Forecasting Sri Lanka's Commodity Net Export Price Index Using ARIMA Models

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Outline

Introduction

- International trade mainly takes place in two directions, known as exports and imports.
- The combined effect of exports and imports is measured by net exports, which is the difference between these two.
- For effectively monitoring and understanding these trade dynamics, it is important to depend on accurate and timely indicators.
- **Commodity Net Export Price Index** is a important trade indicator.

Objectives

Main Objective

- Forecast Sri Lanka's Commodity Net Export Price Index using ARIMA models by building a parsimonious statistical model.

Specific Objective

- Provide insights for policymakers, businesses, and researchers regarding expected trends in trade and their implications for economic stability.

Literature Review Summary

In the world context

- Researchers have forecasted:
  - Imports and exports using various time series models
  - Export price indices and survey-based indicators
- But no net exports

In Sri Lankan context

- Researchers have forecasted:
  - Imports and exports using various time series models
- But no net exports and any of the trade price indices

The indicator that we studied in our research hasn't been forecasted by any researcher so far.

Data

- Source: International Monetary Fund (IMF) commodity terms of trade database
  International Monetary Fund (IMF) – Legacy Data Portal
- Time duration : From 1980 January to 2025 March
- Frequency: Monthly
- Variable: **Commodity Net Export Price Index**, Individual Commodities Weighted by Ratio of Net Exports to GDP

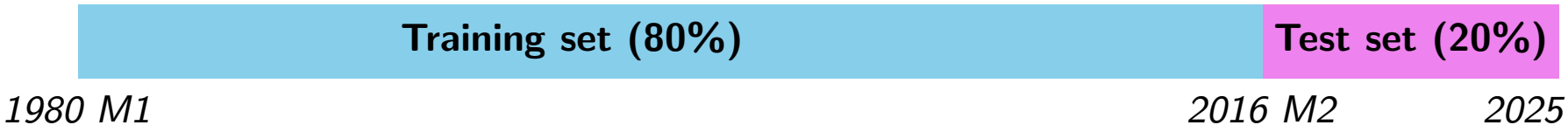
Methodology

Methodology Steps:

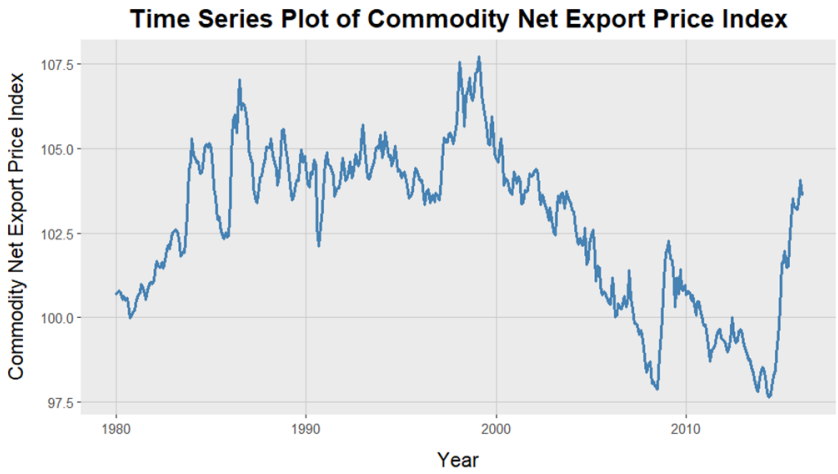
1. Stationarity testing
2. Model identification via ACF/PACF
3. Model estimation
4. Forecast evaluation
5. Diagnostic checking
6. Forecasting future values

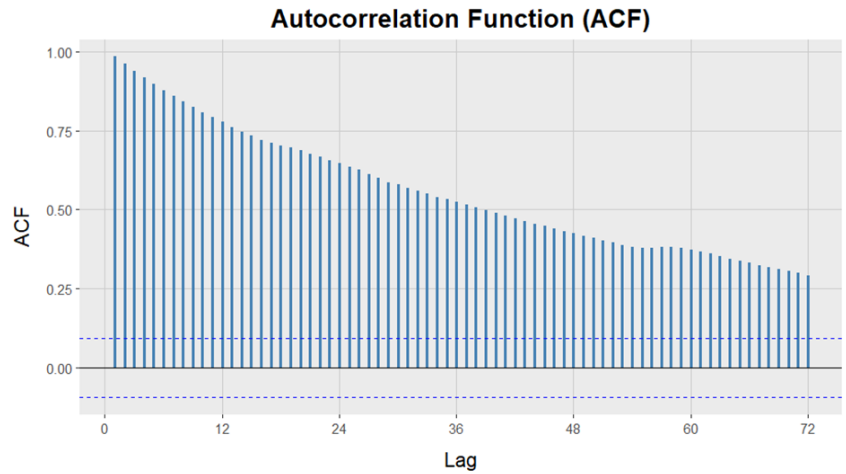
Model Development

- Split data set into two groups



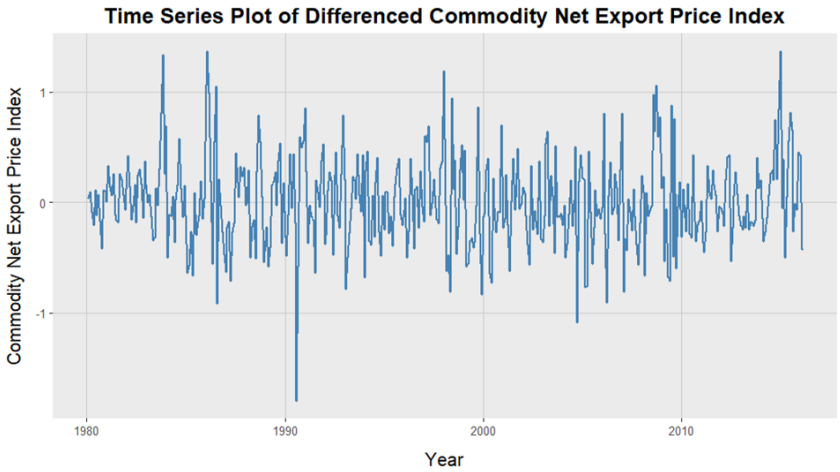
- No stationary (ADF test p = 0.3243)

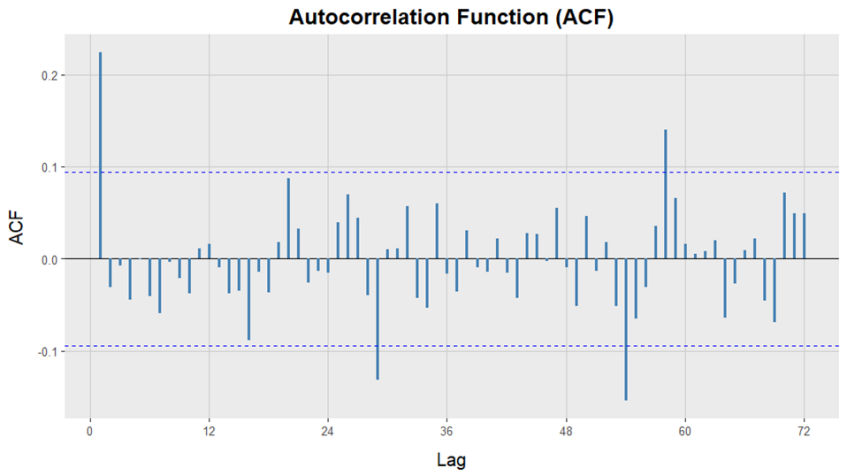




- No seasonal pattern

- Apply first differencing

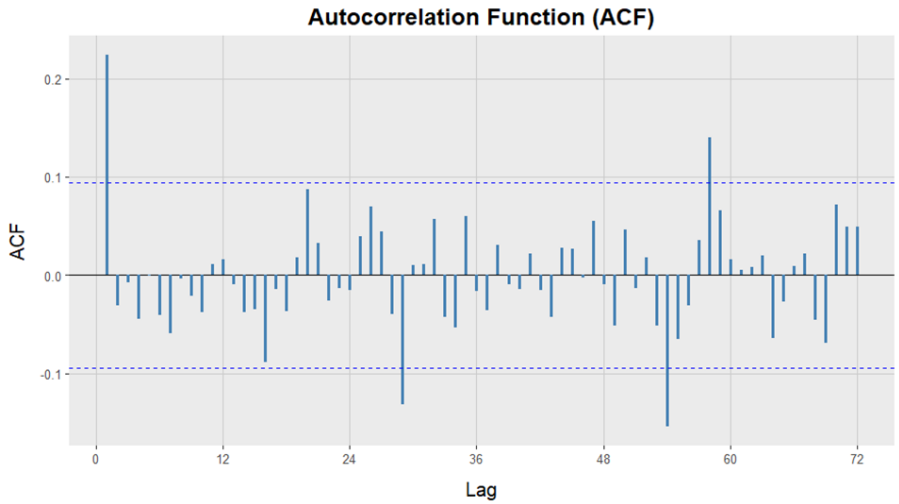


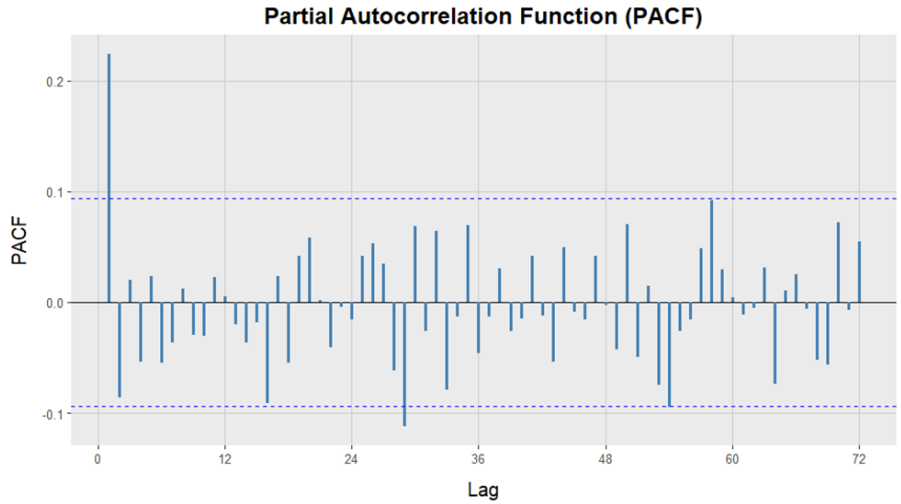


Test	Data	Test Statistic	Lag Order	p-value
ADF Test Result	train_ts_diff	-7.6126	7	0.01

ADF test for differenced series

- ARIMA(1,1,1) selected as the initial candidate model





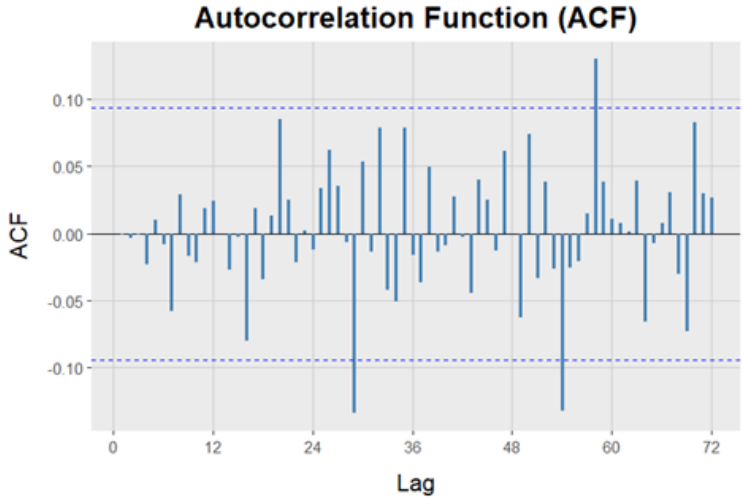
Forecast Accuracy

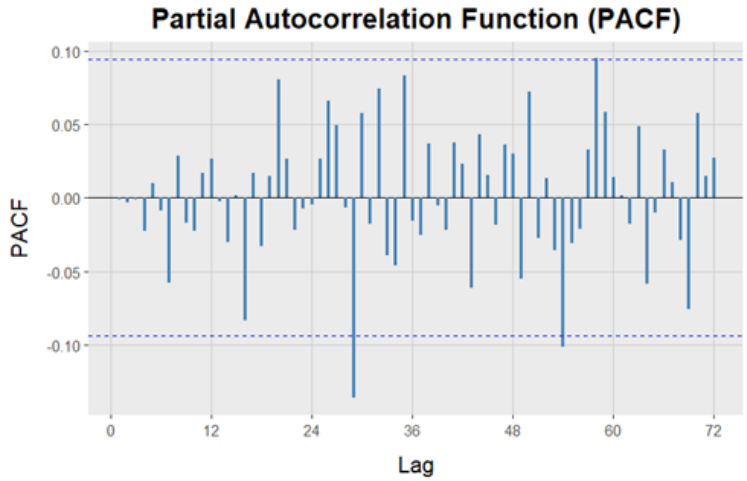
- ARIMA(2,1,3) selected as the best-performing model.

ARIMA	AIC	BIC	Testing Set			
			RMSE	MAE	MAPE	MASE
(1,1,1)	425.39	441.67	3.6540	3.2925	3.296	2.8390
(0,1,1)	424.27*	436.48*	3.6289	3.2657	3.269	2.8159
(1,1,0)	427.50	439.71	3.6310	3.2689	3.272	2.8186
(0,1,0)	447.85	455.99	3.7629	3.4089	3.412	2.9394
(2,1,2)	428.98	453.40	3.6156	3.2572	3.261	2.8086
(2,1,1)	427.06	447.42	3.6549	3.2936	3.297	2.8400
(1,1,2)	426.85	447.20	3.6457	3.2833	3.287	2.8311
(2,1,0)	426.23	442.52	3.6345	3.2717	3.275	2.8211
(0,1,2)	425.54	441.82	3.6463	3.2845	3.288	2.8321
(1,1,3)	428.78	453.20	3.6410	3.2793	3.283	2.8277
(3,1,1)	428.71	453.13	3.6415	3.2792	3.283	2.8276
(3,1,2)	428.68	457.17	2.6689	2.2918	2.297	1.9762
(2,1,3)	428.24	456.74	2.3036*	2.0122*	2.0156*	1.7351*
(3,1,3)	430.67	463.24	2.6888	2.3091	2.3148	1.9911
(3,1,0)	428.07	448.42	3.6427	3.2805	3.2838	2.8286

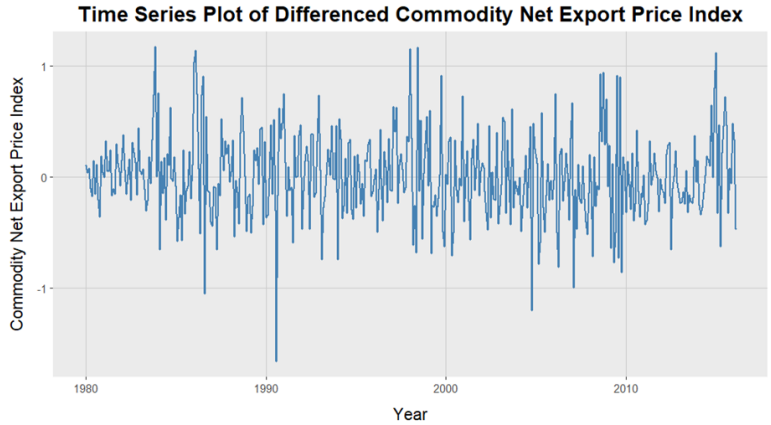
Model Diagonestic

- Residuals are independent (Box–Ljung p = 0.9905).





- Residuals satisfies the zeroth mean and the constant variance



- Residuals are not normal (Shapiro-Wilk Test p = 0.0012)

Results and Forecasts

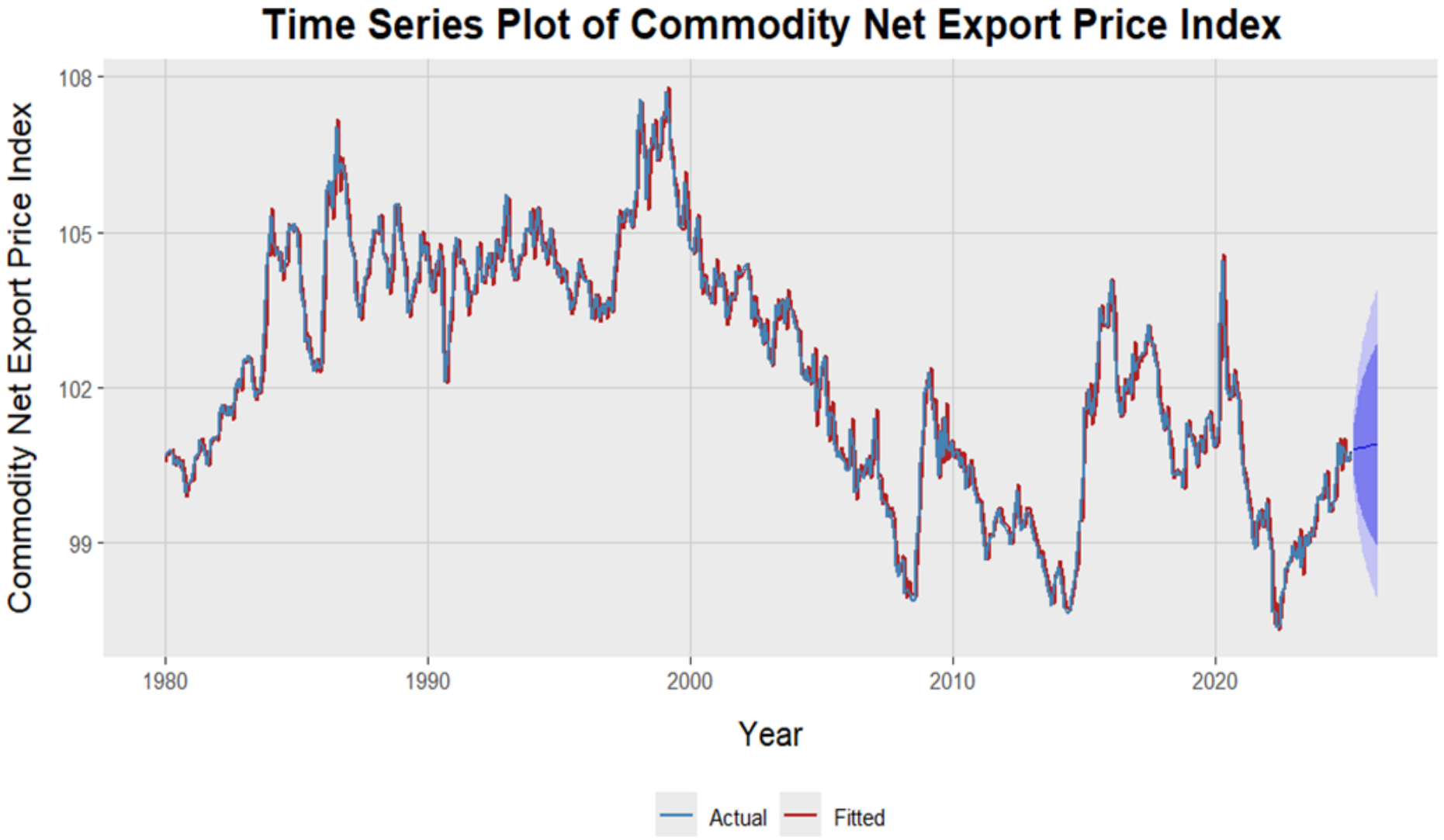
Final model equation

$$Y_t = -0.0022 + B\,Y_t + 0.1130(1-B)B\,Y_t + 0.8485(1-B)B^2 Y_t + 0.1279\,B\,Z_t - 0.9217\,B^2\,Z_t - 0.2062\,B^3\,Z_t + Z_t$$

Note: B denotes the backshift operator where $B\,Y_t = Y_{t-1}$.

- Forecasted CNEPI from 2025 April to 2026 March

Year	Month	Forecasted Value
2025	April	100.8114
2025	May	100.8102
2025	June	100.8325
2025	July	100.8339
2025	August	100.8529
2025	September	100.8561
2025	October	100.8725
2025	November	100.8770
2025	December	100.8913
2026	January	100.8967
2026	February	100.9094
2026	March	100.9153


Time Series Plot of Commodity Net Export Price Index
Commodity Net Export Price Index
108
105
102
99
1980
1990
2000
2010
2020
Year
Actual
Fitted

Conclusion

- ARIMA(2,1,3) effectively forecasts Sri Lanka's CNEPI.
- The forecasts suggest a gradual upward trend, with values rising from 100.81 in April 2025 to 100.92 by March 2026. This indicates a modest recovery and stabilization of Sri Lanka's net export competitiveness soon.
- Export businesses can use these forecasts to make better plans since the increasing trend shows Sri Lanka's products are becoming more competitive in world markets.

Limitations and Future Research

- The index used in the study is only for commodities and does not include growing shares of the services provided in Sri Lanka's trade. These should be added to the future indices.
- ARIMA rely only on the past values of the index.The effect of other exogenous factors such as exchange rates, interest rate can be included in the forecasting models.
- The machine learning approaches can be considered in the future.

References

1. Hyndman, R.J. & Athanasopoulos, G., 2021. Forecasting: principles and practice. 3rd ed. Melbourne: OTexts.

2. Gruss, B. & Kebhaj, S., 2019. Commodity Terms of Trade: A New Database. IMF Working Paper No. 19/21. Washington, D.C.: International Monetary Fund.

3. Dridi, J. and Zieschang, K., 2004. Export and import price indices. IMF Staff Papers, 51(1), pp.157-194.

Thank You

Thank You!

Questions and comments are welcome.

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