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Coffee prices

**COFFEE PRICE DETERMINATION
AND VOLATILITY**

Executive Board/
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COFFEE PRICE DETERMINATION AND VOLATILITY

Introduction

1. There are a number of endogenous and exogenous factors affecting the world coffee industry which contribute to the determination and evolution of coffee prices. The key determining factors continue to be production, consumption and stocks although a number of exogenous elements can sometimes profoundly change the impact of such key factors on the determination and evolution of prices.
2. There are ongoing discussions on coffee price volatility, particularly on the role and influence of investment funds in the determination and volatility of commodity prices, including coffee prices. Coffee price volatility continues to add to the risks of the coffee industry, particularly for producers, exporters, traders and roasters.
3. This report, which complements an earlier study on coffee price determination and volatility (document EB-3629/97), raises a number of issues which could be discussed at a proposed ICO seminar bringing together a number of experts on this matter. The terms of reference for the proposed seminar are contained in document EB-3619/97. In fact, the important question still open is whether coffee prices have become more volatile and what are the key factors determining such volatility.
4. Following a review of the literature on price volatility studies and a graphic analysis of the relationship between coffee prices and certain market fundamentals and technical market factors, the study contained in document EB-3629/97 proceeded to review the broad understanding regarding the dynamics of the coffee market and various views on determining factors in price behaviour. This initial study concluded that it is very difficult to pinpoint the factors determining price volatility because the causal relationship between this volatility and market factors is constantly changing direction.

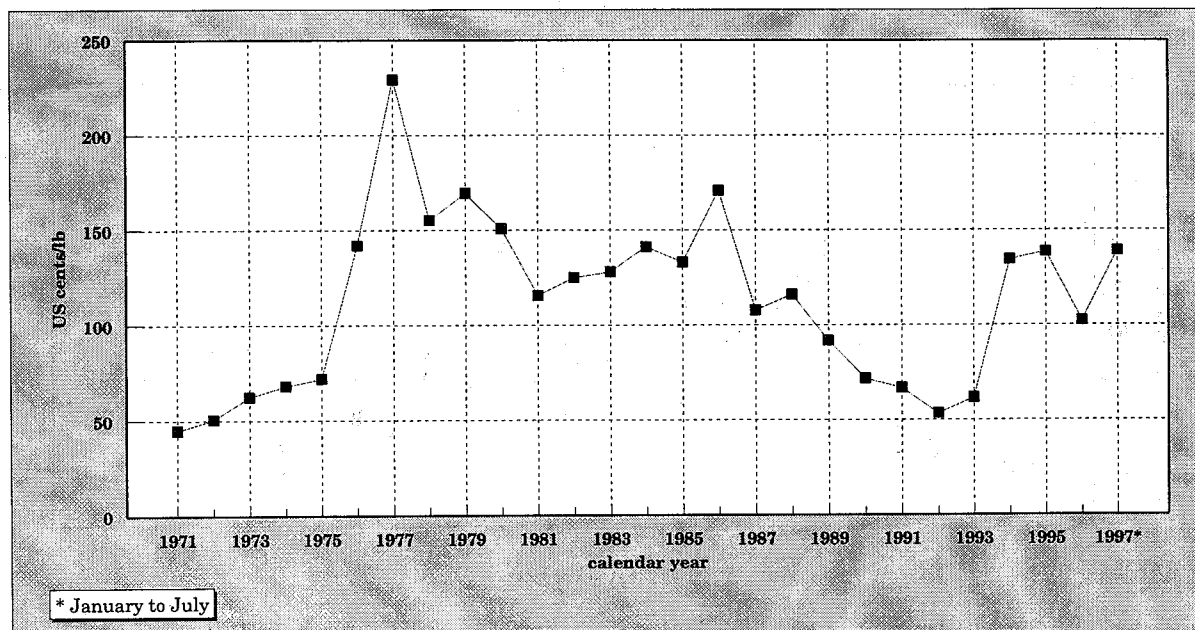
5. This complementary study provides a comparative analysis of price volatility according to specific groups of coffee, commodity exchanges and time periods. The following three periods will be covered: 1971 to 1979, 1980 to 1989, and 1990 to 1997. It is considered that an approach taking into account the period from 1971 to 1997 and the different groups of coffee will provide a better basis for highlighting endogenous and exogenous factors in the coffee economy which can influence price volatility. The following subjects will be considered:

- I. Historical and recent evolution of prices
- II. Comparative analysis of coffee price volatility
- III. Commodity exchanges and coffee price volatility

I. Historical and recent evolution of coffee prices

6. Graph 1 below shows the evolution of the ICO composite price from 1971 to 1997. This historical record of the composite price reveals the cyclical phenomena and instability that characterize the coffee market. It will be seen that there were three major periods of rising prices alternating with periods of falling prices. The first and longest period extends from 1971 to 1977, with very high price levels from 1975 to 1977. This first period of rising prices is attributable to the imbalance between supply and demand, aggravated by frosts in Brazil. Quotas were suspended in December 1972. This was followed by a brief period of slightly falling prices between 1978 and 1980 leading to the reintroduction of quotas in October 1980. Prices began to recover in 1981 and there was a second period of rising prices lasting until 1986. This period was also characterized by climatic problems in Brazil and other major producing countries. A lengthy period of falling prices began in 1987 despite the reintroduction of quotas in October 1987 and a brief recovery in 1988. The quota system was suspended in July 1989 and prices remained low until 1993. The third period of rising prices was between 1994 and 1995, followed by a fall in 1996 and an upturn in prices during the current year.

GRAPH 1
EVOLUTION OF THE COMPOSITE PRICE
1971 TO 1997

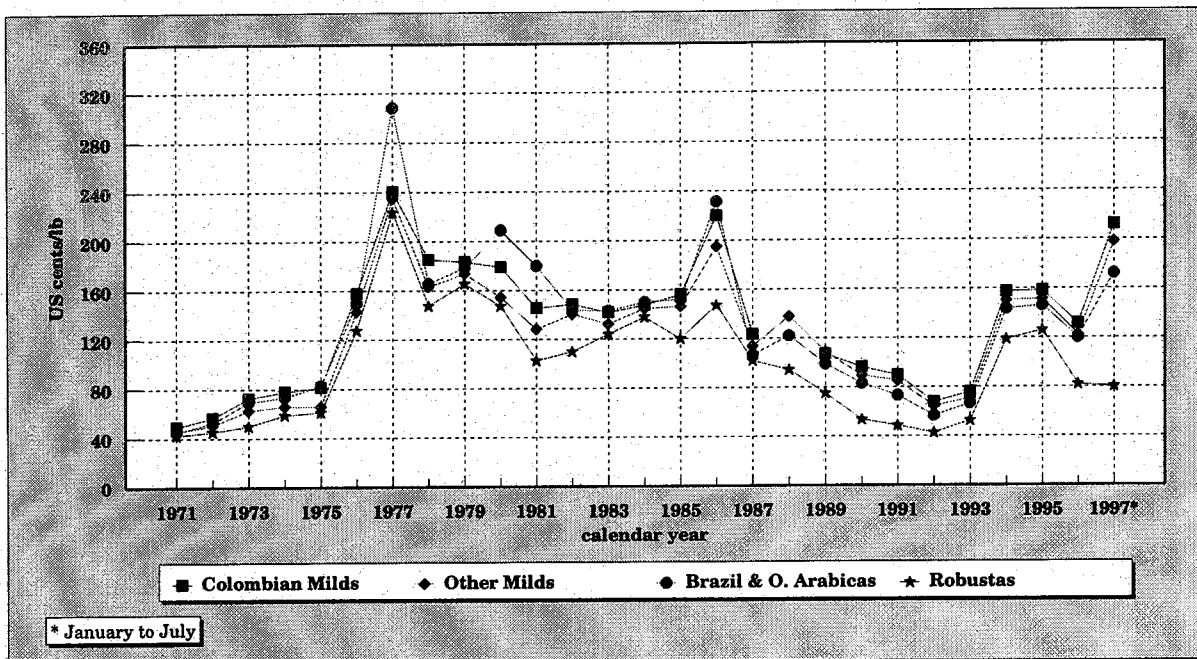


7. Analysis of this historical evolution of coffee prices shows the key role played by fundamental supply and demand factors. The first three periods of rising prices (1971 to 1977, 1981 to 1986, and 1994 to 1995) were mainly the result of climatic events in Brazil. The first two periods were lengthy, corresponding more or less to the time required for new investments in coffee growing to become productive. On the other hand, the third period of rising prices, which also coincided with climatic events in Brazil (frosts and drought,) was much shorter and seems to mark a change in the nature of the factors determining the behaviour of coffee prices. We could add a fourth period of rising prices, beginning in January 1997, which, unlike the three earlier periods, seems not to be attributable to supply problems.

8. We will now consider the evolution of prices since 1971 in more specific terms, through other indicator prices and prices on futures markets. Graph 2 shows the evolution of indicator prices for the four groups of coffee. Graph 3 shows price movements for futures contracts on the New York and London futures markets.

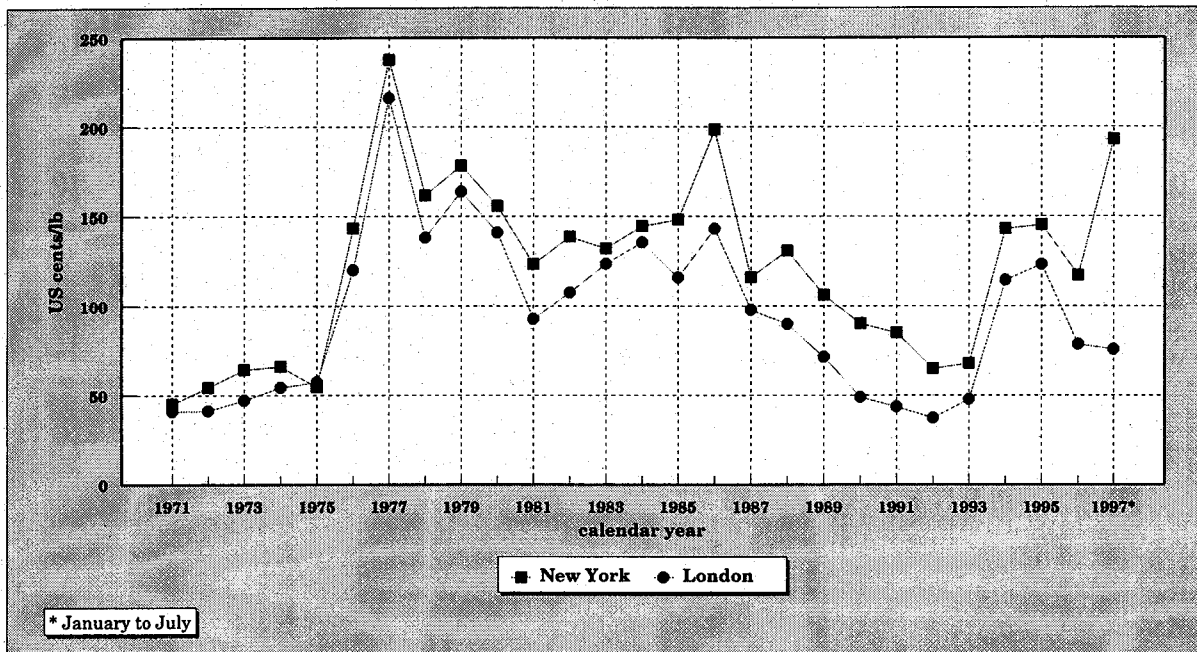
GRAPH 2

INDICATOR PRICES FOR COLOMBIAN MILDS, OTHER MILDS, BRAZILIAN AND OTHER ARABICAS, AND ROBUSTAS 1971 TO 1997



GRAPH 3

PRICES ON FUTURES MARKETS 1971 TO 1997



9. Graphs 2 and 3 indicate a certain convergence in the evolution of prices for the four groups of coffee. The four periods of rising and falling prices noted in the case of the composite price are clearly distinguishable.

10. The determining factors in the cyclical behaviour of coffee prices since 1971 are to be found in: changes in production volumes attributable essentially to climatic events in major producing countries, mainly Brazil; stock levels; low supply elasticities; the substantial volume of trading in futures markets; and low demand elasticities.

II. Comparative analysis of coffee price volatility

11. Studies on price determination and volatility continue to proliferate¹. Professor Christopher Gilbert has carried out a number of studies on volatility, which he defines as the variation in observed prices, on the basis of intra-day, intra-week, or intra-month changes, disregarding the long-term trend. In a paper written jointly by Gilbert and Celso Brunetti, the authors establish two different ways of calculating volatility: historical volatility for which the most commonly used measure is the sample standard deviation of previous daily, weekly or monthly percentage changes in price; and implied volatility, which is applicable to options and tends to anticipate movements in actual volatility².

12. Our comparative analysis of volatility is based on observed price behaviour during three periods corresponding to three decades in the evolution of coffee prices. The first period covers the years 1971 to 1979; the second is from 1980 to 1989, coinciding with the suspension of the system for regulating the market through export quotas under the International Coffee Agreement; and the last period begins in 1990 and continues to the first semester of 1997. This last period is marked by the liberalization of the coffee trade,

¹*Cf. document EB-3629/97 for bibliographical references.*

²*Christopher Gilbert and Celso Brunetti, Commodity price volatility in the nineties, Occasional Paper, Queen Mary and Westfield College, London, 1995.*

both at national level, through the progressive disappearance of marketing board monopolies in many producing countries, and at international level, with the abolition of all systems for regulating the coffee market.

13. We consider monthly observations to be appropriate for analyzing changes in volatility since 1971. We have abandoned the traditional volatility index, i.e. the coefficient of variation representing the relationship between the standard deviation and the mean of observed prices. Volatility has been measured on a monthly basis, using the deviation between the highest and lowest prices during the course of the month. The second volatility measure taken into account is the variation in successive months.

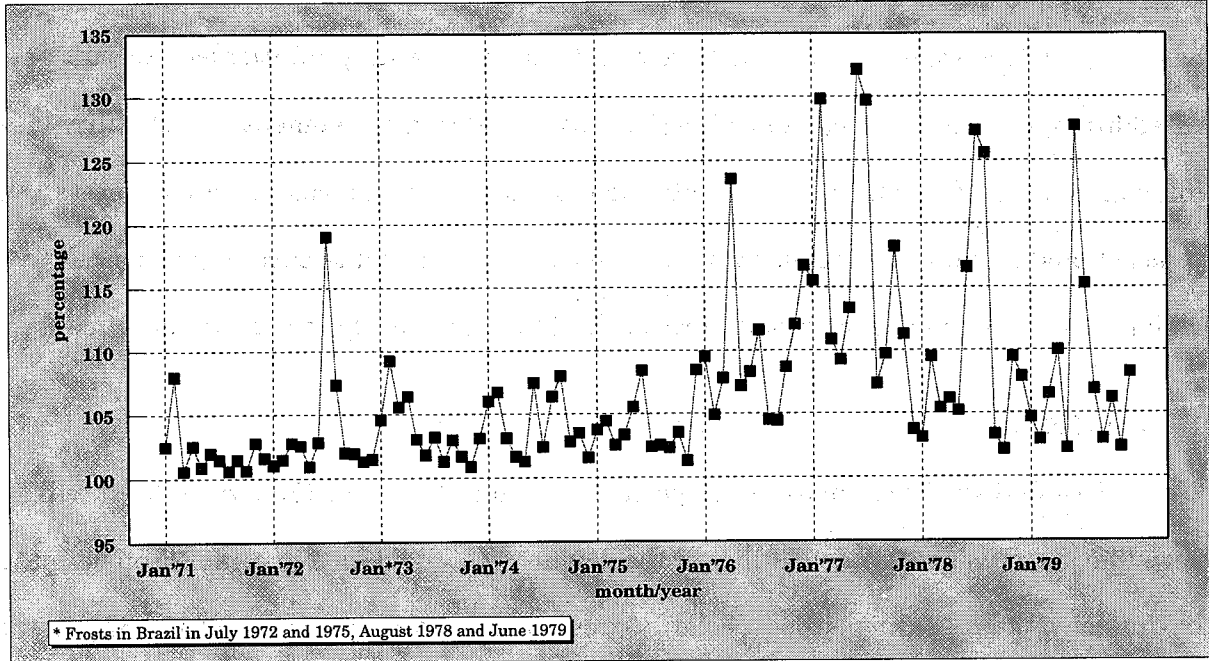
1971 to 1979

14. Graph 4 illustrates volatility during the period from January 1971 to December 1979. It will be seen that volatility was particularly marked between 1976 and 1979, especially in 1977 when prices were highly volatile during practically all months of the year, with the highest volatility level being 132.13 percent recorded in June 1977. Over the period as a whole, the year showing the highest rate of price instability was 1976, with a volatility coefficient of 247.70 percent. 1976 was marked by considerable instability, with an upsurge in prices which reached their highest level for the decade in 1977. Quotas had been suspended since 1972. During this period, there were frosts in Brazil in July 1972, July 1975, August 1978 and June 1979.

15. Comparison of contract prices (1st position) on the New York and London futures markets (Graph 5) shows increased volatility during the same periods. Adverse weather conditions reduced production in the major producing countries and contributed towards a fall in world stock levels (Annex A: World stocks since 1971).

GRAPH 4

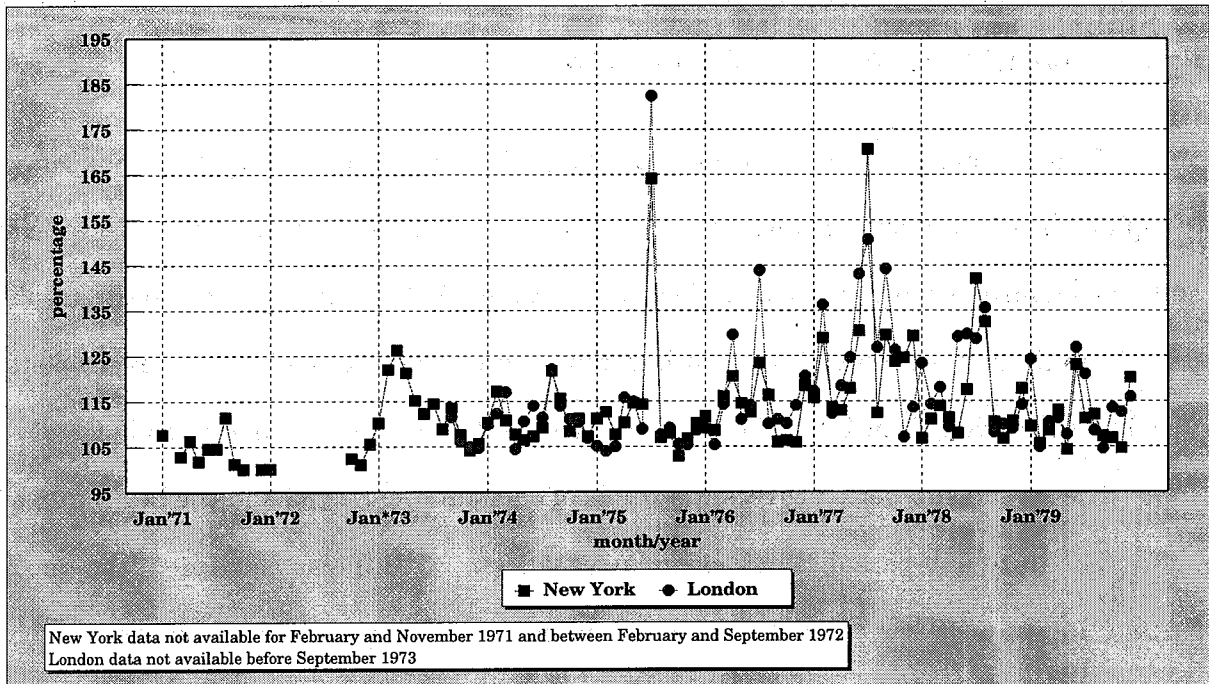
COMPOSITE PRICE VOLATILITY
1971 TO 1979



GRAPH 5

PRICE VOLATILITY ON FUTURES MARKETS
1971 TO 1979

(New York and London monthly data for 1st position)



16. Most studies of price fluctuations during the period from 1971 to 1979 emphasize the impact of the crisis caused by the rise in world petroleum prices, which triggered price rises in other commodities. In the case of coffee, price rises were attributable not only to basic supply factors, but also to fairly strong demand reflecting inflationist expectations. In addition, international currency fluctuations introduced an element of instability into international trade, which was heightened by increases in real interest rates and international liquidities. In other words, financial crisis elements encouraged speculative activity and accentuated commodity price volatility, particularly in the case of coffee.

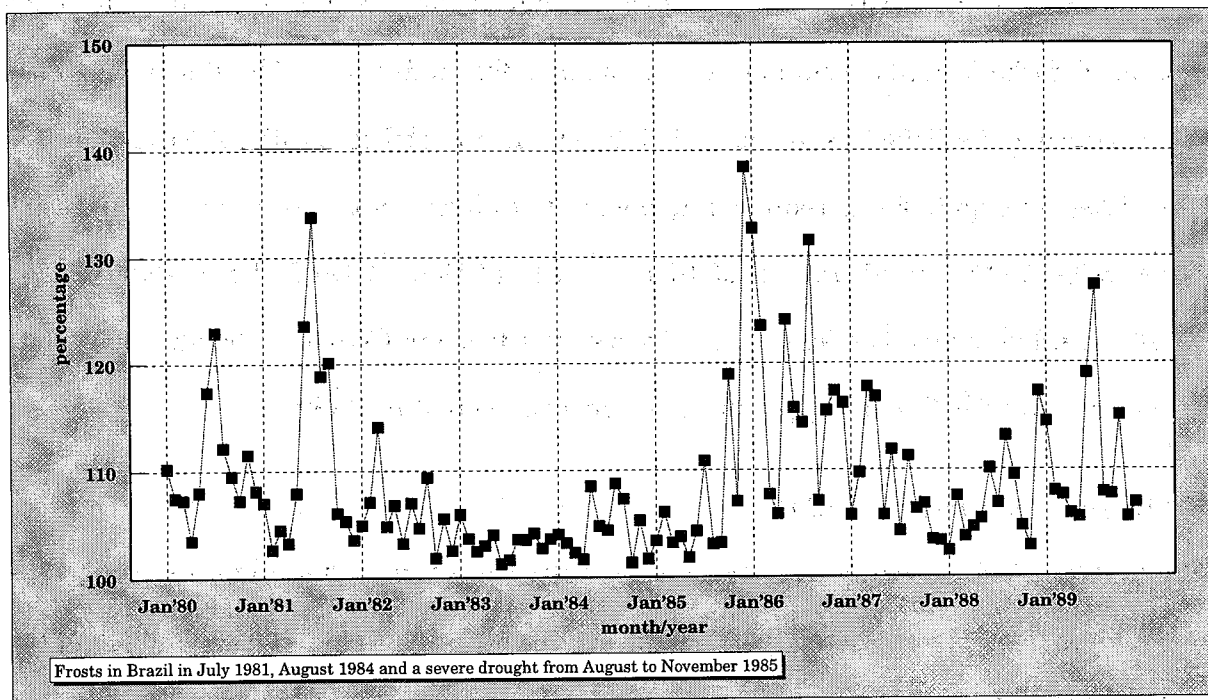
1980 to 1989

17. Graph 6 shows changes in composite price volatility from 1980 to 1989. It will be seen that there was marked volatility at the beginning of the period in comparison with the beginning of the preceding period. Volatility returned in 1986, with levels of 132.67 percent in January and 131.50 percent in August. The last years of the 1980s were relatively unstable, with levels of 118.96 percent and 127.23 percent in June and July 1989 respectively. Climatic problems occurred in Brazil in July 1981 (frost), August 1984 (frost), and August to November 1985 (drought). Quotas introduced in October 1980 were suspended in February 1986 following a surge in prices attributable to the prolonged Brazilian drought from August to October 1985.

18. Prices on futures markets were very volatile throughout practically the entire period (Graph 7). The volatility in composite prices was reflected in futures prices on the New York and London futures markets. The period from 1980 to 1989 can be divided into three sub-periods of marked price instability, both at composite price level and in futures markets. The first sub-period, from 1980 to 1982, is marked by the introduction of quotas in October 1980. The second sub-period covers the whole of calendar year 1986 and the beginning of 1987. The third sub-period covers calendar year 1989, with the suspension of the quota system in July 1989. These composite price movements, attributable to market fundamentals, were considerably amplified in the case of the futures markets.

GRAPH 6

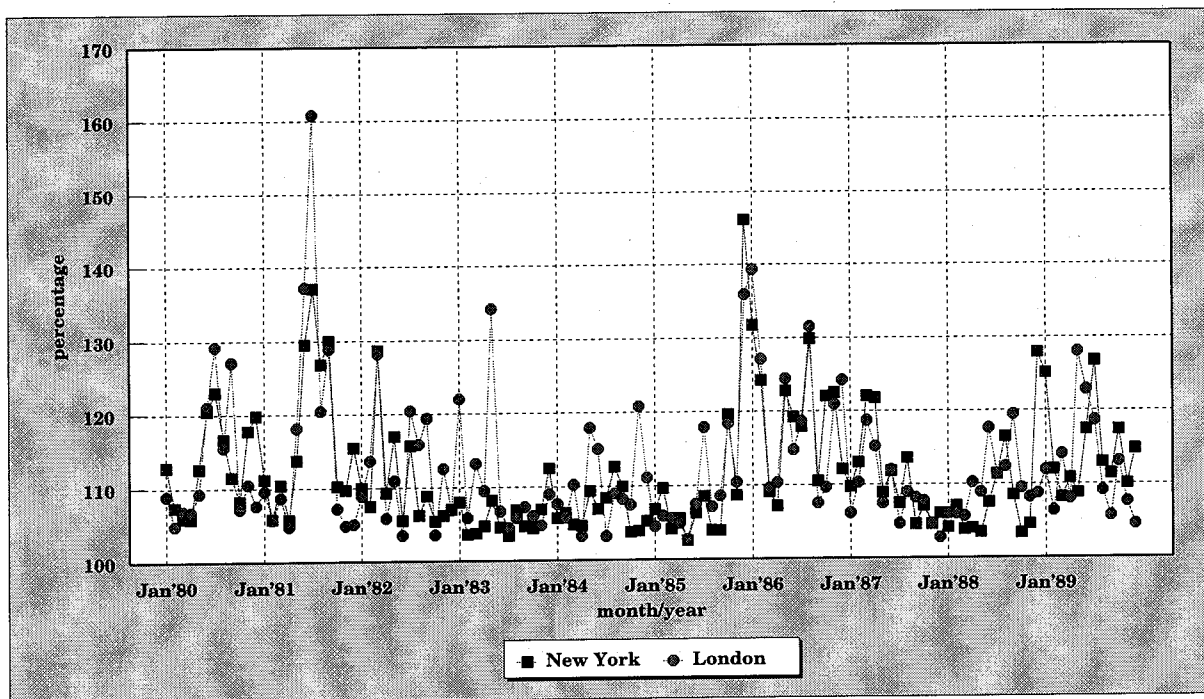
COMPOSITE PRICE VOLATILITY
1980 TO 1989



GRAPH 7

FUTURES PRICES VOLATILITY
1980 TO 1989

(New York and London)



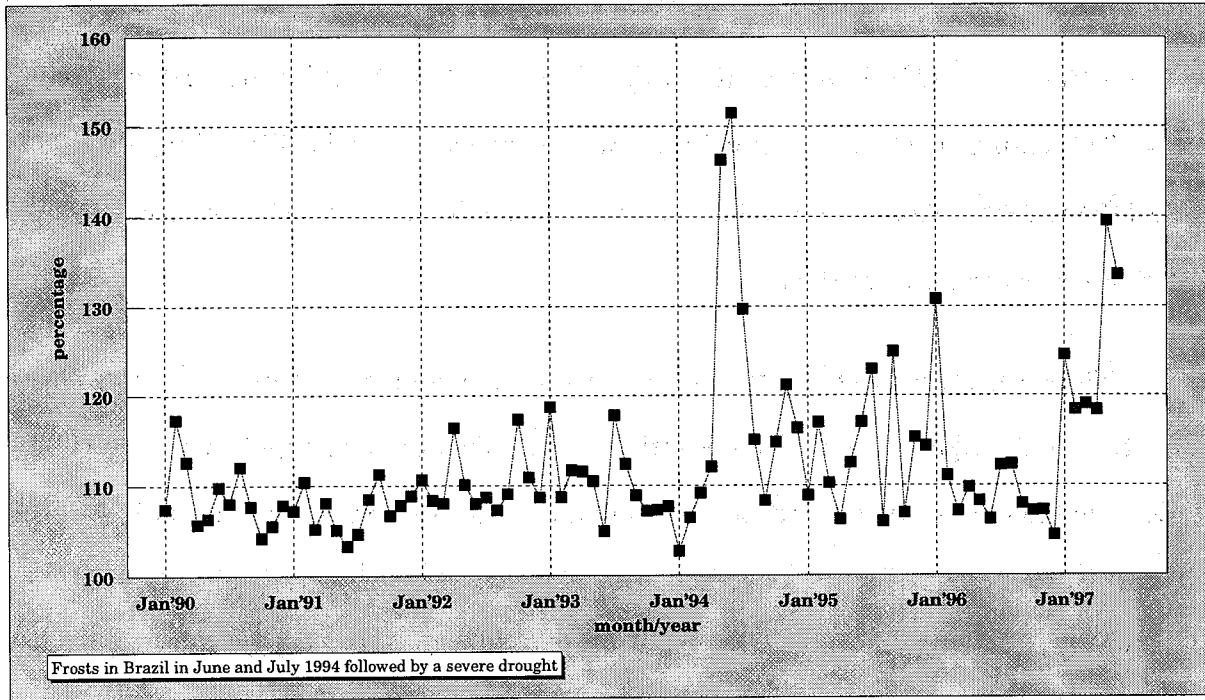
19. Financial factors played an important role in price behaviour during the period from 1980 to 1989. Interest rates were abnormally high at the beginning of the period and led to an increase in the costs of holding stocks. As a result, there was a reduction in the volume of stocks held in consuming countries and a fall in demand. The sharp rise in the value of the dollar during this period contributed to the instability of coffee prices by causing an increase in supply and a reduction in demand. In terms of the variation in successive years, prices fell by an average of 63.07 percent from 1986 to 1987. From 1982 to 1985 prices remained relatively stable. Quotas were introduced in October 1980 and suspended in February 1986 before being permanently suspended in July 1989.

1990 to the first semester of 1997

20. Graph 8 illustrates composite price volatility since 1990. The sub-period from 1990 to 1993 was relatively stable compared with the second sub-period. The second half of the period 1990 to 1997 was marked by a very high degree of instability. In 1994 volatility reached record levels with an average volatility coefficient of 316.68 percent. With the exception of 1996, the period from 1994 to 1997 was very unstable. Prices on futures markets showed the same movements at a higher degree (Graph 9).

GRAPH 8

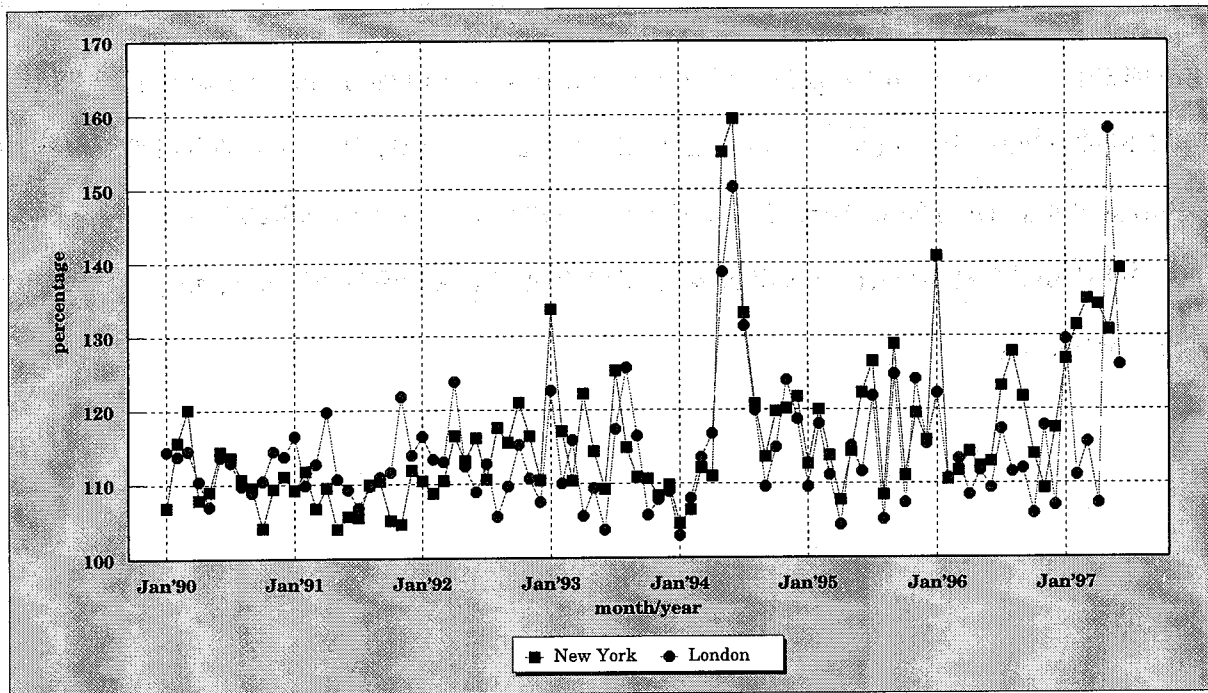
COMPOSITE PRICE VOLATILITY
1990 TO 1997



GRAPH 9

FUTURES PRICES VOLATILITY
1990 TO 1997

(New York and London)



21. The volatility observed since 1994 seems to be attributable to exogenous factors related to climatic conditions, mainly in Brazil, which affected supply and created an imbalance in relation to demand. Climatic incidents in Brazil (frosts and drought) occurred in June and July 1994. The relevant graphs indicate that volatility has increased since 1994. The graphs attached at Annex B show the evolution of volatility during each year from 1994 to 1997. The coffee market seems to have become much more volatile since the Brazilian climatic crises of 1994.

22. The cases of increased volatility observed in the historical evolution of coffee prices have the same origin, with adverse weather conditions affecting supplies and causing a serious imbalance between supply and demand. The essential characteristic of price volatility since 1994 is that the reduction in supplies following climatic problems has taken place in the new context of supply management by roasters, whose stock levels are too low to enable them to offset excessive price fluctuations. In other words, in periods of excess demand and low stock levels, prices tend to fluctuate widely and this fluctuation is accentuated by speculative fund activity in coffee futures markets.

III. Commodity exchanges and volatility

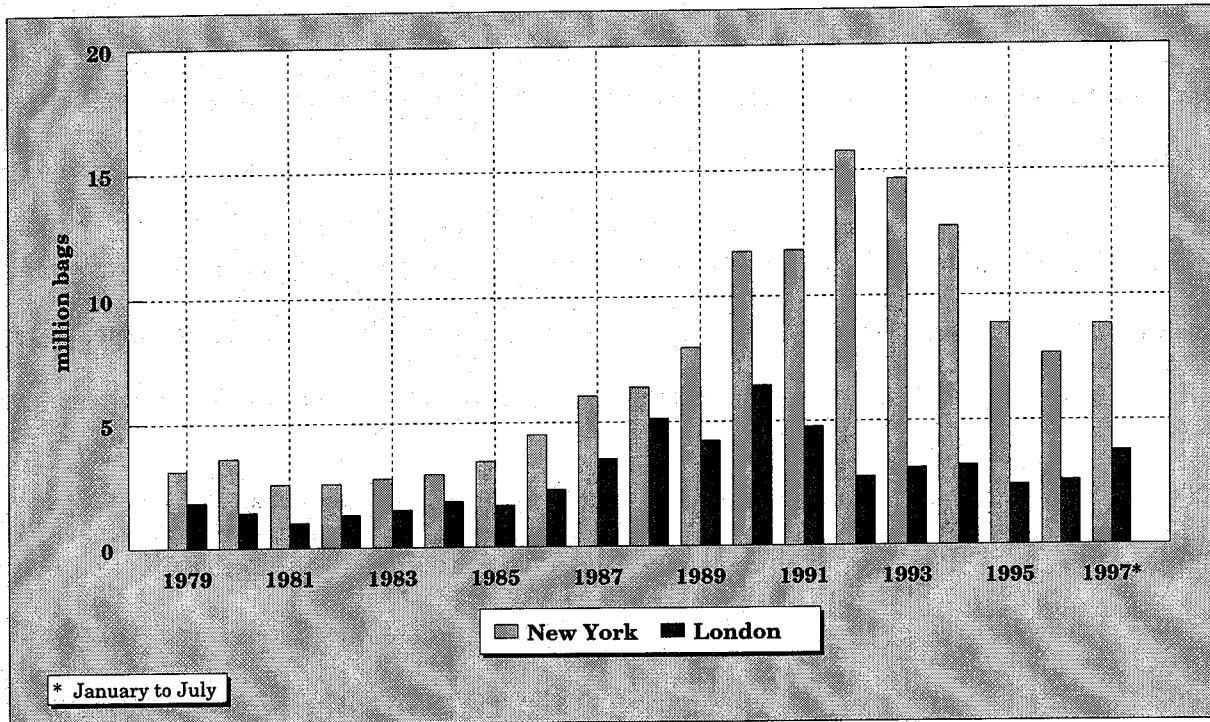
23. A great deal has been written and said about the highly active role of speculators and investment funds in coffee price volatility and this is a matter that continues to be the subject of debate. It should be noted that futures markets only attract so-called speculative interest when prices show wide fluctuations. Supply and demand imbalances lead to price instability and this attracts speculative funds which, in certain conditions, may accentuate such instability.

24. In fact, market operators provide the liquidity required for effective futures markets. The substantial volume of open interest indicates the degree of current liquidity of the market and hence its volatility, and shows the extent of interest in the coffee industry. In other words, volatility determined by market fundamentals attracts investors who can accentuate this volatility as a result of different anticipatory activities based on conflicting interpretations of information.

25. The Singapore futures market, which has been active since March 1995 and deals in Robusta contracts, is experiencing problems in achieving liquidity to attract operators, as the London (LIFFE) and New York (NYCSCE) futures markets have already done.

26. The volume of trading in futures markets and options has increased substantially in recent years. This growth may have contributed towards increased coffee price volatility. In fact, the technical approach used by investment funds is not based on analysis of factors affecting supply and demand but on the use of tools designed to aid decision making, which are based on analysis of historical price movements. Although commodity investments represent only a small proportion of investment fund activities, such fund investment seems to encourage sharp price fluctuations in a market characterized by low stock levels and the absence of any regulating mechanisms. Graph 10 illustrates the evolution of the volume of open interest, indicating the degree of liquidity of the futures market.

GRAPH 10
VOLUME OF OPEN INTEREST
IN THE LONDON AND NEW YORK FUTURES MARKETS
1979 TO 1997



Conclusions

27. A study carried out by the UNCTAD on coffee price instability and the determining factors involved established that the index of coffee price instability was 11.8 percent during the period 1980 to 1986 compared with 16.8 percent during the period 1986 to 1991 and 11.5 percent during the period 1991 to 1993, making coffee the least stable tropical beverage³. In the period not covered by the UNCTAD study, price volatility seems to be most pronounced in 1994, with a coefficient of 316 percent, as shown in the graphs attached at Annex B. The above analysis suggests, therefore, that the coffee market has become more unstable than in recent decades. As a result, producing countries and certain coffee industry operators have experienced a great deal of uncertainty in relation to future price levels.

³UNCTAD, *Recent trends on the world coffee market*, UNCTAD/COM/59, 1995.

28. Trading techniques used by chartists influence coffee price determination and volatility. These market operators base their decisions on technical factors which do not respond directly to conditions affecting supply and demand. For these operators, who study a large number of graphs, the only fundamental market factor influencing their predictions is the size of the Brazilian crop. The tools they use as decision-making aids are the historical price structures plotted on various graphs.

29. The analysis of coffee price fluctuations carried out so far indicates that delays in the reaction of production and consumption to price movements tend to trigger over-reaction phenomena which may lead to sizeable variations in price. In addition, the impact of exogenous crises also increases price volatility. Exogenous factors undoubtedly have a periodic influence on prices and a significant impact on the market, but what really accounts for the instability of coffee prices is the situation of factors affecting the coffee economy and the absence of any self-regulating mechanism (such as availability of stocks held by producers and consumers). In fact, cyclical production patterns, with good and bad crop years, or the vagaries of the weather, frequently cause sharp fluctuations in supply, triggering price volatility. Financial markets, commodity exchanges, or speculative funds are among the factors accentuating the volatility of the coffee market.

30. Volatility is thus attributable to exogenous crises unrelated to market fundamentals, the most important of which are:

- climatic incidents (frosts, droughts);
- social conflicts or wars in exporting countries;
- marketing policies in exporting countries;
- supply policies in importing countries, particularly stock management;
- market supply policies; and

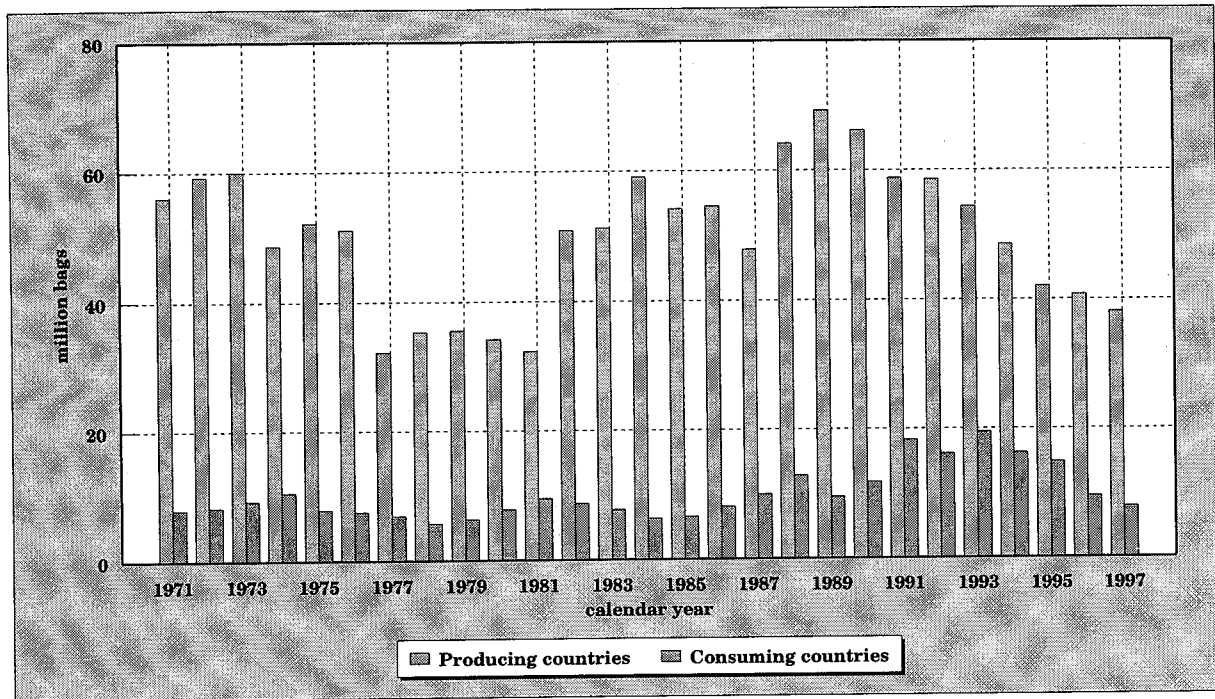
- the wide variety of crop estimates, with the errors and contradictions that can result.

This marked volatility may be at the origin of the poor allocation of resources in the coffee industry.

31. Finally, to answer the question of whether volatility has increased during the last few years, we must take into account specific events which have occurred in the world coffee industry. In fact, besides the elements which have always existed in the coffee industry, namely climatic problems and a supply and demand imbalance, new elements have come into play, particularly:

- the low levels of stocks as a result of high interest rates;
- supply management policies;
- the growing importance of investment funds;
- the absence of any market-regulating mechanism; and
- the liberalization of commodity trade following the economic reforms carried out in most coffee-exporting countries.

32. In addition, the lack of an official source of estimates based on objective factors and speculation on the level of world stocks seem to encourage price volatility.

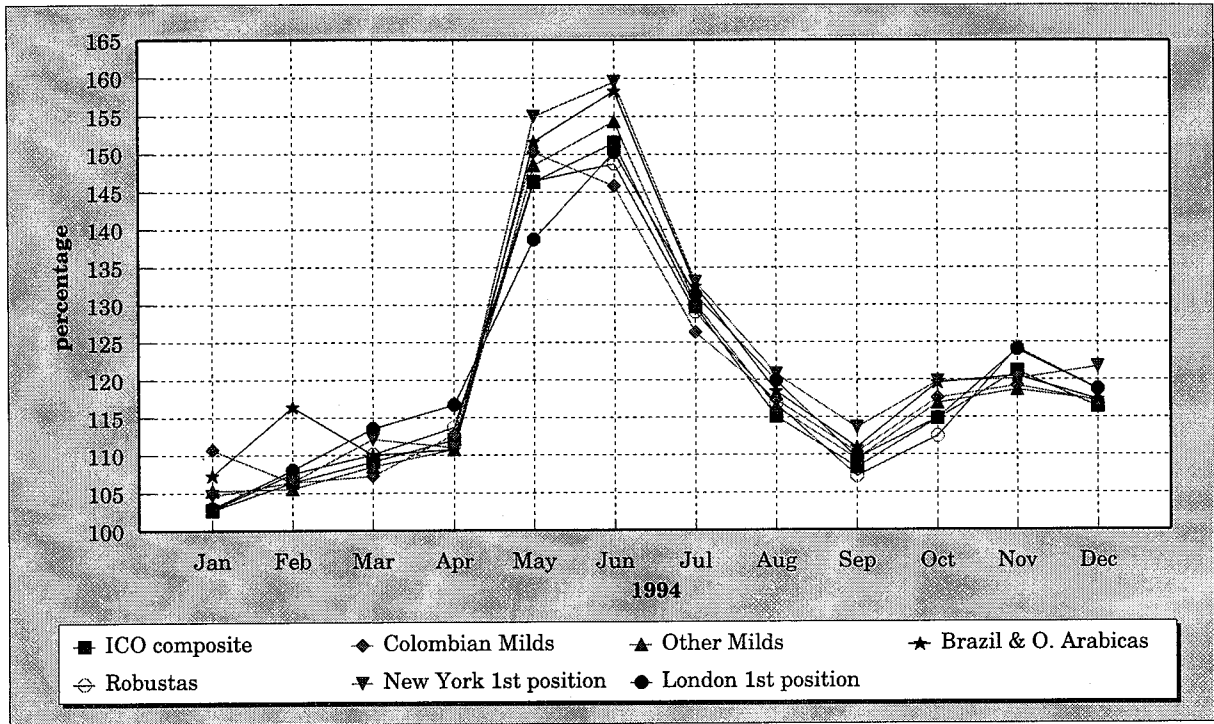
**EVOLUTION OF WORLD COFFEE STOCKS
1971 TO 1997**

THE UNIVERSITY OF CHICAGO

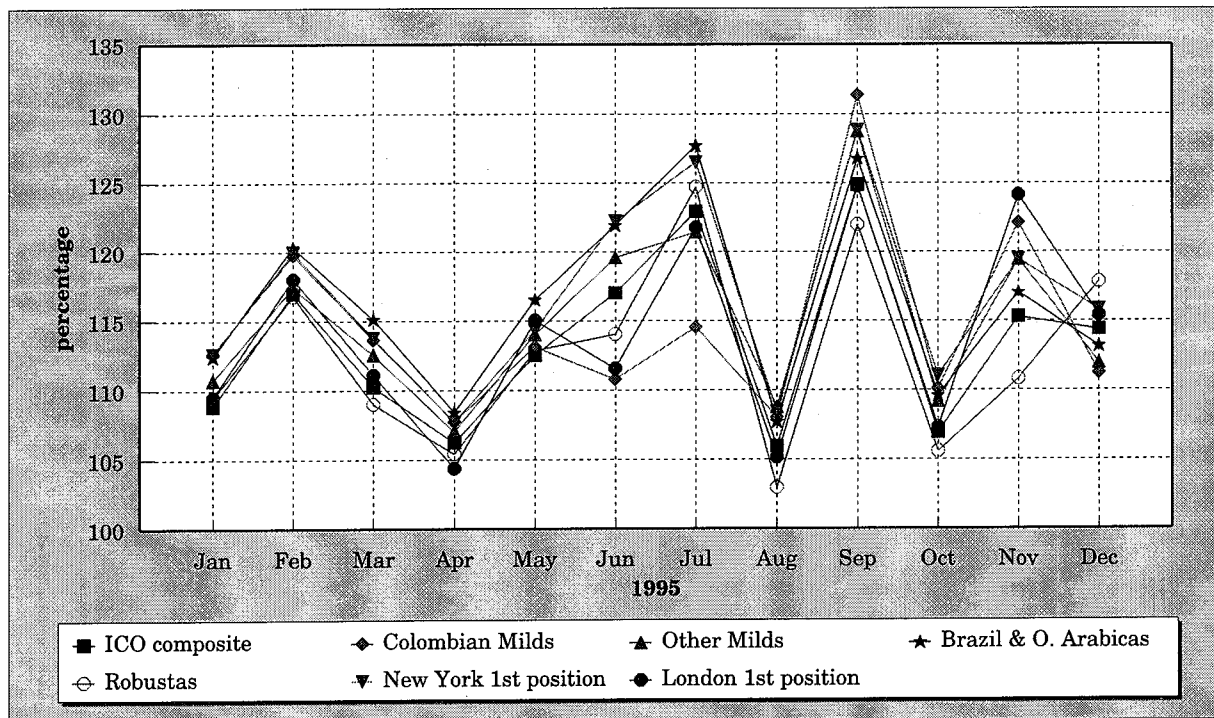
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**PRICE VOLATILITY
1994**



**PRICE VOLATILITY
1995**



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