

Forecast: Activision Blizzard

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Introduction

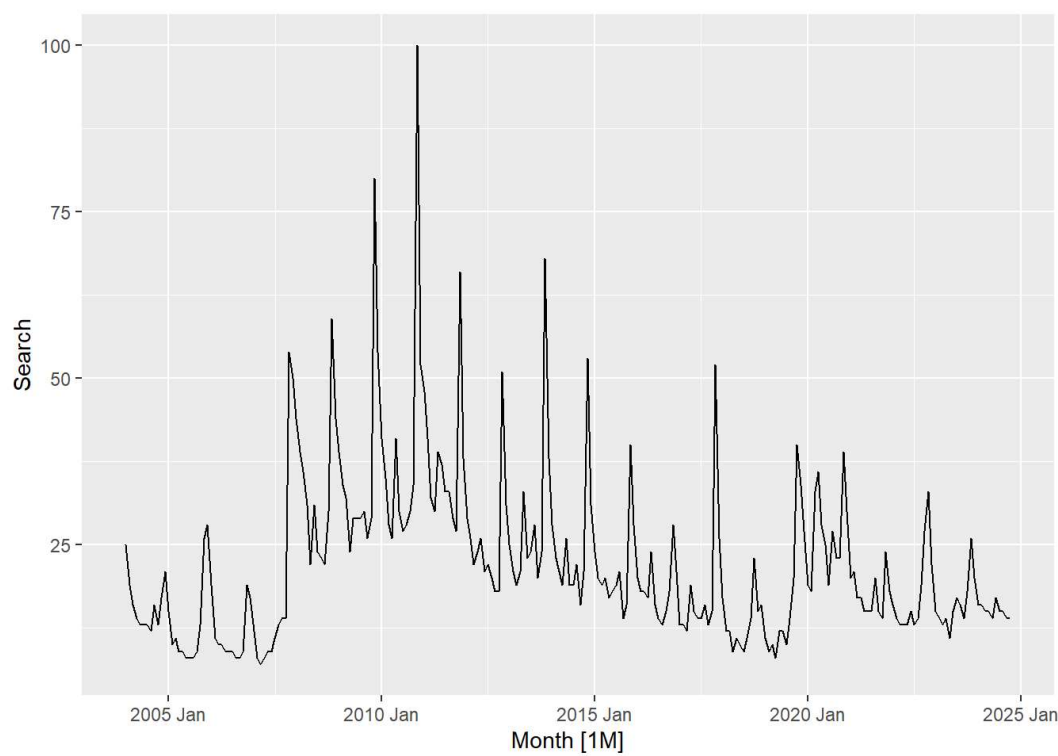
Activision Publishing Inc, is a California based American gaming company popular for its popular franchises such as “Call of Duty” and “World of Warcraft”. The company is one of the largest third party video game publisher in the world and largest American publisher in 2016.

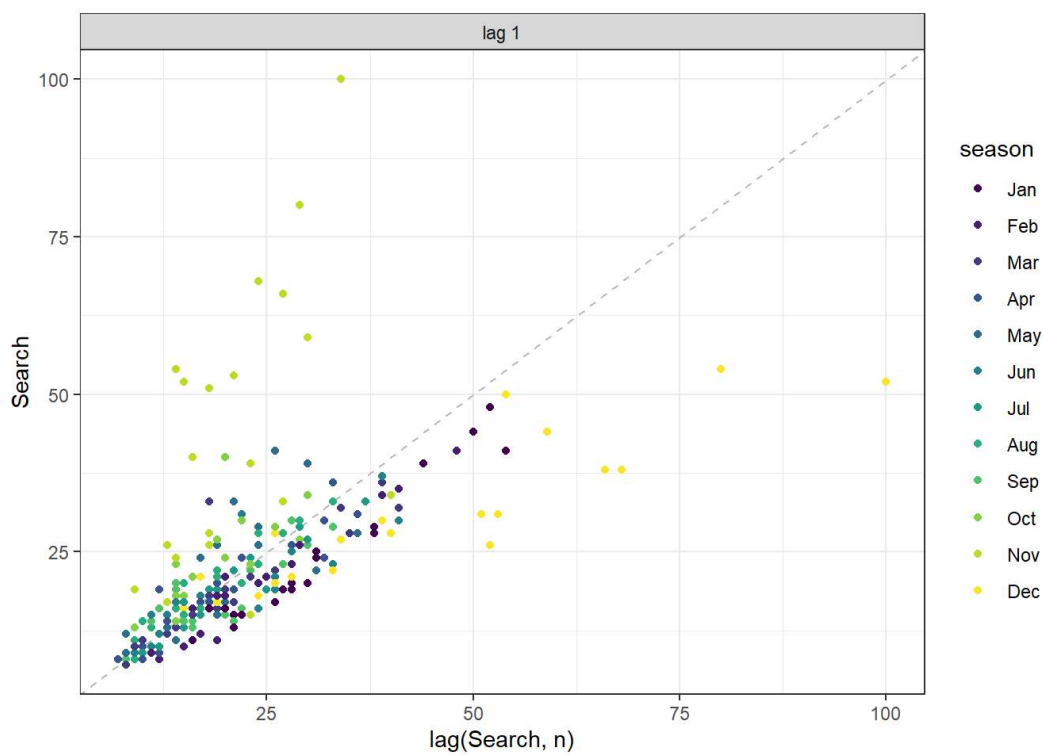
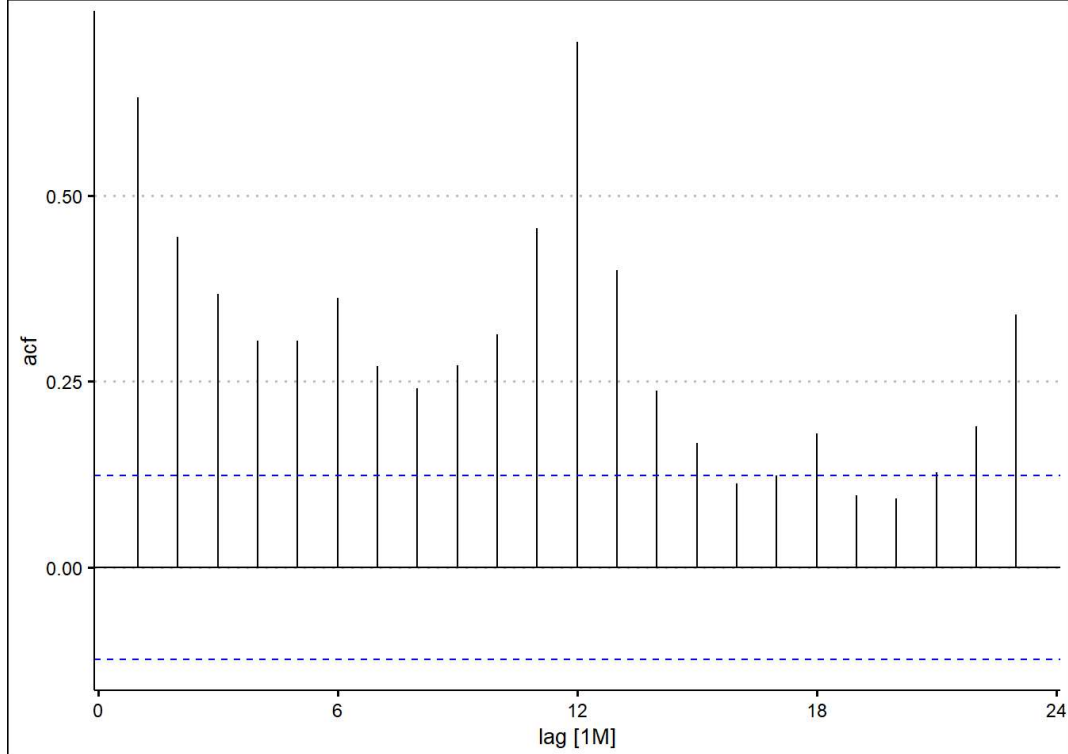
In this analysis, we focus on forecasting two key variables:

- 1. Quarterly Income
- 2. Search Trends for “Call of Duty”

We picked quarterly income to measure business performance over time. We picked search trends for “Call of Duty” which is one of Activision’s main franchises. We wanted to see if popularity of the franchise had any correlation to the company’s income and if so, by how much.

Search Trends for “Call of Duty”

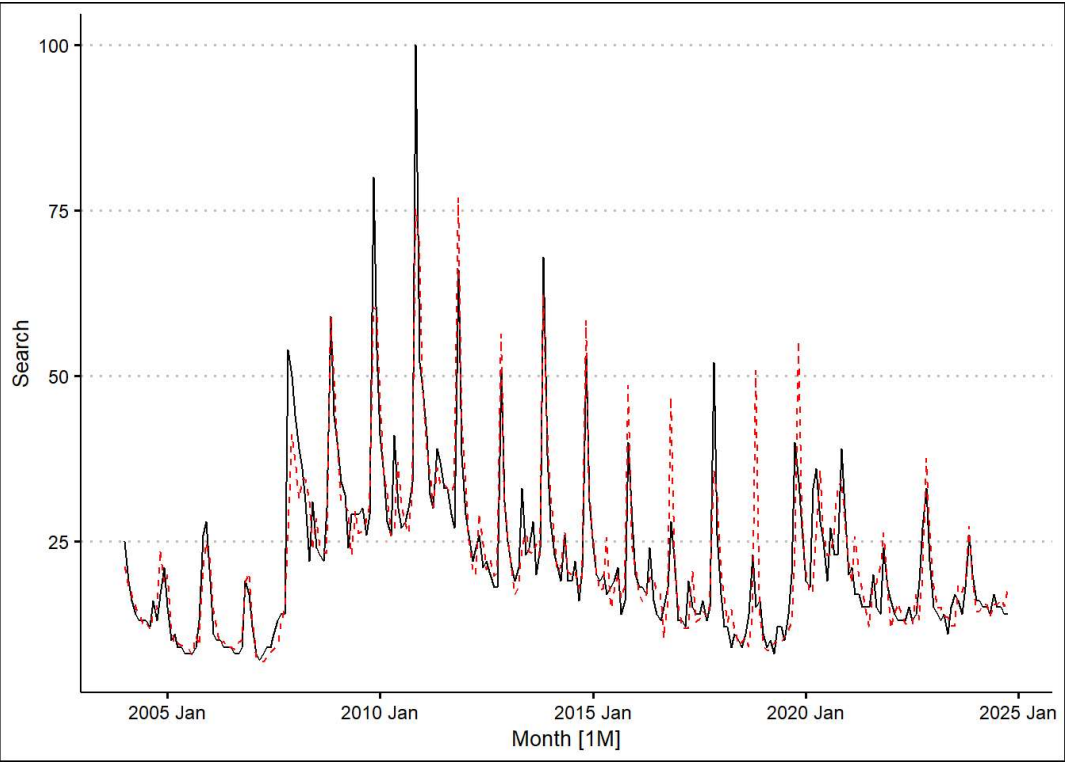
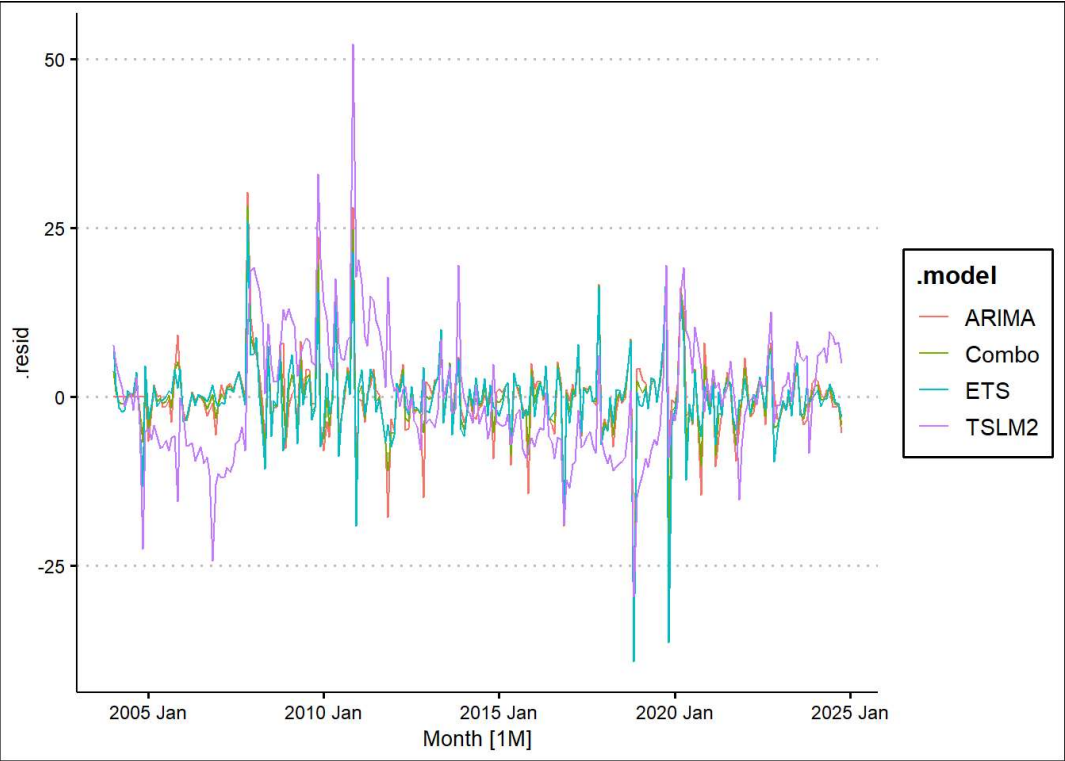




```
# A tibble: 4 × 10
  .model .type      ME  RMSE  MAE  MPE  MAPE  MASE  RMSSE  ACF1
  <chr>  <chr>    <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>
1 TSLM   Training  1.02e-15 10.3  7.65 -19.9  41.4  1.12  1.05  0.737
2 TSLM2  Training -6.71e-16 9.37  7.16 -15.6  38.6  1.05  0.960  0.682
3 ETS    Training -2.58e- 1 6.11  3.60 -2.90  15.8  0.528  0.625 -0.167
4 ARIMA  Training  2.52e- 2 6.10  3.75 -2.27  16.5  0.549  0.625  0.0204
```

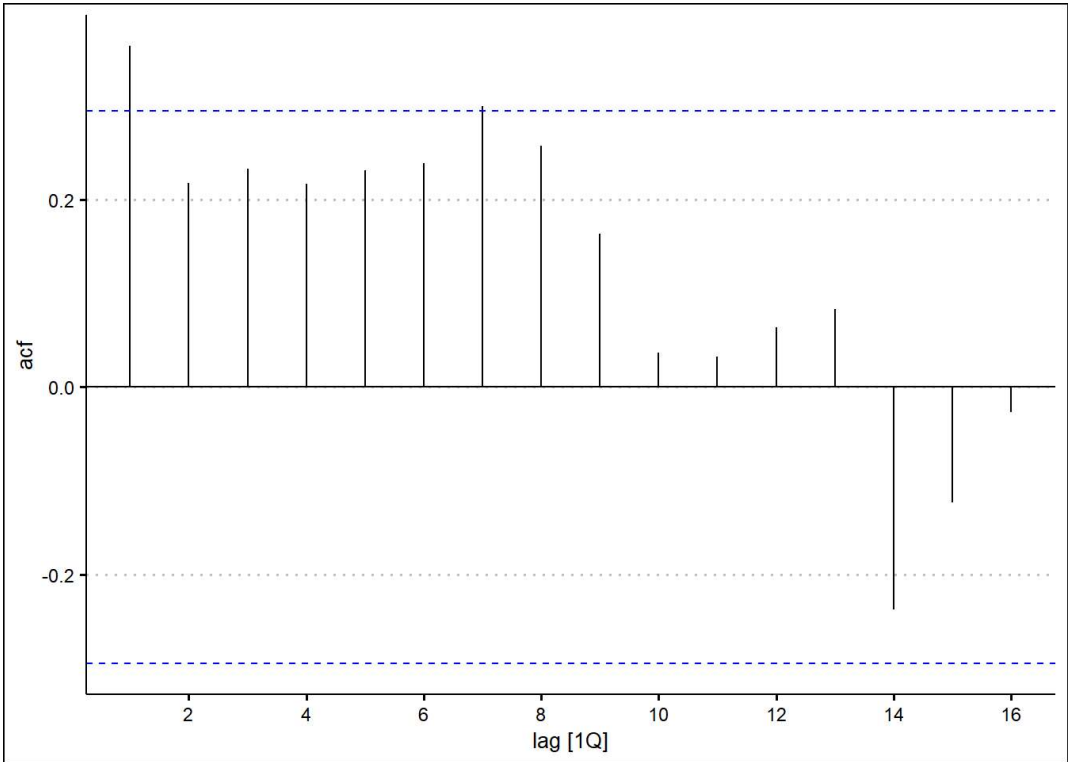
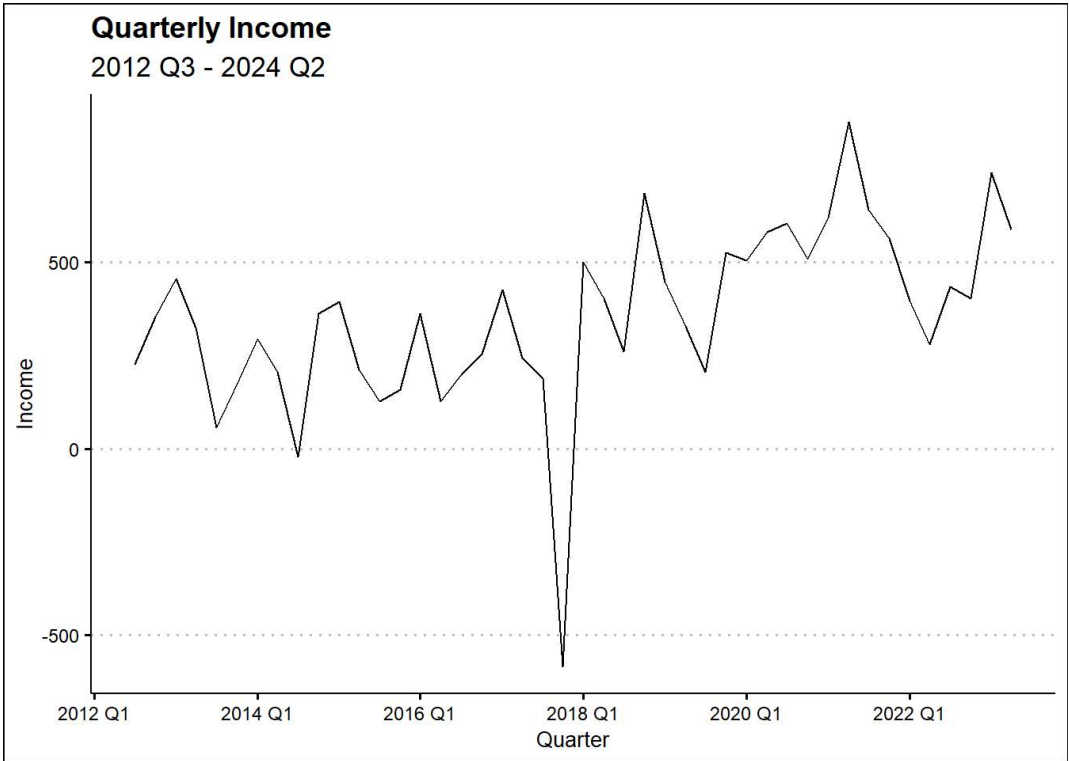
```
# A tibble: 4 × 4
  .model  AIC  AICc  BIC
  <chr>  <dbl> <dbl> <dbl>
1 TSLM   1183. 1184. 1232.
2 TSLM2 1140. 1142. 1193.
3 ETS    2109. 2111. 2162.
4 ARIMA  1547. 1547. 1561.
```

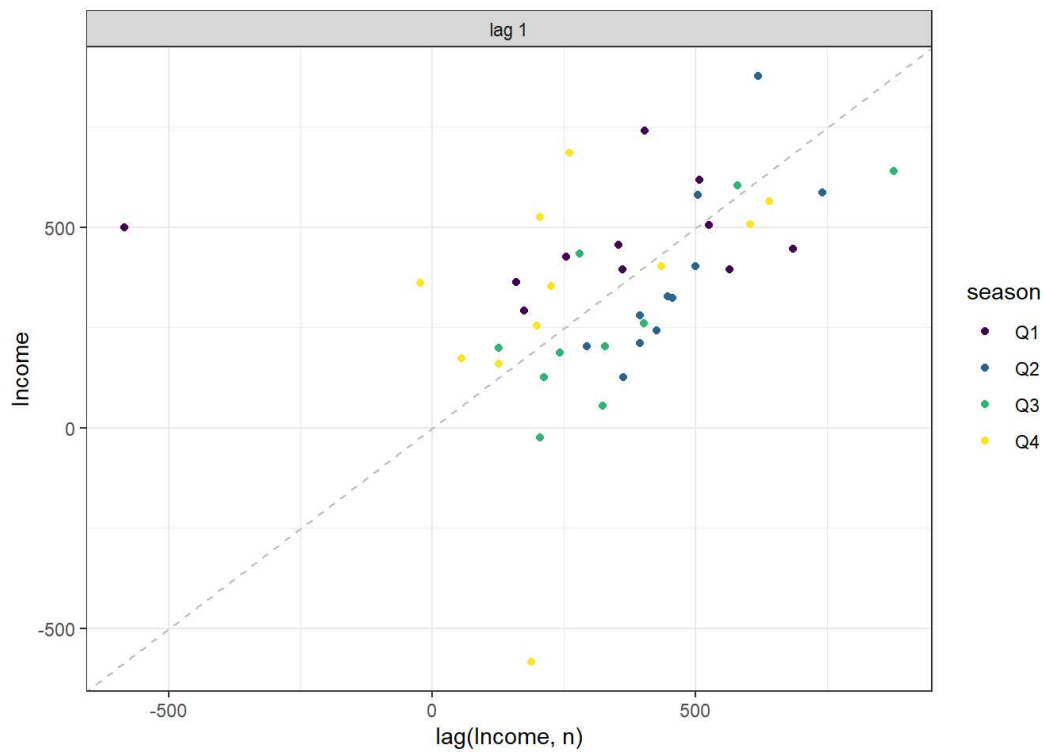
```
# A tibble: 4 × 3
  .model .type winkler
  <chr>  <chr>  <dbl>
1 ARIMA Test    24.7
2 ETS    Test    13.1
3 TSLM   Test    42.6
4 TSLM2  Test    39.4
```



```
# A tsibble: 4 × 5 [1M]
# Key:      .model [4]
  .model  Month
  <chr>   <mth>
1 TSLM2  2024 Nov
2 ARIMA  2024 Nov
3 ETS    2024 Nov
4 Combo  2024 Nov
# 3 more variables: Search <dist>, .mean <dbl>, `95%` <hilo>
```

Quarterly Income





A tibble: 4 × 10

	.model	.type	ME	RMSE	MAE	MPE	MAPE	MASE	RMSSE	ACF1
	<chr>	<chr>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>
1	TSLM	Training	-2.30e-15	195.	127.	15.7	53.1	0.674	0.644	0.183
2	TSLM2	Training	5.29e-15	189.	120.	15.4	51.3	0.638	0.624	0.143
3	ETS	Training	2.99e+ 1	218.	158.	23.2	74.9	0.838	0.719	0.0554
4	ARIMA	Training	2.67e+ 1	218.	157.	21.7	75.2	0.833	0.720	0.0479

A tibble: 4 × 4

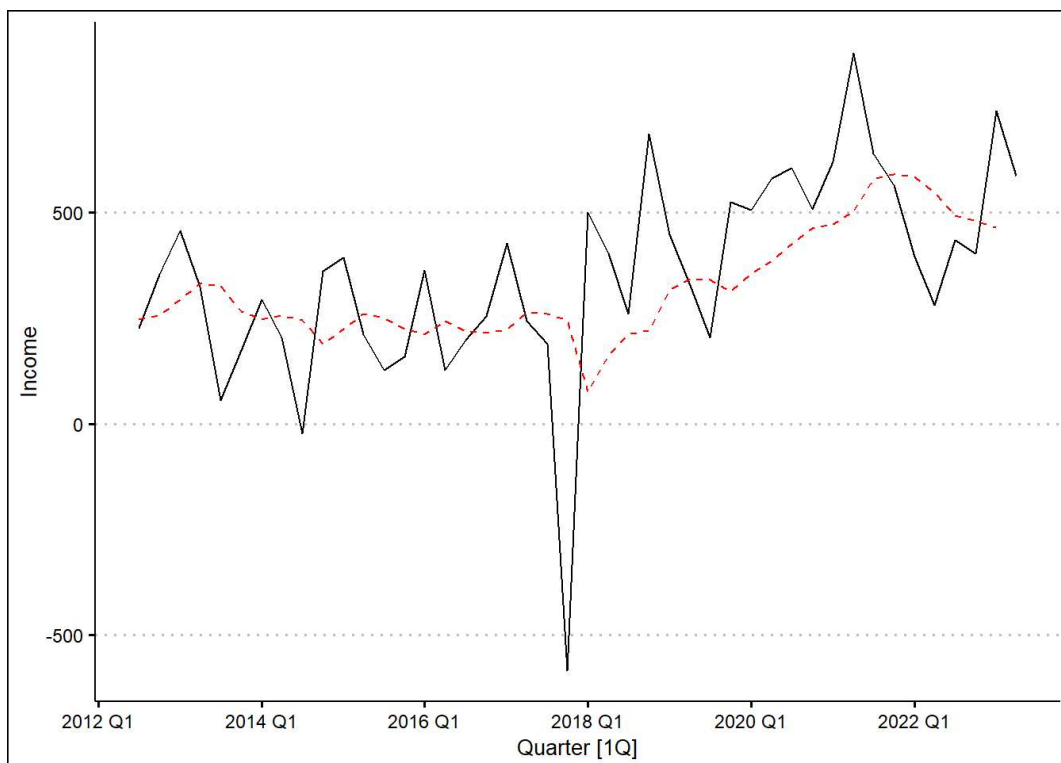
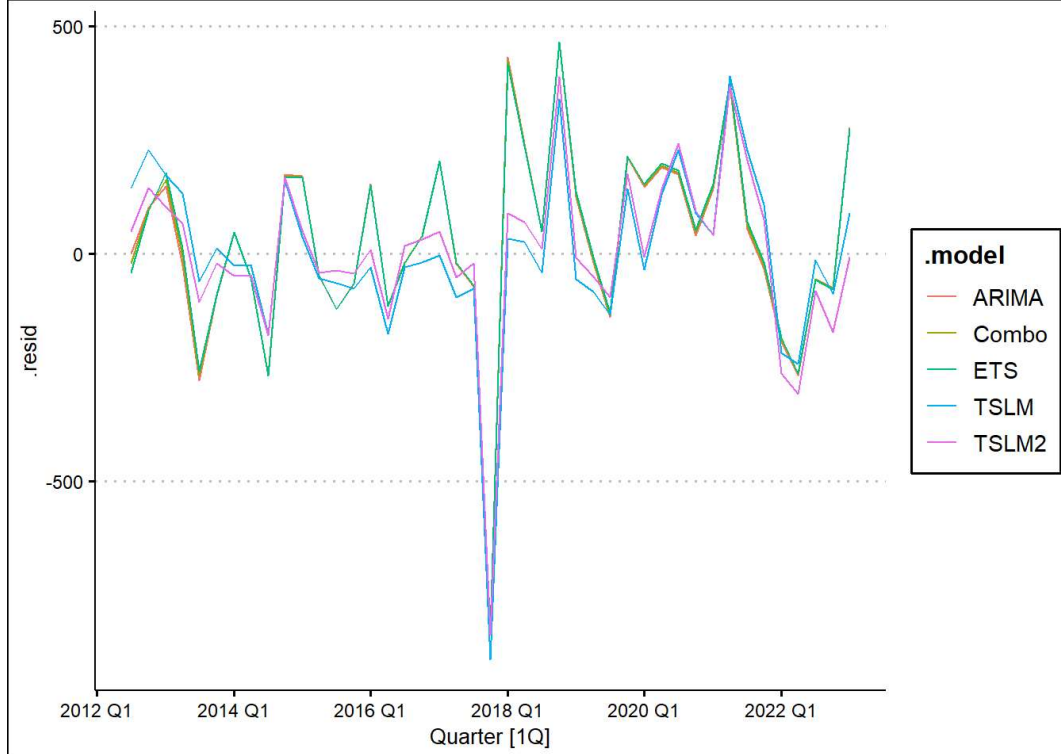
	.model	AIC	AICc	BIC
	<chr>	<dbl>	<dbl>	<dbl>
1	TSLM	465.	468.	476.
2	TSLM2	465.	468.	477.
3	ETS	631.	631.	636.
4	ARIMA	577.	578.	581.

A tibble: 4 × 3

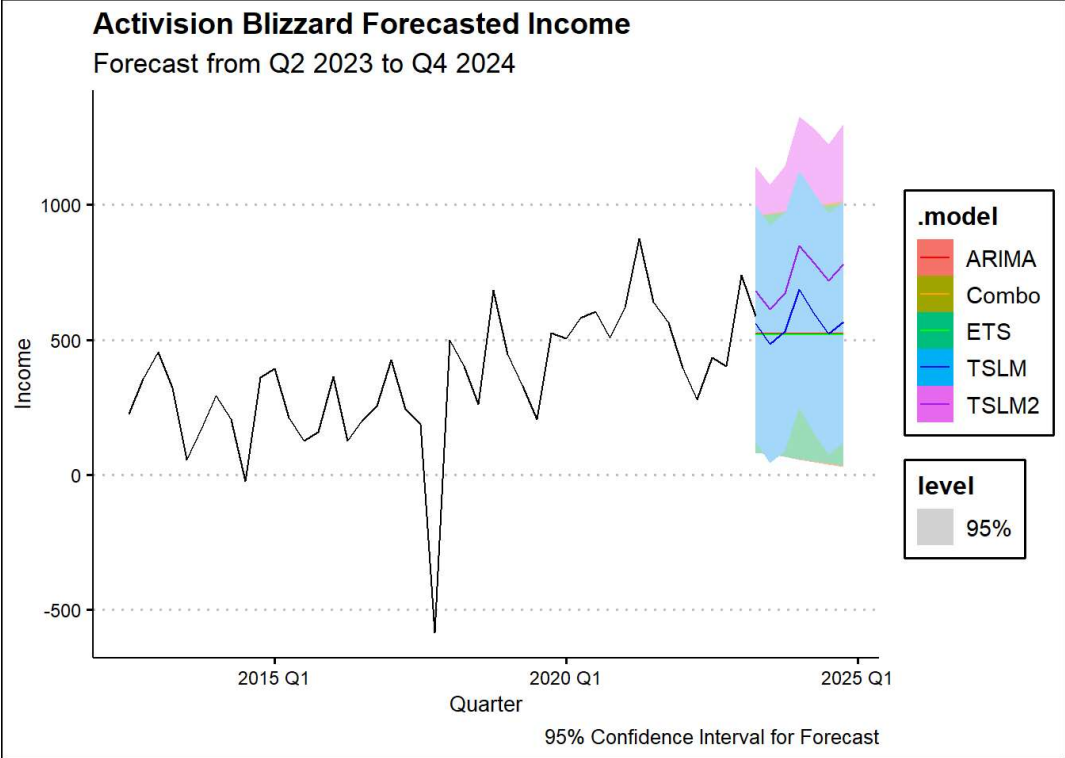
	.model	.type	winkler
	<chr>	<chr>	<dbl>
1	ARIMA	Test	874.
2	ETS	Test	873.
3	TSLM	Test	879.
4	TSLM2	Test	919.

A tibble: 5 × 10

	.model	.type	ME	RMSE	MAE	MPE	MAPE	MASE	RMSSE	ACF1
	<chr>	<chr>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>
1	ARIMA	Test	161.	284.	236.	28.5	44.2	1.23	0.940	0.476
2	Combo	Test	144.	282.	234.	25.1	44.5	1.22	0.933	0.513
3	ETS	Test	126.	287.	238.	21.7	46.0	1.24	0.950	0.561
4	TSLM	Test	143.	282.	225.	28.7	46.0	1.17	0.931	0.344
5	TSLM2	Test	-90.0	331.	252.	-19.2	58.8	1.32	1.09	0.604



```
# A tsibble: 35 x 5 [1Q]
# Key:   .model [5]
  .model Quarter
  <chr>   <qtr>
1 TSLM    2023 Q2
2 TSLM    2023 Q3
3 TSLM    2023 Q4
4 TSLM    2024 Q1
5 TSLM    2024 Q2
6 TSLM    2024 Q3
7 TSLM    2024 Q4
8 TSLM2   2023 Q2
9 TSLM2   2023 Q3
10 TSLM2  2023 Q4
# i 25 more rows
# i 3 more variables: Income <dbl>, .mean <dbl>, `95%` <hilo>
```



```
# A tibble: 5 × 10
  .model .type      ME  RMSE  MAE  MPE  MAPE  MASE  RMSSE  ACF1
  <chr>   <chr>      <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>
1 TSLM   Training -2.30e-15 195.  127.  15.7  53.1  0.674  0.644  0.183
2 TSLM2  Training  5.29e-15 189.  120.  15.4  51.3  0.638  0.624  0.143
3 ETS    Training  2.99e+ 1 218.  158.  23.2  74.9  0.838  0.719  0.0554
4 ARIMA  Training  2.67e+ 1 218.  157.  21.7  75.2  0.833  0.720  0.0479
5 Combo  Training  2.83e+ 1 217.  157.  22.5  75.0  0.834  0.719  0.0513
```

Model Selection & Process Overview

Search Trends Analysis

Using read.csv and cleaning up the data in excel prior to extracting from it, we imported the search trends data and converted the Month column into a time series tibble (tsibble) for further analysis. We applied various models, including:

1. TSLM (Trend + Seasonal) models
2. ETS (Exponential Smoothing)
3. ARIMA (AutoRegressive Integrated Moving Average)

We found that the ETS model performed most accurately and consistently across different metrics.

Key steps:

- Autoplot of search trends
- Autocorrelation (ACF) plots
- Lag plots
- Fitting models on training data (up to August 2024) and forecasting for September 2024
- Evaluating the accuracy of the models using AIC, BIC, and accuracy metrics
- Combining models (ARIMA and ETS) for improved forecast accuracy.

Visualization

- **Search Trends Autoplot:** Showcasing historical trends and model residuals.
- **95% Confidence Interval Forecast:** Visualizing the forecast for search trends with confidence intervals.

Net Income Quarterly Analysis

After cleaning the data in excel, we extracted it from a csv and transformed it into a time series format. Then, we applied several models (TSLM, ETS, ARIMA) to predict future income, combining ARIMA and ETS for better results.

Upon examining the accuracy metrics, we found that our Combination (ARIMA + ETS) model performed well, but had a high ACF1, so we chose to designate our TSLM model as our most accurate in terms of being better balanced on accuracy metrics overall.

Key steps:

- Autoplot of income over time (2012 Q3 - 2024 Q2)
- Autocorrelation (ACF) and lag plots
- Model fitting and validation using training data (up to Q1 2023) and testing on Q2 2023
- Stretching the time series to predict future income for up to 7 quarters (until Q4 2024)

Visualization

- **Quarterly Income Autoplot:** Shows income from 2012 Q3 to 2024 Q2.
- **Income Forecast Plot:** Displays forecast for 7 quarters with a 95% confidence interval.

Results and Business Impact of Forecasting Results

Using our chosen most accurate models for Search Trends and Quarterly Net Income, Activision Blizzard is predicted to stay stable with a tendency towards positive growth forecasted in Net Income and continue to show seasonality with a trend towards decrease in Search Trends.

Taking the forecasted increasing net income and decreasing search relevancy, Activision Blizzard should consider investing strategically in marketing campaigns for its current and upcoming products, especially given the fast-paced trend cycle in the gaming industry. Reputation and “hype” can be powerful forces that make or break gameplay longevity and new release sales.