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# CEPAL

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## REVIEW



UNITED NATIONS

SECOND HALF OF 1978

# CEPAL Review

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UNITED NATIONS  
ECONOMIC COMMISSION FOR LATIN AMERICA  
SANTIAGO, CHILE / SECOND HALF OF 1978

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Sales N° S.78.II.G.4

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Price: US\$ 3.00 (or equivalent in other currencies)

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## C O N T E N T S

The ambivalence of Latin American agriculture <i>Enrique V. Iglesias</i>	7
Accumulation and creativity <i>Celso Furtado</i>	19
False dilemmas and real options in current Latin American debate <i>Aníbal Pinto</i>	27
Economic trends in Central America <i>Gert Rosenthal</i>	45
Some changes in United States attitudes towards CEPAL over the past 30 years <i>David H. Pollock</i>	57
Protectionism and development <i>Pedro I. Mendive</i>	81
Socio-economic structure and crisis of peripheral capitalism <i>Raúl Prebisch</i>	159
Notes and comments	253
Thirty years of CEPAL	267

# Notes and comments

## A forecast of world oil prices

*J.W. Mullen*

### *Background*

This paper presents a summary of a forecast of world crude oil prices that was developed in a study soon to be published in CEPAL's *Cuaderno* series.<sup>1</sup> The forecast is unusual in the sense that it argues that real world oil prices will be substantially below those now being predicted for the rest of this century by many authorities on the subject. Specifically, it argues that the most likely price of internationally traded crude oil will decline from its level in July 1978 of 9.74 dollars of 1975 per barrel (12.70 dollars per barrel in current prices) to 8.63 and 7.05 dollars per barrel, FOB Persian Gulf, in 1990 and 2000, respectively. By way of contrast, many forecasts point to real oil prices remaining steady, or increasing (and, in some cases, quite sharply) during the eighties. There is widespread agreement that real world oil prices will probably increase rather rapidly during the nineties.

### *The record of oil prices in the past*

The study begins with two simple questions: what has been the record of world oil prices in the postwar era; and how might that record be explained? It is argued that explaining the record of world crude oil prices in the past is an indispensable prelude to predicting them convincingly in the future.

The study isolates four distinct periods of world crude oil prices: 1945-1949; 1950-1957; 1958-1970; and 1971-present. The mechanics of price formation in each of these periods is examined at length from the point of view of three

causal variables: the upward pressure on price born of rising demand acting on increasing long-run industry supply costs; the structure of the world oil industry; and the complex of energy policies in the industrialized, market-directed economies. From an economic point of view, the price of world oil, or of any other commodity for that matter, is explainable by the operation of these three variables — economic scarcity, industry structure, and government policy.

The study concludes that, in all four periods, changes in the economic scarcity of world crude oil do not explain changes in its price. Quite the contrary: throughout the entire postwar era, the world oil industry has been capable of supplying far more crude oil than demanded at existing prices. The fact that the price of world oil has remained consistently far above its long-run supply cost in the postwar era reflects the operation of a continuously acting block to competition. This block has its origin in the structure of the world crude oil producing industry, on the one hand, and in the complex of energy policies in the industrialized market-directed economies, on the other.

### *The forecast: General approach*

With this historical review as background, the study then concentrates on the forecast of world crude oil prices in 1990 and 2000. Two forecasts are presented. The first is a forecast of the most likely price of world crude oil in 1990 and 2000. However, realizing that the probability that either of these most likely prices exactly will emerge in those years is virtually zero, a Bayesian-based forecast is also presented of the probability distribution of price about each of these two most likely prices in each of those two years.

The forecast of most likely prices was developed in the following way. An estimate was made of the upper and lower limits on the price of world oil in 1990 and 2000. An analysis was then made of the pattern of expected changes in the structure of the world oil industry and in the

<sup>1</sup>J.W. Mullen, *Energy in Latin America: The historical record and future prospects*, CEPAL *Cuaderno* series, November 1978. This study examines the policy implications for energy planners in Latin America's oil-deficit countries of expected prices for world oil. It also provides a brief description of the pattern of growth and change in Latin America's energy industries over the past quarter of a century.

complex of energy policies in the industrialized countries, terminating in an assessment of their probable impact on the price of world oil. The forecast technique was selected and applied, and the strengths and weaknesses of the forecast were appraised.

A variety of forecasting approaches were reviewed, and the qualitative (i.e., intuitive) forecasting approach was selected: "...the forecast... was generated qualitatively. Quantitative forecast methods were considered, but they were rejected. The review of world crude oil prices presented earlier argued that in the post-war era there have been four analytically distinct periods of price formation, not just one. The application of least-squares or related techniques would be indefensible because of the serious heteroskedasticity involved. In general, statistical forecasting procedures are rejected because they are incompatible with the large element of instability inherent in the process that generates world crude oil prices and also because of the extended duration of the forecast period, 1978-2000. These reservations are relevant to both time series forecasting techniques and to the variety of causal mathematical modelling predictive techniques as well. This latter collection of techniques are particularly inappropriate in so far as they also presume knowledge of the value of a series of independent, causal variables and their functional relationship not only in the past but over the next quarter century as well. In these circumstances, it seems better to predict price itself, qualitatively and directly".

#### *Crude oil price limits*

The price of world crude oil in 1990 and 2000 will be contained within two theoretically identifiable limits: price will be no lower than the long-run incremental cost of supplying natural crude oil in a competitive market for it; and the price of crude oil will rise no higher than the minimum long-run incremental cost of synthetic crude oil. The study estimates that, with crude oil production in the Persian Gulf rising by five per cent per annum during 1978-2000, the long-run incremental cost of production there will rise from a maximum level of 0.25 dollars of 1975 per barrel in 1977 to 0.40 and 2.00 dollars per barrel in 1990 and 2000, respectively, FOB, Persian Gulf. Prices lower than these levels in those years will evoke an insufficient supply of world crude oil. These prices are the economic floors to price in a competitive market for world oil in those two years: all else is economic rent.

The upper limit on world crude oil prices is given by the long-run incremental cost of synthetic crude oil, approximated in the study by the cost of extracting oil from coal in the eastern United States and converted to an FOB, Persian Gulf, per-barrel-of-oil equivalent basis. This level of cost (calculated with a twenty per cent opportunity cost of capital) is seen as falling from an estimated level in 1977 of 15.94 dollars per barrel to 13.65 and 12.31 dollars per barrel in 1990 and 2000, respectively, FOB, Persian Gulf.

By way of summary, then, the price of world oil in 1990 will be contained within the range 0.40-13.65 dollars per barrel and in 2000 within the range 2.00-12.31 dollars per barrel, FOB, Persian Gulf, all prices in dollars of 1975. The lower limit of each of these two price ranges is that which would emerge in a perfectly competitive market for world oil, and the upper limit is the price toward which market price would tend in a monopolistic market for world crude oil. As noted earlier, in July 1978, the price of world oil was 9.74 dollars of 1975 per barrel, FOB, Persian Gulf.

#### *Industry structure and government policy*

The study then focuses on the operation of the industry structure and government energy policy variables during the forecast period. A variety of factors are examined analytically in this regard, including chiefly the following: changes in the supply of crude oil produced for the world oil market; OPEC accommodation to these expected changes in supply; competitive forces within the OPEC membership and between it and the major oil companies; the strategic stance of the oil-importing industrialized countries on the question of the price of world oil, that is the degree to which these countries, and particularly the United States, act as price-takers or price makers.

The analysis points to a simple conclusion: as in the past, so in the future, the key step in forecasting world oil prices is judging the degree to which the force of competition, born of an immense price-cost gap, continues to be contained over the forecast horizon. In this regard, the study concludes that the net result of the operation of the industry structure and energy policy variables during the forecast period will be to reduce the price of world crude oil during the eighties and more rapidly during the nineties. In both cases the expected decline in price is moderate, and precipitous changes in price, either upward or downward, are not anticipated.

### *The forecast results*

The study argues that during the eighties real world oil prices will decline, on the average, by one per cent per annum *vis-à-vis* 1.1% during 1951-1957. During the nineties, the rate of decline in price is expected to accelerate to two per cent per annum *vis-à-vis* 7.1% during 1958-1970 (Diagram 1).

Diagram 2 shows the results of the Bayesian-based probability exercise for the price of world crude oil in the year 2000. It suggests that the chances are about three-out-of-four that the actual price of world oil in that year will fall in the range of 6.30-8.81 dollars of 1975 per barrel, FOB, Persian Gulf. The odds are about twelve per cent that price will be either above or below this broad range of price in the year 2000. Within the 6.30-8.81 price range, higher prices are more likely than lower prices. Additionally, the most likely price in 2000 (i.e., 7.05 dollars of 1975 per barrel, FOB, Persian Gulf) is far above the estimated level of long-run incremental cost of crude oil supply in the Persian Gulf in that year. It is also above the minimum safeguard price adopted by the International Energy Agency and by the European Commission in 1976: 6.30 dollars of 1975 per barrel (7.00 dollars in 1976 prices). Finally, the forecast price is above a rough estimate of levelized development and production cost per barrel of North Sea oil in the year 2000.

### *Forecast appraisal*

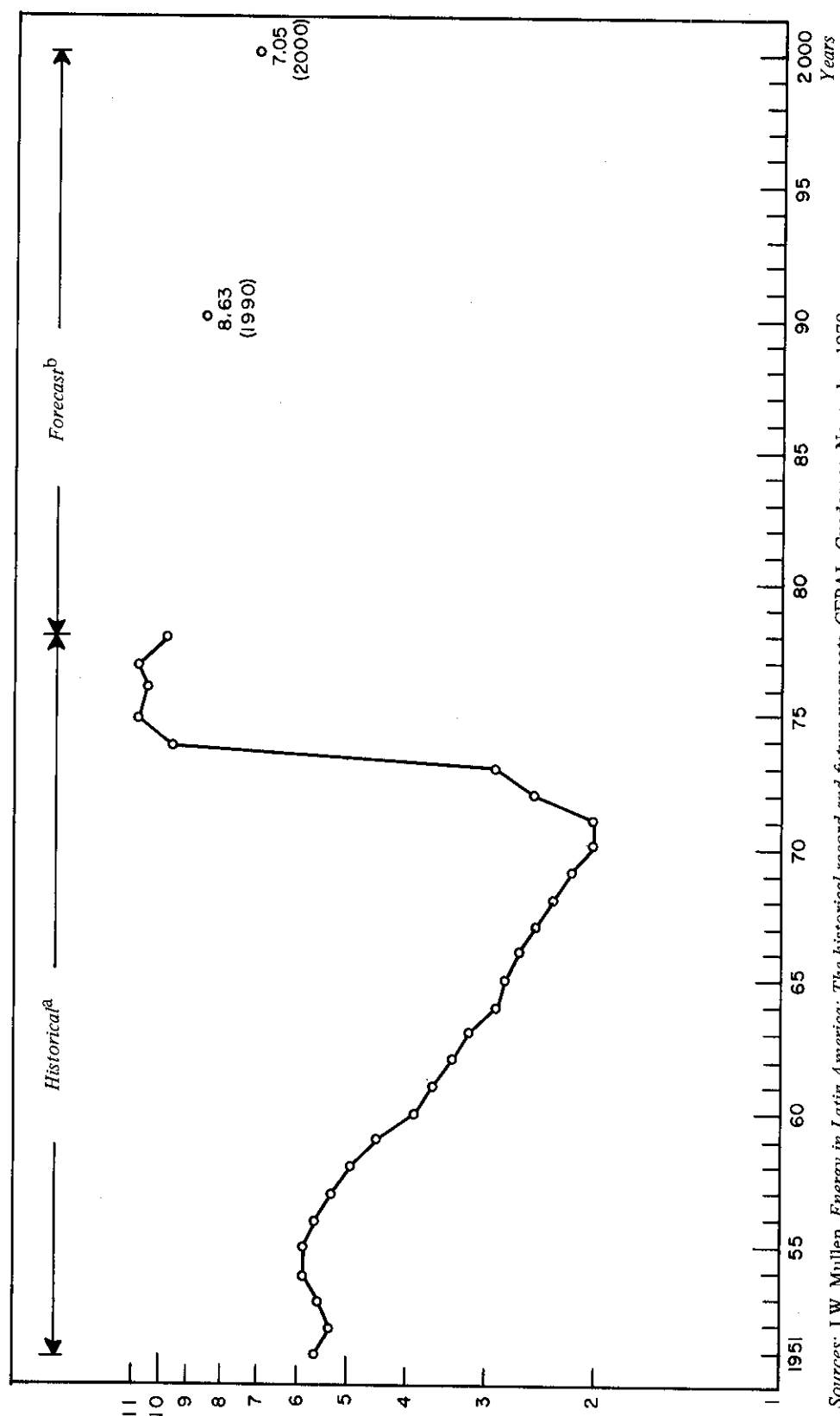
The strengths and weaknesses of the forecast are then appraised as follows: "The critical minded reader will understand that... these forecasts must be taken with a good deal of reservation. It is possible, although improbable, that competition between sellers and buyers in the world crude oil market could break the price structure for world oil tomorrow. Nothing in economic theory opposes this outcome. All that is required is that the strong forces working to break the price structure (i.e., increased supply and its mirror image, market competition) are not offset by strong forces working to dam up the intense downward pressure on price (i.e., OPEC's control over supply and the pattern of country-company crude oil marketing arrangements). On the other hand, OPEC member countries may be successful in maintaining the present price structure for world oil over the next

two decades. Again, nothing in economic theory rules out this possible, but improbable, outcome in a technically logical sense. One very important impoderable is the future emphasis of United States energy policy on bringing down oil prices. There is no such emphasis in either actual or proposed policy at the present time and, effectively, this consideration has been treated as a parameter in this price forecast exercise. If the United States continues its essentially passive attitude towards world crude oil prices, a major potential force for bringing the whole structure of these prices down will remain dormant. On the other hand, if the United States moves determinedly to break world oil prices (believing itself forced, for example, through balance-of-payments pressure), then a powerfully depressant force on world crude oil prices will have been activated. The present forecasts are predicted on the assumption that this change in United States policy will not occur.

"While plummeting, sharply increasing, or steady price trajectories through the year 2000 are perfectly possible, it is hoped that the reader will understand, on the basis of the preceding arguments, why each of these possibilities is believed to be improbable over the rest of this century. However, belief is not certainty, and all that can be hoped, in the present instance, is that the reader understand the logical development supporting the final forecast prices, price ranges and probabilities tabled in this study. The selection of the specific rates of decline in the real price of world crude oil was clearly a subjective operation, but no apologies are called for on this account. The use of a more complicated mathematical forecasting technique might be more fashionable, but it would in no way be more convincing *per se*, an analysis of the process of world crude oil price formation, historically and prospectively, leads to the conclusion that the use of these methods would be misguided.

"It is often said that forecasting the price of world oil is 'anyone's guess'. This is true in so far as it points to the very large element of uncertainty involved. This study simply tables a set of guesses systematically and gives the reasons for making them. In this context, it is hoped that the background material underlying the forecasts is sufficiently clear to enable readers who disagree with the specific rates of change in price that were chosen to substitute their own and to draw the appropriate conclusions."

Diagram 1  
**PRICES OF SAUDI ARABIAN LIGHT CRUDE OIL**  
*(In 1975 dollars per barrel, FOB Persian Gulf)*



Sources: J.W. Mullen, *Energy in Latin America: The historical record and future prospects*, CEPAL, Cuadernos, November 1978.

<sup>a</sup>Prices ex Ras Tanure 1951-1958.

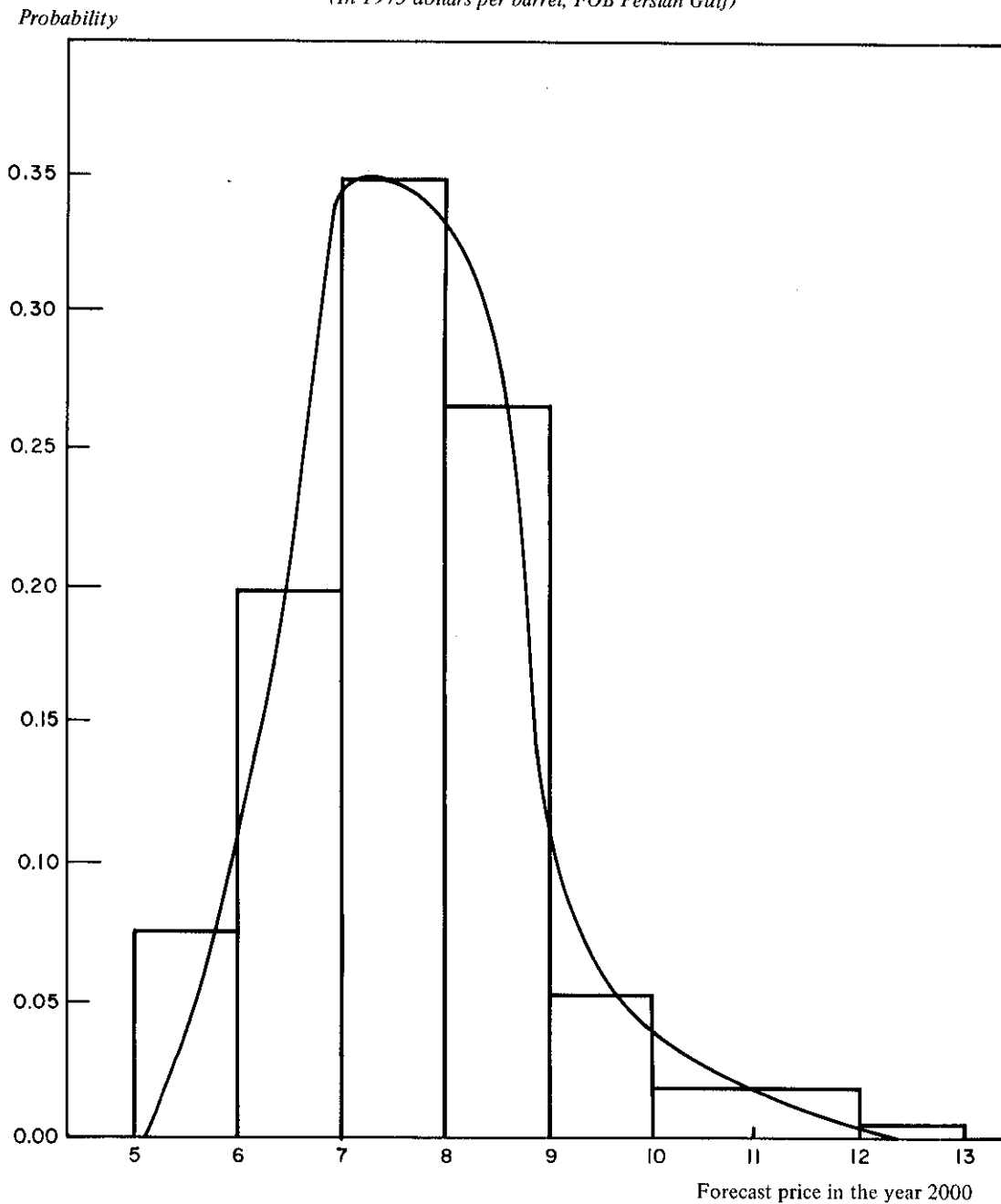
<sup>b</sup>Projection prices, 1990 and 2000



Diagram 2

**HISTOGRAM OF PROBABILITY DISTRIBUTION OF THE FORECAST PRICE IN THE YEAR  
2000 OF SAUDI ARABIAN LIGHT CRUDE OIL AND FREEHAND DRAWN PROBABILITY  
CURVE THROUGH THAT DISTRIBUTION**

*(In 1975 dollars per barrel, FOB Persian Gulf)*



*Source: J.W. Mullen, The Price of World Oil: Prospects and Implications for Energy Policy-Makers in Latin America's Oil-Deficit Countries, 1978.*