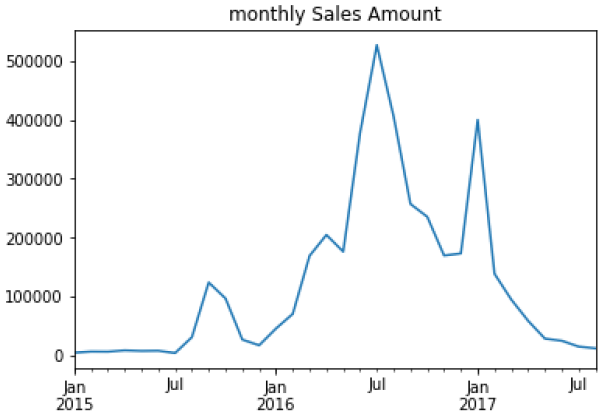
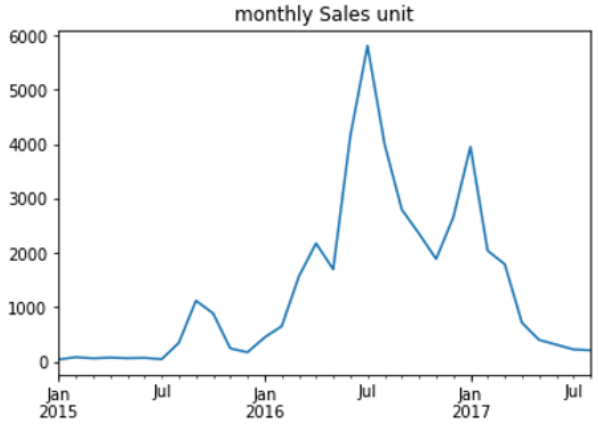
# Monthly Data Overview




- After data cleaning and processing, from the plots, we can find sales data are not stationary, and they don't have clear trend.
- We can find three spikes in Sep 2015, Jul 2016 and Jan 2017. But I won't say there is seasonal effect or pattern. The spikes may be caused by other effects.

# ARIMA Model

- Before applying any ARIMA model, we need to do ADF test to test stationarity and white noise test.
- We have four variables 'Sales Amount', 'Sales Unit', 'Average Price' and 'last month inventory, after the operation of the 1st-order difference, Only 'Average Price' passed two test.
- Use It to fit ARIMA model, with min(BIC), p=0, q=1
- Prediction result: next three months' average sales price=[62.37660715, 61.49550865, 60.61441015]

# OLS Regression

- Now, use the average sales price, and the inventory of the last day of the previous month as independent variables to fit the OLS Regression model with sale units with dependent variables.
- Model result: Adj.R-squared = 0.774 and variables are statistically significant (P-value<0.05)

| | coef | std err | t | P>\|t\| | [0.025 | 0.975] |
|---|---|---|---|---|---|---|
| const | -1796.5616 | 722.187 | -2.488 | 0.019 | -3275.895 | -317.228 |
| avg price | 20.4473 | 7.678 | 2.663 | 0.013 | 4.721 | 36.174 |
| inv | 0.2547 | 0.025 | 10.136 | 0.000 | 0.203 | 0.306 |

# Prediction Results

- If we assume without replenishment

| | | Prediction | |
|---|---|---|---|
| last_mouth_inventory | Average price | Unit | Amount |
| 2903 | 62.37660715 | 218 | 13598.10036 |
| 2685 | 61.49550865 | 145 | 8916.848754 |
| 2540 | 60.61441015 | 90 | 5455.296914 |

- If in the next two months, there will be two replenishments with 2000 units each

| | | | Prediction(replenishment) | |
|---|---|---|---|---|
| last_mouth_replenishment | last_mouth_inventory | Average price | Unit | Amount |
| | 2903 | 62.37660715 | 218 | 13598.10036 |
| 2000 | 4685 | 61.49550865 | 654 | 40218.06266 |
| 2000 | 6031 | 60.61441015 | 979 | 59341.50754 |