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# The application of Seasonal Trend Decomposition Using Loess for Export Forecasting by Economic Commodity Group in North Sumatra

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**ABSTRACT**

In export data, there are often seasonal fluctuations caused by various factors, and STL (Seasonal Trend decomposition using Loess) can help effectively separate these seasonal components. STL is an algorithm developed to decompose a time series into three components: trend, seasonal, and remainder, aiding in a better understanding of the underlying patterns and variations in the data. The data taken in this study are data on the number of exports (tonnes) in the period January 2018 to December 2022 sourced from bps. From the forecasting results it can be concluded that the largest BM export value is 6357.6131 (tons), the largest BP export value is 859804.0 (tons) and the largest BP export value is 113157.64 (tons).



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## 1. INTRODUCTION

Exports and imports play a crucial role in the economic stability of a country as they influence the amount of foreign exchange reserves. The need for foreign exchange is a vital factor in the monetary system of every country because it determines a nation's financial resilience. Many countries strive to bolster their foreign exchange reserves by promoting and increasing exports as one of the sources of foreign exchange. Exports are a crucial sector of the economy that plays a significant role in expanding markets between countries, potentially leading to the growth of various industries. This, in turn, can stimulate other sectors of the economy (Baldwin, 2005). The problem in this research is that the number of exported goods changes every time or season. That's why we need a mathematical model to predict the amount of exports in the future.

Time series analysis is an analysis using statistical techniques through the operation of models that use data from the past to predict the future. (Wei, W. W.S., 2006). STL is a method for decomposing a time series data into three components: seasonal, trend, and remainder. The definition of Loess is a non parametric regression method. This regression method has the advantage of high flexibility because the data automatically forms curve estimates that are not influenced by subjective factors (outliers) (Haritsah, 2015). In export data, there are often seasonal fluctuations caused by various factors, and STL can help effectively separate these seasonal components.

## 2. RESEARCH METHODE

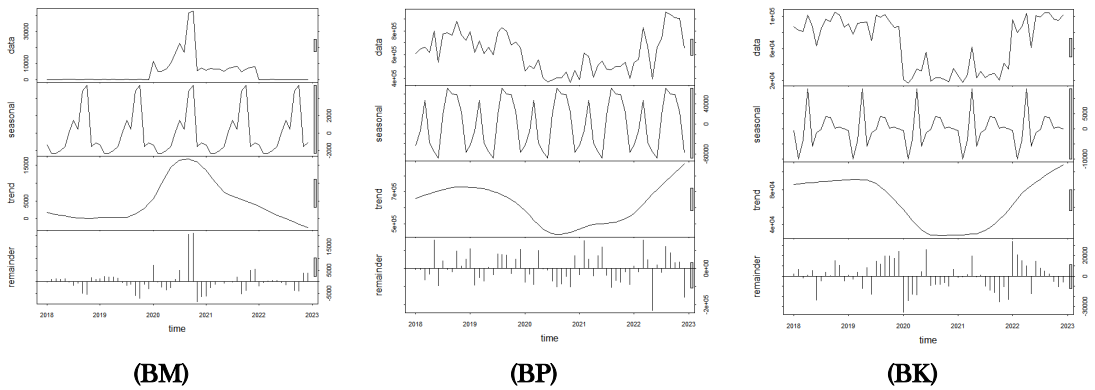
This research uses quantitative research. The form of data used in this research is in the form of time series which is secondary data, the acquisition of data used for this research is the total value of exports by economic goods group in North Sumatra and consists of 3 influential variables,namely barang modal (BM), bahan baku/penolong (BP), and barang konsumsi (BK). The data taken in this study are data on the number of exports (tonnes) in the period January 2018 to December 2022. The stages in the data analysis process in this study include:

1. Data description
2. Application of STL to each export data component
3. Applying seasonal, trend, and residual components to each component
4. Data is analysed descriptively to see any trends or seasonal patterns that may exist.
5. Apply the STL method to the time series data using an appropriate library, such as STL plus or forecasting in R. Select appropriate parameters, such as LOESS windows for seasonal and trend components.
6. Perform forecasting on each component of export data
7. Calculate MAE and MAPE values
8. Interpretation of results

## 3. RESULT AND ANALYSIS

### 3.1 Data Description

Data graph of the number of exports by group of economic goods (tonnes) for the period January 2018 - December 2022 can be seen in Figure 3.1.




(BM) (BP) (BK)

**Figure 3.*1*** Chart of export data pattern January 2018 - December 2022 (tonnes)

Figure 3.1 shows that the number of exports by economic goods group is unstable and has a seasonal pattern.

### 3.2 Application of STL and forecasting on each component of economic goods groups

STL application and forecasting can be assisted by using the R Studio application with packages library(stlplus) and library (forecast).

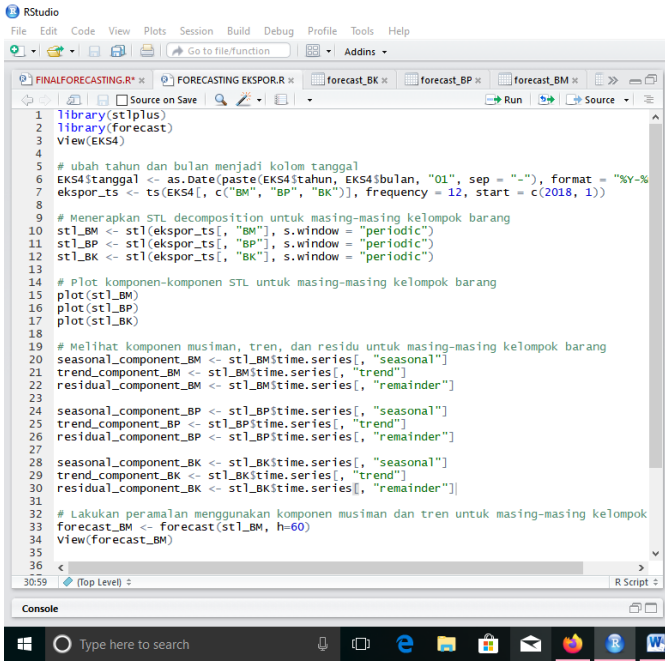
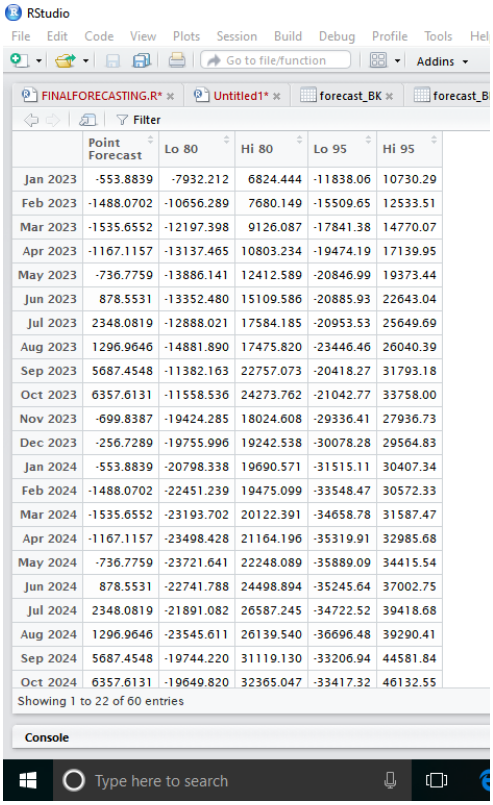


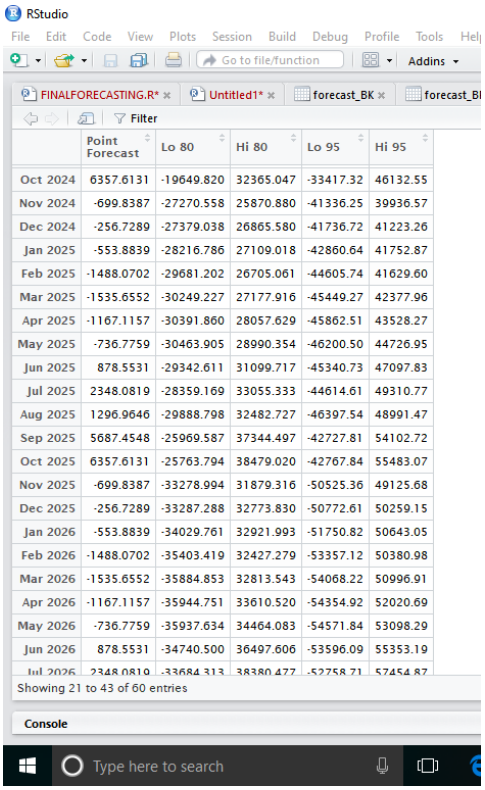

***Figure 3.2*** Application of STL and forecasting on each export component in R studio

From the application of STL, forecasting is obtained:

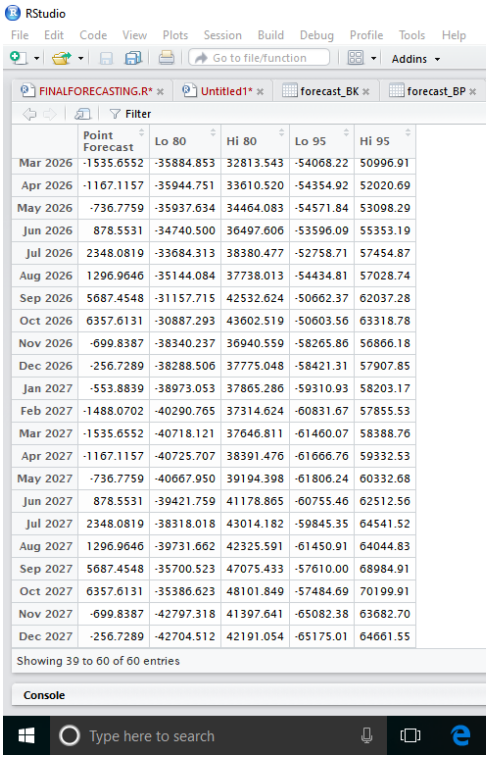
a. BM forecasting results




| | Point Forecast | Lo 80 | Hi 80 | Lo 95 | Hi 95 |
|---|---|---|---|---|---|
| Jan 2023 | -553.8839 | -7932.212 | 6824.444 | -11838.06 | 10730.29 |
| Feb 2023 | -1488.0702 | -10656.289 | 7680.149 | -15509.65 | 12533.51 |
| Mar 2023 | -1535.6552 | -12197.398 | 9126.087 | -17841.38 | 14770.07 |
| Apr 2023 | -1167.1157 | -13137.465 | 10803.234 | -19474.19 | 17139.95 |
| May 2023 | -736.7759 | -13886.141 | 12412.589 | -20846.99 | 19373.44 |
| Jun 2023 | 878.5531 | -13352.480 | 15109.586 | -20885.93 | 22643.04 |
| Jul 2023 | 2348.0819 | -12888.021 | 17584.185 | -20953.53 | 25649.69 |
| Aug 2023 | 1296.9646 | -14881.890 | 17475.820 | -23446.46 | 26040.39 |
| Sep 2023 | 5687.4548 | -11382.163 | 22757.073 | -20418.27 | 31793.18 |
| Oct 2023 | 6357.6131 | -11558.536 | 24273.762 | -21042.77 | 33758.00 |
| Nov 2023 | -699.8387 | -19424.285 | 18024.608 | -29336.41 | 27936.73 |
| Dec 2023 | -256.7289 | -19755.996 | 19242.538 | -30078.28 | 29564.83 |
| Jan 2024 | -553.8839 | -20798.338 | 19690.571 | -31515.11 | 30407.34 |
| Feb 2024 | -1488.0702 | -22451.239 | 19475.099 | -33548.47 | 30572.33 |
| Mar 2024 | -1535.6552 | -23193.702 | 20122.391 | -34658.78 | 31587.47 |
| Apr 2024 | -1167.1157 | -23498.428 | 21164.196 | -35319.91 | 32985.68 |
| May 2024 | -736.7759 | -23721.641 | 22248.089 | -35889.09 | 34415.54 |
| Jun 2024 | 878.5531 | -22741.788 | 24498.894 | -35245.64 | 37002.75 |
| Jul 2024 | 2348.0819 | -21891.082 | 26587.245 | -34722.52 | 39418.68 |
| Aug 2024 | 1296.9646 | -23545.611 | 26139.540 | -36696.48 | 39290.41 |
| Sep 2024 | 5687.4548 | -19744.220 | 31119.130 | -33206.94 | 44581.84 |
| Oct 2024 | 6357.6131 | -19649.820 | 32365.047 | -33417.32 | 46132.55 |




| | Point Forecast | Lo 80 | Hi 80 | Lo 95 | Hi 95 |
|---|---|---|---|---|---|
| Oct 2024 | 6357.6131 | -19649.820 | 32365.047 | -33417.32 | 46132.55 |
| Nov 2024 | -699.8387 | -27270.558 | 25870.880 | -41336.25 | 39936.57 |
| Dec 2024 | -256.7289 | -27379.038 | 26865.580 | -41736.72 | 41223.26 |
| Jan 2025 | -553.8839 | -28216.786 | 27109.018 | -42860.64 | 41752.87 |
| Feb 2025 | -1488.0702 | -29681.202 | 26705.061 | -44605.74 | 41629.60 |
| Mar 2025 | -1535.6552 | -30249.227 | 27177.916 | -45449.27 | 42377.96 |
| Apr 2025 | -1167.1157 | -30391.860 | 28057.629 | -45862.51 | 43528.27 |
| May 2025 | -736.7759 | -30463.905 | 28990.354 | -46200.50 | 44726.95 |
| Jun 2025 | 878.5531 | -29342.611 | 31099.717 | -45340.73 | 47097.83 |
| Jul 2025 | 2348.0819 | -28359.169 | 33055.333 | -44614.61 | 49310.77 |
| Aug 2025 | 1296.9646 | -29888.798 | 32482.727 | -46397.54 | 48991.47 |
| Sep 2025 | 5687.4548 | -25969.587 | 37344.497 | -42727.81 | 54102.72 |
| Oct 2025 | 6357.6131 | -25763.794 | 38479.020 | -42767.84 | 55483.07 |
| Nov 2025 | -699.8387 | -33278.994 | 31879.316 | -50525.36 | 49125.68 |
| Dec 2025 | -256.7289 | -33287.288 | 32773.830 | -50772.61 | 50259.15 |
| Jan 2026 | -553.8839 | -34029.761 | 32921.993 | -51750.82 | 50643.05 |
| Feb 2026 | -1488.0702 | -35403.419 | 32427.279 | -53357.12 | 50380.98 |
| Mar 2026 | -1535.6552 | -35884.853 | 32813.543 | -54068.22 | 50996.91 |
| Apr 2026 | -1167.1157 | -35944.751 | 33610.520 | -54354.92 | 52020.69 |
| May 2026 | -736.7759 | -35937.634 | 34464.083 | -54571.84 | 53098.29 |
| Jun 2026 | 878.5531 | -34740.500 | 36497.606 | -53596.09 | 55353.19 |
| Jul 2026 | 2348.0819 | -33684.313 | 38380.477 | -52758.71 | 57454.87 |



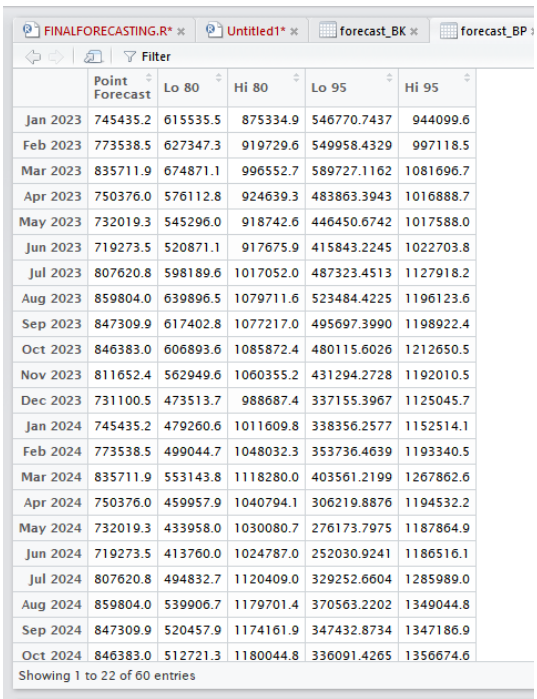
| | Point Forecast | Lo 80 | Hi 80 | Lo 95 | Hi 95 |
|---|---|---|---|---|---|
| Mar 2026 | -1535.6552 | -35884.853 | 32813.543 | -54068.22 | 50996.91 |
| Apr 2026 | -1167.1157 | -35944.751 | 33610.520 | -54354.92 | 52020.69 |
| May 2026 | -736.7759 | -35937.634 | 34464.083 | -54571.84 | 53098.29 |
| Jun 2026 | 878.5531 | -34740.500 | 36497.606 | -53596.09 | 55353.19 |
| Jul 2026 | 2348.0819 | -33684.313 | 38380.477 | -52758.71 | 57454.87 |
| Aug 2026 | 1296.9646 | -35144.084 | 37738.013 | -54434.81 | 57028.74 |
| Sep 2026 | 5687.4548 | -31157.715 | 42532.624 | -50662.37 | 62037.28 |
| Oct 2026 | 6357.6131 | -30887.293 | 43602.519 | -50603.56 | 63318.78 |
| Nov 2026 | -699.8387 | -38340.237 | 36940.559 | -58265.86 | 56866.18 |
| Dec 2026 | -256.7289 | -38288.506 | 37775.048 | -58421.31 | 57907.85 |
| Jan 2027 | -553.8839 | -38973.053 | 37865.286 | -59310.93 | 58203.17 |
| Feb 2027 | -1488.0702 | -40290.765 | 37314.624 | -60831.67 | 57855.53 |
| Mar 2027 | -1535.6552 | -40718.121 | 37646.811 | -61460.07 | 58388.76 |
| Apr 2027 | -1167.1157 | -40725.707 | 38391.476 | -61666.76 | 59332.53 |
| May 2027 | -736.7759 | -40667.950 | 39194.398 | -61806.24 | 60332.68 |
| Jun 2027 | 878.5531 | -39421.759 | 41178.865 | -60755.46 | 62512.56 |
| Jul 2027 | 2348.0819 | -38318.018 | 43014.182 | -59845.35 | 64541.52 |
| Aug 2027 | 1296.9646 | -39731.662 | 42325.591 | -61450.91 | 64044.83 |
| Sep 2027 | 5687.4548 | -35700.523 | 47075.433 | -57610.00 | 68984.91 |
| Oct 2027 | 6357.6131 | -35386.623 | 48101.849 | -57484.69 | 70199.91 |
| Nov 2027 | -699.8387 | -42797.318 | 41397.641 | -65082.38 | 63682.70 |
| Dec 2027 | -256.7289 | -42704.512 | 42191.054 | -65175.01 | 64661.55 |

Showing 39 to 60 of 60 entries

***Figure 3.3*** BM forecasting results

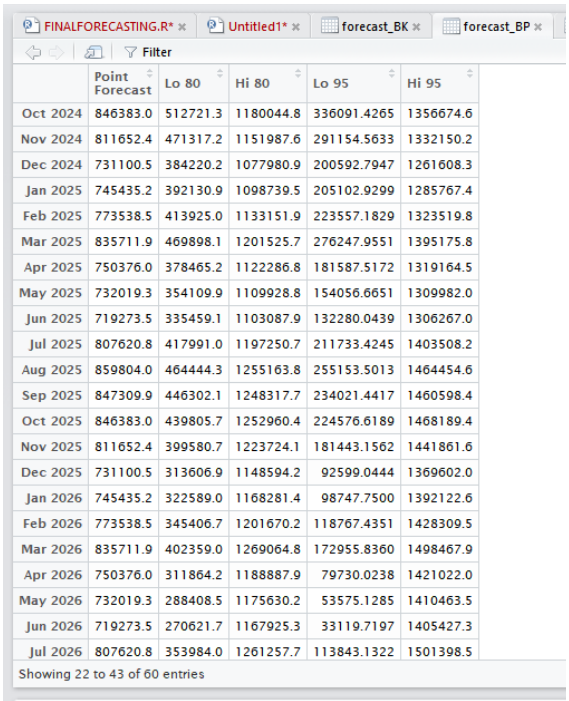
Based on Figure 3.3, the largest BM export value is 6357.6131 (tonnes).

b. BP forecasting results



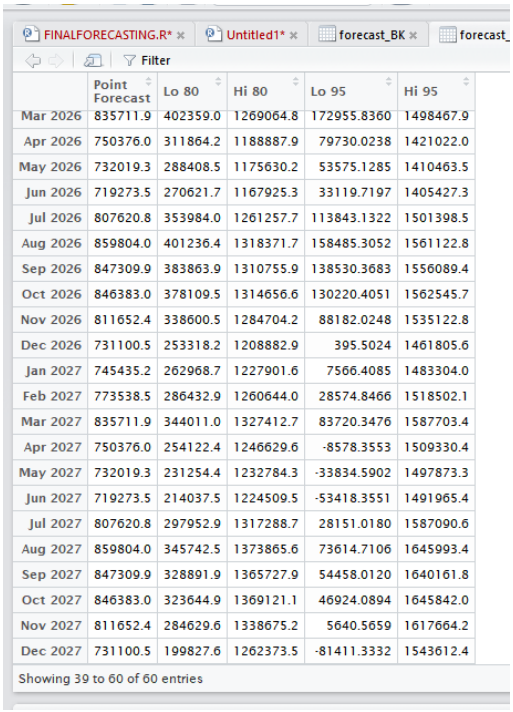
| | Point Forecast | Lo 80 | Hi 80 | Lo 95 | Hi 95 |
|---|---|---|---|---|---|
| Jan 2023 | 745435.2 | 615535.5 | 875334.9 | 546770.7437 | 944099.6 |
| Feb 2023 | 773538.5 | 627347.3 | 919729.6 | 549958.4329 | 997118.5 |
| Mar 2023 | 835711.9 | 674871.1 | 996552.7 | 589727.1162 | 1081696.7 |
| Apr 2023 | 750376.0 | 576112.8 | 924639.3 | 483863.3943 | 1016888.7 |
| May 2023 | 732019.3 | 545296.0 | 918742.6 | 446450.6742 | 1017588.0 |
| Jun 2023 | 719273.5 | 520871.1 | 917675.9 | 415843.2245 | 1022703.8 |
| Jul 2023 | 807620.8 | 598189.6 | 1017052.0 | 487323.4513 | 1127918.2 |
| Aug 2023 | 859804.0 | 639896.5 | 1079711.6 | 523484.4225 | 1196123.6 |
| Sep 2023 | 847309.9 | 617402.8 | 1077217.0 | 495697.3990 | 1198922.4 |
| Oct 2023 | 846383.0 | 606893.6 | 1085872.4 | 480115.6026 | 1212650.5 |
| Nov 2023 | 811652.4 | 562949.6 | 1060355.2 | 431294.2728 | 1192010.5 |
| Dec 2023 | 731100.5 | 473513.7 | 988687.4 | 337155.3967 | 1125045.7 |
| Jan 2024 | 745435.2 | 479260.6 | 1011609.8 | 338356.2577 | 1152514.1 |
| Feb 2024 | 773538.5 | 499044.7 | 1048032.3 | 353736.4639 | 1193340.5 |
| Mar 2024 | 835711.9 | 553143.8 | 1118280.0 | 403561.2199 | 1267862.6 |
| Apr 2024 | 750376.0 | 459957.9 | 1040794.1 | 306219.8876 | 1194532.2 |
| May 2024 | 732019.3 | 433958.0 | 1030080.7 | 276173.7975 | 1187864.9 |
| Jun 2024 | 719273.5 | 413760.0 | 1024787.0 | 252030.9241 | 1186516.1 |
| Jul 2024 | 807620.8 | 494832.7 | 1120409.0 | 329252.6604 | 1285989.0 |
| Aug 2024 | 859804.0 | 539906.7 | 1179701.4 | 370563.2202 | 1349044.8 |
| Sep 2024 | 847309.9 | 520457.9 | 1174161.9 | 347432.8734 | 1347186.9 |
| Oct 2024 | 846383.0 | 512721.3 | 1180044.8 | 336091.4265 | 1356674.6 |

Showing 1 to 22 of 60 entries



| | Point Forecast | Lo 80 | Hi 80 | Lo 95 | Hi 95 |
|---|---|---|---|---|---|
| Oct 2024 | 846383.0 | 512721.3 | 1180044.8 | 336091.4265 | 1356674.6 |
| Nov 2024 | 811652.4 | 471317.2 | 1151987.6 | 291154.5633 | 1332150.2 |
| Dec 2024 | 731100.5 | 384220.2 | 1077980.9 | 200592.7947 | 1261608.3 |
| Jan 2025 | 745435.2 | 392130.9 | 1098739.5 | 205102.9299 | 1285767.4 |
| Feb 2025 | 773538.5 | 413925.0 | 1133151.9 | 223557.1829 | 1323519.8 |
| Mar 2025 | 835711.9 | 469898.1 | 1201525.7 | 276247.9551 | 1395175.8 |
| Apr 2025 | 750376.0 | 378465.2 | 1122286.8 | 181587.5172 | 1319164.5 |
| May 2025 | 732019.3 | 354109.9 | 1109928.8 | 154056.6651 | 1309982.0 |
| Jun 2025 | 719273.5 | 335459.1 | 1103087.9 | 132280.0439 | 1306267.0 |
| Jul 2025 | 807620.8 | 417991.0 | 1197250.7 | 211733.4245 | 1403508.2 |
| Aug 2025 | 859804.0 | 464444.3 | 1255163.8 | 255153.5013 | 1464454.6 |
| Sep 2025 | 847309.9 | 446302.1 | 1248317.7 | 234021.4417 | 1460598.4 |
| Oct 2025 | 846383.0 | 439805.7 | 1252960.4 | 224576.6189 | 1468189.4 |
| Nov 2025 | 811652.4 | 399580.7 | 1223724.1 | 181443.1562 | 1441861.6 |
| Dec 2025 | 731100.5 | 313606.9 | 1148594.2 | 92599.0444 | 1369602.0 |
| Jan 2026 | 745435.2 | 322589.0 | 1168281.4 | 98747.7500 | 1392122.6 |
| Feb 2026 | 773538.5 | 345406.7 | 1201670.2 | 118767.4351 | 1428309.5 |
| Mar 2026 | 835711.9 | 402359.0 | 1269064.8 | 172955.8360 | 1498467.9 |
| Apr 2026 | 750376.0 | 311864.2 | 1188887.9 | 79730.0238 | 1421022.0 |
| May 2026 | 732019.3 | 288408.5 | 1175630.2 | 53575.1285 | 1410463.5 |
| Jun 2026 | 719273.5 | 270621.7 | 1167925.3 | 33119.7197 | 1405427.3 |
| Jul 2026 | 807620.8 | 353984.0 | 1261257.7 | 113843.1322 | 1501398.5 |

Showing 22 to 43 of 60 entries



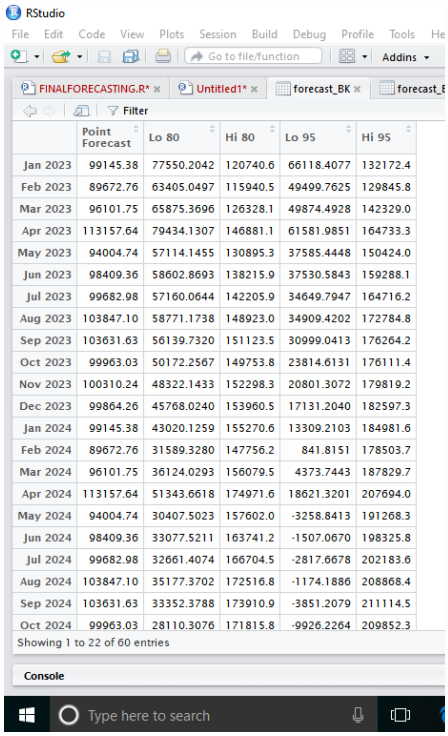
| | Point Forecast | Lo 80 | Hi 80 | Lo 95 | Hi 95 |
|---|---|---|---|---|---|
| Mar 2026 | 835711.9 | 402359.0 | 1269064.8 | 172955.8360 | 1498467.9 |
| Apr 2026 | 750376.0 | 311864.2 | 1188887.9 | 79730.0238 | 1421022.0 |
| May 2026 | 732019.3 | 288408.5 | 1175630.2 | 53575.1285 | 1410463.5 |
| Jun 2026 | 719273.5 | 270621.7 | 1167925.3 | 33119.7197 | 1405427.3 |
| Jul 2026 | 807620.8 | 353984.0 | 1261257.7 | 113843.1322 | 1501398.5 |
| Aug 2026 | 859804.0 | 401236.4 | 1318371.7 | 158485.3052 | 1561122.8 |
| Sep 2026 | 847309.9 | 383863.9 | 1310755.9 | 138530.3683 | 1556089.4 |
| Oct 2026 | 846383.0 | 378109.5 | 1314656.6 | 130220.4051 | 1562545.7 |
| Nov 2026 | 811652.4 | 338600.5 | 1284704.2 | 88182.0248 | 1535122.8 |
| Dec 2026 | 731100.5 | 253318.2 | 1208882.9 | 395.5024 | 1461805.6 |
| Jan 2027 | 745435.2 | 262968.7 | 1227901.6 | 7566.4085 | 1483304.0 |
| Feb 2027 | 773538.5 | 286432.9 | 1260644.0 | 28574.8466 | 1518502.1 |
| Mar 2027 | 835711.9 | 344011.0 | 1327412.7 | 83720.3476 | 1587703.4 |
| Apr 2027 | 750376.0 | 254122.4 | 1246629.6 | -8578.3553 | 1509330.4 |
| May 2027 | 732019.3 | 231254.4 | 1232784.3 | -33834.5902 | 1497873.3 |
| Jun 2027 | 719273.5 | 214037.5 | 1224509.5 | -53418.3551 | 1491965.4 |
| Jul 2027 | 807620.8 | 297952.9 | 1317288.7 | 28151.0180 | 1587090.6 |
| Aug 2027 | 859804.0 | 345742.5 | 1373865.6 | 73614.7106 | 1645993.4 |
| Sep 2027 | 847309.9 | 328891.9 | 1365727.9 | 54458.0120 | 1640161.8 |
| Oct 2027 | 846383.0 | 323644.9 | 1369121.1 | 46924.0894 | 1645842.0 |
| Nov 2027 | 811652.4 | 284629.6 | 1338675.2 | 5640.5659 | 1617664.2 |
| Dec 2027 | 731100.5 | 199827.6 | 1262373.5 | -81411.3332 | 1543612.4 |

Showing 39 to 60 of 60 entries

***Figure 3.4*** BP forecasting results

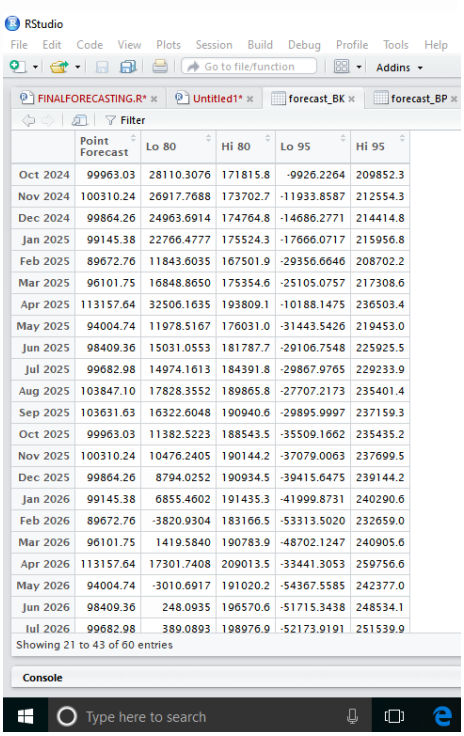
Based on Figure 3.4, the largest BP export value is 859804.0 (tonnes).

c. BK forecasting results



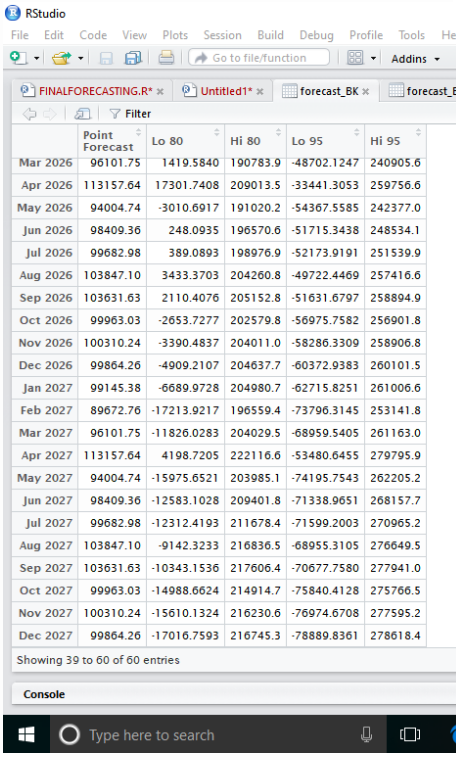
| | Point Forecast | Lo 80 | Hi 80 | Lo 95 | Hi 95 |
|---|---|---|---|---|---|
| Jan 2023 | 99145.38 | 77550.2042 | 120740.6 | 66118.4077 | 132172.4 |
| Feb 2023 | 89672.76 | 63405.0497 | 115940.5 | 49499.7625 | 129845.8 |
| Mar 2023 | 96101.75 | 65875.3696 | 126328.1 | 49874.4928 | 142329.0 |
| Apr 2023 | 113157.64 | 79434.1307 | 146881.1 | 61581.9851 | 164733.3 |
| May 2023 | 94004.74 | 57114.1455 | 130895.3 | 37585.4448 | 150424.0 |
| Jun 2023 | 98409.36 | 58602.8693 | 138215.9 | 37530.5843 | 159288.1 |
| Jul 2023 | 99682.98 | 57160.0644 | 142205.9 | 34649.7947 | 164716.2 |
| Aug 2023 | 103847.10 | 58771.1738 | 148923.0 | 34909.4202 | 172784.8 |
| Sep 2023 | 103631.63 | 56139.7320 | 151123.5 | 30999.0413 | 176264.2 |
| Oct 2023 | 99963.03 | 50172.2567 | 149753.8 | 23814.6131 | 176111.4 |
| Nov 2023 | 100310.24 | 48322.1433 | 152298.3 | 20801.3072 | 179819.2 |
| Dec 2023 | 99864.26 | 45768.0240 | 153960.5 | 17131.2040 | 182597.3 |
| Jan 2024 | 99145.38 | 43020.1259 | 155270.6 | 13309.2103 | 184981.6 |
| Feb 2024 | 89672.76 | 31589.3280 | 147756.2 | 841.8151 | 178503.7 |
| Mar 2024 | 96101.75 | 36124.0293 | 156079.5 | 4373.7443 | 187829.7 |
| Apr 2024 | 113157.64 | 51343.6618 | 174971.6 | 18621.3201 | 207694.0 |
| May 2024 | 94004.74 | 30407.5023 | 157602.0 | -3258.8413 | 191268.3 |
| Jun 2024 | 98409.36 | 33077.5211 | 163741.2 | -1507.0670 | 198325.8 |
| Jul 2024 | 99682.98 | 32661.4074 | 166704.5 | -2817.6678 | 202183.6 |
| Aug 2024 | 103847.10 | 35177.3702 | 172516.8 | -1174.1886 | 208868.4 |
| Sep 2024 | 103631.63 | 33352.3788 | 173910.9 | -3851.2079 | 211114.5 |
| Oct 2024 | 99963.03 | 28110.3076 | 171815.8 | -9926.2264 | 209852.3 |

Showing 1 to 22 of 60 entries



| | Point Forecast | Lo 80 | Hi 80 | Lo 95 | Hi 95 |
|---|---|---|---|---|---|
| Oct 2024 | 99963.03 | 28110.3076 | 171815.8 | -9926.2264 | 209852.3 |
| Nov 2024 | 100310.24 | 26917.7688 | 173702.7 | -11933.8587 | 212554.3 |
| Dec 2024 | 99864.26 | 24963.6914 | 174764.8 | -14686.2771 | 214414.8 |
| Jan 2025 | 99145.38 | 22766.4777 | 175524.3 | -17666.0717 | 215956.8 |
| Feb 2025 | 89672.76 | 11843.6035 | 167501.9 | -29356.6646 | 208702.2 |
| Mar 2025 | 96101.75 | 16848.8650 | 175354.6 | -25105.0757 | 217308.6 |
| Apr 2025 | 113157.64 | 32506.1635 | 193809.1 | -10188.1475 | 236503.4 |
| May 2025 | 94004.74 | 11978.5167 | 176031.0 | -31443.5426 | 219453.0 |
| Jun 2025 | 98409.36 | 15031.0553 | 181787.7 | -29106.7548 | 225925.5 |
| Jul 2025 | 99682.98 | 14974.1613 | 184391.8 | -29867.9765 | 229233.9 |
| Aug 2025 | 103847.10 | 17828.3552 | 189865.8 | -27707.2173 | 235401.4 |
| Sep 2025 | 103631.63 | 16322.6048 | 190940.6 | -29895.9997 | 237159.3 |
| Oct 2025 | 99963.03 | 11382.5223 | 188543.5 | -35509.1662 | 235435.2 |
| Nov 2025 | 100310.24 | 10476.2405 | 190144.2 | -37079.0063 | 237699.5 |
| Dec 2025 | 99864.26 | 8794.0252 | 190934.5 | -39415.6475 | 239144.2 |
| Jan 2026 | 99145.38 | 6855.4602 | 191435.3 | -41999.8731 | 240290.6 |
| Feb 2026 | 89672.76 | -3820.9304 | 183166.5 | -53313.5020 | 232659.0 |
| Mar 2026 | 96101.75 | 1419.5840 | 190783.9 | -48702.1247 | 240905.6 |
| Apr 2026 | 113157.64 | 17301.7408 | 209013.5 | -33441.3053 | 259756.6 |
| May 2026 | 94004.74 | -3010.6917 | 191020.2 | -54367.5585 | 242377.0 |
| Jun 2026 | 98409.36 | 248.0935 | 196570.6 | -51715.3438 | 248534.1 |
| Jul 2026 | 99682.98 | 389.0893 | 198976.9 | -52173.9191 | 251539.9 |

Showing 21 to 43 of 60 entries




| | Point Forecast | Lo 80 | Hi 80 | Lo 95 | Hi 95 |
|---|---|---|---|---|---|
| Mar 2026 | 96101.75 | 1419.5840 | 190783.9 | -48702.1247 | 240905.6 |
| Apr 2026 | 113157.64 | 17301.7408 | 209013.5 | -33441.3053 | 259756.6 |
| May 2026 | 94004.74 | -3010.6917 | 191020.2 | -54367.5585 | 242377.0 |
| Jun 2026 | 98409.36 | 248.0935 | 196570.6 | -51715.3438 | 248534.1 |
| Jul 2026 | 99682.98 | 389.0893 | 198976.9 | -52173.9191 | 251539.9 |
| Aug 2026 | 103847.10 | 3433.3703 | 204260.8 | -49722.4469 | 257416.6 |
| Sep 2026 | 103631.63 | 2110.4076 | 205152.8 | -51631.6797 | 258894.9 |
| Oct 2026 | 99963.03 | -2653.7277 | 202579.8 | -56975.7582 | 256901.8 |
| Nov 2026 | 100310.24 | -3390.4837 | 204011.0 | -58286.3309 | 258906.8 |
| Dec 2026 | 99864.26 | -4909.2107 | 204637.7 | -60372.9383 | 260101.5 |
| Jan 2027 | 99145.38 | -6689.9728 | 204980.7 | -62715.8251 | 261006.6 |
| Feb 2027 | 89672.76 | -17213.9217 | 196559.4 | -73796.3145 | 253141.8 |
| Mar 2027 | 96101.75 | -11826.0283 | 204029.5 | -68959.5405 | 261163.0 |
| Apr 2027 | 113157.64 | 4198.7205 | 222116.6 | -53480.6455 | 279795.9 |
| May 2027 | 94004.74 | -15975.6521 | 203985.1 | -74195.7543 | 262205.2 |
| Jun 2027 | 98409.36 | -12583.1028 | 209401.8 | -71338.9651 | 268157.7 |
| Jul 2027 | 99682.98 | -12312.4193 | 211678.4 | -71599.2003 | 270965.2 |
| Aug 2027 | 103847.10 | -9142.3233 | 216836.5 | -68955.3105 | 276649.5 |
| Sep 2027 | 103631.63 | -10343.1536 | 217606.4 | -70677.7580 | 277941.0 |
| Oct 2027 | 99963.03 | -14988.6624 | 214914.7 | -75840.4128 | 275766.5 |
| Nov 2027 | 100310.24 | -15610.1324 | 216230.6 | -76974.6708 | 277595.2 |
| Dec 2027 | 99864.26 | -17016.7593 | 216745.3 | -78889.8361 | 278618.4 |

**Figure 3.5 BK** forecasting results

Based on figures 3.4, the largest BP export value is 113157.64 (tons).

### 3.3 Calculating MAE and MAPE values

Mean Absolute Error (MAE) and Mean Absolute Percentage Error (MAPE) are evaluation metrics used to measure the quality and accuracy of a forecasting model. Both provide information on how well the forecasting model matches the actual data. With the help of Microsoft Excel obtained:

- MAE BM = 5416.38199
  MAPE BM = 1357.237
- MAE BP = 187622.757
  MAPE BP = 38.21681
- MAE BK = 34043.7192
  MAE BK = 120.3839

## 4. CONCLUSION

From this research, the following conclusions were drawn:

1. This research uses the STL method which functions to decompose and forecast the value of exports by group of economic goods in sumatera utara
2. It can be seen from the forecasting results that the export value is a component that has a trend and seasonal pattern.
3. From the forecasting results it can be concluded that the largest BM export value is 6357.6131 (tons), the largest BP export value is 859804.0 (tons) and the largest BP export value is 113157.64 (tons).

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