FORECASTING MARINE PRODUCT EXPORTS— TIME-SERIES ANALYSIS

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ABSTRACT

A technique using Box-Jenkins model, based on monthly time series, is proposed for forecasting the exports of marine products from India. By demonstrating its application in a sample case, the technique has been shown to prove its effectiveness to arrive at predictions close to actuals.

The marine fish production in India has gone up from 0.5 million tonnes in the early fifties to 1.4 million tonnes during early and middle seventies, and, after which, stabilized itself at about 1.3 million tonnes. This spectacular increase in the fish production is mainly due to the development of export markets, increased utilization of marine products, better capture techniques and effective postharvest technology evolved through an efficient R & D.

The market research carried out has revealed increasing demands for marine products in foreign countries. Forecasting the quantity exportable will be of immense help to the Export Development Authority and to those involved in the export industry, as it will facilitate better planning and export strategy. In this paper a forecasting technique is proposed for predicting the total marine product export using a Box-Jenkins model (D. C. Montgomery and L. A. Johnson, 1976).

The method: The forecasting of total marine products given in this paper is based on the monthly time series from 1971 to 1980, the source of data being Marine Products Exports Authority (Statistics of Marine Products Export 1971 to 1980). The data are presented in Table-1.

As the variability of the series increased as the general level increased through the period 1971-80, the time series was analysed on logarithmic scale. The sample autocorrelation function for the log series decayed slowly owing to

TABLE 1. *Monthly export trend of marine products,* 1971-80 (*kg*).

	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980
Jan	2424832	3098144	3223477	4254904	3443877	4327974	7147718	6347571	8110991	8082505
Feb	2457037	2966908	3171158	3212336	4115163	3692003	5713636	6128669	8124491	8238386
Mar	3072001	3379819	3686682	6108277	4486132	5072322	4829441	6217292	11405792	5536315
Apr	3539278	4153033	3928958	4600498	4790194	6600113	5204439	6331446	9490375	5517663
May	3473225	3858586	4019760	3645852	6639310	6928765	4514910	6971184	7577727	5588980
Jun	2260302	2761534	2774972	4030115	4132941	4367902	4523299	7129995	7133619	6224174
July	2366843	2510684	4170584	3482264	3527565	6166280	4991018	6302378	6443360	5552585
Aug	2667146	2585163	5259403	2625273	4148532	4056377	5401103	6243686	5803379	7638740
Sept	2407045	3124570	3821245	4327459	3675275	4769537	6045281	4929837	7081472	4943725
Oct	2894528	3061970	4535627	3031296	6484362	5687619	4747053	7045525	6802153	5736468
Nov	3664019	3305895	4448637	3802588	3816246	5361345	5646603	6692680	6605818	5031622
Dec	2806103	3464538	574402	3508077	4152291	5120966	6199291	7605443	7705054	6457100
Total	34032359	38270849	48785105	46628939	53411688	62151203	64963792	77945706	92184421	74542263

Source: Statistics of Marine Products Exports, 1971 to 1980; The Marine Products Export Development Authority.

nonstationarity and displayed large autocorrelations at seasonal lags. The sample autocorrelation function for the series of first differences still displayed large autocorrelations, particularly at lag 11, indicating that seasonal differencing is necessary. The autocorrelation function of the transformed series was found to cut off, having large autocorrelations at lag 11, whereas the partial autocorrelation was found to decay more slowly, which suggested the multiplicative seasonal model of order $(0, 1, 1) \times (0, 1, 1)_{11}$ might fit the data, the expression for the model being:

$$(1 - B)(1 - B^{11})\, Z_t = (1 - a_1 B)(1 - C_{11} B^{11})\, e_t$$

where B = Backward shift operator

$Z_t = L_n X_t$

X_t = the export at time t

a_1 and C_{11} are the parameters to be estimated

e_t = residual

Using the data in Table 1 the model parameters were estimated, which were as follows:

$$a_1 = 0.70$$
$$a_{11} = 0.52.5$$

Thus the model when expanded takes the following form:

$$Z_t = Z_{t-1} + Z_{t-11} - Z_{t-12} + e_t - 0.7e_{t-1} - 0.525e_{t-11} + 0.368e_{t-12}$$

The validity of the model was examined by studying the residual autocorrelation function. None of the residual autocorrelations was significant, which indicated that the residuals were a white noise process. Therefore it has been concluded that the above model adequately describes the time series.

The monthly forecasts for 1981 using the model are given below along with the actual values:

Months	Forecast	Actual
January	6722	9182
February	6049	7563
March	6039	6162
April	6070	6255
May	6296	5401
June	5284	4511
July	6558	7108
August	5451	4838
September	5686	4522
October	5234	5438
November	6032	6617
December	7572	7777
Total for 1981	73006	75374

That forecast of total export for 1981 was thus quite close to the actual value demonstrates the feasibility of application of Box-Jenkins models for forecasting marine product exports, which will be of immense use for planning suitable export strategy.

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