EXPORT OF KNITTED READY-MAD GARMENTS FROM BANGLADESH: ANALYSIS AN FORECAST

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1

SUPERVISOR

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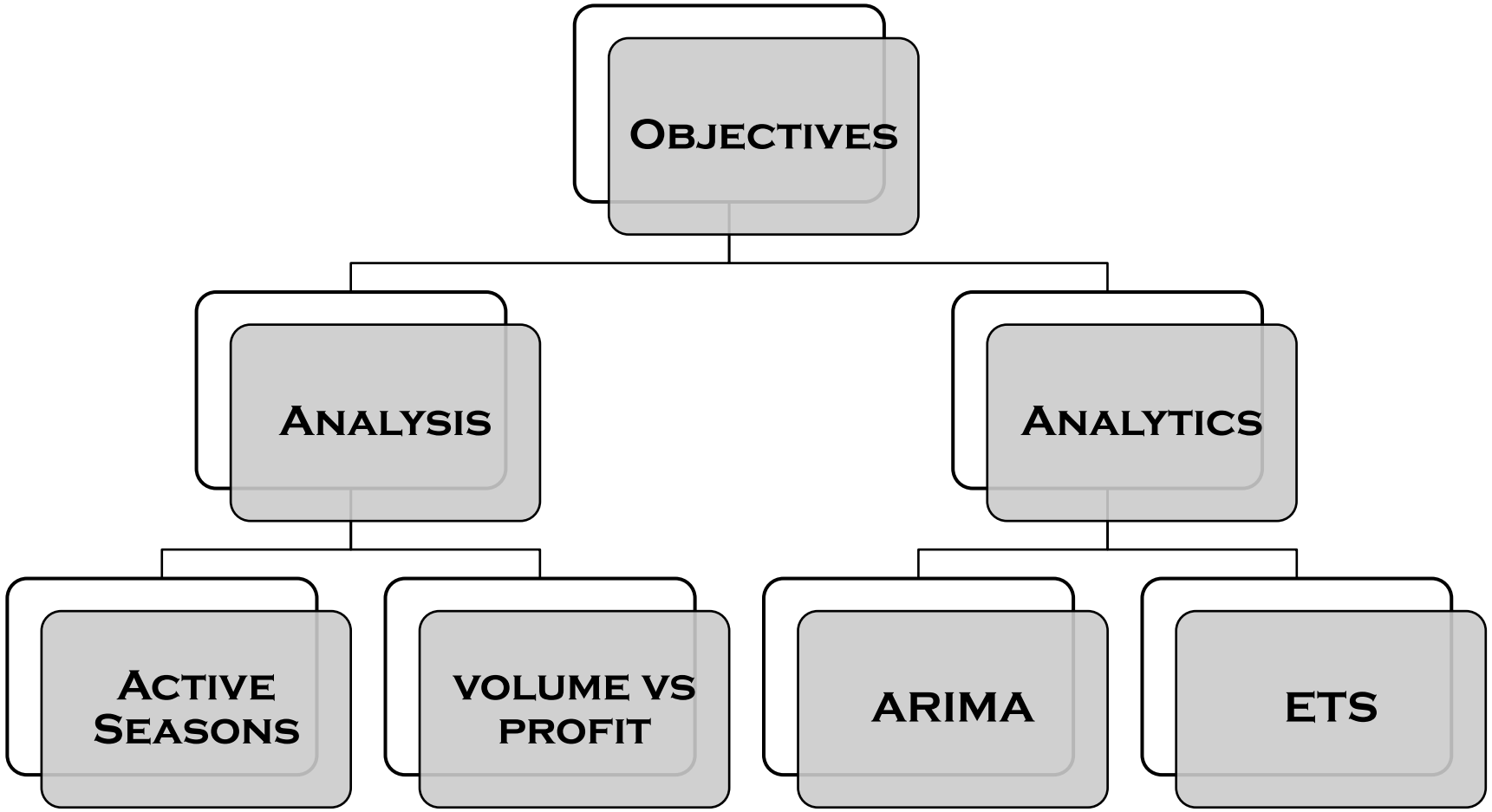
BACKGROUND

More than 80% of Total Exports

- Started in 1978

US$31.45 Billion in 2020-21

- 7 Million People in 5,000 Facilities


Objectives
Analysis
Analytics
Active Seasons
volume vs profit
ARIMA
ETS

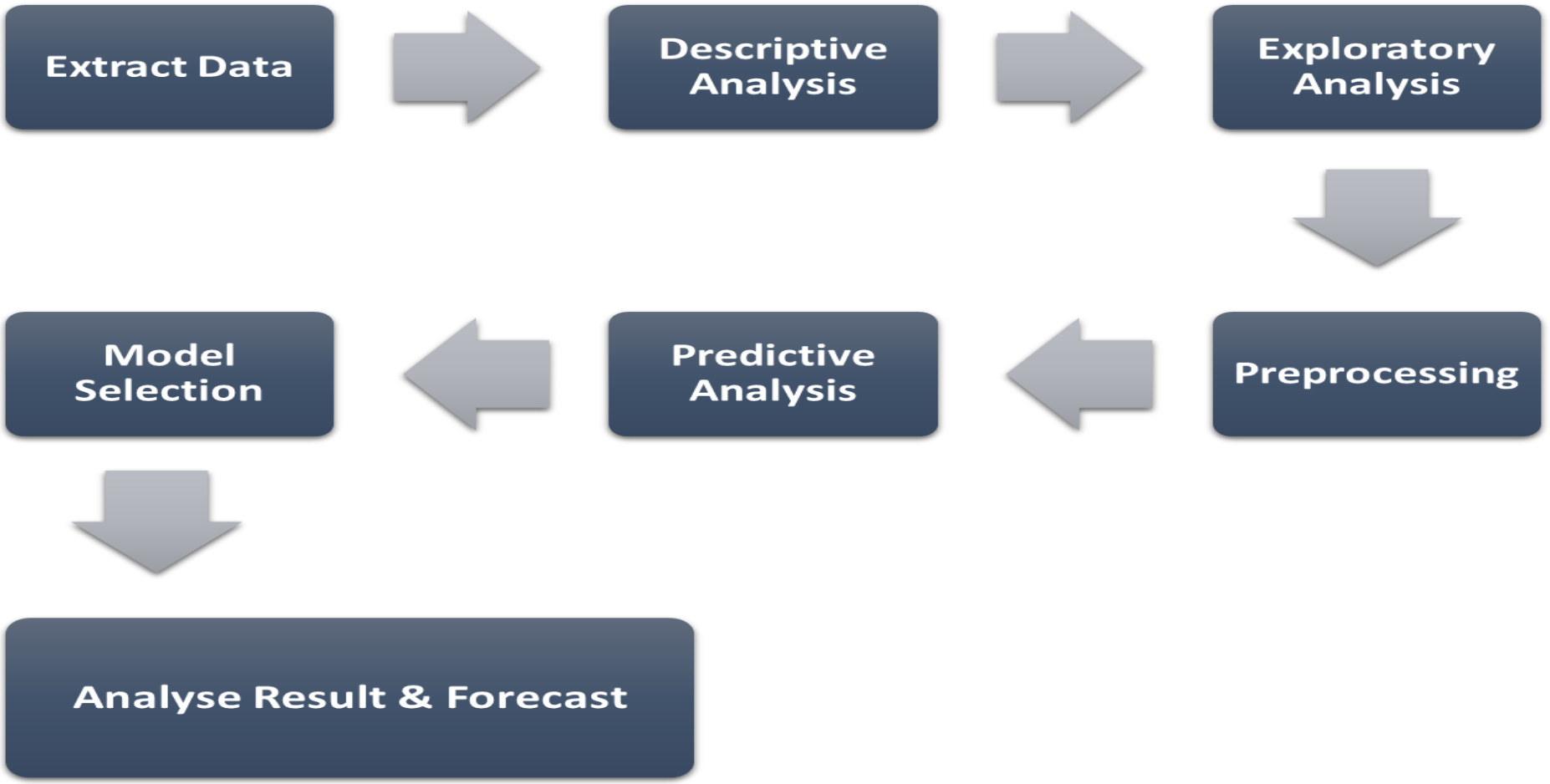
Why Knitted RMG?

SHIRTS

T-SHIRTS

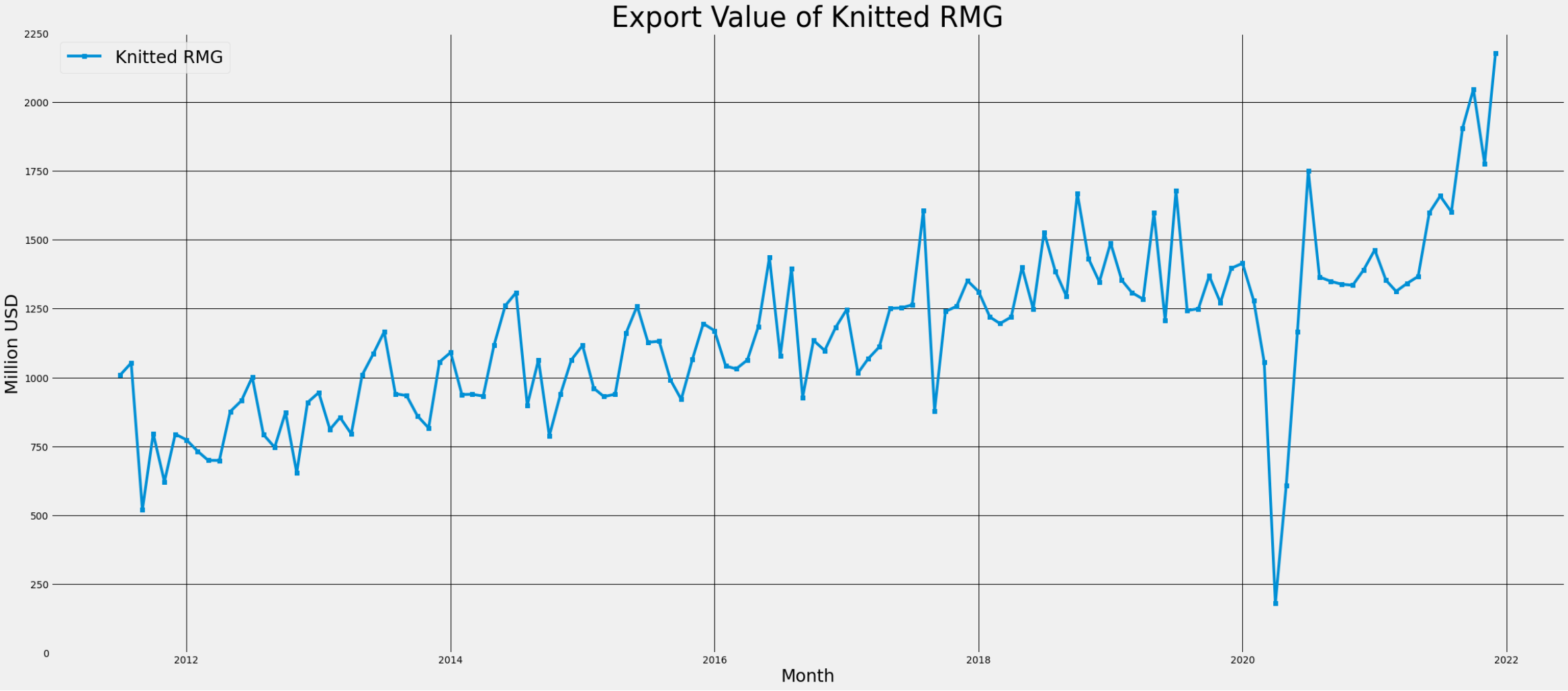
Woven or Knitting ?

Methodology

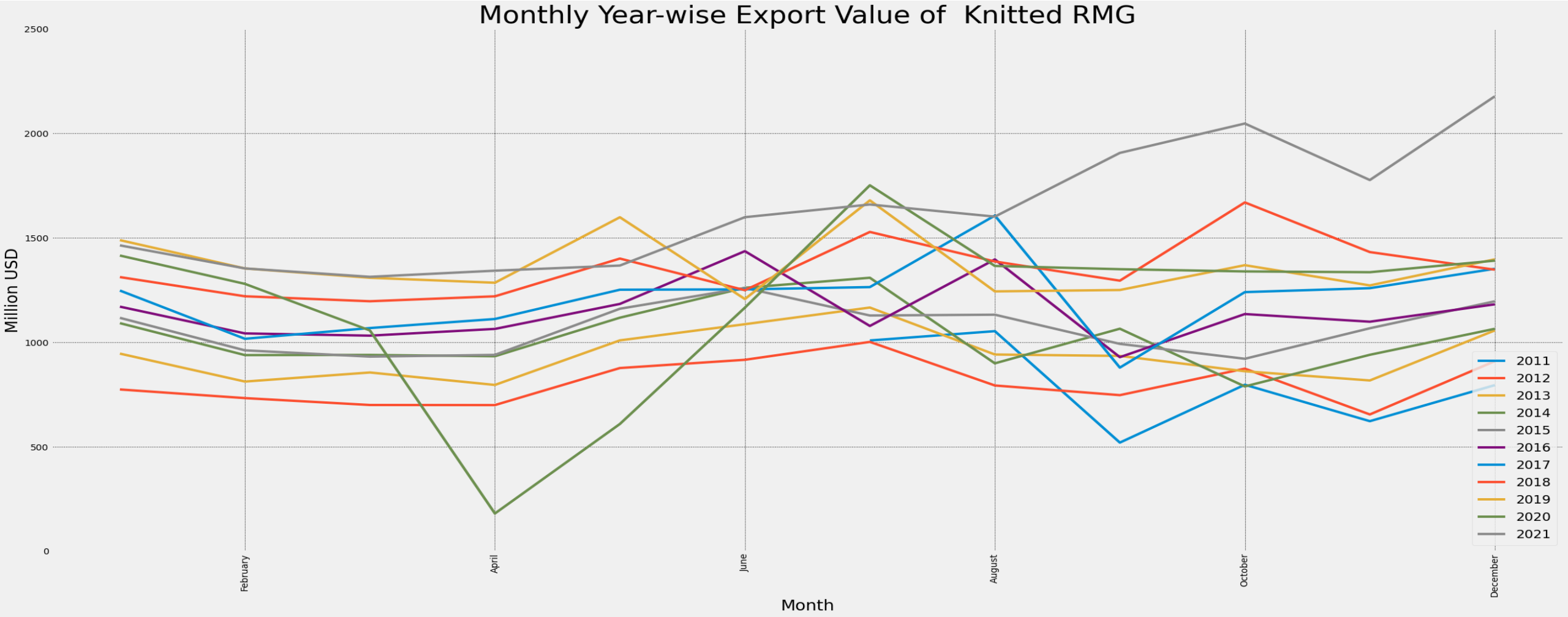


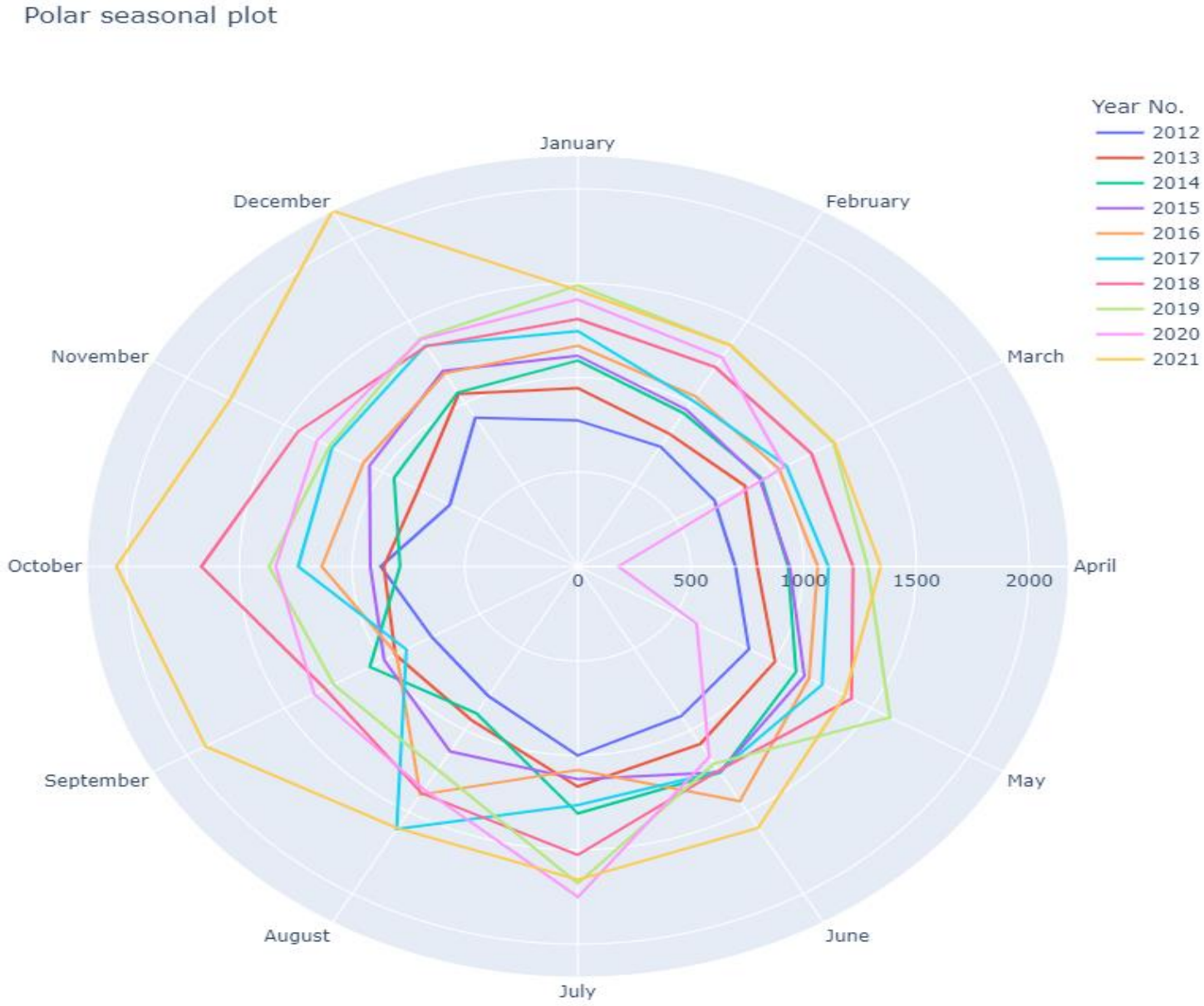
Data Source

Export of Knitted RMG



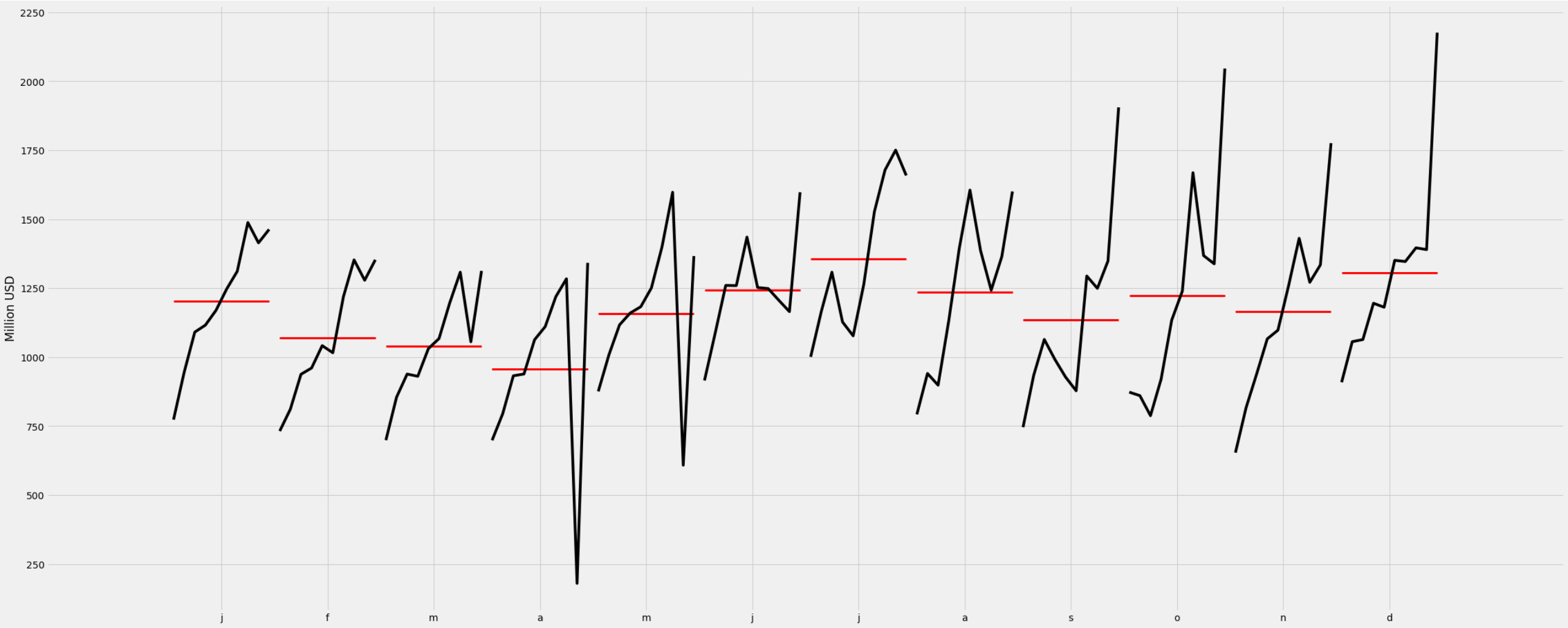
Monthly Year-wise Value




Polar seasonal plot
Year No.
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
January
February
March
April
May
June
July
August
September
October
November
December
0
500
1000
1500
2000

Polar seasonal plot
Year No.
2018
2019
2020
2021
January
February
March
April
May
June
July
August
September
October
November
December
0
500
1000
1500
2000

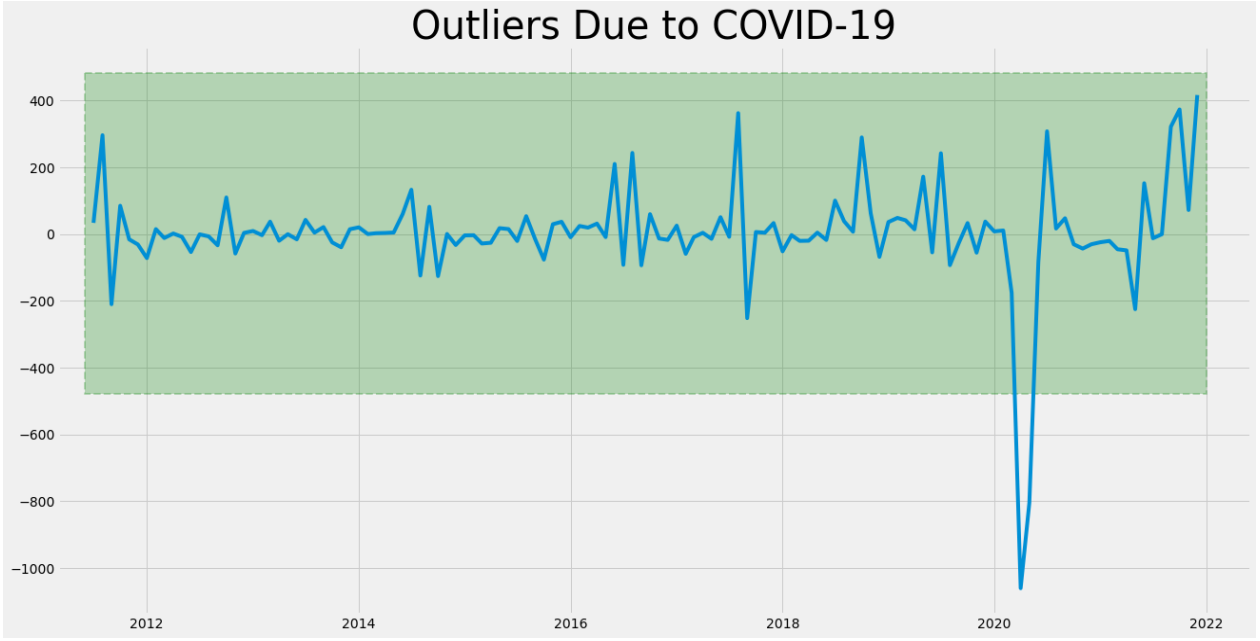
Monthly Plot

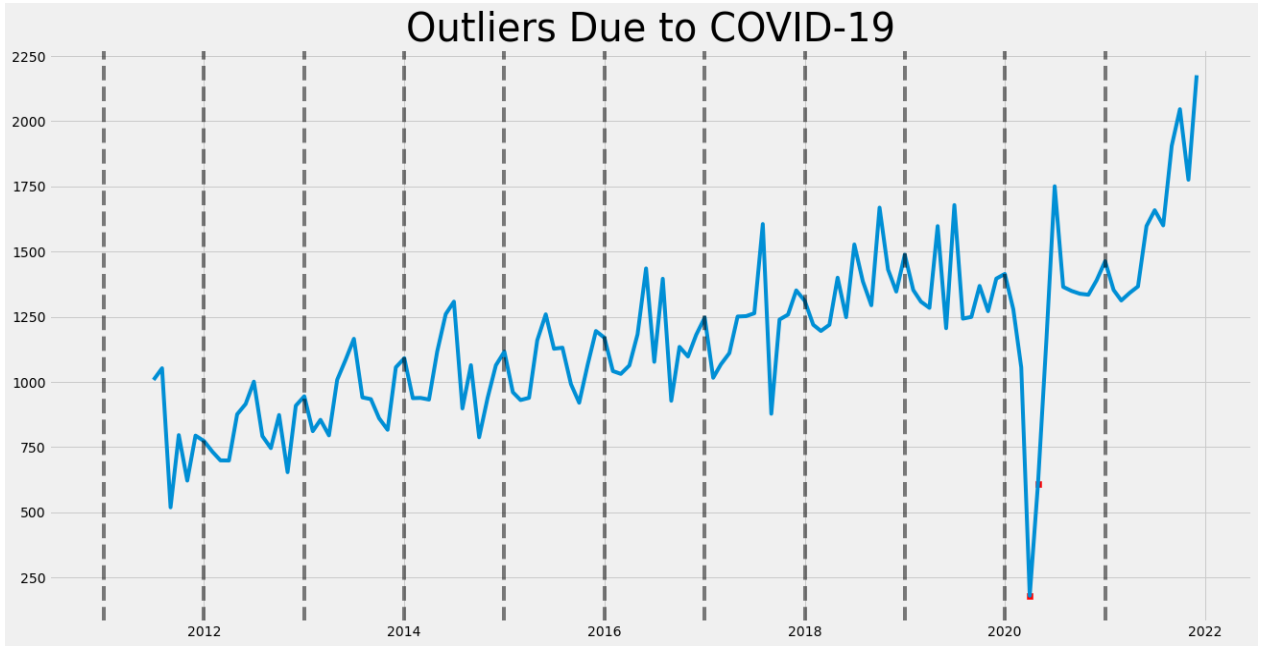


Quarterly Plot

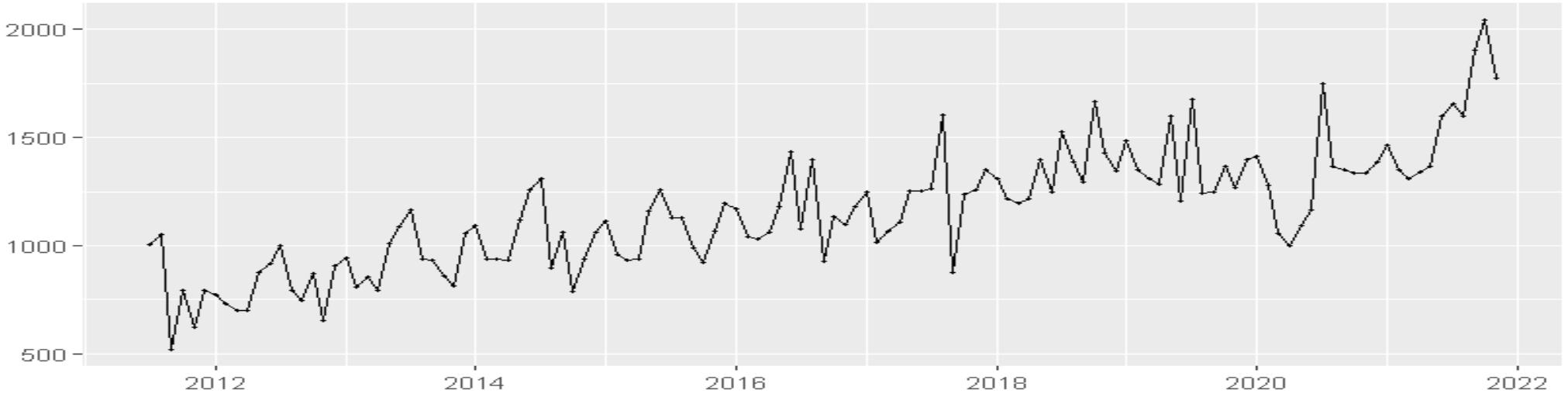
Impact of COVID-19

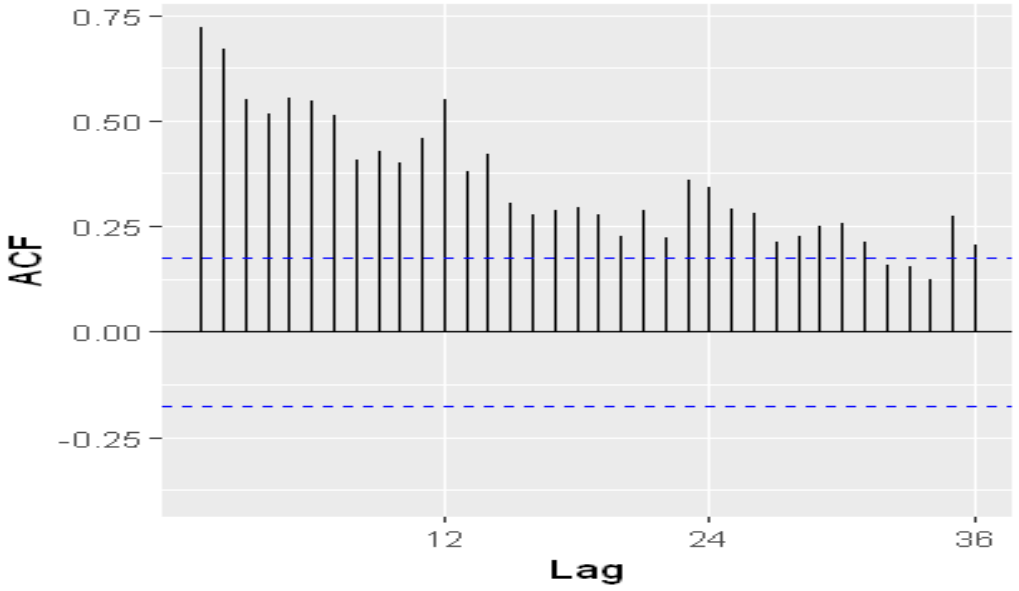
Span	Actual Value	Decomposed Value
April 2020	US$ 180 Million	US$ 1002.397 Million
May 2020	US$ 608 Million	US$ 1100.265 Million

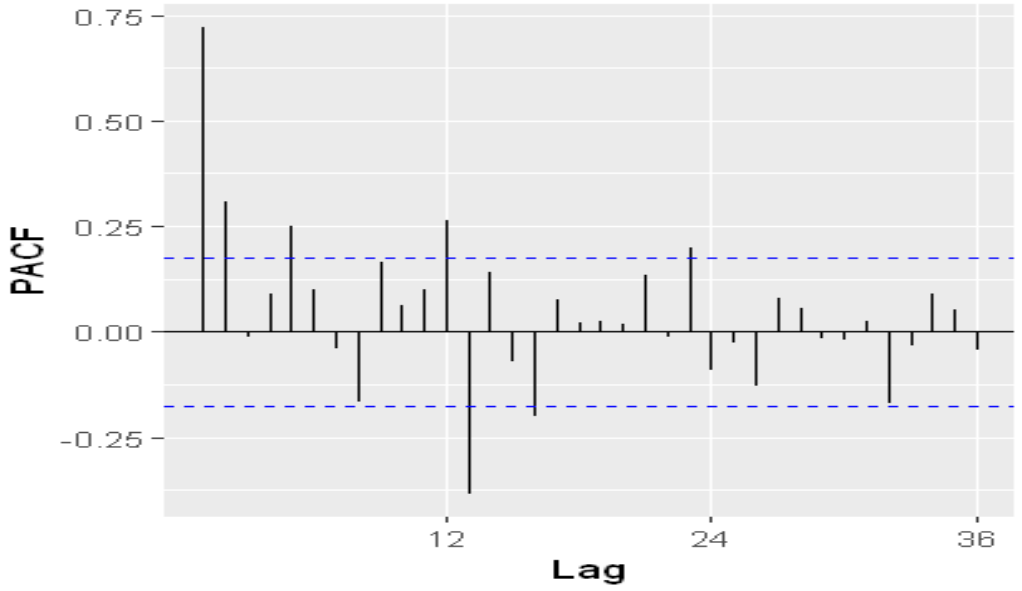




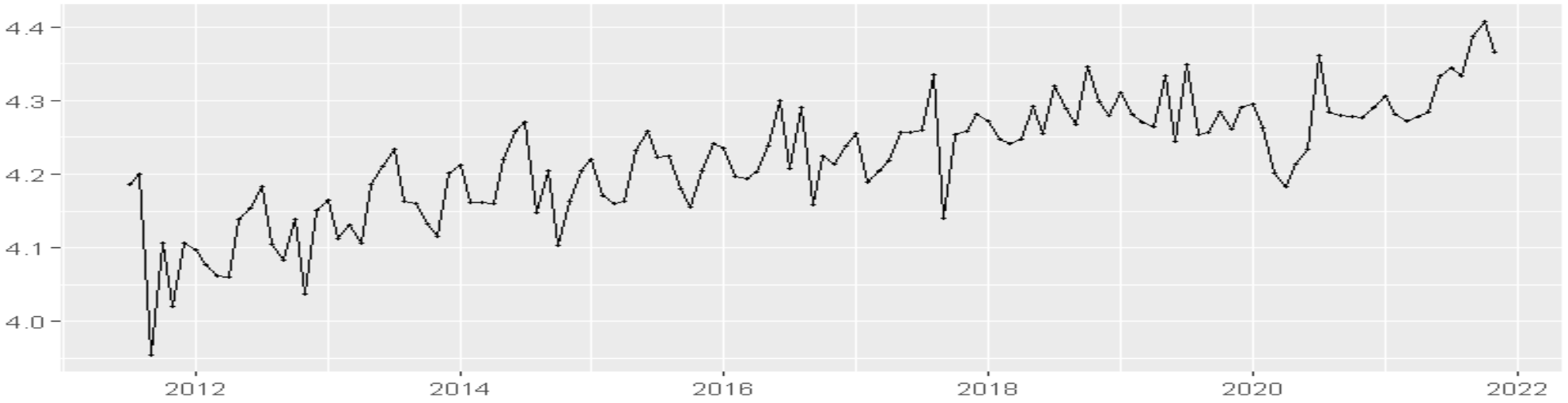
Processed Data

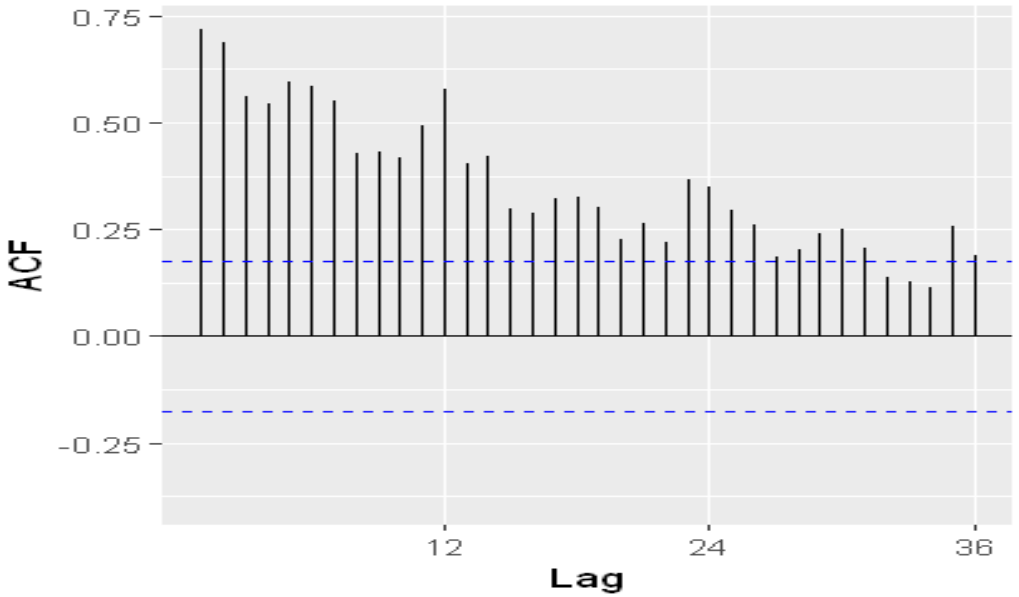


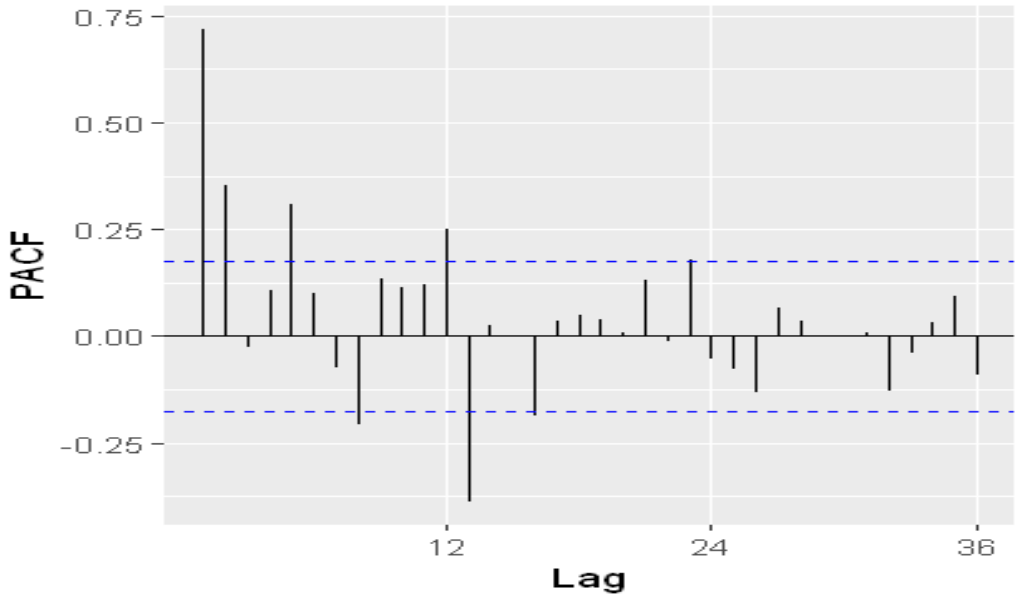




Box-cox Transformation







(Lambda= - 0.2761949)

ARIMA Model

Test of Stationary

Data	ADF Test	KPSS Test	Result
Export of Knitted RMG	0.1536 > 0.05	0.01 < 0.05	Not Stationary
Box-cox Transformed Data	0.07791 > 0.05	0.01 < 0.05	Not Stationary
Difference of Transformed Data	0.01 < 0.05	0.1 > 0.05	Stationary

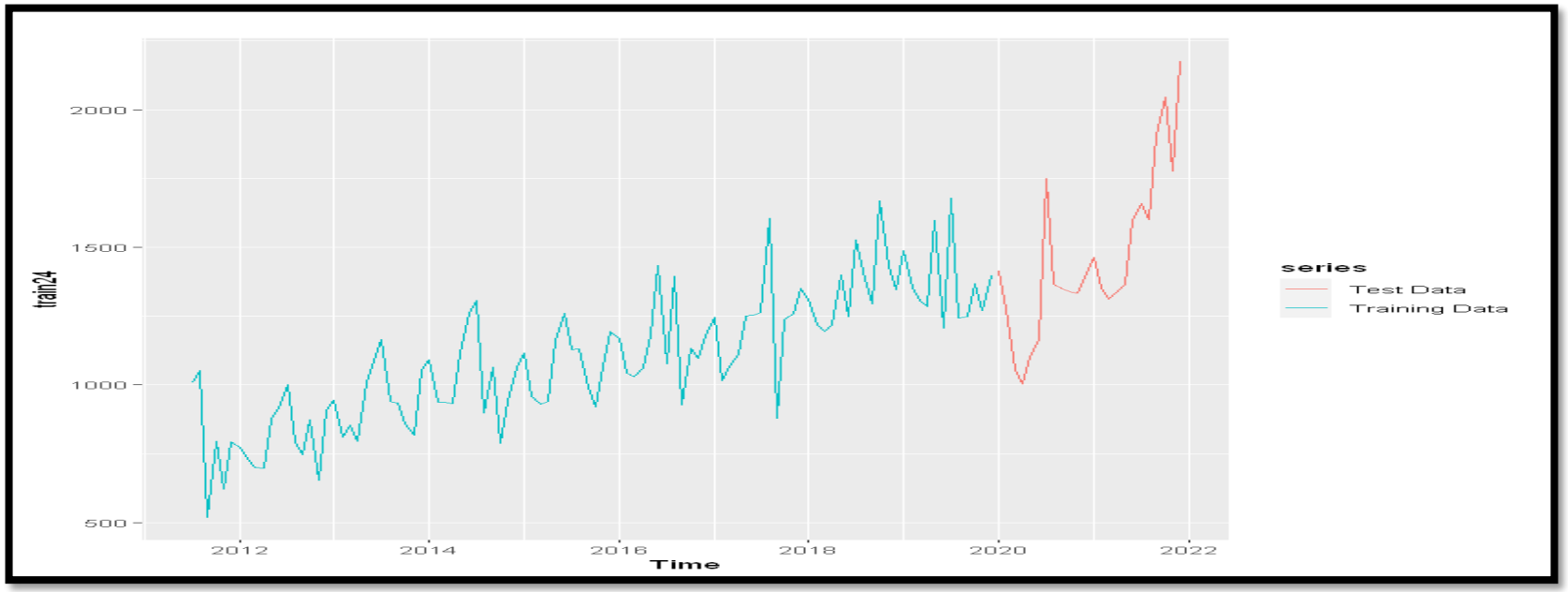
ARIMA Model

Data	ARIMA Model Order	Model Selection Criterion		
		AIC	AICc	BIC
Without Transformation	(0,1,1) (1,0,0) [12]	1597.20	1597.40	1605.68
	(0,1,1) (2,0,0) [12]	1597.76	1598.10	1609.08
	(0,1,1) (1,0,1) [12]	1597.99	1598.32	1609.30
	(1,1,1) (1,0,0) [12]	1598.18	1598.51	1609.49
	(0,1,2) (1,0,0) [12]	1598.39	1598.72	1609.70
	(0,1,1) (0,0,2) [12]	1598.43	1598.76	1609.74
Box-cox Transformation & Adjusted Back-transformed (Lambda= -0.2761949)	**(0,1,1) (1,0,0) [12]**	**-654.72**	**-654.53**	**-646.24**
	(1,1,1) (1,0,0) [12]	-654.51	-654.17	-643.19
	(0,1,1) (2,0,0) [12]	-653.77	-653.43	-642.45
	(0,1,1) (1,0,1) [12]	-653.57	-653.23	-642.25
	(0,1,4) (1,0,0) [12]	-653.44	-652.72	-636.46
	(2,1,1) (1,0,0) [12]	-653.25	-652.73	-639.10

ETS Model

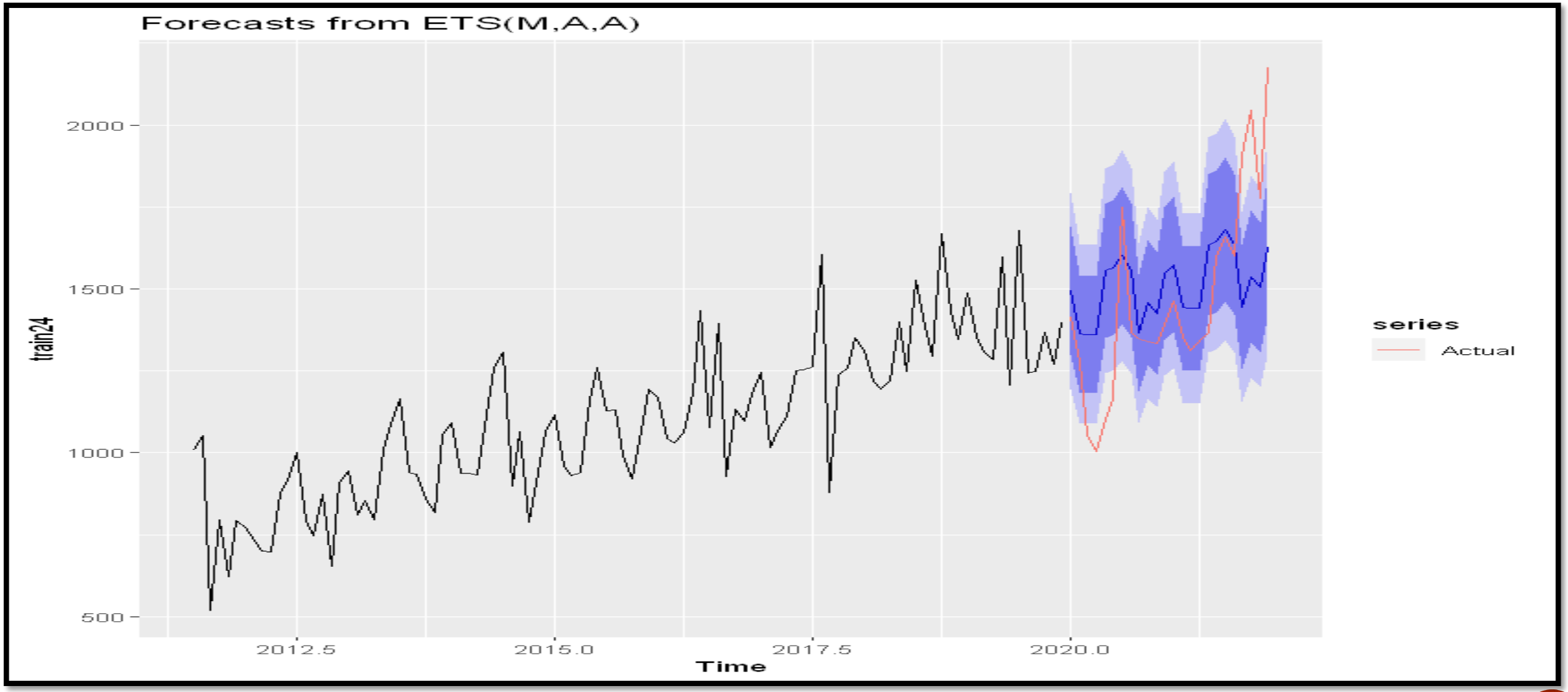
Data	ETS	Model Selection Criterion		
		AIC	**AICc**	**BIC**
Without Transformation	**(M, A, A)**	**1856.131**	**1861.798**	**1904.348**
	(M, Ad, A)	1860.933	1867.325	1911.986
Box-cox Transformation & Adjusted Back-transformed (Lambda=1)	(A, A, A)	1876.939	1882.606	1925.156
	(A, Ad, A)	1879.660	1886.053	1930.713

Cross Validation



Model	Set	ME	RMSE	MAE	MPE	MAPE	MASE
ARIMA (0,1,1)(1,0,0)[12]	Training	-0.63	112.40	85.89	-0.80	8.05	0.71
	Test	89.46	303.33	208.46	2.76	13.41	1.72
ETS (M,A,A)	Training	1.55	104.87	74.77	-0.80	6.94	0.62
	Test	-46.78	264.33	208.26	-6.44	14.60	1.72

ETS (M, A, A)


Forecasts from ETS(M,A,A)
2000
1500
1000
500
train24
2012.5
2015.0
2017.5
2020.0
Time
series
Actual

Forecast

$$y_t = (l_{t-1} + b_{t-1} + s_{t-m}) (1 + \varepsilon_t) ,$$
$$l_t = l_{t-1} + b_{t-1} + \alpha (l_{t-1} + b_{t-1} + s_{t-m})\varepsilon_t ,$$
$$b_t = b_{t-1} + \beta (l_{t-1} + b_{t-1} + s_{t-m})\varepsilon_t ,$$
$$s_t = s_{t-m} + \gamma (l_{t-1} + b_{t-1} + s_{t-m})\varepsilon_t ,$$

Here, l_t = Level, b_t = Trend, s_t = Seasonal Component, m=12 (Monthly data), ε_t = Error

The smoothing parameters of the exponential smoothing state space model ETS(M, A, A) that adequately fit the export of knitted RMG data are listed as follows:

α = 9e-04,

β = 1e-04,

γ = 1e-04,

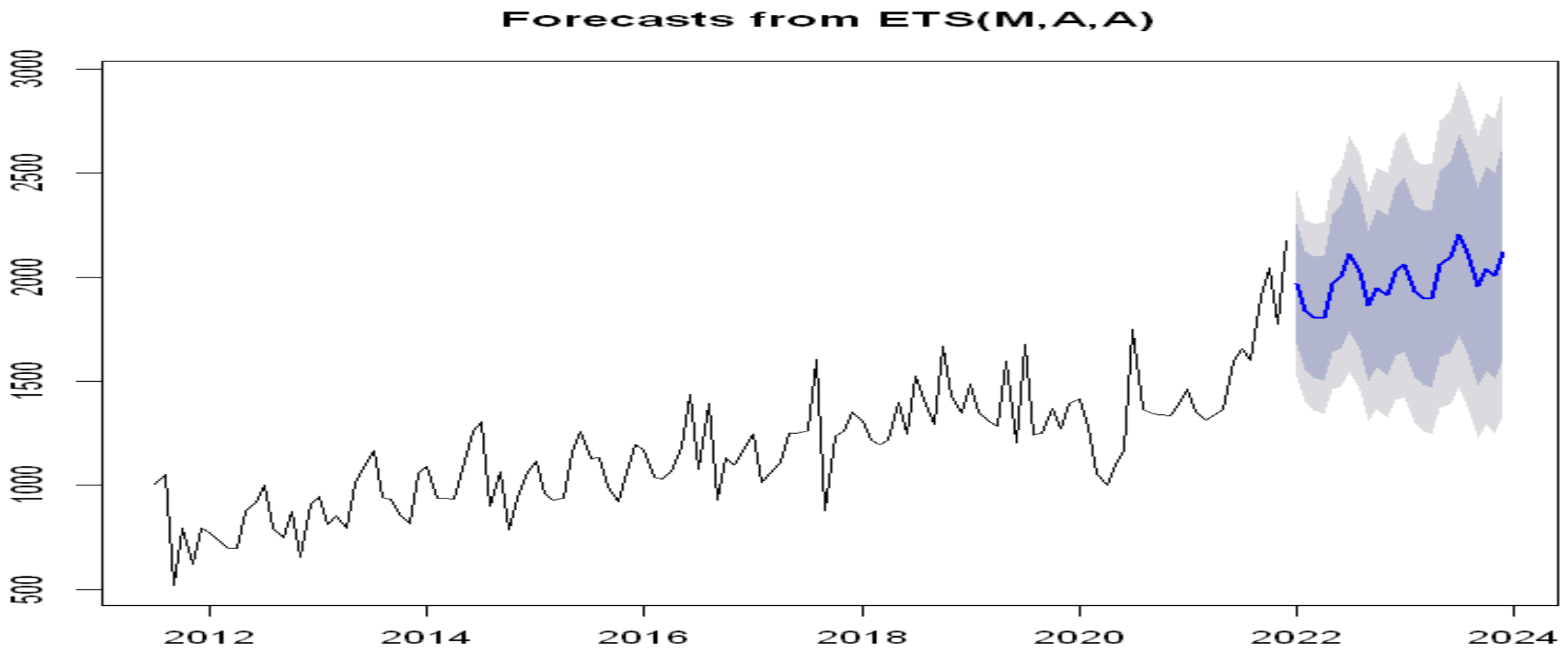
The components of the state space vector are listed as follows:

l_{t-1} = 754.9199,

b_{t-1} = 6.5859,

s_{t-m} = 96.0779, 93.9635, -93.7404, -86.9318, -77.8236, 59.9213, 39.4195, -75.4649, -36.0346, -121.9282, 75.4239, 127.1174,

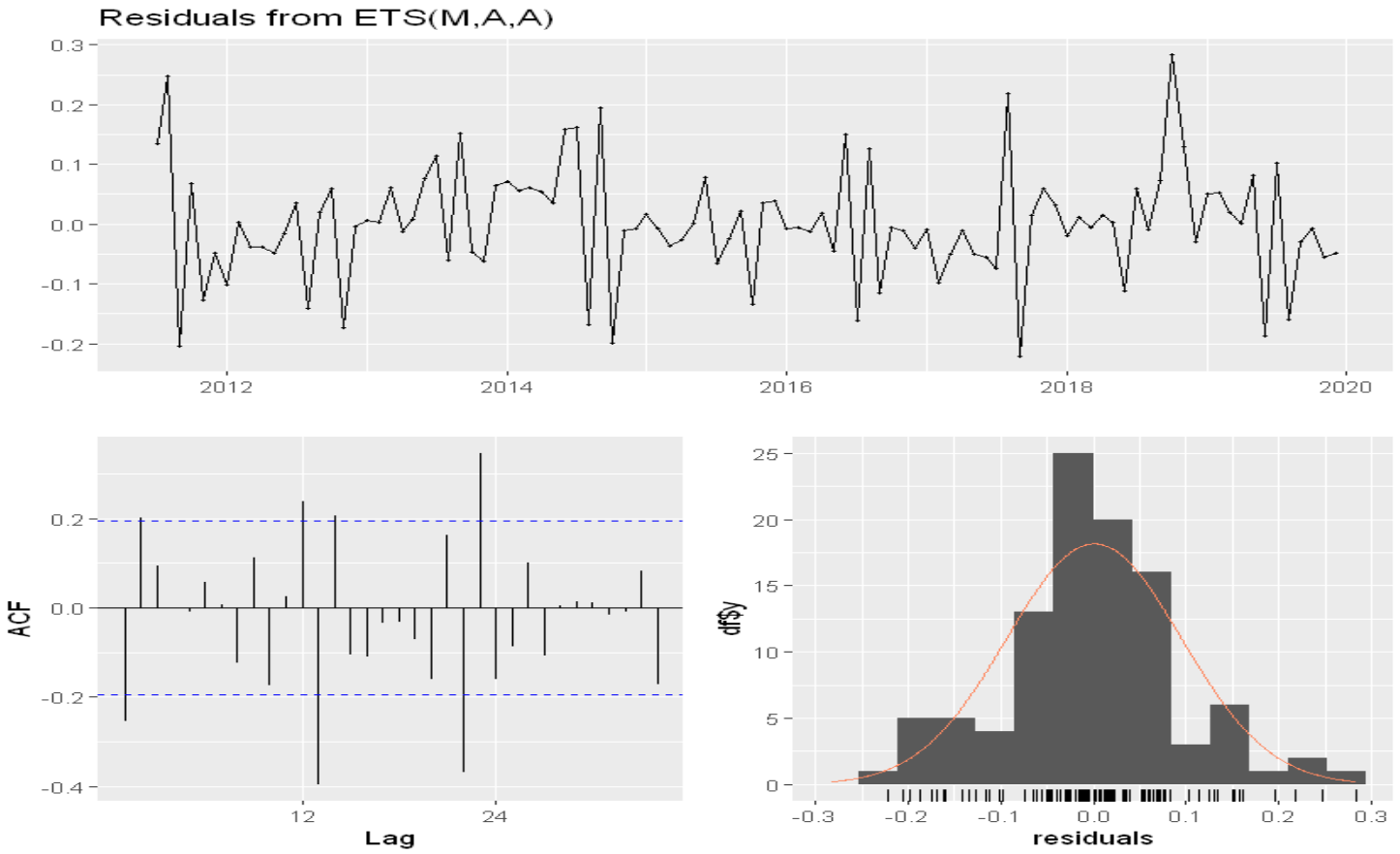
Forecast


Forecasts from ETS(M,A,A)
3000
2500
2000
1500
1000
500
2012
2014
2016
2018
2020
2022
2024

Forecast

	Point Forecast	Lo 80	Hi 80	Lo 95	Hi 95
Jan 2022	1968.687	1676.039	2261.336	1521.121	2416.254
Feb 2022	1840.002	1554.261	2125.744	1402.998	2277.006
Mar 2022	1808.686	1516.956	2100.417	1362.524	2254.849
Apr 2022	1804.490	1503.552	2105.428	1344.245	2264.735
May 2022	1969.785	1637.934	2301.637	1462.262	2477.308
Jun 2022	2003.762	1657.359	2350.165	1473.984	2533.539
Jul 2022	2113.488	1743.198	2483.778	1547.179	2679.798
Aug 2022	2024.439	1654.414	2394.463	1458.535	2590.342
Sep 2022	1861.686	1500.781	2222.591	1309.729	2413.643
Oct 2022	1947.656	1568.582	2326.729	1367.913	2527.399
Nov 2022	1914.284	1530.038	2298.531	1326.630	2501.938
Dec 2022	2030.201	1624.825	2435.577	1410.232	2650.170
Jan 2023	2061.688	1643.860	2479.517	1422.675	2700.702
Feb 2023	1933.003	1519.651	2346.356	1300.835	2565.172
Mar 2023	1901.687	1483.414	2319.961	1261.993	2541.382
Apr 2023	1897.491	1471.877	2323.105	1246.571	2548.411
May 2023	2062.786	1613.183	2512.389	1375.177	2750.395
Jun 2023	2096.763	1635.284	2558.241	1390.993	2802.533
Jul 2023	2206.489	1725.495	2687.483	1470.872	2942.106
Aug 2023	2117.440	1636.137	2598.742	1381.351	2853.529
Sep 2023	1954.687	1480.188	2429.185	1229.004	2680.370
Oct 2023	2040.657	1551.038	2530.276	1291.849	2789.464
Nov 2023	2007.285	1512.970	2501.600	1251.295	2763.275
Dec 2023	2123.202	1611.041	2635.363	1339.919	2906.485

Residuals



Residual Test	p-values
Residual Autocorrelation Box-Ljung test	1.59 x 10-11
Residual Normality Jarque Bera Test	0.2691

References

[1] D. S. E. P. B. C. b. BGMEA, "Bangladesh Garment Manufacturers and Exporters Association (BGMEA)," [Online]. Available: https://www.bgmea.com.bd/page/Export_Performance.

[2] M. Y. a. T. Yamagata, "The Garment Industry in Bangladesh," World Bank, 2012.

[3] R. J. a. K. Y. Hyndman, "Automatic Time Series Forecasting: The forecast Package for R," Journal of Statistical Software, vol. 27, pp. 1-22, 2008.

[4] R. J. H. a. A. B. K. a. J. K. O. a. R. D. Snyder, Forecasting with Exponential Smoothing: The State Space Approach, Springer, 2008.

জাহাঙ্গীরনগর বিশ্ববিদ্যালয়

Thank
You!