

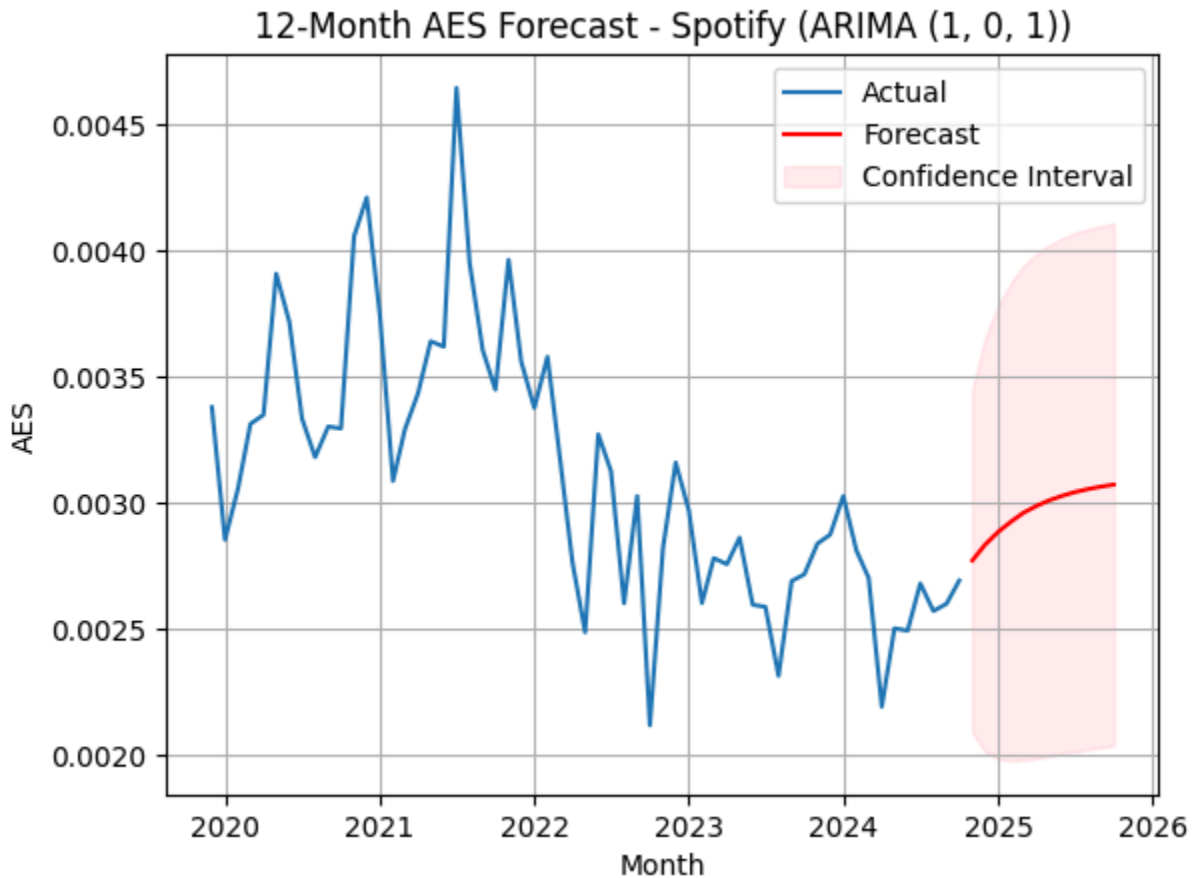
AES 12-Month Forecast - Spotify

Good afternoon Mr. Katzen,

This report contains graphically represented 12-month forecasts of the Average Earnings per Stream ('AES') from the audio streaming platform, Spotify, utilizing Lamanna's streaming data from start-of-year 2020 to end-of-year 2024.

ARIMA Model

ARIMA models assume that data is stationary; showing a consistent pattern or structure. However, further analysis led to a discovery of non-stationarity within the data emphasized by extreme confidence intervals in the 12-month forecast. These confidence intervals act as an overall range where predictions can land, the larger they are, the more uncertain the predictions become.

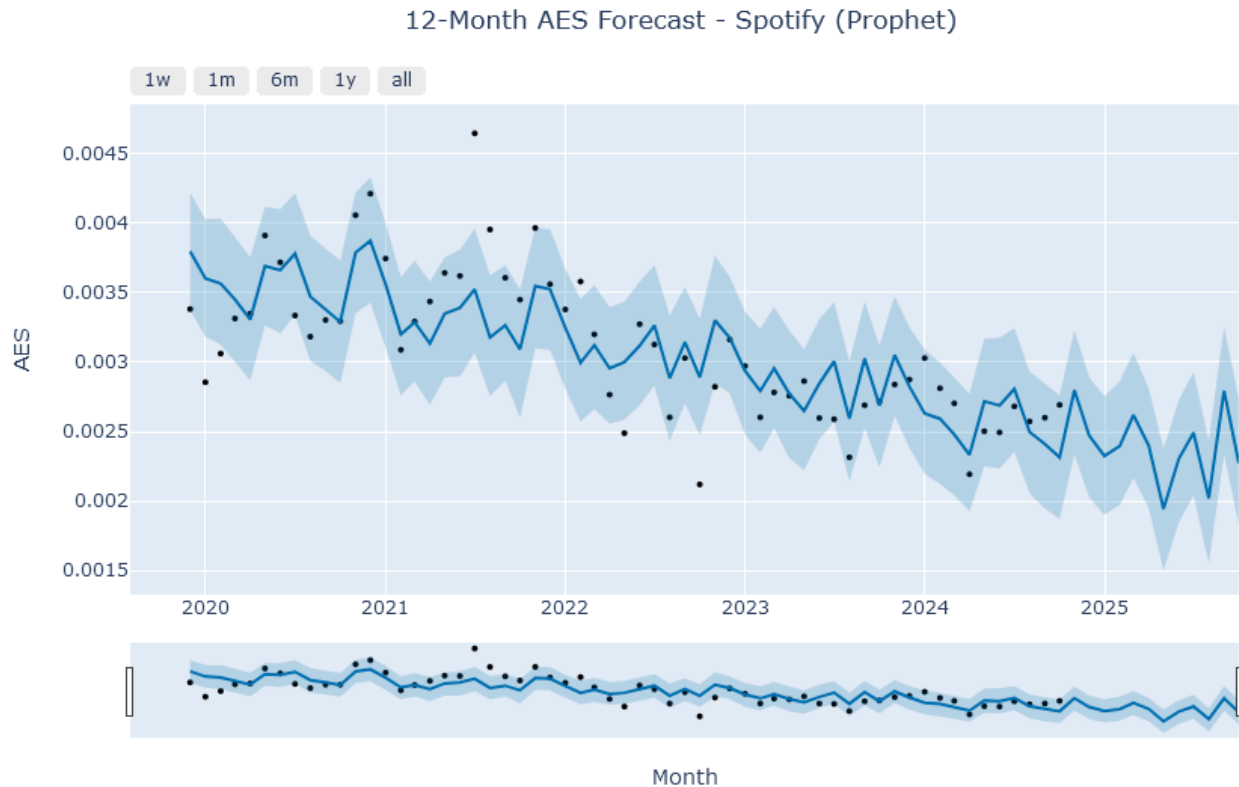


Key Takeaways:

Although the ARIMA model indicates a lot of uncertainty, it pointed the project in the right direction as the first parameter, the autoregressive term metric, indicates extreme importance of past data on future predictions with a strength of 81% (0.81). See *full SARIMAX results at the bottom of this report*.

Prophet Model

Prophet models are capable of handling irregular, or non-stationary, data. The confidence intervals, or range, for the model's predictions are dramatically decreased leading to more certainty in future forecasting.



This is further proven through the model's mean absolute error (MAE) which describes the average error between a model's predicted value and the actual value. The short-term, 30 day, MAE range of \$0.000079 - \$0.0004 indicates incredible precision to the actual AES with a slight increase to \$0.0007 over a 365 day period. In other words, the model's predictions are only \$0.000079 - \$0.0004 off from the actual AES with a maximum MAE of only \$0.0007. See *full Prophet model metrics at the bottom of this report (not aggregated)*.

Report Conclusions: Focusing efforts on improving Prophet model parameters will best benefit forecasting Spotify AES. This model has not been tested on Apple Music AES.

- Dominic Lamanna, Snapshot

ARIMA Model Results for Spotify AES:

SARIMAX Results

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Dep. Variable: AES

No. Observations: 59

Model: ARIMA(1, 0, 1)

Log Likelihood 385.256

Date: Sat, 25 Jan 2025

AIC -762.513

Time: 16:10:21

BIC -754.203

Sample: 12-01-2019

HQIC -759.269

- 10-01-2024

Covariance Type: opg

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	coef	std err	z	P> z	[0.025	0.975]
const	0.0031	0.000	14.593	0.000	0.003	0.004
ar.L1	0.8139	0.132	6.183	0.000	0.556	1.072
ma.L1	-0.1467	0.209	-0.703	0.482	-0.556	0.262
sigma2	1.209e-07	2e-08	6.051	0.000	8.18e-08	1.6e-07

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Ljung-Box (L1) (Q): 0.03

Jarque-Bera (JB): 6.46

Prob(Q): 0.86

Prob(JB): 0.04

Heteroskedasticity (H): 0.24

Skew: 0.53

Prob(H) (two-sided): 0.00

Kurtosis: 4.23

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Warnings:

[1] Covariance matrix calculated using the outer product of gradients (complex-step)

Prophet Model Results for Spotify AES:

	horizon	mse	rmse	mae	mape	mdape
0	30 days 00:00:00	8.446927e-07	0.000919	0.000684	0.238810	0.238810
1	59 days 12:00:00	6.382086e-09	0.000080	0.000079	0.029373	0.029373
2	60 days 00:00:00	6.775751e-08	0.000260	0.000223	0.079288	0.079288
3	89 days 12:00:00	1.814774e-07	0.000426	0.000421	0.155795	0.155795
4	91 days 00:00:00	5.257610e-07	0.000725	0.000694	0.242832	0.242832
5	120 days 12:00:00	4.080841e-07	0.000639	0.000456	0.150808	0.150808
6	122 days 00:00:00	1.606896e-07	0.000401	0.000287	0.102435	0.102435
7	151 days 00:00:00	4.295555e-07	0.000655	0.000650	0.236383	0.236383
8	151 days 12:00:00	2.750398e-07	0.000524	0.000422	0.156214	0.156214
9	181 days 12:00:00	5.256879e-07	0.000725	0.000565	0.208085	0.208085
10	182 days 00:00:00	5.317570e-07	0.000729	0.000588	0.223118	0.223118
11	212 days 00:00:00	1.310600e-08	0.000114	0.000099	0.044066	0.044066
12	212 days 12:00:00	7.042391e-08	0.000265	0.000208	0.074090	0.074090
13	242 days 12:00:00	1.866174e-07	0.000432	0.000428	0.149796	0.149796
14	243 days 00:00:00	1.193694e-07	0.000345	0.000276	0.097687	0.097687
15	273 days 00:00:00	1.604108e-08	0.000127	0.000117	0.044466	0.044466
16	273 days 12:00:00	5.432509e-07	0.000737	0.000597	0.200809	0.200809
17	304 days 00:00:00	6.467128e-07	0.000804	0.000757	0.263983	0.263983
18	304 days 12:00:00	3.542603e-07	0.000595	0.000586	0.216492	0.216492
19	333 days 12:00:00	7.363383e-07	0.000858	0.000844	0.307197	0.307197
20	335 days 00:00:00	7.218897e-07	0.000850	0.000833	0.313032	0.313032
21	364 days 12:00:00	3.330121e-07	0.000577	0.000569	0.235353	0.235353
22	365 days 00:00:00	6.085995e-07	0.000780	0.000734	0.292413	0.292413