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Impact of the International Coffee Agreement's Export Quota System on the World's Coffee Market

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The new global coffee model shows which producing countries have gained and which have lost from the operation of the International Coffee Agreement — and what would happen if the Agreement were discontinued.

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Ex-post simulations of the global coffee model over the recent period of operation of the International Coffee Agreement's export quota system, 1981-86, show the following. The quota system had a stabilizing effect on world coffee prices in the 1981-85 period. In 1986, when coffee prices increased sharply due to the drought in Brazil and the export quotas were suspended, prices would have been 24 percent higher in the absence of the quotas over the 1981-85 period. But the quotas have reduced export revenues (in real terms), except for such large producers as Brazil and Columbia. These countries gained from the scheme because they face very small or even zero marginal export revenues from increased exports, due to their large market shares.

In projections of the coffee market, with and without the export quota system, prices would be substantially lower during the first half of the 1990s if the quota system were suspended in 1990. But prices would recover in the second half of the decade as production and exports declined in lagged response to the very low prices of the first half.

For 1990-2000 most producing countries would be better off in total real export revenues with the export quota system. But the extent of the benefits vary considerably from one country to another. Low-cost countries — such as Costa Rica, Indonesia, the Philippines, and Papua New Guinea — could more than compensate for the lower world prices under the without-quota situation by large increases in exports. High-cost countries — such as Côte d'Ivoire, El Salvador, Ethiopia, and India — would suffer both from the lower prices and lower export quantities without the export quota scheme. The two largest producers — Brazil and Columbia — would also benefit from the extension of the quota scheme.

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IMPACT OF THE INTERNATIONAL COFFEE AGREEMENT'S EXPORT QUOTA SYSTEM ON THE WORLD COFFEE MARKET

I. Introduction

1. The International Coffee Agreement (ICA), utilizing an export quota system, has been an important factor in the international coffee market in recent years. The export quota scheme has succeeded in keeping world coffee prices fairly stable in the most recent period of its operation (since October 1980) in spite of wide fluctuations in world coffee production. However, recent criticisms against the quota system, especially from consuming countries, have been intense. The major reasons for the frustration of consuming countries are (i) inflexibility in allocation of quotas among producing countries and among coffee varieties and (ii) the sales to the non-member countries at large price discounts. The current Agreement is to expire in September 1989 and discussions are already underway among the ICA members for the negotiation of a new agreement. Because of the wide differences of opinion over the unresolved issues, there is a fairly high degree of uncertainty about whether a new agreement will come into force in October 1989.

2. Given this uncertainty, it is of interest to assess the impact the ICA has had in the past and could have in the future on the world coffee market and on each of the major exporting countries. For this purpose a new global econometric model of the coffee economy was built. This paper presents

the model and some simulation results based on assumptions of an industry with and without the quota system.

II. Recent Developments in the World Coffee Market and the ICA

3. The first international coffee agreement came into force in October 1963 with the main aim of halting a declining price trend. Its main market regulatory instrument was an export quota system. The quota system was discontinued in 1973 because producing and consuming countries could not agree on the price and quota levels.

4. World coffee prices were at historically low levels in the early 1970s. When an extremely serious frost hit Brazil in 1975, prices skyrocketed to reach US¢379/kg in 1977. After 1977 prices declined sharply and this sharp decline prodded producing and consuming countries into negotiating a new agreement with an export quota system as its main economic provision.

5. The export quota system was quite successful in keeping a floor under prices between October 1980 and February 1986, when the quota system was suspended. The suspension was triggered by a sharp increase in prices caused by a forecasted reduction in Brazil's 1986/87 crop as a consequence of a very severe drought in 1985. Prices declined steadily after the spring of 1986, which led to prolonged discussions among ICA members and the eventual reinstatement of the quota system in October 1987.

6. When the export quota system is operative, the global quota and each exporting member's quota are determined at the beginning of each international coffee year (October to September). Exporting members (covering over 95% of world exports) can export only up to their quota levels to importing members (covering between 85% and 90% of world imports). The quotas are adjusted frequently, depending on the relationship between world prices and the price range set under the Agreement. When the quota system is not operative there are no constraints on members' exports.

7. There are no restrictions on exports from exporting members to non-ICA importing members (non-quota market). The non-quota market countries consist of New Zealand, the USSR and other centrally planned economies of Eastern Europe except Yugoslavia, and all developing countries except Portugal and Greece. No consistent and reliable data exist on prices in the non-quota markets. Some ICA exporting members burdened with large stocks are reported to have given as much as 50% discount to quota market prices. It is also known that many transactions with the non-quota market countries involve barter trade. Attempts to penalize these discounted sales have been made by the ICO but with limited success.

III. Description of the Model and Validation

8. Specifications of commodity models vary greatly, depending on the purposes for which the models are designed--short-term, long-term, global, country-specific, etc. The present model was built to analyze the global market as well as the coffee sectors of major producing countries, and to

undertake analysis of the operation of the ICA over the long run. The specification of this model differs from the earlier World Bank model (Akiyama and Duncan, 1982), especially in the way in which world prices are determined. In solving for world prices the present model searches for a price that equilibrates export supply and import demand in the quota market. In the earlier model price was solved as a function of stocks and world demand.

9. The new model also incorporates a simple version of the vintage capital approach to the specification of the supply response (Akiyama and Trivedi, 1987). In this specification, supply of all the major producing countries is determined in two stages--at planting and at harvesting. The model also uses country-specific retail prices in the demand equations for all the major consuming ICA-member countries and country-specific farmgate prices in the supply equations for all the major producing countries.

10. The basic structure of the model is depicted in the flow charts of Figures 1 and 2. The model consists of a supply block (Figure 1) and a demand block (Figure 2). The supply block models new plantings, production, domestic consumption and exports for 31 countries/regions. The demand block models demand in 22 ICA-importing member countries. (The non-quota market is exogenous to the model).

11. When the export quota system is operative, global and member-country exports to the quota market are fixed. When the quota system is not operative the exports of each country/region are determined by production, domestic

Figure 1: SUPPLY BLOCK OF THE MODEL

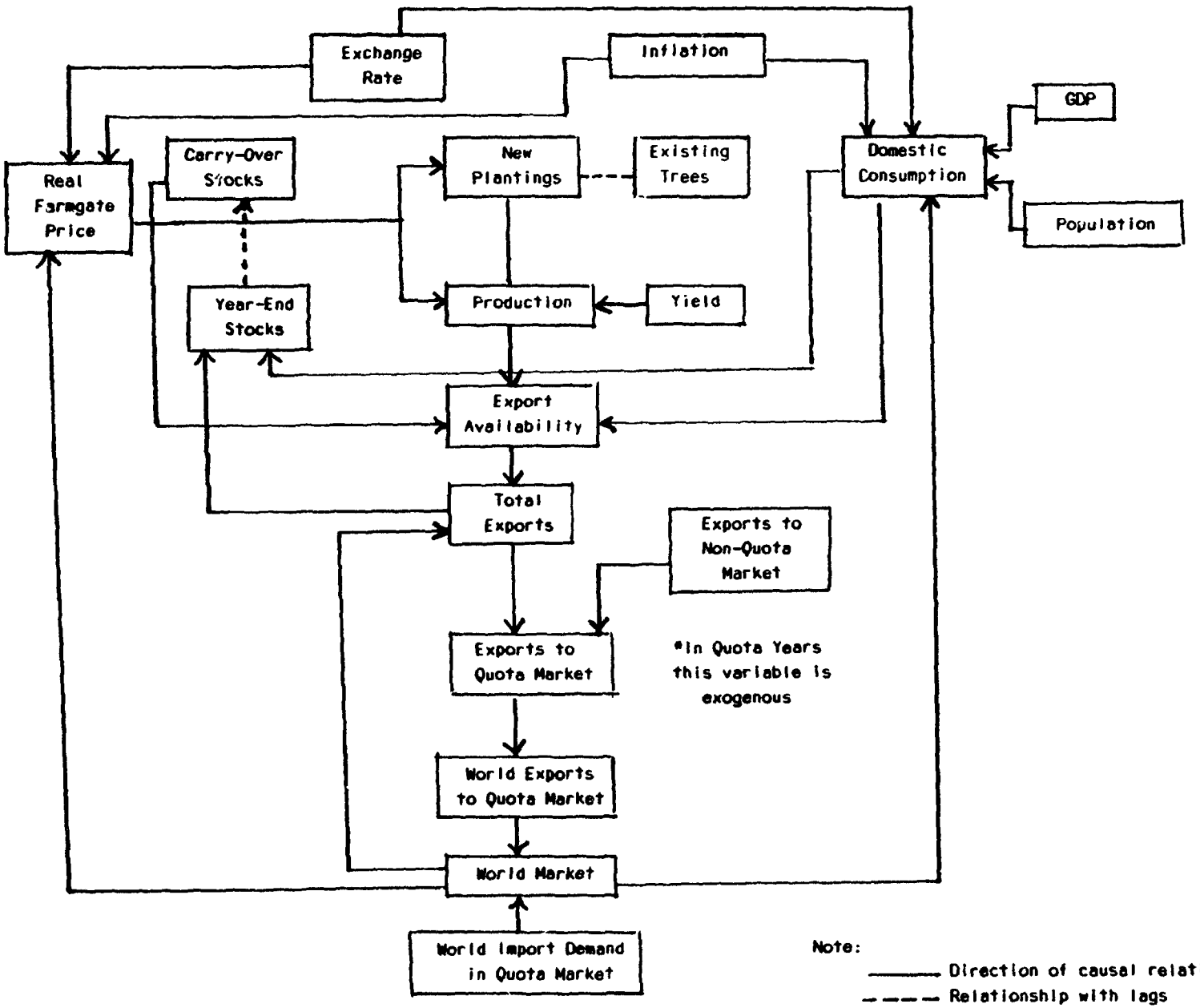
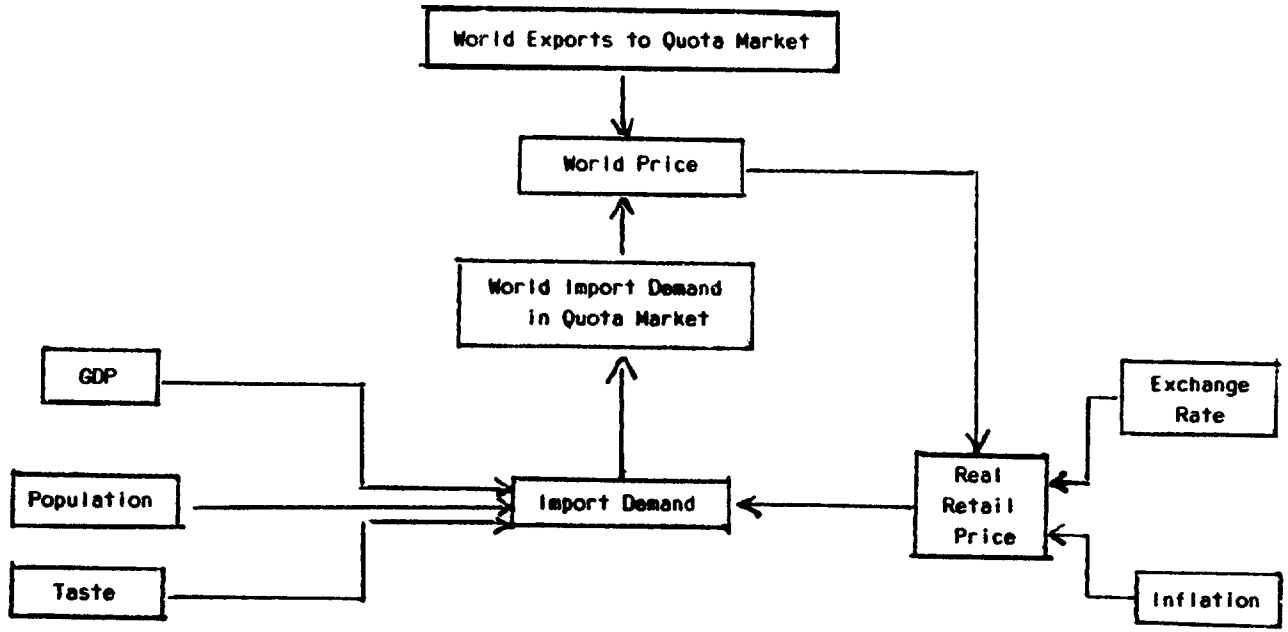


Figure 2: DEMAND BLOCK OF THE MODEL



Note:

→ Direction of Casual Relationship

consumption and carry-over stocks of these countries/regions and are responsive to world prices. World prices, proxied by the ICO "Other Milds" Indicator Price, are determined by equating export supply to import demand in the quota market. This price-determination algorithm is used both when the quota system is operative and when it is not.

Supply Block

12. For each producing country, behavioral equations were estimated for new plantings, production, domestic consumption, total exports and farmgate prices. Identity equations are also used to define or link endogenous variables. The equations consist of the following:

$RFGP_t = f\ (EX_t, CPI_t, WP_t, \ldots)$	Behavioral	(1)
$NP_t = f\ (RFGP_t, RFGP_{t-1}, \ldots)$	Behavioral	(2)
$PCAP_t = f\ (NP_t, NP_{t-1} \ldots, YLD \ldots)$	Identity	(3)
$PD_t = f\ (PCAP_t, RFGT_t \ldots)$	Behavioral	(4)
$DC_t = f\ (EX_t, CPI_t, POP_t, GDP_t, WP_t \ldots)$	Behavioral	(5)
$ES_t = PD_t + ES_{t-1} - DC_t - X_t$	Identity	(6)
$XAV_t = PD_t + ES_{t-1} - DC_t$	Identity	(7)
$X_t = f\ (XAV_t, WP_t, EX_t, CPI_t, \ldots)$	Behavioral	(8)
$XM_t = X_t - XNM_t$	Identity	(9)

where:

RFGP = Farmgate price in real local currency terms.

EX = Exchange rate vis-a-vis US dollar.

CPI = Consumer Price Index.

WP = World coffee price, ICO "Other Milds" Indicator Price.

NP = Net change in number of "bearing trees" (USDA, Foreign Agriculture Service: Coffee) from one year to the next.

PCAP = Production potential based on existing trees and estimated yields.

YLD = Yield per hectare.

PD = Production.

DC = Domestic consumption.

POP = Population

GDP = Real Gross Domestic Product.

ES = Year-end stocks.

X = Total export quantity.

XAV = Export availability.

XM = Exports to quota market.

XNM = Exports to non-quota market.

13. Specification of production is based on a vintage-capital production approach. First, new plantings are determined by recent real farmgate prices, which in turn are a function of exchange rates, inflation and world prices. New and past plantings with yield determine production capacity. Production is a function of production capacity, recent real farmgate prices and other variables such as weather and the biennial production cycle.

14. Domestic demand equations in exporting countries are a function of world price, inflation rate, exchange rate, population and GDP. Export availability is defined as production plus carry-over stocks minus domestic consumption. Export availability, world price, exchange rate and inflation determine total exports. Finally, exports to the quota market are defined as total exports minus exports to the non-quota market. Exports to the non-quota market are exogenous. As discussed above, when the quota system is operative, exports to the quota market also become exogenous.

15. There are 31 individual countries/regions modelled as ICA-exporting countries. They are Costa Rica, Dominican Republic, El Salvador, Guatemala, Honduras, Nicaragua, Mexico, Rest of Central America and Carribean, Brazil, Colombia, Peru, Ecuador, Venezuela, Rest of South America, Cameroon, Burundi, Ethiopia, Kenya, Madagascar, Rwanda, Tanzania, Uganda, Côte d'Ivoire, Angola, Zaire, Rest of Africa, India, Indonesia, Philippines, Rest of Asia and Papua New Guinea.

Demand Block

16. The total quota-market demand is defined as the sum of demand in 22 ICA importing member countries. For each country, demand is specified in a conventional manner, i.e., on a per capita basis with real income per capita, population, taste and real retail prices as explanatory variables. Real retail prices, in turn, are a function of exchange rates, inflation and world prices. A time trend is used as a proxy for taste change. The 22 countries modelled as ICA importing countries are the United States, Canada, Federal Republic of Germany, France, United Kingdom, Italy, Portugal, Spain, Greece, Belgium, Netherlands, Ireland, Switzerland, Austria, Denmark, Sweden, Norway, Finland, Yugoslavia, Japan, Australia and New Zealand.

Parameters and Elasticities in the Model

17. A large number of parameters and elasticities were estimated and used in the model. Those for supply and import demand are discussed here.

(i) Supply

18. Depending on availability and reliability of data, there are four categories of supply specification in the model. They are:

(a) For Colombia, equations describing new plantings, stumping, production capacity of old trees and production were established. 1/

(b) For ten countries, equations describing net new plantings and production were estimated. The countries specified in this way are Costa Rica, Guatemala, the Dominican Republic, Honduras, Mexico, Brazil, Côte d'Ivoire, Kenya, India and Indonesia.

(c) For 15 countries and regions, simple supply equations were specified due to lack of success in the estimation of new planting equations or the unavailability of tree stock data. They are the El Salvador, Nicaragua, Ecuador, Peru, Rest-of-South America, Cameroon, Burundi, Ethiopia, Madagascar, Rwanda, Tanzania, Zaire, The Philippines, Rest-of-Asia, and Papua New Guinea.

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1 More detailed analysis was possible for Colombia, because of the availability of reliable data from the Federation de Cafecultores on new plantings, stumping and stock of old trees.

(d) For five countries and regions, production is exogenous. They are Venezuela, Uganda, Angola, Rest-of-Africa and Rest-of-Central America. 1/

19. In terms of world production shares, the countries for which the vintage-capital approach was used (countries which fall into categories (a) and (b) above) cover about 70%. Equations (1)-(4) above constitute the components of supply for these countries. Table 1a presents the price elasticities of new plantings for the countries in categories (a) and (b).

20. For countries in category (c), no account was taken of tree stocks. For these countries, it was assumed that tree stocks or production potential change with time, and prices affect production only in the short term, i.e.,

$$PD_t = f\left(TM\ ,\ RFGP_t,\ RFGP_{t-1}\ldots\right) \qquad (10)$$

1/ For these countries, production was taken to be exogenous due to the unsatisfactory results obtained from attempts to estimate supply equations. However, due to the small role these countries play in the world market we do not believe that this reduces the effectiveness of the model.

Table 1a: PRICE ELASTICITIES OF NEW PLANTINGS

Country	t-1	t-2	t-3	t-4
Costa Rica				2.03 (1.93)
Guatemala		2.88 (3.18)		
Honduras				0.49 (3.17)
Mexico			1.23 (3.78)	
Dominican Republic			1.49 (2.47)	0.73 (2.18)
Colombia	1.68 (3.37)			
Brazil	1.02 (2.06)			2.34 (7.72)
Côte d'Ivoire	4.19 (2.52)			
Kenya			1.72 (4.1)	1.56 (3.82)
India			2.59 (2.95)	
Indonesia				0.56 (2.67)

21. Short-, medium- and long-term supply elasticities are given in Table 1b for most of the countries in categories (a) (b) and (c). 1/ These elasticities were derived from model simulations. As discussed by Akiyama and Trivedi (1987), the price elasticity of supply is not time-invariant. Elasticities tend to be high in countries where general economic and coffee policies have been stable and where data are reliable. 2/

(ii) Net Import Demand

22. Net import equations are specified in double-log form except for the Federal Republic of Germany, Italy, Netherlands, Great Britain, Australia, Austria and Japan. For these countries, they are specified as,

$$NM_t = a_o + a_1 P + a_2 \ln Y_t \qquad (11)$$

where: NM = Net imports per capita

P = Real retail price

Y = Real GDP per capita

1/ Prices were not significant in the new plantings and supply equations for Honduras and Mexico.

2/ In countries where data on new plantings and production are unreliable, estimates of price elasticities tended to be statistically insignificant and low.

Table 1b: ELASTICITIES OF SUPPLY IN SELECTED COUNTRIES

	Years After Price Change		
	Two Years	Five Years	Ten Years
Brazil	0.03	0.10	0.36
Burundi	0.03	0.47	0.95
Cameroon	0.04	0.14	0.16
Colombia	0.16	0.44	0.74
Costa Rica	0.11	0.15	0.41
Côte d'Ivoire	0.55	0.68	0.84
Dominican Republic	0.19	0.34	0.78
Ecuador	0.11	0.13	0.14
El Salvador	0.13	0.15	0.16
Ethiopia	0.06	0.15	0.19
Guatemala	0.13	0.13	0.20
Honduras	0.13	0.15	0.20
India	0.09	0.10	0.15
Indonesia	0.14	0.17	0.25
Kenya	0.04	0.14	0.45
Mexico	0.02	0.06	0.13
Papua New Guinea	0.07	0.18	0.18
Philippines	0.06	0.18	0.20
Zaire	0.02	0.15	0.17

This specification was used because in these countries income elasticities are observed to decline with per capita net imports. 1/ Average income and price elasticities of demand for the estimated period 1968-86 2/ are given in Table 2. 3/

Evaluation of Ex-Post Simulation Results

23. The model was run for the period 1974-84 and the results compared with the actual values. The simulation results and the actual values for the ICO "Other Milds" Indicator Price, world production and total exports to the quota markets are given in Figures 3-5. As these figures show, the fit to the actual values are very good and the model captures all the important turning points. The differences between the simulated and actual values for

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1/ Income elasticity is given by a_2/NM_t. Thus it declines with NM_t.

2/ The crop year used in producing countries varies from one country to another in terms of starting date. For example, Colombia's crop year is the same as the international year which starts on 1 October, but Brazil's crop year starts on 1 July. In this paper the production year refers to the ending year unless otherwise specified, e.g., Brazil's production for the 1987/88 crop year is referred to as Brazil's 1988 crop. All exports are on the international coffee year basis, thus exports for the period October 1987-September 1988 are referred to here as exports of 1988.

3/ Income elasticities for some countries such as Japan and Ireland were found to be very high. This is due to the low per-capita consumption levels in these countries in the 1960s and early 1970s.

Table 2: DEMAND ELASTICITIES

Importing Countries	Income	Price	Importing Countries	Income	Price
Belgium	0.36	-0.28	United States	N.S. /a	-0.46
Denmark	0.58*	-0.43	Australia	1.72	-0.37
France	0.68	-0.13	Austria	1.30	-0.54
Federal Republic of Germany	0.98	-0.17	Canada	0.28	-0.13
Greece	0.52	-0.49	Finland	0.34	-0.08 *
Ireland	2.89	-0.34	Japan	2.03	-0.31
Italy	0.92	-0.18	Norway	0.26	-0.14
Netherlands	0.89	-0.34	Sweden	N.S.	-0.29
Portugal	0.62	-0.28	Switzerland	0.56 *	-0.24
Spain	1.07	-0.07 *	Yugoslavia	N.S.	N.S.
United Kingdom	1.26	-0.51	New Zealand	1.28	-0.13

Selected Producing Countries	Income	Price /b
Ecuador	0.40	-0.08
Mexico	N.S.	-0.14
Brazil	N.S.	-0.09
Colombia	0.41	-0.14
India	0.24	N.S.
Indonesia	N.S.	-0.07
Dominican Republic	N.S.	-0.08

/a Statistically not significant.

/b Note that due to the unavailability of retail price data for these countries, the international coffee price in terms of local currencies and deflated by the local CPI was used. Therefore, the price elasticities presented here should be underestimates of the demand response to changes in retail prices.

* Significant at 10% level of significance. All others significant at 5% level of significance.

FIGURE 3: *Actual and Simulation Results*

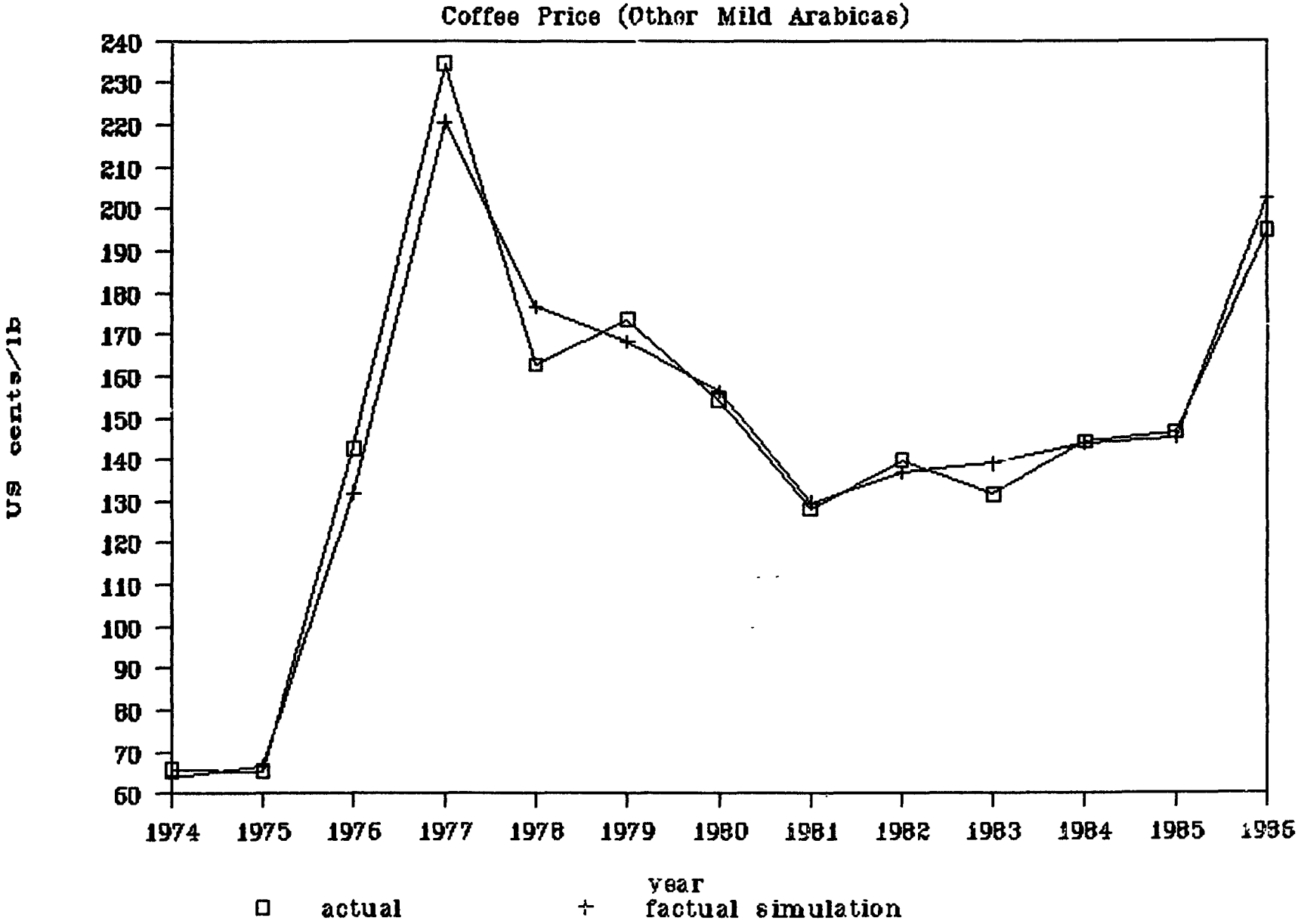


FIGURE 4: *Actual and Simulation Results*

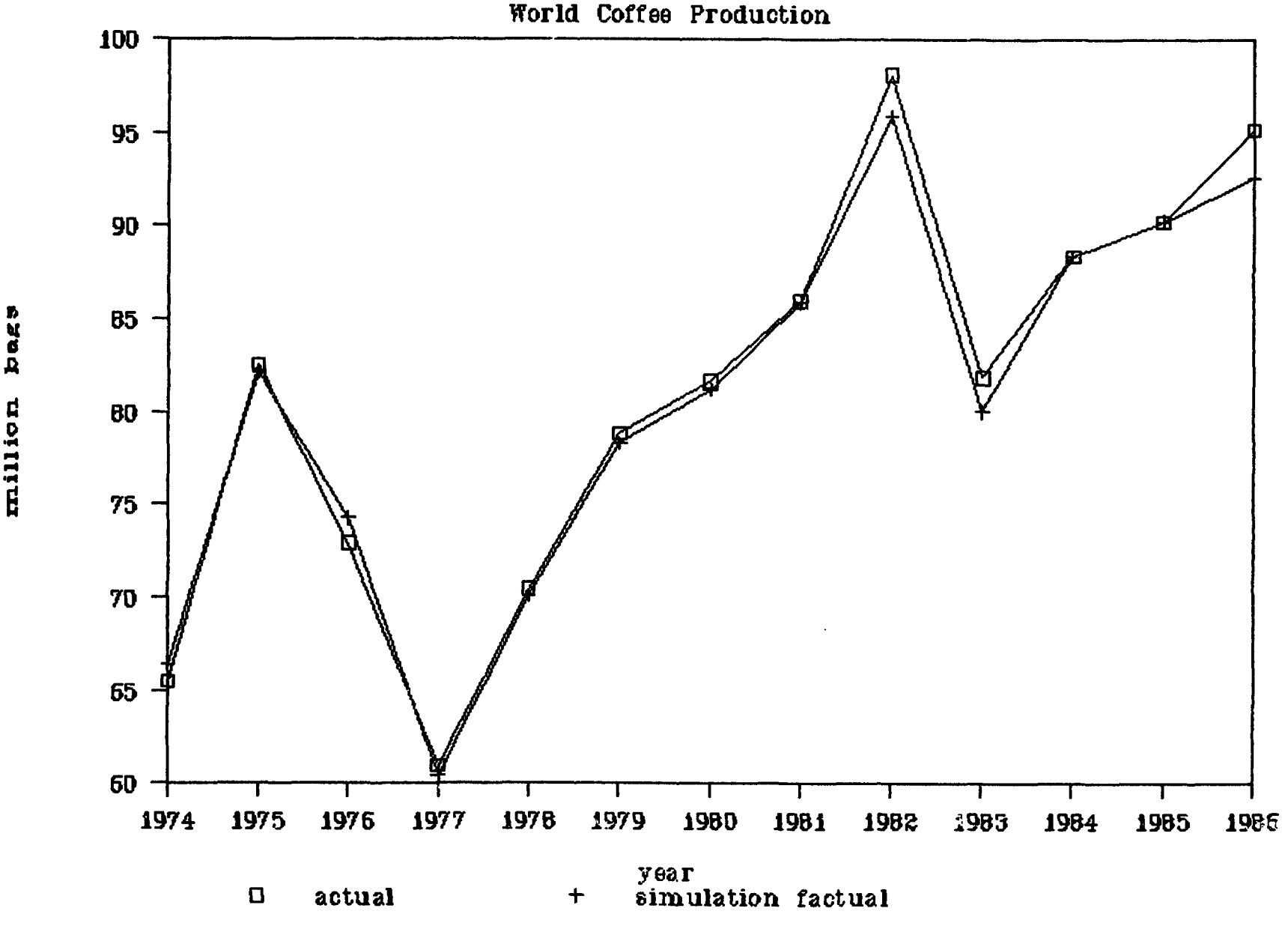
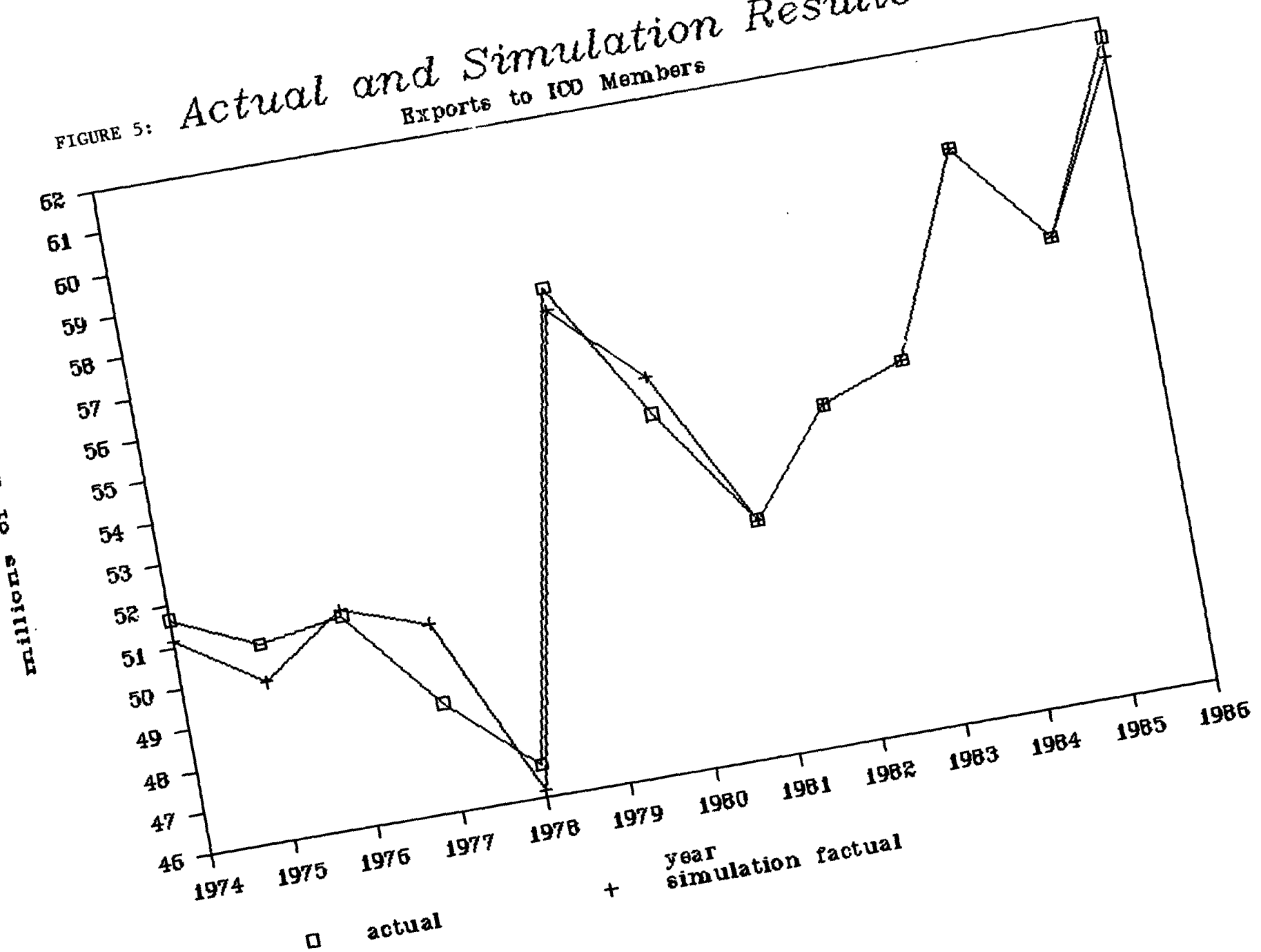


FIGURE 5: *Actual and Simulation Results*



the total exports to the quota markets are zero for the period 1981-85 because in the simulation run these values are exogenous.

24. Some test statistics for these variables are given in Table 3. The root-mean-squared-percentage error for the price is only 4.3% and that for world production only 1.4%.

Table 3: TEST STATISTICS FOR THE EX-POST SIMULATION RUN

	ICO "Other Milds" Indicator Price	World Production	Total Exports to The Quota Market
Mean % Absolute Error	5.4	1.1	0.9
Root Mean Squared % Error	4.3	1.4	1.4

IV. Ex-Post Simulation Results of the Model With and Without the ICA

25. In order to evaluate the effects of the ICA, the model was run with the quotas (factual) and without the quotas (counter-factual) for the period 1981-86. The simulation results for some of the key variables are given in Figures 6-8.

26. To allow examination of the market stabilizing effects of the ICA, variances of these key variables are given in Table 4. The results show the significant price stabilization effects the ICA had during the period 1981-

FIGURE 6: *Factual vs. Counterfactual Simulations*

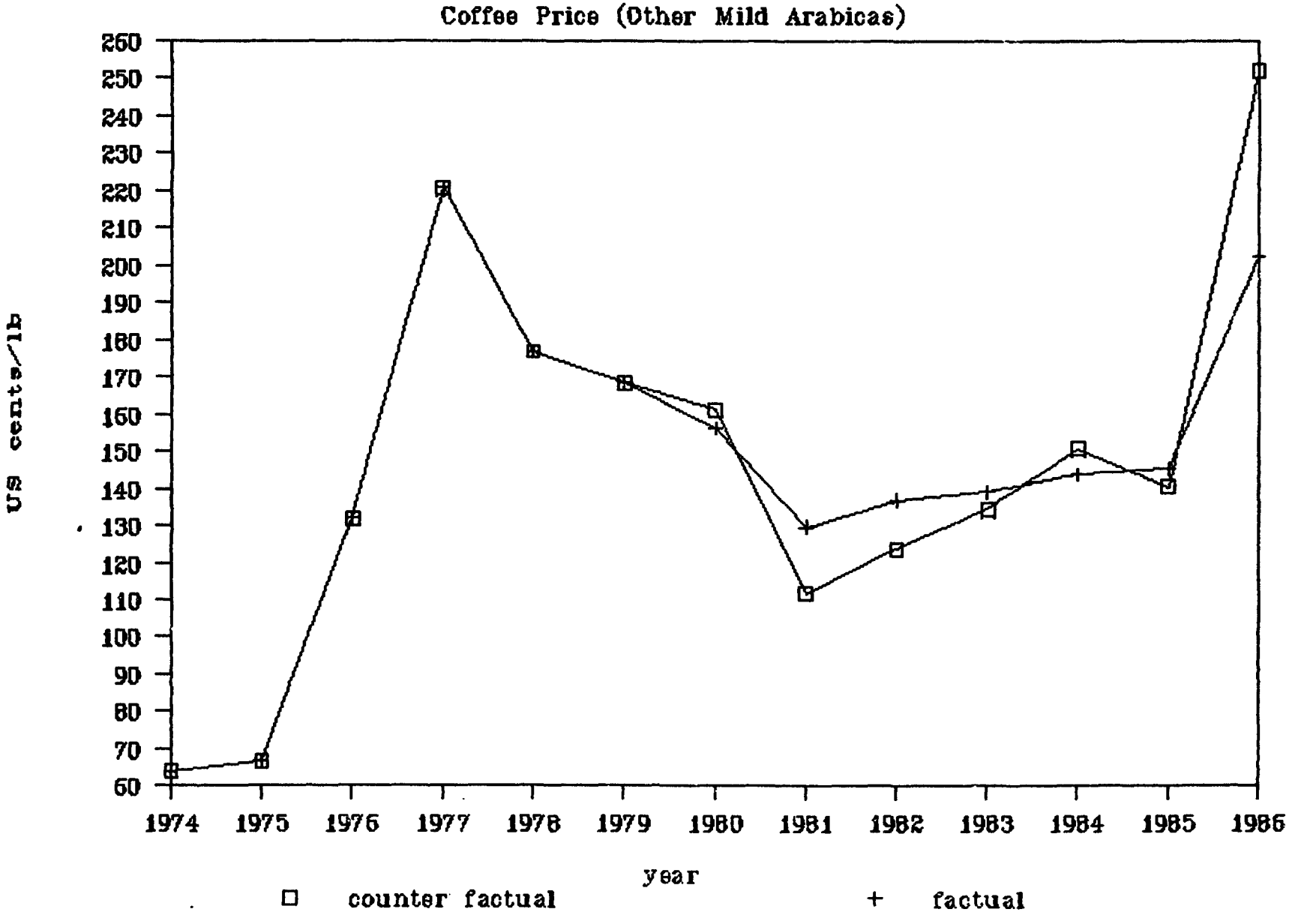


FIGURE 7: *Factual and Counterfactual Simulations*

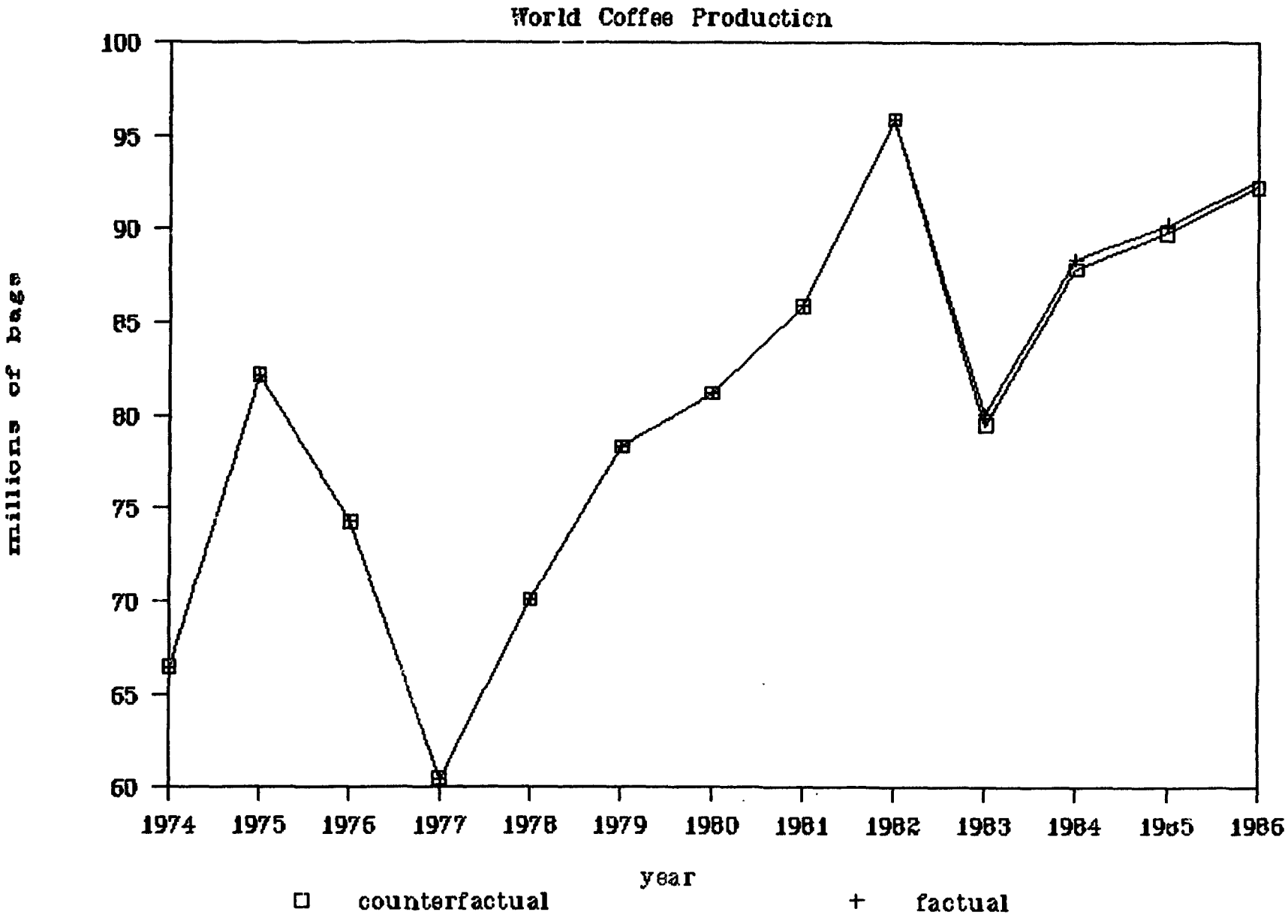
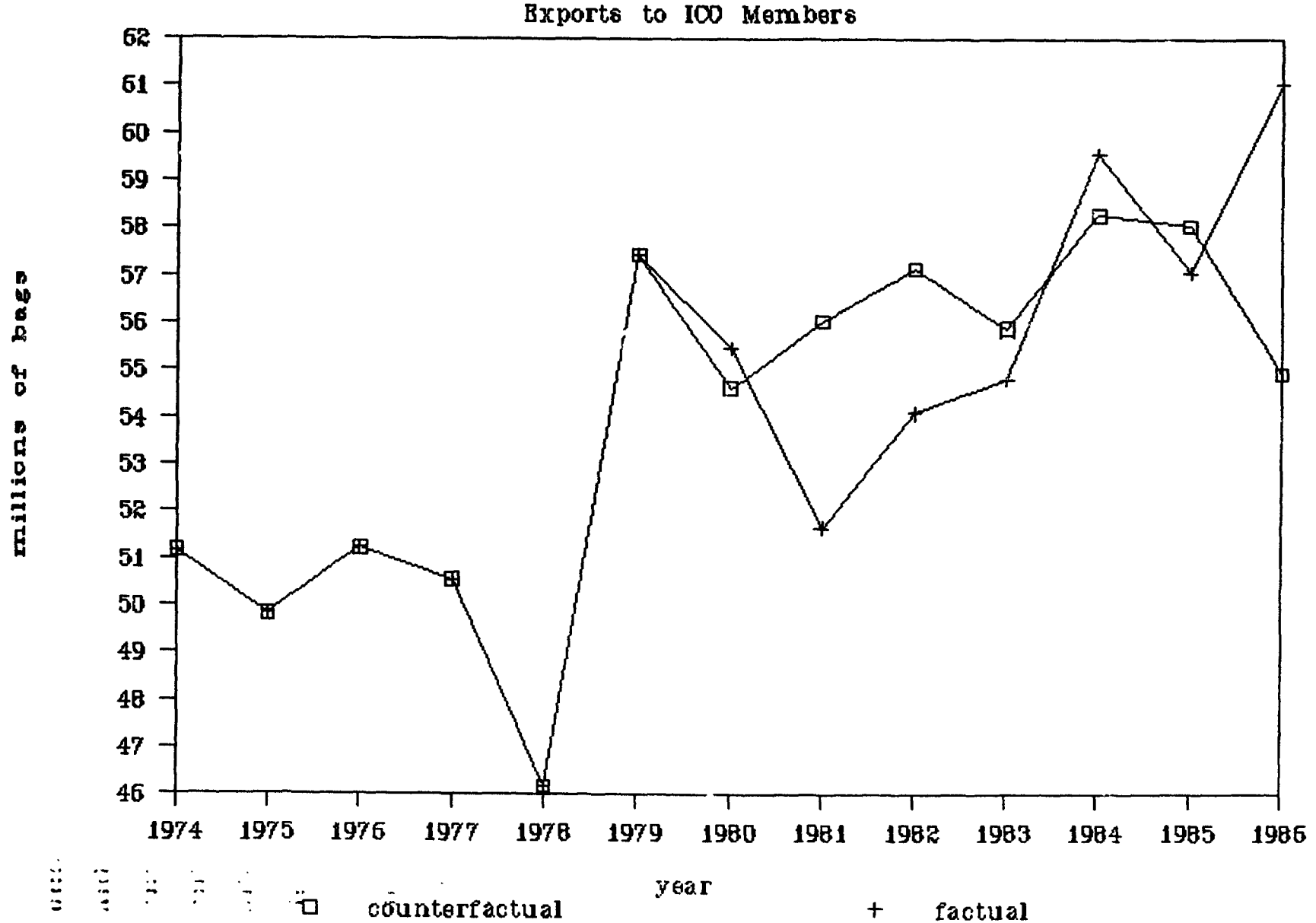


FIGURE 8: *Factual and Counterfactual Simulations*



85. An interesting result is the ICA's price stabilizing effect in 1986 when the quota system was not in force. The explanation for this is that when the quota system was in force during the period 1981-85, many producing countries were forced to accumulate stocks. When the quotas were lifted in 1986, these stocks were released which pushed prices down. The simulation results show that had the quotas not been in force for the period 1981-85, total stocks held in producing countries at the end of 1985 would have been 22 million bags instead of an actual 33 million bags. The results also show that exports to the quota market would have been 55 million bags in 1986 instead of the actual 62.5 million bags had the quota system been non-operative. Thus the quota system had a significant effect in reducing world prices in 1986. If there had been no quota scheme during the period 1981-85, world coffee prices would have been 24% higher in 1986. This result would not have been found if the simulation was performed over only a short period.

27. The results in Table 4 also show that under the quota system exports to the quota market were more unstable than without the quota; but total real export revenues were more stable. In other words, under the quota system total exports are adjusted to stabilize prices and this results in stabilizing export revenues.

28. In order to evaluate the costs and benefits of the quota system for major producing countries, factual and counter-factual simulation results were compared. Originally, an atttempt was made to calculate economic welfare of individual countries. However, as discussed in the Annex, it was found to be very difficult to calculate these. Thus, comparisons were made only for real export revenues. The deflator used was the World Bank's MUV. Also it was

Table 4: VARIANCES OF KEY VARIABLES WITH AND WITHOUT THE EXPORT QUOTAS; 1981-85 AND 1981-86

Dates	World Prices		Total Export Quantity to the Quota Market		Total Real Export Revenue /a	
	With Quota	Without Quota	With Quota	Without Quota	With Quota	Without Quota
1981-85	31.5	182.5	7.3	1.0	1,496	3,622
1981-86	584.9	2,142.8	10.4	1.5	3,490	9,762

/a Deflated by World Bank's MUV.

assumed that sales on the non-quota market were made at prices 30% less than in the quota market.

29. Total export revenues in 1985 constant dollar terms for total exports and for individual country exports under the quota and without-quota scenarios are given in Table 5. For the total of real export revenues there is hardly any difference for the period 1981-85. However, if 1986 is included the world total would have been 4.7% higher if the quota system had not existed during the period 1981-85. As discussed above, this is because world prices would have been higher in 1986 had the quotas not existed in the period 1981-85.

30. For individual countries it is interesting to note that most of the small exporters would have been better-off in terms of real export revenues without the quotas. But large exporters such as Brazil, Colombia and Côte d'Ivoire are among the few countries that gained from the quota system. When large countries increase their exports world prices decline--often to the

Table 5: TOTAL REAL EXPORT REVENUES (1981-85/86)

Country	Date	Quota	No Quota	% Difference /a
	---------millions of constant 1985 US$---------			
World Total	1981-85	54,869	55,115	-0.5
World Total	1981-86	69,828	73,087	-4.7
Costa Rica	1981-85	1445	1524	-5.5
Costa Rica	1981-86	1781	1942	-9.1
El Salvador	1981-85	2230	2184	2.1
El Salvador	1981-86	2831	2932	-3.6
Guatemala	1981-85	1947	1978	-1.6
Guatemala	1981-86	2468	2627	-6.4
Honduras	1981-85	942	969	-2.9
Honduras	1981-86	1278	1387	-8.5
Mexico	1981-85	2166	2261	-4.4
Mexico	1981-86	3001	3302	-10.0
Nicaragua	1981-85	721	737	-2.3
Nicaragua	1981-86	859	909	-5.9
Colombia	1981-85	8271	8114	1.9
Colombia	1981-86	10876	11358	-4.4
Venezuela	1981-85	37	35	5.0
Venezuela	1981-86	125	144	-15.7
Cameroon	1981-85	1397	1353	3.1
Cameroon	1981-86	1809	1867	-3.2
Ethiopia	1981-85	1232	1223	0.7
Ethiopia	1981-86	1508	1567	-3.9
Cote d'Ivoire	1981-85	3726	3659	1.8
Cote d'Ivoire	1981-86	4712	4887	-3.7
Kenya	1981-85	1305	1300	0.4
Kenya	1981-86	1769	1878	-6.2
Uganda	1981-85	2172	2081	4.2
Uganda	1981-86	2712	2755	-1.6
Zaire	1981-85	1018	976	4.1
Zaire	1981-86	1514	1593	-5.3
India	1981-85	1050	1135	-8.1
India	1981-86	1453	1613	-12.6
Dominican Republic	1981-85	485	581	-20.0
Dominican Republic	1981-86	773	772	0.2
Brazil	1981-85	15568	15191	2.4
Brazil	1981-86	17979	18327	-1.9
Ecuador	1981-85	1198	1316	-9.8
Ecuador	1981-86	1661	1757	-5.8
Peru	1981-85	748	859	-14.8
Peru	1981-86	1091	1118	-2.5
Burundi	1981-85	427	459	-7.3
Burundi	1981-86	604	599	0.7
Madagascar	1981-85	776	783	-0.9
Madagascar	1981-86	991	1041	-5.1
Rwanda	1981-85	446	452	-1.4
Rwanda	1981-86	638	663	-4.0
Tanzania	1981-85	776	809	-4.2
Tanzania	1981-86	973	1029	-5.8
Angola	1981-85	408	420	-3.0
Angola	1981-86	444	487	-9.6
Indonesia	1981-85	3327	3588	-7.8
Indonesia	1981-86	4550	5035	-10.7
Philippines	1981-85	394	457	-16.2
Philippines	1981-86	595	586	1.6
Papua New Guinea	1981-85	660	662	-0.2
Papua New Guinea	1981-86	854	914	-7.0

/a Negative indicates lower total export revenues in the with-quota case.

extent that marginal export revenues are small or even zero.

31. A qualification has to be made about the interpretation of these results. It was assumed when the counter-factual runs were made that there would be no changes in government policies on production. In many producing countries, export taxes on coffee are reported to be high because the governments wanted to suppress production so there would not be large stocks accumulated under the quota system, i.e., export taxes are necessary because of the implementation of the quota system. If this is the case, in the counter-factual case some of these countries could have had lower export taxes on coffee and consequently larger production and exports than what the simulation results indicate--and therefore world prices would have been lower. However, it may be in the large countries' interests to increase export taxes when there is no global export quota. Therefore, it is not clear what the net impact on production, exports and price would be if we allow for export taxes being endogenous.

V. Ex-Ante Simulation Results of the Model With and Without the ICA

32. The model was run ex-ante to project the world coffee market with and without the ICA quota system. Assumptions used for the main exogenous variables in the model are:

(i) Purchasing power parity is assumed to hold for the projected period. To implement this assumption, all exchange rates were kept at their average for 1987 and the inflation rate at 0%.

(ii) Population increases at the rate given in the World Development Report of 1988.

(iii) GDP in industrial countries increases at an average rate of 2.5% p.a. and that of developing countries increases at an average rate of 4.5%.

(a) Projections with the quotas

33. The assumption was made that the ICA export quota system will continue through 2000 and that the global quota will increase at a rate of about 1.5% p.a. for the period 1989-2000--which approximates the projected demand growth rate of total import demand of the importing ICA members when prices are about US¢200/kg in terms of 1985 constant dollars. Non-quota imports are assumed to increase at about 2.6% p.a.--a slightly lower rate than the long-term trend of demand in these countries as consumption growth rates usually decline with higher per capita consumption levels. The total domestic demand growth rate in producing countries is projected to be 2.3% p.a., which, with the export demand growth rate, gives total world demand growth of about 2% p.a. Projections for key variables under the quota and without-quota scenarios are given in Figures 9 to 12.

34. Under these assumptions, world coffee prices in 1985 US dollar terms are projected to be about US¢210/kg until the early 1990s and show some decline to the US¢205/kg level in the late 1990s. World production is projected to increase at only about 1.2% p.a. for the period 1985-2000 but this will be sufficient to meet the expected demand increase because present

FIGURE 9: *Forecasts with and without Quotas*

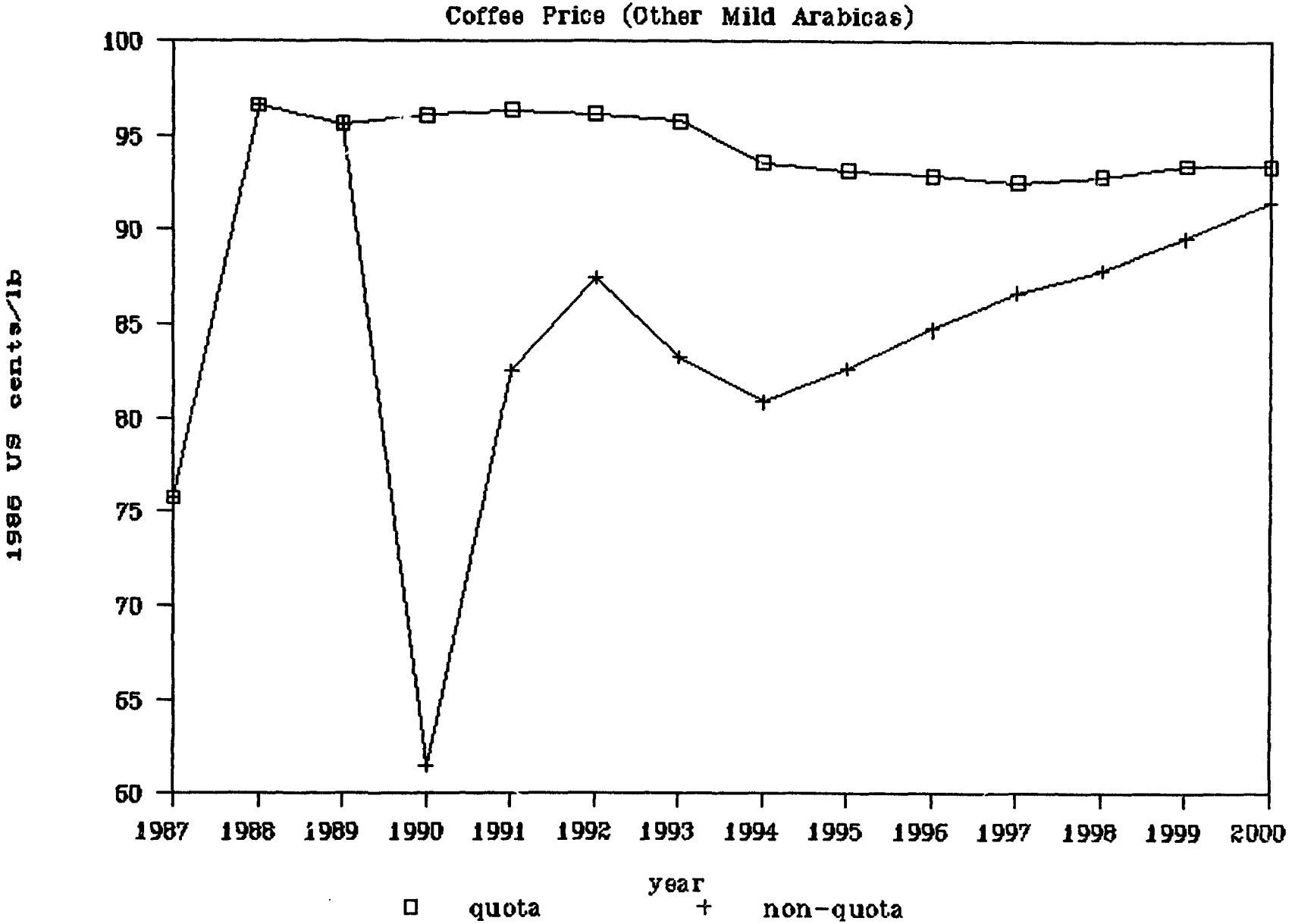


FIGURE 10: *Forecast with and without Quotas*

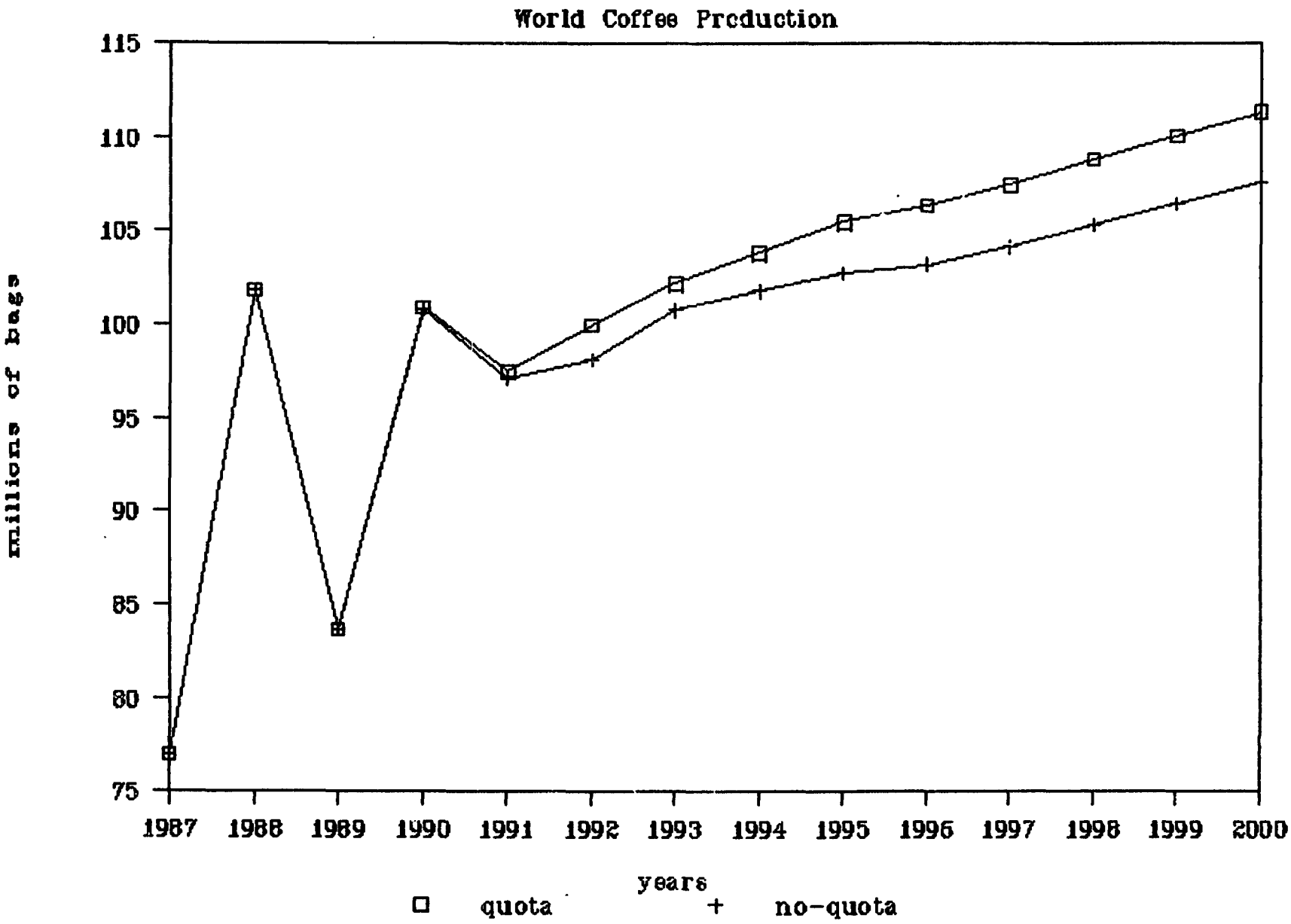


FIGURE 11: *Forecast with and without Quotas*

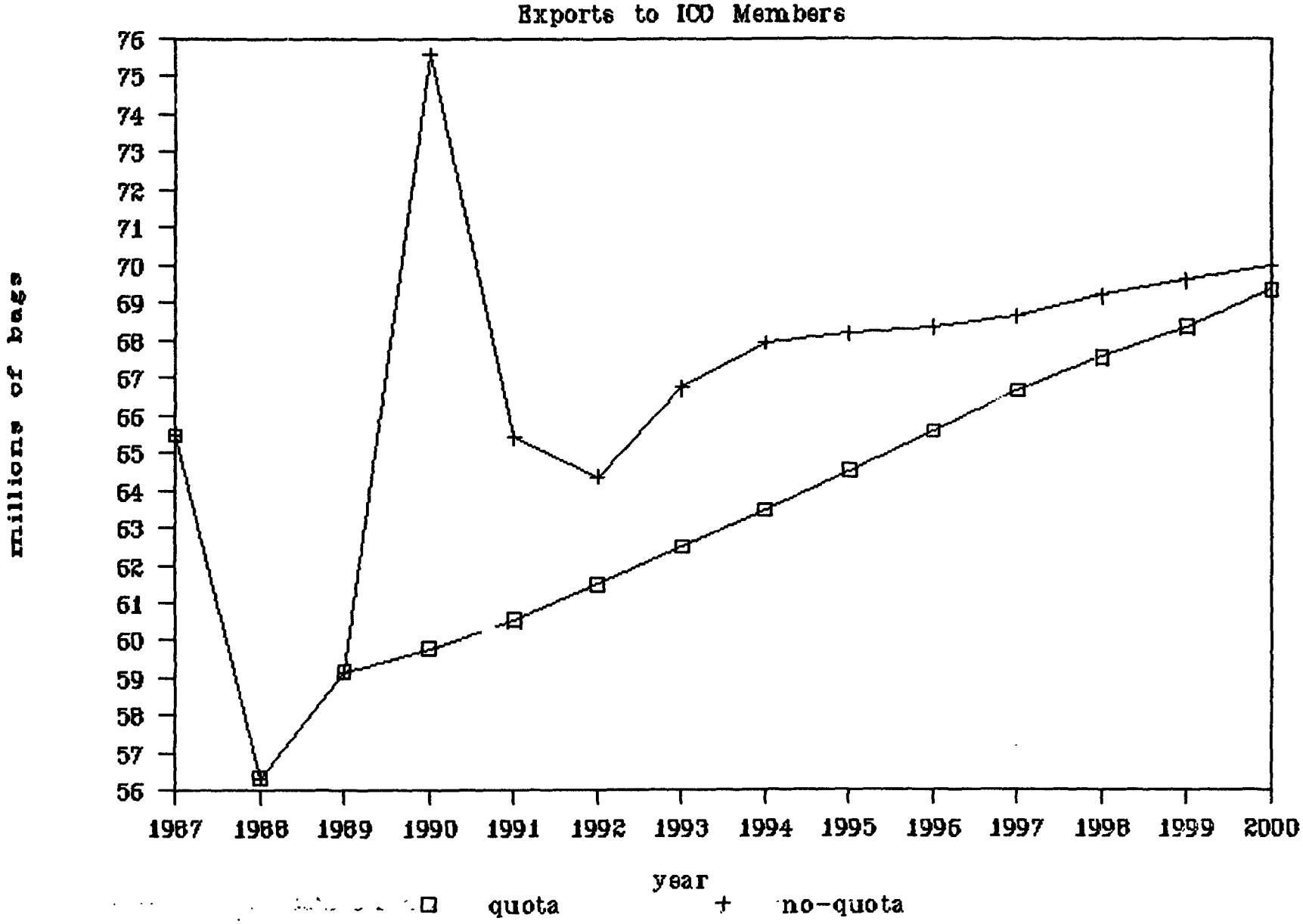
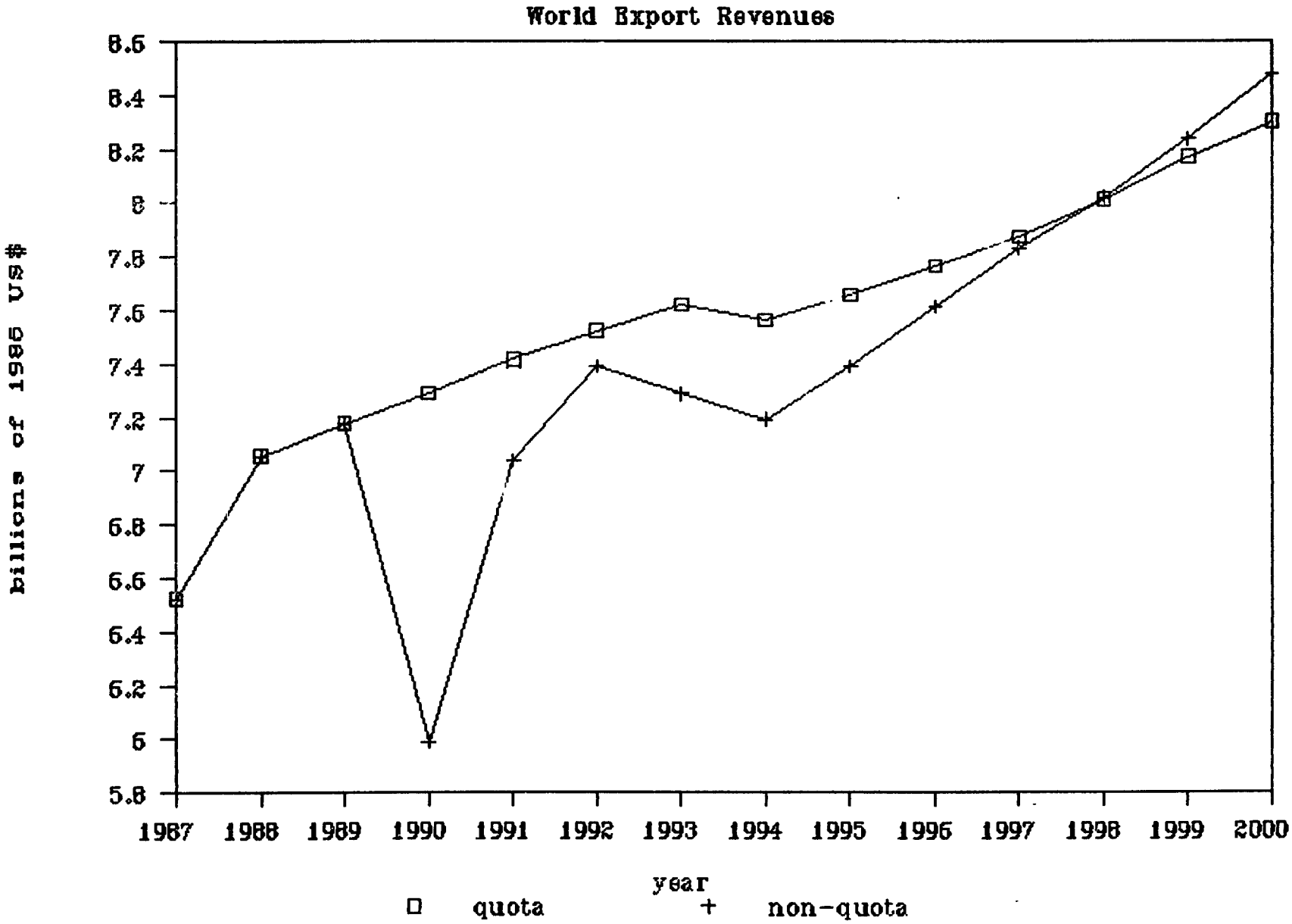


FIGURE 12: *Forecasts with and without Quotas*



world production--taken as the base year for calculating growth rates--is considerably higher than world consumption. The model shows that the world's three largest coffee producers, Brazil, Colombia and Indonesia, will increase their production at about 2% p.a. An important reason for their high expected production growth rates is the high rate of real depreciation of the currencies of these countries (about 30%) that took place over the last five years. However, production in many other countries such as Côte d'Ivoire, Ethiopia, Madagascar, El Salvador, Nicaragua, Dominican Republic and Haiti, is projected to decline, or at best stagnate, due to overvaluation of their currencies or to the very limited rate of new plantings in the recent past due to various reasons such as low real producer prices.

35. To evaluate the impact on world prices of different GDP growth rates in importing countries and different global export quota growth rates, two additional simulation runs were made with the coffee model. One had GDP growing at 0.5% p.a. lower than the base case and the global export quota increasing at 1.7% p.a., the other had the GDP growing at 0.5% p.a. higher than the base case and the global quota increasing at 1.3% p.a. The results are given in Table 6.

36. As the simulation results in Table 6 show, the differences in projected prices widen substantially with time. The large price differences under the two scenarios are a result of the low price elasticities of demand. Thus prices are considerably higher when the secular demand trend is higher and the quotas lower. The figures in Table 6 also suggest that real world coffee export revenues are likely to increase at a very modest rate in the 1990s--about 1.5% p.a. in the base case and 2.3% p.a. in the "Higher GDP growth and lower quotas" case.

Table 6: PROJECTED PRICES a/ UNDER ALTERNATIVE SCENARIOS

Year	Base Case	Higher GDP Growth and Lower Quotas	Lower GDP Growth and Higher Quotas	Without Quotas from 1990
		(1985 US¢/kg)-/b		
1988	213 (97) c/			
1989	211 (96)	212 (96)	210 (95)	
1990	211 (96)	214 (97)	208 (94)	137 (62)
1995	204 (93)	220 (100)	179 (81)	183 (83)
2000	205 (93)	234 (106)	167 (76)	200 (91)

a/ ICO "Other Milds" Indicator Price in 1985 prices.
b/ Deflator used is MUV of the World Bank.
c/ Figures in brackets are US¢/lb.

(b) Projections without the quotas

37. Under this scenario it was assumed that the ICA export quota system will be suspended from 1990 through 2000. The projections for the key variables are also given in Figures 9 through 12.

38. A major difference between the simulation results for the with- and without-quota situations is in the projected prices. As expected, prices are projected to be lower where there are no quotas. The extent of the price fall in 1990 is especially severe as accumulated stocks in producing countries are projected to be released in that year. However, with time the price differences narrow. This is because the very low prices during the period

1990-1994 discourage production; hence, by the late 1990s exports and prices are not very different from the quota case. In the absence of quotas, however, the coffee cycle would extend into the 21st century, with the higher prices after 1995 giving rise to increased plantings and resulting in lower prices after the year 2000. The extent and speed of price recovery after the very low prices of 1990 depends on the size and lagged nature of the price elasticities of supply in major coffee-producing countries. At the extreme, if the price elasticities of supply in these countries were near zero, world prices would not recover quickly. The shape of the price recovery path also depends on government policies taken in major producing countries. The simulation results given here assume that changes in world prices will be passed to producers to the same extent as in the past 20 years or so. It is also assumed that the stocking behavior of these countries is the same as their pre-1981 behavior. However, if governments in producing countries take policies such as real devaluations or reductions in export taxes or both, it would have the same effect as if world prices fell little. There would be no price recovery because world production would not fall.

39. Production and exports under the non-quota scenario vary from one country to another. The simulation results show countries following three types of production/exports path. They are:

40. Category I. These countries consistently export more under the without-quota scenario than under the quota scenario. The reason for this is that they are able to increase production capacity even with low world prices--mainly due to the low cost of production or of high real producer prices.

Countries which fall in this category are Brazil, Costa Rica, Mexico, Peru, Burundi, Cameroon, Rwanda, Tanzania, Zaire, Indonesia, Philippines and Papua New Guinea. Projected exports to the ICA members under the two scenarios for Brazil, Costa Rica, Burundi, Uganda, Indonesia and Papua New Guinea are shown in Figures 13 to 18.

41. Category II. These countries have enough production potential to export more in the without-quota case than in the quota case. But the low world prices of the early 1990s reduce production potential and by the late 1990s their exports are less in the without-quota case than in the quota case. Countries that fall in this category are Colombia, Ecuador, Dominican Republic, Guatamala, Honduras, Venezuela, Kenya and Madagascar. Projected exports to the ICA members under the two scenarios are given for Colombia, Honduras and Kenya in Figure 19 to 21.

42. Category III. These countries have hardly enough production potential to export the quota quantities in 1990. If prices fall due to the quota suspension throughout the 1990s their production falls and their production is projected to be lower in the without-quota case than in the quota case. El Salvador, Angola, Côte d'Ivoire, Ethiopia and India are in this category and the projected exports to the ICA members by Côte d'Ivoire and El Salvador are shown in Figures 22 and 23.

FIGURE 13: *BRAZIL*

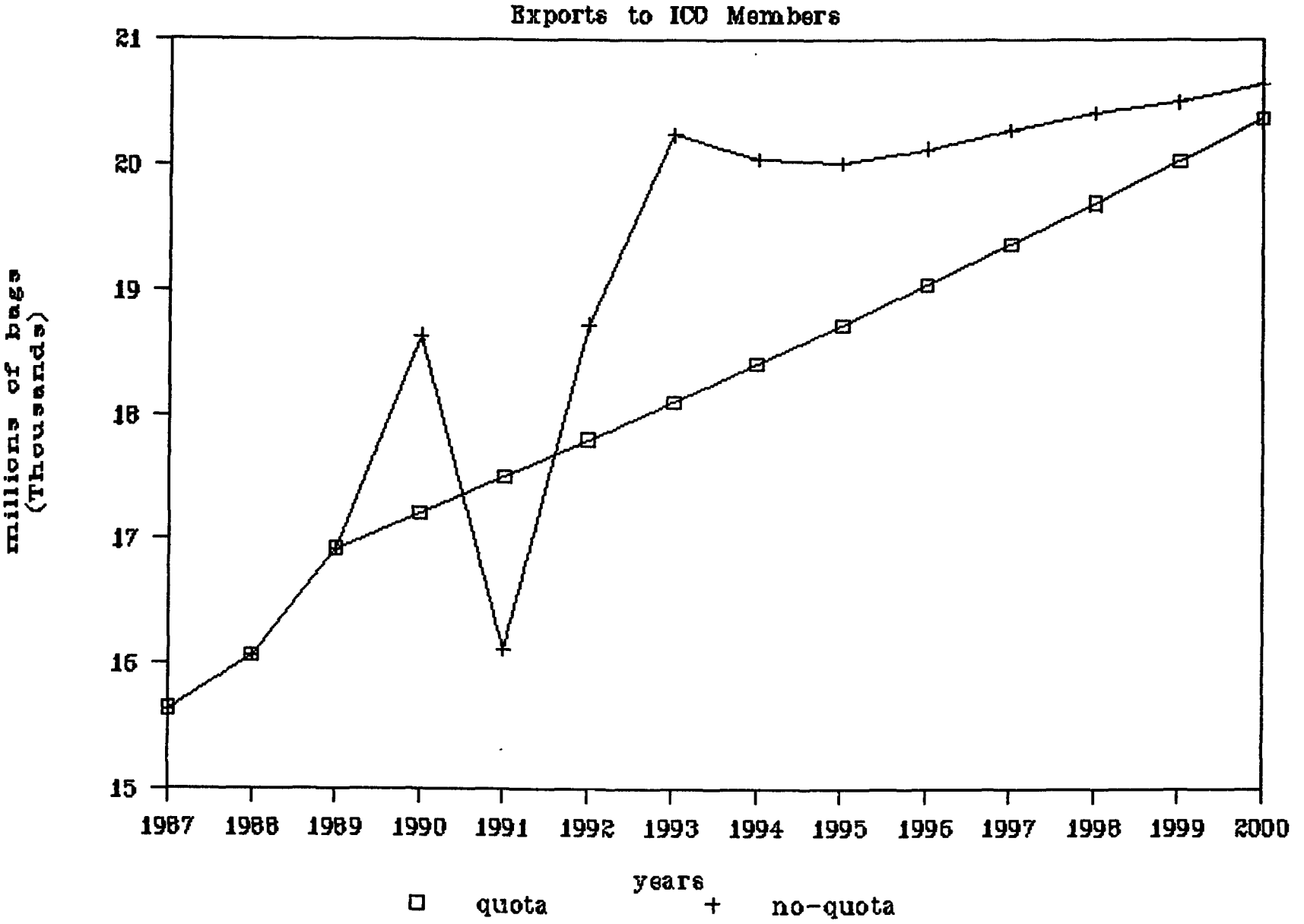


FIGURE 14: *COSTA RICA*

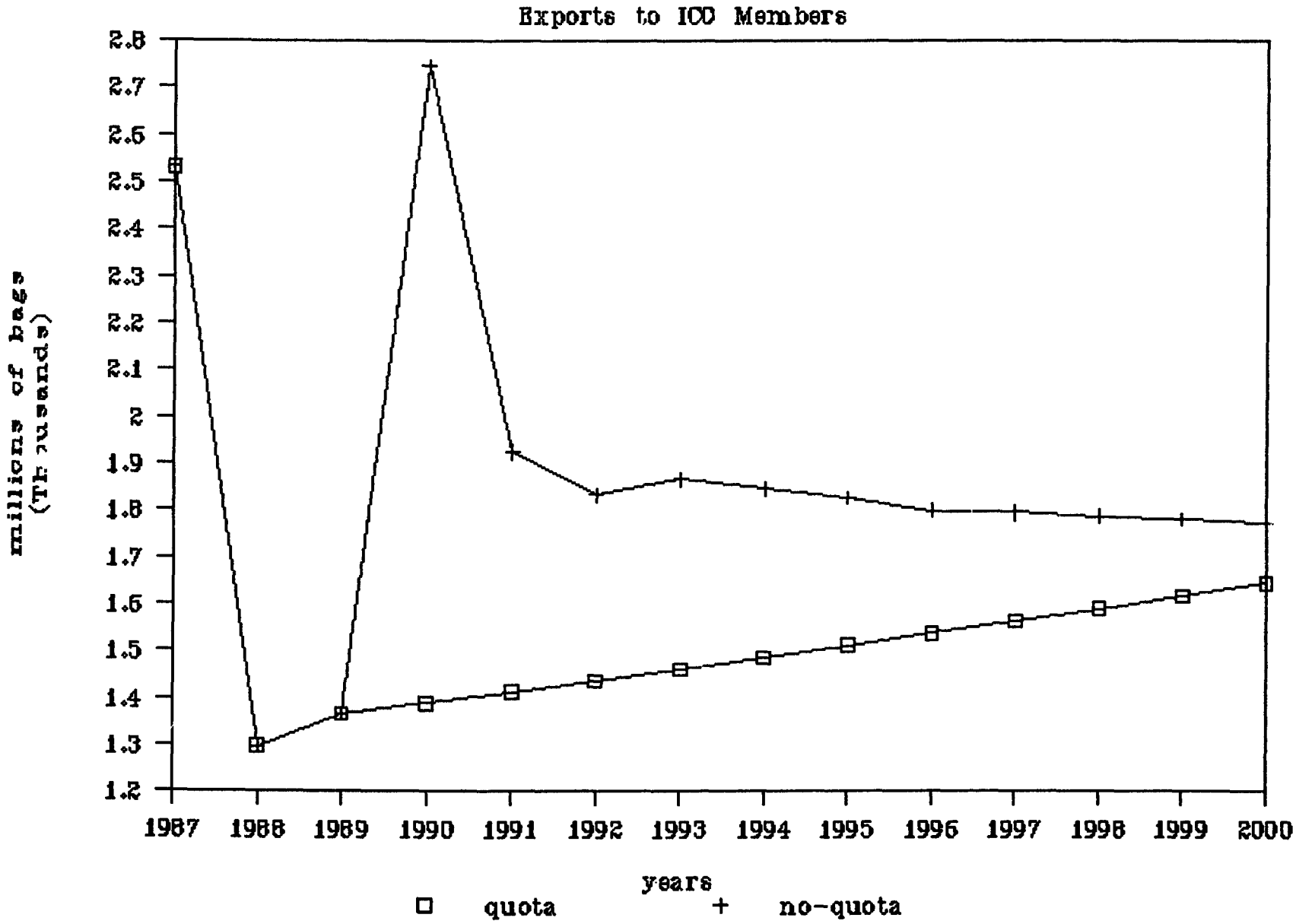


FIGURE 15: *INDONESIA*

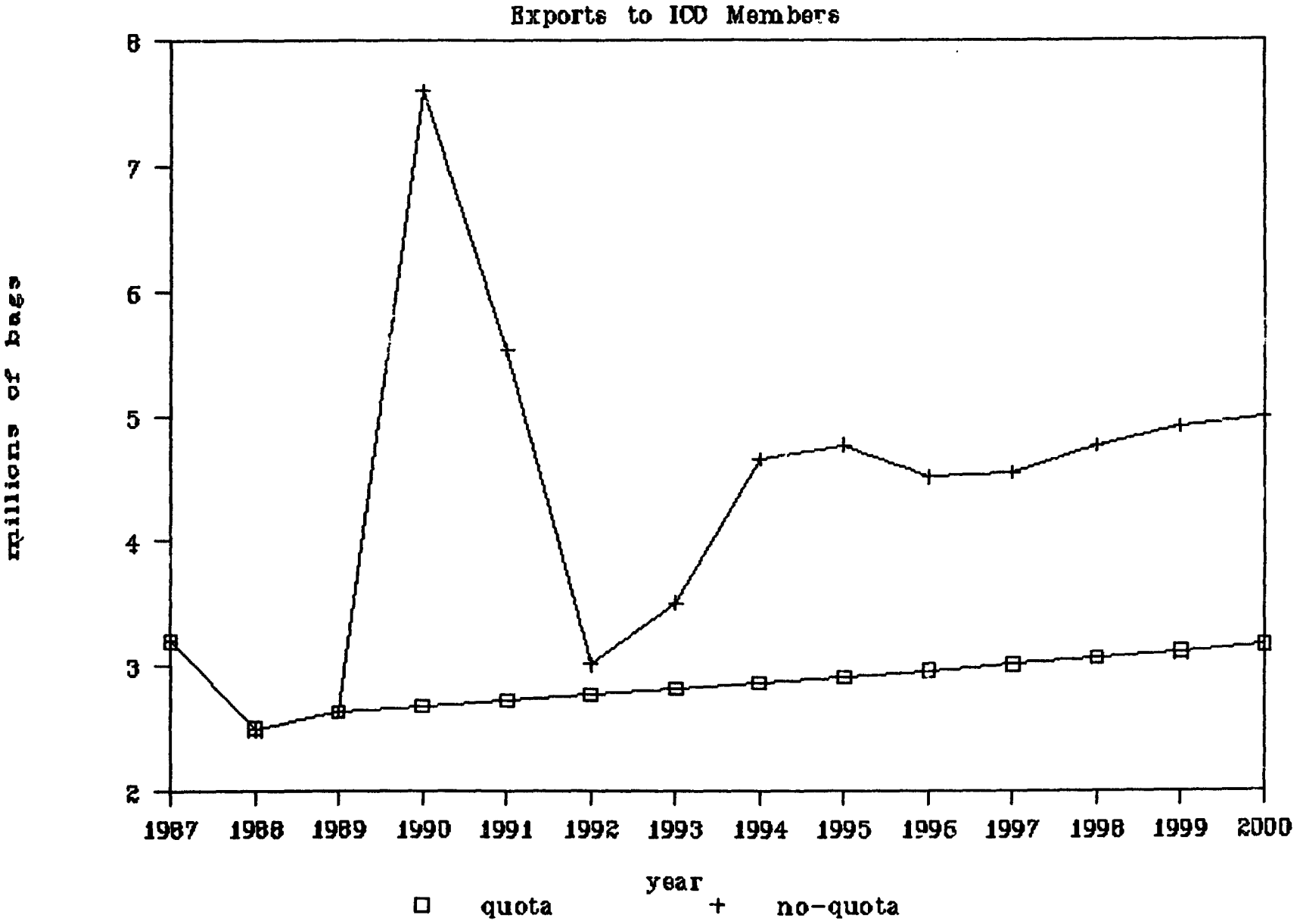


FIGURE 16: *PAPUA NEW GUINEA*

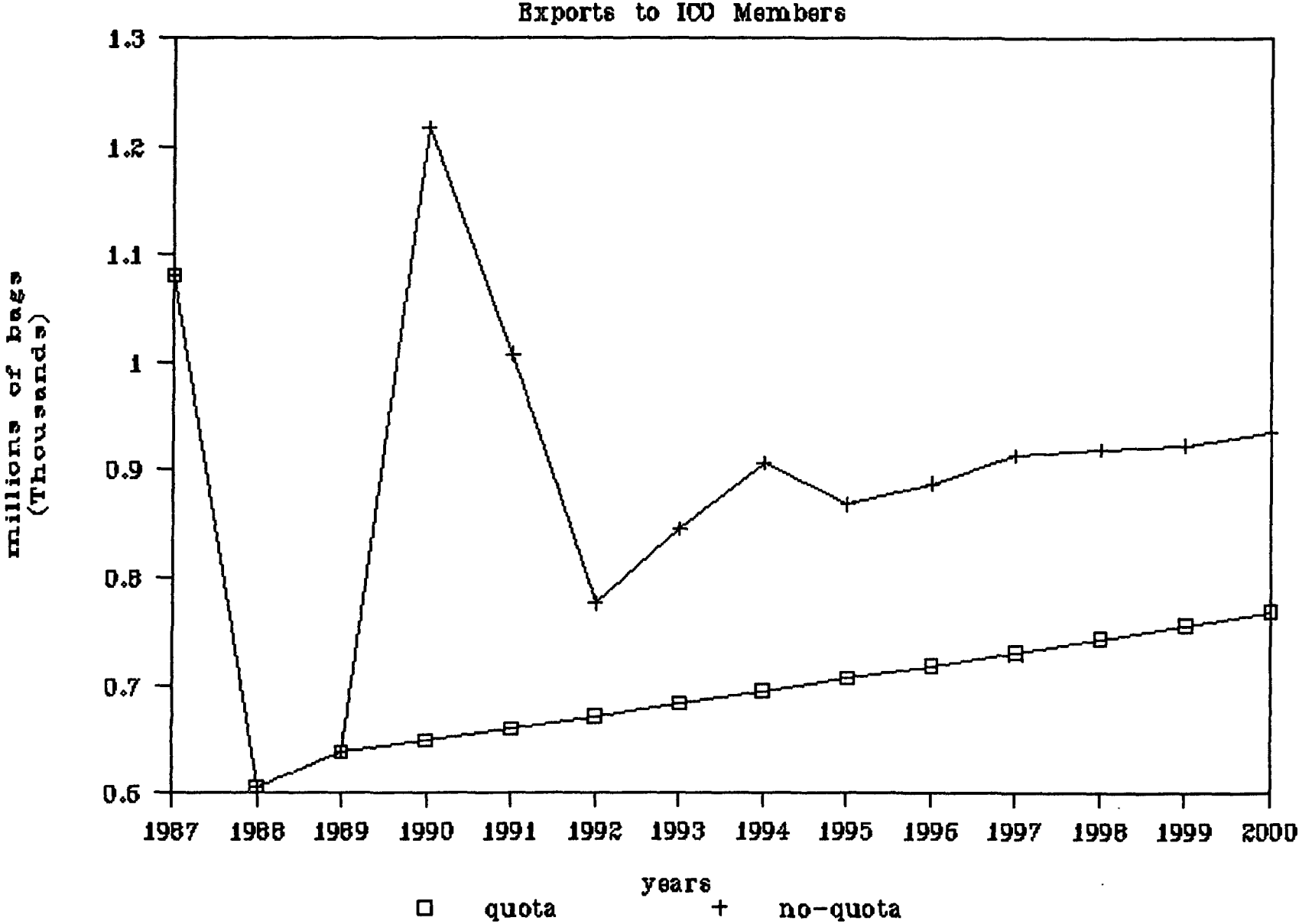


FIGURE 17: *UGANDA*

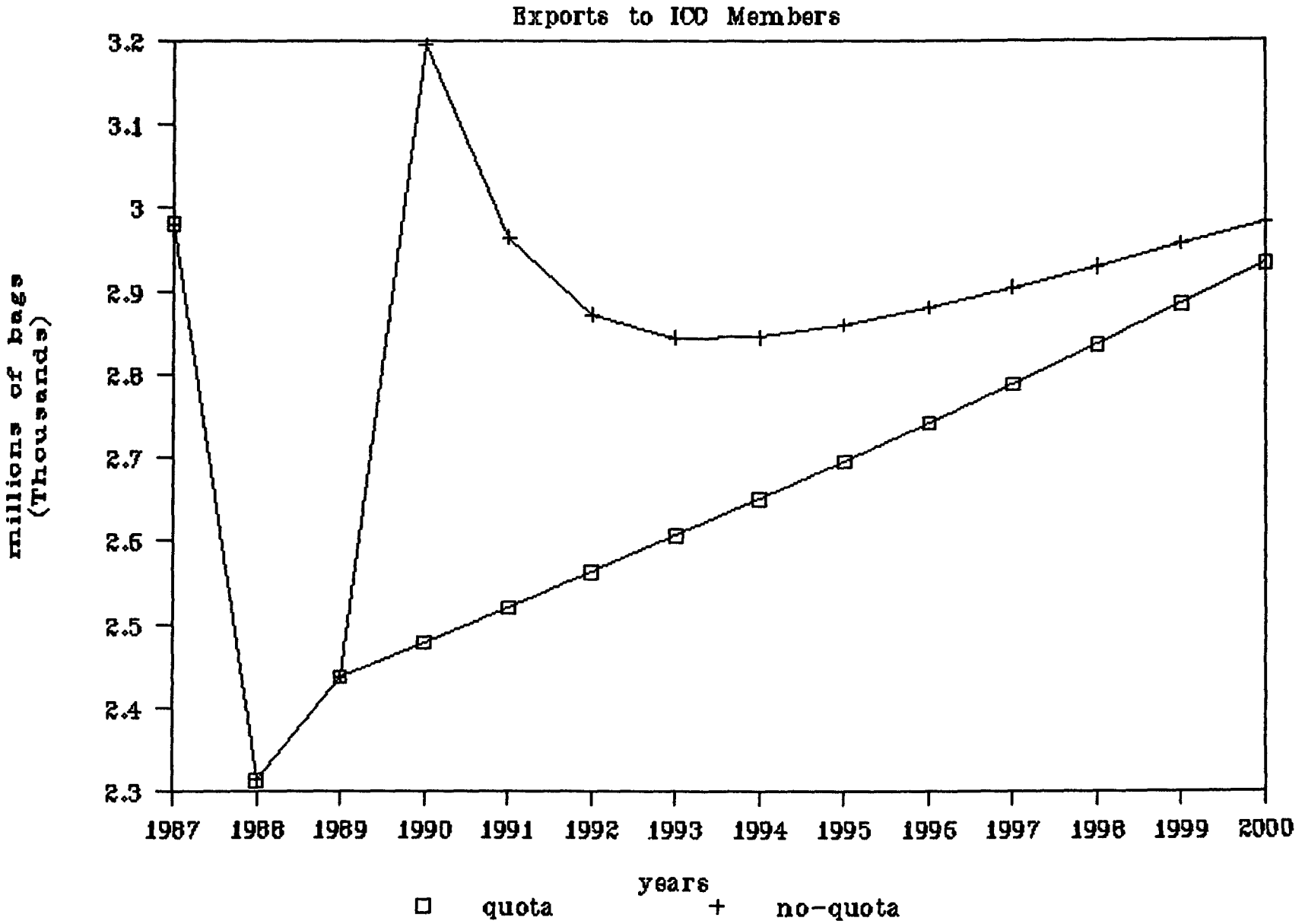


FIGURE 18: *BURUNDI*

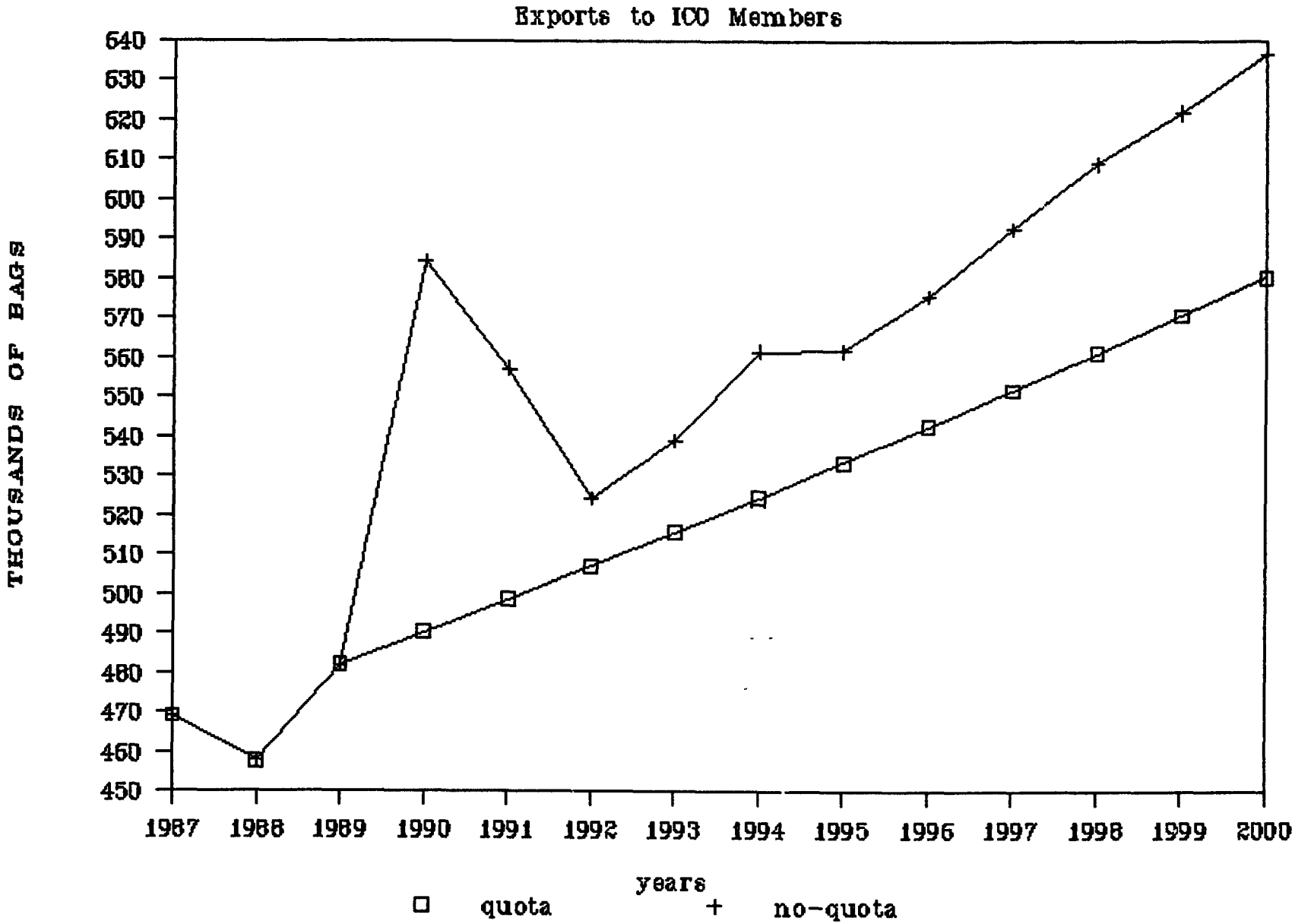


FIGURE 19: *COLOMBIA*

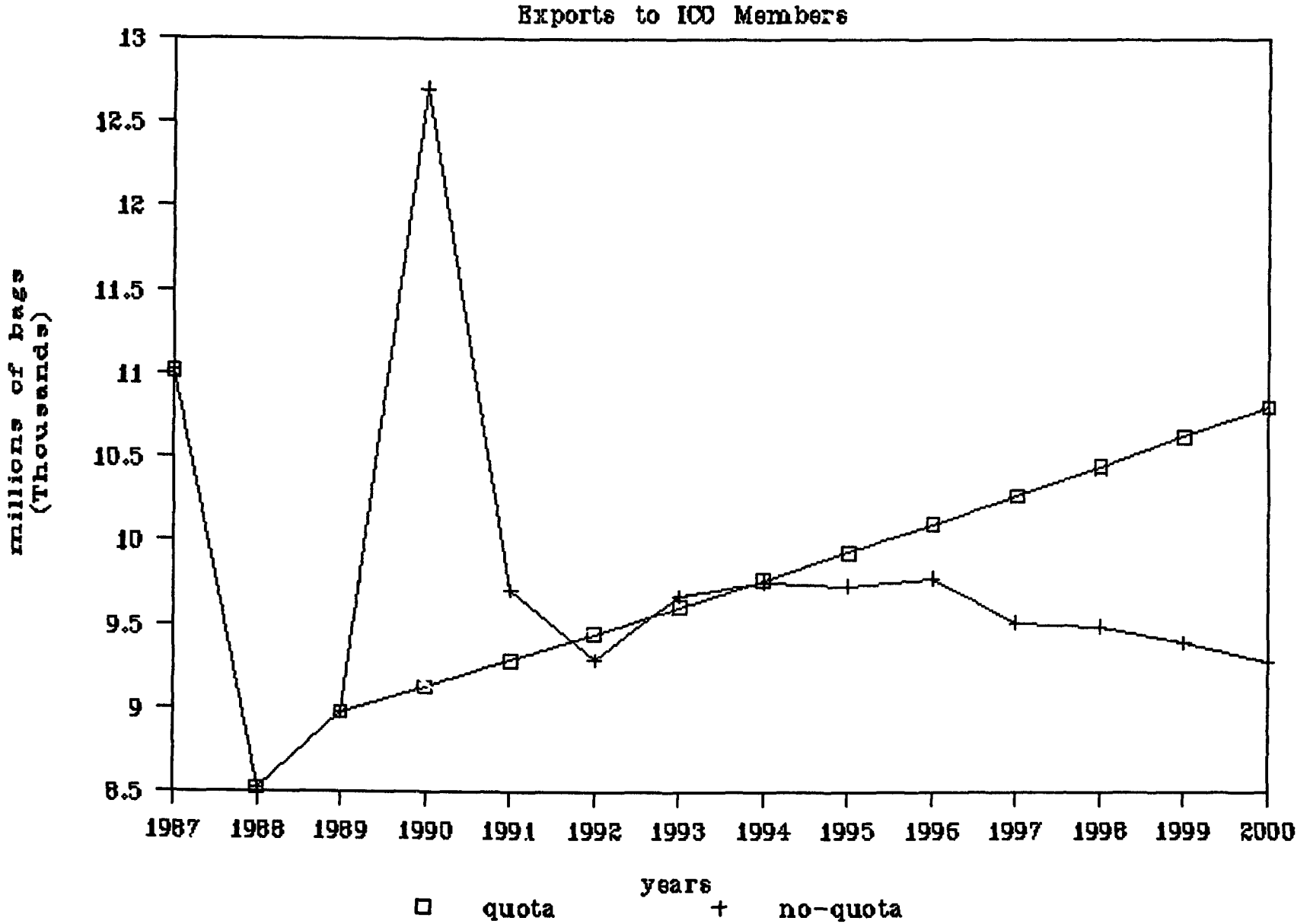


FIGURE 20: *HONDURAS*

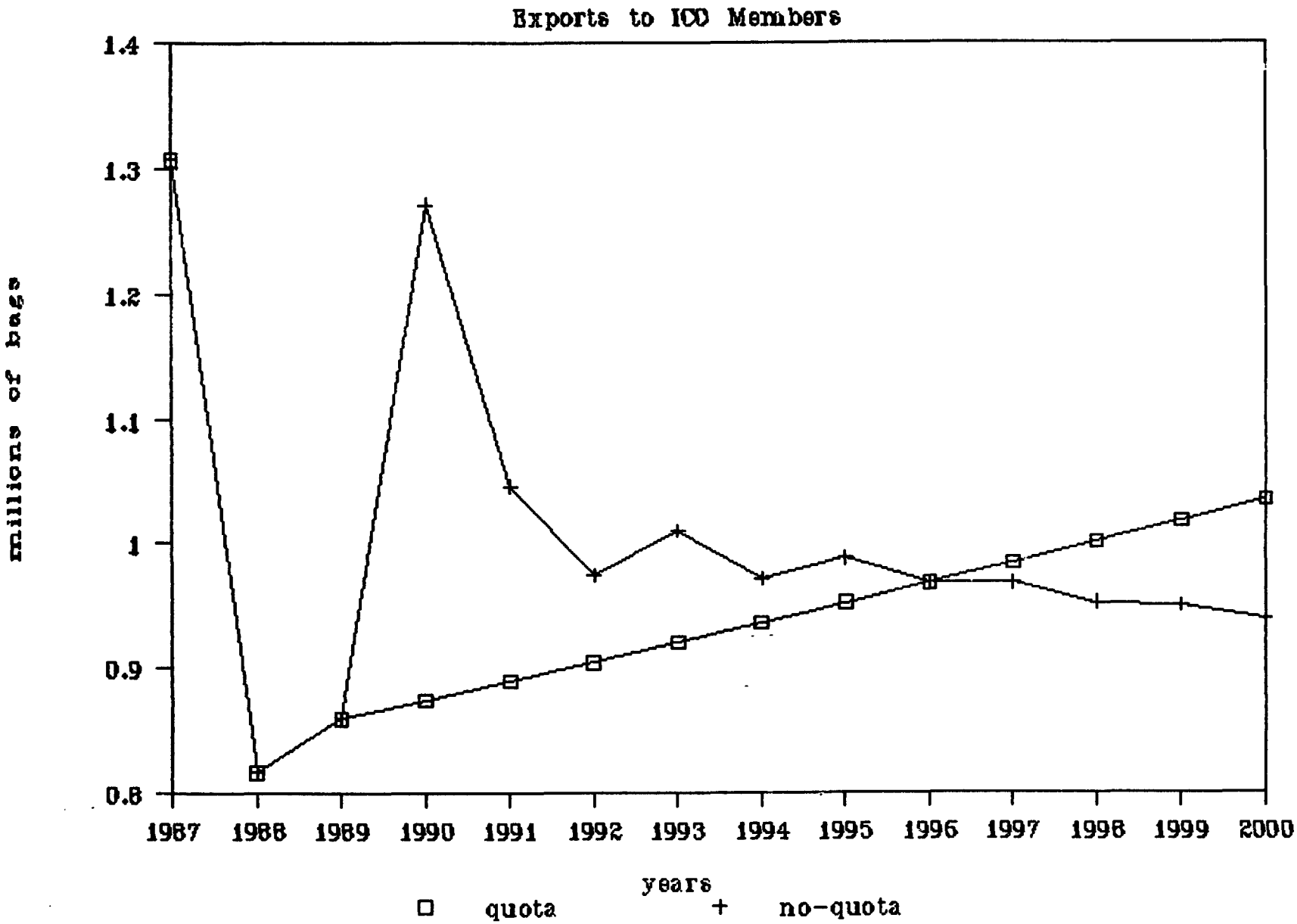


FIGURE 21: *KENYA*

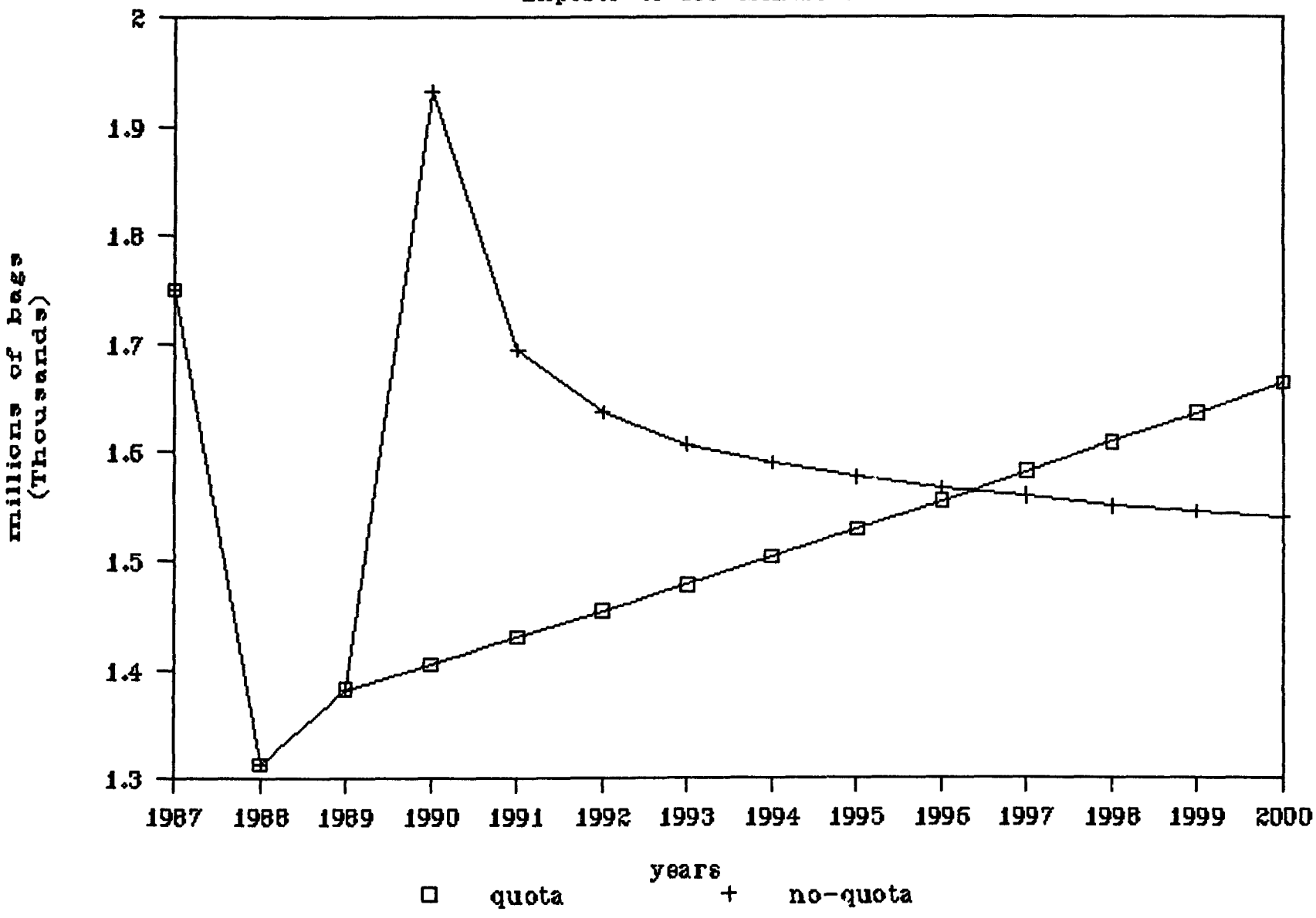


FIGURE 22: *COTE D' IVOIRE*

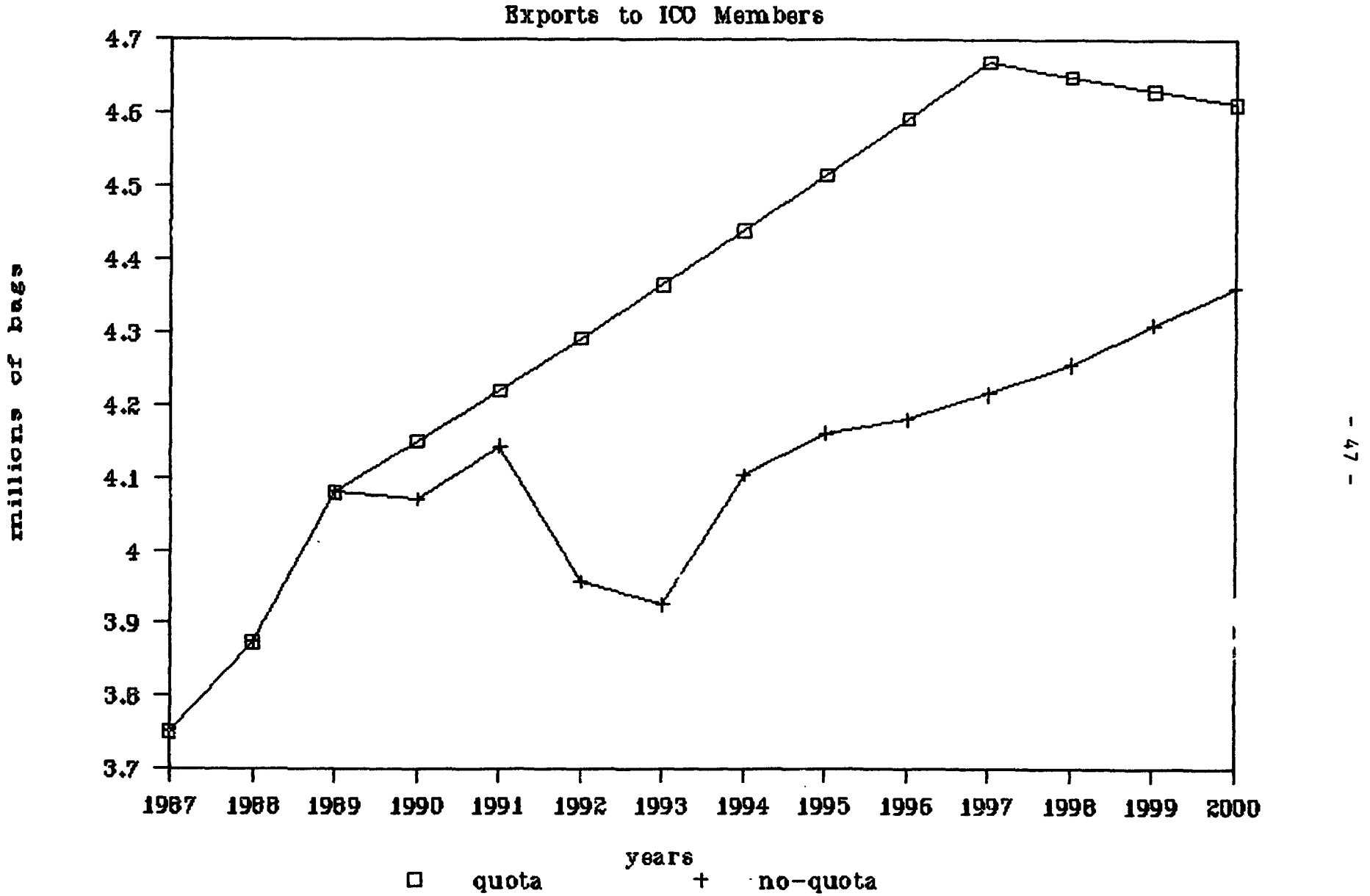
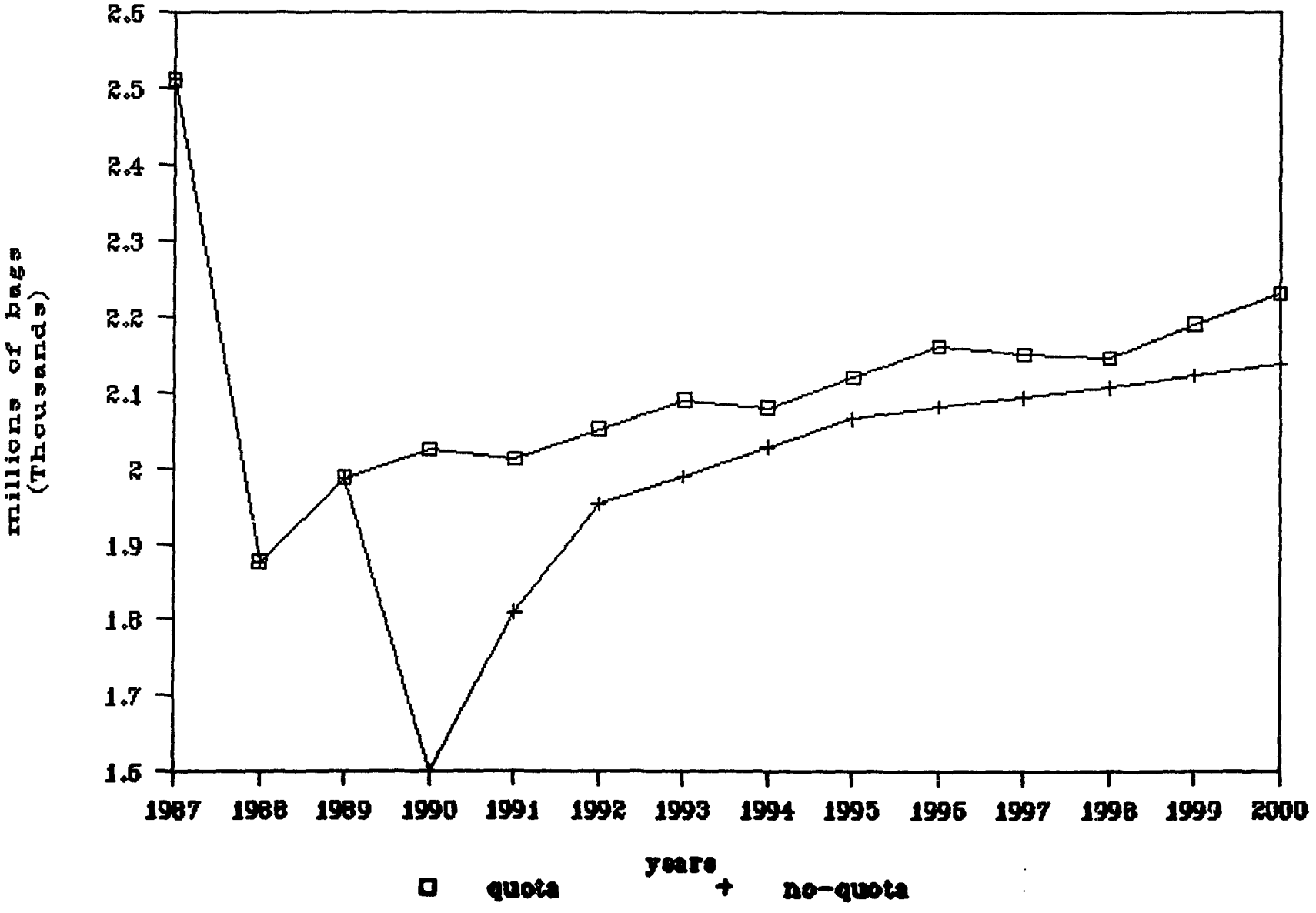


FIGURE 23: *EL SALVADOR*

Exports to ICO Members



VI. The Impact of the Quota System

43. The expected impact for producing countries of the quota system were estimated by comparing projected export revenues in real terms during the period 1990-2000 from the quota and without-quota simulations (see Table 7). The quota system benefits the producing countries as a whole by US$2.7 billion in 1985 constant US dollars (or 3.3% increase) over this period but as Figure 12 shows its benefits decline with time and in the late 1990s the combined export revenue of coffee-producing countries is higher under the without-quota scenario.

44. The benefits vary greatly from one country to another. The extent of the difference in a country's export revenues between the quota and without-quota case depends mainly on the extent of the difference in the export quantities under the two scenarios. If a country has enough production potential that it can increase its export quantities to cover the loss incurred from lower world prices under the without-quota scenario, its export revenues would be higher under the without-quota scenario than under the quota scenario. Thus Category III and most of Category II countries gain from the quotas while most countries in Category I lose from the quota system; an important exception in Category I is Brazil, which gains from continuation of the export quota scheme.

Table 7: TOTAL REAL EXPORT REVENUES (1900-2000)

Country	Quota	Without-Quota	% Difference /a
	-(millions of constant 1985 US$)-		
World Total	85,202	82,456	3.3
Costa Rica	2475	2830	-14.3
El Salvador	2964	2371	20.0
Guatemala	2819	2509	11.0
Honduras	1459	1408	3.6
Mexico	3876	3514	9.4
Nicaragua	655	560	14.5
Colombia	14795	13328	9.9
Venezuela	173	72	58.2
Cameroon	1816	1972	-8.6
Ethiopia	1570	1272	19.0
Côte d'Ivoire	4901	3946	19.5
Kenya	2584	2497	3.4
Uganda	2966	2821	4.9
Zaire	1425	1511	-6.1
India	1774	1590	10.4
Dominican Republic	797	763	4.3
Brazil	24120	22408	7.1
Ecuador	1923	1810	5.9
Peru	1299	1229	5.4
Burundi	723	678	6.3
Madagascar	879	758	13.7
Rwanda	826	887	-7.4
Tanzania	1057	1006	4.8
Angola	207	124	40.0
Indonesia	4647	6458	-39.0
Philippines	616	774	-25.7
Papua New Guinea	977	1130	-15.7

/a Negative indicates lower total export revenues in the with-quota case.

VII. Policies to Cope with the Lower Prices in the Absence of The Export Quota

45. The simulation results discussed in the last two sections show that real coffee export revenues of many coffee-exporting countries would decline sharply if the quota system is suspended in 1990. For each country there are limited policy options available to cope with such a situation. In countries where other cash crops are available, diversification out of coffee may be the most appropriate option. But this is a decision which has to be made within a long-run context, because of the nature of tree crop investment. In some countries this option may be desirable even if the quota system is continued; even under the quota scenario real export revenues of coffee are expected to increase only at low rates.

46. Countries which do not have the diversification option, may have to increase their competitiveness in producing coffee. This may be accomplished through employment of more efficient production and processing technology, reductions of export taxes on coffee and real devaluation of their currencies. Some improved management practices, such as stumping, can improve yields in the short run. This is not the case with replanting of higher-yielding varieties which has a negative impact on farm incomes in the short run. Because the very low world coffee prices under the without-quota scenario could last as long as four years, governments might consider emergency policies to reduce export taxes or devalue their currencies, or both--at least until coffee production technology improves. One catch in such a suggestion is that if all producing countries take these measures, world coffee prices may remain very low for a period considerably longer than that projected here.

VIII. Conclusions

47. The simulation results in this paper gave several interesting findings which models foscussed on short-term effects would not be able to reveal. The ex-post simulation results show that the quota system had an important effect in stabilizing world coffee prices for the period 1981-85. They also show that world coffee prices in 1986, the year prices increased sharply due to the drought in Brazil in 1985, would have been much higher had the quota system not operated during the period 1981-85. Thus the quota system had a price stabilizing effect on the upside too. The simulation results for individual exporting countries showed that the quotas led to decreased real export revenues for most countries, except for large exporters like Brazil and Colombia. These countries gained from the export quota system because they face very small or even zero marginal export revenues from increased exports due to their large market shares.

48. The projections of the world coffee market, with and without the export quota system, showed that world coffee prices would be substantially lower during the first half of the 1990s if the system were to be suspended in October 1989. However, the differences in prices between the quota and non-quota scenarios narrow with time as production and hence exports in many countries decline due to the low prices in the early 1990s.

49. Total coffee export revenues in real terms are projected to be less under the without-quota scenario than under the quota scenario until the late 1990s; but in the late 1990s total real export revenue is higher under the without-quota scenario as the price differentials narrow.

50. For the period 1990-2000 most producing countries would be better off in terms of total real export revenues with the export quota system. However, the extent of the benefits of the quota system vary considerably from one country to another. Countries with low production costs could more than compensate for the lower world prices under the without-quota situation by large increases in export quantities; while other higher-cost countries would suffer both from the lower world prices and lower export quantitites in the absence of the quota.

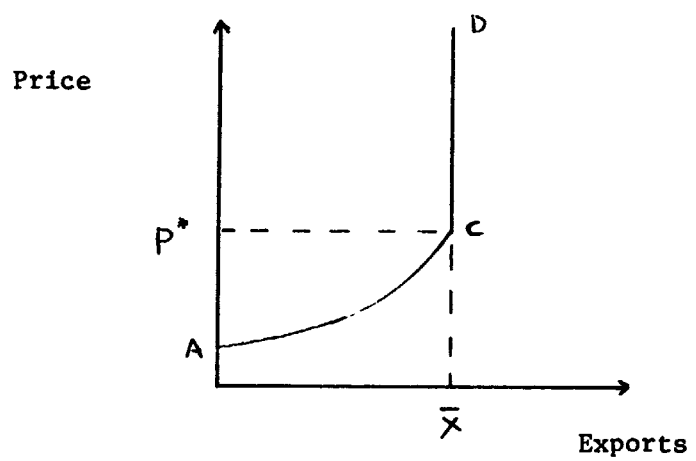
51. As the period of lower world prices following suspension of the export quota scheme is projected to last for several years, countries with high production costs may have to consider reductions in coffee export taxes or devaluation of their currency to reduce the impact on their coffee industry. However, if large producers followed this strategy it would have a depressing impact on world prices.

ANNEX

Problems in the Estimation of Economic Welfare Changes

52. An attempt was made to calculate and compare economic welfare under the quota and without-quota scenarios. 1/ The estimate of the economic welfare depends greatly on the shape of the supply curve. At an extreme, if the price elasticity of supply is assumed to be zero in the short-run, producer surplus is reduced to export revenues. However, this assumption is a poor one for estimating producer surplus as it assumes that the same quantity of exports will be made at any price, even if the price drops down to zero. A more realistic export supply curve for the case when the export quota is in effect is the one depicted in Annex Graph 1.

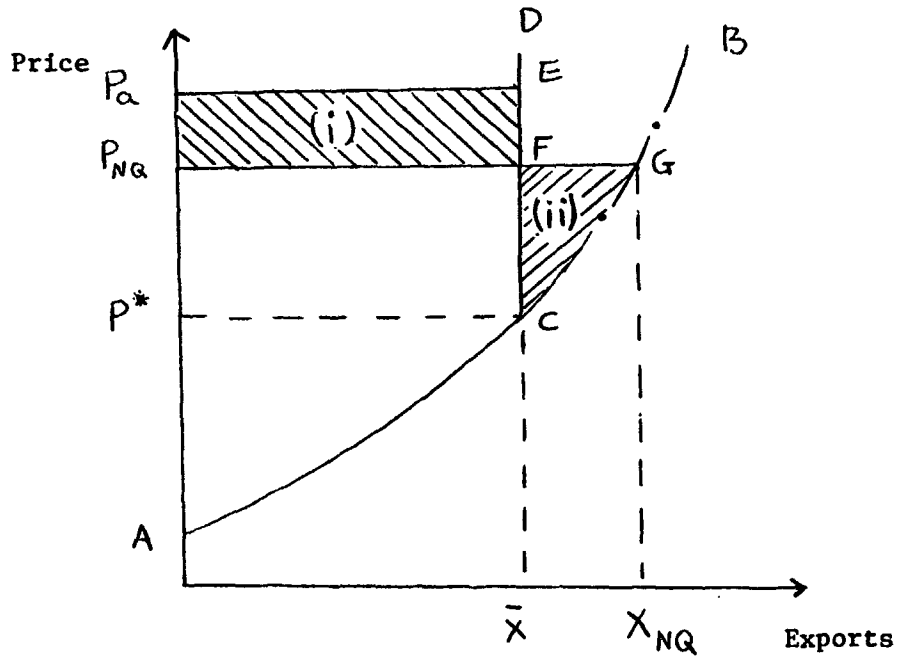
Annex Graph 1



1/ The producer surpluses are derived from export supply curves rather than from supply curves.

53. According to this curve, exports will be $\bar{X}$ only when prices are above P^*. Below P^*, exports will decline even in the presence of a quota fixing exports at $\bar{X}$.

Annex Graph 2



To calculate and compare economic welfare under quota and without-quota scenarios, the export supply curves under these two scenarios need to be carefully defined. In Annex Graph 2 curve ACD corresponds to the quota case and curve ACB to the without-quota case. The calculation and comparison of the producer surpluses for a small country (price taker) under the two scenarios is as follows: Without the quota the price is P_{NQ}, while if quotas exist the price is P_Q. The producer surplus under the without-quota scenario is then $P_{NQ}GA$ and under quota P_QECA. Comparing the two is reduced to comparing the area (i) to area (ii). In order to calculate area (ii) one needs to calculate P^*. P^* is the price at which exporters would export $\bar{X}$ in

the without-quota scenario. In order to calculate P^*, some constant price elasticity of export supply has to be assumed because the estimated supply elasticities are not considered reliable when P^* is low. For selected countries the differences in the producer surpluses between the quota and without-quota scenarios for each year for the period 1990-2000 were calculated and are given in Annex Table 1. The assumed short-term elasticity of supply is 0.3. Positive figures imply benefits from the quota system and negative figures imply losses. Among the selected countries only Indonesia, Papua New Guinea, and the Philippines manage to do better under the without-quota scenario, especially in the long run. These three countries have managed to substantially expand exports. All three of them are considered low-cost coffee producers.

Other than the ad-hoc imposition of a constant price elasticity of export supply and the magnitude of its elasticity, there is a more serious problem concerning the economic welfare calculations above. This problem arises when the supply curve shifts when quotas are lifted.

In Annex Graph 3(a) the export supply curve shifts in and in 3(b) shifts outwards when export quotas are lifted. These shifts are possible if, for example, the stocking behavior of exporters changes as a result of the change in the export quota regime. In both cases, the calculations of P* and the areas (i) and (ii), as depicted in Annex Graph 2, will not be accurate. Actually, for a number of countries and for a period of years, the P* was calculated to be higher than P_Q and P_{NQ}. In Annex Graph 3(a), the method of comparing economic welfare as depicted by Annex Graph 2 gives erroneous

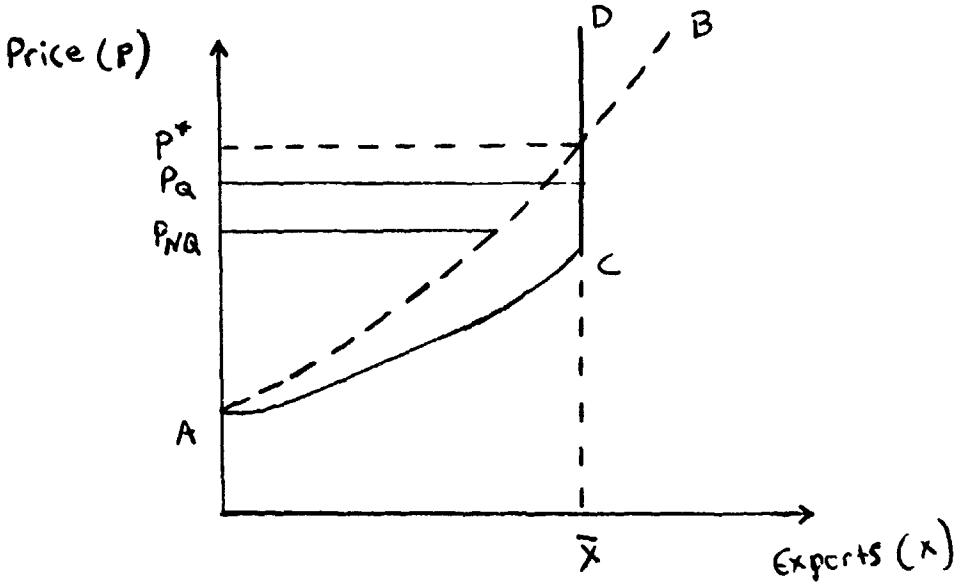
: 1: CALCUL ION OF LUS /a IF ARE L IED /b

Date	Republic	Costa Rica	Equador	Burundi	Tanzania	Uganda
1987	0	0	0	0	0	0
1988	0	0	0	0	0	0
1989	0	0	0	0	0	0
1990	25.3	2.8	81.2	29.5	47.1	135.8
1991	12.2	8.0	30.1	11.5	19.2	50.4
1992	3.8	3.6	18.2	8.2	11.6	33.5
1993	11.3	15.1	29.7	12.0	16.4	56.9
1994	11.7	20.4	31.8	12.0	16.6	60.6
1995	10.1	17.6	27.0	10.2	14.2	51.3
1996	8.1	14.5	21.2	7.8	10.4	40.4
1997	5.9	9.8	15.5	5.4	6.5	29.7
1998	5.0	9.4	13.4	4.3	5.0	25.8
1999	4.0	7.7	10.6	3.0	3.2	20.4
2000	1.9	3.5	5.4	0.8	-0.1	10.4

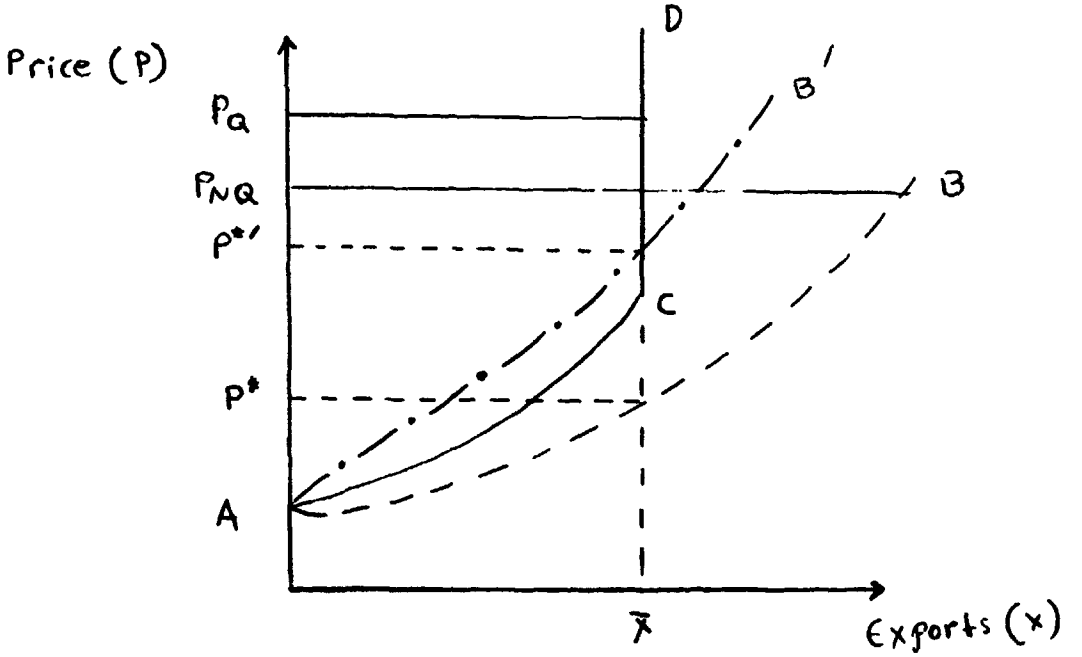
Date	Zaire	Cameroon	Rwanda	Indonesia	Papua New Guinea	Philippines
1987	0	0	0	0	0	0
1988	0	0	0	0	0	0
1989	0	0	0	0	0	0
1990	46.7	36.5	11.0	-194.3	6.9	3.4
1991	15.1	-3.2	-0.6	-176.7	-6.5	4.4
1992	6.3	-0.8	4.5	40.3	7.5	-7.7
1993	18.4	15.5	10.6	36.7	9.1	1.8
1994	24.6	25.8	10.7	-59.8	6.2	2.1
1995	18.9	25.2	8.7	-79.8	7.3	-0.0
1996	12.5	19.5	7.0	-62.2	3.6	-3.3
1997	7.5	14.0	5.4	-74.2	-0.4	-8.1
1998	6.0	12.9	5.0	-97.1	-1.1	-10.0
1999	3.5	10.7	4.1	-116.4	-2.0	-12.1
2000	-1.4	5.4	2.1	-132.1	-4.7	-15.4

/a Gain if sign is negative
/b In September 1989.

Annex Graph 3



(a)



(b)

results. In Annex Graph 3(b), producer gains from the lifting of the quota are overestimated (if the export supply curve shifts in to AB') or underestimated (if the export supply curve shifts outwards to AB') as compared to the results obtained from the analysis leading to Annex Graph 2.

Examination of the simulation results revealed that, in fact, the export supply curves of the majority of the countries considered shifted substantially with time. Thus, this approach was not adopted in the paper.

Mathematical Appendix

In this appendix the area (ii) in Annex Graph 2 is calculated.

It is assumed here that the export supply equation has constant elasticity, such as:

$$\ln X = e \ln P + A_o \qquad (1)$$

where X = export

P = Price

e = price elasticity of supply

A_o = intercept

To determine numerically the intercept, it is known that (1) passes through (P_{NQ}, X_{NQ}) so:

$$A_o = \ln X_{NQ} - e \ln P_{NQ} \qquad (2)$$

substituting (2) into (1)

$$\ln X = n \ln P + \ln X_{NQ} - e \ln P_{NQ} \qquad (3)$$

when $X = \bar{X}$, then $P = P^*$. By substituting $\bar{X}$ for X and P^* for P into (3) and solving for P^*, an expression for P^* is obtained.

$$P^* = \exp (\ln (\bar{X} / X_{NQ})/e) * P_{NQ}$$

After calculating P^*, the next step is to calculate the area (ii) = (GFC) in Annex Graph 2. This area is equal to:

$$(GFC) = (P^*CG\ P_{NQ}) - (P^KCFP_{NQ}) \qquad (4)$$

where:

$$(P^*CGP_{NQ}) = \int_{P^*}^{P_{NQ}} \exp (e \ln P + \ln X_{NQ} - e \ln P_{NQ}) dp$$

and:

$$(P_{NQ}\ FCP^*) = (P_{NQ} - P^*)\ \bar{X}$$

By performing the integration, (4) becomes:

$$(GFC) = X_{NQ} \left(P_{NQ} - P^{*}\right) / \left[(1+e) \quad P_{NQ}\right] - \left(P_{NQ} - P^{*}\right) \bar{X} \qquad (5)$$

After calculating the area (GFC) the producer surplus gain from lifting the export quota becomes:

$DIF = (GFC) - (P_{Q}EFP_{NQ})$ or,

$$DIF = X_{NQ} \left(P_{NQ} - P^{*}\right) / \left((1+e) \quad P_{NQ}\right) - \left(P_{Q} - P^{*}\right) \bar{X} \qquad (6)$$

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