic information and DEA price reports.
1988-89: national average price between $11,000-35,000 per Kg., for an average of $23,000/Kg.
1990-91: national average price between $11,000-40,000 per Kg., for an average of $25,500/Kg.
1992: national average price between $11,000-42,000 per Kg., for an average of $26,500/Kg.
1993-96: national average price between $10,500-40,000 per Kg., for an average of $25,250/Kg.

TABLE 18

U.S. RETAIL VALUE OF SEIZURES* (Mill US$)	1988	1989	1990	1991	1992	1993	1994	1995	1996
Coca Leaf	5.39	13.32	21.85	1.92	52.30	58.95	60.58	15.27	22.85
Coca Paste (1)	239.48	292.01	366.20	30.65	8.45	-	-	-	-
Coca Base	110.11	895.70	210.00	284.87	552.39	569.75	708.40	489.50	475.53
Cocaine	19.85	98.28	16.80	33.60	57.75	33.33	112.20	835.01	348.48
"Agua Rica" (base equiv.)	0.00	0.00	0.00	57.32	98.53	41.42	50.17	17.89	270.50
TOTAL	374.83	1,299.31	614.84	408.37	769.43	703.44	931.35	1,357.67	1,117.36

* Without considering difference in purity. If included, values could increase up to 28 percent.
(1) Due to improvements in processing technologies for producing HCL, this stage of production was largely eliminated beginning in 1993.

SOURCE: ECON/USAID based on INCSR basic information and DEA price reports.
1988-89: due to lack of data, national average price is estimated from wholesale values for an average of $94,500/Kg.
1990-91: national average price between $35,000-175,000 per Kg., for an average of $105,000/Kg.
1992: national average price between $15,000-150,000 per Kg., for an average of $82,500/Kg.
1993: national average price between $15,000-200,000 per Kg., for an average of $107,500/Kg.
1994-96: national average price between $20,000-200,000 per Kg., for an average of $110,000/Kg.

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